20th Annual NCTA Convention

OFFICIAL TRANSCRIPT

THE SECOND GENERATION

NATIONAL CABLE TELEVISION ASSOCIATION

JULY 6-9, 1971

SHERATON PARK HOTEL

WASHINGTON, D. C.

TECHNICAL PROGRAM

20th Annual National Cable Television Association Convention

July 7 — 9, 1971
Sheraton Park Hotel
Washington, D.C.

CONVERTERS, ENCODERS & SPECIAL SERVICES

Chairman: Hubert J. Schlafly
TelePrompTer Corporation
New York, New York

CATV SYSTEM DESIGN

Chairman: Delmer C. Ports
NCTA
Washington, D.C.

MANAGEMENT SESSION

20th Annual National Cable Television Association Convention

July 7 — 9, 1971
Sheraton Park Hotel
Washington, D.C.

FEDERAL REGULATION AND COPYRIGHT

Chairman: Gary L. Christensen
NCTA
Washington, D.C.

STATE REGULATION

Chairman: Charles S. Walsh
NCTA
Washington, D.C.

FINANCING, TAXATION, AND SPECIAL PROBLEMS

Chairman: Stuart F. Feldstein
NCTA
Washington, D.C.

THE EDUCATOR AND CATV: POSSIBILITIES FOR PARTNERSHIP

Chairwoman: Mrs. Ethel Greenfield Booth
Beverly Hills, California

ORIGINATION CONCEPTS -- PROFIT OR PERIL

Chairman: Robert Weisberg
TeleMation Program Services
New York, New York

MARKETING -- STATE OF THE ART

Chairman: Jack Gault
American Television and Communications Corp.
Denver, Colorado

A SECOND GENERATION CATV CONVERTER

BY

EUGENE C. WALDING
MANAGER - CATV ENGINEERING
OAK ELECTRO/NETICS
CRYSTAL LAKE, ILL.

PREPARED FOR PRESENTATION TO TWENTIETH ANNUAL CONVENTION NATIONAL CABLE TELEVISION ASSOCIATION, WASHINGTON, DC JULY 6-9, 1971.

A SECOND GENERATION CATV CONVERTER

INTRODUCTION

Set top converters have been on the market for over five years. For the most part, they have performed their intended function admirably. However, due to changing requirements and more stringent specifications, we are moving into an era in which second generation converters are required.

BACKGROUND

Set top converters evolved as a means of solving the direct pickup problem prevalent in strong signal metropolitan areas.

The method used was to down convert the cable signals to a 44MHz I-F and then up convert to a channel that was unoccupied by a broadcast signal. The RF circuitry to perform this function was enclosed in a well shielded metal compartment. The basic tuning methods were well established VHF TV tuner concepts and hardware.

It soon became apparent that the set top converter did not have to be limited to a meager twelve channels. To achieve more channels, the initial attempts were to either add another TV type tuner or to expand the coverage of the existing tuner. In either case, the 44MHz I-F was retained. As a result, the local oscillator signal emanating from the tuner antenna terminals fell into the CATV signal band. When only twelve standard channels are used, this is relatively unimportant. When mid and super bands are used, it results in converter to converter "cross talk".

GAMUT 26 - DESIGN PHILOSOPHY

In reviewing optimum approaches to second generation converters, a number of factors should be considered.

GAMUT 26 - DESIGN PHILOSOPHY (cont'd.)

Unlike broadcast, the cable signal levels operate within a relatively narrow range (-6 to +12db mV). Thus a dynamic, AGC able front end is not a requirement.

The future of cable is dependent upon providing additional channels and services to the subscriber. It would seem prudent, therefore, to avoid any energy emanating from the converter that could penetrate into the cable system.

The customer interface must be simple to operate and non-ambiguous.

The cost/performance factor must be equivalent or better than first generation converters.

DESIGN APPROACH

In developing the Gamut 26, we abandoned the use of a "TV tuner" as a tuning element. Also, the use of a high frequency I-F is mandatory if oscillator energy is to be prevented from entering the cable system.

Our approach can best be illustrated by referring to the block diagram. Figure 1.

The cable signal flows through a set of filters into a passive double balanced mixer (DBM). It is combined with a local oscillator frequency to form an I-F of 330MHz. Twenty-six channel tuning is achieved by simply switching in the appropriate oscillator frequency.

The I-F amplifier provides gain and selectivity to the up converted signal. Combining with a fixed tuned 2nd local oscillator, the signal is down converted to the desired output channel.

DOUBLE BALANCED MIXER

Little trouble from intermodulation, in the form of sums and differences of the signal or from its harmonics, are experienced when using the standard twelve channel VHF frequency allocation. Historically, these frequencies were carefully chosen to avoid this.

With the use of multichannel coverage, second order distortion becomes a severe problem. In particular, the low band can react with the mid, high and superband to create spurious signals which manifest themselves in the TV receiver as "beats". For example, the sum of a channel 2 and a channel A signal will produce an interference in channel 7. It has been our experience, and that of others, that the suppression of these beats should be in the order of 60db. See Ref. 2. It is for this reason that we have used a double balanced mixer as a front end.

Its operation can be described by referring to Figure 2. The RF signal is applied at the input port and combining with a strong local oscillator at the second port is converted into two side bands, equally spaced about the local oscillator signal. These side bands are available at the third port. In the case of the Gamut 26 the lower sideband (330MHz) is used as the I-F. It will be noted that the images (upper side bands) are in UHF, well out of the cable signal band.

By virtue of its inherent balance, the double balanced mixer (DBM) is a device that automatically provides a great deal of suppression to second order beats. Good port to port isolation and excellent cross modulation characteristics makes the device well suited for CATV applications.

BACK TO BACK OSCILLATOR

To tune the DBM, twenty-six discrete, ultra high frequencies are required (386 to 572MHz). These local oscillator signals must be high level, accurate and repeatable.

This is achieved by using the basic hardware from a VHF tuner transistor oscillator. Two oscillators were mounted "back to back" on a common shaft. Instead of thirteen positions common to VHF tuners, twenty-six become available. The memory fine tuning mechanism became a means of aligning the oscil-

BACK TO BACK OSCILLATOR (cont'd.)

lators in production. The B+ was fed through the tuning coils thus providing automatic switching to the appropriate oscillator. See Fig. 3.

As there is a separate tuning inductance for each frequency, the sequence of operation is completely independent. This is an advantage in the Channel Selector readout as the numeric channels of the low and high bands can be arranged in sequence as can the letter channels of the mid and super bands.

Detenting is provided by a large index wheel mounted mid-way down the shaft. By devoting careful attention to this detail we have achieved reset accuracies superior to VHF tuners even though the oscillators are working at UHF frequencies.

The circuits are basic, temperature compensated, Clapp type oscillators using high F_T transistors.

PASS/STOP FILTER

As well as the DBM functioned, we found that we could not maintain the proper balance in production to guarantee the 60db suppression of beats with an input signal level of +12db mv.

To ensure compliance to this specification we found it necessary to insert, what we term, a pass/stop filter into the circuit prior to the DBM. This device acts as a lowband filter when the converter is tuned to channels 2 thru 6. At any other channel the filter is switched to an elliptic function high pass with its zero of transmission tuned to the low band. Thus, any potential for forming sums and differences of the input frequencies is completely removed.

The low pass filter connected to the input terminal has a cutoff of 300MHz and is used to help prevent any oscillator energy from leaking out into the system.

PARTITION FILTER

The output of the DBM is fed to the I-F via a filter mounted in a metal partition wall. This broadly tuned bandpass filter has its center tuned to 330MHz. It primary function is to provide good selectivity at frequencies far removed from the I-F.

Another feature of this filter is the use of an open circuit quarter wave transmission line as a circuit element. At 330MHz the stub looks essentially like a capacitor. At the frequency of the 2nd LO, and its third harmonic, the stub behaves like a short circuit and provides a zero of transmission to these frequencies. This is invaluable in preventing the 2nd LO from penetrating into the DBM, and causing internally generated beats.

INTERMEDIATE FREQUENCY AMPLIFIER

The I-F video frequency is 331MHz and the sound is 326.5MHz. These particular frequencies were chosen so that the sums of the R-F signal frequencies that fall in this vicinity are converted into the sound trap and the adj.-channel sound traps in the TV receiver's I-F.

The input to the I-F is tied directly to the base of a common emitter transistor amplifier. The low noise transistor operates under self bias conditions with a large voltage drop in the collector circuit. This method was used so as to foil any instabilities due to feeding the collector with a choke - a problem with high FT devices.

The selectivity prior to the 2nd mixer is achieved with double tuned capacity coupled circuits. Attempting to achieve high selectivity (1.5% bandwidths) at 330MHz with lumped LC filters results in high insertion losses. To overcome these losses two stages of gain are used.

The mixer is a common emitter transistor whose output is tuned to desired output channel. In most cases this is channel 12. The output filter is again a two pole, high side capacity coupled circuit.

The 2nd LO is a Clapp type oscillator operating at 536.25MHz (when using Channel 12 as the output). Fine tuning is achieved

INTERMEDIATE FREQUENCY AMPLIFIER (cont'd.)

by varying the base current by means of a fine tuning pot. This changes the capacity of the depletion area of the p-n junction which in turn changes the frequency of oscillation to the point that fine tuning is achieved.

The output from the mixer tank is connected to the output terminal via an attenuator pad. The value of this pad is such that the overall gain is limited to an average of 6db.

The I-F amplifiers, 2nd LO and the mixer circuitry are all mounted on one printed circuit board. Although the frequencies used would normally preclude the use of a PC board, careful placement of parts and the optimum use of the ground plane has resulted in a circuit that is stable and uniform in production.

POWER SUPPLY

The power supply is a 24v, series regulated type drawing 35ma. To prevent direct pickup the entire supply is placed in a separate compartment and completely shielded from the rest of the circuitry.

An AC convenience outlet, controlled by the ON-OFF switch, enables the converter to be used as a remote control device.

FUTURE USES

We feel that we have fulfilled the design criteria and have produced a viable product that not only fulfills todays needs but it also can serve as a fundation for other services.

For example: By changing the output channel to 44MHz we would have a tuner for an All CATV receiver.

The addition of decoder modules would permit the use of pay TV channels.

The basic unit can serve as the subscriber interface in two way systems.

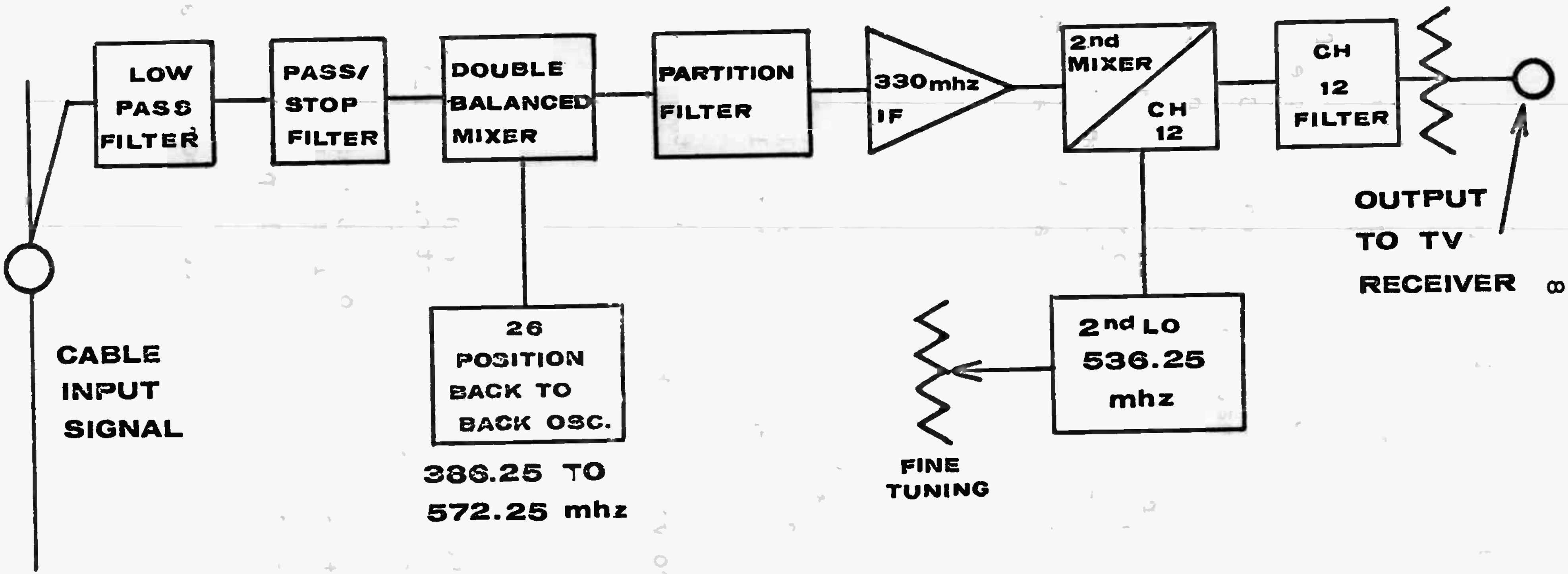


FIG.1

BLOCK DIAGRAM

GAMUT 26 CONVERTER
(CH 12 OUTPUT)

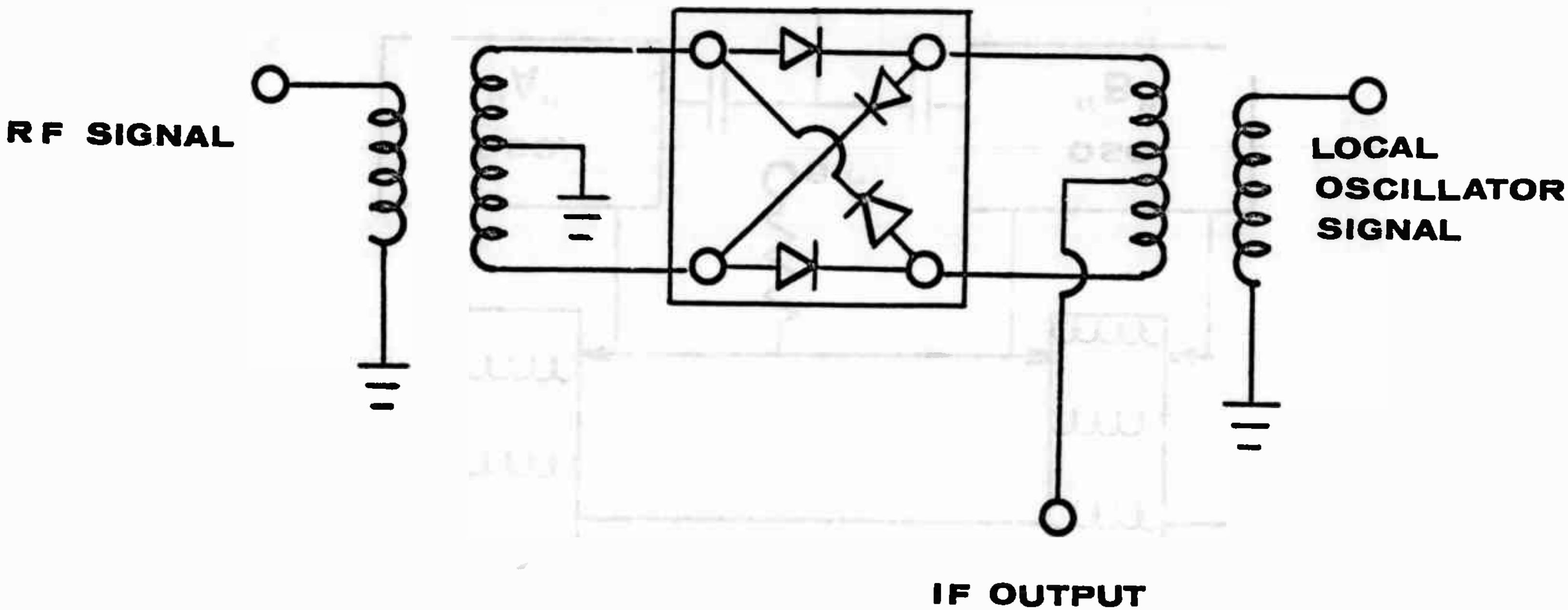


FIG. 2 DOUBLE BALANCED MIXER

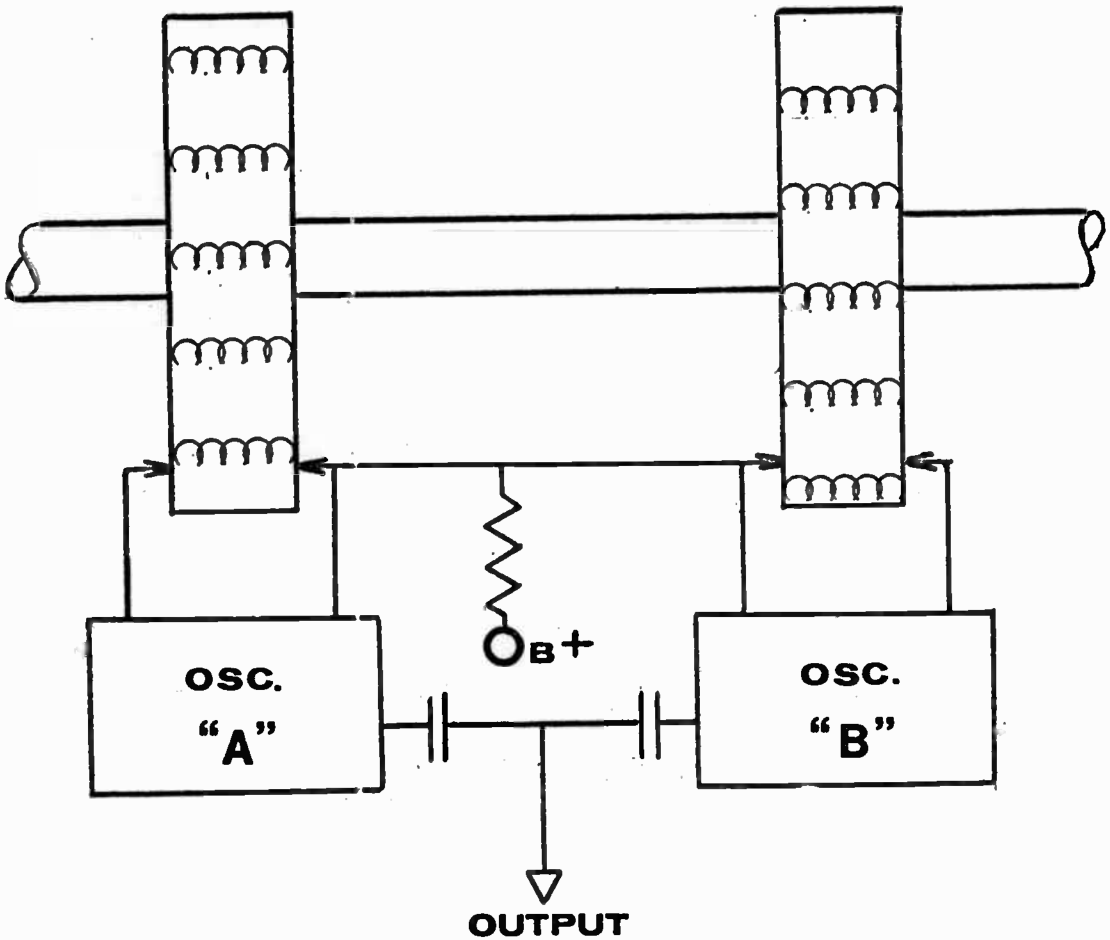


FIG. 3

BACK TO BACK OSC.

REFERENCES

1. Mauw and Fukuchi, "Broadband Double Balanced Mixer/Modulators," the Microwave Journal, March and May 1969.

2. "Technical Standards and Procedures for Cable Television Systems" Canadian Department of Communications, Release Date March 29, 1971.

3. Simons, "The Fundamentals of Distortion in CATV Amplifiers", Technical Handbook for CATV Systems, Jerrold Electronics Corp., 1968.

EnDe-CODE

TELEVISION SIGNAL ENCODING AND DECODING

FOR

CABLE SYSTEMS

By

Abraham M. Reiter

Director of Advanced Engineering

Athena Communications Corp.

Prepared for Presentation to

Twentieth Annual Convention

National Cable Television Association

Washington, D. C.

July 8-9, 1971

EnDe-CODE TELEVISION SIGNAL ENCODING AND DECODING FOR CABLE SYSTEMS

Abraham M. Reiter

Director of Advanced Engineering

Athena Communications Corporation

ABSTRACT

A low cost system for encoding and decoding the picture and sound signals on CATV channels is described. A simple encoder is connected to the modulator for each encoded channel and an all-channel set top decoder can decode all channels--standard and non-standard. No modifications to the cable system are required.

The heart of the system is the patented "gray blank" method of encoding video by replacing the synchronizing and blanking components of the composite video signal with a steady voltage midway between black and white. The color reference burst is superimposed on the steady voltage. Proper synchronization on a normal television receiver is lost because the receiver attempts to lock on the blackest portions of the video signal. The sound is encoded by positioning the FM sound carrier 1 MHz below the video carrier. Pulse signals that are used to restore the video to normal are amplitude modulated on the repositioned sound carrier. Decoding is accomplished without demodulating the video or audio.

SUMMARY

EnDe-Code is a system for transforming any 6 MHz channel into a private channel that is available only to those who have decoders. The system consists of an encoder that is connected to the modulator of the channel to be encoded and a decoder that is connected to the antenna terminals of the television set.

Composite video is modified by the encoder resulting in the gray blank video waveform shown in figure 1. Horizontal sync and blanking and vertical sync (not shown) are replaced by the gray level, i.e. the level midway between black and white. In the modulator, gray blank video is modulated on a 45.75 MHz carrier and converted to the desired output channel in the usual way.

The encoder also takes the frequency modulated 41.25 MHz sound carrier from the modulator, converts it to 46.25 MHz and amplitude modulates video restoring pulses. The 46.75 MHz is sent back to the modulator to be converted to the desired output channel along with the video carrier. The 41.25 MHz is suppressed.

The encoder is provided with a switch that returns the channel to normal service without the need to make any other adjustments or change any cables.

A standard television receiver that is tuned to the encoded channel is deprived of normal sync and receives no sound.

The decoder restores the sync and blanking to the video carrier (45.75 MHz) using the pulses on the 46.75 MHz carrier, and sound is restored by repositioning 46.75 MHz to 41.25 MHz. The restored carriers are converted to a convenient standard channel and delivered to the TV set. The entire decoding process is accomplished without demodulating the sound or video information.

ENCODER

Interconnections between the modulator and the encoder are shown in a general way by figure 2. The encoder is compatible with any modulator that generates standard IF carriers (45.75 MHz video and 41.25 sound) and converts these carriers to the output channel.

Video is connected directly to the encoder but audio is connected to the modulator where it frequency modulates the sound carrier in the normal way. The FM 41.25 MHz carrier from the modulator is diverted to the encoder.

The encoder does three things:

- -it generates gray blank video
- -it converts 41.25 MHz to 46.75 MHz at the same level
- -it amplitude modulates video restoring pulses at a modulation level of 30% on the 46.75 MHz

In the encode mode the encoder delivers gray blank video and 46.75 MHz to the modulator. The 41.25 MHz carrier is suppressed. In the normal mode the encoder delivers normal video and 41.25 MHz to the modulator and 46.75 MHz is suppressed. In either mode there are just two carriers.

The method of combining carriers for conversion to the output channel depends upon the modulator design. If a single mixer is used the lines carrying 45.75 MHz, 41.25 MHz and 46.75 MHz are combined and go to the mixer. If separate mixers are used for video and sound, the 46.75 MHz line may be combined with either of the other two lines.

Manipulation of signals within the encoder is shown in the block diagram in figure 3 and waveforms that aid in understanding encoder operation appear in figure 4.

Gray Blank Video

Gray blank video is generated in a switching circuit. The input video is clamped on the back porch of blanking to provide a reference voltage to which the gray level can be referred. When suppressing pulses are applied, the switching circuit output switches to the gray level. The color reference burst is superimposed on the gray level.

Figure 4 shows several lines of normal video, suppressing pulses and gray blank video starting just before field 1 and ending just after vertical blanking. The start of field 1 is defined by a whole line between the first equalizing pulse and the preceding horizontal sync pulse. All horizontal retrace intervals and the entire six line interval at the start of the field are gray.

Restoring Signal

The restoring signal, also shown in figure 4, is slightly modified sync that is band limited to 200 KHz before it is amplitude modulated on the 46.75 MHz carrier. Aside from band limiting, the difference between the restoring signal and sync is that the three half-line equalizing pulses following vertical sync are not present in the restoring signal. These pulses are left in the video as part of the gray blank video signal.

The band limiting filter delays the restoring signal and further delay occurs in the narrow band circuits in the decoder. To compensate for these delays the encoder advances the restoring signals approximately five microseconds with respect to the suppressing signals.

Front Panel Controls

There are three adjustments to assist in setting up gray blank video. They control the suppressing pulse width, suppressing pulse position and gray level, respectively. A video gain control is provided to set the depth of modulation.

The functional mode of the encoder is controlled by a three-station pushbutton switch. One station selects the normal mode, another the encoded mode and the third switches power off. Indicator lights display the selected operating mode.

DECODER

The decoder operates on signals in the standard television IF band, 41 MHz to 47 MHz, so it is necessary to convert the encoded channel to that band before decoding. After decoding, the restored channel is converted to a standard VHF channel and delivered to the antenna terminals of the TV set. If more than one channel is encoded, the same decoding circuits are used, but a tuner is required to convert each encoded channel to the 41 MHz - 47 MHz band. The output conversion remains the same regardless of the number of encoded channels or their frequencies.

Video Restoring

Figure 5 shows a block diagram of the decoder and figure 6 shows some waveforms that aid in understanding how the video is restored.

The augmenter is a three level RF switch, i.e. a circuit that can be switched to any one of two higher gain (or lower loss) states from a given reference state. If the gain is increased by 4.7 Db, the gray level will become the blanking level and an increase of 7.2 Db results in the sync level.

Two sets of pulses are applied to the augmenter to restore the blanking and sync levels, respectively. The pulses are derived from the restoring signal that is amplitude modulated on the 46.75 MHz carrier. After demodulation the restoring signal passes through a 0-200 KHz filter. Sync is made by clipping and squaring the restoring signal and blanking is made by stretching sync.

The restored video has a front porch that remains gray. Since the front porch occurs before retrace, it is not visible. If the receiver were underscanned, it would show as a gray, rather than black, border on the right hand side of the picture. The gray front porch is just as effective as black as a guard band, preventing the video content from affecting the position of sync in the sync separator circuits.

The color burst is keyed up to the blanking level and its amplitude increases as a result of augmenting. Anticipating this, the color burst is reduced in amplitude in the encoded video.

The bandwidth of the augmenter is 4.2 MHz and there are traps for 46.75 MHz and for adjacent high channel video, 39.75 MHz.

Sound Restoring

A simple heterodyne operation with a 5.5 MHz oscillator is all that is required to move the 46.75 MHz carrier to 41.25 MHz. The 5.5 MHz oscillator is crystal controlled to provide an accuracy of 550 Hz to the repositioned carrier. Tuned circuits in the output of the sound mixer reject 46.75 MHz.

Functional Integration

The decoder shown in figure 5 may be considered as a component that can be integrated with other equipment in a subscriber's home. For example, a decoding module could be built into a converter to provide a very attractive combination. The augmenter is on at all times and functions as an amplifier: The remaining circuits are tuned on for decoding only. A program is now under way to put a decoder module in the Gamut 26 converter manufactured by Oak Electro/Netics.

Another attractive possibility is a transponder with a decoding module. In addition to its other functions, the transponder could also sense when the decoder is on.

SYSTEM CONSIDERATIONS

Security

The security of the EnDe-Code system is adequate to block a number of possible approaches to unauthorized reception:

1. No adjustment of the television receiver can possibly restore the picture or the sound.

2. No commercially available standard equipment can be purchased to decode picture or sound.

3. Although the bill of material is simple, the construction and alignment of the decoder from a kit of parts requires sophisticated equipment and considerable electronic skill.

4. The proprietary nature of the system is an effective deterrent to unauthorized manufacture and distribution of decoders.

Interference

It is essential that adjacent channel interference from an encoded channel to a normal channel, from a normal channel to an encoded channel or between encoded channels should not be greater than that between normal channels.

One general observation can be made. A carrier modulated with gray blank video has a peak power that is limited to the black level which is about 3Db less than sync. On the average it is much lower than that because video signals rarely have sustained intervals of black.

As a result, encoded video carriers will interfere much less with adjacent channels than carriers modulated with normal video. For the same reason, encoded video carriers will contribute less to intermodulation and beats.

In figure 7, the positions of the carriers in four adjacent channels are shown. Two of the channels are encoded and two are normal. The case that appears to have the greatest potential for mutual interference involves an encoded channel and a lower adjacent normal channel because the sound carriers are only 0.5 MHz apart. That case will be discussed in some detail.

Consider first the effect of the normal sound carrier on the encoded channel. In the decoder, the 46.75 MHz amplifier must reject the adjacent sound carrier which appears at 47.25 MHz. Failure to reject 47.25 MHz will result in a 0.5 MHz beat on the restoring pulses. The design of the decoder is such that if the beat is smaller than the restoring pulses, sync will not be affected because the 200 KHz band limiting filter is adequate to remove it, after detection. Since the 47.25 MHz and 46.75 MHz carriers are about equal in level on the cable, very little attenuation of 47.25 MHz is required.

A more subtle, but far more serious possibility results from an undesired output in the sound mixer. The 47.25 MHz combines with 5.5 MHz yielding 41.75 MHz. That is just 420 KHz from the color subcarrier. To insure that it will not be visible requires that it be 40 Db below the video. Since it is 15 Db lower on the cable, the decoder must provide 25 Db of attenuation, which is well within its capability.

Consider next the effect of the encoded sound carrier on the normal channel. The sound in the normal channel will not be affected because the 4.5 MHz sound IF in the TV set can easily reject a signal of equal level that is 0.5 MHz away. To be sure that a visible beat does not appear the encoded sound must be no greater than -8 Db with respect to the video carrier in the normal channel, and the encoded sound satisfies that requirement.

Compatability with Existing Systems

EnDe-Code can be applied to any television channel and all the required signals are transmitted within that channel. This is why it can be installed in any CATV system without changing any hardware from the head end to the subscriber's matching transformers.

Cost

The cost of the decoder is clearly the most important element of the EnDe-Code system cost. The design was guided by the principle that manipulating video and sound signals on modulated carriers and at low level is simpler, less expensive and gives better results than manipulations that require demodulation. The decoder is low in cost because of success in adhering to that principle.

CONCLUSION

EnDe-Code, a low cost system of encoding and decoding television signals in CATV has been described.

It has been shown that it can be applied to any channel, standard or non-standard, to any number of channels and that a channel is readily switched between normal and encoded service in seconds.

It has also been shown that EnDe-Code does not interfere with normal CATV service or require any changes to the CATV system other than installation of encoders and decoders.

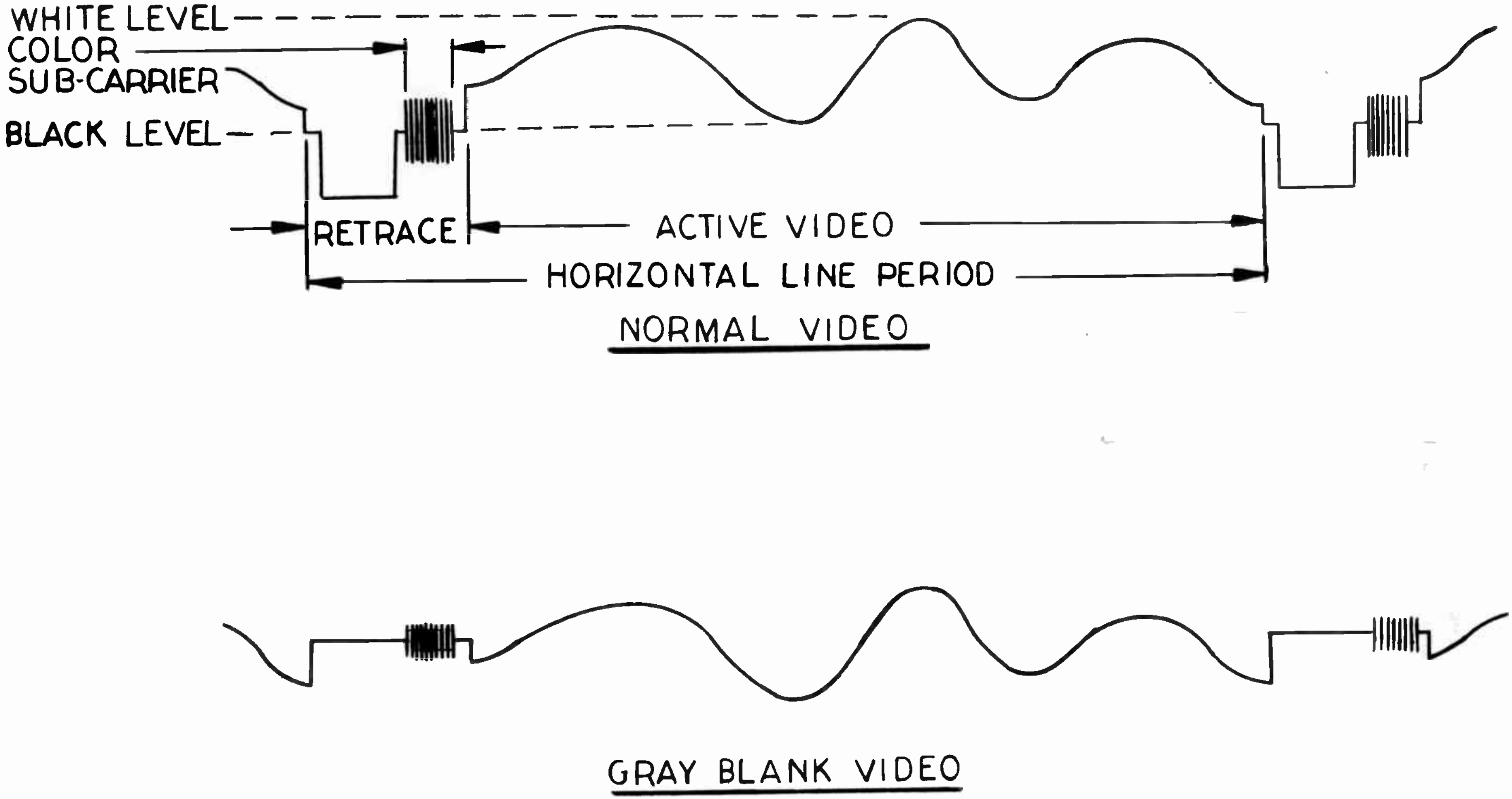


FIGURE 1- VIDEO WAVEFORMS

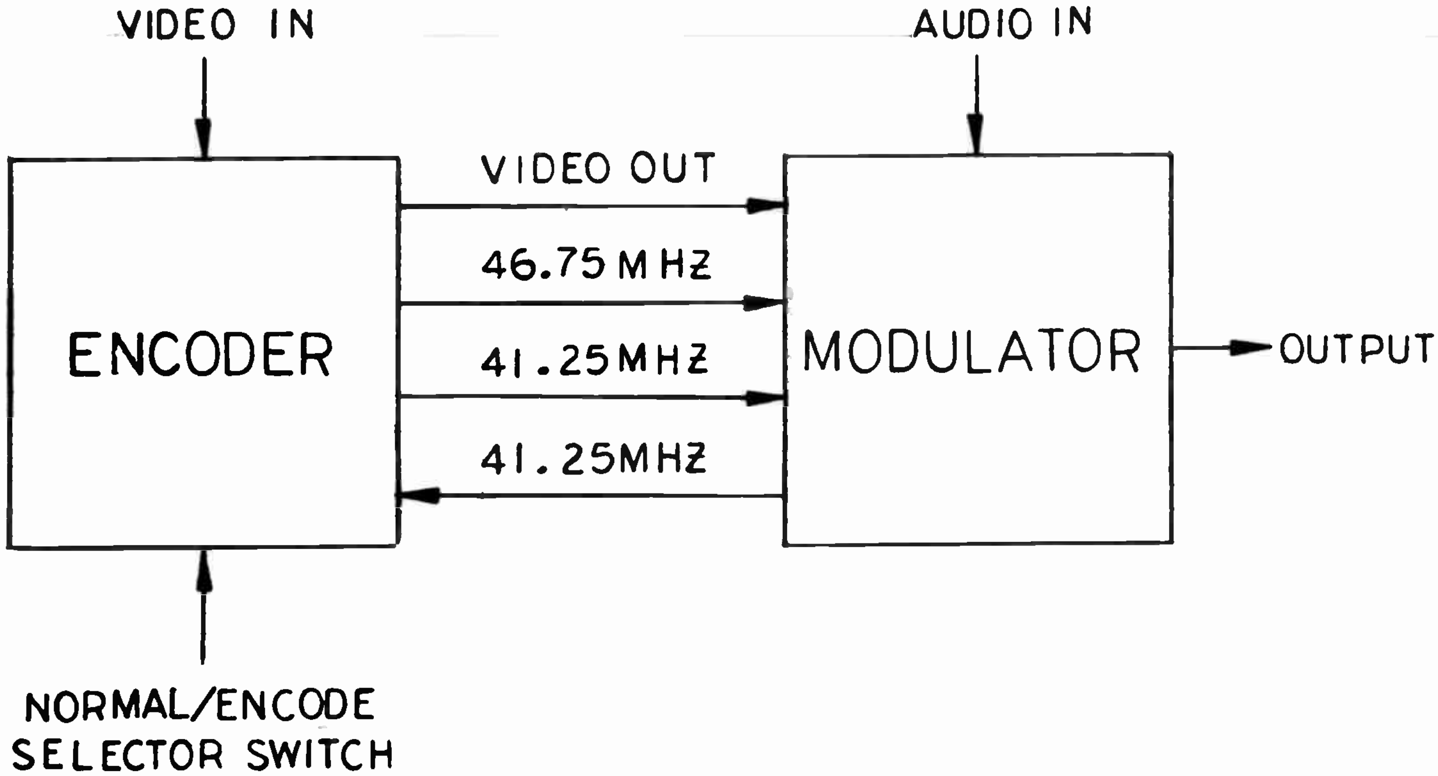


FIGURE 2-INTERCONNECTIONS BETWEEN ENCODER & MODULATOR

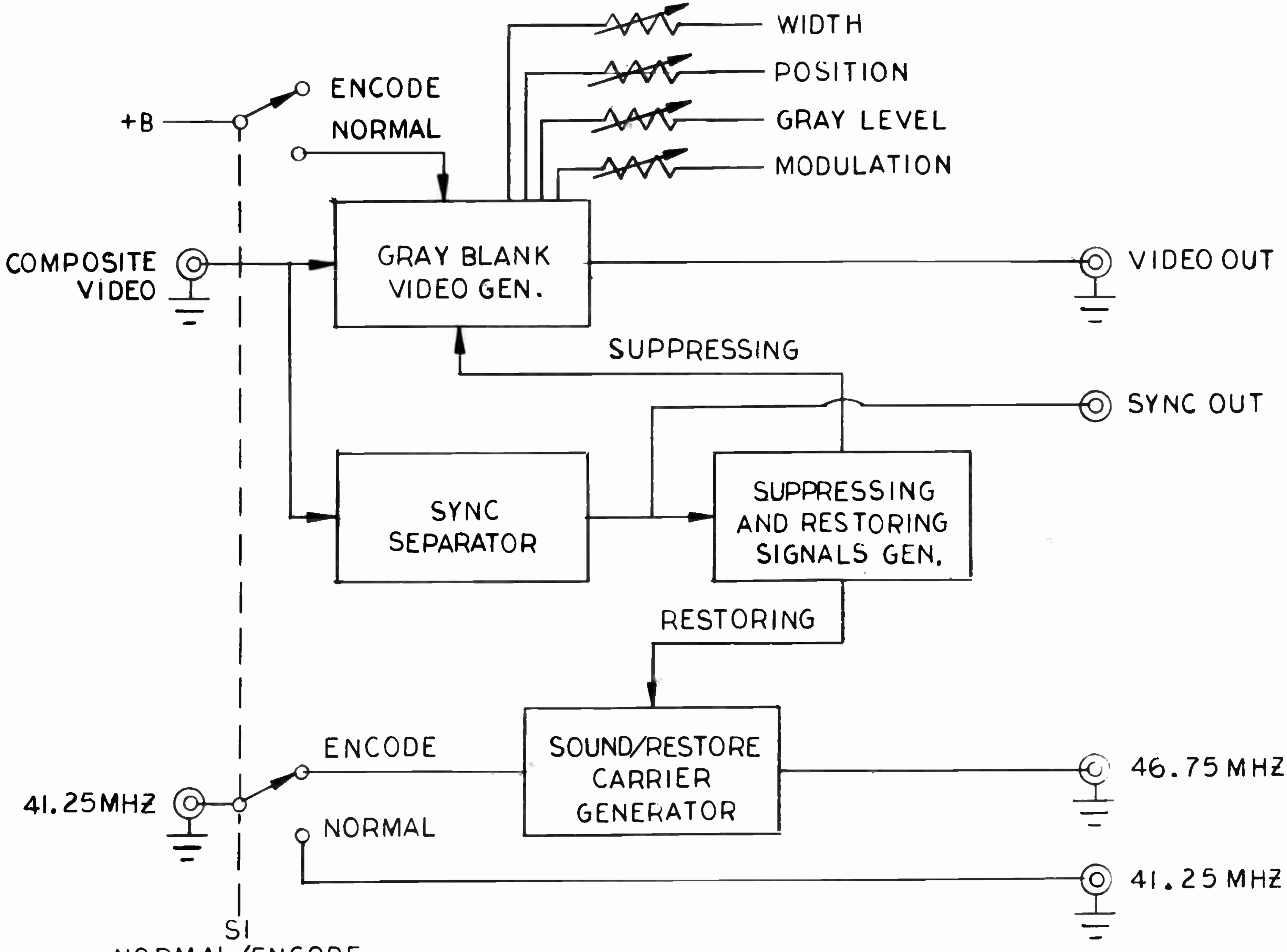


FIGURE 3
BLOCK DIAGRAM OF ENCODER

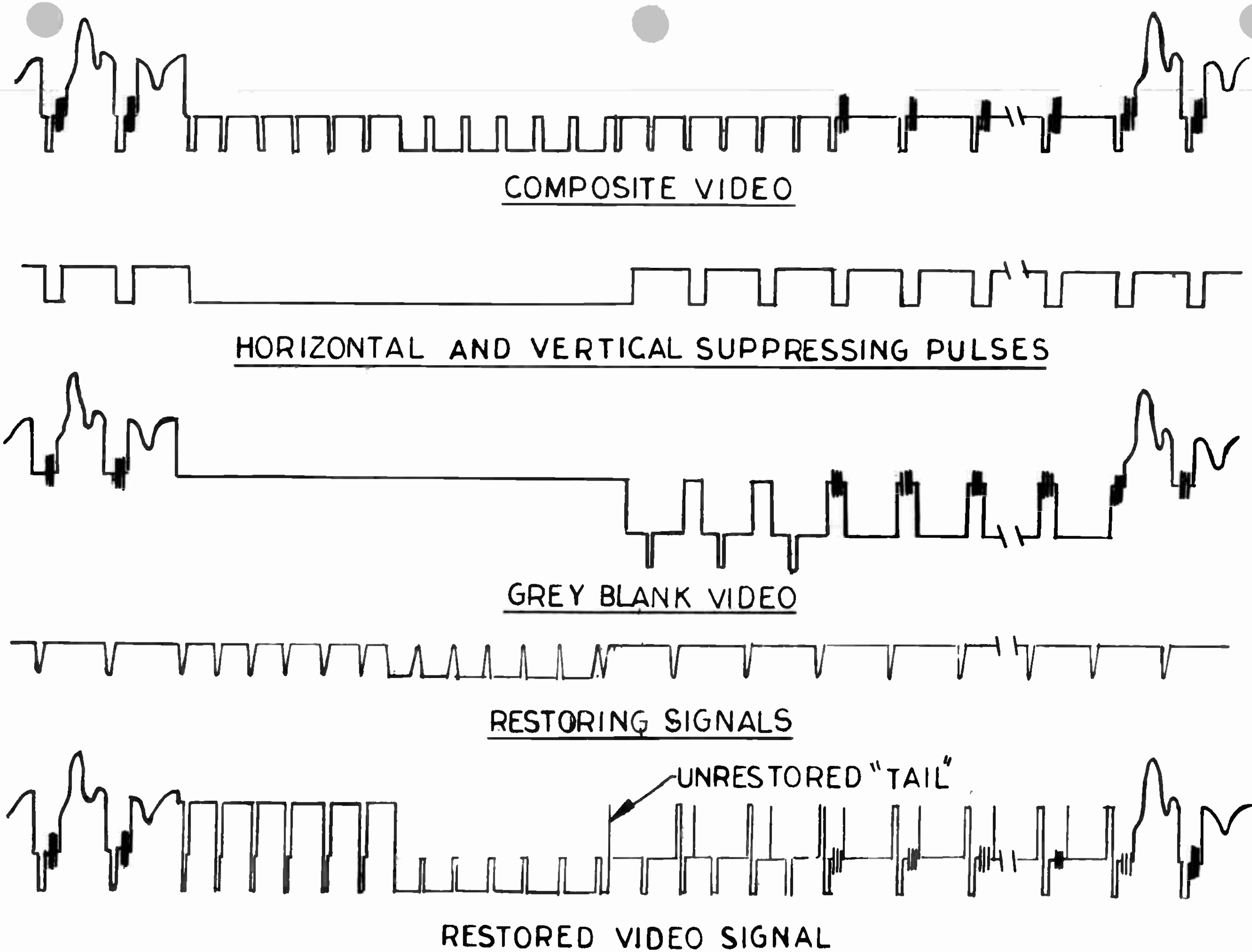


FIGURE 4 - WAVEFORMS

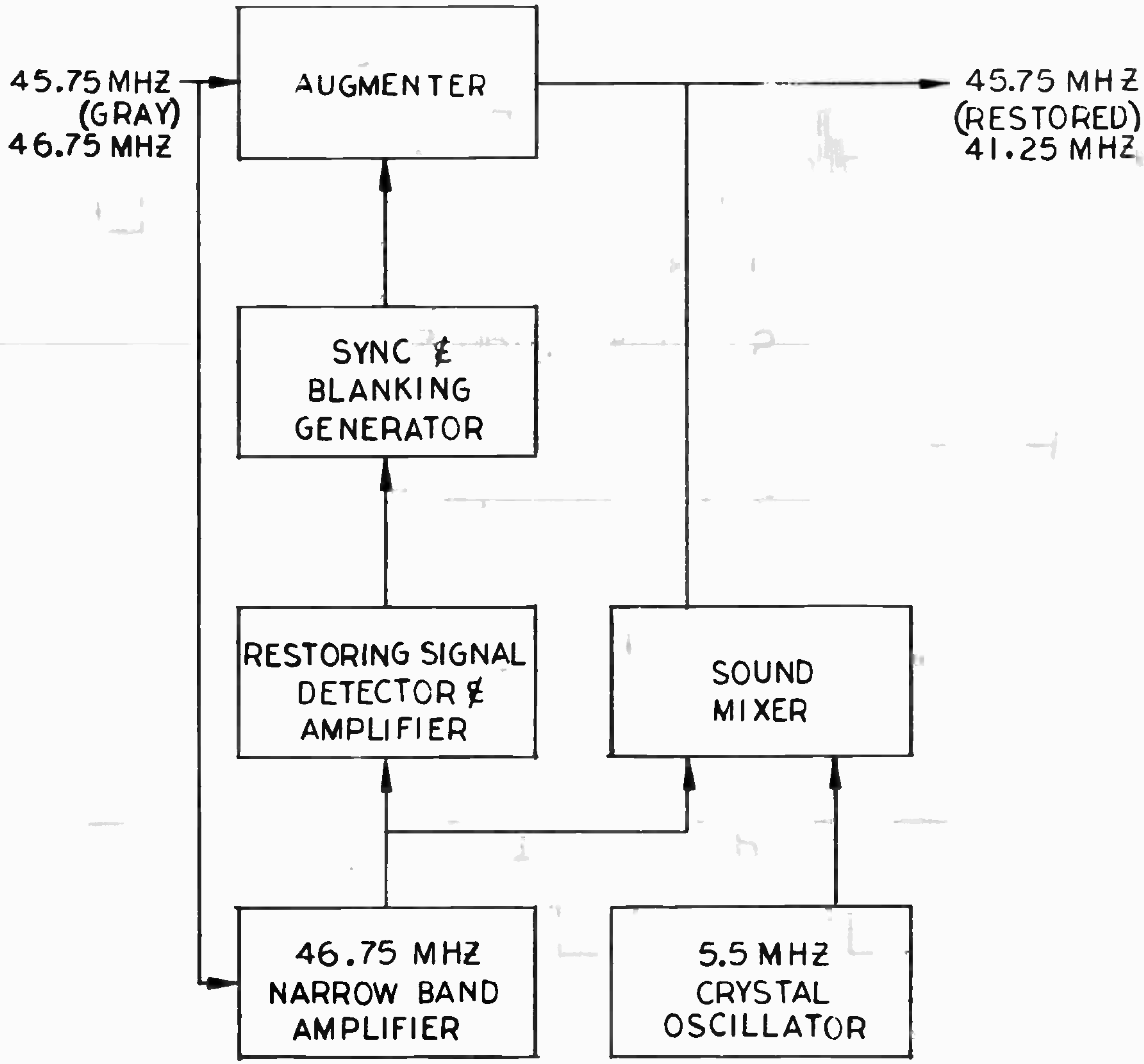
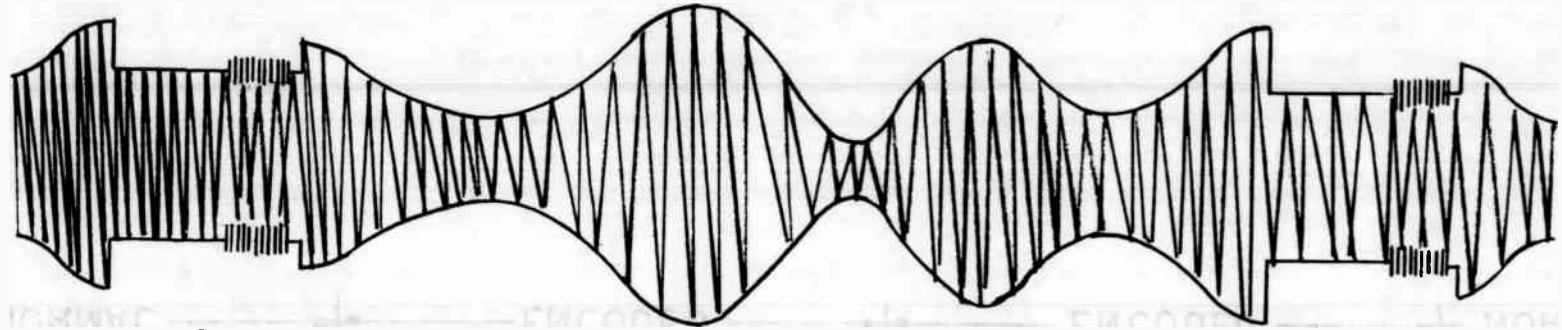
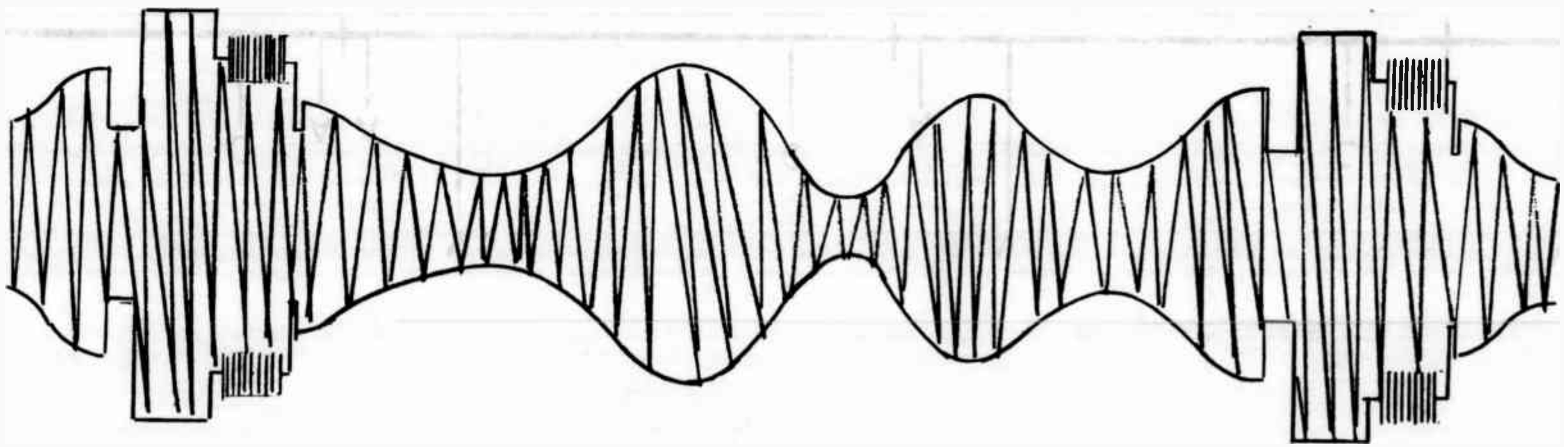


FIGURE 5
BLOCK DIAGRAM-DECODER



GREY BLANK VIDEO MODULATED ON AN IF CARRIER



RECONSTITUTED COMPOSITE VIDEO SIGNAL ON AN IF CARRIER

FIGURE 6-VIDEO WAVEFORMS

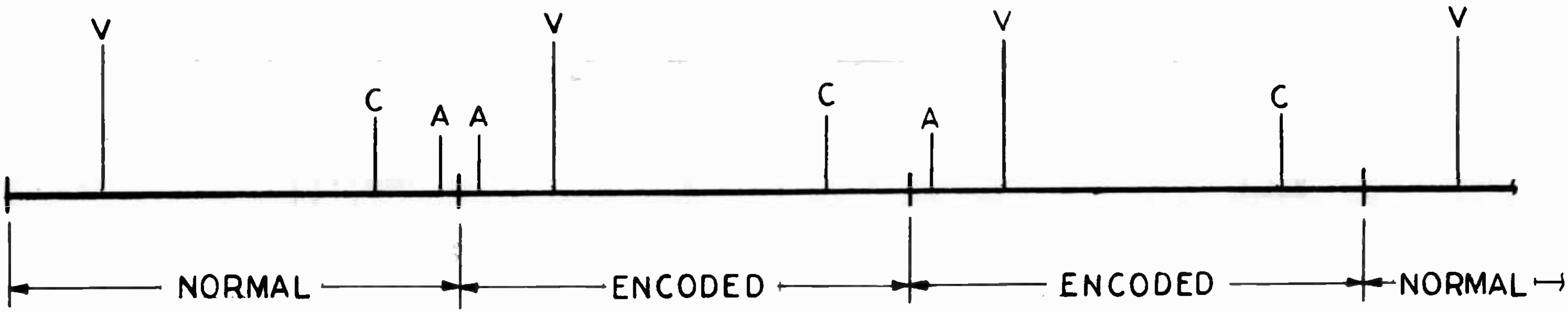


FIGURE 7-POSITION OF CARRIERS

ABSTRACT

CATV ANCILLARY SERVICES

H. J. Moeller
EDC Company
Hatboro, Pennsylvania

The paper provides a description of future services to be offered, including telemetry circuits, secured closed circuits and communications channels and the basis upon which such services will be available.

Current state-of-the-art of terminal devices are presented in a definitive manner relating to services that will either simplify everyday social and economic activities and/or contributions to the entertainment and cultural needs of the subscriber. A base for broadband communications services in 1972, 1975 and 1980 are presented along with projected economics, hardware and software considerations.

THE SUBSCRIBER RESPONSE SYSTEM

R. T. CALLAIS AND E. W. DURFEE
HUGHES AIRCRAFT COMPANY

The Need

Communication between individuals or groups in today's world takes place in a variety of ways, each of which involves a particular medium. Many of our habit patterns and our general way of life are strongly affected by the communications media to which we are exposed to or choose to use.

The well-known mass communications media include radio, television, telephone, motion pictures, correspondence (mail), newspapers, and large circulation magazines. With the exceptions of the telephone and mail, these media are largely one-way communications systems from which the general public, may receive information but cannot readily communicate back in the same medium.

One-way communication media have serious drawbacks for those on both ends. The receiver cannot make his individual opinions and needs known without resorting to another medium. And the originator does not have access to those opinions and needs which could be exceedingly valuable. A two-way mass communication medium would, in contrast, not only allow the receiver to express his views, and possibly get what he wants, it also allows the originator to modify his operation for whatever effect he chooses.

The presently available two-way media (mail and telephone) have serious shortcomings for mass communication. The traditional distribution system for mail is slow and expensive, particularly where mass distribution is required; and the telephone is much better suited to communication between individuals than to mass communications.

The public is at a considerable disadvantage under a unidirectional mass communications system. The medium constrains the public to act in essentially a passive role. Reactions and responses to the "downstream" information are either absent, indirect or must get back "upstream" via telephone or mail, with the penalties noted. As a consequence, only a very small percentage of any mass audience responds in any detectable way, and it is extremely costly and time consuming to obtain anything like a precise determination of response.

The reaction of the public to advertising, entertainment, sports or other types of programming is ascertained presently by very limited surveys conducted after the fact. It is consequently difficult for private corporations or governmental agencies to know what the public accepts, rejects, or is willing to purchase until the acid tests of sample polls, sales reports or vote tabulations reveal the facts. Even reasonably rapid responses are not generally possible, and the validity of extending the results from selected population samples to the entire public may be questionable.

The explosive expansion of the freeway system and the wide acceptance of air travel has resulted in a complete change in business and social habits. It is commonplace for a businessman to fly cross country for a short meeting - whereas in earlier times the business would have been conducted by letter or telephone. In a similar manner, the housewife makes use of her automobile to travel relatively long distances for food and other shopping services.

Increasing public interest on the effects of pollution as well as the growing inconveniences due to congestion in the airways and freeways may well augur another change in life style, particularly if an acceptable substitute can be found. The key to a new life style could well be an adaptive two-way communication system in which people could perform a greater portion of their work, make more of their purchases and receive even more of their entertainment without leaving their homes or offices.

Another universal need which is not adequately satisfied by current media is emergency communication of medical, fire, intrusion, and other alarms to the proper agency without delay and at a reasonable cost.

Other examples could be cited in which presently available communication methods do not adequately satisfy human needs. Even more disturbing is the realization that technological limitations inherent in the present media not only prevent resolution of these difficulties and shortcomings but also allow for little foreseeable growth to answer needs which have been clearly recognized by both government and industry alike. Moreover, such communications requirements will in fact constitute the very corner stone upon which the life styles in this and future decades will be based. In its response to the F.C.C., (Docket #18397 - The Future of Broadband Communications) the IED/EIA stated that "--- The mushrooming growth in available information and the demands for access to this information is bringing about a revolution in communications which will produce a profound change in the very way society is structured and in the way we live."

The need, concisely stated, is for a widely available, broadband, two-way communications system that can rapidly handle large amounts of information in both directions. In other words, a mass communication system that can actually be used by the masses. It need not compete destructively with existing media but could, complement the impressive communication services we already enjoy.

Such a system would have to meet the present and emerging needs for sound, pictorial, and data transmission and allow for undefined future growth by economically viable modular expansion.

The Means

Cable television, the one-time stepchild of broadcast television, now appears as the leading candidate to solve the major communication needs cited. Here again the IED/EIA states that, "The terms "CATV" for Community-antenna television and "CTV" for cable television fail to do justice to the potential of the medium." The great natural assets of CATV is that its facilities are either in now or are planned and the new two-way services can be provided requiring only a relatively small incremental unit investment. Further, it can be expected that the additional revenues resulting from both these new services and associated increased market penetration will provide the system operator with greater financial resources necessary to keep pace with anticipated growth demands. The 300 MHz electromagnetic spectrum contained within the radiation-tight cable does not violate free space as does the emanations of off-the-air television. Once having exhausted the initial 300 MHz capacity to meet present needs, additional 300 MHz bandwidth units can be added by the expedient of additional small diameter coaxial cables.

The technology for installing a cable system is similar to that now providing universal telephone and power service to the entire country. It requires no technological breakthrough to conceptually substitute coaxial cable for wire and visualize a nation wired for broadband cable service limited only by customer demand. The next logical step is the expansion of such a service into two way operation.

Two-way use of cable television is already technological feasible: either by simply utilizing separate downstream and upstream cables or by simultaneous bi-directional signalling on a single cable with frequency multiplexing and two-way amplifiers and filters.

Viewed broadly, therefore, the solution to interactive, universal communication is in hand. There remains however, the choice of a specific implementation: the selection of a specific sub-technology to accomplish this two-way communication. But this is really a second priority decision. The first requirement is to define what the system is to do in a market which has not yet been proven. Which of the inadequacies of the present media and which of the foreseen needs should be addressed first in the choice of system design parameters and techniques?

Another fundamental question is that of design obsolescence. Should considerations of low cost installations in this fledgling market override the risk of relatively early obsolescence as public acceptance and usage grow rapidly? Or should a system be devised wherein growth capability and modular expansion are integral parts of the design plan.

Recognizing the uncertainties of customer acceptance and the time span required to fully exploit the services offered, Hughes has elected to approach the problem from a systems viewpoint. We have, designed a complete two-way communications system rather than a single device or service.

The total system approach has produced a design that can grow to meet the long term goals and does not attempt to prejudge the relative value or eventual marketability of services to be offered.

The System

The Subscriber Response System (SRS) is designed to permit the cable system operator to add two-way communication capability with a modest initial investment and yet be able to expand in a modular fashion as the number of subscribers, the traffic, and the demand for additional services increase - all without obsolescence of previously installed equipment.

The Subscriber Response System is shown in Figure 1 incorporated into a typical CATV system. The two-way communications take place between a computer complex termed the "Local Processing Center" (LPC) and the Subscriber Terminals located in the subscribers' residences or places of business. The LPC equipment shown in Figure 2 can be located at the Head End, at the Local Origination Studio, or remotely from the local CATV system.

Depending on the choice of location, signals between the LPC and the Head End are fed by cable or microwave relay. At the Head End, the downstream SRS signal is frequency multiplexed with the normal CATV video spectrum and sent downstream through the cable network, including the existing trunk and distribution system.

At the subscriber's home or business location, the composite signal at the normal drop line cable is routed to the Modem Unit of the Subscriber Terminal shown in Figure 3.

The Modem frequency converts a 26 channel TV spectrum and furnishes a fixed frequency signal to the TV set, normally channel 8 or 12, thus eliminating a separate frequency converter. The Modem performs all of the radio frequency modulation and demodulation and most of the digital signal processing required at the Subscriber Terminal. It also furnishes the interface for all accessories used in the system. The Modem requires no operating controls and is designed for installation at an unobtrusive location, nominally behind the TV set.

All operating controls for the terminal are located at the Subscriber's Console shown in Figure 4. The Console is interconnected to the Modem by a small diameter cable which allows approximately 50 feet separation between the units depending on the installation requirements at the subscriber's location.

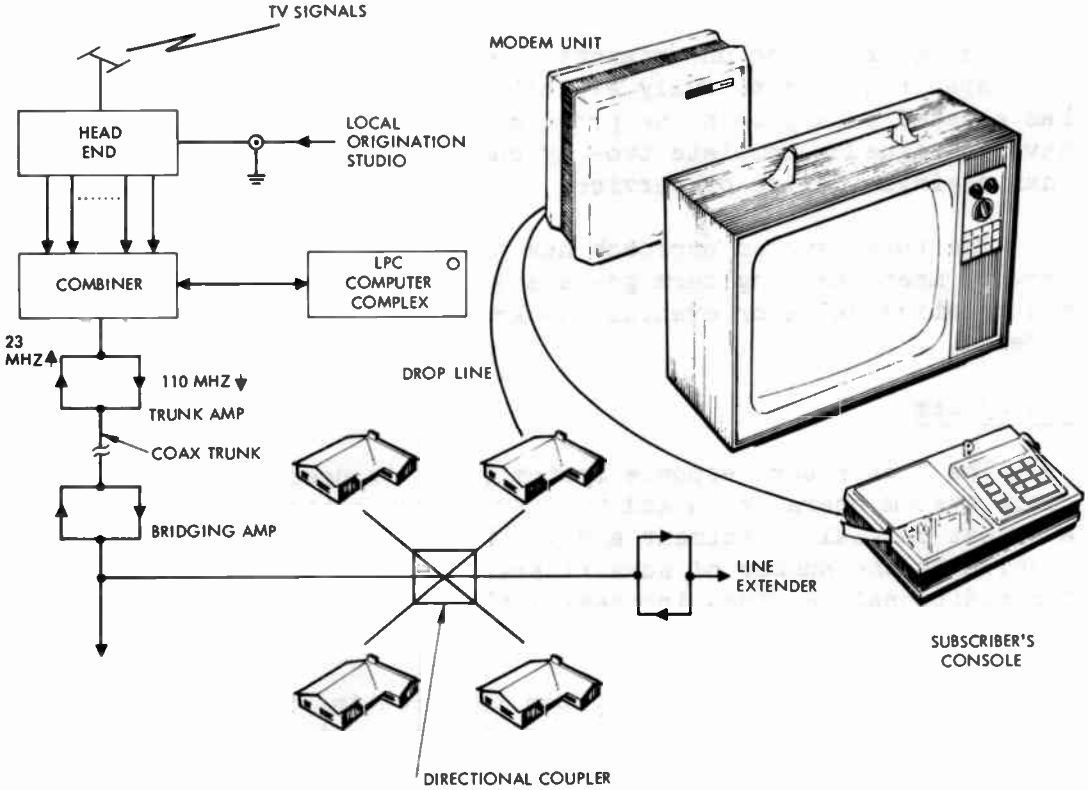


Figure 1. Overall CATV Two-Way System

Figure 2. SRS Local Processing Center

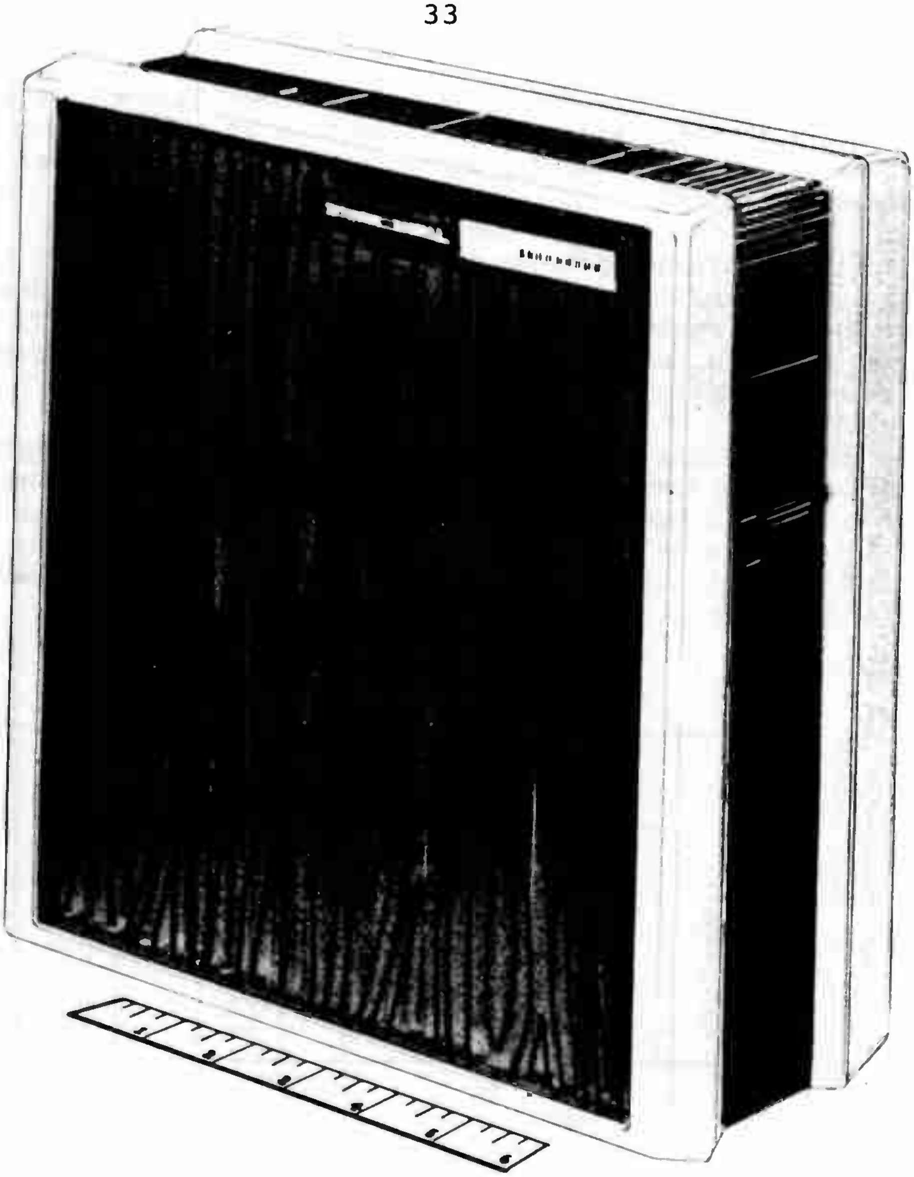


Figure 3. SRS Subscriber Terminal Modem

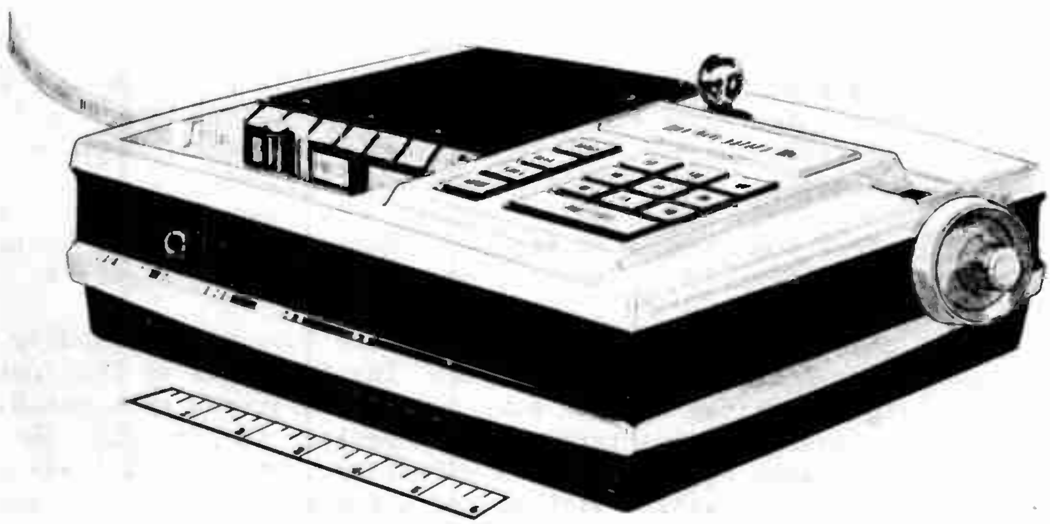


Figure 4. SRS Subscriber Terminal Subscribers' Console

In addition to a TV Channel Selector Switch the Console contains a keyboard and a small strip printer allowing the subscriber to engage in two-way communications with the Local Processing Center.

Communications upstream from the Subscriber Terminal to the Local Processing Center are transmitted back from the Modem either over the same cable network with suitable upstream amplifiers and filter networks to by-pass the existing downstream amplifiers, or over a separate cable in a two cable system.

The resulting spectrum of signals on the cable is shown in Figure 5. The downstream SRS signals occupy a 4 MHz bandwidth from 108 to 112 MHz. The downstream form of communication is digital pulse code modulation (PCM) at a 1 Megabit per second rate. The digital data is then used to frequency shift key (FSK) a 110 MHz carrier.

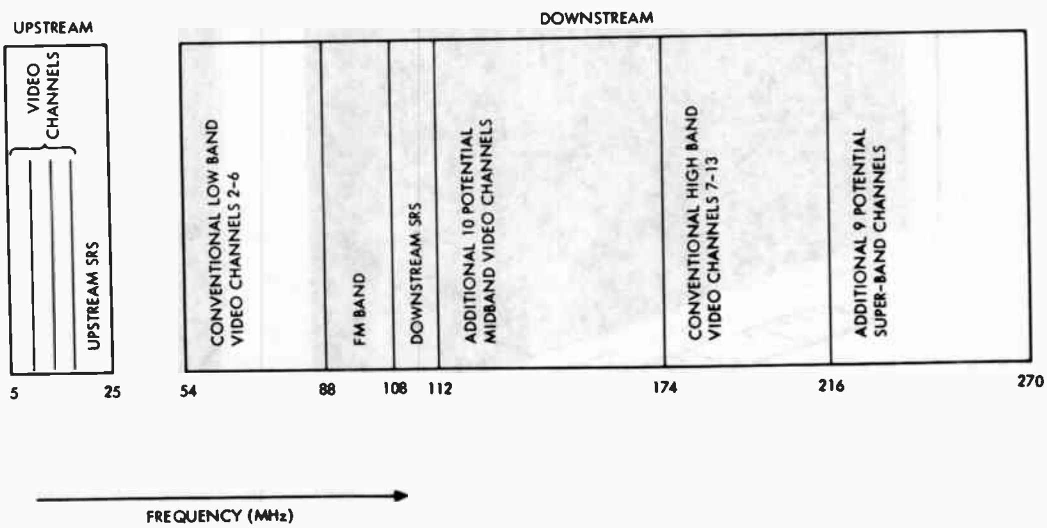


Figure 5. Cable Spectrum Allocation

The upstream signal occupies a 4 MHz bandwidth extending from 21 to 25 MHz. Again the communication is via digital PCM at a data rate of 1 Megabit per second. In this case the digital data is used to phase-shift key (PSK) a 23 MHz carrier.

A typical communications sequence that illustrates the basic principles of operation of the SRS system is shown in Figure 6.

All communications are initiated in the Subscriber Response System at the Local Processing Center. The LPC sends an interrogation message addressed to each subscriber in sequence at a periodic rate. The meaning of the interrogation message is basically the query "Do you have requests?" The Subscriber Terminal will always reply to the interrogation with any of a number of possible requests or statements. The subscriber's replies will be sent upstream

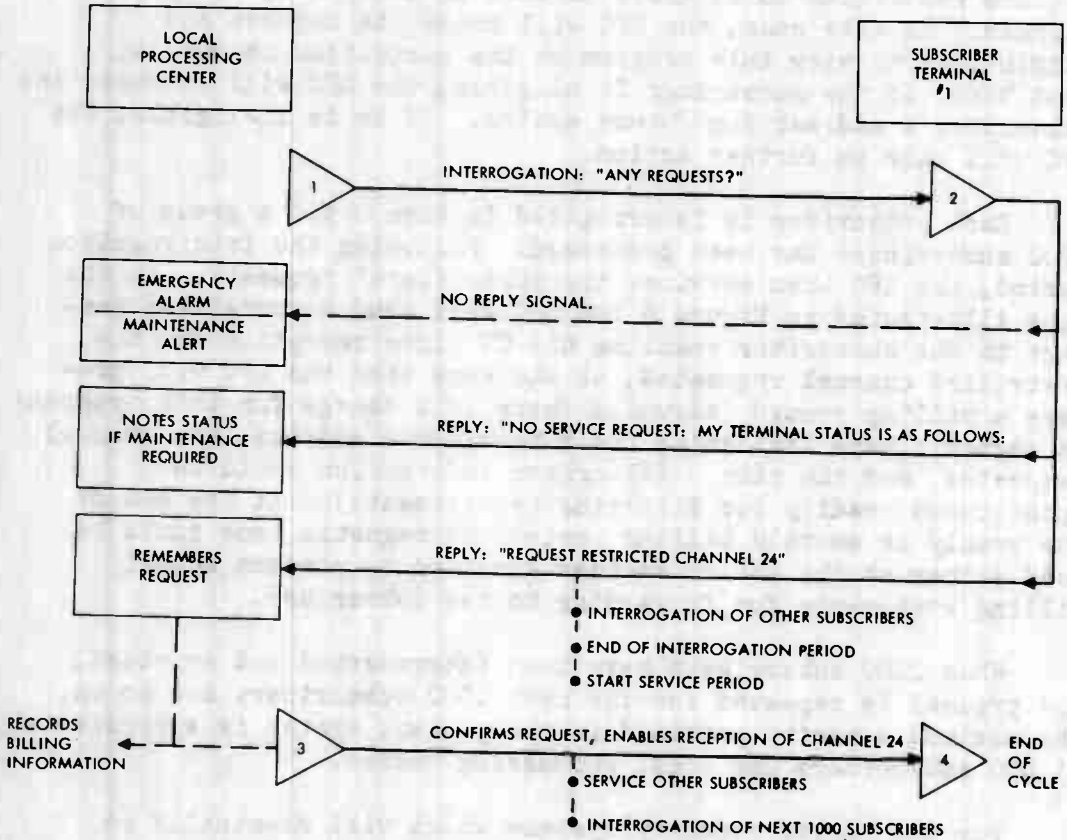


Figure 6. Typical SRS Communications Sequence

bearing the subscriber's address followed by a number of bits devoted to the content of the message. The absence of a return signal from the subscriber will indicate either a physical break in the cable path to his location or a defective Subscriber Terminal. The Local Processing Center will recognize the absence of an expected signal and take appropriate automatic action: it will post a maintenance alert for service personnel and will also flag a potential emergency alarm to cognizant police or protection agencies when such service is requested.

If a particular subscriber has initiated no requests when his terminal is interrogated, the terminal will automatically reply, giving a terminal status report. The terminal status report will indicate the state of the terminal with regard to proper functioning of the terminal circuitry, the condition of accessory devices, and other diagnostic information. The LPC will note the terminal status and take appropriate action.

When a subscriber has initiated a prior request his reply to an interrogation will indicate his address and the particular request, rather than the terminal status report. In the example shown in Figure 6, he requests permission to view a "restricted channel", which might be programmed at that time for a medical lecture restricted to eligible doctors or other eligible professionals. In this case, the LPC will check his request and eligibility to view this program on the particular channel at that time. If the subscriber is eligible, the LPC will remember the subscriber's address for future action. If he is ineligible, the LPC will take no further action.

Each subscriber is interrogated in turn until a group of 1000 subscribers has been processed. Following the interrogation period, the LPC then services the subscribers' requests. In the case illustrated in Figure 6 the LPC will send a downstream message to the subscriber enabling his TV video reception for the restricted channel requested; at the same time the LPC will prepare a billing record (assuming there is a charge for this program) on magnetic tape indicating the subscriber's address, the channel requested, and the time. (Alternate information could be substituted readily for differing requirements). At the end of the weekly or monthly billing period the magnetic tape could be used either at the LPC or another location to prepare actual billing statements for forwarding to the subscriber.

When 1000 subscribers have been interrogated and serviced, the process is repeated for the next 1000 subscribers and so on. The maximum capacity provided in the present system is approximately 65,000 subscribers per Local Processing Center.

For the larger capacity systems which will eventually be required in densely populated metropolitan areas, it may prove more efficient to centralize the Local Processing Center so that it can service a number of Head Ends. The centralized LPC would use a full-sized computer system rather than a minicomputer; it would be a faster unit with greater computing power, more storage capacity, and a greater selection of peripheral devices. Conversely the data handling equipment required at each Head End would be considerably reduced. The central LPC would be interconnected with the Head End two-way data interfaces by cable or microwave relay.

While it was previously stated that the Local Processing Center rather than the subscriber initiated all communication contacts, the communication sequence is so rapid that the subscriber subjective reaction is that he initiates all contacts. Typically for a system of 10,000 active subscribers the time required for a subscriber to receive a reply in response to his manually initiated request (i.e. depressing a key) will be less than 2 seconds, even in the prime times of heavy evening hour traffic.

The SRS system design provides functions necessary to provide a long list of potential services. Even services which appear to be purely visionary at the present time can be provided by later versions of SRS Subscriber Terminals without obsolescence of the earlier terminals or a major redesign of the system.

A listing of services that can be provided by existing designs of the SRS system is shown in Figure 7. As indicated earlier the SRS Console provides remotely controlled channel selection. At the present time, provisions have been included to select 26 possible channels by a voltage-controlled varactor tuner located in the Modem Unit.

- REMOTE CHANNEL SELECTION
- PREMIUM TV
- RESTRICTED TV
- CHANNEL POLLING
- OPINION POLLING
- EMERGENCY ALARMS
- METER READING
- ACCESSORY POWER CONTROL/TIMING
- TWO-WAY MESSAGE CAPABILITY

- SYSTEM DIAGNOSTICS
- SYSTEM CONTROLS
  - MASTER ENABLE/DISABLE
  - TRANSMIT ENABLE/DISABLE
- ERROR RESISTANT TECHNIQUES

Figure 7. SRS Present Services Capability

Six of these channels have been reserved for Premium Television usage, whereby the channel, at the control of the Local Processing Center, may be made available to the subscriber on a fee basis for premium cablecasting such as the showing of first run movies, live dramas, musicals or sporting events. The subscriber is required to indicate by a positive action (depression of a Premium TV key) that he wishes to purchase a program on the channel to which he is tuned. His request is immediately granted by an enabling of the video on his set, and he is automatically billed at the LPC. Provisions have also been included to allow free previewing periods on all Premium channels which can be individually varied in time of occurance and duration by the cable operator.

The restricted channel concept, alluded to earlier, is similar to that of Premium TV. It involves, however, eligibility as an additional requirement. The possible usages are numerous, including use by professional groups and societies, home educational programs, religious or other specialized interest groups, business meetings and home seminars, and adult video programming. Two channels are provided for restricted use in the present SRS design.

Both Premium and restricted channels, however, may be converted back to standard TV channels at any time by control signals from the Local Processing Center.

The restricted channel concept and implementation can be readily extended to include the enabling of groups of channels on a long term or permanent basis. This would allow the cable operator to base monthly rental charges on the number of channels to which the subscriber wishes access.

Channel Polling, somewhat analogous to the well-known Nielson type ratings is provided in the SRS system. In contrast to the limited sampling provided by currently available polling systems, the SRS system can provide polling of all subscribers in a CATV system on a program basis. It can also sample viewer response every few seconds if desired to obtain the response to political announcements, spot commercials, etc. The results of the channel survey can be displayed in a variety of ways. For example, within 5 seconds of the actual survey, a graphics display terminal shown in Figure 8 available as an accessory at the Local Processing Center, can be programmed to produce a histogram, illustrated in Figure 9. A hard copy readout is also available. The demographics of CATV system subscribers can also be correlated with the channel polling results or used to determine selective polling of particular subscribers or groups of subscribers.

Opinion polling in the SRS can range from simple "Yes", "No", or "Undecided" answers to TV video originated questions, to coded replies to more elaborate video or mailed questionnaires. Correlation and display of opinion polling results can be handled as flexibly as the techniques described for channel polling.

Any existing emergency alarm system - fire, intrusion, medical, etc. - can be monitored by the SRS system. The emergency signal is given priority over all other transmission, it is sent by the SRS Modem upstream and notifies the LPC of the address of the subscriber and the time and identification of the alarm or alarms. The LPC verifies the validity of the alarm, by immediate reinterrogations and sends a notification to the proper governmental, medical or protection agency - within seconds after the occurrence. The

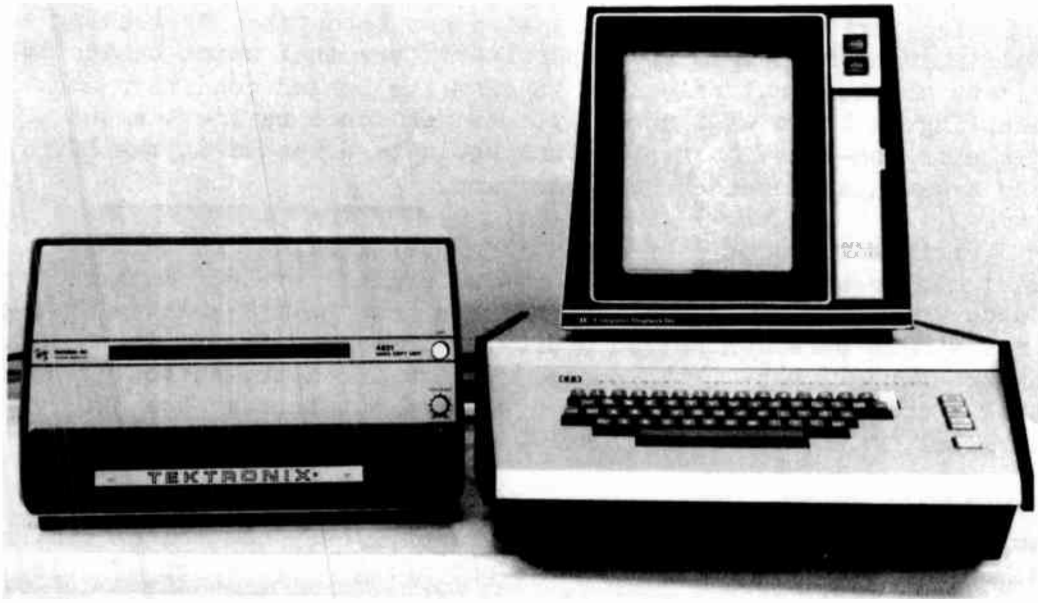


Figure 8. Graphics Display Terminal

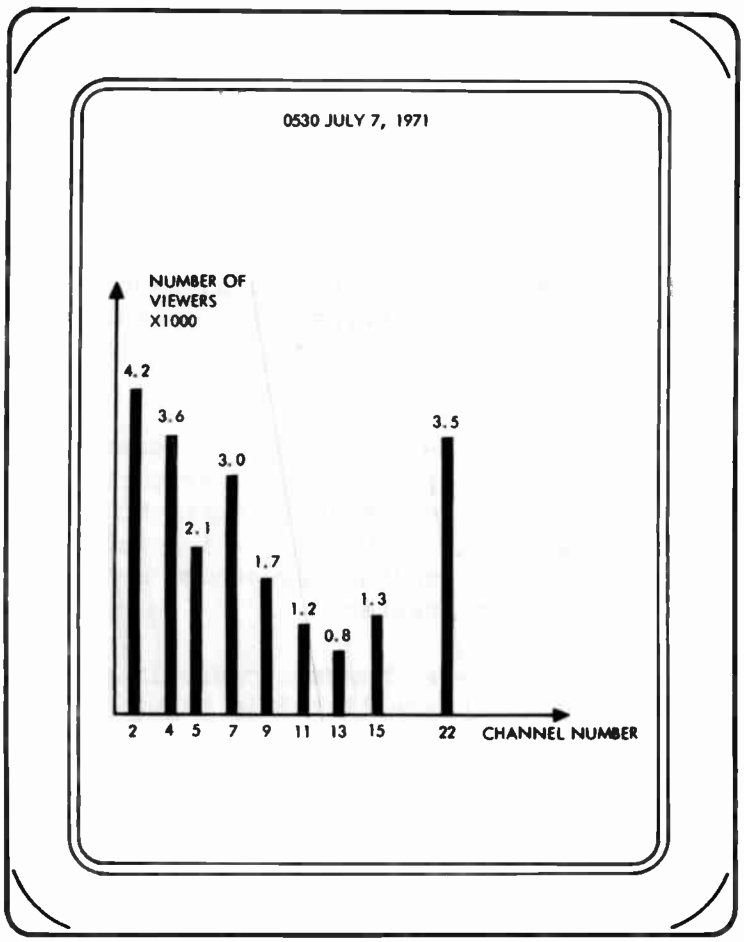


Figure 9. Channel Polling Display

LPC also verifies that proper action has been taken by sending a confirmation signal to the subscriber's terminal which basically resets the terminal releasing it from its locked condition and enabling it to be used normally. As mentioned earlier, a cut cable or non-functioning terminal would be detected at the LPC and treated as an emergency condition.

Various forms of data including meter reading can be automatically read out of the Subscriber Terminal by LPC command. Up to 20 digits per Subscriber Terminal can be transmitted upstream in a single burst which would provide for four-five digit utility meters for example. With an appropriate accessory switching unit, entire apartment dwellings could be read out through one SRS terminal.

By prior arrangement with the Local Processing Center, the subscriber can be provided with accessory power control or timing signals at any desired time. The potential application of this service include the control of power to accessories. For example, a video tape recorder could be turned on automatically to record a desired program. Other uses include wake up alarms, automatic sprinkler systems, and so on.

The SRS system is also provided with a two-way message capability. Upstream messages are initiated by the subscriber at the small numeric keyboard shown in Figure 4. The subscriber may enter messages in groups of up to twenty characters at a time. Assuming the message required more than 20 characters, the "Busy" indicator would light after entering the first 20. With a second or two the "Busy" lamp would be extinguished, indicating the LPC has received the message, and the remainder of the message could then be entered. As the subscriber enters the keyboard data, each character is printed on a half inch paper strip, allowing him to check for errors and providing a permanent hard copy record of purchases or other financial transactions.

Alphanumeric character messages may be transmitted downstream by the LPC, and would also appear on the strip printer. Alternatively, it is planned to offer as an optional accessory at the Subscriber Terminal a paragraph printer which would permit the downstream transmission of lengthy downstream messages at rates of 100 words per minute or greater.

The utilization of two-way message capability has manifold applications, some of which are listed in Figure 10. A full discussion of the applications is beyond the scope of this paper, but the generalized approach involves some form of coding and the insertion into the message of numerical data which specifies the request. The coding required could be furnished by mail in printed catalog form. Naturally occurring numerics such as credit card data, quantities, dates, time of day, etc., could be entered normally. Punctuation marks available from the keyboard would be used to separate logical message groupings for proper interpretation at the Local Processing Center. A typical message sequence using such coding is shown in Figure 11.

- HOME SHOPPING
- EDUCATIONAL INSTRUCTION
- RESERVATION SERVICES
- STOCK MARKET TRANSACTIONS, ORTS
- QUIZ SHOWS
- MAIL/ADVERTISING
- DATA BANK ACCESS

Figure 10. SRS Two-Way Message Capability

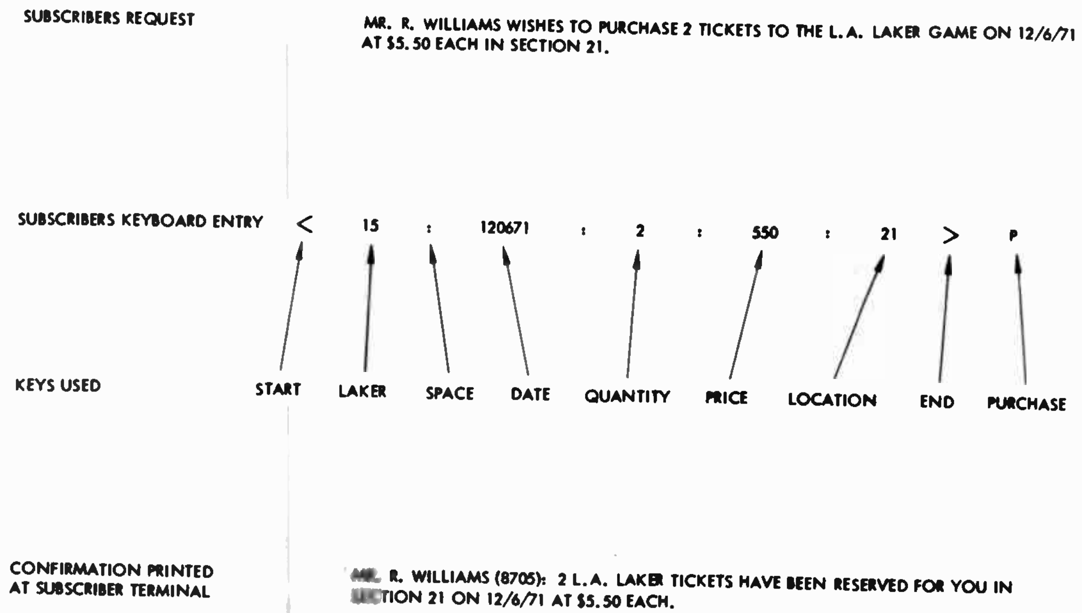


Figure 11 Typical Message Sequence

The discussion of services can be concluded with mention of services which are primarily useful to the CATV system operator, particularly with regard to the maintenance of high reliability of the CATV system.

The system design includes both hardware and software for self diagnosis of system malfunctioning. Provisions, have been included, as previously mentioned to diagnose individual terminal malfunctioning or outages, and cut or defective cables. In addition the terminal can detect and subsequently transmit indications of loss of power, noise bursts, loss of incoming carrier, and downstream parity errors.

The LPC will also detect loss of upstream carrier, noise bursts, power failure, upstream message parity errors, and malfunctioning in the computer and its peripherals. The LPC can also command off the transmitter of any suspected errant subscriber terminal, and can completely disable the terminal if desired for any reason.

Several other error resistant techniques have also been included in the system design which will drastically diminish the probability of error. Among these are dual transmission of all infrequent commands and the requirement for confirmational commands from the LPC to the terminal to indicate the satisfactory completion of particular message sequences.

Two models of the Subscriber Terminal have been planned at the present time. In addition to the SRS-102 model shown previously, a simpler, lower cost version, the SRS-101, is available without the strip printer and associated electronics. This model, shown in Figure 12, has four keys rather than the full keyboard furnished with Model SRS-102. The keys provided will enable purchase of Premium and Restricted TV, opinion polling, and TV shopping with a more limited coding capability. TV Channel Selection is of course retained in this model, and the Modem Unit remains substantially the same as in Model SRS-102. With the exception of the printer deletion, and reduced keyboard size, the SRS-101 can provide all other functions listed in Figure 7. The SRS-101 and SRS-102 are fully compatible and can be used interchangeably in the SRS system.

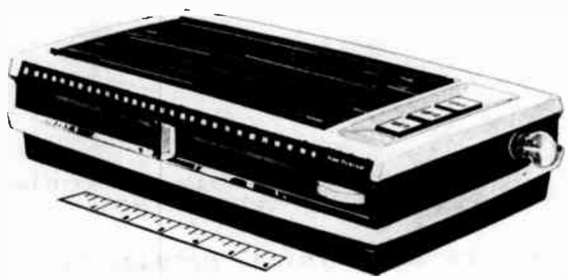


Figure 12. SRS-Model 101 Console

With regard to system growth potential Figure 13 illustrates some of the technically feasible increases in capability which can be modularly added to the SRS as the market demand warrants.

The Hardware

The SRS functional system diagram is shown in Figure 14.

The Local Processing Center described contains a standard PDP-11 mini-computer, including 24K words of core memory and a Model 35 Teletype. An Input-Output Processor has been designed to convert the parallel input-output of the PDP-11 into a serial form for transmission and reception of signals on the cable. For the prototype system the peripheral equipment includes a time of day clock, a 256 K word disc memory, a 7 track magnetic tape drive unit a card reader and a graphics display terminal together with hard copy readout.

PRESENT MODELS

SRS-101 FUNCTIONAL KEYBOARD

SRS-102 NUMERIC KEYBOARD WITH INTEGRAL STRIP PRINTER

OPTIONAL ACCESSORIES

100 WPM IMPACTLESS PARAGRAPH PRINTER

EMERGENCY ALARM INTERFACE

METER READING INTERFACE

EXTERNAL POWER CONTROL AND TIMER UNIT

POTENTIAL FUTURE CONFIGURATION

SRS-103 ALPHANUMERIC KEYBOARD WITH INTEGRAL PARAGRAPH PRINTER

OPTIONAL ADDITIONAL ACCESSORIES AND FEATURES

FRAME GRABBER

TWO-WAY AUDIO CAPABILITY

MULTI-TV SET CAPABILITY

Figure 13. SRS System Growth Potential

The required type and number of peripheral equipments for operational use will, of course, depend on the nature and number of the services provided, the number of subscribers in the system and the anticipated or actual traffic volume. Modular expansion capability is also provided in the LPC and software design to accommodate such growth situations.

Inputs to the computer can be made by punched cards or paper tape, or by manual operation of the teletypewriter.

The LPC system is designed to operate unattended except for routine maintenance. Manual inputs for special programming can be made by remote teletype interconnection or by use of the Model 35 Teletype at the LPC.

At the Subscriber Terminal, the downstream TV video is separated from the 110 MHz SRS signal and is routed to the varactor tuned frequency converter which furnishes the video input to the TV set. The 110 MHz signal is demodulated and 1 Megabit digital data processed in the Modem Unit to furnish signals to the frequency converter, external accessories or to the Operator's Console depending on the particular message sequence.

Upstream data originates at the Operator's Console, or at the accessory sensors and devices. It is encoded and stored at the Modem to await upstream transmission. In transmission the data is fed to a 23 MHz phase modulator, passed through a low pass filter and on to the subscriber's drop cable.

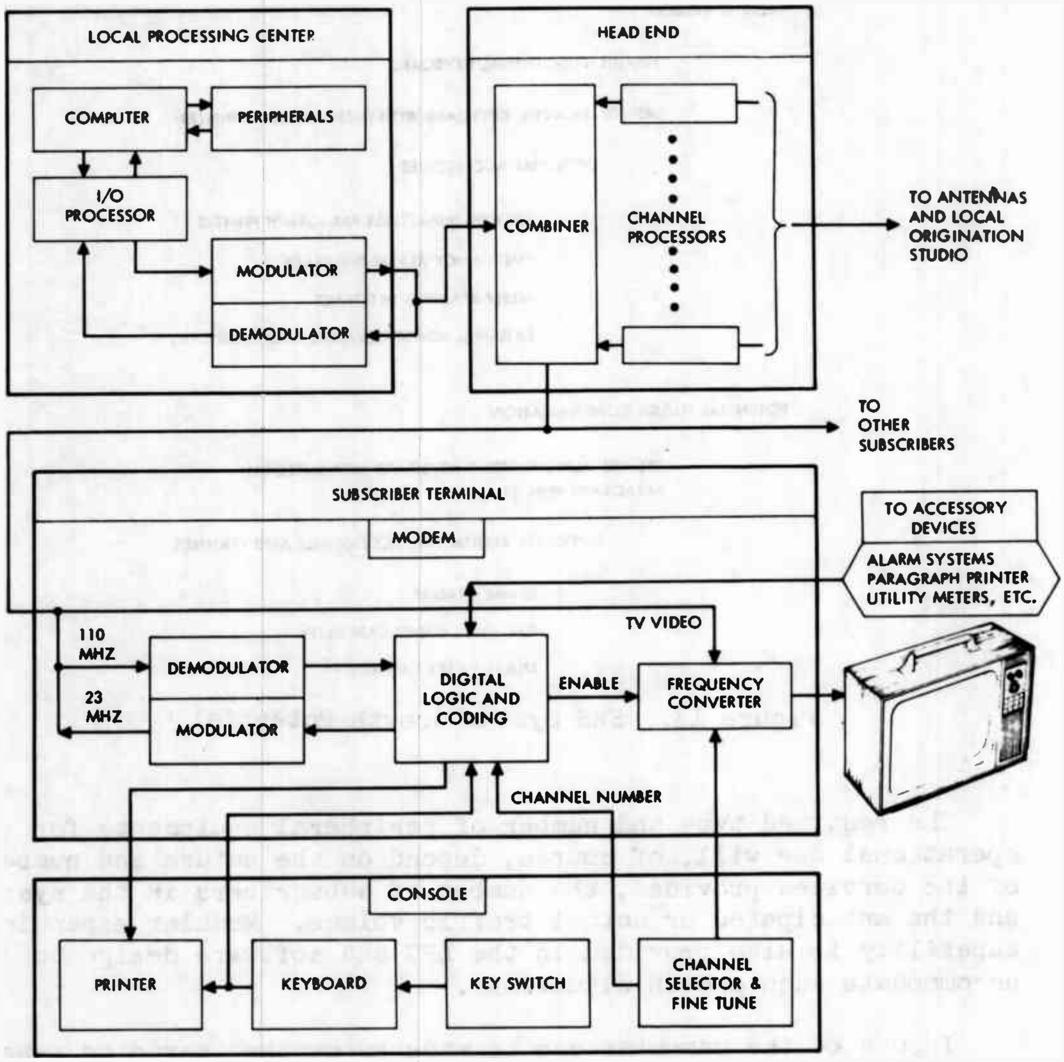


Figure 14. System Functional Block Diagram

Integrated circuitry of the TTL and MOS varieties is used widely in the Prototype Subscriber Terminal. Future plans for large quantity production include the use of large scale integration to further reduce size, cost, and power consumption and to increase system reliability.

Status

Some of the areas of technical concern in the design of any digital data communications system are:

1. A determination of the required bandwidths
2. The required bit error rate.
3. The effects of impulse and other noise forms.

4. The effects of various transmission deviations caused by the cable system and its associated components on system performance.

In designing the SRS system, these concerns were taken into account as were human factors considerations in designing the Subscriber Terminal.

In order to confirm design expectations and to answer questions that can only be resolved by actual trial, a demonstration system was completed early in 1971. This system consisted of a Modem and an Operator's Console shown in Figure 15 and 16. In addition, a small simulator (Figure 17) was designed to produce driving stimuli for the terminal to simulate desired features of the LPC. The demonstration system has been extensively tested both at the Hughes facilities in the Culver City area and on an experimental Tele-Prompter two-way cable system at Los Gatos, California. While this testing is continuing, the results to date have validated the design concept. All of the present system functions described previously herein were successfully demonstrated repeatedly even in the presence of near band burst transmissions in close proximity to the equipment. While measurements are still incomplete bit-error rates appear to be in the 10^{-6} to 10^{-7} range which correlates with expectations. Message errors which remain undetected in the system are expected to be orders of magnitude less than the bit error rates as a result of the error compensating message sequencing and verification techniques employed.

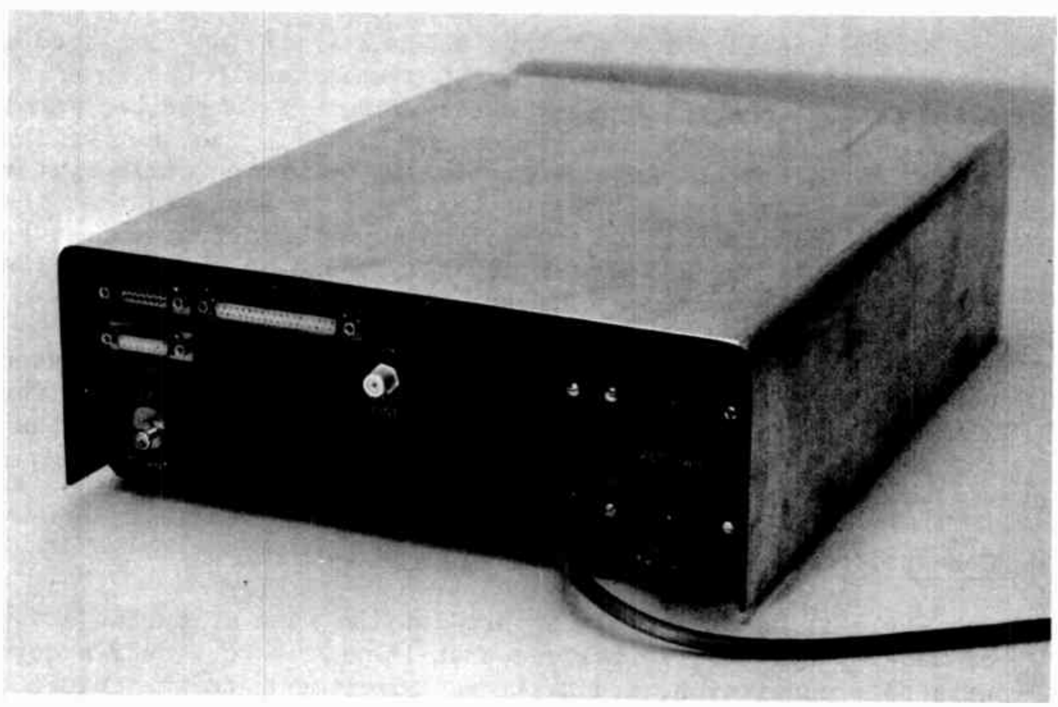


Figure 15. Subscriber Terminal - Demonstration Modem

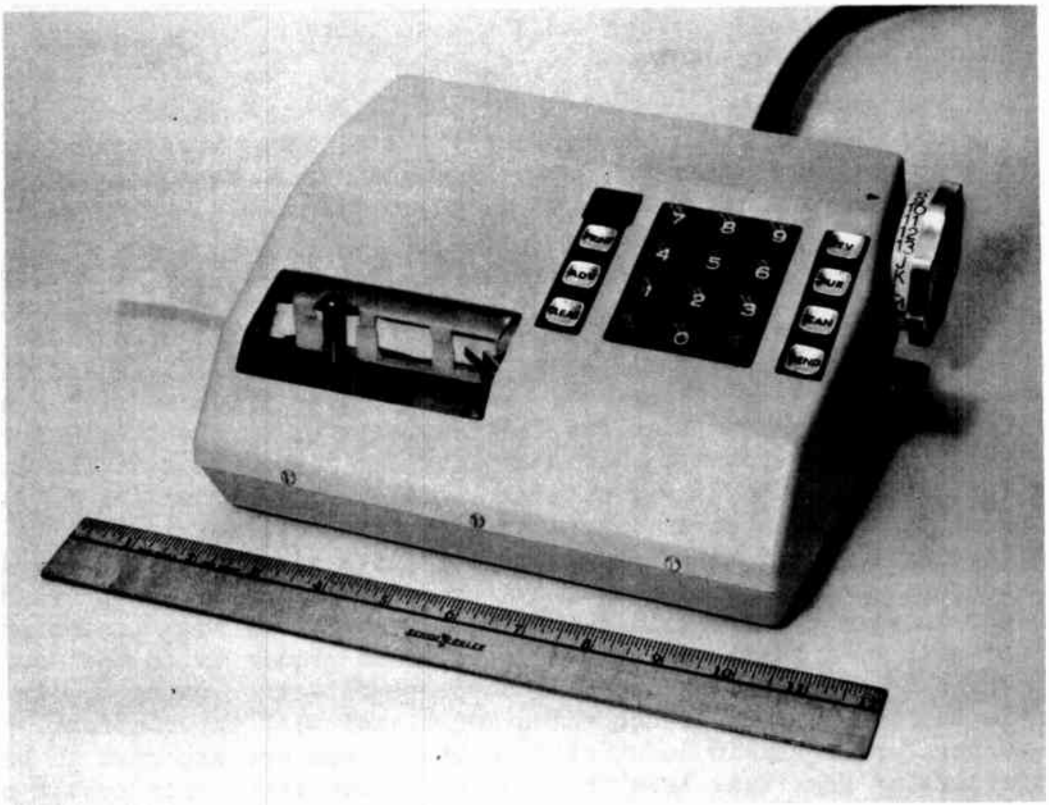


Figure 16. Subscriber Terminal - Demonstration Console

At the present time software designs are being completed and hardware is in production to permit a small scale but intensive field test with approximately twenty-five SRS Subscriber Terminals and a fully equipped Local Processing Center. The test will be conducted in the Los Angeles area on an operating cable system starting in the last quarter of 1971. It is expected that the test will include both technical and consumer oriented features to demonstrate the SRS system capability and to obtain the consumer reaction to the services offered.

Pending the results of the small sample to be tested later this year, and continued consumer surveys, plans are being formulated for the large scale production of SRS equipment by the Theta-Comm Company. This equipment will be used in a system wide test in 1972.

Conclusion

While it is impossible to predict the rate of public acceptance of two-way systems, we believe that they will be widely accepted. With this conviction, and a strong commitment to the future of communications, we submit that any two-way mass communication system worthy of serious consideration must meet the following vital requirement.

Figure 17. LPC Simulator

The system must have a well thought out approach allowing for the impossibility of predicting the market accurately.

- It must not be limited by prejudgement of the relative saleability of services.
- It must be flexible to change without becoming unwieldy or obsolescent.
- It must be economically viable as well as technically sound and reliable.
- It must deliver what is promised not only from a hardware standpoint but even more importantly from a software view.

We believe that the Subscriber Response System meets these requirements. It has not only the basic capabilities to meet a wide variety of existing needs with minimum cost but also the growth potential to mature with the market in whatever direction it may develop.

BIOGRAPHY FOR NCTA

William F. Mason
Technical Director
Systems Development Division
The MITRE Corporation

Mr. Mason is the Technical Director of MITRE's Systems Development Division. He has been with MITRE for ten years, working on a variety of civil and military systems projects.

Before MITRE, he worked thirteen years at Hazeltine Electronics Corporation on radar and beacon systems.

He has an ME from Stevens Institute of Technology and an MSEE from Brooklyn Polytechnic Institute.

BIOGRAPHY

KENNETH J. STETTEN

Associate Department Head, MITRE Computer Systems Department and Project Leader of MITRE's TICCIT (Time-Shared Interactive Computer-Controlled Information Television)

Mr. Stetten joined MITRE in 1968. He is the originator of the TICCIT minicomputer technical concept and is the co-inventor (patent pending) of the Television Home Computer Terminal. He has had 15 years of diversified experience in information systems and other technologies. His previous work encompasses the areas of CRT development and TV systems, space electro-optical instrumentation, infrared chemical warfare and airborne contaminant detection/identification and a vast range of related technologies. He served as an officer in the U.S. Air Force Special Weapons Center. He holds 5 U.S. patents.

Mr. Stetten holds a B.S. in Engineering Physics from Lehigh University and an M. A. in Physics from Boston University.

A LOW COST INTERACTIVE HOME TV TERMINAL

William F. Mason & Ken Stetten
The MITRE CORPORATION

As part of the design of a cable system for a large city, MITRE has had to take an objective look at the many ideas that have been proposed relative to providing new services into the home via cable. Part of the analysis involved identification of the variations in home terminal hardware that would be required to provide these services.

Types of Home Terminals

Figure 1 indicates one way in which the hundreds of services that have been proposed can be grouped into the eight fundamental hardware configurations that would be needed to provide them. Starting on the left of the figure with conventional black and white television, the cost rises with color or an A-B switch or converters, as additional channels are added. In group two we add the ability to encode transmissions for selective distributions to people who have unscramblers in their homes. Special distribution/capabilities on the network can also be "hardwired" to provide exclusive distribution to groups of subscribers, e.g., doctors.

Adding some form of a frame grabber (third category) allows distribution of another class of service wherein a single channel can provide many different displays, e.g., stock reports, ballgame scores, local activity schedules, etc. In this case, each frame is coded and the subscriber can set his decoder to choose any of hundreds of services on a single channel.(more about this later).

Going now into two way services, we have the conventional voting or polling capability wherein a central computer polls the network and accepts the votes or selections input from each subscriber. This class of terminals ranges from inexpensive, where there are only a few voting options, to an elaborate alphanumeric keyboard capability for use in general two way communications.

In category five, a credit card checking device is added to the network capabilities of category four. This category is listed separately because of certain validation procedures that should be part of such a system. Meter reading, burglar and fire alarms, etc., are possible in the next category, wherein various types of sensors in the home are used to measure or monitor various phenomena and then report to the central system using the fundamental hardware provided in category four, but with special interface to the various sensing devices in the home. We include in this category the ability of the central system to control certain devices in the home if desired. For example, the second heating element in a hot water heater can be controlled by the utility company to help alleviate peak power problems. Utility customers have been offered lower rates for such cooperation.

Category seven provides interactive communications of the type that would be needed for sophisticated computer aided instruction (CAI) or computer mediated instruction (CMI) into the home. Finally, we have services that involve high bandwidth digital or video communications between terminals.

Demonstrating These Capabilities

In order to examine the hardware involved in each of these categories as regards both cost and technical feasibility, MITRE has installed in six homes in Reston, Virginia, a terminal system that is capable of providing most of the services in Figure 1. Reston is located about 10 miles from the MITRE facilities in McLean, Virginia, and our computer is connected via a microwave link to the Reston Transmission Company headend in Reston. Reston has a dual cable distribution system and Channel 13 of their A-cable is used to distribute computer interactive services. Figure 2 is a schematic of the system showing that the computer provides on a single channel, 600 different frames of information, any of which can be selected by any subscriber having the appropriate terminal equipment. We call this the "public service" channel because of the types of information we are putting on it. The subscriber simply selects with a thumb dial on the home equipment, Figure 3, any of the demonstration material that we are interlacing (Figure 4). The particular materials we are providing are simply to show the types of things that may be offered on such a system.

The demonstration terminals also have the capability to let the subscriber interact dynamically with the computer. Since the Reston cable system is not equipped for two-way services yet, we are using telephone lines for the up-link from the subscriber to the computer. (Within the MITRE facilities we use two-way cable.) This class of service allows the subscriber to telephone the computer and receive a response on his TV screen that is not seen by other subscribers. He first receives a frame that introduces him to the services available. The touch-tone telephone is used as an input device to select services. Our demonstration allows subscribers to take computer-aided instruction in math or to use the computer to perform mathematical calculations (add, subtract, multiply, divide, raise to powers, take square root, store, etc.) or, more simply, to use the computer to sort through a variety of information. For example, we allow the subscriber to look up telephone numbers using his TV screen.

The "home calculator" demonstrates how computational capabilities can be provided in the home. The educational and social materials illustrate more wide ranging possibilities.

Our system also has the capability to record programs off-the-air or to record movies addressed to a single address, possibly during the quiet hours of the night, for replay as desired. Although full movies by this method would be impractical, we plan to use this capability to send short sequences of frames that can be "stepped" onto and off the tape recorder in a manner that might be used for delivering newspapers or mail by TV.

In this demonstration MITRE has concentrated on the use of readily available equipment in the home, i.e., the TV set and the telephone. The only special equipment that has been added is the circuitry for decoding the material sent to the home and a video tape recorder, which we feel will be a common item in a few years. As a matter of fact, the technical services that we are demonstrating in Reston will have a tremendous influence on the popularity of these video tape recorders if the addition of the simple circuits to grab a frame and refresh a TV set are added, as in the models we are using.

Cost Information

Although this is not the platform for publicizing the information we have accumulated relative to cost, a few comments are in order. The Figure 1 chart indicates the general range of costs for home terminals of various types assuming reasonably large implementation. Two-way digital services are not all that "futuristic" but we have avoided putting bounds on what the terminals may cost because it is so dependent on bandwidths used, etc. On the other hand, a sufficient number of devices can be bought in the $150 to $350 range so that this category of services should not be considered impractical. Studies now being performed by and for various large companies indicate that a very practical system can be described for certain types of markets. Within each Figure 1 system classification there are of course cost variations, depending on the particular service offered, how fancy the terminal is to be made, production quantity, implementation density, etc. Each of you will have opinions relative to the particular category of services of interest to your company or provided by your system. MITRE would be interested to have your comments relative to our cost summary.

Now let's turn to the cost of providing the computer services. We have made a number of analyses that indicate that interactive service can be provided into homes at a cost of around 20 cents per terminal hour. Roughly it goes like this: a minicomputer center to provide services to a population of around 10,000 would cost about $150K. Amortizing this over four years gives $37K per year. Adding $18K maintenance, clerical overhead and floor space, gives $55K per year to provide to each of 10,000 subscribers one hour a day interactive with the computer. (The actual computer time is a very small part of this because we serve an average of 100 interactive terminals at a time; more during peaks.) This amounts to about $55.00 per year or $5.00 per month cost to the operator. This can also be considered as $5.00 for thirty hours of use, or about 20 cents per hour of use by the subscriber. He would probably pay several times this for the service. Billing would be handled by the computer. If the system operator provided $400.00 worth of capabilities from Figure 1, he would have to charge around $10/month, which seems very attractive for the kinds of services we are discussing.

Conclusion

A complete analysis of the types of capabilities discussed here will be published by MITRE in the near future, but sufficient information has been summarized in this paper to indicate our belief that the time to start large scale experiments with computer interactive TV is now.

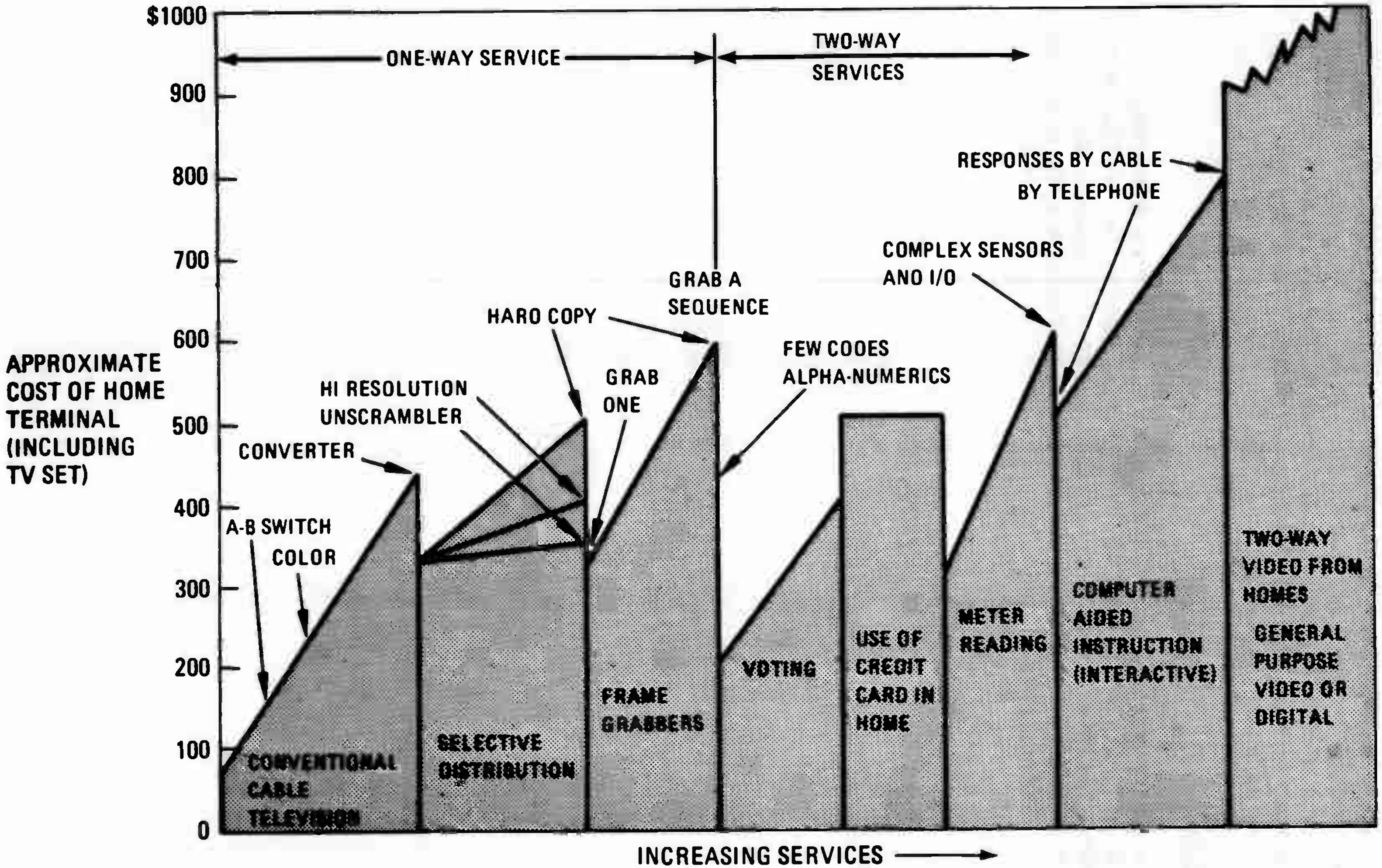


FIGURE 1
HOME TERMINAL OPTIONS

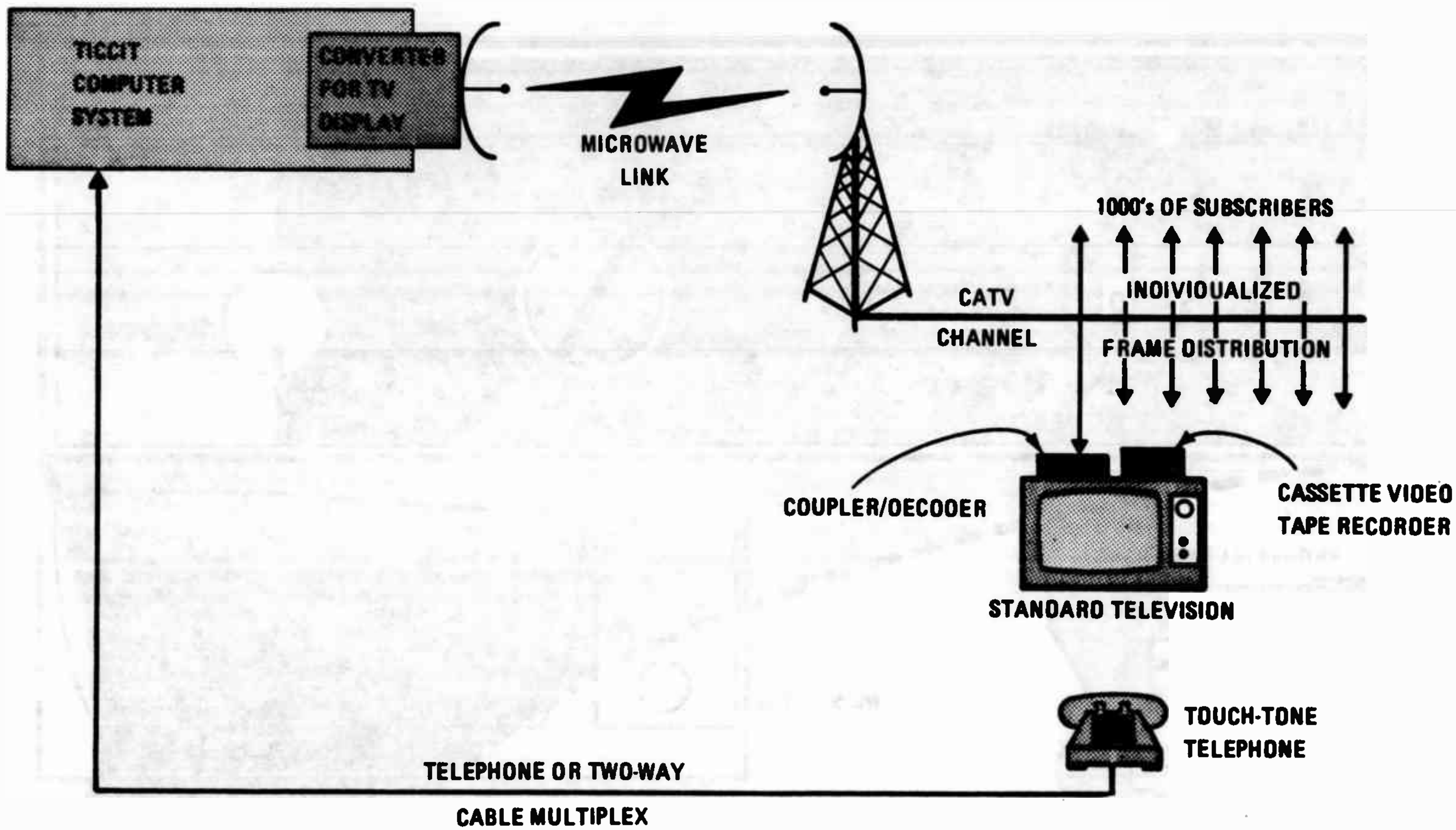


FIGURE 2
SYSTEM DIAGRAM

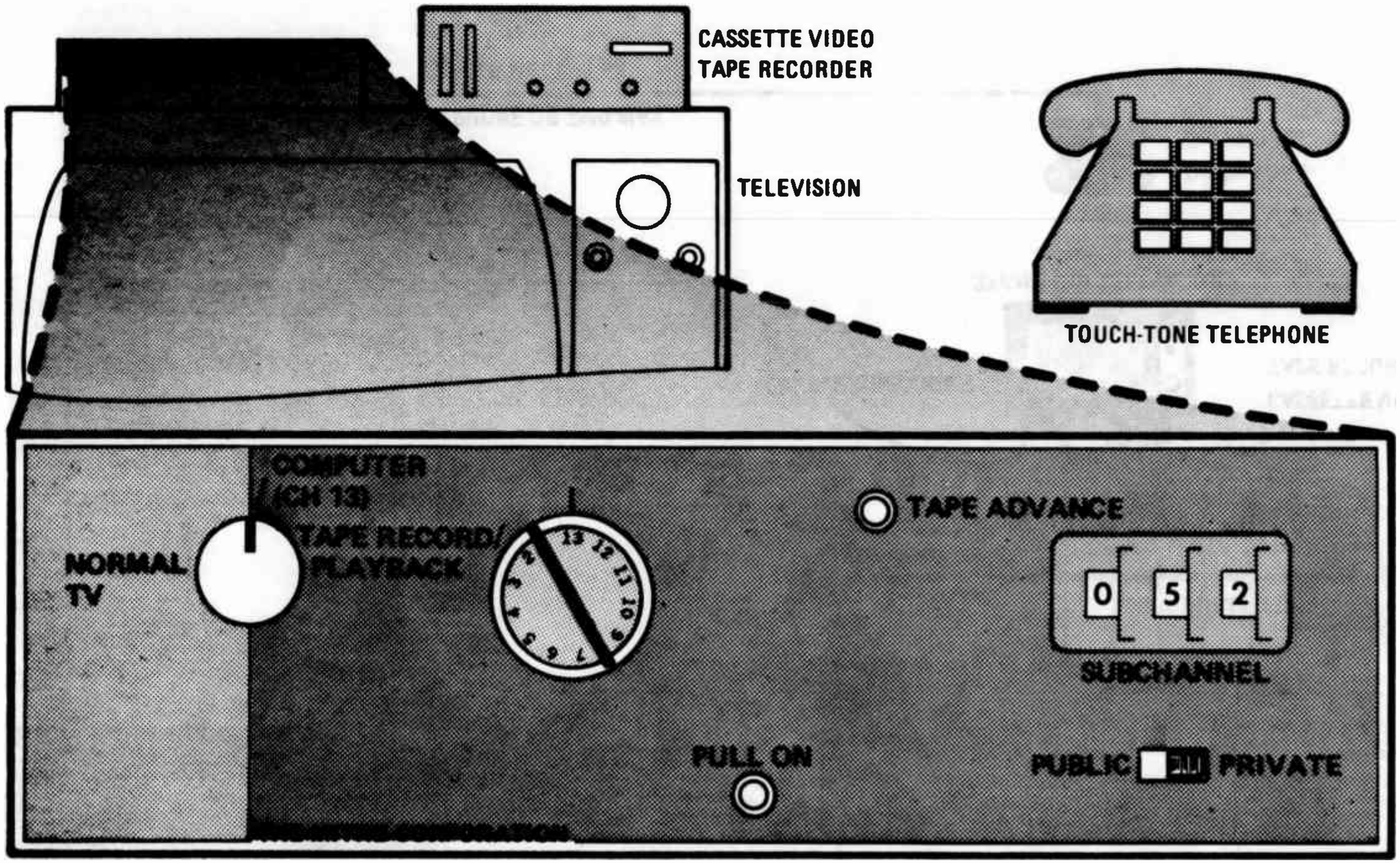


FIGURE 3
COUPLER/DECODER ("BROWN BOX")

DIRECTORY OF INTERACTIVE SERVICES

- RESTON COMMUNITY INFORMATION
  - DIRECTORY OF RESTON COMMUNITY ORGANIZATIONS – LIST OF 30 AND FILES ON EACH (SEE TEXT)
  - RESTON TELEPHONE DIRECTORY
- HOME CALCULATOR: ADD, SUBTRACT, MULTIPLY, SQUARE ROOT, RAISE TO POWER ETC.
- COMPUTER AIDED INSTRUCTION MATERIALS
  - ADDITION LESSON 2 DIGIT NUMBERS (CARRY)
  - ADDITION DRILLS (STANFORD U. CAI PROJECT)
- DIRECTORY OF NON-INTERACTIVE SERVICES (PUBLIC MODE)

DIRECTORY OF NON-INTERACTIVE SERVICES (PUBLIC MODE)

TIME OF DAY
ADVERTISEMENT
DIRECTORY OF NON-INTERACTIVE SERVICES (PUBLIC)
WEATHER REPORT
DIRECTORY OF INTERACTIVE SERVICES (PRIVATE)
BASEBALL SCORE BOARD (NATIONAL LEAGUE)
BASEBALL SCOREBOARD (AMERICAN LEAGUE)
MOST ACTIVE STOCKS, NYSE
MOST ACTIVE STOCK, AMEX
FISHING REPORT
DAILY RACING FORM (SHENANDOAH)
DAILY RACING FORM (PIMLICO)
SPECIALS AT THE DELICATESSEN
CLASSIFIED ADVERTISEMENTS
TELEVISION LISTINGS
PERSONAL STOCK PROFILE
ACTIVE BASEBALL GAMES
SUMMER SKI REPORT
VOTER REGISTRATION INFORMATION
VOTER ELECTION INFORMATION
COMMUNITY RECYCLING INFORMATION
NEW FICTION IN THE LIBRARY
NEW NON-FICTION IN THE LIBRARY
DEPARTURES RESTON COMMUTER BUS
K ST. ROUTE
M ST., CONSTITUTION AVE., PENTAGON
MENU RESTON CHILDREN'S CENTER

FIGURE 4
LIST OF INTERACTIVE AND NON-INTERACTIVE SERVICES
AVAILABLE AT RESTON DEMONSTRATION

FIGURE 5
TERMINAL INSTALLED IN HOME

MATCHING REPEATER AMPLIFIER PERFORMANCE CHARACTERISTICS TO CABLE SYSTEM LEVEL REQUIREMENTS

by
Gaylord G. Rogeness
Director of Engineering
Anaconda Electronics

PRESENTED AT THE 20th ANNUAL NCTA CONVENTION,
WASHINGTON D.C., July 7, 1971

INTRODUCTION

A cable television system provides a transmission path from a single signal processing center (traditionally referred to as head end) to multiple subscriber television receivers (Figure 1). The advent of transmission requirements from any point in the cable system back to the signal processing center results in a system with inputs from multiple locations in the cable system converging to a single output from the cable distribution system back to the head end.

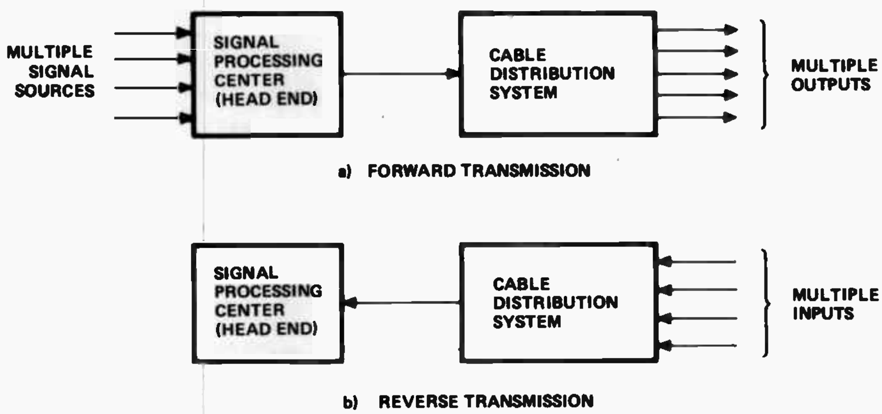


FIGURE 1

Numerous articles have been written on parameters and performance requirements of the cable distribution system. This paper will focus on the television signal level from cable distribution system input (head end output) to its output, the TV receiver input terminal.

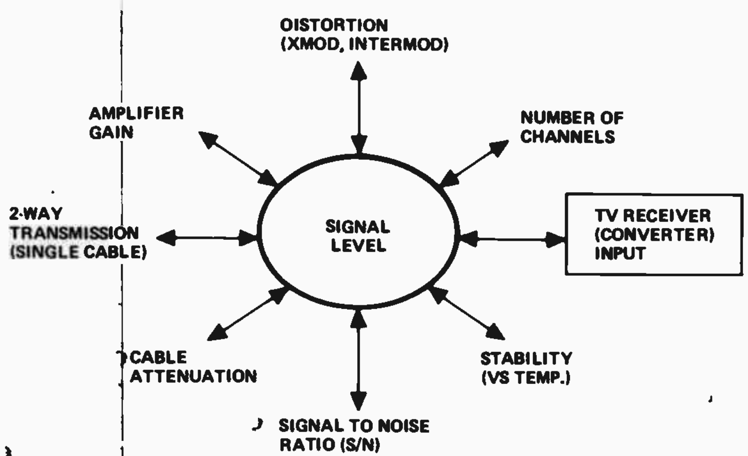
Knowledge of the signal level requirements in the cable distribution system guides the equipment designer to a hardware design which economically matches system requirements and likewise guides the system designer in selection of system components required to meet his system design objectives. Signal level, as the independent variable, determines many component (amplifier, cable, and directional taps) and system design decisions.

After considering the cable system signal level requirements, a coefficient system similar to that described by Carson (Reference 9) is used to exemplify sources of system performance limitations. The coefficient system is useful in weighting the performance of repeater amplifiers which have different operating characteristics.

Signal Level As Related to Equipment/System Parameters

A cable distribution system must deliver television signals to each subscriber's television receiver which produce acceptable pictures. Insight into cable equipment and system design results when the signal transmitted through the cable distribution system is distinguished by both level and quality. Signal level and quality specifications which are necessary to produce an acceptable picture are described in detail in such references as (4), (5), (6), and (7). The purpose of this paper is to show how certain cable amplifier performance characteristics are defined as a result of the television receiver input level requirements, and to relate the signal level to various signal quality performance factors.

A summary of parameters shown in Figure 2 may be viewed as defining cable system signal levels and/or as cable system signal levels defining cable system parameters. The value of these viewpoints will become apparent later.



CABLE SYSTEM SIGNAL LEVEL-CABLE SYSTEM PERFORMANCE PARAMETERS

FIGURE 2

For example, the television receiver or converter must be given multi-channel input signal levels within a given range, assuming acceptable signal quality, to produce an acceptable picture. Distributing a signal level above the minimum value required by the TV receiver or converter unnecessarily increases system cost. Some excellent work has been done (4), (5) in determining the range of levels which should be provided by the cable system to the TV receiver input.

Another example of the importance of selecting system signal levels relates to the system distortion and S/N parameters. The original source of the majority of noise and distortion in CATV equipment is the amplifying device, the transistor. Recent advances in microelectronic circuit technology (1), (2), (11) can allow efficient circuit designs to realize low noise and low distortion performance which are basically device limited. An example of a broadband microelectronic circuit currently used by Anaconda Electronics in production repeater station amplifiers is shown in Figure 3.

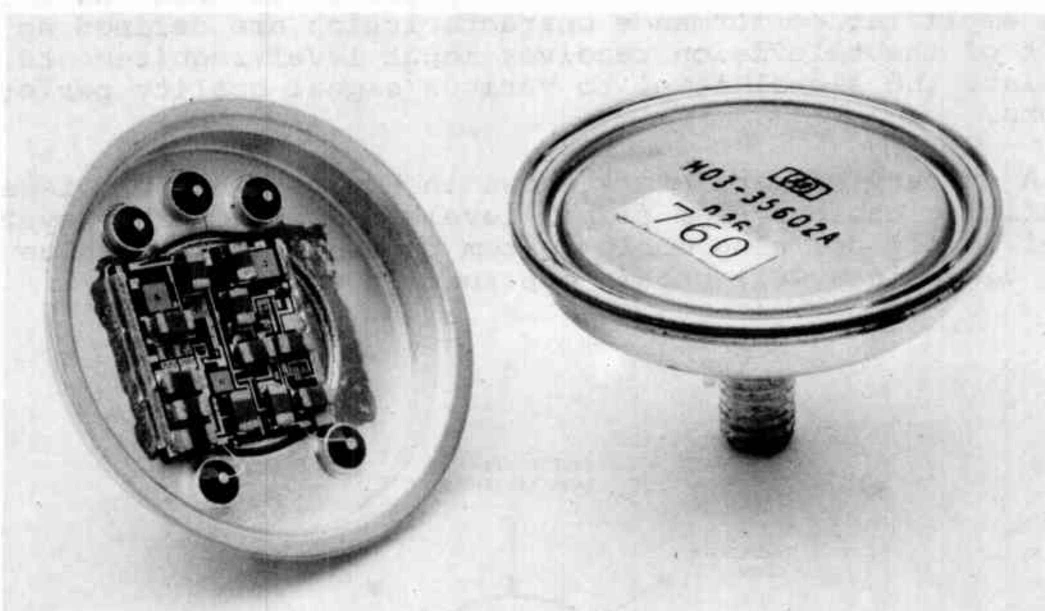


FIGURE 3

Trunk system signal levels may therefore be chosen to operate within the amplifier constraints of noise and distortion so that system design may be optimized. Alternatively, signal levels may be selected to provide added performance margin if system length is not a performance limiting factor.

Judicious apportionment of noise and distortion between trunk and feeder systems can be accomplished not only by choice of equipment but also by selection of system signal levels. This system design approach can result in a reduced system cost.

CABLE DISTRIBUTION SYSTEM

The cable distribution system provides the means of distributing head end signals to multiple subscriber locations in an area. The signal delivered to the subscriber's receiver terminals must be of such a level and quality as to produce acceptable pictures.

Definition of what signal characteristics produce acceptable pictures are covered in detail in (4), (5), (14). To design the most economical and efficient cable distribution equipment, the designer must consider in depth the requirements of the subscriber receiver equipment.

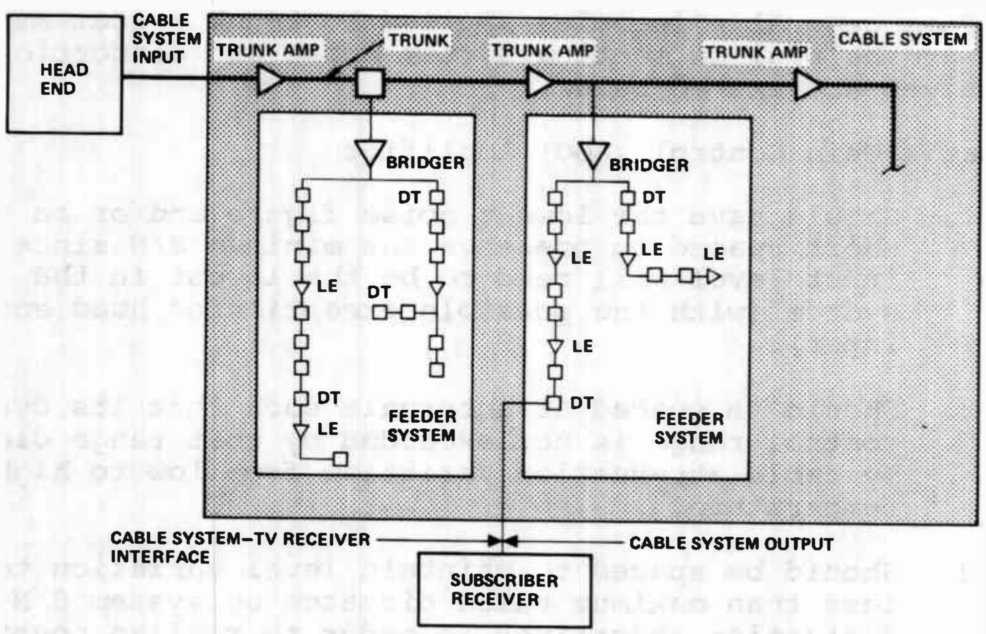


FIGURE 4

In Figure 4 is shown a representative block diagram of a cable distribution system. A trunk system is used for transmission of the signal from the head end to the areas in which the signal is to be distributed and does not directly feed signals to subscribers. A feeder system consists of equipment which is used to deliver signals from the trunk system to subscribers.

TRUNK SYSTEM

Trunk amplifiers are required at intervals along the trunk cable route to offset signal attenuation due to cable, power splitters, and intermediate bridging amplifier insertion losses. The amplifiers are spaced so that the signal level does not drop below the minimum value required to meet the system S/N objective nor exceed the maximum level consistent with the system distortion specification.

The laws of cascaded amplifier distortion and noise accummulation (6), (12), (15) provide guidelines for selecting levels on the trunk system needed to match trunk amplifier noise and distortion characteristics to the trunk system transmission objectives.

Some general principles applied to trunk system amplifiers which are helpful in meeting system noise and distortion objectives are listed below.

Automatic Gain Control (AGC) Amplifier

1. Should have the lowest noise figure and/or be short spaced to preserve the minimum S/N since its input level will tend to be the lowest in the system (with the possible exception of head end input).

2. Should be spaced at intervals such that its dynamic control range is not exceeded by that range dictated by cable attenuation variation from low to high temperature.

3. Should be spaced to maintain level variation to less than maximum value dictated by system S/N and distortion objectives in order to realize consistent year round service.

4. Should have distortion characteristic which does not change as a function of dynamic gain. The AGC amplifier should have consistent same crossmodulation, regardless of ambient temperature.

Manual Gain Control (MGC) Amplifier

1. S/N for MGC amplifier will vary as a function of temperature, but will always be greater than S/N of AGC amplifier (assuming amplifier with equal noise figure).

2. Distortion at cold temperature will be worst in the MGC trunk amplifier immediately preceding the AGC amplifier.

3. Open loop thermal compensation in the MGC will tend to minimize the amount of increased crossmodulation at low temperature.

Level Tilt in Cable Distribution System

The relationships between signal levels of each channel carried in the cable distribution system are established at the head end. The actual setting however, is determined by the design of the repeater amplifier and performance of other system components. It is essential that levels are set to match the characteristics of the repeater amplifier if the system S/N and distortion objectives are to be met in an optimum manner.

FEEDER SYSTEM

The amount of noise and distortion added to the television signals in the trunk system limit the amount of noise and distortion which may be introduced by the feeder system while meeting the system objectives. The minimum allowable signal level in the feeder system is established by the minimum level to be delivered to the subscriber receiver. Designing the feeder amplifiers (bridging and line extender) within this constraint establishes the feeder system S/N for amplifiers of a given noise figure and feeder leg cascade length.

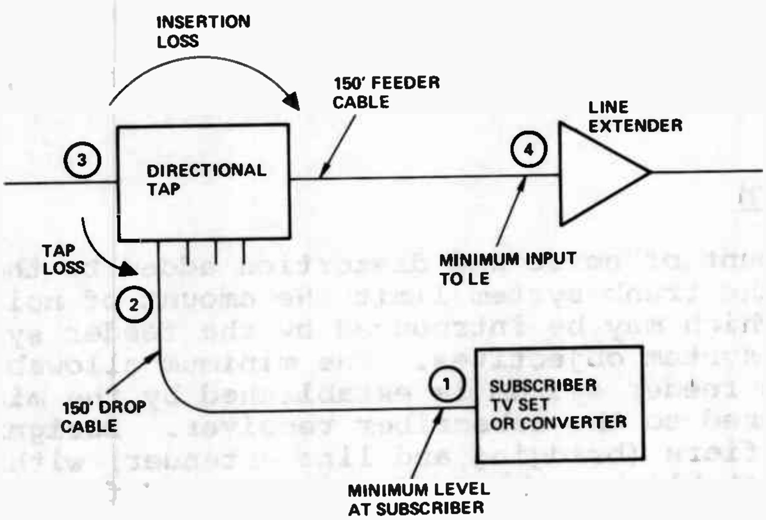
Noise and distortion accummulates along the trunk system cascade as stated previously. This fact means that noise and distortion in the trunk system near the head end is much less than at the trunk line extremities. Therefore, the feeder system fed from the trunk system consisting of a small number of trunk amplifiers can be allowed to operate in modes which tend to produce more distortion than would be allowed near the end of long trunk line cascades. Examples of these modes are: higher signal levels in feeder system, longer cascade of feeder amplifiers, lower output capability (assumed lower cost) line extenders.

Feeder amplifiers designed to serve the maximum number of subscribers require the highest possible signal level output with low enough distortion to meet system objectives. The maximum gain required for a feeder amplifier, and in particular a line extender, is therefore equal to the difference between minimum input and maximum output signal power. Examples which follow will clarify the requirements of a line extender amplifier.

MINIMUM INPUT LEVEL TO LINE EXTENDER AMPLIFIER

The minimum input to the line extender is a function of the minimum input signal delivered to the subscriber receiver terminals.

The determination of this level will be clarified by referring to Figure 5 and the following example.



MINIMUM INPUT LEVELS, SUBSCRIBER RECEIVER AND LINE EXTENDER

FIGURE 5

It has been shown (4), (5) that a minimum level of 0 dBmv or greater at location 1.0 in Figure 5 will result in picture quality which is system S/N limited and not television set limited.

To determine the minimum line extender (LE) input level, the attenuation between points 1 and 3 in Figure 5 will be calculated at the highest frequency supplied to point 1. Adding this attenuation in dB to the minimum subscriber level at point 1 establishes the input level to the directional tap. From this level is subtracted the sum of tap insertion loss plus feeder cable span loss to arrive at the minimum input level to the line extender.

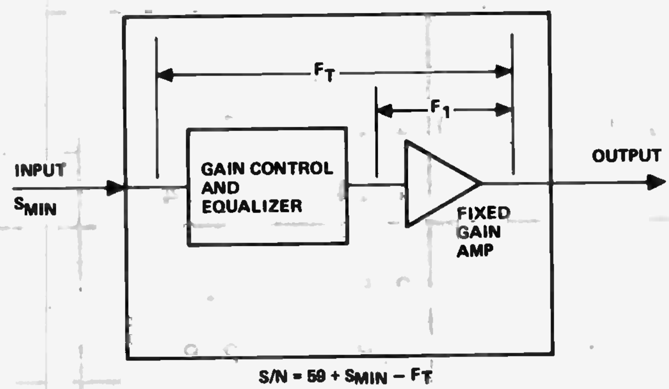
TABLE I LOSSES IN DB (Freq = 270 MHZ)

Feeder Cable Type Drop Cable Type	412 RG/59	412 *RG/59	500 RG/59	500 *RG/59
150' Drop Cable	8.4	5.4	8.4	5.4
Tap Loss (4-Output, 11 dB Tap)	11.0	11.0	11.0	11
SUM A	19.4	16.4	19.4	16.4
Tap Insertion Loss	2.5	2.5	2.5	2.5
150' Feeder Cable Loss	2.8	2.8	2.1	2.1
SUM B	5.3	5.3	4.6	4.6
Amount LE Input Level Above Subscriber Level (A-B)	14.1	11.1	14.8	11.8
Subscriber Level in DBMV	6	6	6	6
Minimum Input to LE in DBMV	20.1	17.1	20.8	17.8

*RG/59 (Type) Drop Cable Belden 8228

Feeder cable attenuation values are based on nominal catalog values at 70°F for Anaconda Sealmetic (SLM) 412 and 500. Drop cable values are extrapolated to 270 mHz from Belden Catalog No. 871.

The minimum level at point 4, the LE input, is 14.1 dB (for RG-59 drop cable and 412 feeder cable of length noted above) above the subscriber level in dBmv. For this example assume a subscriber level of 6 dBmv. Then the minimum LE input level is 20.1 dBmv.



LINE EXTENDER AMPLIFIER S/N

FIGURE 6

The affect of the line extender noise figure (F) on feeder system S/N (Figure 6) can now be determined by referring to the equation below:

$$S/N = 59 - F + S_{min} \quad dB$$

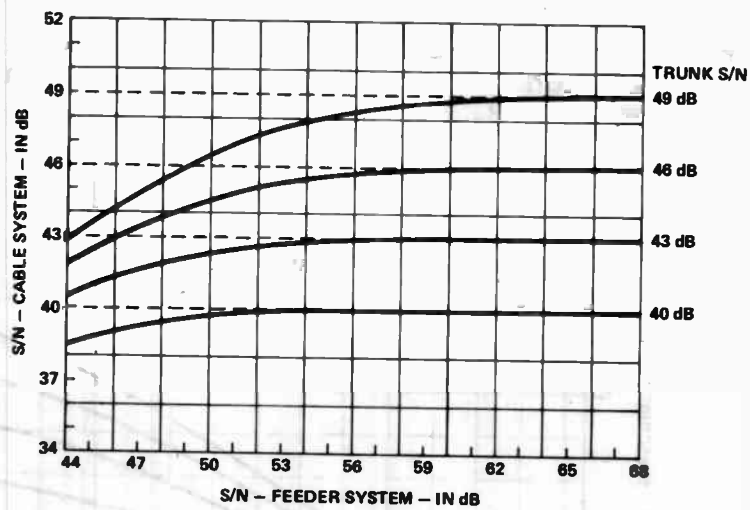
S/N for single line extender

$$S/N = 59 - F + S_{min} + \text{Log } n \quad dB$$

S/N for cascade of n identical line extenders

A noise figure of 20.1 dB results in a single LE S/N of 59 dB for the minimum input signal calculated previously.

The affect of feeder system S/N as a function of trunk system S/N on subscriber drop S/N is shown in Figure 7. Note that for a trunk system S/N of 43 dB, the most distant subscriber in the feeder system suffers almost no S/N degradation for a cascade of two identical line extenders, each with an S/N of 59 dB. This fact is extremely significant in terms of LE amplifier circuit design, because an LE S/N of 59 dB for the minimum signal level calculated above means that the LE noise figure can be 20.1 dB.



CABLE SYSTEM S/N APPORTIONMENT BETWEEN TRUNK AND FEEDER

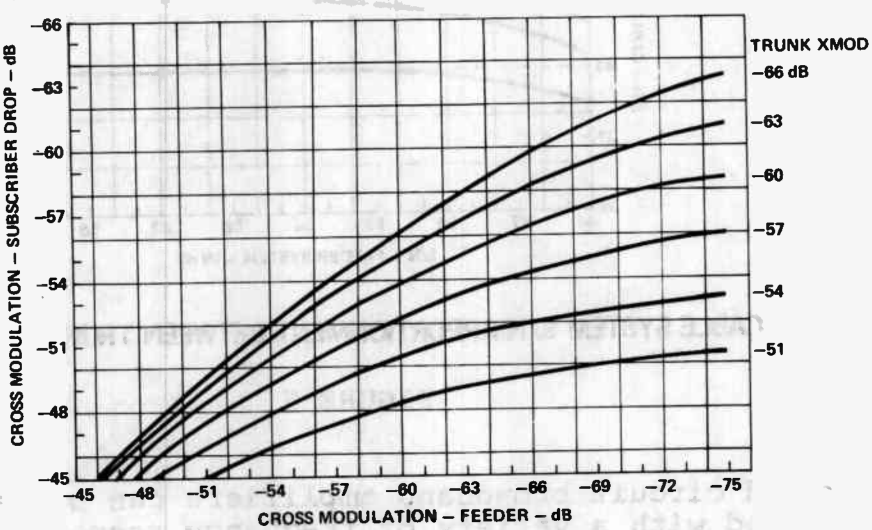
FIGURE 7

Integrated circuit broadband amplifiers can be designed and manufactured with a variety of frequency response shapes and with access to multiple gain stages. However, one of the most economical designs is a fixed gain block with flat frequency response. Permitting an LE station noise figure in the 16 to 20 dB range would allow use of a fixed gain, input-output integrated circuit amplifier of economical design. The line extender station block diagram is then accurately represented in Figure 6. A high noise figure line extender requires education of the customer because a high noise figure does not necessarily mean a low S/N. The individual system component or amplifier specifications must be related to system performance to realize the most economical design.

FEEDER SYSTEM DISTORTION

The feeder system is allowed to produce an amount of distortion equal to the difference between the distortion objective at the subscriber and the amount of trunk system distortion. The examples and discussion which follow mention only crossmodulation distortion, which to date has been a familiar system performance limiting parameter. However, similar and possibly additional analyses must be made to account for second and third order intermodulation products as well as triple beats in systems carrying more than 12 channels.

A relationship between crossmodulation at the subscriber drop as a function of trunk and feeder system crossmodulation is shown in Figure 8.



SUBSCRIBER XMOD APPORTIONMENT BETWEEN TRUNK AND FEEDER

FIGURE 8

The axes of this figure have been interchanged from those of Figure 5 in (5). The chart of Figure 8 is useful in determining the allowable feeder system crossmodulation distortion as a function of the crossmodulation objectives at the subscriber and the trunk system crossmodulation.

Feeder system distortion determines the maximum output level at which the line extender can be operated. From the method described previously, the minimum LE input level is defined. The LE gain required in the feeder system is now defined.

Some general considerations related to feeder system amplifier performance are summarized below.

Bridger Amplifier

1. System crossmodulation distortion performance can easily be limited by the bridger amplifier, since it operates at the highest level.

2. Cold temperature operation is the most critical for the bridger amplifier driven from an MGC amplifier or an intermediate bridger in the span preceding an AGC amplifier. The level will be the highest and therefore the crossmodulation distortion will be the worst.

3. There may be a system distortion advantage in operating the four (4) output bridger at a level <u>lower</u> than the line extender. Uniformity of feeder system levels is lost, but improved distortion performance results.

4. The bridger amplifier noise figure is relatively unimportant because its input level is relatively high, typically only 10 to 12 dB below the trunk output level.

Line Extender

1. For rigid feeder system level control, an AGC line extender (10) should be placed in each bridger amplifier leg where an MGC trunk amplifier drives the bridger, including intermediate bridger stations preceding AGC trunk amplifier stations.

2. Every other line extender in a feeder cascade should contain an AGC amplifier.

3. Level control to the subscriber home may be more critical in a converter system than a non converter system.

4. Open loop thermal compensation is advisable in each line extender.

5. Noise figure of line extender amplifier is relatively unimportant because it operates at level approximately 10 dB above trunk amplifier.

Channel Levels Across Band at Subscriber Receiver Terminals

The difference in levels between channels across the system bandwidth is becoming increasingly important for broadband (greater than 50-216 mHz) multichannel (greater than 12 channel) systems. Subscriber converters developed to date have a limited dynamic range so that the level spread across the bandwidth and the absolute level stability are critical.

The level spread from channel to channel across the band at the subscriber receiver or converter terminals is a function of the following:

1. Block tilt of channel levels (set at head end)
2. Type of feeder cable (loss per 100 feet)
3. Length of feeder cable preceding tap
4. Number of taps and splitters (and amount of flat loss in feeder line)
5. The magnitude of tap loss
   - 5.1 Frequency response of tap loss (flat and/or slope)
6. Type of drop cable (loss per 100 feet)
7. Length of drop cable

Amplifier Coefficient System

To further exemplify the sources of noise and crossmodulation distortion in the cable distribution system, use is now made of an amplifier coefficient system.

Carson (9) outlines a method for calculating amplifier cascade performance with amplifiers of different characteristics. Taylor, in reference (13), clarified the data obtainable from the principles outlined in (9), and his format is used in what follows. The different characteristics can be noise figure, distortion due to different operating level or distortion characteristics, number of channels (such as transportation amplifier), etc. The method basically normalizes the performance of each amplifier type in the cascade to a reference trunk amplifier.

After each component of the system which generates noise and/or distortion has been normalized to an equivalent reference amplifier (component coefficient), the component coefficients are summed to equal a total equivalent cascade. The system S/N and crossmodulation distortion are then determined by the following familiar equations:

$$S/N\ (\text{System}) = S/N\ (\text{Ref Trunk}) - 10 \text{ Log } C_n$$

Where C_n is the equivalent cascade of reference trunk amplifier.

$$XM\ (\text{System}) = X_1\ (\text{Ref Trunk}) + 20 \text{ Log } C_x$$

Where C_x is the equivalent cascade of reference trunk amplifiers.

The following example is given to illustrate the principle involved:

Given: Trunk Amplifier

XM = -82 dB at level of 40 dBmv (12 channels)

X_1 = -98 dB at operating level of 32 dBmv

Line Extender

XM = -82 dB at level of 40 dBmv (12 channels)

X_3 = -78 dB at level of 42 dBmv

Line Extender Coefficient

L_1 = 10 raised to exponent $(X_3-X_1)/20$=10 amplifiers

In other words, a single line extender produces as much crossmodulation as a cascade of ten (10) trunk amplifiers operated at a level of 32 dBmv.

A separate coefficient for noise must be calculated. The resulting coefficient is the equivalent number of reference trunk amplifiers to which the line extender is equivalent in terms of S/N degradation. The method for making this calculation is contained in Appendix B.

<u>Component Coefficients as Function of Temperature</u>

Three sets of coefficients are required to characterize the system S/N and XM as a function of temperature. The coefficients for each component are initially calculated for nominal temperature. At the maximum temperature, a set of coefficients is required to determine the worst case S/N. At the minimum temperature, a set of coefficients is required to determine the worst case crossmodulation.

For every one (1) dB increase in level due to cable attenuation reduction at low temperatures, a 2 dB increase in crossmodulation results in the "well behaved amplifier". The level variation of each component in the system which produces crossmodulation is accounted for and a coefficient for low temperature operation assigned to each component. Total system crossmodulation distortion at low temperature is then calculated by summing each of the component coefficient. Since levels increase at low temperature, the S/N will not be reduced.

In a similar manner, a set of coefficients is required at the high temperature to determine the amount by which the S/N is reduced because of the increased cable attenuation. Crossmodulation distortion is less than at the minimum temperature due to cable attenuation change, because the increased cable attenuation results in lower levels. However, care must be taken in the amplifier design to insure that gain reduction due to AGC action does not increase the amplifier distortion.

The component coefficients at low and high temperature depend upon the amount of level control in the system. The spacing of AGC amplifiers and degree of thermal compensation are the controlling factors in wide temperature range operation for maximizing S/N and minimizing crossmodulation.

An example of the coefficient system follows and is made under the following assumptions:

1. Crossmodulation, noise figure, and gain values are those given in Appendix A and B.

2. Cable attenuation changes .12% per degree F

3. Trunk amplifier spacing is 22 dB with AGC amplifiers spaced every other trunk station position.

4. Bridger coefficients calculated with bridger driven from MGC trunk amplifier.

5. Line extenders spaced at 12 dB of cable.

6. AGC line extender spaced every other position.

7. Noise figure and crossmodulation constant as function of gain.

8. Trunk amplifier output level 32 dBmv.

9. Bridger amplifier (4 outputs) output level 38 dBmv.

10. Line extender output level 43 dBmv.

11. Crossmodulation changes 2 dB for 1 dB of output signal level change.

The amplifier coefficients and system S/N and crossmodulation distortion are calculated for temperatures 0°F, 70°F and 110°F and are shown below:

TABLE II

		S/N		Crossmodulation	
Cascade	Actual	Equivalent		Equivalent	
Temperature		110°	70°	70°F	0°F
Trunk	20	27.58	20	20	24.455
Bridger (4-Out)	1	.276	.225	19.953	28.842
Line Extender	2	.287	.225	25.178	45.972
Coefficient C_n		28.14	20.45		
System S/N (dB)		44.01 dB	45.39 dB		
$S/N = 58.5 - 10 \text{ Log } (C_n)$					
Coefficient C_x				66.13	100.27
System Crossmodulation (dB)				-61.59	-57.97
$XM = -98 + 20 \text{ Log } (C_x)$					

The system S/N and crossmodulation in the table above could be calculated by a number of methods. Each method would result in the same answer if the identical assumptions are used for each method. The coefficient C_x = 66.13, at 70°F, is the equivalent number of reference trunk amplifiers which generate a total system crossmodulation distortion of -61.59 dB. Note that for the assumptions made, which are realistic, the amount of distortion generated in the 4-output bridger amplifier is equivalent to the distortion which would result from a cascade of 19.95 reference trunk amplifiers. Because of system level variation due to cable attenuation change, the crossmodulation distortion generated at 0 degrees F is equivalent to that generated by a cascade of 28.84 reference trunk amplifiers. Table II graphically displays the sources of system S/N degradation by the different types of amplifiers used in the system.

CONCLUSION

Cable distribution system performance as related to system levels have been described. Clear insight into cable distribution equipment and system requirements is provided by use of signal level as a vehicle for analysis and design. This approach can result in providing guidelines for more economical designs.

An amplifier coefficient analysis and/or the use of Figures 7 and 8 are helpful in determining the allowable apportionment of noise and distortion between trunk and feeder systems.

ACKNOWLEDGEMENT

Portions of this paper are the result of investigations prompted by technical discussions with Mr. George Milner, Engineering Vice President, Cablecom General.

REFERENCES

1. R. Eschenbach, "Hybrid Thin-Film Techniques Applied to Broadband Cable Communication Repeater Amplifiers" Hewlett-Packard Co., Palo Alto, California, June 1970.

2. L. Besser, N. Gri, and B. C. Jones, "The Computer-Aided Design of a CATV Amplifier Using Hybrid Integrated Circuits", Fairchild Microwave and Optoelectronics Co., Mountain View, California, June 1970.

3. "Special Issue on Cable Television", Proceedings of IEEE, Volume 58, No. 7, July 1970, pp. 961-1125. (Numerous articles on Cable Television Art)

4. Malarkey, Taylor, and Associates, Inc., "Performance Characteristics of Television Receivers Connected to Cable Television Systems", prepared for NCTA January 6, 1971, relating to Federal Communications Commission, Docket No. 18894 (RM-1530).

5. J. R. Palmer, "CATV Systems - Design Philosophy and Performance Criteria as the Basis for Specifying Equipment Components", IEEE Transactions on Broadcasting, Vol. BC-13, No. 2, April 1967, pp. 57-68.

6. Collins and Williams, "Noise and Intermodulation Problems in Multichannel Closed-Circuit Television Systems", Bell System Monograph 4057.

7. A. D. Fowler, "Observer Reaction to Video Crosstalk", Journal of SMPTE, New York, Vol. 57, November 1957, pp. 416-24.

8. B. L. Jones, "A Proposed Quality Factor for Repeater Amplifiers in CATV Systems", TV Communications, March 1966, pp. 63-65.

9. D. N. Carson, "CATV Amplifiers" Figure of Merit and the Coefficient System", IEEE Transactions on Communication Technology, Vol. COM-14, No. 4, August 1966, pp. 512-520.

10. J. Harrer, "Level Control for Multichannel and Two-Way Systems", to be presented at 1971 NCTA Convention.

11. G. Rogeness, "Two Way Repeater Station Utilizing Hybrid Thin-Film Amplifier as Building Block", Anaconda Electronics, Technical Bulletin, Vol. 2, No. 1, June 1970.

12. Members of the Technical Staff Bell Telephone Laboratories, "Transmission Systems for Communications", Revised Third Edition, pp. 219-232, 1964.

13. Malarkey, Taylor, and Associates (Washington, D.C.), "Cable TV System Proposal for Tulsa and Performance Specifications", September 28, 1970.

REFERENCES (CONT)

14. Dean, "Measurements of the Subjective Effects of Interference in Television Reception", Proc IRE, Vol. 48, pp. 1035-1049, June 1960.

15. Simons, "The Optimum Gain for a CATV Line Amplifier", Proceedings of the IEEE, Vol. 58, No. 7, July 1970, pp. 1050-1056.

APPENDIX A CROSSMODULATION COEFFICIENT

Reference Trunk Amplifier

M1	=	-82 dB	Xmod at reference level (12 channels)
Y1	=	40 dBmv	Reference Level
F1	=	9.5 dB	Noise Figure at 270 MHz
G1	=	23 dB	Gain of Reference Amplifier
Q1	=	20 (Log (N9-1)- Log (11))	N9 is actual number of channels

X1 is crossmod of reference amplifier

X1 = (M1 + Q1)-(2)(Y1-E1)   Where E1 is output level

Bridger Amplifier

M2	=	-82 dB	Xmod at reference level (12 channels)
Y2	=	40 dBmv	Reference Level
F2	=	12 dB	Noise Figure of bridger amplifier
G2	=	27 dB	Gain of bridger amplifier
E2	=	Output level of bridger amplifier	
X2	=	(M2 + Q1) -2 (Y2 - (E2 + 7)	Crossmod of bridger at level (E2 + 7) dBmv

The bridger coefficient or number of equivalent trunk amplifiers in cascade (in terms of Xmod) is:

B1 = 10 raised to the power (X3 - X1)/20

Line Extender

M3	=	-82 dB	Xmod at reference level (12 channels)
Y3	=	40 dBmv	Reference Level
F3	=	12 dB	Noise Figure at 270 mHz
G3	=	22 dB	Gain of line extender

X3 = (M3 + Q1) -2 (Y3 - E3)   X mod at level E3

The line extender coefficient (or equivalent number of trunk amplifiers is cascade, in terms of Xmod) is

L1 = 10 raised to the power (X3 - X1)/20

For a cascade of N2 line extenders,

L1 = (N2) (L1)

Total System Crossmod Coefficient CX (at nominal temp)

The total cascade number is then -	EQUIVALENT CASCADE	ACTUAL CASCAD
Total trunk cascade	N1 amplifier	N1
Bridger Coefficient	B1	1
Line Extender	L1	N2

System Coefficient = N1 + B1 + L1 = C_x

System Crossmod = X1 + 20 Log (C_x)

APPENDIX B - SIGNAL TO NOISE RATIO COEFFICIENT

Reference Trunk Amplifier

S1 Trunk S/N Ratio

$S1 = 59 - F1 + (E1 - G1)$ dB Equation

Bridger S/N Ratio

$S2 = 59 - F2 + (E2 + 7 - G2)$ dB Equation

Equivalent Trunk Cascade (In terms of S/N)

N3 = 10 raised to the power (S1 - S2)/10

Line Extender S/N Ratio

$S3 = 59 - F3 + (E3 - G3)$

Equivalent Trunk Cascade of single LE (In Terms of S/N)

Q4 = 10 raised to the power (S1 - S3)/10

N4 = (Q4) (N2) Where N2 = number of LE in cascade

System Noise Coefficient	EQUIVALENT CASCADE	ACTUAL CASCADE
Total Trunk Cascade	N1 Amplifiers	N1
Bridger Coefficient	N3	1
Line Extender Coefficient	N4	N2

System Noise Coefficient $C_n = N1 + N3 + N4$

System S/N = $S1 - 10 \text{ Log } (C_n)$

A COMPUTER DESIGN OF CATV DISTRIBUTION SYSTEMS

Ivan T. Frisch, Vice President
Bill Rothfarb, Sr. Engineer
Aaron Kershenbaum, Sr. Engineer

Network Analysis Corporation
Beechwood, Old Tappan Road
Glen Cove, New York 11542

Abstract

CATV distribution systems are expensive. To reduce hardware costs, we have developed a package of computer programs that generates complete layouts and designs for CATV distribution systems. Since the computer does not rely on "intuition", it is not restricted to using routine approaches but is free to select the best combination of components and layout which meet the system specifications.

To illustrate how money can be saved with network optimization by computer, we examine a number of results derived from actual computer runs. These results include the layout of feeder and trunk cable, the location of distribution amplifiers, and detailed assignment of amplifier locations as a function of cable sizing and coupler assignments. The computer's designs not only save money but are free of the approximations, rules of thumb and inadvertent errors introduced by human designers.

Introduction

The large number of subscribers and the requirements on signal quality make well-designed broadband cable television systems among the most difficult networks to achieve. For this reason we at Network Analysis Corporation have combined modern network analysis and computer methods to optimize CATV distribution system design. The result is a computer program which completely engineers a CATV distribution system. The computer-designed systems, when compared to manually-designed systems are produced faster, are more dependable and have significantly lower hardware cost. Furthermore, once a design has been developed, its details and specifications are already in a form suitable for computerized inventory, maintenance and replacement studies.

The Problem

The CATV system designer is faced with a host of competing variables and requirements such as cross-modulation, noise, bandwidth, temperature, alternate routes and component characteristics. Somehow, he must contend with all of these factors to produce his design. The design involves many crucial decisions.

TABLE 1

The Complex Decisions for CATV Design

- Selection of head end sites
- Location of messenger cable
- Selection of trunk distribution points
- Selection of components and manufacturers
- Selection of amplifier output levels and gains
- Location of trunk and feeder cable
- Sizing of cable, location of amplifiers and assignment of splitters and couplers
- Specification of tilt compensation, padding and settings for amplifiers
- Assignment of automatic gain and slope control, and temperature compensation
- Specification of subscriber taps
- Location of power supplies
- Provision for future system expansion

If any of these aspects are not given adequate consideration, the result can be a costly or a low performance design.

The result of the design process must be a complete design detailing: location and specification of all components including cable, couplers and amplifiers, signal levels, cross modulation and noise levels throughout the system, a bill of materials, and all of the other items shown in Table 1 above.

To cope with all this, the human designer must compromise and decide on many of the design parameters either independently or without examining the full range of interactions among them. These compromises can be costly. In all cases in which good manual designs produced by professional designers have been directly compared with designs independently generated by NAC's computer programs, the computer has produced substantial savings while obtaining equal or superior system performance. The savings on hardware have ranged from 8% to 40% of the cost of the manual design. Even for a small system with only 15 miles of strand, NAC's design was 8% lower than the best effort of a group of designers who designed their system as part of a competition among themselves.

Examples of Savings by Computer CATV Design

Since the computer does not rely on "intuition", it is not restricted to using routine approaches that were developed to handle similar but not identical cases. The computer is free to select the best combination of layout and components which will meet the system specifications. After studying the results of the computer's optimizations, it becomes evident that the computer designs are based on sound engineering principles applied in unique and original ways to each particular situation. The best way to illustrate how money can be saved using NAC's computer CATV design program is to examine results derived from actual computer runs. Component specifications for these examples are shown in Table 2.

The computer can, of course, use any components with any characteristics from any manufacturer or manufacturers. The simplified characteristics in Table 2 are representative and are used for the sake of illustration. The specifications, such as output level, which is normally chosen by the computer, are assumed to have been selected on the basis of overall system constraints on noise, cross modulation, intermodulation and performance under temperature variation. Thus, the examples are reduced to their simplest terms.

In the examples we assume the following system specifications and constraints:

1. The telephone poles are located 100 feet apart.
2. The minimum signal level at the termination of any feeder is 26 dBmV for an undedicated system. Amplifier gains have been derated to allow for subscriber tap losses.
3. There can be no more than two extender amplifiers in any cascade.

4. Cable size can change only at a splitter, coupler, or amplifier.
5. Amplifier output levels must be exactly as in Table 2. Variable gains and equalizers are included in the amplifiers.

6. Items such as AGC, power supplies and reflections are ignored for case of illustration.

• A cable television distribution system involves a vast number of possible structures or layouts--far too many to select by eye, experience, intuition, or by evaluating every possibility. For example, examine the strand map shown in Figure 1. Any CATV designer would consider this system trivial--there are only 4 blocks with 4 telephone poles per street. Yet for even this simple example, if every street is to be covered, there are 49,152 possible feeder cable layouts. One possible layout is shown by the heavy lines.

It is easy to see that even for a very small town with only 15 miles of strand, the number of possible layouts is so large that both intuition and brute force enumeration of all possibilities fail as optimum design methods. In fact, for most small systems if one were to cover the earth with computers each 1 square inch in area and each making one million evaluations per second, it would take more than the lifetime of the universe to examine all possible system layouts for the town. NAC's computer programs are able to avoid these problems to produce savings.

• Cable is available in certain fixed diameters. For trunks, designers usually select .412 inch, .500 inch, .750 inch or 1.00 inch coaxial cable. The discreteness of cable sizes can invalidate most insights the human may have while at the same time creating a huge and onerous selection from possible cable size combinations. Even for the small section of trunk shown in Figure 2, with cable sizes changing only at splitters or amplifiers, and allowing only two possible sizes for the trunk, there are 1024 possible cable size combinations.

Figure 3 shows how the computer's optimum choice of cable has reduced the hardware cost in one actual case of trunk design. We assume the location of the first trunk amplifier is given. The next trunk amplifier is moved 1.5 db left, a splitter combination is changed and as a result $78.00 is saved in cable cost.

- The steps required in creating a well designed CATV system are all extremely dependent on one another. It is usually impossible for a human designer to consider simultaneously even a small number of interacting problems, i.e., distribution point locations and the complete feeder and trunk layout. But to find the lowest cost system, many factors must be considered simultaneously. The human uses rules of thumb to reduce his problem to a manageable size. For example, one such rule used by some designers is: "keep the trunk as short as possible by pulling back the distribution points as far as possible." A design using this philosophy is shown in Figure 4a. The feeder design shown is the best possible one given the distribution point. A superior design, produced by the computer, is shown in Figure 4b. This design has a longer trunk and even has an extra trunk amplifier. But it costs $158 less.

- Changes in one part of a design can often have suprisingly significant effects on other seemingly remote parts of the system. Engineers have great difficulty in considering more than one local area at a time. For example, in the system of Figure 5a, a designer placed a 3-way hybrid splitter, the SP3W, on one output of the trunk bridger. He correctly judged the trunk bridger with 4 feeder outputs to be wasteful in this situation. Looking at the overall picture, the computer cascaded an SP8 and an SP3 to obtain the design shown in Figure 5b., using one less extender amplifier, with a resultant saving of $92.

- Small changes in design decisions can cause large changes in cost and performance. One of the most complex decisions is the location of distribution points. $140 was saved by moving the distribution point only 100 feet from the position in Figure 6a to the position in Figure 6b even though the layout was not affected. The money was saved by removing extender amplifiers and converting .500 cable to .412 cable.

In some cases it is undesirable to use more than one cable size for feeder cable. This may be due to the added cost of inventory or the added installation problems. However, often costs can be assigned to these factors. When they are added into the cost of cable, it is usually still worth while to use more than one cable size. Certainly, in many cases near the ends of feeder lines, small sections of cable of large diameter can eliminate many extender amplifiers. The computer can take these factors into account in its optimization.

- For the sake of simplicity, the above examples have been for undedicated systems. NAC's computer program integrates the assignment of subscriber taps into the overall design procedure to achieve large additional savings over conventional techniques. For example, the system in Figure 7. is a good manual design for a system designed with a flat loss allowance for subscriber taps of 6 dB between extender amplifiers. Required subscriber tap locations are indicated by darkened squares.

When the taps are added to this system, the resulting design will have four extender amplifiers. However, if the design procedure takes into account the actual tap losses rather than allowing a fixed flat loss, savings can be made. Thus, for the taps with characteristics shown in Figure 8 with a required signal of 11 dBmV at the tap output at 270 mHz , the design in Figure 9 is achieved with the given tap locations. The extender amplifier inputs can now go as low as 20 dBmV and the extender gains are 17 dB or 20 dB. Note that only two extender amplifiers are now required instead of four.

<u>A Complete CATV Computer Service</u>

As mentioned previously, the above examples were simplified for case of illustration. The computer program also performs temperature and AGC calculations, assigns equalizers, locates power supplies, and can add extra poles and strand where allowed and where economical.

In addition to the savings, speed and performance assured in performing these operations by computer, there are two other striking advantages.

a. Suppose a new line of components appears on the market. The human designer must begin anew to gain experience before he can produce efficient designs. NAC's program has no such problem. The computer has actually designed systems with components that do not yet exist but are being considered as possible new products. The computer program is simply fed the characteristics that the manufacturer would like his device to have and the computer program produces its design. The manufacturer can then judge whether the proposed device is worth producing. Among the system features the program has evaluated are integrated circuit components, two-way systems, new lines of equipment and specialty items.

b. Once a system has been built, the program is not through. It can be used to set up a data base for inventory maintenance and replacement schedules, and to monitor, study, adjust, alter or update the system throughout its lifetime. Its uses have included:

- Aging and replacement studies
- Modernization by using new equipment
- System expansion
- Expansion of capabilities
  - bandwidth
  - addition of two-way sections

<u>Conclusion</u>
The CATV industry stands at the threshhold of one of its most explosive and vital periods of growth. The design decisions and commitments made now will have long lasting effects on the cost, performance and ultimate capability of the vast cable television enterprise. It is essential that these new systems be designed efficiently and economically. NAC's computer CATV design program can play a vital role in this effort.

COMPONENT CHARACTERISTICS

COMPONENT	TRUNK OUTPUT LEVEL (DBMV)	MAXIMUM GAIN ON TRUNK (DB)	FEEDER OUTPUT (after all splits) (DBMV)	MAXIMUM GAIN TRUNK TO FEEDER (DB)	COMPONENT	FEEDER OUTPUT LEVEL (DBMV)	MAXIMUM GAIN ON FEEDER (DB)
TRUNK AMPLIFIER	29	22.5	—	—	EXTENDER AMPLIFIER (one in cascade)	40	14
		SYMBOL:				SYMBOL:	
		COST:	$350			COST:	$150
TWO OR FOUR FEEDER TRUNK BRIDGER AMPLIFIER	29	22.5	42	48	EXTENDER AMPLIFIER (two in cascade, must be used for both amplifiers in a cascade of two)	37	11
	TWO FEEDER SYMBOL:		FOUR FEEDER SYMBOL:			SYMBOL:	
	COST:	$600	COST:	$700		COST:	$150
TWO OR FOUR FEEDER DISTRIBUTION AMPLIFIER	—	—	42	36	CABLE		
	TWO FEEDER SYMBOL:		FOUR FEEDER SYMBOL:		.500": 1.5 db loss/100' at 270 MHZ SYMBOL: - - - - COST: $.095/ft.		
	COST:	$400	COST:	$500	.412": 2.0 db loss/100' at 270 MHZ SYMBOL: —— COST: $.065/ft.		

SPLITTERS AND COUPLERS

$16: SP8 — 1.5 db loss; 8 db loss

$18: SP3 — 3.5 db loss; 3.5 db loss

$19: SP3W — 6.5 db loss; 3.5 db loss; 6.5 db loss

<u>Table 2</u>
Extender amplifier gains have already been reduced by 6 dB to allow for tap insertion losses in examples of designs of undedicated systems.

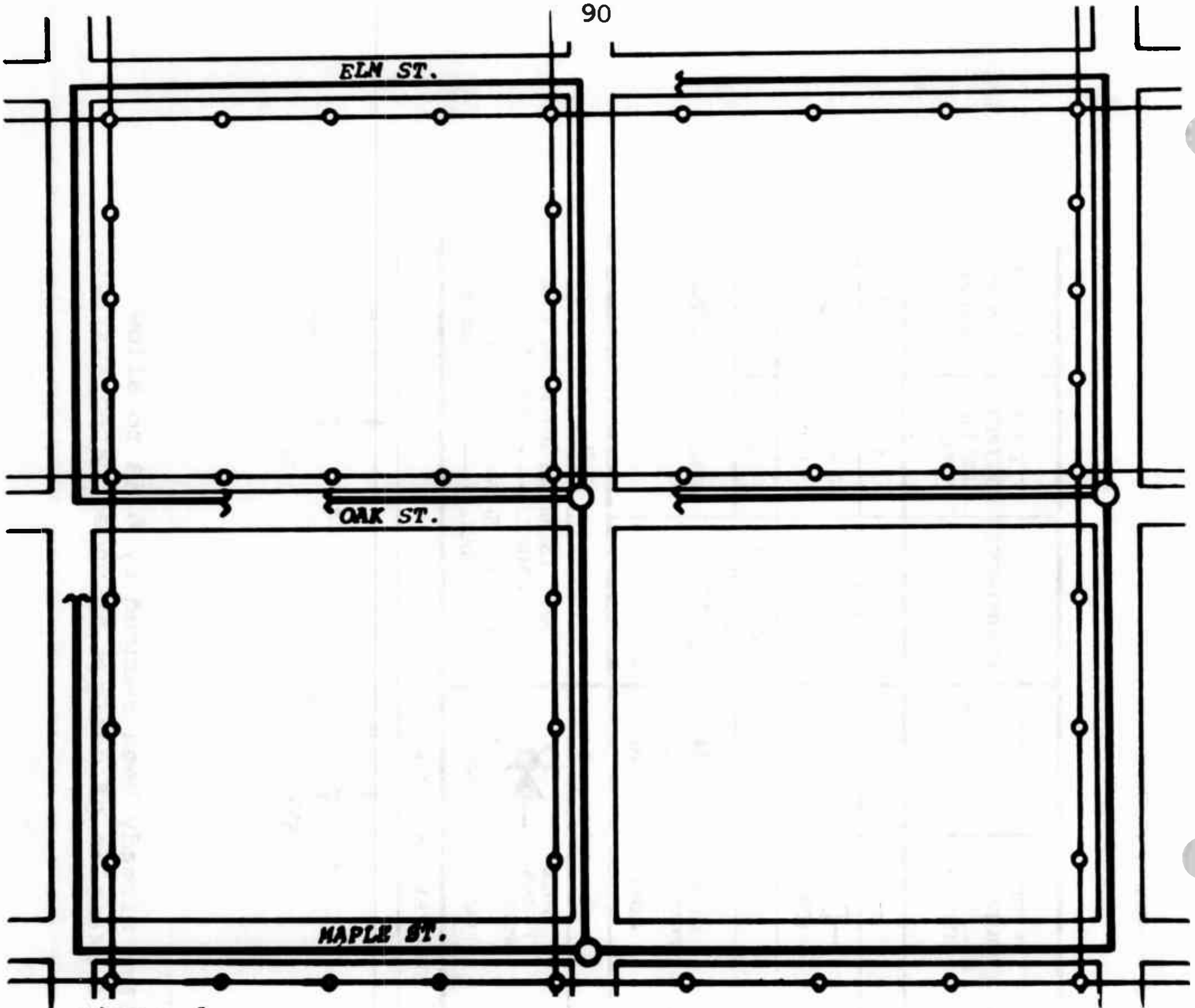


Figure 1
There are 49,152 possible feeder layouts for this four block strand map.

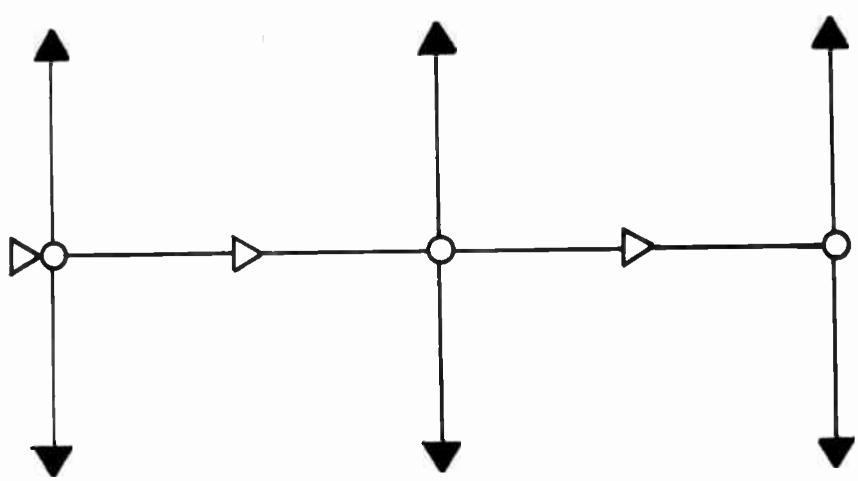


Figure 2
There are 1,024 possible cable diameter combinations for this layout.

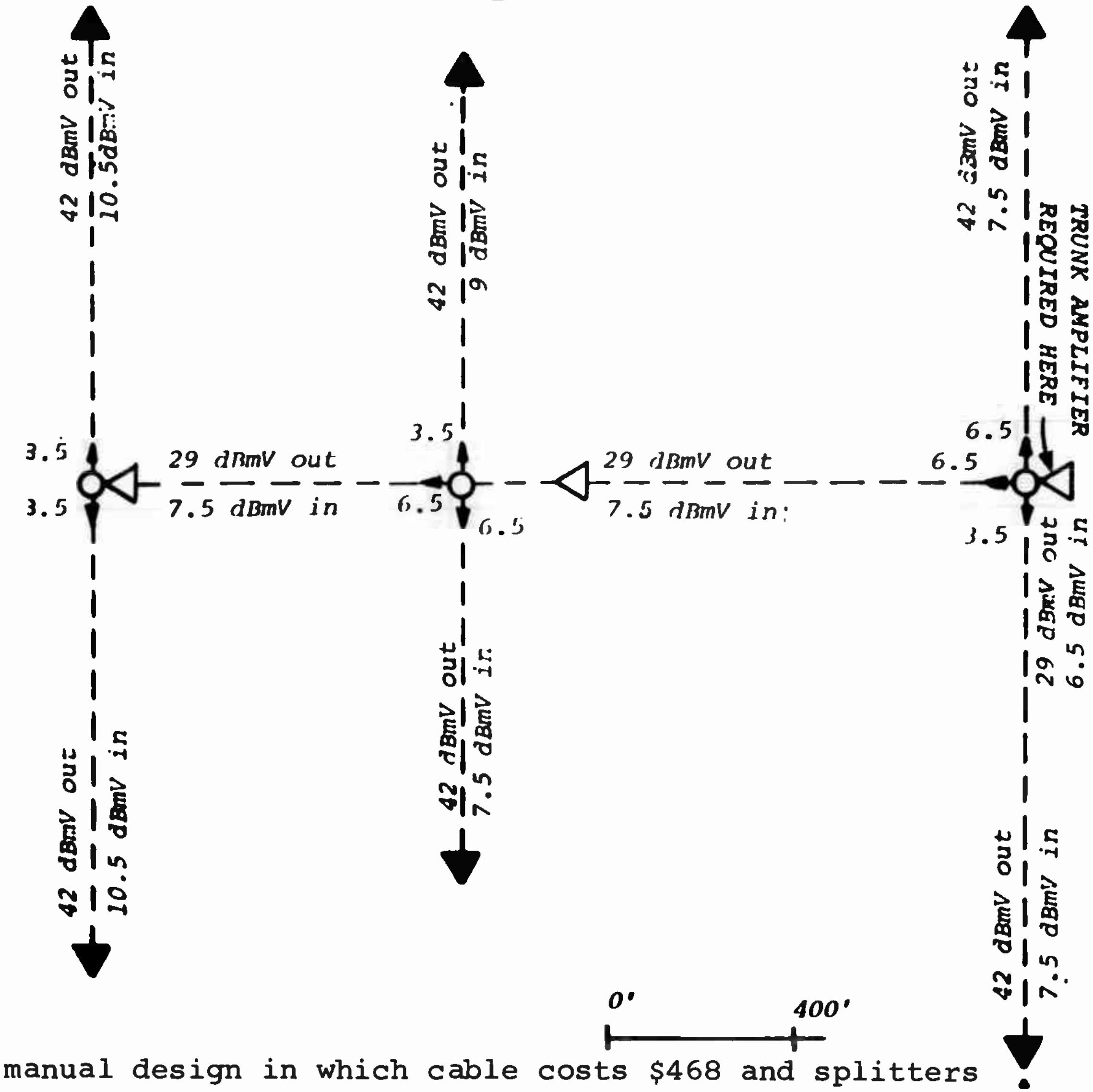
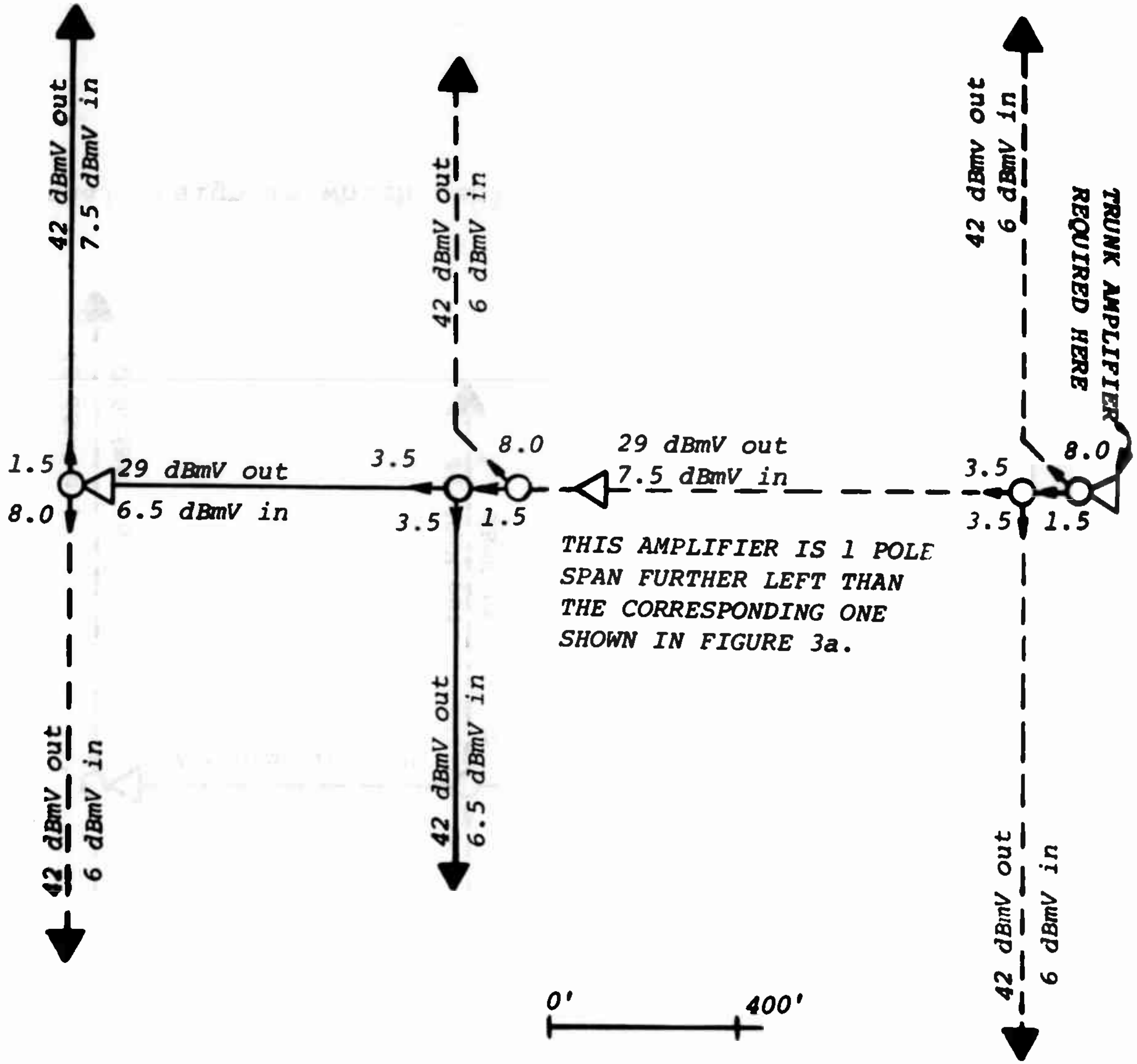


Figure 3a
An excellent manual design in which cable costs \$468 and splitters cost \$56.



<u>Figure 3b</u>
In NAC's computer design splitters cost \$84 but the cable cost saving is \$78.

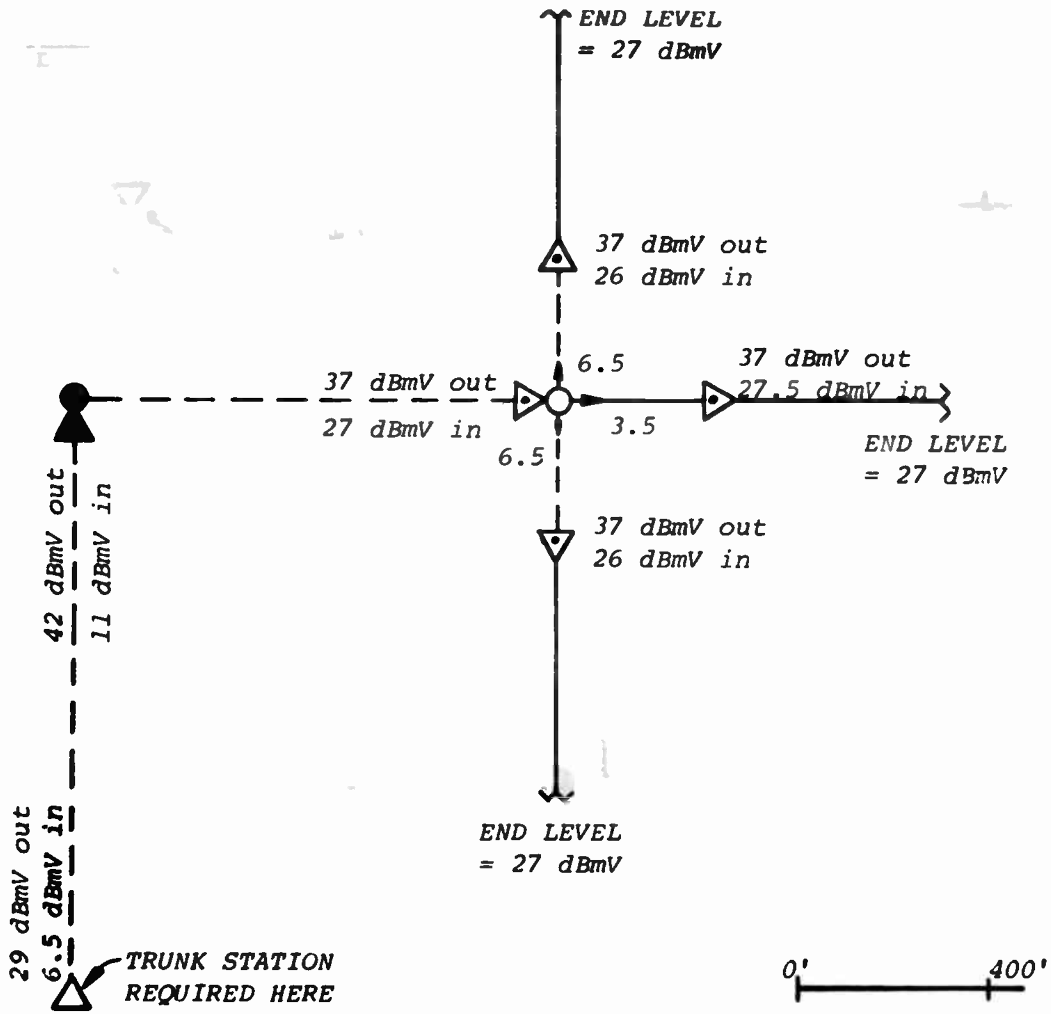


Figure 4a
Manual design.

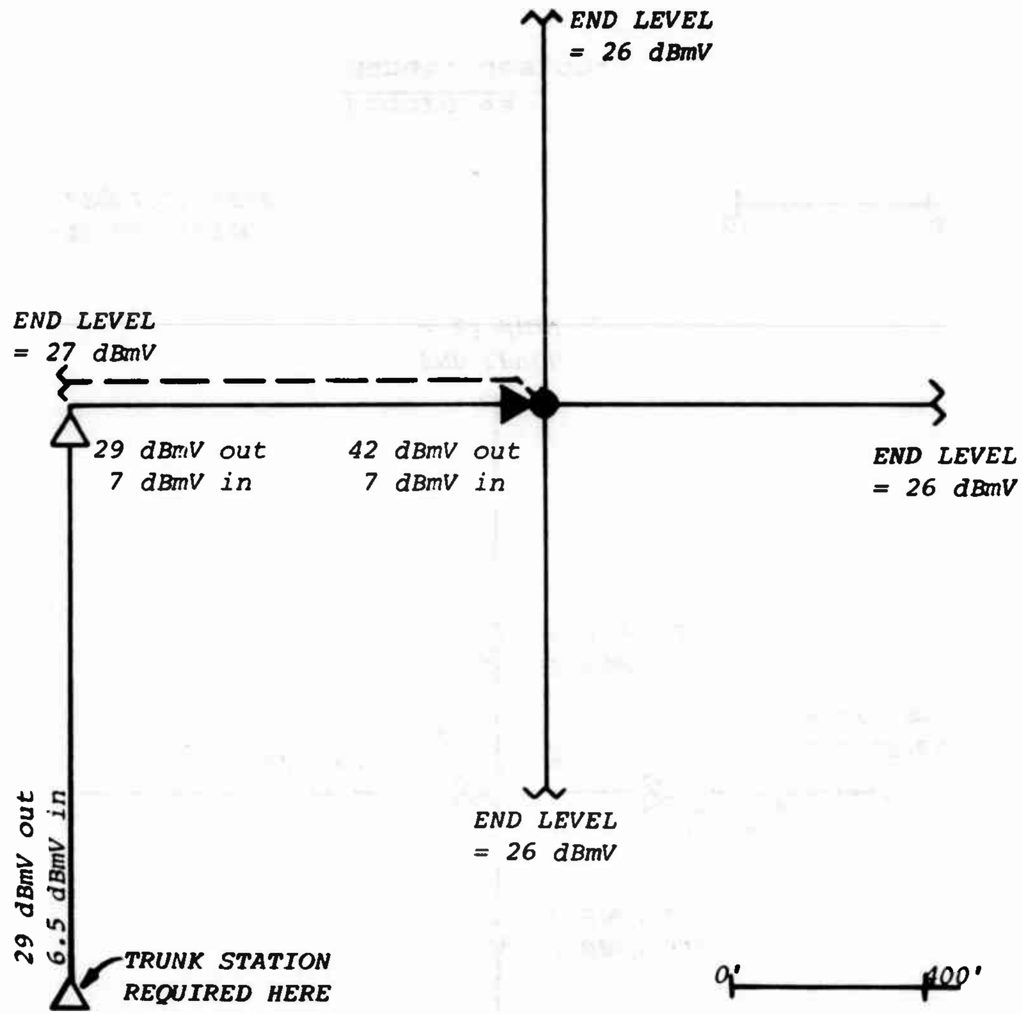


Figure 4b
The computer design costs $158 less--even though the computer design (Fig. 4b) contains one more trunk amplifier and has more trunk cable than the man-made design (Fig 4a).

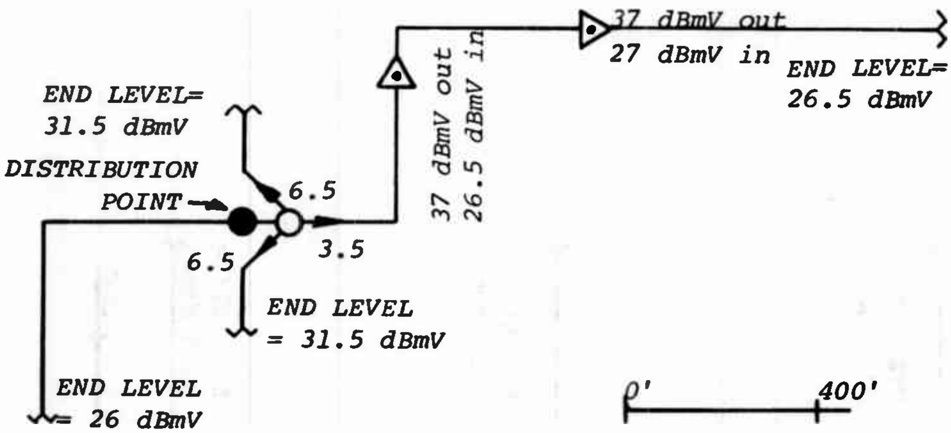


Figure 5a
Manual design.

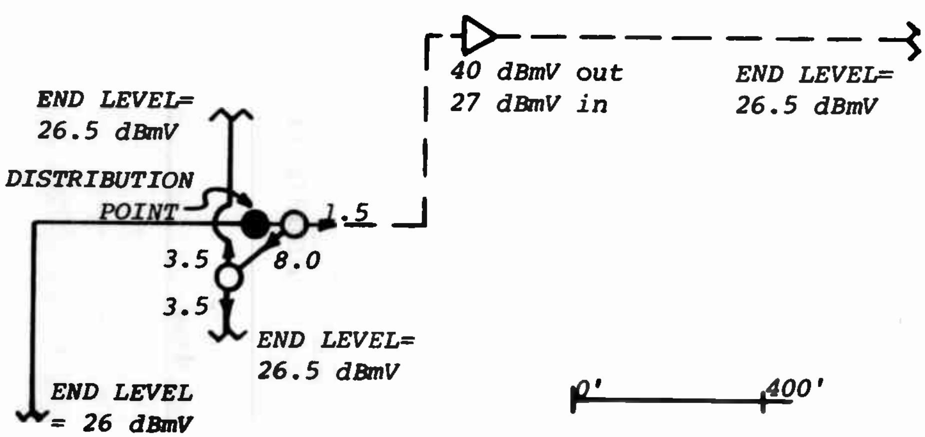


Figure 5b
NAC computer design. The computer excels at solving a tough problem--tailoring splitter losses to system needs. The computer design (Fig. 5b) saved more than 17% of the cost of the human designed system (Fig. 5a). It did this by using a directional coupler instead of a hybrid splitter at the distribution amplifier and by making better use of amplifiers and cable.

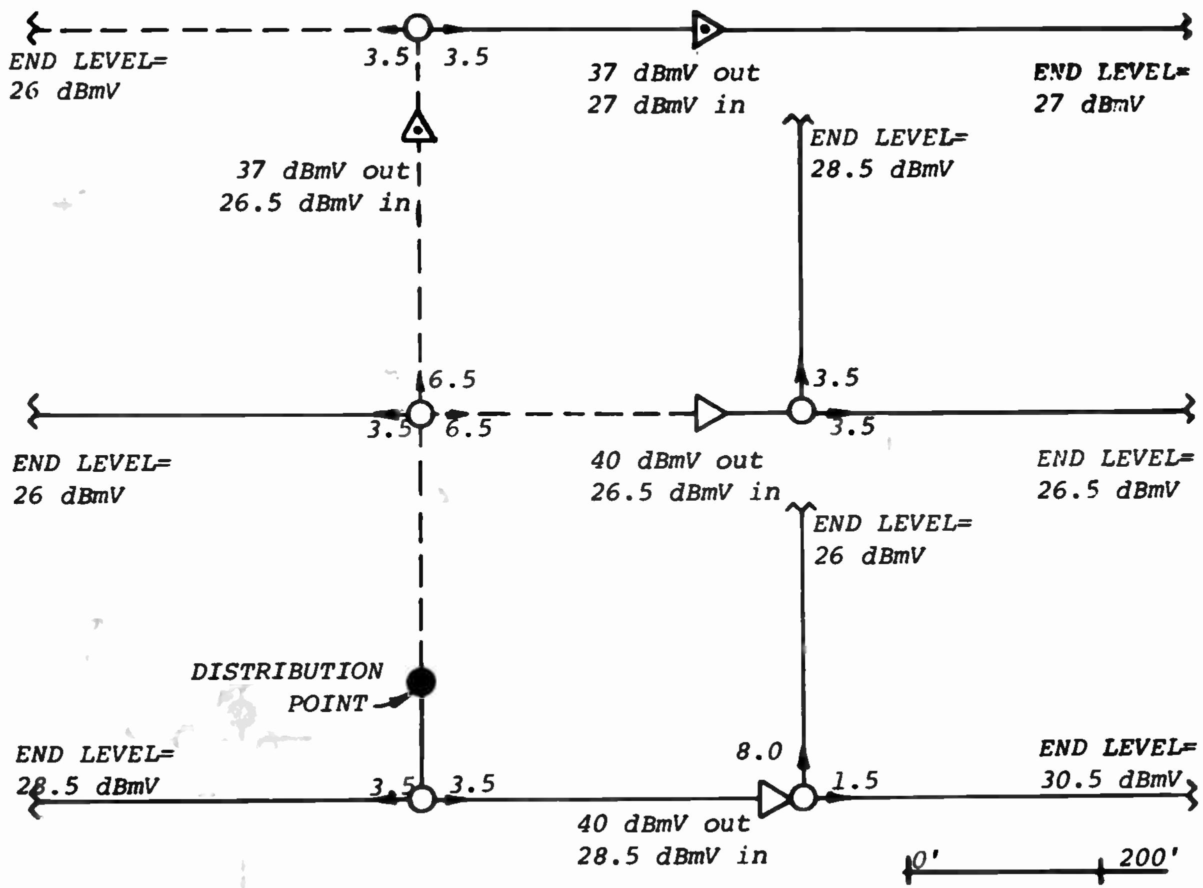


Figure 6a
Manual design.

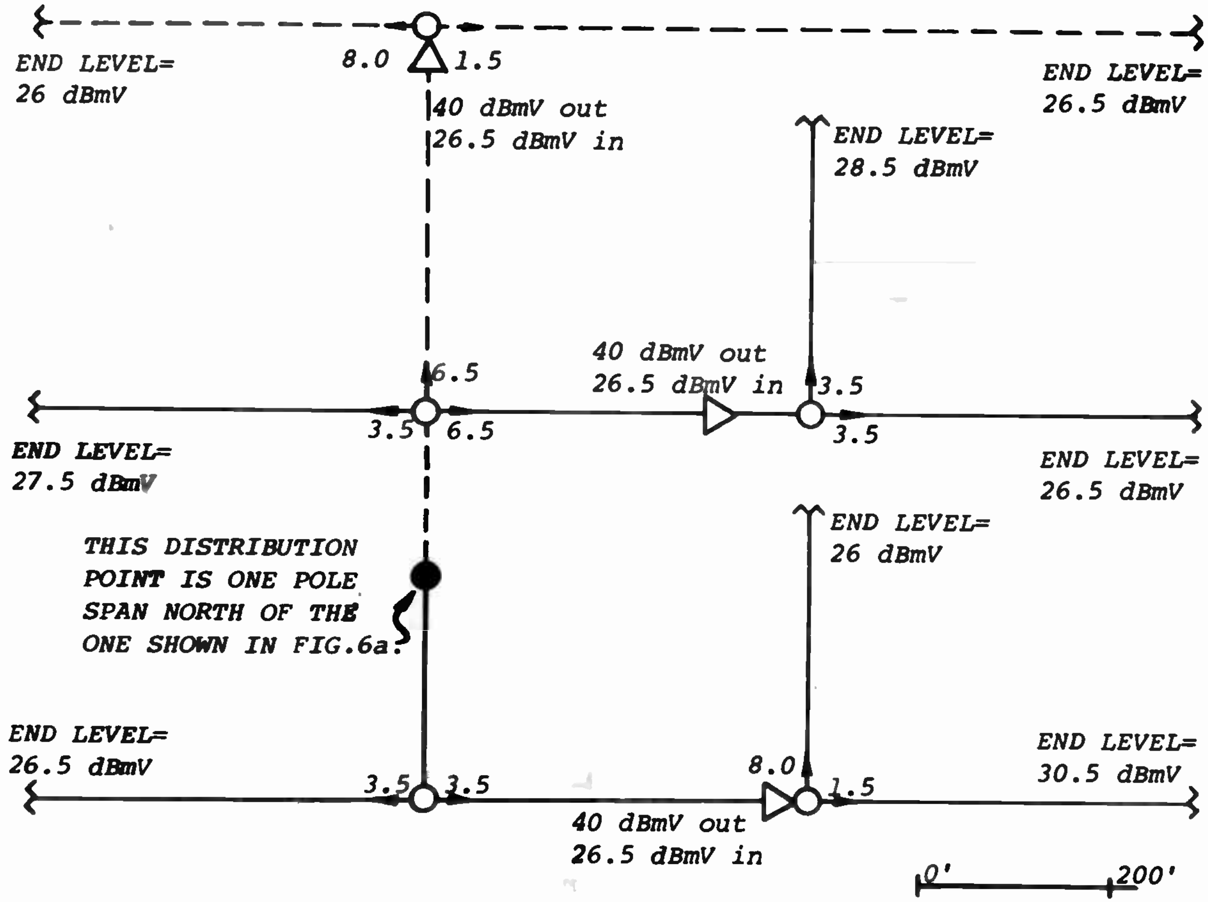


Figure 6b
In NAC's computer design, a 100 foot difference in distribution point location saves $140 or 13%.

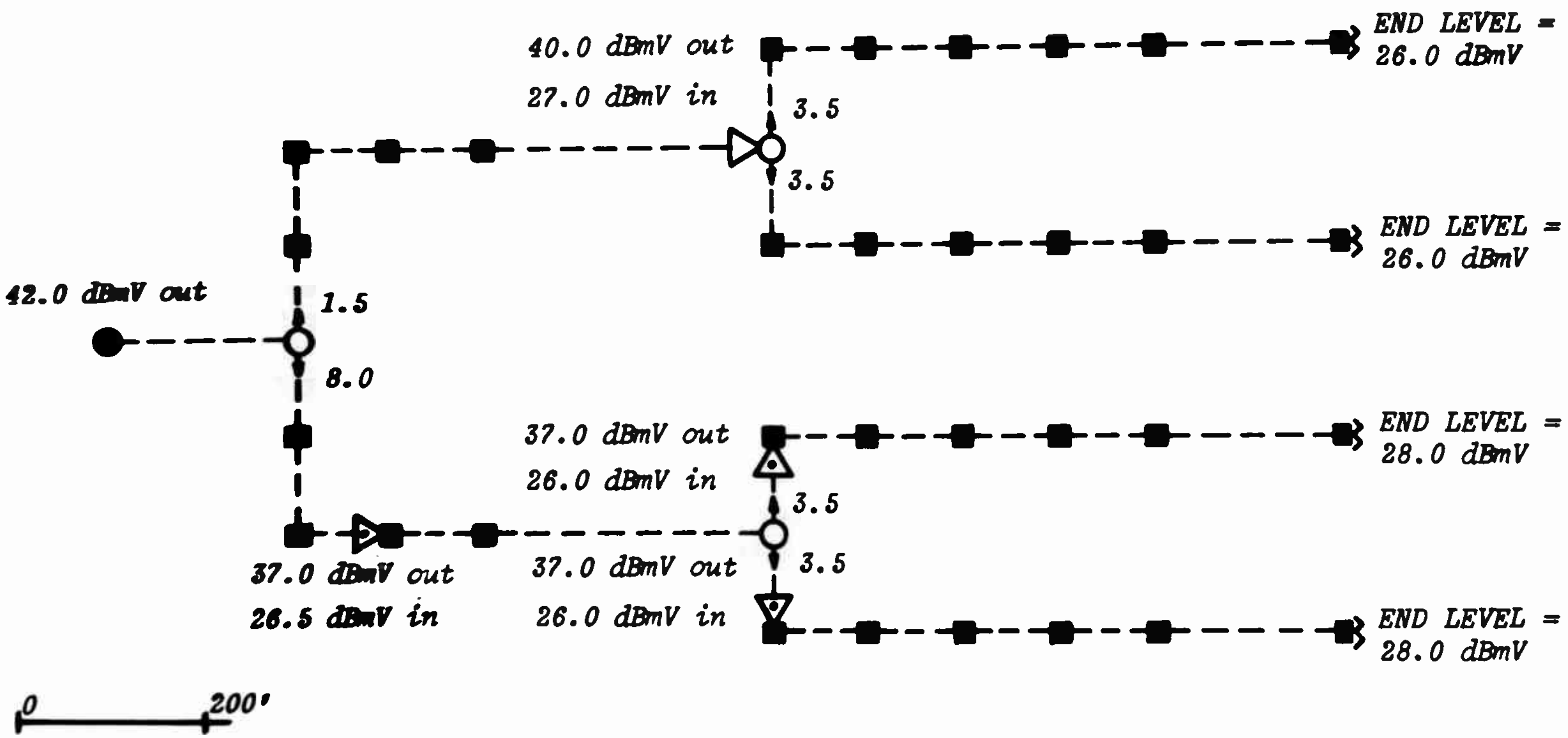
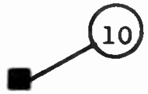
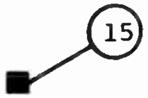
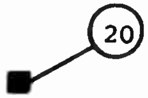
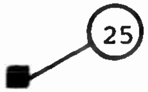
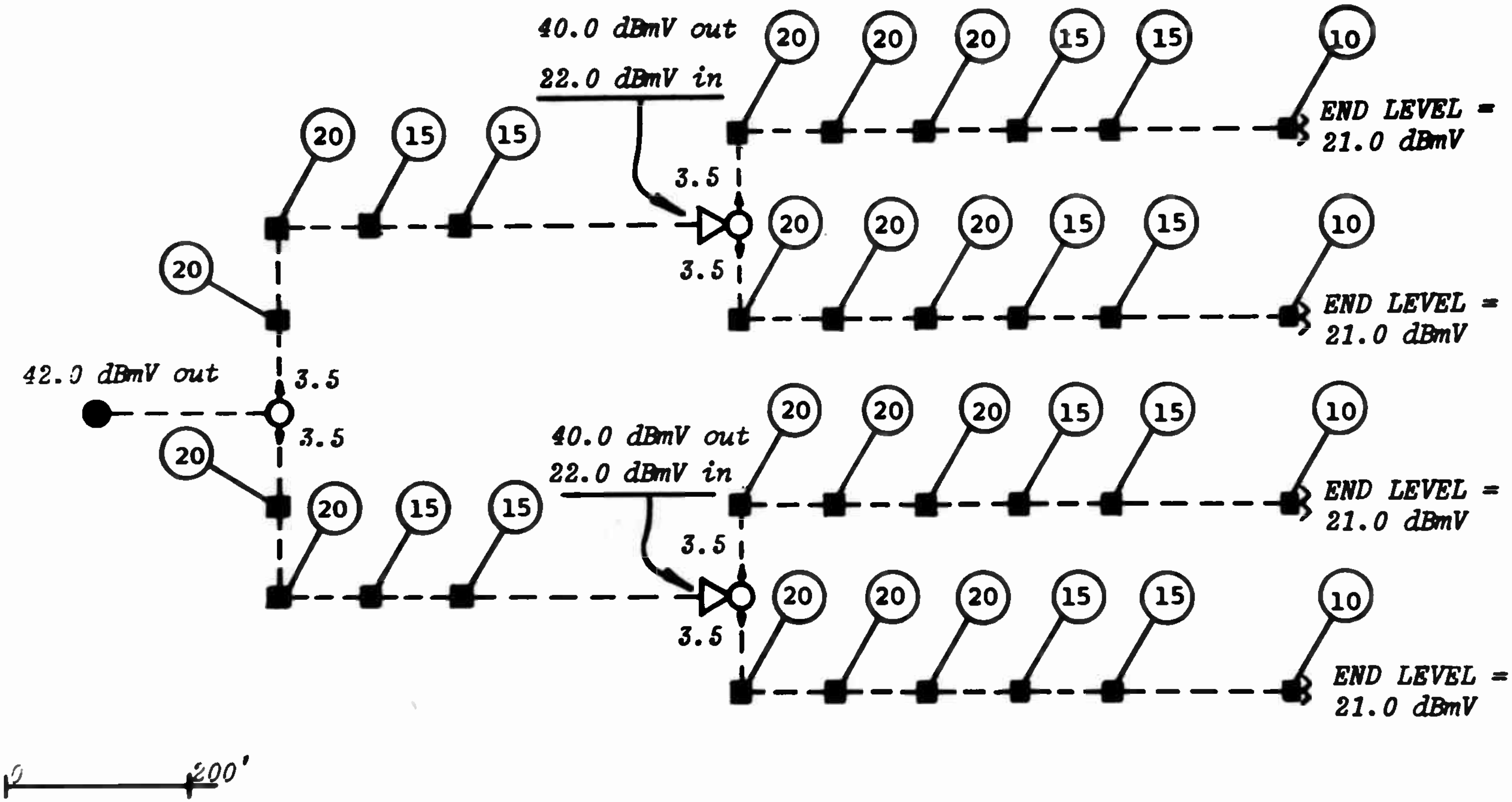


Figure 7
A manual design allowing 6 dB flat loss for taps.

Tap Symbol	*Tap Loss at 270 mHz (dB)*	*Insertion Loss at 270 mHz (dB)*
	*10.0*	*1.5*
	*15.0*	*1.0*
	*20.0*	*0.5*
	*25.0*	*0.4*

<u>Figure 8</u>
Subscriber tap characteristics.



<u>Figure 9</u>
The computer design takes the tap characteristics into account in the optimization. The design above contains two less extenders than the manual design in Figure 7.

Cable TV System Calculator

by J.Cappon.P.Eng.

Pres.J.Cappon & Assoc. Ltd. Cable T.V. Consultants.
1 Cathcart St., Willowdale,Ont., Canada.(416) 222-7376

INTRODUCTION.

If someone who is not familiar with Cable T.V. would ask me what planning a Cable T.V. system is like, my answer would be: it is very much like playing chess. Before you make a move you have to consider all the consequences of that move, as well as the consequences of the moves you plan to take thereafter.
To illustrate this, fig 1 shows a typical situation.

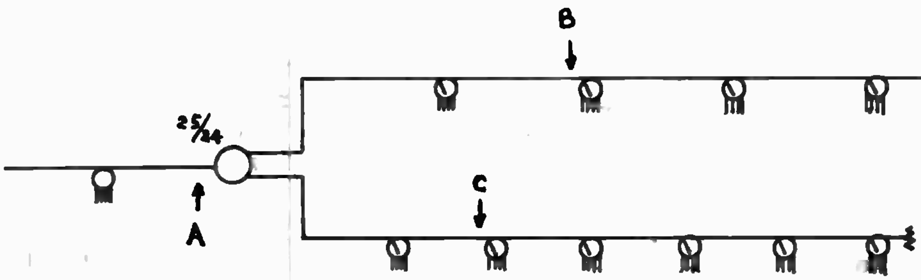


Fig.1

Signals arrive at the cable split with +25dBmV at ch 13 and +24dBmV at ch2. By merely splitting the signal amplifiers are required at point B and point C.
However, with one amplifier before the splitter at point A, this one amplifier is able to serve these two branches.
Fig. 2 shows the computation required to find out where the signal needs reamplification. Roughly three times as much effort is required to conclude that one amplifier would suffice.

CH 13 LINE	TAP	CH 2 LINE	TAP		CH 13 LINE	TAP	CH 2 LINE	TAP	
25.00		24.00			25.00		24.00		
3.30		3.30		SPLITTER	3.30		3.30		SPLITTER
-----		-----			-----		-----		
21.70		20.70			21.70		20.70		
1.70		.85		100FT .412	2.50		1.30		150FT .412
-----		-----			-----		-----		
20.00	10.00	19.85	9.85		19.20	9.20	19.40	9.40	
3.30		3.30		4-10 TAP	3.30		3.30		4-10 TAP
-----		-----			-----		-----		
16.70		16.55			15.90		16.10		
1.70		.85		100FT .412	2.50		1.30		150FT .412
-----		-----			-----		-----		
15.00	X	15.70	X		13.40	X	14.80	X	

Fig.2

From this example it is rather obvious that an aid to take over the time consuming calculations would be highly desirable.

COMPUTER ASSISTED DESIGN

A computer therefore, which in a split second could perform these calculations and come up with the optimum solution would be very helpful.
However, we must realize that the "Cable T.V. system computer" faces the same problems as his cousin the "chess playing computer".
The basic problem in programming a computer to play chess is in teaching the machine to be selective in the possible lines of play it considers. Where the human player is able to reject over 95% of possible continuations, the computer must labour through all variations before making a selection.
There are ofcourse more possible alternatives to consider by the "chess playing computer" than by the "Cable T.V. system computer".
To be precise there are six major alternatives to consider:

a. a splitter.
b. an amplifier followed by a splitter.
c. a directional coupler (-8dB) with the branch line pointing down.
d. a directional coupler (-8dB) with the branch line pointing up.
e. an amplifier + a dir.coupler (-8dB) with the branch line down.
f. an amplifier + a dir.coupler (-8dB) with the branch line up.

In a section of a distribution system with 16 cable splits, there are 6^{16} different combinations, (2.82×10^{12}). Allowing 1 m sec. for the computer to calculate the effect of one change we will have our answer in 89 years. This example illustrates that the computer, though fast, cannot consider all possibilities; it must therefore, as we stated earlier, be selective in it's choice removing the assurance that all possible alternatives were tried.

THE OPTIMUM SYSTEM.

In attempting to write specifications for an optimum design, four aspects need to be considered:

a. signal quality.
b. reliability.
c. maintenance cost.
d. initial cost.

A low cost system could have pieces of .412" and .500" intermixed, but for the sake of standardization this is not done. Each amplifier could be set to operate at nonstandard levels even while keeping an eye on distortion products. However, for the sake of standardization this too is unacceptable. House drops at -6dBmV could provide acceptable pictures, but out of consideration for older sets, safety factors, direct pick-up and possible second sets, this is not done. Even the most important cost factors such as amplifier operating and subscriber drop levels as well as the maximum number of "distribution line amplifiers in cascade" are compromises between these four previously mentioned aspects. Making these cost determining factors rigid, as one has to do when they are entered as design parameters in a computer program, may result in poor "trade offs".

Let me illustrate: Raising the minimum "tap Off" level by 1dB in a typical distribution line having seven 4 way tap off units spaced 100 ft. apart, will reduce the amplifier spacing by approximately 7%. Guaranteeing this new minimum level for 28 subscribers, based on an amplifier cost of $175.00 would cost approximately $\frac{7}{100}$ x $175 x $\frac{1}{28}$ = $ 0.44/dB/subscriber, which can be considered a reasonable compromise.
However, if at the end of a distribution line the signal would dip below its specified minimum, an additional amplifier would be required because 4 subscriber levels were .5dB below specification. Then the cost is $87.50/dB/subscriber, which should be considered a very poor trade off.
Had the "human touch" been involved this situation would have been spotted immediately, and one of the following possible alternative routes could have been taken:

a. permit the .5dB low subscriber level.
b. lower loss drop cable.
c. amplified tap.
d. indoor amplifier.
e. low power line extender.

Other areas where it is difficult to let the computer decide are where the requirements may alter because of:

a. new subdivisions.
b. possible rezoning of build-up areas.
c. difficulties in obtaining "right of ways".

To let the computer decide would require the programmer to establish probability factors which may be more difficult to determine than to solve the problem itself.

A CALCULATOR?

But up to now there has not been much choice. It is either a slow planner or a "fast" computer, and the cost per mile stayed somewhat the same. Yet a combination of a planner doing the design and a calculator performing the routine calculations appears to have merit. Such a calculator (preferably a desk type) must be capable of the following:

a. accepting input level information.
b. accepting cable type and length information between taps as well as from tap to TV set.
c. being programmed for required minimum level at TV set.
d. instantaneously providing tap off type and value.
e. working in reverse direction (from the end of a line).
f. retaining previously entered data when changes are made.
g. accepting a wide choice of dir.couplers and taps.
h. recording R.F. levels.

Almost all of these requirements could be met by a panel as shown in figure 3.

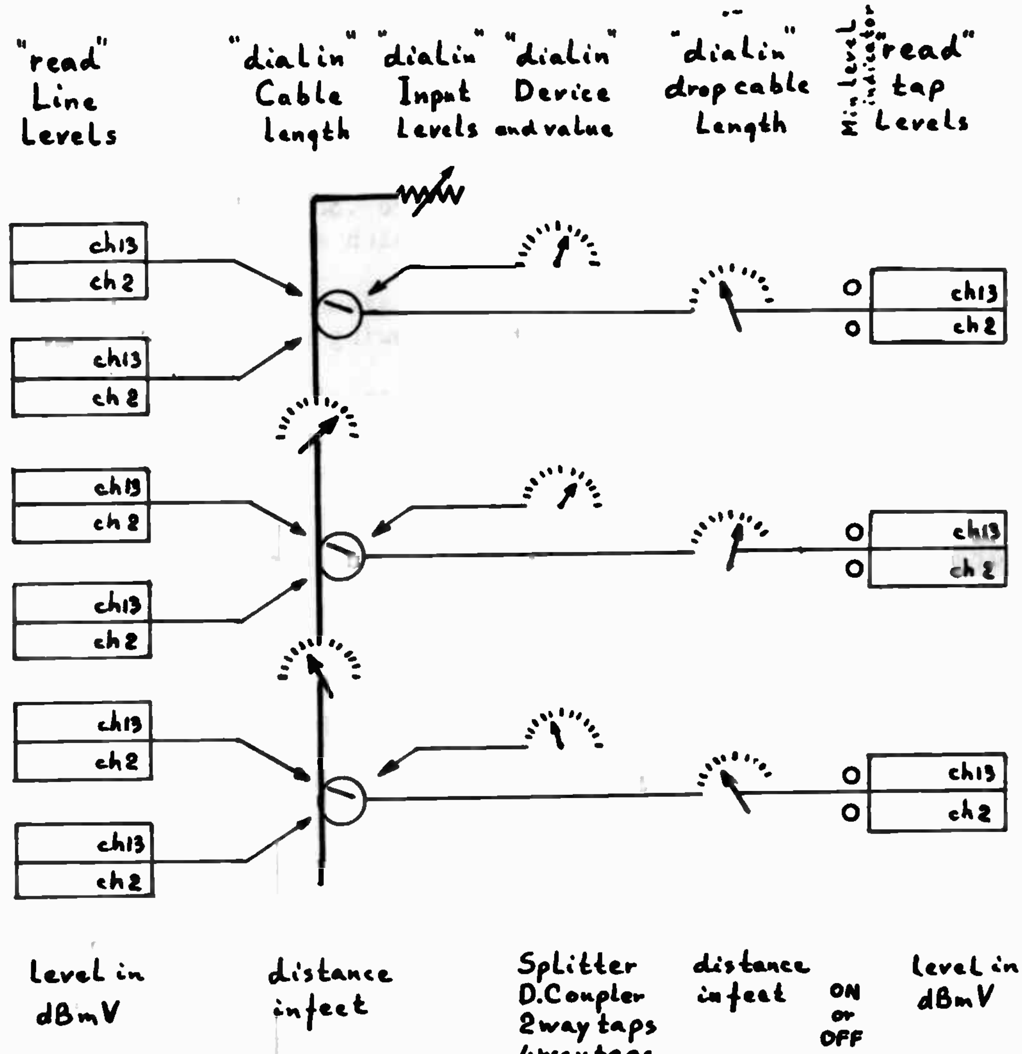


Fig.3

Input level is set with control and is displayed in the first window under "Line Levels". The largest drop cable length is "dialed in" for the first tap, and, subject to the setting of the "device knob" the tap level will now appear in the first window under "tap level". The "device knob" is set for the type of tap-off e.g. 2 way taps and then rotated to a value until both red lights have just extinguished. This process is repeated for each tap-off. When this calculator is requested to work in the reverse direction a feedback loop is required to maintain the last tap level at it's preset levels by controlling the input level.

a. In order to make a panel like this function, simulation can be achieved with RF through the use of high loss cable, switchable attentators, and digital read-cut RF level meters.

This possible solution is obviously too cumbersome.

b. Direct Current can be used. In order to prevent the wide dynamic ranges a current scale whould be chosen where each dB equals 10 mA.
All attenuating devices can now be represented by parallel resistors which are connected to ground,(providing that a constant voltage source is used as a supply) assuring a fixed current through each component according to the attenuation in dB of the device it simulates.
All contacts, plugs and sources need to be constructed in duplicate to simulate ch 2 & ch 13 operation simultaneously.

c. Similarly one dB can be represented by 1V, in which case a constant current source should be employed and each component be simulated by a series resistor, providing a fixed voltage drop according to the attenuation in dB of the device it simulates.

b and c are far simpler than the RF simulation technique; however these methods still leave much to be desired.

A MECHANICAL CALCULATOR?

Could it be that a mechanical-graphical method will out-perform electronics to serve RF distribution calculations?
The basis is a graph as shown in fig.4 with signal level at ch 2 p and ch 13 p plotted along the axes; each point on this graph will then represent a certain signal condition. The point marked A on this graph 41/34 respectively representing ch 13 p and ch 2 p carrier levels, is a typical output for a four way bridger amplifier.

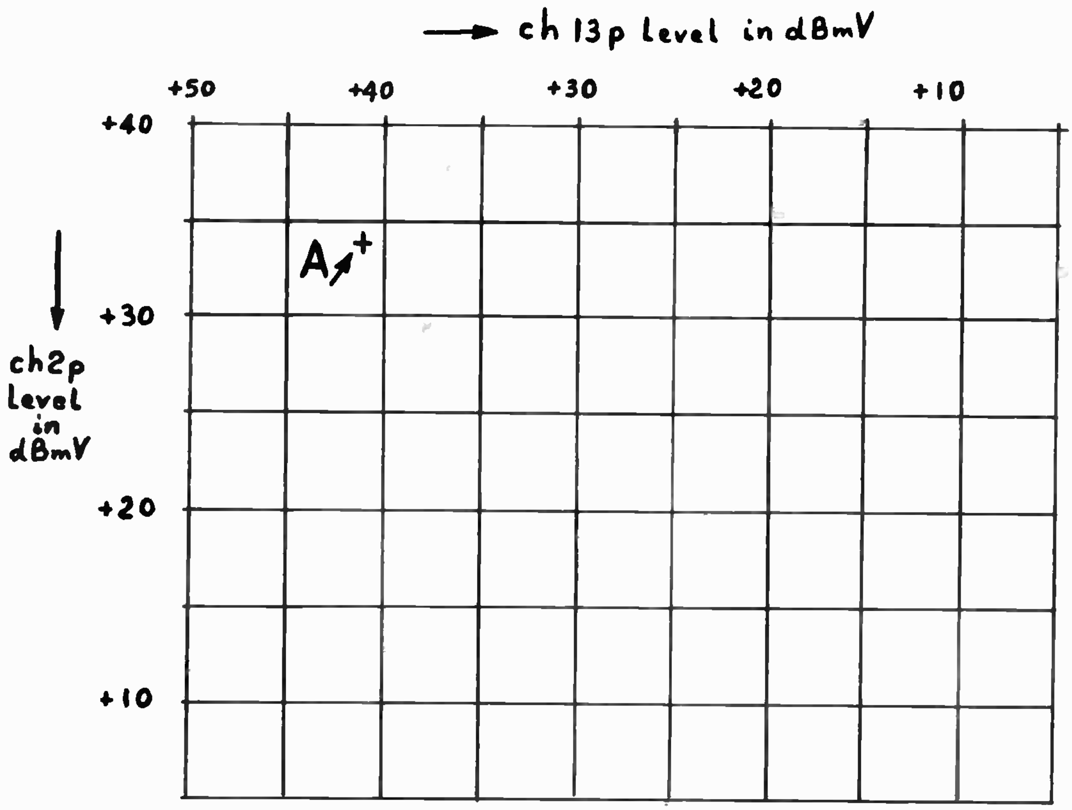


Fig.4

A cable run as shown in fig.5 can be plotted on the original graph. see fig.6

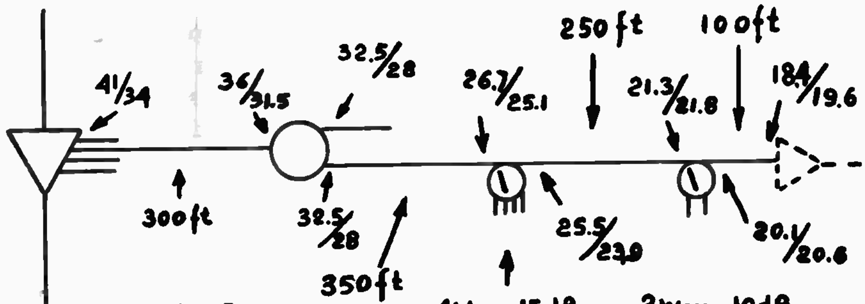


Fig.5

The first 300 ft. cable piece is represented by a straight line between it's input levels of 41/34 and it's output levels of 36/31.5. The 2 way splitter is represented by a straight line between it's input levels of 36/31.5 and it's output levels of 32.5/28. The other levels are represented similarly. It should be noted that the lines representing the flat losses of the splitter and taps have a 45 degree slope on the graph, while the lines representing cable are nearer 30 degree.

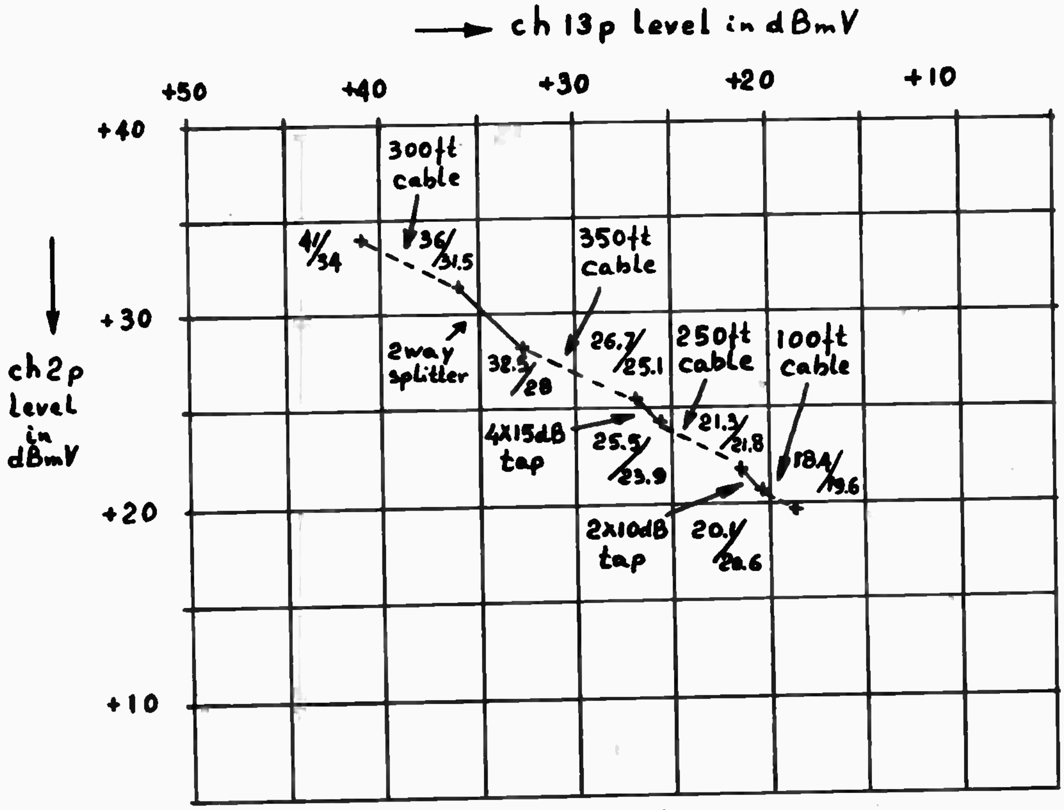


Fig.6

The graph can contain more information. Figure 7 shows the 2 way 10dB tap again; the horizontal dimension of that square represents the through loss at ch 13p; the vertical dimension represents the through loss at ch 2p.

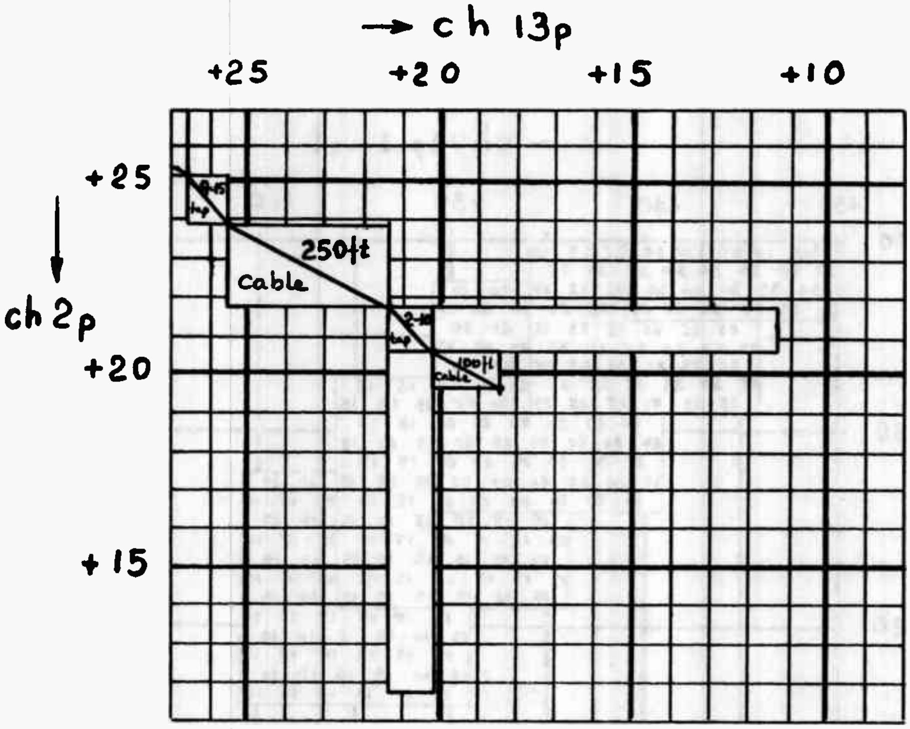


Fig.7

By changing the square to an L shape, through the addition of two rectangles as drawn, the tap off levels as well as the output levels can be read off the graph.
This is achieved by making the horizontal leg equal to the tap off loss at ch 13 and by making the length of the vertical leg equal to the tap off loss at ch 2.
A plastic module in the shape of an L can therefore be placed on the graph (see fig.8), indicating input, output, and tap off levels. Other L shaped modules representing other taps, dir. couplers and cables can also be placed on the graph and by sliding them together the signal flow and levels can be observed.

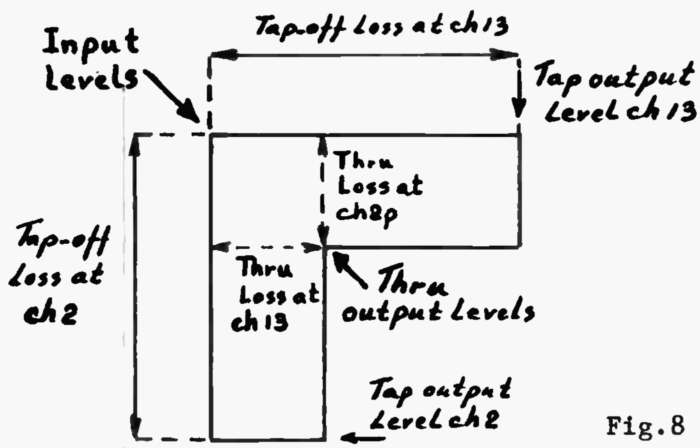


Fig.8

Once the required minimum tap off levels are established for the typical case (e.g. 100 feet of drop cable), it is possible to mark the area of levels on the graph where a 10dB device would be required, where a 15dB is required, etc. (see fig.9).

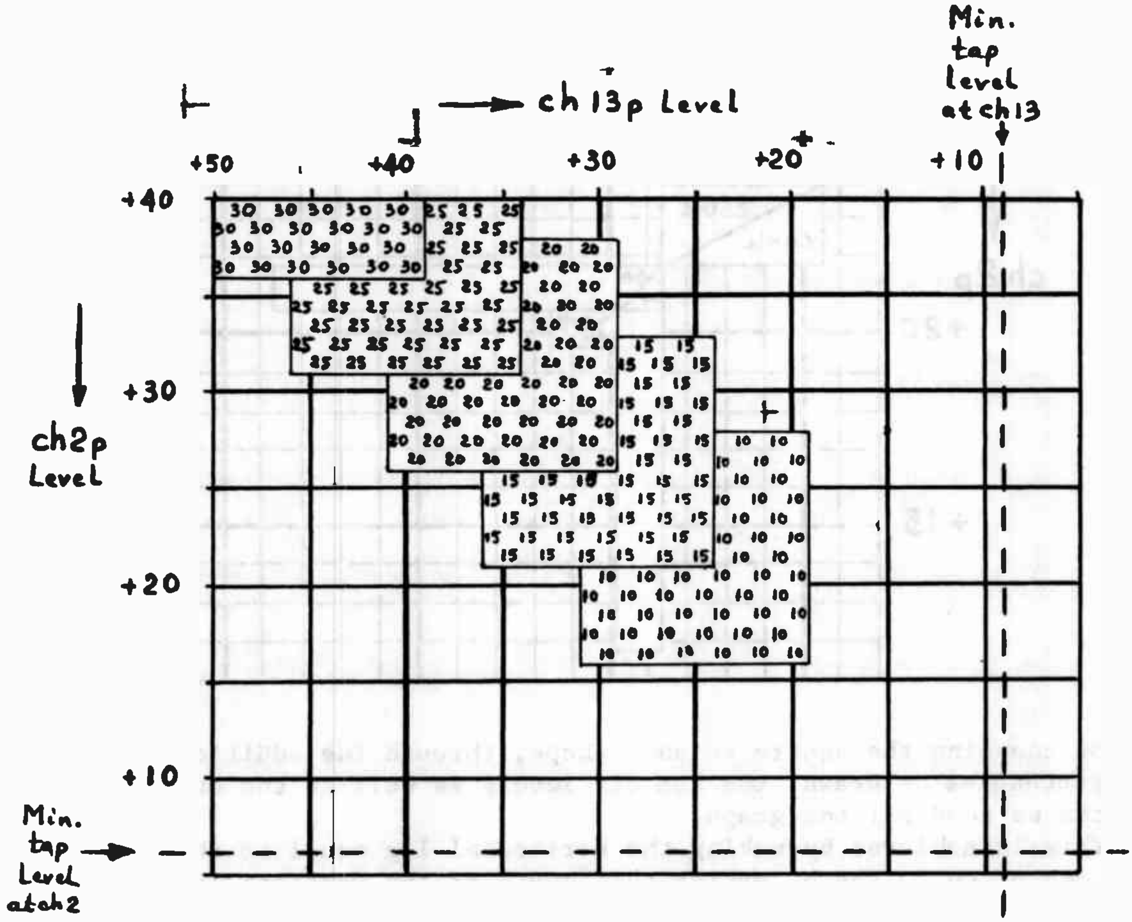


Fig.9

Since operators use different types of drop-cable and have different ideas as to what the tap levels should be, the area information and minimum required tap levels is printed on a transparent overlay and can be shifted to any operator's heart's content.

We have known for years that the tilt between ch 2 and ch 13 changes along the line between amplifiers and therefore a number of companies have marketed sloped taps.
However, it becomes difficult when designing in the conventional way, to decide if a sloped tap is desirable in a particular location and which frequency to choose first in order to determine the tap-off value. This problem can be solved because the overlay indicates whether a sloped tap or flat tap should be used and shows the value of the tap.(see fig.10)

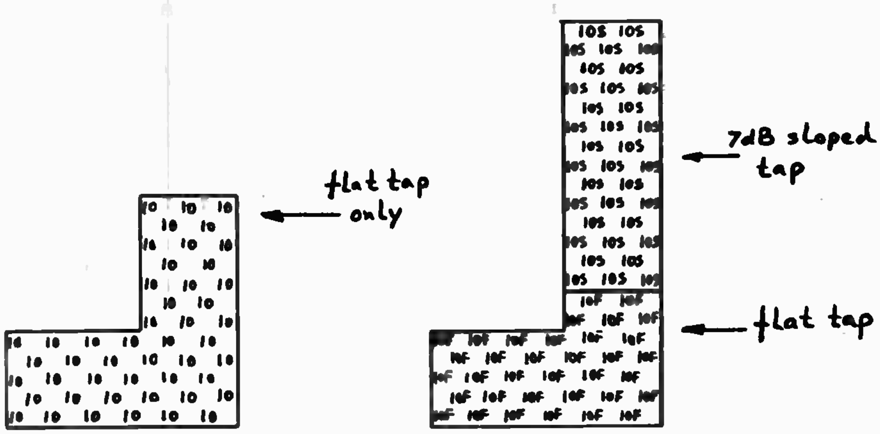


Fig.10

Yet there is more in this graph we can use. How does one determine which plug-in equalizer and, or pads to use in an amplifier when the input and output levels are known? Well, it takes some arithmetic. I have seen one techinician who carried a number of sheets around with all the tabulated data for two types of distribution amplifiers. It showed him what to do in regard to plug-in pads, switchable attenuators, and tilt and gain control for every conceivable input signal combination. Those days will soon be gone. Let us go through a little arithmetic again. Assume the desired output level is 40/36. A typical amplifier with all controls set for maximum gain provides 22dB at ch 13 and 20dB at ch 2. Minimum permissible input level therefore equals 18/16.(see fig.11)

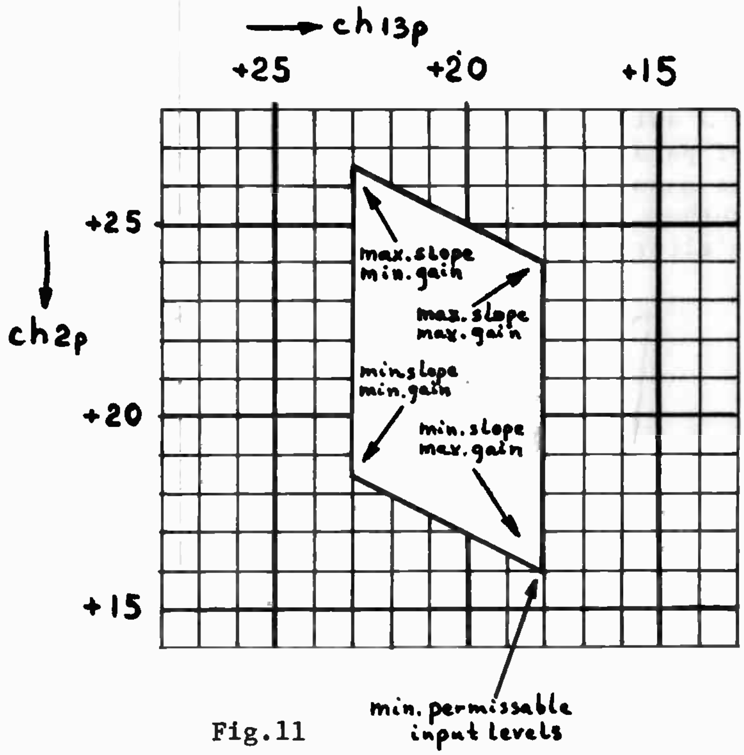


Fig.11

The internal slope control can reduce the gain at Ch 2 by 8dB. Therefore any point on the vertical line between 18/16 and 18/24 can be amplified to the desired output 40/36, by proper adjustment of the slope control. Similarly the gain control line between 18/16 and 23/18.5 indicates the levels which can be accomodated with the gain control.
Therefore any point within the drawn parallelogram can be amplified to the desired output levels
The shape of the usable area characterizes the behaviour of the controls, while the size indicates the control range. Fig.12 shows 4 possible amplifier characteristics.

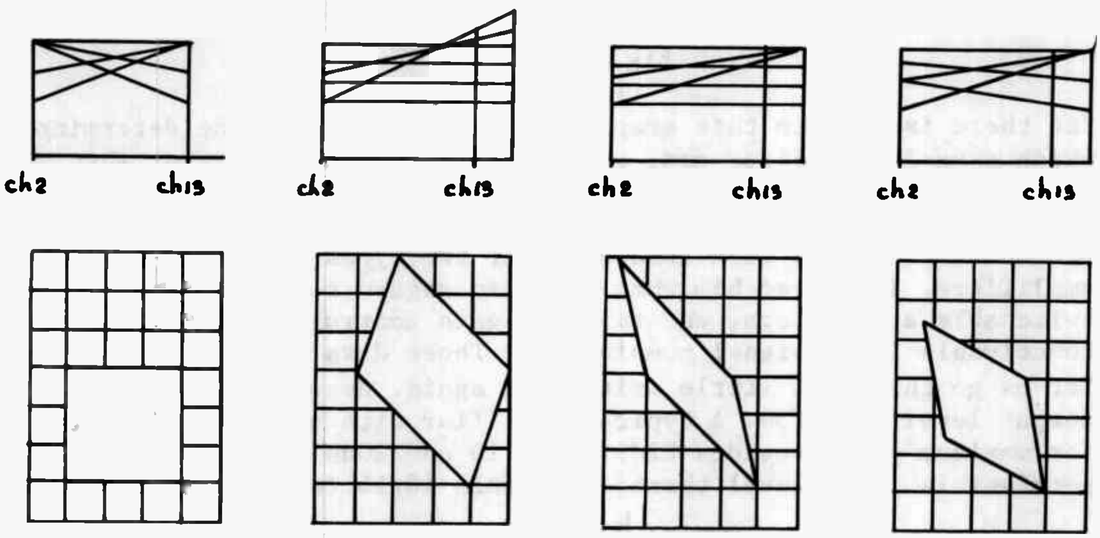


Fig.12

The addition of a switchable attenuator or "plug in" pads, results in a combination of parallelograms with overlapping areas. (see fig 13a) This permits the manufacturer to indicate a preference of one switch setting over another in these overlapping areas, resulting in one of the possible alternatives as shown in fig.13 b,c and d

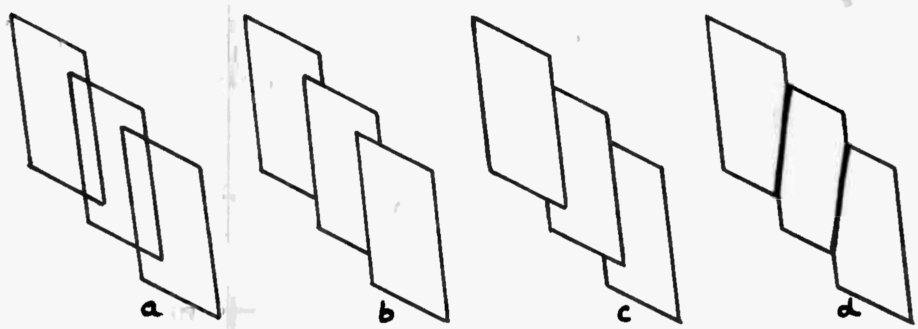


Fig.13

Similarly, switchable equalizers result in the effect shown in fig. 14b, while 14c shows the effect of the availability of plug-in equalizers and pads.
Here too it would be advantageous to know which setting to choose for optimum performance, especially where some input signals can be accomodated with 4 different combination "plug-ins".

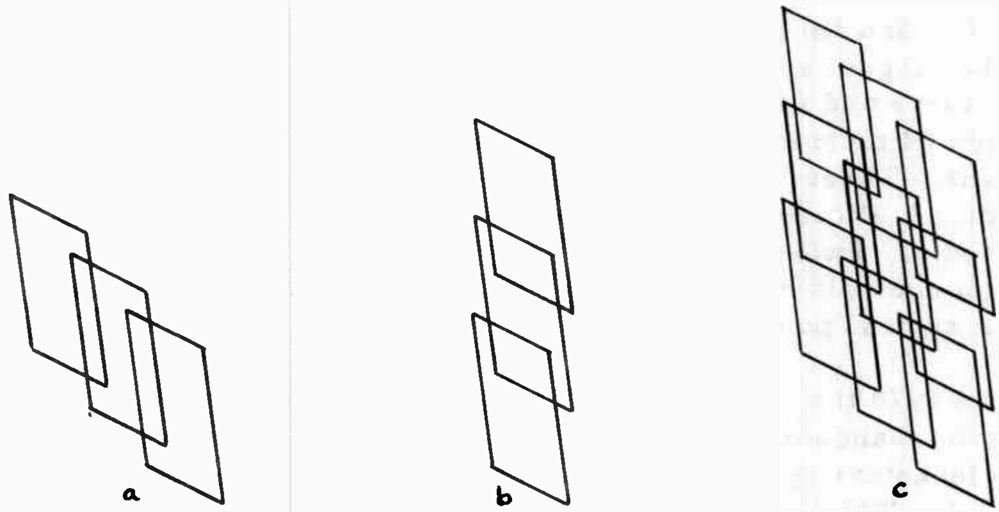


Fig.14

CONCLUSION.

As can be readily seen, there is an enormous difference in the cost and complexity of a panel constructed with RF or DC simulation techniques as compared to the graph and module method. The Cable TV calculator furthermore is portable and meets all the goals set out earlier.
It does not require leased telephone lines, terminal rental or expensive computor programs, it is completely self-contained.
The calculator has given the manual planners a new lease on life by increasing their efficiency by an estimated 50%-100%.

MAINTENANCE OF LARGE CATV SYSTEMS

Jack Long
Vice President-Engineering
Transvideo Corporation
A Division of Cox Cable Communications

The San Diego CATV System began operation in 1962. Today it is the largest system in the United States with more than 49,000 subscribers and 660 miles of distribution plant. The system employs 64 technicians and installers and has a fleet of 51 trucks and vans. Three head-ends are needed to cover the area of the system. A Micro-wave link connects the system to the origination studio. Two-way radio is used extensively for communications but also controls non-duplication switching of the three head-ends from a central point.

In 1970 the City of San Diego passed an Ordinance governing the performance of CATV systems within the city boundary. Some of the technical specifications of this Ordinance are shown in Figure 1. While these specifications seem very reasonable, it must be realized that these are minimums for any point in the system including the subscriber's termination. This fact, coupled with long amplifier cascades, make exceeding these specification minimums more difficult. During the nine years it has been in operation, Transvideo has developed maintenance methods and procedures which make it possible to accomplish this. The main areas of maintenance fall into seven categories which I will discuss briefly.

HEAD-END MAINTENANCE

The three head-ends are routinely maintained by one highly trained technician. This man and his equipment are completely separate from the rest of the system so that he can give his undivided attention to this important function. Each week the head-ends are checked for signal levels, AGC and AFC action and the quality of video on each channel. Spurious frequency generation is investigated using a spectrum analyzer. A frequency counter is utilized to check the output carrier frequency of processors and modulators. Each month input levels to the antenna system and processors are checked for quality and level. Signal to noise and signal to hum are read and recorded. Every six months processors and other equipment are checked for alignment and response. Two forms have been developed for head-end maintenance. Figure 2 is used to record data at the various inspection times. Figure 3 is used in conjunction with the antenna system at time of installation and serves as a record of equipment configuration and signal condition on each channel.

TRUNK MAINTENANCE

The San Diego system is divided into service areas and technicians are assigned to each area. They normally work only in this part of the system and become very familiar with it. The condition of the trunk system is mainly determined by a series of test-monitor points strategically located in each of the three systems (Figure 4). Each maintenance day begins with a check of channel levels and quality at each of these points by the assigned technician. The result of these checks is relayed to the chief technician by radio who can then take proper remedial action. Most of the maintenance and trouble calls are dispatched by radio which eliminates delay. After reporting the monitor points the technician continues with routine balancing and system check out. Figure 5 shows the form used by the technician to report defective equipment in his area.

The test monitor points were established by inserting directional couplers in an output line of bridger amplifiers. This provides the highest signal level on the system so that the noise figure of the signal level meter will not be a factor. The signal to noise ratio of all channels at each monitor point is logged every three months using methods covered in NCTA Standards 005-C. This is done during non-broadcasting hours. Relative signal to noise readings can be taken during normal service hours by reading the noise above channel six or below channel seven. Care must be taken, however, that no FM or Commercial radio stations are present. Figure 6 is a compilation of some of the results obtained using these methods.

Monitor points are also used to determine cross modulation levels and system stability. Twenty-four hour recordings are made of one lowband and one highband channel at three months intervals. Figure 7 is a condensed recording showing proper action of the system. Figure 8 shows an abnormal system condition with improper AGC action or thermal control. Finally, the monitor points are used in conjunction with a spectrum analyzer to check for spurious products. (Figure 9) This form is used to record the above monitor point data. (Figure 10 and 11). These forms are used as records for each amplifier in the system.

SYSTEM RADIATION MAINTENANCE

In each service area routine radiation checks are made following the methods outlined in FCC Rules and Regulations Part 15 sub-part D.

Not only are non-subscribers protected, but system integrity to the high level signals of local broadcasters is maintained.

DIRECT PICK-UP PROCEDURES

Due to the number of Los Angeles signals carried by the system, it is necessary to carry the local channels 6, 8, 10, 12 on the system on frequency.

Much testing and evaluation is necessary to minimize the direct signal present at most subscribers' sets. Hilly terrain and the fact that two transmitters are located in Mexico prevent a uniform approach to the problem. Switches, better shielded drop cable, balanced transformers, high subscriber signal level, grounding and other methods are used to combat this problem. Naturally, none of these methods will work if the direct signal penetrates the distribution system. This makes the system integrity check used in radiation work doubly important. The form shown here in Figure 12 is used for both radiation and direct pick-up work.

DISTRIBUTION AND SUBSCRIBER MAINTENANCE

The mobility of the area trunk maintenance men is duplicated by the service technicians who cover the distribution plant and subscriber maintenance. These men are also assigned to specific areas and receive most of their calls by radio. The subscriber call is taken by a dispatcher who logs it in his Daily Work Report (Figure 13) and radios the call to the service man. At the home, all the channel levels are read and recorded as well as an analysis of the problem. A separate form is used (Figure 14) for each service call and turned into the dispatcher at the end of the day. Considerable importance is attached to subscriber level readings as these random samples of the system often serve as a good indication of conditions of the distribution plant. Any cases of direct pick up are also noted and passed on to a special group handling this work. A similar procedure is used for new installations.

COLLECTION AND ANALYSIS OF SYSTEM DATA

System data is derived from two sources--trunk maintenance and subscriber maintenance. Trunk data is derived from the form shown previously and is put into program form for computer analysis by the system chief technician. Subscriber data is derived by the dispatcher. When he receives the subscriber trouble call he verifies it against his work sheet and then fills out a Customer Service Call form (Figure 15). Data for the computer is taken from this card. Each month this information is fed to the computer which is programmed to analyze it by types of trunk and subscriber trouble, solutions to the problem, subscriber identity including phone number, technician identity etc. The computer tabulation allows us to determine the efficiency of maintenance being performed in an area and indirectly indicates plant conditions. The constant flow of data from these service areas is used to determine the overall system status and dictates what action is needed. Using these methods, we have been able to detect developing problems before they became the cause of widespread outage.

EQUIPMENT REPAIR

Complete records are kept on equipment from the time it is initially installed. Bench technicians work independently from the rest of system maintenance. In such a large system a constant program of equipment repair is necessary and vital.

SUMMARY

In conclusion let me point out that the degree and complexity of system maintenance obviously increases with system size. When large numbers of subscribers are involved, it becomes mandatory to keep ahead of developing system problems. If I were to pick the most important maintenance feature of the San Diego system it would have to be the establishment and full utilization of monitor points. An example of the effectiveness of this program is the decrease in subscriber trouble calls this past year. At the beginning of 1970 we were averaging a ratio if trouble calls/month to subscribers of over 3.5%. In May of this year the trouble call ratio was 1.2% or about 30% of the 1970 figure.

San Diego Ordinance Specifications

Minimum Subscriber Level	0 dBmV at 75 Ohms
Minimum S/N at Any Point	34 dB at 4 MH_z
Cross Modulation at Any Point	−46 dB at 32° F
Spurious Products	−46 dB
Hum Modulation	3 %
Multiburst Response	F.C.C. Sec. 73.687 (a)
Radiation	F.C.C. Part 15 Subpart D

Figure — I

Cox Cable Communications, Inc.

ANTENNA SITE OPERATIONAL REPORT FORM

Location: **Date:**

Com. Ch.	Date Tube	Date Aligned	S/N Ratio	AGC Oper.	St. By Carrier	Operating Levels	Trap Al. Date	Beats, Problems or Component Change-Outs
2						in out		
3						in out		
4						in out		
5						in out		
6						in out		
7						in out		
8						in out		
9						in out		
10						in out		
11						in out		
12						in out		
13						in out		

Pre-Amp Ch.				Levels	UHF Conv. Ch.	Date Tube	Date Aligned	S/N Ratio	Output Level	Mixing Network
				in out						tube
				in out						align
				in out						sweep
				in out						
				in out	Hi CCG	Out	Tube			
				in out	Lo	Out	Tube			

Remarks:

Signed: **Title:** **Approval:**

Figure – 2

Cox Cable Communications, Inc.

ANTENNA INSTALLATION CHECK LIST

System ______________________

City ______________ State ________

Date ______________ Temp ____

Channel ______________

Preamp Used Yes ☐ No ☐

Type of Downlead __________ Ft. ____

SIGNAL MEASURMENT	VIDEO	AUDIO
CALCULATED SIGNAL		
MEASURED CARRIER WITHOUT PREAMP		
MEASURED CARRIER WITH PREAMP		

TYPE OF CONVERTER USED ______________

REMARKS ______________

ANTENNA ARRAY

CONFIGURATION ______________

DIRECTION ______________

TYPE ______________ GAIN ______ DB

HEIGHT ________ FT.

RETURN LOSS ______________ DB

HORIZONTAL SPACING __________ IN.

VERTICAL SPACING __________ IN.

MIXING DEVICES

SPLITTER ______ PHASING LINES ______

PHASED YES ☐ NO ☐

PHASED FOR OFFENDING STATIONS

(1) __________ (2) __________

HOW WEATHERPROOFED ______________

TRAPS USED ______________

____
ENGINEER

CCC FORM 101-71

Figure-3

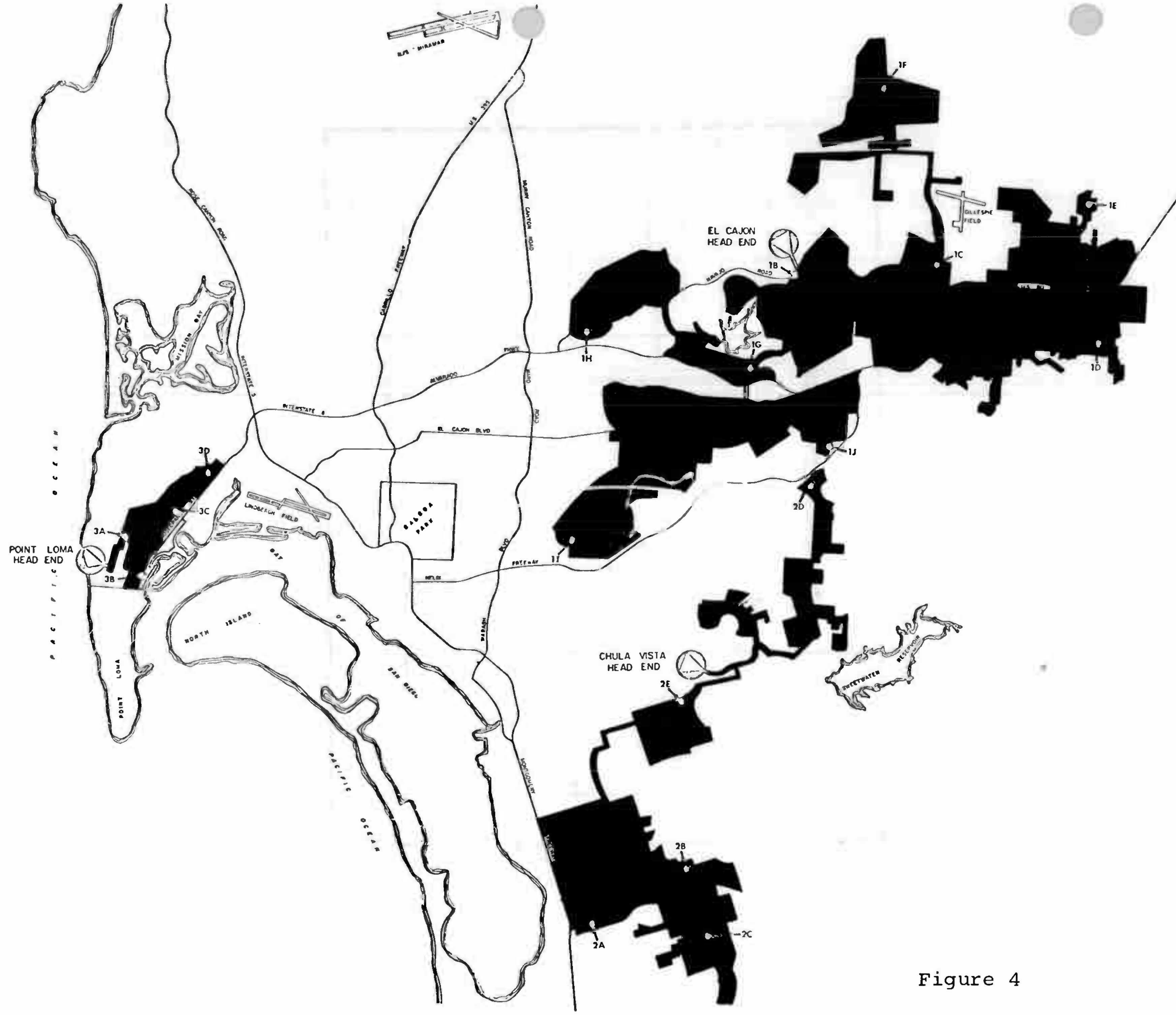

1F
1E
EL CAJON
HEAD END
1B
1C
1H
1G
1D
1J
3D
3C
3A
POINT LOMA
HEAD END
3B
LINDBERGH FIELD
1I
2D
CHULA VISTA
HEAD END
2E
2B
2A
2C
INTERSTATE 8
EL CAJON BLVD
MISSION BAY
NORTH ISLAND
POINT LOMA

Figure 4

TRUNK PROBLEM REPORT

Location ______________________ Date ______________

	In	Out		In	Out
Ch. 2			7		
3			8		
4			9		
AGC			10		
5			11		
6			12		
			13		

Pad ______________

Equal. ______________

Problem ______________

Type of Equipment ______________________

Remarks:

Turned in By:

Completed By:

Date ______________

Figure - 5

Location	Amplifier Cascade	Theoretical S/N	Actual S/N	NCTA 005-C S/N	Band Edge S/N					
					Ch. 2	73.5 MHz	Ch. 6	Ch. 7	Ch. 13	
			EL CAJON							
1B	2	53	53.7	49.2	34	48	53	55	51	
1C	14	44.6	46.2	43.1	33	44	44	49	47	
1D	30	41.2	42.5	41.6	36	41	40	45	44	
1E	31	41.1	41.8	40.7	32	42	46	44	46	
1F	27	41.7	42.9	39.6	31	39	43	44	35	
1G	13	44.9	42.6	43.3	34	37	40	41	32	
1H	24	42.2	42	42	36	40	41	44	36	
1I	35	40.6	38	41.4	33	38	38	39	31	
1J	28	41.5	40.7	40.4	36	41	41	44	39	
			CHULA VISTA							
2A	26	41.9	41.4							
2B	27	41.7	39.7							
2C	33	40.9	38.3							
2D	18	43.5	45.6							
2E	6	48.2	49.2							
			POINT LOMA							
3A	2	53	49.6							
3B	8	47	43.3							
3C	9	46.5	42.5							
3D	16	44	39.3							

Figure – 6

LOCATION Linden & Wintergardens

DATE 2-1-70 to 2-2-70

CHANNEL MONITORED 10

NUMBER OF AMPLIFIERS IN CASCADE 31

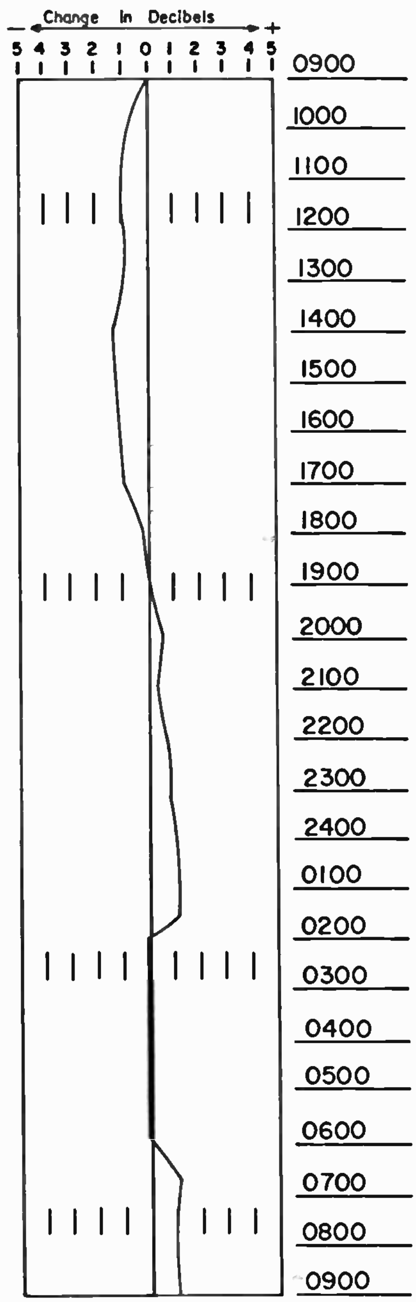


Figure – 7

LOCATION 8712 Magnolia

DATE 2-10-70 to 2-11-70

CHANNEL MONITORED 12

NUMBER OF AMPLIFIERS IN CASCADE 24

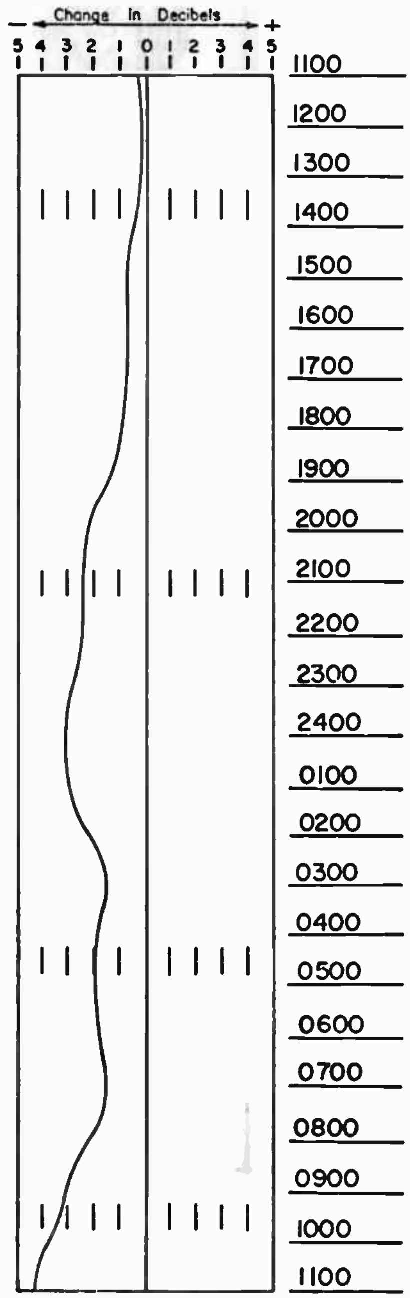


Figure -8

Cox Cable Communications, Inc.

Amplifier Extremity & Temperature Variation Test

System ______________________ Date __________ Temp. __________

LOCATION ______________________ CASCADE ______ AMPLIFIER NO. __________

CHANNEL	CARRIER LEVEL	NOISE LEVEL	SIGNAL-TO-NOISE RATIO	% HUM MODULATION	CROSS MODULATION	PICTURE QUALITY
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
P.C.						

CHANNEL	DATE ______ TEMP. ______ LEVEL (dbmV)	DATE ______ TEMP. ______ LEVEL (dbmV)	DIFFERENTIAL
2			
6			
7			
13			

____
ENGINEER

Figure - 9

CCC FORM 106-71

Cox Cable Communications, Inc.

TRUNK AMPLIFIER

System ______________ Date ________ Temp. ____

SIGNAL READINGS (dbmv)

CHANNEL	LINE AMPLIFIER INPUT	LINE AMPLIFIER OUTPUT	BRIDGER OUTPUT
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
P.C.			

LOCATION ______________

DC VOLTS ______ AC VOLTS ______

AMPLIFIER NO. ______ TYPE ______

PAD ______ EQUALIZER ______

EQUIPMENT DIAGRAM

REMARKS ______________

____

ENGINEER

CCC FORM 103-71

Figure - 10

Cox Cable Communications, Inc.

LINE EXTENDER AMPLIFIER

System ____________ Date ________ Temp. ____

Location ____________

SIGNAL READINGS (dbmv)

CHANNEL	INPUT TEST POINT	OUTPUT TEST POINT
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		

AMPLIFIER NO. ____________

PAD ________ EQUALIZER ________

AC VOLTAGE ______ DC VOLTAGE ______

EQUIPMENT DIAGRAM

REMARKS ____________

ENGINEER

Figure -11

CCC FORM 104-T1

NAME ____________________ ADDRESS ____________________

DIVISION ____________________ DATE ____________________

DIRECT PICKUP REPORT

1. System trunk and feeder cable radiation

   SECTION ____________________

   SLM TYPE ____________________

   CALIBRATION DATE ____________________

   ANTENNA USED ____________________ ANTENNA GAIN ____________________

   CHANNEL MEASUREO ____________________

   DISTANCE FROM CABLE ____________________

   RADIATION LEVEL IN MICROVOLTS ____________________

   ACTION TAKEN: ☐ NONE ☐ SPLICE ☐ CONNECTOR ☐ CABLE BREAK

   NEW RADIATION LEVEL AFTER REPAIR (IN MICROVOLTS) ____________________

2. DIRECT PICKUP ON CUSTOMER SERVICE DROP

   (a) Leakage found on cable ____________ set ____________

   (b) Method used to test leakage: converter ______ shielded set ______

   (c) Other methods ____________________

   (d) Channels affected ____________________

ACTION TAKEN

(a) New house drop ____________________ Type cable used ____________________

(b) Transformer ____________________ Type ____________________

(c) Switch Transformer ____________________ Type ____________________

300 OHM side of switch connected to: ☐ Rabbit ears
☐ Built in antenna ☐ Outdoor antenna ☐ Nothing

(d) Pickup results ____________________

____

____

Signal 1st reading 2 ______ 6 ______ 8 ______ 10 ______ 13 ______

Signal adjusted to 2 ______ 6 ______ 8 ______ 10 ______ 13 ______

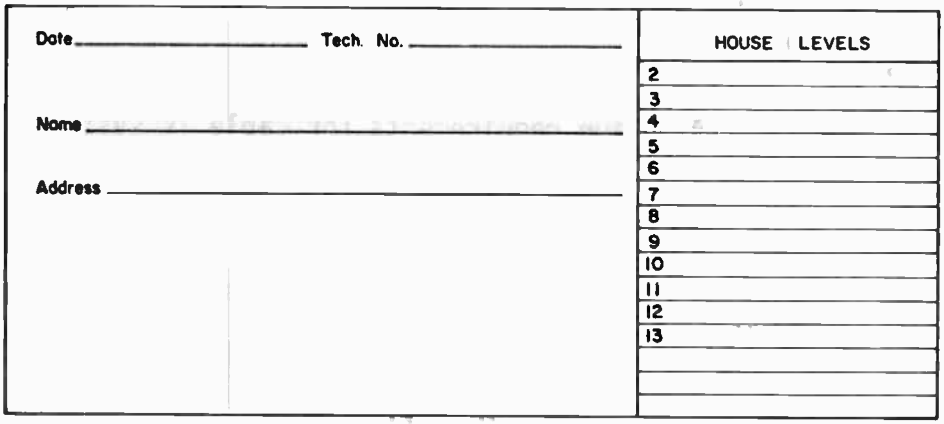
Figure - 12

DAILY WORK REPORT SERVICE **CABLE TV** CALLS

DATE

	Name	Address	Phone	Trouble	TBW Code	Appt. Time	Tech	Code	Time
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									
13									
14									
15									
16									
17									
18									
19									

Figure-13



Date ______ Tech. No. ______

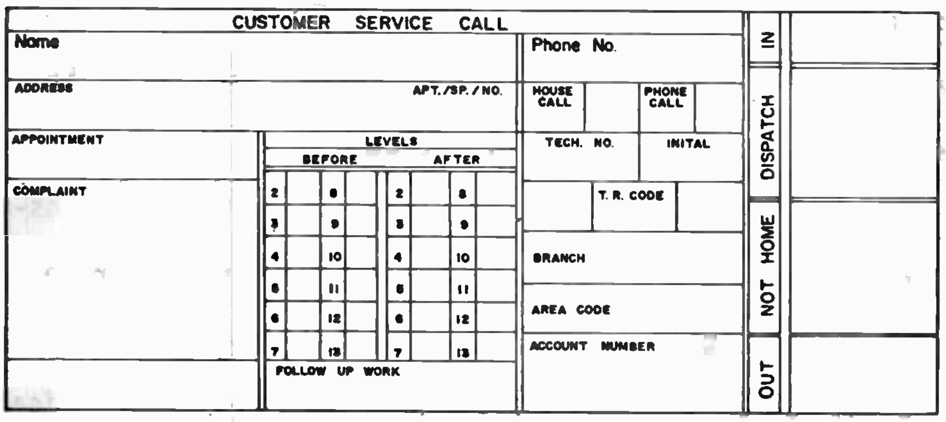
Name ______

Address ______

HOUSE LEVELS

2
3
4
5
6
7
8
9
10
11
12
13

Figure – 14



CUSTOMER SERVICE CALL

Name

Phone No.

ADDRESS

APT./SP./NO.

HOUSE CALL

PHONE CALL

APPOINTMENT

LEVELS

BEFORE

AFTER

2		8		2		8	
3		9		3		9	
4		10		4		10	
5		11		5		11	
6		12		6		12	
7		13		7		13	

FOLLOW UP WORK

TECH. NO.

INITAL

COMPLAINT

T. R. CODE

BRANCH

AREA CODE

ACCOUNT NUMBER

IN

DISPATCH

NOT HOME

OUT

Figure – 15

CASCADING OF INTER-MODULATION DISTORTION IN CABLE TELEVISION SYSTEMS

Daniel Lieberman
GTE Sylvania Incorporated

INTRODUCTION

Expansion in channel carriage of cable TV systems so that channel allocations appear either between TV channels 6 and 7, or above channel 13, has resulted in new distortion requirements for cable TV systems and amplifiers.

These distortion requirements define the permissible second order distortion in the system and in each amplifier. This is an additional requirement to that of third order distortion. For the latter case, it is already possible to have third order inter-modulation "beats" occur as interfering signals in the standard TV channels. Third order distortion specifications have always been maintained in Cable TV systems rather vigorously to prevent this occurrence. This unique quality of low third order distortion was generated from the specification limitation on cross-modulation distortion; the latter distortion occurring from third order non-linearities. The maintenance of the magnitude of third order interferences to acceptable limits resulted as a by-product of the cross-modulation specification, since if the cross-modulation distortion for 2 channels was down a prescribed magnitude from 100% modulation, then theoretically the triple beat interfering carrier had to also be down from the desired carrier by a related prescribed magnitude. This comparison of the magnitude of third order inter-modulation products and the cross-modulation product has been analyzed and shown by Lotsch[1] and Simons[2]. Before the expansion of cable systems to more than 12 channels, little work had been done in ascertaining or maintaining the magnitude of second order inter-modulation products in Cable TV amplifiers, since the TV channels were originally spaced to preclude second order interfering products from developing. With expansion in the number of channels, attempts were made to use the amplifiers which had exhibited low third order distortion for those new systems in which requirements for second order distortion were severe. The amplifiers performed with varying success, since they had not been originally designed to proper second order distortion specifications.

This then lead to a new generation of amplifiers with improved second order specifications and with new techniques for minimizing the build-up of second order distortions in the CATV trunk cascades.

This paper will examine certain aspects concerning the increase of second order and third order inter-modulation products in CATV amplifier cascades.

A general theory of the manner in which second order distortion cascades in the system will be examined. It will be shown that the magnitude of the cascade effect depends upon the low frequency phase intercept of the phase shift vs. frequency curve of the amplifier. Calculations for several values of the phase intercept will be done to demonstrate the dependence of the second order cascading effect upon the phase intercept. Results of inter-modulation distortion products cascading in CATV systems will be shown as an indication of the manner in which the second order distortion practically cascades, and also as an experimental validation of the theoretical work.

Conclusions will show that second order distortion requirements for Cable TV trunk amplifiers can be fulfilled by state-of-the-art amplifiers, and that amplifiers which operate at higher levels (such as distribution and line extender amplifiers) require a similar magnitude of second distortion levels at their operating levels as those of the trunk amplifier. It will also be shown that in cascaded amplifier systems, third order distortion products cascade in magnitude more rapidly than second order distortions, and are therefore a limiting factor to the length of transmission systems. It will further be stated that the developed theory is applicable to transmission systems other than Cable TV systems.

SYSTEM SPECIFICATIONS FOR INTERFERING CARRIERS

In a Cable TV system, repeater amplifier gain together with cable attenuation is made equal to unity over the complete operating band. For systems of this type, in which the information is carried by amplitude modulation of the carriers, it has been shown that the overload-to-noise ratio of the channels decreases at the rate of 20 log n, where n is the number of amplifiers.[3] This is determined by the increase in noise by 10 log n (power addition) as the signal progresses through the amplifiers, and a required decrease in operating level by 10 log n, since the cross-modulation distortion (which increases by 2dB for each 1dB increase in signal level) increases by 20 log n (voltage addition) as the signal information is cascaded. System specifications for carrier-to-noise ratio, and allowable cross-modulation distortion, are the two most determining factors in defining amplifier appearance for achieving system objectives of Cable TV systems. In other words, repeater amplifier performance in regard to noise figure and cross-modulation distortion are determined by specific system requirements. The object in the repeater amplifier design is to achieve an amplifier which under cascaded type operation will perform in a manner so that system requirements are fulfilled. This amplifier design must achieve its performance at the most economical cost and with a required reliability factor. Over-design of performance factors which add to the manufacturing, installation or maintenance cost, or which degrades the maintainability or reliability of the system should not be considered as a positive factor in the amplifier design. Repeater amplifiers for state-of-art Cable TV systems generally exhibit specifications for noise figure of about 9-10dB and for cross-modulation of about -93dB at operating levels. This is sufficient for achieving cascade operation to system lengths of 1000dB at operating levels of 30-35dBmV. Although improved performance in these areas could be achieved by use of more expensive transistor devices and more expensive techniques (such as paralleling output transistors), the system performance objectives have dictated the amplifier performance, and amplifiers have thus been designed with suitable performance to achieve these objectives with suitable margins.

The criteria for allowable repeater amplifier inter-modulation distortion magnitude should also, therefore, be dictated by system requirements. In order to accomplish this, it is required to define the limits of inter-modulation distortion by the knowledge of the system requirements as to tolerable levels of interfering signals, and the manner in whicn second and third order distortions cascade in a transmission system such as that of Cable TV.

Several investigators have made subjective tests on observations of interferences in TV pictures in order to determine the tolerable level of single frequency interference in a TV picture. The results of these investigations are summarized in Figure 1. Fink considered an in-band carrier interference, such as that of co-channel interference, 55dB down from the video carrier to be a sufficient requirement for limiting interference to a non-observable level. Further work by CATV equipment manufacturers demonstrated that a value of 60dB could be a better requirement for certain worst-case type of situations. Bell Telephone Laboratories considered a worst case of -70dB for peak-to-peak signal vs. RMS interference. The Canadian BP-23 specification dictates a -57dB spec at the horizontal sync frequency and at the color sub-carrier frequency. The value of 60dB has become an acceptable value in the cable TV industry.

This single frequency interference, which is similar to co-channel interference, could result from spurious signals generated from either second or third order, or higher order inter-modulation products. For solid-state linear Class A circuits,such as those of Cable TV amplifiers, the second order distortions are predominate distortion products.

The above mentioned studies have considered only single frequency interferences. To the writer's knowledge, there have been limited and incomplete studies on multi-frequency interferences in TV pictures. Although much work is being done in examining multi-frequency interferences, published results are still sparse. This information is greatly needed since expansion of channel usage to 20 or 30 channels, in which the frequency band is from 50 to 270 MHz (present frequency limits of cable TV amplifiers) results in a multitude of interfering "beats" within each channel.

Evidently, a multitude of operating situations utilizing a multitude of interfering channels will have to be made and be subjectively studied in order to ascertain some criteria for the magnitude of disturbance which can be tolerated. Because of the indeterminate effects of multi-carrier interferences, it is not possible to fully define the tolerable magnitude of interference in a cable system cascade. If only the single frequency interference case is considered, then the figure of -60dB for video carrier to interfering carrier ratio would be an acceptable criteria.

EFFECTS OF AMPLIFIER CASCADING ON INTER-MODULATION DISTORTION

A broadband amplifier, such as the amplifiers used in Cable TV systems, has a linear phase curve within its pass-band. This is a necessary requirement for minimizing differential delay distortions which could otherwise occur. A typical amplifier phase shift curve is shown in Figure 2. An analysis of the variation of inter-modulation products in transmission systems utilizing broadband amplifiers having linear phase shift, has been made by Bell Telephone Laboratories[4]. Results are summarized as follows:

A. Second Order Distortion Components

1. The cascaded second order beat distortion signal A from Amplifier n-1 appears at the output of amplifier n as :

(1) $A_{n-1}(w_1 + w_2) = \cos [(w_1 + w_2)t + \theta_1 + \emptyset]$

Where $A_{n-1}(w_1 + w_2)$ is the relative magnitude of the sum frequency of carriers w_1 and w_2, θ_1 is a fixed phase shift dependent upon the phase shift from one amplifier to the next of the carriers w_1 and w_2, and $\emptyset$ is the extrapolated low frequency phase shift, determined by extending the phase versus frequency curve of the amplifier cable combination along its linear plot down to low frequency. This phase intercept is shown in Figure 2, which is a phase vs frequency plot of a trunk amplifier. It is the intercept at zero frequency of the tangent to the phase curve at any frequency. For an amplifier with linear phase shift, it becomes the extrapolated phase curve to zero frequency.

2. The developed distortion at the output of amplifier number n is

(2) $A_n (w_1 + w_2) = \cos [(w_1 + w_2)t + \theta_1 + 2\not{0}]$

where the symbols have the same meaning as previously.

B. Third Order Distortion of form $(w_1 + w_2 - w_3)$

1. The cascaded third order distortion signal from previous amplifier appears at the output of the succeeding amplifier as

(3) $A (w_1 + w_2 - w_3) = \cos [(w_1 + w_2 - w_3)t + \theta_2 + \not{0}]$

where

$A_{n-1} (w_1 + w_2 - w_3)$ is the relative magnitude of the triple beat product of carriers w_1, w_2 and w_3, where θ is a fixed phase shift dependent upon the phase shift from one amplifier to the next of the three carriers, and where $\not{0}$ is the zero-frequency intercept described previously.

2. The developed third order distortion at the output of amplifier n is

(4) $A_n (w_1 + w_2 - w_3) = \cos [(w_1 + w_2 - w_3)t + \theta_2 + \not{0}]$

where the symbols have the same meaning as described previously.

Examination of the second order distortion of equations (1) and (2) indicate that the distortions do not directly add from amplifier to amplifier unless $\not{0} = 0^o$. If $\not{0}$ is made equal to 180^o, a direct cancellation of second order distortion in every other amplifier can occur. For other values of the phase intercept, the result is between total cancellation and total addition.

For the third order distortion case, equations (3) and (4) are shown to be equal, regardless of the value of $\not{0}$ (the zero-frequency phase intercept). Therefore, third order distortions of this type will cascade on a voltage addition basis, or as 20 log n, where n is the number of amplifiers in the cascade.

Other forms of second order distortions such as "beats" arising from the different frequencies, and second harmonics and third order distortions, such as those arising from third harmonics, and the sums of three frequencies, could also be studied from a similar analysis as that given in equations (1) through (4).

Analysis shows that the distortions can be summarized by the following:

1. All forms of second order distortions will cascade according to the formula given in equations (1) and (2).
2. Only third order products of the form $w_1 + w_2 - w_3$ and $2w_1 - w_2$ will cascade according to equations (3) and (4).
3. Other forms of third order distortion such as $w_1 + w_2 + w_3$, $3w_1$, and $2w_1 + w_2$ will cascade according to the following:

   Cascaded third order distortion signal from previous amplifiers appears at amplifier n as: (5) $A_{n-1}(w_1 + w_2 + w_3) = \cos[(w_1 + w_2 + w_3)t + \theta_3 + \emptyset]$

   The developed third order distortion at amplifier n is: (6) $A_n(w_1 + w_2 + w_3) = \cos[(w_1 + w_2 + w_3)t + \theta + 3\emptyset]$

It can be seen from equations (5) and (6) that for a specific value of $\emptyset$ that the generated distortion at amplifier n can be made out-of-phase with previously generated distortions, so that periodic cancellations of the distortion can be made to occur.

Figure 3 shows polar plots of the relative magnitude and phase of the growth of second order distortions from amplifier to amplifier as a function of the phase of the zero-frequency intercept $\emptyset$. These plots are calculated from summing the distortion contribution from amplifier n-1 and that contributed by amplifier n. The following can be noted from the polar plots:

1. For exactly a zero degree phase shift of the intercept, the distortion increases linearly with the number of amplifiers.
2. For exactly a 180^0 phase intercept, the distortion completely cancels every other amplifier.
3. For phase shifts between 0^0 and 180^0, the distortion magnitude oscillates between a certain limit and the single amplifier value. The distortion magnitude and phase returns to that of the single amplifier value after the number of amplifiers in which $n = \frac{360^0}{\phi^0}$

From this figure, it becomes obvious that if a repeater amplifier and its cable combination could be designed so that the zero frequency intercept is close to 180^0, then the absolute magnitude of the growth of the second order distortion would be not much greater than that from any one amplifier. This is a completely practical situation as will be shown in the succeeding paragraph.

PHASE RESPONSE OF CABLE TV AMPLIFIERS

Figure 4 is a phase vs. frequency plot of the Sylvania trunk amplifier set for flat gain. The phase shift is linear throughout the operating band of 50-270 MHz. If the linear portion of this curve is further extrapolated, as shown by the dotted line of Figure 4, it can be noted that at zero frequency the extrapolated phase shift is 180^0. This is because this particular amplifier has an odd number of stages.

This unique quality of the Sylvania CATV amplifier fulfills the requirement demonstrated in the previous section, that if the repeater amplifier phase intercept is close to 180°, then the second order distortion does not cascade appreciably. However, the flat aligned amplifier is not the actual operating condition of the amplifier. Phase plot in its actual operating condition is also shown in Figure 4. This is with the amplifier aligned for compensation of 23dB of cable, as measured at 270 MHz. It will be noted that the equalization introduces an additional phase shift so that the phase intercept now appears to be closer to 120°. This is still a worthwhile condition, since Figure 3 indicated that a 120° phase intercept results in the cascaded second order distortion still never becoming worse in absolute magnitude then that of any amplifier.

Amplifiers with phase shift type shown in Figure 4 have been used in amplifier cascades in order to test the cascade effects on second order inter-modulation distortion.

CASCADE TESTS FOR SECOND ORDER INTER-MODULATION DISTORTION

Figure 5 shows the results of measurements of a second order inter-modulation "beat" signal after each amplifier in the cascade. This particular beat signal was the sum of channel 5 and channel 6 video carriers. The "beat" frequency was 160.5 MHz. It can be ascertained from Figure 5 that no monotonic increase of the second order distortion occurred in the cascade. Partial cancellation of the distortion appeared to occur after every third amplifier.

Figure 6 is the result of another cascade using channels 4 and 13 as the carriers with the measured distortion being their difference beat. Again periodic cancellation becomes obvious.

Some rise in distortion can be noted. This is due to the fact that amplifier number 9 generated much greater distortion than the previous amplifiers. It, therefore, determined the magnitude of the distortion in the 10-amplifier cascade.

Figure 7 shows results of the cascading of a triple beat. It can be clearly seen that the triple beat cascades, according to theory, at the rate of 20 log n.

Figure 8 shows cascading of a second order distortion sum beat for amplifiers of different types of phase intercepts. For the amplifier with the zero-degree phase intercept, it is obvious that the distortion increases monotonically. With the same amplifier modified so that its phase intercept is 180^{0}, a periodic cancellation occurs.

CONCLUSIONS

It has been shown that second order distortion products in a transmission system can be controlled by judicious choice of the zero frequency intercept of the phase shift curve of the repeater amplifier. Although tests for validating this theory were made for a cable TV system, the theory is fully applicable to any transmission system.

Additional conclusions are:

1. Distribution and extender amplifiers have the same distortion requirements at their higher operating levels as the turnk amplifier, since they appear as additional amplifiers in the cascade. Their zero-frequency phase intercept should also be designed close to 180^{0}.
2. The method of achieving less than the required tolerable maximum of second order distortion for a single repeater amplifier should consider cost, reliability, maintainability, etc. Distortion reduction can be achieved by various means such as proper device

selection and circuit basing, feedback techniques, split-band techniques, proper selection of zero-frequency phase intercept, or by "push-pull" action. Results and performance and not the method should be the governing factors.

3. Certain third order distortions will cascade so as to increase monotonically. For this reason, the third order distortion becomes the predominant factor in limiting the lengths of cable TV cascades.

4. More intensive studies are required by the CATV Industry to more fully ascertain the effects of multi-frequency interferences in expanded channel systems. These studies should be coordinated with consistent criteria so that results can be more readily compared. Among some of the criteria to be defined are:

   a. Exact number of channels.
   b. Exact frequencies, tolerances, and stabilities of all channels.
   c. Levels of all channels.
   d. Effects of changing frequencies and/or levels of certain channels.
   e. Conditions of TV viewing.

   Results should then be noted on each and every channel.

Acknowledgement is given to Mr. Timothy Eller and Marty Zelenz of GTE Sylvania CATV Operations for their assistance in validating some of the analysis and in providing some of the test data.

REFERENCES

1 H.K.V. Lotsch — "Theory of Nonlinear Distortion Produced In A Semiconductor Diode"; IEEE Transactions on Electron Devices, May 1968, pp. 294-307.

2 Ken Simons — Technical Handbook for CATV Systems; Third Edition, March 1968.

3 William A. Rheinfelder — CATV System Engineering; Second Edition.

4 Bell Telephone Laboratories — Transmission Systems for Communications; pp. 224-228, Revised Third Edition.

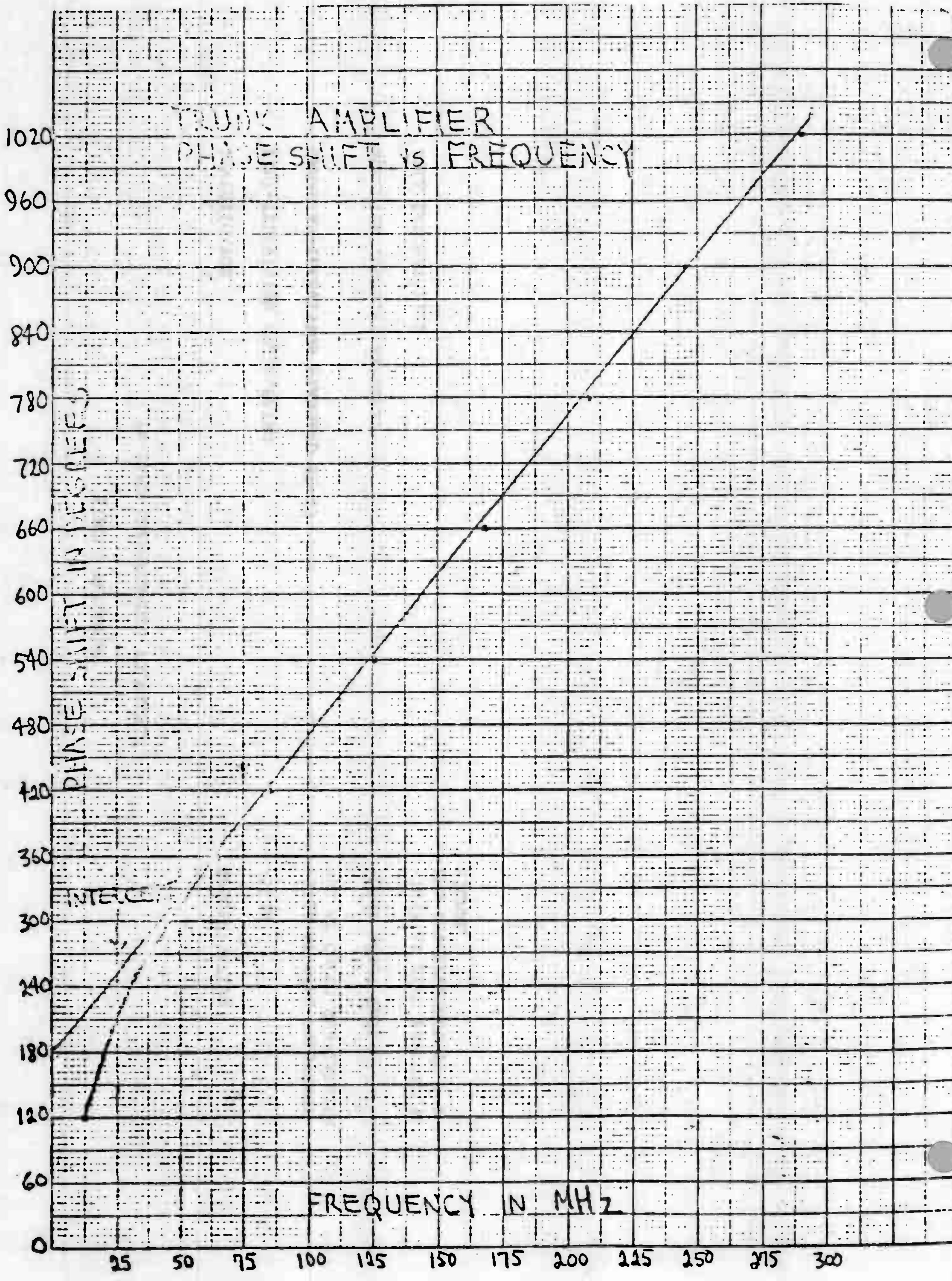
Figure 1

SINGLE FREQUENCY

IN-BAND INTERFERENCE TOLERANCE

INVESTIGATOR	SPECIFICATION
FINK-TELEVISION ENGINEERING	-55dB
CANADIAN-TELEVISION STANDARD BP-23	-57dB AT SYNC FREQUENCY AND AT COLOR SUB-CARRIER
ACCEPTED INDUSTRY STANDARD	-60dB WORST CASE
BELL LABORATORIES	-70dB AT SYNC FREQUENCY RMS INTERFERENCE TO P-P SIGNAL

Figure 2


TRUNK AMPLIFIER
PHASE SHIFT vs FREQUENCY
PHASE SHIFT IN DEGREES
INTERCEPT
FREQUENCY IN MHz
0
60
120
180
240
300
360
420
480
540
600
660
720
780
840
900
960
1020
25
50
75
100
125
150
175
200
225
250
275
300

2ND ORDER DISTORTION INCREASE AS FUNCTION OF PHASE INTERCEPT

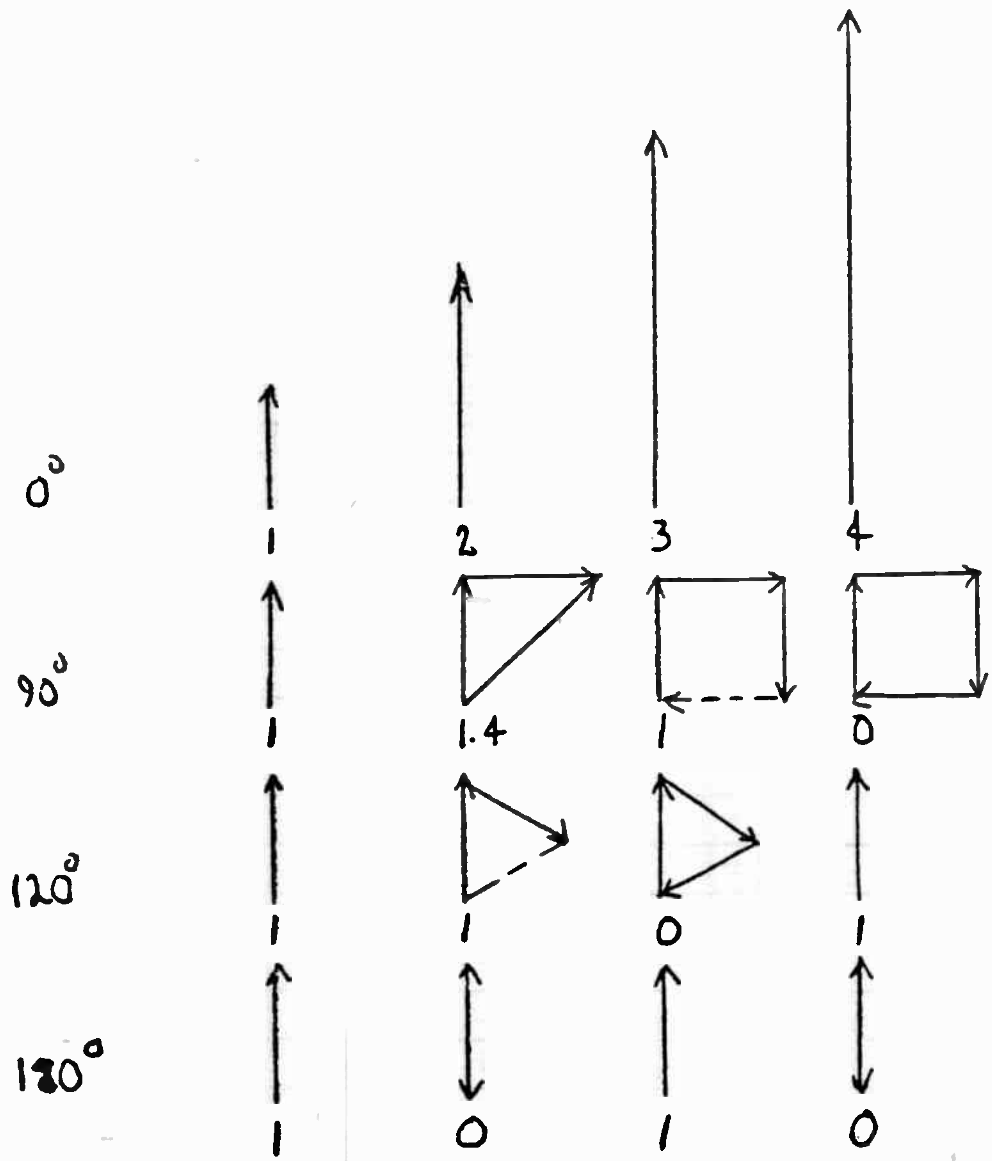


Figure 4

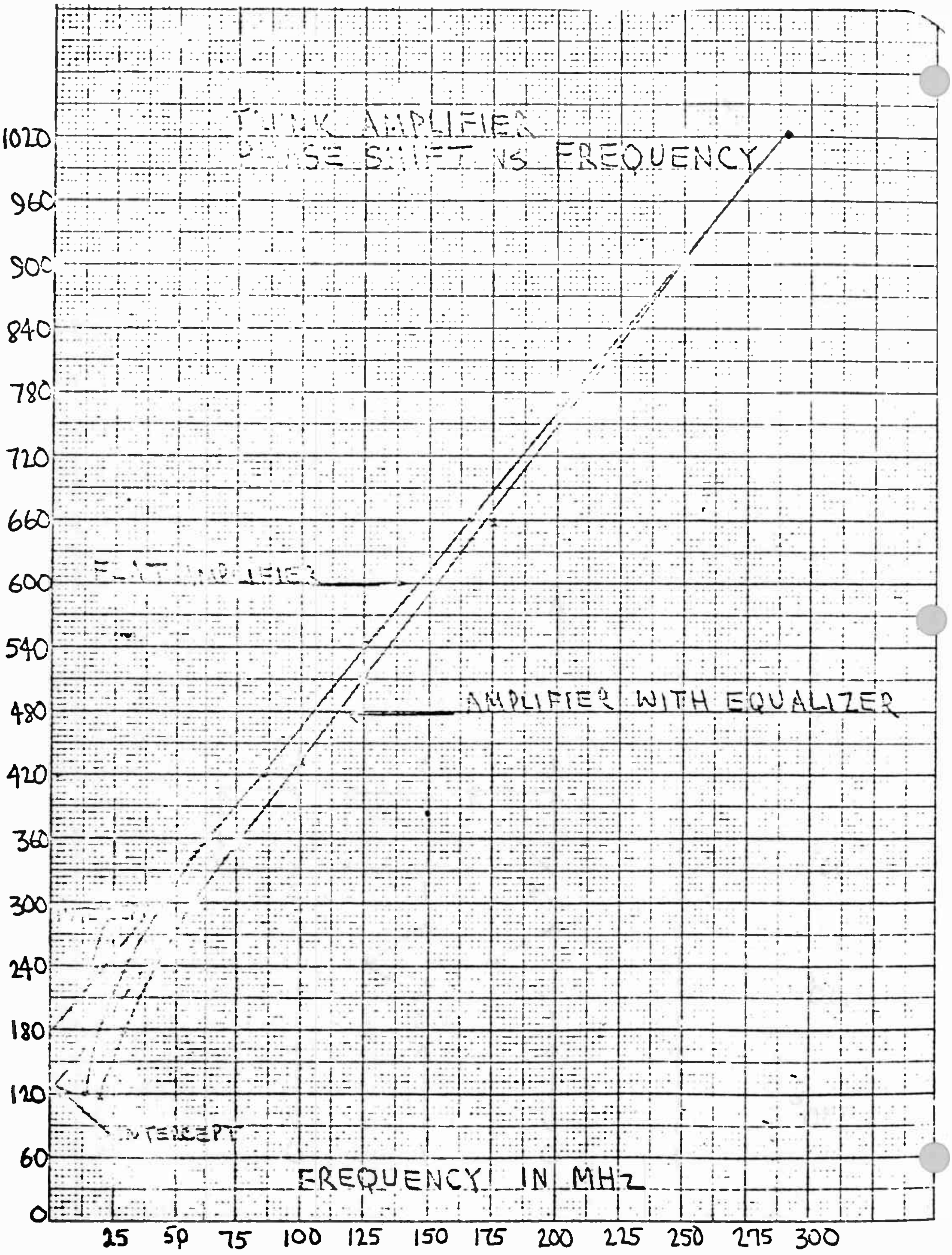
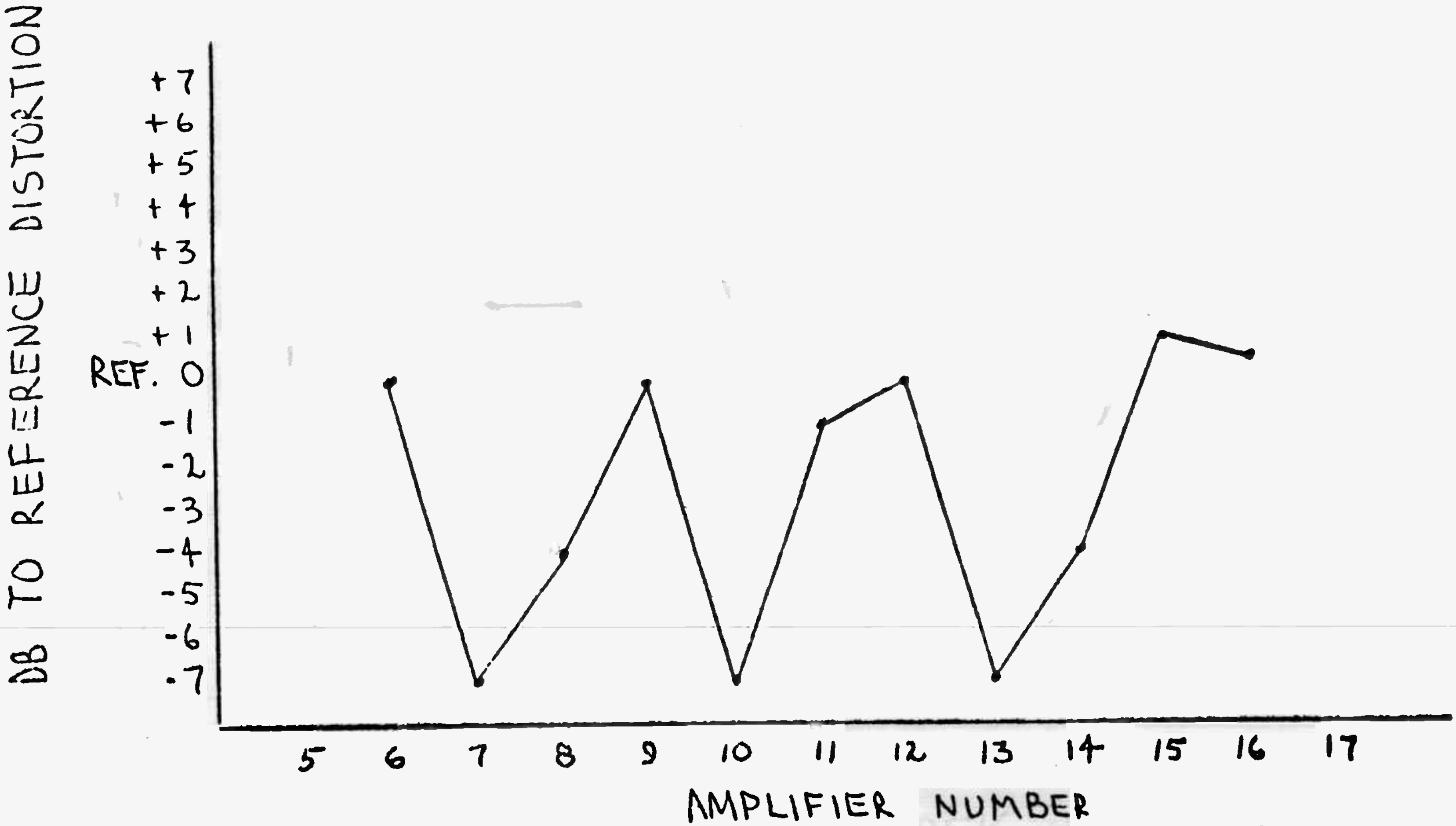

TRUNK AMPLIFIER
PHASE SHIFT VS FREQUENCY
FLAT AMPLIFIER
AMPLIFIER WITH EQUALIZER
INTERCEPT
FREQUENCY IN MHz
0
60
120
180
240
300
360
420
480
540
600
660
720
780
840
900
960
1020
25
50
75
100
125
150
175
200
225
250
275
300

Figure 5

CASCADING OF 2ND ORDER INTER-MODULATION
CHANNEL 5 + 6 BEAT



CASCADING OF 2ND ORDER INTERMODULATION
CHANNEL 4 + 13 DIFFERENCE BEAT

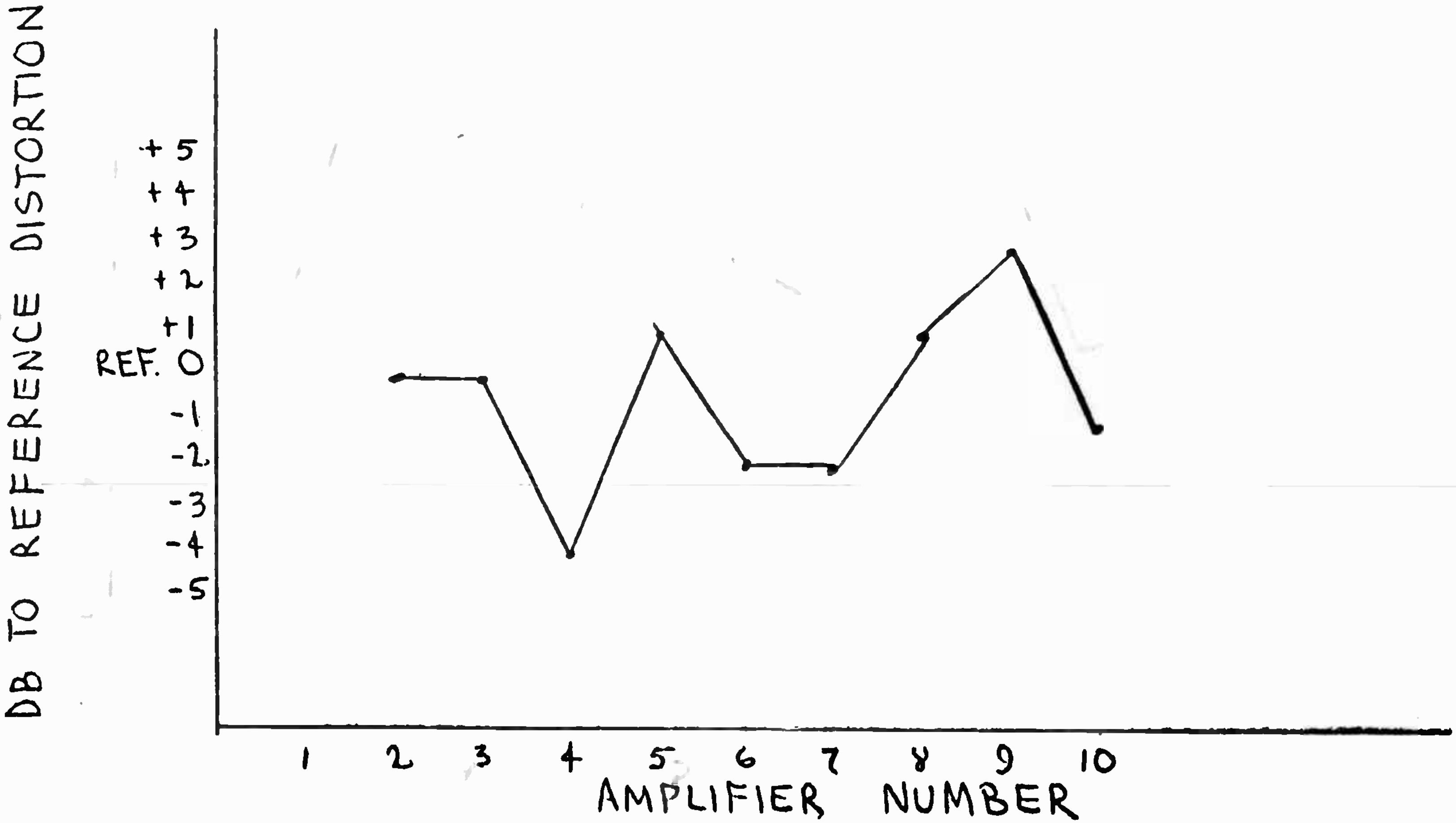


Figure 6

Figure 7

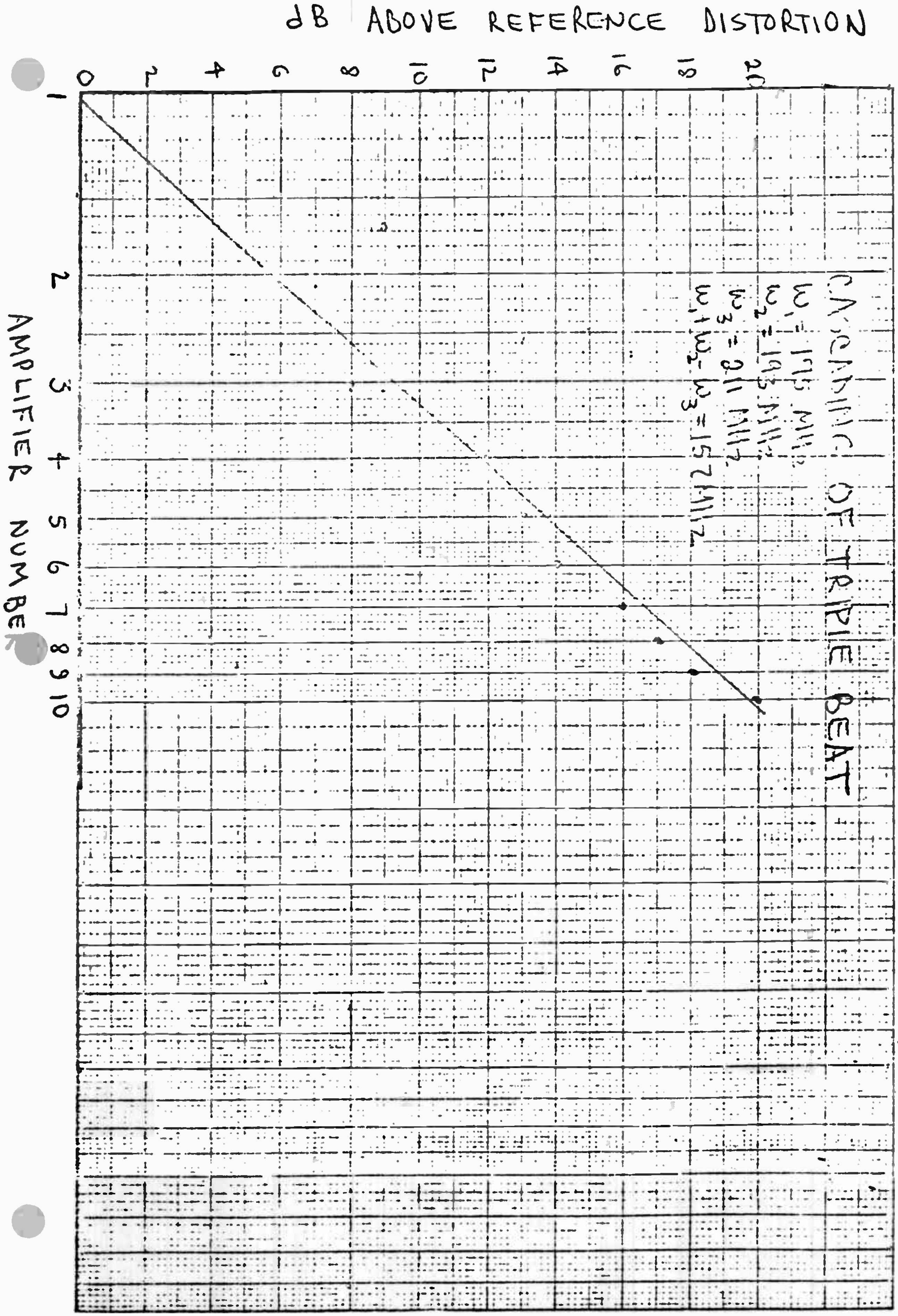
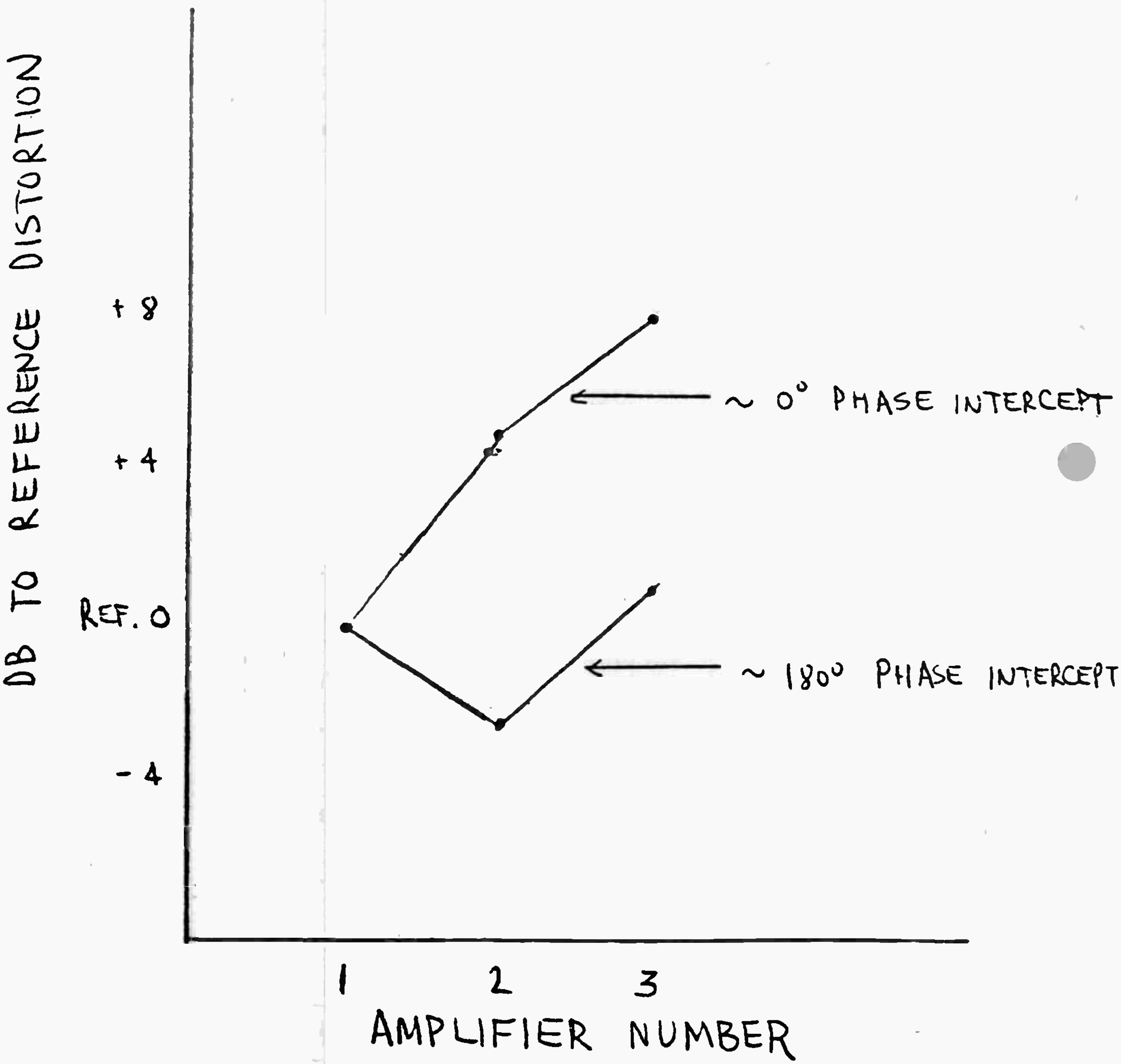

dB ABOVE REFERENCE DISTORTION
0 2 4 6 8 10 12 14 16 18 20
AMPLIFIER NUMBER
1 2 3 4 5 6 7 8 9 10
CASCADING OF TRIPLE BEAT
$\omega_1 = 175$ MHz
$\omega_2 = 193$ MHz
$\omega_3 = 211$ MHz
$\omega_1 + \omega_2 - \omega_3 = 157$ MHz

Figure 8

CASCADING OF DISTORTION
IN 3 AMPLIFIER CASCADE
CHANNEL 5+6 BEAT



"TWO-WAY OPERATION -- BOOM OR BUST"

Panelists

August Bruns
Advanced Research
Atlanta, Georgia

Joel Beck
Video Informational Systems
New York, New York

Dr. Harold Katz
VICOM
Dexter, Michigan

Don Chandler
EIE
North Hollywood, California

Moderator

Archer S. Taylor
IEEE Senior Member
Malarkey, Taylor & Associates
Washington, D. C.

Archer S. Taylor -- Every Convention seems to have its keynote subject, as far as the engineering aspects are concerned. The 1969 San Francisco Convention was the Year of the Demodulator. After crying for a demodulator for years, we all of a sudden had 5 of them all at once that same year.

Several years ago 18 Channels was the magic showing at the Convention.

This is the year of the Two-Way Operation. Everybody's interested in it. It holds one of the most exciting potentials, I think, that any of us have faced for many years; and yet it is also frightening.

Most of us don't know which way to turn. I think that's why we have a roomful here this morning. We have gathered together a number of people, not by any means all who are knowledgeable, but we have several experts in this two-way operation area, as expert as anybody can be in a field that is not generally operational.

This is an open-ended discussion this morning. We have no inherent time limit except when you get hungry or have an appointment elsewhere. So we'll call upon the members of the panel to stimulate your thinking, first, with some direct presentations so that you can get to know the members of the panel, what their particular expertise is; then we'll be happy to have questions from the floor, questions from panelists, and we'll take off on whatever road opens.

I am going to call first on Mr. August F. Bruns. Mr. Bruns attended Upsala College, Drew University and Harvard Graduate School, where he received his commission in the Navy Supply Corps.

Following a 3-year stint with the Navy in the Korean War, he joined Aerojet General Corporation where he served in sales management positions. His 11 years with Aerojet dealt with the development of new concepts in technology, principally in the areas of rocket engines, infra-red surveillance, micro-electronic instruments and other aerospace expertise.

He was responsible for guiding the company into the automation field where sophisticated sorting systems for the Post Office and industrial customers were produced.

Mr. Bruns is Vice President of Marketing for Advanced Research Corporation in Atlanta, Georgia.

August Bruns -- Actually, my presentation will be very informal. I intend to cover two principal areas. One is just to give you a very brief description of the system that we're working on and then, secondly, to get into more of the philosophy of two-way communications and where is it going -- what's its handle, so to speak.

Our company has been working on a two-way system for about 3 years now and we call it Versacom because it is versatile. But basically it's an interrogation approach where we use a central station to produce a pulse train which sends out an interrogation signal to transponders. These remote transponders are out in the field.

The remote transponders in turn are time-shared with roughly 15 homes and we can determine the functions from each home, whether they be sensor functions, fire, burglary, panic button, etc. In the transponder itself we have about 63 transponders per frequency channel and each transponder is assigned 64 addresses. We scan twice through these 64 addresses so we get 32 usable functions.

We use two for our telemetry check, and that leaves us 30 functions. We can go to 15 homes each with 2 functions.

We are presently making an installation with hardware and within two or three weeks will be ready to announce this sytem.

At the central station we use for the fire, burglary and panic button system a visual means of displaying the alarm situation. This is a CRT cathode ray tube of about 23 inch diagonal and on it we can put 2,000 locations. This, we think, is a breakthrough in the annunciator type panel where we can concentrate an awful lot of information in a very small amount of area.

This slide gives you an example of this central station to give you an idea of what it is.

What you see up there are 300 grid squares and normally it's all green, as we're interrogating these transponders and in turn the homes. When we get an alarm signal, red will appear in the appropriate square emanating from that particular station that we're interrogating and by getting the coordinate square from the rows and columns you will know what location is reporting an alarm.

The red will indicate, for example, a fire. The blue can do a burglary, yellow can do a panic button. All green means the system's all okay; everything's normal.

We also have a black that we can put on there for malfunctioning.

So what this essentially does is to give you one panoramic view of the complete alarm situation as opposed to the alpha-numeric readouts which are strictly one at a time. In other words, you don't know that the alarm is there until the number comes up. This system gives you a panoramic view of the complete alarm status.

We have some redundant readouts. Thus, as the red would appear in a particular block, let's say, 132, up there, a redundant alphanumeric display also shows the number down here. Then we have a clock, and so forth.

That's all for that. Thank you. Lights please.

By time sharing the transponders in the field, we can reduce the cost, and this is the particularly important thing. Now from each home we'll get fire, burglary and panic button functions, if you will.

The system has a great deal of capability in the way of numbers. We operate in a low kiloHertz range, 300 to 500 kiloHertz, both for the interrogation and reply frequencies. We can get roughly 2,000 locations per channel of about 10 kiloHertz.

We can get about 2,000 functions -- we prefer to call them functions -- per 10 kiloHertz channel. As you will see, we have come up with a philosophy of the separate cable. We call it a data cable approach. There are numerous reasons why we take this approach. One is reliability. In other words, a separate data cable, we think, can be less expensive than going bidirectional on a CATV cable. We think it gives you the utmost reliability.

So in capability then we could go essentially up to about 10 kiloHertz without repeater amplifiers in the system and this gives us our reliability. In other words, we don't need active components in the system. It's a passive telemetry system.

I won't spend any more time on our system. I wanted to get into some of the philosophy of where we are and where we're going in the two-way communications. As we at Advanced Research see it, and we think that there should be a very objective look at this peripheral service business, there are, we think, three existing conceptions or, if you will, maybe misconceptions.

One is that the information-carrying capacity of this big three-quarter inch coaxial cable is so great that one should go to almost any extreme to use this one cable.

Secondly, that the amplifiers and other components for two-way systems can be made to sell for a low price and still provide a large number of forward-direction TV channels of high quality.

Third, that bidirectional transmission per se is a panacea for the cable operators, that once he has installed the two-way communications equipment the battle is won and he's now ready to doublt or triple revenues through peripheral services without any other major efforts.

Let's suppose that you have a two-way system and you are now ready to go out and solicit your subscribers for added revenue. What services are you able to offer these people and what money would they pay?

For the purpose of this discussion then let us group these return services into three main categories:

One - Those services that require a high bit rate.

Two - Those requiring a moderate bit rate, and moderate reliability, and

Third - Services requiring extreme reliability and a transmission network but not necessarily requiring a high bit rate per subscriber.

The first category would be upstream transmission of live TV channels and is mainly concerned with the transmission of local origination material to the head end and visual communications between medical and educational institutions, etc.

This requires several megaHertz of band width per channel.

The second group includes communications of a teletype nature, namely, credit card verification, TV shopping, audience measurement, audience polling, pay TV billing, etc., and a maximum of 10 or so kiloHertz is required for each subscriber terminal for the time interval during which it communicates with its computer.

The third group that I mentioned involves mainly alarm emergency information. It also would include utility meter reading, monitoring and industrial equipment and the like. In other words, high reliability but low bit rate.

We think that a market exists today for these emergency alarm services. The size of the market can be very limited or very large, depending on the price and the quality of this service that can be offered.

In other words, if we can go after mass application in the alarm security field, then I think that's where the first golden eggs lie.

To be successful on a large scale then, alarm service must be ultra-reliable. This means not only a high percentage of reporting true alarms but also to control and to protect a low false alarm rate.

I don't need to tell you how important it is, when you're dealing with human lives, that reliability is the main criteria.

Today this alarm reporting service is being done principally by telephone dialing systems. The telephone company charges a coupler charge of about $2 or $3 per month and the system is costly. A coupler costs about $150, plus the $2 or $3 a month, and they have been outlawed in many states. Minnesota, I think, is one of the states that's outlawed them. There are some deficiencies in this system.

So in order to open up the market on a large scale then the cable operator must provide transmission reliability comparable to that of hard wire pairs and for a price comparable to the tariff of an ordinary coupler.

The success of this cable operator in the security business has three requisites:

First. His communication transmission path must have reliability approaching 100 per cent.

Second. He must have means to detect false alarms due to human error and then, therefore, protect the people and minimize wasted effort on the part of police.

Third. He also must provide for sales, service, customer indoctrination, police backup and other services. In other words, if he's going to get into the security business, he must make provisions not only for the transmission path and the equipment to do this with but he must decide whether he essentially wants to be in the security business?

Now he has several choices. One is to form a joint venture with someone already in the security business; or he can become strictly a common carrier and provide the transmission path for a security service company.

We at ARC believe that the second and third requirements are irrelevant unless the first one can be met and we have devoted considerable effort towards this end. To achieve almost perfect reliability, we must make the following effects negligible: that is, the loss of service due to primary power; the loss of service due to cable breaks; and the loss of service due to component failures or interruptions of continuity by maintenance personnel.

Our solution to this problem is to use a completely passive coaxial cable transmission system; that is, the elimination of amplifiers.

If anyone here knows about aerospace electronics, it is evident that any time you put an active device in, and you keep adding active devices, your reliability factor goes down considerably. We want to keep it passive.

The only active devices in our system then are transponders, these remote transponders which are passively coupled to the cable. The failure of one transponder affects only the subscribers which it serves and does not block any communications with subscribers down . . . (error in transcription) . . . seen a lot of terminal devices around in the show this week.

The question is whether there are enough potential subscribers at the price that would have to be charged to cover the cost of central station processing equipment as well as subscriber terminal equipment. Markets for these services will develop slowly. The central station equipment will be expensive whether the number of subscribers is large or small. In other words, you've got to make your initial capital outlay. Therefore, it seems more practical to develop the market for security alarm services first and then to subsidize; that is, go after the security services and that will pay for your initial capital investment in the telemetry network and then you can run after the others.

As demand for a large number of forward channels develops, the cable operator can decide between the dual CATV cables, each carrying VHF channels, and a single TV cable carrying midband or superband channels with set top convertors.

So we believe that the passive cable system is needed for emergency alarms in either case. It can also handle other requirements for data transmission as they become marketable and thus the cable operator can pursue the market for peripheral services without being forced into any early decision regarding the bidirectionality of the CATV cable.

Archer S. Taylor -- Our next panelist, Mr. Joel Beck, is Vice President of Video Information Systems, the designer of a two-way terminal and system.

Joel Beck has the Bachelor of Electrical Engineering and Master of Electrical Engineering degrees. He was the Technical Director of Subscription Television's Pay TV System in Los Angeles and San Francisco in 1964. He has 17 years' experience in military electronics systems.

Joel Beck -- In talking about two-way communications, there are basically two aspects that have to be considered.

One aspect is the actual bidirectional transmission medium and the other aspect is the terminals which are at the ends of the transmission medium. I will devote my talk this morning to the actual terminal which is at the end of the transmission medium and the terminal which is at the head end or the central location for the computer.

Video Information Systems has installed a pilot operational system in New York City in Manhattan Cable's TV system and has 12 operational units in operation on a pilot basis.

Initial testing of the system was made at the end of 1970 and we've been in operation in Manhattan Cable for the past 6 months. Basically what we have done is we've taken a TPI convertor. At the time we started the only convertor available was the Focus 12. We've added transponder electronics to the convertor and we've added some push buttons to enable the subscriber to answer questions by means of these various push buttons.

As the Gamut 26 was developed, we also added our transponder to it so that we can interrogate it and get back the response as to which of the 26 channels the convertor is tuned.

Basically there is no limit to the number of channels that we can monitor. It's just a function of the system. If the system can handle 40 or 50 channels, we'll be able to report back on which channel is being viewed.

In addition to finding out which channel the viewer is watching, we will also have push buttons on our transponders on the home terminals. The original design had incorporated 5 push buttons, 4 push buttons to respond to questions and there are combinations of these push buttons. Since there are 4 push buttons, there are 2 to the 4th power combinations; which means you can ask a question which has 15 possible answers and yet get a response from the subscriber.

The fifth push button is called a transmit button. Our system is capable of interrogating at the rate of 40,000 subscribers per second and in that time we can find out which channels he's watching and also which combination of push buttons he has pressed.

So therefore it is conceivable that he may be pushing buttons in the middle of an interrogation, in which case we will get an incomplete answer. So we have incorporated the T button, the transmit button, which disables the interrogation until he has pushed that button and then when he has pushed that button the complete answer will be transmitted to the centrally located computer.

Also, since this device can be used, let's say, for purchasing -- you know, an item to be sold is displayed by TV and the viewer can sit at home and push the buttons to buy whatever he wants -- we have also incorporated a lockout key so that only authorized people can use the push button to make purchases. So that in case, let's say, a babysitter is home and you don't want her to use the push button to purchase something, you just disconnect it by means of the key.

We have brought with us some original prototype models which I have displayed over here but apparently it's too low for everyone to see, so I'll try to give a demonstration now and, if anybody can't see it, we will demonstate it, I guess, after the talk individually, if you like.

So, if you don't mind, I'll just talk about it right now. Basically, we have four terminals here. Three of them are Focus 12's and one of them is a Gamut 26.

In order to demonstrate the capability of two-way communication, this will eventually be operated by a computer but in order to really demonstrate that we can, in fact, interrogate these terminals, we designed this computer simulator which stores the address of each of these terminals.

All of these terminals are electrically identical with one exception. They all have a different electronic address and when we generate an address, it goes to all the terminals in the system and only that one being addressed will reply. We will display the replies on our computer simulator.

Since we have 4 models, 4 terminals, we allocate an address number one, two, three and four. This one over here is address number three, number one, number two and number four. We will display the results of the interrogation for address number one over here, address number two here, address number three here and address number four here.

These windows will display the result of which channel is being viewed and these indicator lights will indicate which push buttons have been pushed.

Let me demonstrate this thing. (A demonstration of the simulator followed.)

As I say, it is difficult for everyone to see the display but if you'll come by later we'll be able to show it again.

Archer S. Taylor -- I see a few faces in the audience that probably are old enough to remember the term Key TV, which was used at one time. It's interesting to see that this key is an essential part of the new generation of terminal devices.

I'm sure you're all welcome to come up later and look at the demonstration personally and look at the devices that are on the table here and Joel, I'm sure, will be available to discuss it with you.

Our next panelist is Dr. Harold W. Katz. Dr. Katz graduated from Rensselaer Polytechnic Institute in 1944 with a BS in Electrical Engineering. He was an Instructor in Electrical Engineering at the University of Illinois from 1946 to 1952, received his Ph.D. in Electrical Engineering at the University of Illinois in 1954.

He was engaged in research and development in magnetic devices at General Electric Company from 1954 to 1960 and he was manager of the solid state devices group at General Electric from 1960 until 1964. He was the Director of Research at Tecumseh Products Laboratory in Ann Arbor, Michigan, from 1964 to 1967 when he joined the KMS Industries for two years in commercial product development. He was one of the founders and is the President of VICOM Industries which was formed in 1969 to develop technology for two-way cable communications.

Dr. Harold Katz -- One, I was a little bit chagrined perhaps or disturbed at the title of the session, "Boom or Bust"; it had a sound of desperation in it. I hope by the time we're through we can indicate that it's a boom and not the reverse.

What I'd like to do first is to present our own viewpoints on two-way CATV in essentially a set of statements which are conclusions without any detailed rationale and hope that it will provoke some questions afterward and then show you where we are in terms of the actual hardware which is now operating within the field.

I think it's clear from the discussions that we have had with various city councils throughout the country in the major cities, the various citizens advisory groups to these councils, that two-way is going to be a requirement as CATV moves into the major markets, primarily because sheer entertainment, TV entertainment really is an insufficient stimulus for the development of CATV in the major areas. The parameters really are not there.

The problem of successful operation of two-way CATV, I think, involves the recognition of what is the relationship between the real market needs and the technology which can provide an economically sound approach to these market requirements.

We feel the factors which the technology must be able to cope with, so far as the two-way market is concerned, fall roughly in about 4 categories, out of which you can then develop the services to meet these requirements.

I think the first is that CATV must recognize that it's in the communications business and, as such, in its two-way modes must be able to provide all forms of communication on a sound level. Whatever equipment goes in must have the capability of communicating either an audio mode or a visual mode or digital or combinations thereof. It cannot afford to leave out any of these because the demand is for communications.

Secondly, recognition that the TV set is the prime focus of interest. It's kind of a qualitative parameter but the TV set has a drawing factor in and of itself and hence services that consumers and others will pay for should tend to focus around the TV set and their interaction with that TV set.

The third factor is a time problem. As the CATV industry would grow and as more terminals, whatever they be, are put into operation, they must have enough flexibility to avoid having to remove what already has been installed, and then trying to put new equipment in. That is obviously economically unsound. So, from the very start, one must build in something that has a time growth potential and is also economically sound.

The fourth factor with respect to CATV is that the generation of program material should require minimum overhead costs to the cable operator. That is an obvious statement but I think many of the areas that one has looked at previously represent high operating costs to the operator and hence are unlikely to develop sufficient revenue.

Now we have classified the various services which can meet this type of criteria in the following way.

The class of services which we think can be entered into economically have two characteristics. One, as far as the consumer is concerned, he has access primarily to information which he himself has generated. Those applications which require access to big data banks, I think, tend to ignore the enormous software costs in developing data banks.

The information that the consumer will be involved in, and we'll show this briefly later, is some information that he himself has created and he wants access to.

The other aspect is the audio-visual-interactive programming. The programming should be such that people can interact and create their own television programs using the two-way capability to originate visual programs from any point on the cable so that people can interact both in an audio and a visual and a digital mode with programming and we'll illustrate applications of that a little bit later on.

But again what these two things essentially do is to transfer the programming responsibilities from the operator to the actual user.

We would designate another class of services which don't tend to meet this criteria and which will probably be less economical -- and perhaps this is where the controversy may start. This would include services like the fire alarm, burglar alarm, meter reading, channel monitoring.

There are several reasons. One, in the fire and burglar alarm area you require a great deal of ancillary equipment. The cable operator can supply a signal from the alarm back to the head end but really there's much more equipment involved at the subscriber location. Secondly, the fire and burglar alarm is not simply a transmission problem. It's an assistance problem. You have to do something with the information. You have to respond to the information that comes back. As it was pointed out, this is really far beyond the capability of the CATV operator.

Meter reading also requires expensive ancillary equipment; it requires an enormous penetration of the market before the meter reading will be remunerative.

Channel monitoring simply to give statistics on who is watching a channel is really a short term effect. The Neilsen people today do their channel monitoring with 1,000 or 2,000 samples. Once the first few systems are in and you have 10,000 or 20,000 subscribers who you're monitoring every second, that data doesn't give you any more information than you had in the first few thousands. So it may be economically sound for the first system or two but after a while it would not be a revenue-generating item because the information really is not of concern.

The third category of programs are straight TV programs which are, in a sense, sold to the subscriber and you monitor his channel to find out whether he's watching it and charge him. I think the success there depends not on the technology but on the program material. Is there enough valid software around that can be developed economically so that there is a return?

I somehow personally question whether that software is there and can be done in an economic fashion. But it represents kind of a mid-ground between the pure subscriber involvement and the more passive areas such as meter reading and alarms.

Taking this kind of generalized approach, we have over the past two years developed a completely interactive system which has this growth potential. We now have two such systems in operation. One is in an industrial environment which is used right now primarily for data entry and retrieval, using the same technology as we have out in the field.

The second one is out in Overland Park, Kansas, on an actual cable system.

So let me illustrate with a few slides the capabilities of these terminals in their actual application setting.

This is a slide of the terminal itself. It is built in a modular form so that we can modify it for various applications. Here it is being used in the industrial environment but the characteristics are quite the same, even for the subscriber application. It has the following capabilities.

The system capability is that we're interrogating and handling data at a megabit rate in order to be able to accommodate a large number of functions and a large number of subscribers.

It has the following interactive capability. Inside is a microphone so that people can talk back directly to programs which originate on the cable and interact in an audio mode in a controlled manner, which we'll illustrate a little bit later.

We have a 12-key keyboard whose salient feature is that no key is a dedicated key. There isn't a pay TV key, there isn't a purchase key. It is a complete alpha-numeric keyboard in which the person can insert alphabetic information or numerical information and we let the computer take care of the application. So that as new applications develop we simply enter different codes for the application itself.

There is one button which is a language button and the language button plus a number enters a person into a particular program or a particular mode of operation and that's changeable with the computer at the head end.

The last button on the left is a clear button. If errors are made, the clear button will erase or essentially delete what has been initially put in.

There is then another button which is a push-to-talk button which we'll see in operation which, under control, is illuminated, which allows the person to then talk back to a program.

The terminal itself can accept ancillary equipment such as a TV camera so that wherever the terminal is located that point can be a source of program origination.

The first application we had for this was in the area of a large industrial firm in Michigan. Let me show you the next slide. Oh, let me say one other point.

In order to enter information into the keyboard, there should be some means for knowing what information you have put in and the ability to send the information to the user itself. We have centered that type of action on the television set itself. Inside the terminal is a small amount of storage which allows us to display on the person's TV set one line of information of about 16 characters per individual.

This display you see was part of a merchandising program in which the head end computer had entered for that subscriber the command: "Enter your ID number"; and it appeared directly on his own TV screen.

As the person enters numbers with the keyboard, the computer reflects back to him exactly what he has put in. In the next slide you will see that.

And here is the ID number which has come back to the individual. To correct any errors he makes, he hits the clear button; it erases the information and he can then start over again.

This is to be compared to systems which have a hard copy printer associated with the terminal. We feel it is much cheaper, much more flexible to have information stored at the head end and a person retrieves what he wants on his TV screen. So the information storage is there for his own retrieval without the need for maintaining the paper. So that using solid state micro-electronics it is very easy to put into the system a small amount of storage to allow alpha-numeric information to be fed to each individual subscriber. What we call a one-line alpha-numeric unit.

The next slide shows the application of this system in an industrial environment. Here is the same terminal. We have a coaxial cable through about a mile of plant. It will be expanded to about 6 miles of plant. It's probably one of the noisiest electrical environments one can put a cable system in but this was part of the test in the actual operation to see whether we can operate within this type of environment.

You will notice the terminal is out on the production line. Here is the basic terminal that we have seen before. An interface with an alpha-numeric screen which presents data to people on the production line. In this particular case they enter the defects they have found in cars, as you've seen here. The computer keeps updating displays and presents the information to people on the production line so they can respond to it immediately.

We'll take a look at the next slide. This is what they tend to see. The defects that have accumulated, what has accumulated in the last 4 or 5 minutes and they can access the computer for a wide variety of displays. We won't go through all of them completely.

Let's look at the next slide. Here is another location within the plant which is a smaller screen for a supervisor who has used the keyboard to access the computer which presents him with the updated defects which occurred the last hour.

We'll look at the next slide. When he enters a code, the computer sends back to him the code that he entered to see if it is the correct one. If not, he can hit a clear button and change the code.

On the next slide, if he enters incorrect codes, the computer will send back an error message to him and then he reiterates and goes back through the system.

The system now is in operation on the line. Let me show you what the head end looks like in the next slide. This is the computer which drives the system. It has 16,000 words of core memory. It's operating at a megabit rate. At the top of the computer is sitting the digital receiver and transmitter which is sending the information along the cable and back at a megabit rate, which you recognize is relatively standard CATV equipment.

In the back is a disc storage and the next slide which shows a better view of the disc itself. That's 11 million words of storage which are being accessed by the keyboards that are distributed throughout the plant. This will be expanded to about 6 miles of cable and eventually have something like 300 of these terminals with data entry and retrieval. It will then be expanded to use the rest of the cable capacity for audio-visual transmissions throughout the plant. In other words, it will be a self-contained community having interactive audio-visual operation as well as data retrieval.

The second application was in Overland Park, Kansas, where there is a two-way EIE cable system in which our own terminals have been installed, shown in the next slide. It's the same cable, the same basic terminal. The other terminal you looked at did not have directly the audio capability. This has the audio capability added and, hence, it has the push-to-talk button with a light which went on when an authorization to talk was permitted but it uses the same keyboard with different software at the computer to have different applications.

The two applications that are under test now in Overland Park are in education and in direct merchandising by Sears. Again, let me re-emphasize the fact that we are using exactly the same modular forms for the industrial one as we are for the cable system in Overland Park, which is now in operation.

The next slide is a shot inside the head end where there's a smaller computer for this operation. It's a Hewlett Packard computer with only 8 cores of memory for this particular application with no disc being used since the applications are much more limited.

The next slide was a typical audio-visual interaction with a teacher controlling the program. The program is originating from an arbitrary location on the cable. The teacher has one of these terminals plus a video monitor which is an alpha-numeric terminal which presents on it the names of the people who are in the class, as it were, and it shows when people are making requests to either talk or to cablecast.

Tomorrow Mr. Herring will be presenting some movies on the actual operation at Overland Park and you'll get to see more of the details of the system.

We'll look at the next slide and we'll get a closeup view of what the teacher sees. Now this is not the exact format that was used in Overland Park. You'll see that in more detail tomorrow. But on the monitor the computer presents the individual who is originating the program, the list of the names of the people who are in the class, the people have used the keyboard to type their names in as they registered in the class.

The computer presents the little letter "w" that says these people are actually watching that particular channel. There are many people who are assigned to the class who are not watching the channel but this indicates that they are actually participating in the program.

If they wish to talk back on the program, they press a particular code, the computer sends the code back to the person originating the program, shown in the next slide. In this case it happens to be A-1-6. When the person who is originating this program presses the code A-1-6, the audio unit is turned on for that particular individual. The computer then presents, in the next slide, a code which, if pressed, turns off that particular audio unit. It sends a computer-assisted instruction to the person leading the program but she does not have to know the code. The computer is doing all the software for the individual.

If there's a reason for having the video in that particular program originate at another location, that person can put in a code and request that his camera be turned on. That code will also appear on the next column, as you will see in the next slide. Actually, the code came up. This is the one which will have to turn off the particular camera at the remote location.

So essentially you end up with the same system with a change in software in which an individual can originate a program in any location that he wishes. Using the reverse capability of the two-way channel, we can essentially assign a channel to a given number of people in the community, have them interact in a closed forum and deny access to that channel to all of the rest of the people and do this on a time basis which is controlled by the computer itself.

This is a general description of the overall system's capability now that is in both the industrial and commercial environment.

We have also done some analytical work and hope it proves out by further testing some of the economic factors associated with the revenues that could be generated by the services that are available with such a diverse terminal and computer system as we have here.

The next slide shows what happens when a student has requested that his camera be turned on. He has a terminal, a microphone, and now this is what would be seen by the other participants in the program, the reverse of the situation where only the teacher or the leader of the program was seen previously.

Let me indicate that this particular individual who is being worked with through the summer is a handicapped child. He had some type of brain deficiencies whose details I'm not familiar with; but, interestingly enough, he learned the keyboard within a few minutes, and was able to present information in a very simple form. We could not get him away from the keyboard, his interest in wanting that interaction was so great.

In the next slide, we have listed the various types of applications. We have made estimates of the revenues that will be contributed both by subscribers and by advertisers who may be associated with our programming. I won't go through all of the details of this. It's done for an average family per week and it turns out that we can obtain a revenue under these conditions of about $30 a month, half of which is paid by the subscriber, half by other organizations. We can go into the details of that later.

But let me give you some of the percentages that we think are of concern here. Of the total charge, about 15 per cent of that is just the base charge to be on the cable system itself.

The item called "Shows" are shows which people pay to see, specific shows. About 15 per cent of the revenue is generated from that area.

The interactive areas such as social group interactions where various people have leased a channel in a sense for a short period of time, be it a club, a school, a professional organization, the area of games where, via the keyboard, people can participate directly in games, some of which we've already programmed outselves, and the educational area account for about 25 per cent of the revenue, just for the interactive mode alone.

The merchandising area we feel can account for about 10 to 15 per cent of that total revenue.

The area of alarms, reaction to programs, the fire alarm, burglar alarm, channel usage, all of those total less than about 10 per cent, primarily because we feel there is the saturation problem and the high cost associated with all of the other peripheral equipment that is required.

This is a brief review of where we are and I'd like to leave it at this point and leave it open to questions after that.

Archer S. Taylor -- Mr. Don Chandler is Executive Vice President of Electronic Industrial Engineering, Incorporated, for marketing and operations.

Mr. Chandler is a graduate engineer of California State College of Los Angeles. He was formerly engineering manager at Electronics Specialty Company. Mr. Chandler is a member of the SMPTE.

Don Chandler -- I'm going to read a little caption here from the July 5th issue of Television Digest which you all, I'm sure, have read. It says: "Two-way CATV experiment in Overland Park, Kansas, suburb of Kansas City, started last week with teaching, shopping, burglar alarm and opinion survey. Student home-bound because of brain tumor received history lesson in video-audio exchange with teacher. System is operated by Telecable Corporation, Norfolk-based organization. Terminal was furnished by VICOM Manufacturing, Dexter, Michigan, amplifiers by EIE, North Hollywood."

Obviously Dr. Katz is from VICOM and I'm from EIE, which is very interesting since both of us are somewhat competitors but it shows what is going to take place in the future. There are going to be competitors working together as partners to bring this thing off.

I'd like to describe our system a little bit. I'm sure a lot of you have heard me speak on this before but I think to set the frame I should describe it again.

We have developed a time division multiplex system. It has the capability of interrogating individually and uniquely up to 30,000 subscribers in less than 25 seconds and to bring back from each of these subscriber locations up to 128 bits of data. We can also from the head end unit originate 15 individual commands to each of these subscriber locations to perform such functions as remotely connecting and disconnecting subscribers, using it for turning on surveillance cameras or whatever, but anyway, 15 discrete commands from the head end location.

The system has the capability of providing pay TV or, if you will, subscription TV. We can provide up to three interdicted channels. These channels are available with the subscriber selecting the channel and also engaging the key, to prevent the babysitter from looking at the pay channel while he's gone. We can do this on three individual channels.

We like to refer to this as restricted programming because this programming is completely under the control of the head end operator. In other words, you could supply an individual discrete program to only one of, for instance, 30,000 subscribers.

In addition to this, of course, we have the ability with this system to monitor the channel which is used in conjunction with the pay TV remotely. In other words, we can monitor the channel to which the TV set is tuned from the pole location, if you will, which is unique. In addition, of course, you can bring back the security burglar, fire alarm, meter reading or whatever, all of the ancillary services.

So this system is not too much unlike the one that Dr. Katz described except for the unique feature that we have of doing all of this remotely.

At the subscriber location we have a terminal device also which allows the subscriber to be interactive with either the head end or, in the case of educational situations, interactive with the teacher-instructor.

We also have the ability to provide two-way audio as well as video communication from a subscriber location. The system has the ability to move highspeed data from one data bank to another data bank simply by addressing the two different data banks from which the data is gathered.

So I think that's about all I can say about the system. I didn't bring any visual aids today because across the street at the Heritage Room in the Shoreham Hotel we are running, every 15 minutes continuously, the audio and visual story on total communications, and it's much more vividly described over there than I could do here. So I would appreciate it, if you have the opportunity in the next couple of days, if you would drop across the street to the Shoreham Hotel to the Heritage Room and watch this presentation.

Now for the last couple of years we've all heard about the blue sky two-way and so forth and things are starting to happen. You've seen some things here that were shown this morning.

We have in our facility in North Hollywood a 24-trunk amplifier, completely dual, cable system in operation within our plant on which we have our peripheral equipment, both the head end control and monitoring unit. We're in the process of installing a computer to control the system. We have the ability there to monitor the TV channels and interdict the channels. We have, if you will, security cameras that you can control from the head end location, with respect to pan, tilt, zoom, focus and so forth.

So all of this is visually displayed, actively displayed in our plant out in North Hollywood, and we'd be happy to invite one and all to come out and see it, if you'd like to.

In addition to Overland Park, Kansas, we have provided the bidirectional transportation system and VICOM has provided the existing terminals and the head end equipment for the two-way experiment. We have 9 other systems throughout the United States in which we have supplied two-way equipment.

We have an experiment in two-way applications that will be starting in September of this year in a very large metropolitan area. We'll be doing that on an experimental basis. Hopefully by the end of the year we should have up to 20 remote subscriber units connected.

The next phase after that will be on the order of 200 to 300 units, hopefully by this time next year. So certainly by NCTA time next year we will have had a chance to put it on the line so I'll have to be here next year and tell you all about what's happened this past year.

But, as Dr. Katz prefaced, we are very bullish on cable and we're very bullish on the two-way.

Now beyond that, I am basically fundamentally an engineer and our company has the unique ability, if you will, in that we are really the only CATV equipment supplier that supplies the transportation equipment, the active devices that go into the system, as well as the peripheral equipment. To date we have shipped over 3800 bidirectional amplifiers.

In fact, in our history of approximately 2 years of shipments of CATV amplifiers, we have never shipped an amplifier that is not bidirectional. So I think we can speak with some authority with regard to the application, utilization of the bidirectional two-way CATV systems or cable communications systems.

And it's not all sweet. Let's think about it for a minute. You have the natural application or site for a bidirectional system in the larger metropolitan area. You have large numbers of subscribers.

You have to construct this CATV system using the latest and the best construction techniques. Some of the techniques that aren't even available in the typical CATV industry today. You have to have an extremely tight system, RFI-proof, otherwise bidirectional won't happen, because you have a large number of generators in the atmosphere, low frequency generators that a cable system is susceptible to.

So the techniques of construction dictate that you use better connectors, that you use better cable, that you use cable with better shielding. This is what you have to do to build a true two-way system. We know.

Now in addition to the problems with just the construction of the system, you're talking about more attention to detail, tighter control on equipment, tighter control on components. Therefore, you're talking about additional capital investments that are higher than normally projected for building CATV systems. You're talking about higher operational costs. You're talking about people with higher levels of management and technical qualifications.

It's one thing to talk about a cable system that has active amplifiers in it but it's a completely different thing to talk about systems that have either terminal devices as Dr. Katz has described here or devices such as ours which appear on the poles.

Our system handles up to four subscribers. It takes the place of a tap that hangs on the poles. But that box contains a transmitter, it contains a receiver, it contains logic that's uniquely used for each of the subscribers. So it's a lot more electronics. So from a maintenance standpoint and reliability standpoint the systems of the future are different from the systems that you people know today.

When you move into a metropolitan area, the industry talks about the need for importation of distant signals. How viable really is that going to make a metropolitan area when you really think about it? Because in a metropolitan area you have many more people and activities that are competing for the entertainment dollar. You have Broadway shows; you have Los Angeles shows; you have sports activities, and so forth. All of these activities are competing for the dollar, and considering the typical TV fare that's available today, who needs more imported from somewhere else?

Again, these are just notes I jotted down. In a metropolitan cable communication system, there's a greater need for higher quality of performance and reliability. As you know, the typical CATV operation in the past is very unlike the CATV systems of the future, the cable communication systems of the future.

We need less concern with how cheap can you buy it but more concern with how high a quality of performance and how reliable. Can you imagine, for instance, Fred Schulz and the Manhattan Cable System trying to maintain a system where an amplifier might be located underground, that's under a manhole at 42nd and Broadway? Reliability is of extreme importance; and, obviously, to get the reliability it's going to cost more; to get the higher degree of performance it's going to cost more.

I think that's enough for that except I want to dwell on one last subject. In our system the terminal device -- not the terminal device in terms of the push button device, but the buffer interface device -- is located on the pole. Now there's a very good reason for this.

First. The CATV operator has control over it. He can maintain it. He can get to it.

Second and most importantly. That unit, located at the pole provides system integrity. What I mean by that is that no subscriber can gain access to the system in a reverse direction without the head end selecting that particular subscriber.

This is very important. For example, if these terminal devices in a bidirectional system are located at the subscriber's set, what is to prevent the subscriber from disconnecting that particular unit and placing a noise source, for instance, on the cable system that would completely wipe the whole system out? So that is a very important point.

The transponder units must and should be located remotely at least at the pole location.

DISCUSSION

Wally Bear (Rand) -- A question for Dr. Katz. These systems that you described are certainly capable theoretically of serving several tens of thousands of subscribers but right now we have 10 terminals on the cables and if we learned anything from our experience with the time sharing and other data industries in the sixties it was that the scale of problems aren't . . . when you go from tens of units to somewhere in thousands of units.

So two questions:

First of all, what sort of a software effort do you think will be required to serve, say, 10,000 subscribers in this field?

And secondly, realistically given today's state of the art, how large a system are you confident of building and turning on and actually having it work with relatively little . . . problems?

Dr. Harold Katz -- I guess we're confident about 5 terminals. Our own concept is to think in terms of modular construction in the sense of a single computer serving roughly the order of about 10,000, not thinking of a single computer necessarily trying to serve a hundred thousand people.

If the interactions are really there, if the demand for the service is there, you will need satellite computers, essentially, the small minicomputers, serving roughly the order of 10,000 people.

If we look at the cost involved, the computer represents really a very small fraction of the total system. If you had 10,000 terminals and even if you had the terminal cost down to $100 per subscriber, we're speaking about a million dollars of capital equipment.

A computer head end, at least as far as we can tell from all the applications that we have thought about, the hardware probably would run no more than maybe $100,000 or $150,000, and this would be a system probably with 32 k of core and disc memory.

The system that you saw described in actual operation in the industrial application had roughly about $100,000 worth of equipment.

Wally Bear -- It's the software costs I was thinking of.

Dr. Harold Katz -- The software programming, for example, for the programs which we have discussed such as the polling of the channels, the interactive programming, this we supply with the system at roughly somewhere between $15,000 to $20,000 for the software itself.

Additional software is really not that expensive per application. Now, of course, one has to describe the application itself. Typically it might run on the order of a given application say $5,000 to $10,000, $15,000 for that type of operation.

Wally Bear -- You're confident that that level of software would serve 10,000 subscribers?

Dr. Harold Katz -- Yes. Serving 10,000 subscribers, of course, really has to be qualified and discussed as to the specific application.

The particular problem really isn't the number of subscribers as much as what fraction of the subscribers are asking for anything at any one particular time.

If 10 per cent of the people were doing anything at any one time, roughly 1,000 of those subscribers, that reasonably well can be handled by the system that we are thinking about.

By the way, we ought to point out that we don't stop the system because the person is operating the keyboard as you have seen in some of the other systems. The system is fast enough so that you keep operating the keys without being concerned about overflowing a message.

Joel Beck -- Basically in our system, which is a pole system on a time division multiplex scheme, we have no problems with interrogating 100,000 subscribers with a small computer, even a PDP-8. We find that it will do the job. Even if 40,000 or 100,000 people have simultaneously requested access to the computer and have pushed buttons in response to questions we will handle that rate with a PDP-8 with no difficulty whatsoever due to our interrogation and answering scheme.

Basically we believe that our four push buttons will be adequate for all household functions. Now the additional push buttons with 128 bits of information or the 12-button keyboard we think is rather excessive and costly right now for home TV use. After all, we're trying to get involved in a reliable type operation and we think a simplified system -- in fact, our system is modular and we already have in our laboratory a 16-touchtone keyboard, if this is necessary. But we envision that as being used in an industrial type operation and not in a home TV environment.

Now basically all the computer has to do is to generate the addresses for each individual terminal and then record the responses of the channel information as well as the push button information. The programming costs to generate the addressing and the storing sequence on tape or disc, the programming effort is in the order, as Dr. Katz pointed out, in the order of $15,000 to $20,000 worth of programming effort.

We will supply in any installation the complete system, the computer, its programming to generate the address code as well as to record the replies. In addition, we'll monitor in real time the activity for each particular channel, how many viewers are watching this particular channel.

Now I take exception in regard to this thing of channel monitoring with Don here or Dr. Katz who said channel monitoring was not important. I think it is important. For example, if we're interrogating at the rate of 40,000 a second, it's important to know if a subscriber is indeed watching the program during the time that an advertisement is being played or during what time he is turning away from one program to another program. This is very important to the advertising people and this information is more valid than the Neilsen type situation.

Also, there're more statistics involved here. You have 100 per cent saturation, 100 per cent indication of what's being done at any given time. I think this is a very important aspect of the system.

Don Chandler -- Basically, you know, there are four of us up here on the panel. The three over here on my left all have basically the same type of systems. They're all time division multiplex systems so their computer interfaces are approximately the same kind of computer interfaces. Out studies show that the programming necessary for the full, complete gamut of services, this includes even data processing centers, is in the order of $200,000. It's unique enough, we've done enough evaluation, investigation on this that that seems to be in the ball park. It's going to cost a couple hundred thousand dollars to develop the program.

After that, of course, on a per user basis or per operator basis, it should be in the order of $10,000 to $15,000. But it will cost that much to develop it.

Dr. Harold Katz -- But I indicated that that programming has already been done. The numbers I was quoting were the specific application. We've already programmed that interactive involvement.

I think one ought to look at this 40,000 interrogations. The problem is not how many addresses you send out but how do you handle the information that comes back.

And 40,000 can come back, but you have to calculate the number of milliseconds that it takes to process that and it isn't as straightforward as to put it on tape. To go from computer to tape is x number of milliseconds. To go from the computer to a disc is x number of milliseconds.

Joel Beck -- We have run through those calculations and we are satisfied that the PDP-8 can handle those rates.

Dr. Harold Katz -- You have to be very specific as to what you're talking about. You can't generalize in this area.

How do you, for instance, access a computer to get data back or access a library to get data back, whatever? These things take time and they're very complex programs.

Joel Beck -- It's all a question of the system approach and we have come up with a very simplified system approach which -- additional interfacing electronics to the computer has simplified the problem overall and it's just a question of getting addresses out. Due to our technique we do not store all addresses in the computer. We have some electronics such that once a fundamental address is selected we operate on that address to get us additional addresses so we have minimum access to the computer and reformulate the words in correct sequence and put them on tape. It's overall a very simple program.

August Bruns -- Was the question really directed to the cost of the central station computer or was it directed to the capacity, technical capacity of how many addresses you could get to?

Dr. Harold Katz -- It was the programming cost.

Wally Bear -- Yes, the software cost involved in serving 10,000 subscribers.

August Bruns -- In our system we're not using a computer at this point in time, so it's strictly the security services. So it's minimal, by comparison.

From the Audience -- Dr. Katz, could you go into any more detail on how you calculate your alpha-numeric capability on your subscriber service?

Dr. Harold Katz -- It's obvious that one approach is to build a big keyboard. That's not the type of thing that's going to sit in anybody's living room.

The second thing is to build something with which he is more familiar, such as a keyboard which looks much like his telephone keyboard. This is one of our reasons for going to the 12-key system. You can look at this in more detail after the discussion is over.

On the keyboard you will find the alpha-numeric letters. The alphabet, for example, on this key is ABC and the number 1. The way we are able to distinguish among all the possible characteristics is to use two keys, two stokes per input. In other words, with the letters A, B, and C, you associate the numbers 1, 2 and 3. So that, if you wanted to press the letter A, you would hit the A and the 1. If you wanted to press the letter B, you would press the B as you see it and key 2 because B is the second letter in the sequence. C would be the same first key and then hit the number 3.

This may sound complex but let me indicate that kids have been taught this thing within minutes to operate. It's actually been done at the University of Michigan and they're interfacing between the telephone keyboard as an input to remote terminals.

The second thing we do and it's not shown on this particular model is a light which indicates which of the two stokes you're on. When you hit the first key, this light goes on. When you hit the second it goes off. So you can't lose track of which stroke you're in.

Secondly, the reason the light goes on is that the computer has received the first stroke and when the light goes on it's an indication to you that your response has been received.

From the Audience -- When you're transmitting numerics only, you simply don't go through the second key?

Dr. Harold Katz -- No, with numerics we have two possibilities. One can use two strokes so we can intermix numbers and letters. The number 1 would be 1 and zero. Number 2 would be 2 and zero.

In some applications where you know only numbers are to be entered, for example, some type of merchandising in which only numerical information is being entered, you would hit the language key which says I am now in this merchandising mode and then the computer will interpret single strokes as being just numbers.

So we let the software make the change for you. So we can do either the mixed alpha-numerics and, if you look at it closer, we can do the punctuation as well.

I think it's extremely important that the input terminal have this flexibility; the two key, three key, or limited one will have just that effect. It will be limited. You can't put much more information in.

I'd also like to indicate the cost, the fractional proportion of the costs for the keyboard of this variety are not high. We're not paying a price for it. In fact, once you build the basic wide band width interrogation system, you absorb about 70 per cent of all the costs and hence it should be done on a system approach where the additional pieces aren't large fractions of that cost and this is what we have found, that once we have built a comprehensive digital portion of the system the other parts were relatively small in cost.

James Justice (Westinghouse, England) -- I'd also like to know what precautions you've taken against magnetic interference with tape.

Joel Beck -- Basically, we have the terminal devices and the centrally located computer. We have operated our system for the past 6 months on Manhattan Cable's systems in New York and we've been running some error checks on it and actually the sources of error or the error rate is really a characteristic of the noise characteristics of the cable.

There have been hours and hours of run whereby we have no errors. The entire interrogation system is synchronous and controlled by the computer. So that, if there were zero noise characteristics on the cable, we'd have pretty low error rates. Maybe one in ten to the fifth, one in ten to the sixth or something like that.

Basically, during an impulse noise lasting only a fraction of a second, since we are interrogating at these rates, we have accumulated maybe a dozen or so errors in the matter of a few seconds. Then if the impulse noise was dropped down, we operated again for a couple of hours without any error.

Basically it's a question of controlling the noise characteristics of the cable as well as the signal to noise ratio.

Now our system, both on the interrogation end and reply end, works without errors on the dynamic range of 20 db. In most cable systems they hold the dynamic range to plus or minus 6 db so our system will function after the TV picture itself is unacceptable by CATV standards.

When one talks about errors one has to consider the data being transmitted. For example, let's say we're monitoring a channel and since we're interrogating so fast we can have a redundant type situation and we interrogate 2 or 3 times within a couple of minutes and we compare the result of the interrogation. If there was an error in one or two of them or one we already, by majority logic situation, can select which is the correct answer.

If we're talking about fire alarms or burglar alarms, we don't have to rely on the first alarm coming in. We can re-interrogate a number of times and if the alarm still persists, we know that it's a valid alarm. So therefore if error gets in occasionally it will not disturb the system.

Now as far as actually -- for purchasing purposes -- let's say we do get one error in ten to the fifth, which is a number which people in data communication live with today, one error in ten to the fifth, which just means that one out of the 10,000 subscribers will have placed the wrong order. But this is small compared to the normal return in merchandising or small when compared to the number of wrong buttons a person could push.

So I would like to re-emphasize due to redundancy of the system and the fact that there may be one in ten to the fifth or one in ten to the sixth is really irrelevant because we will re-interrogate and determine what the true status is.

August Bruns -- I don't know if I'm qualified technically to answer your question but I'll try here.

On the reliability factor in our installation we haven't gotten to the point of getting reliability data so I can't answer that directly. However, we do have built into the system a malfunction check and we have four ways of checking our reply signals and this is if F-1, F-2 -- are they coming back in the right sequence? Are they coming back at all? And a couple of others that I can't recall right now. So there are four ways of detecting a malfunction in the system.

This is a constant thing. In other words, if they don't come back the reply signals do not come back in the right sequence or back at all, we get a malfunction color on our status board.

The bit rate is 2 kc per channel for our system, and we use up to about a thousand channels that would take us up to about 10 mega-Hertz.

Dr. Harold Katz -- I think the problem of error rate is more complex than one is perhaps led to believe. As soon as you get up to the very high data rates, of course, the error rate is a very significant problem and it's not solved by saying you do it in a redundant fashion.

The error rate, of course, depends on the kinds of noises that are on the line, the noise you'll see on a TV set, where you talk about a 50 db signal to noise ratio, that does not disturb a digital system. It's obviously the pulse noise. So it's extremely important to have a modulation scheme which is more immune to pulse type errors, which is the type of thing we have incorporated into our wide band digital transmission and reception.

We've actually operated the system out at Overland Park where we experienced just the problem that Don was referring to, a tremendous amount of low frequency noise pickup in the system. However, we lost no information in the weeks that we have been operating; that is, information that is entered into the digital computer through the modulation scheme that is being used.

The problem associated with the mechanical structure of the cable and its ability to decrease the amount of low frequency noise is a severe problem. So the error rates that we've experienced, from the digital viewpoint, have been extremely low, though I don't think at this point we can put a number like one part in ten to the fifth or ten to the sixth. I think it's better than that but no actual numerical data has been taken.

Also, we've operated the system within the industrial environment, as you saw, in which the most common noise, from the kinds of machines that are around, are the digital pulse noise.

Don Castro (Hughes Aircraft) -- I guess I would like to just solicit a comment from the panel members in general on the subject which I think is fairly important and must be resolved and involved in this system. We have better develop a system concept which has the ability to provide beginning services at the beginning and can grow and evolve into the more complex one versus one which could be totally optimized for, say, a specialty service with additional specialty services added on to new concepts as the systems development progresses.

August Bruns -- In fact, we discussed that at breakfast today: the counter position to your position of doing it all, the systems approach, in the beginning.

I don't know who's right at this particular point in time but we figure that to do one thing with the, I might say the crawl, walk, run approach, which is to get in and do the one thing well and not try to be all things to all people right off at the beginning. So at this point in time and although we haven't given it real detailed analysis and thought, this is the road we've chosen to take, that we'll go in with a simple approach and get that working and then we'll look at the total systems aspect.

I think from both the technical and the economic aspect it's going to be better to not try to grab off too much in the beginning. So I don't have any firm stand on this other than we've chosen to go the crawl before we start running approach.

Don Chandler -- It's our philosophy and I think a fairly valid one that you've got to look at the total system. It's got to be a total system utilizing all of the applications, if you will. At least prepare for that. If you use the modular building block approach to it, then you can either run or walk first. But you should, from the system standpoint, prepare the total system for the total number of applications that you want to use it for.

With regard to cost, I somewhat disagree. You sort of have to piggy-back all of these ancillary services across the transponder, or the system. So you're much better off if you can amortize the total cost, because the incremental cost of the equipment is not that much to add the additional services. So if you can spread it across the subscription TV's, the security systems, the meter reading and so forth, it makes economic sense to do it that way.

Joel Beck -- Basically, Video's approach has been a modular concept where you start off with a minimum cost system and provide module space in the actual terminal for additional functions. Since the entire system is computer controlled, it is just a question of changing software in the future to accommodate the additional functions. We think this way it will be more palatable to the CATV operator initially, and then as he gets competent in the system he can order more exquisite and more expensive equipment to perform additional functions.

Dr. Harold Katz -- I think the situation is perhaps a bit more complex in terms of the costs of specialized functions versus the broad approach. One, the terminal has to be capable of accepting the additional function, which, first of all, means more band width. You can't have a low band width, simple system and just add on in addition.

You have two problems. One, you have to go back to that terminal and do something to it. Let me talk about the modular approach and say I will add on a gadget to it but you have to also calculate the cost of sending a man out to every one of these terminals that are already installed and doing something to it.

You will soon find that the cost of that far outweighs the cost of the terminal itself initially.

Secondly, to provide this capability means you simply need a broad band terminal initially and, as we pointed out, the cost of that is not very high. It is not an excessive cost even to provide the limited functional capability.

Software can be added only if the terminal has the capability of accepting variable software and this implies a wide band width system in order to add the software in a simple manner.

Mel Henry (Time-Life Communications) -- I'd like to address the question to Dr. Katz. From your slides that you showed to us today you were estimating a little over $30 per unit revenue in optimum cases. At the same time, did you project, or should I say predict, the dollar investment per subscriber before you could generate that revenue?

Dr. Harold Katz -- Yes, we have done work in that area. Assuming that a two-way cable system is in, and that has some variability to it as we have two kinds of problems. One, are you retrofitting a system that's one-way and now converting it to two-way or are you starting with a two-way system that's already in?

In general, let me quote the concluding data. It roughly doubles the expense per subscriber to put in the two-way system and the doubling of the expense comes primarily from the terminal itself and not the head end computer at all. So you have to, in a sense, be able to generate revenue at least twice what you're generating with the one-way system.

Don Chandler -- That's also our finding. It costs about twice the normal cost for a CATV system, when I say normal, a well built, secure, special connectors and so forth type of system.

From the Audience -- You've got to relate that to penetration.

Don Chandler -- What do you mean? It's just like you relate, you know, 100 subscribers per mile kind of thing. How do you relate a system? It typically costs $100 to $150 per subscriber, it costs twice that.

From the Audience -- I attended a meeting yesterday and Irving Kahn and Mr. Thompson got into a debate as to what it would cost for a modular system versus the expanded system. In other words, you build on more, once you say you want to go two-way or add additional services.

Their comments were the first or the initial would cost about $150 per subscriber in investment but if you were to go to the rediffusion system it was about $300 to $350.

Well, with $30 of revenue per month on a normal 3-year payback, you've invested $1080 per subscriber. If you're talking about a 5-year payback, you're talking about $1,800 investment per subscriber.

So my point is maybe you're talking absolute assets in plant and the devices to carry or transmit this information maybe in this $1,800 we have to add in software and management and office and other overhead.

But my point is yesterday we were talking $350 investment per subscriber and today you're talking about $1,080 or $1,800, depending on the period, whether it's a 3 or 5-year payback.

Don Chandler -- We don't understand that.

Dr. Harold Katz -- I don't see where you got the $1,800 per subscriber. This was a revenue generated -- the revenue generated. We're pointing out that much of the revenue, the greatest fraction of that revenue is developed from programming material which does not involve a high overhead cost to the operator himself. Much of the programming --

From the Audience -- Then you're talking about something that's fantastically profitable.

Dr. Harold Katz -- Precisely. I think this is why the words are boom and bust. It is boom. That's exactly the message. The profits are fantastic. If you pick the services correctly and if you pick the rate of the way you enter the field and you must pick those which are remunerative and those that won't require large software costs or large amounts of ancillary hardware and have the growth built in.

From the Audience -- Then you're saying that it would be a large initial investment and a relatively small cost for maintaining that system. So that once you pay back . . .

Dr. Harold Katz -- It's close to that kind of number, within reason.

Don Chandler -- You know, the most widely known two-way system today is an audio system, right? The telephone. And each of us in here has a telephone in our home and each of us pay in excess of $15 a month for the telephone two-way voice communication service. So the numbers that Dr. Katz talks about really aren't that far out of line. They're a little more optimistic than our projections but basically we agree.

From the Audience -- My question is addressed to Dr. Katz. In your experiments with computer aided instructions, you are limited to the alpha-numeric displays. Is that correct?

Dr. Harold Katz -- Let me indicate when I said computer-aided instruction, I meant that in a sense the information presented to the person leading the program was presented in a computer-assisted mode. Our real emphasis is not on computer assisted instruction where a person is interrogating the computer. That's a very expensive software operation, as people have found over the years in trying to develop interaction between an individual and a computer for learning.

The key to what we're saying is that we want to introduce the person, the people back into the educative process and give them a very simple, studio configuration in which they can control the program on their own in which the computer leads them through the operations. But the teacher and the individual are brought back into the environment, not the computer.

From the Audience -- My concluding question, Dr. Katz. Can you quote us some sort of a figure on the cost of the terminal?

Dr. Harold Katz -- Yes. Today, if you were to order, which we hope you do, on the order of, say, 100 to 200 terminals with the one-line alpha-numeric capability, which, by the way, I don't think can be underemphasized, the ability to gain information back from a computer and the ability to see what you have put in -- with that capability, we're speaking about a terminal that's on the order of about $280. Our projected costs when we're roughly in the 50,000 to 60,000 terminal production environment is the order $135 to $145.

Joel Beck -- Excuse me, Dr. Katz. Did that cost include the cost of the converter?

Dr. Harold Katz -- That includes the converter, it includes the keyboard, the digital logic and it includes the one-line alpha-numeric display.

From the Audience -- I'd like to raise another question. Have you considered the minimum number of subscribers to support the system in terms of revenue and therefore the capacity of the device and the arithmetic growth in the cost of the system involved?

In other words, if you have a satellite operation where you're serving so many people off one satellite and then when you say that serves 10,000 subscribers, then, as the system grows, you have to have a tradeoff to optimize the minimum number of subscribers to support the system and the size of the system and the number of subscribers the system can support.

Dr. Harold Katz -- Let me say there are two viable directions that we are taking. One is the commercial application. I mean commercial not in the sense of an industrial environment but serving the local business community in which you can be profitable after several hundred or maybe a thousand terminal environment with that same computer head end and then expand out into the consumer service area where you're probably talking about a break point of the order of maybe a 4,000 to 5,000 terminals with all of the services that are involved. At 10,000, you will have by far exceeded any of the real costs.

Ray Gilford (Canterbury Cable, Columbus) -- I direct by question to Don Chandler. Both in answering back questions and in your earlier talk you mentioned special fittings and special cable because of the high oscillation factor. Are the manufacturers of cable and of the hardware now in operation and do they meet your specifications or have you set up a set of specifications for them?

Don Chandler -- Yes, we have set up specifications. And the cable and connectors are available. It's just that you can't buy strictly by price. You have to look at all the contingencies and you have to have good RFI shielded type connectors and cable, that's all.

August Bruns -- We've been bandying around here price and cost and things and I'd like to make a few comments on this. We talk about the real systems approach and the sophisticated approach and then the, let's say, going after the first things first.

In our system, to give you some rough ideas and it's always dangerous to toss out numbers, but with fire, burglary, panic buttons, security alarm system, the telemetry cost, that is, up to the house -- we're discounting now the devices in the house for the moment -- the telemetry cost including the central station will run about $100 per subscriber.

If you want to go into that a little bit further, figure $150 to $200 per home would probably give them an adequate protection system, that is, with a control box for exit-entry for the burglar system and so forth devices throughout the house.

So you've got an investment then, and we're talking now of a small system of 2,000 subscribers, we'll say, so you've got an investment of about $250. All right. How can you recoup this? There are numerous ways.

Number one, you could charge the subscriber $150 initial cost to take care of that installation in his house and then a monthly charge. So you've got $250 invested. If you sell that for $10 a month, you've got a two-year payout on the system. So that'll give you some rough idea. We're not talking about at this point in time the computer interface for $150,000.

From the Audience -- Then with 2,000 subscribers you are talking about a $200,000 investment to build the plant? In other words, this is without a cable system like you were talking about earlier? Are you talking about the system other than the cable system?

August Bruns -- Suppose you were building a new system. You string a data cable, in our concept, along with your main cable. By the way, this is very inexpensive to do, it's about $400 a mile to string the second 412 cable. Okay, so you've now got two cables hanging on the poles. Then all you need is our equipment to go in and be in the security business.

And that's pretty cheap, I might add. If you investigate what systems cost today from crime central station security, you'll find out, for example, that Westinghouse doesn't balk at $1,500, Rollins in Atlanta doesn't balk at $1,800 and $5,000 isn't uncommon for a house system.

So what I'm saying is that the biggest thing today besides pollution is crime and that's the market in my opinion to go after and the central station is the best way to do it, as proven by the Small Business Administration's report on Crime Against Small Business. They also say that CATV is the means to do it and I think that that's the real golden egg, as I mentioned before, as to where to hit first.

Now this isn't to say that our system won't accommodate all of the other things we're talking about in terminal modems and so forth in sophistication. But I'm just trying to zero in on where is the dollar and that's where I think it is.

From the Audience -- Mr. Chandler, on this bidirectional system, is the same quality requirement on the signal going back where everything's flat, signal to noise, or can you ease off on some of that?

Don Chandler -- It's more restrictive in the sense that if you originate a video program at the extremity of the system, bring it back up the system in a reverse direction, upconvert, and send it down in the forward direction, it obviously has to have higher quality.

From the Audience -- I mean this program originating in the home, a video program originating in the home. You might well not have to meet the same standards. I just wondered what your experience had been.

Don Chandler -- That's true. From the security standpoint, right. The video quality is not as demanding as, say, a locally originated, remotely originated program, right.

But in our case the reverse direction is of a higher quality. It has better overload performance, better signal to noise, better noise figure.

Dr. Harold Katz -- I'd just like to reinforce that comment you made that the program originating in the home or some such location doesn't have to have the quality that's expected of a professional program that's originating at a high quality studio.

We have watched people in our own experiments in this interactive mode where a program originated from locations that are familiar to them in their own surroundings. The noise background was not of concern to them. The fact that they were involved with people they knew, knew by name or knew by person, the quality of the medium was not a real issue for them. That's a very significant factor.

Don Chandler -- Right.

For presentation July 8, 1971,
NATIONAL CABLE TELEVISION ASSOCIATION,
Washington, D. C.

TELECINE SYSTEMS
FOR THE CATV ORIGINATION CENTER

by

Kenneth K. Kaylor

Philips Broadcast Equipment Corp.

Although "live" programming is considered a necessary part of the program origination services of a community-oriented CATV system, <u>tele-cine</u> facilities will hold the key to success or failure of such an operation from an economic standpoint. The word "tele-cine" was developed during the early days of television broadcasting to define those facilities devoted to the video reproduction of the various film media.

Since the original commercial telecine television camera was an "iconoscope" camera which had a very large sensitive surface (about 3" x 4"), a film projector was focused onto the sensor by using a standard projection lens as shown in Fig. 1. This technique was quite simple and optical alignment was very easy.

Eliminating the "Shutter Bar" effect

In the case of motion picture film, the theatre projector had to be modified in order to prevent a "shutter bar" effect caused by the difference in frame rates between television and motion picture standards. Standard sound motion picture film operates at 24 frames per second while the U. S. standard for television scanning is 30 frames per second. The intermittent mechanism had to be modified so that the length of time between "pull-downs" alternates between 1/20 and 1/30 second. The average of these two fractions is 1/24 second, or the time demanded by the standard 24-frame-per-second motion picture projection rate. When this particular intermittent mechanism is coupled with a five bladed shutter, the frame that remains for 1/20 second is scanned by three 1/60 second fields, while the one remaining for 1/30 second is scanned by two fields. It is not practical simply to speed the motion picture film speed up to 30 frames per second. Unnatural motion results, of course, and sound frequencies are distorted.

The introduction of new super-8mm sound film projectors with different frame rates further complicated the technical aspects of television film coverage. These commercial projectors also had to be specially modified for proper operation at commercial television standards.

Multi-projector systems

As the requirement for more and more film and slide origination developed at the television stations, it became apparent that techniques whereby more than one projector could be used with each camera were necessary. One such arrangement used at the WNBT film studio in New York (Figs. 2 and 3) was a track assembly whereby the camera could be rolled from port to port in the studio wall in order to pick up several slide and motion picture film projectors. A somewhat similar arrangement used at another early television station provided for the camera to be mounted on a pedestal with a panning mechanism. This camera could be turned by remote control to face a number of different projectors mounted on stands placed in a semi-circle. Both of these systems had the inherent disadvantage of a significant time lapse when changing from projector to projector.

With the introduction of the vidicon television sensor in later years, the image size of the sensor was reduced to 3/8" and 1/2" and optical alignment became much more difficult. "Uniplex" television cameras coupled to one projector were still used (Fig. 4); however, scan reversal was necessary when using the one-for-one system.

An economical method for using several projectors with one camera was needed. Furthermore, it was desired to reduce the time lapse required to alternate between projectors. These requirements were accomplished by using a prism or mirror "multiplexer" assembly which would direct the light from as many as three projectors directly onto the surface of the vidicon tube (Fig. 5). Mechanical "dousers" were inserted or removed from the light path of each projector to select the proper image.

Although this technique was relatively inexpensive, it was extremely difficult to align the images. Control of light levels had to be accomplished by use of "automatic target" controls or individual remotely controlled "neutral density disks" mounted in the light path from each projector.

A simple method to accomplish alignment of several projectors, as shown in this picture (Fig. 6), was to provide the camera with an objective lens which was focused upon the image plane developed at a "field lens" located between the projectors and the pick-up device. The use of this lens provided several advantages (Fig. 7). First and most important, optical alignment was considerably less complex. Secondly, the light could be controlled by inserting a neutral density disk in the camera optical path thus reducing the number of disks required. Light control could also be accomplished by using an automatic iris on the objective lens. In addition to douser operation with a prism multiplexer, selection of the proper image was accomplished by pneumatic insertion or removal of "first surface" mirrors as shown in Fig. 8.

Two-camera, multi-projector systems

With the introduction of the multiple surface mirror multiplexer head as shown in the left half of the illustration (Fig. 9), it became practical to use two cameras with three or four projectors as indicated in the layout on the right. A control system that would allow the image from any of the projectors to be directed to either camera was used. An intricate system of automatic controls prevented the image which was "on air" from being disturbed if a conflicting command was given for the alternate camera. Control of the light was accomplished by neutral density disks at the sources or located in the light path at each camera. Although these systems were quite versatile and economical for large television stations, it appears that the complexity is not required for most CATV installations.

Color telecine for cable TV

A typical color telecine film island for CATV use is shown in this "exploded view" (Fig. 10). Components of the system include a remote-controlled slide projector, a remote controlled super-8mm film projector, and a specially developed lightweight 16mm film projector. These units are mounted on a rigid framework and coupled through a mirror multiplexer system to a Norelco LDH-1 type Color Film Camera. Here (Fig. 11), light control is provided by an automatic iris on the objective lens coupled with automatic target control of the vidicon sensors. The use of a wave-form monitor and a monochrome picture monitor is recommended if one desires to have the highest picture quality. A high quality system such as the one described will assure a noise-free picture which will meet or exceed the quality picked up from local stations or network originations and relayed to your customers. This system is compatible with either monochrome or color operation. The high quality color system shown in the diagram costs about $25,000.

Sometimes it is desirable from an economy standpoint to utilize one camera for both telecine applications and pick-up of cards, opaque objects or "live" action scenes. Two methods are reasonable when such cost reductions are deemed necessary.

One method is to use a live camera with a zoom lens that can be integrated with an optical multiplexer. A precision wedgeplate is coupled to the multiplexer in such a way as to allow the camera to be critically aligned to the field lens (Fig. 12). The camera can then be attached or detached at will. Since many of the new cameras, either monochrome or color, have zoom lenses with automatic iris mechanisms, the light control is still automatically corrected.

Rear-screen projection

The second method for utilization of a live camera as a film chain involves the use of the rear screen principle. This method reverts back to the early days of television film systems inasmuch as a single "live" camera can be used to pick up the images from several projectors as well as from cards, radar displays, meters, or "live" objects. You are all familiar with several of the "time n' weather" devices which form the simplest device in this category (Figs. 13 and 14).

One might expand this concept by using a large translucent screen and projecting several images from various projectors onto its image surface from a rear position. These images would be picked up by a camera located in front of the screen. Either one large screen can be used or several small ones with individual projectors as shown in Fig. 15. The advent of a special new type of rear projection screen which reduces "hot spots" and defocusing problems is the heart of the system. This screen allows a standard vidicon or Plumbicon* TV camera to be used for viewing images from practically any existing audio-visual projector and still be used to view a "live" scene (Fig. 16).

For this sample system, we have chosen to use four projection sources, a card rack and a live "video disk jockey" set (Fig. 17). We have provided for a "stop-motion" 16mm sound projector, a filmstrip projector, a 35mm projector and a television-modified super-8mm projector. Thus, one could accommodate almost any type of locally originated material as well as a vast storehouse of educational materials and "Freebies." In this case, two cameras are mounted on a pedestal (Fig. 18) located at the center of focus of a zoom lens that is provided with a close-up adapter. All pick-up points are located on an arc centered on the pedestal. Each projection console (Fig. 19) forms a chord of the circle. The card rack (Fig. 20) also forms an equal chord. Economy is the "name of the game" in the rear screen system. It is designed for minimum operator costs in the "disk jockey" format. All "start," "stop," and "change" controls for each projector are located in a convenient place on the operational console (Fig. 21).

Since the camera is on a pan/tilt device and employs a zoom lens, one can modify materials brought to the station by amateur photographers. That is, if slides are poorly framed, they can be edited by changing size and framing position simply by focusing on the desired portion of the projected image as illustrated here (Fig. 22). This, of course, is a capability unique to the rear screen system.

All other monitoring, switching, and camera control functions are located in this same desk so that your local "disk jockey-engineer" can have everything at his finger tips.

Titles

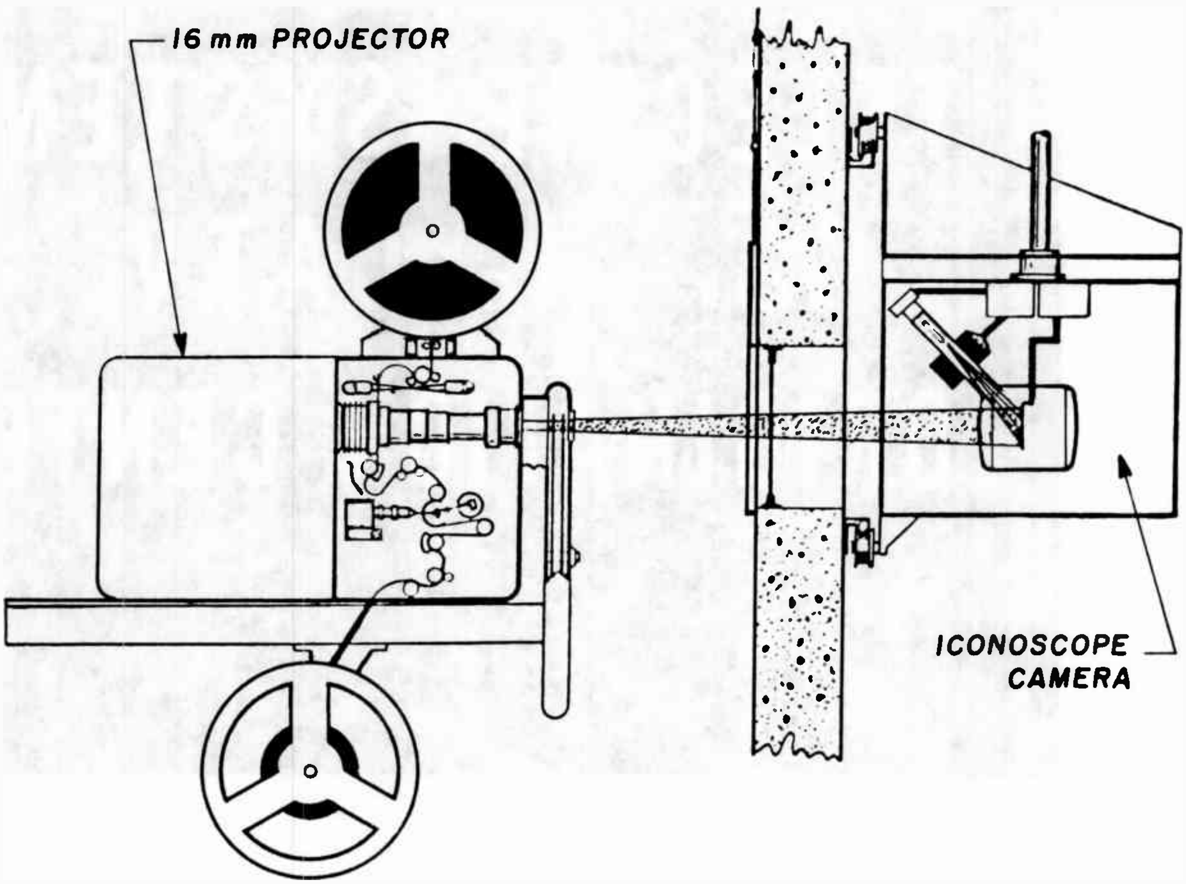
Several methods for title reproduction have been developed. In addition to the card rack previously discussed, both vertical and horizontal "crawl" devices have been fabricated from moving belt systems as shown in Fig. 23, or the rotating wheel principle shown in Fig. 24. The ability for a cable operator to use a standard typewriter, "rub-off" lettering, "paste-ups" or Polaroid* pictures is a real time and money saver for quickie commercials or promotional slides. A simple "document viewer" (Fig. 25) which again uses a zoom lens and appropriate lighting is ideal for this service. A "positive/negative" phase reversal switch on the camera control provides for image polarity to be reversed, thus allowing black letters to be reproduced in white. Electric zoom allows for size control, while "scan reversal" switches on the camera provide for special effects when desired. Either monochrome or color cameras can be used with this system.

"The telecine production center"--that's really where the action is in the money-making end of cable television origination. I hope that this review of the evolution of the telecine system and its variations, along with some of the tricks of the trade, will help each of you bring greater flexibility and imagination to your own plant to provide new versatility without mortgaging the ranch. If you want any help, give the boys in the Norelco back room a call. They might have just the solution for your problems!

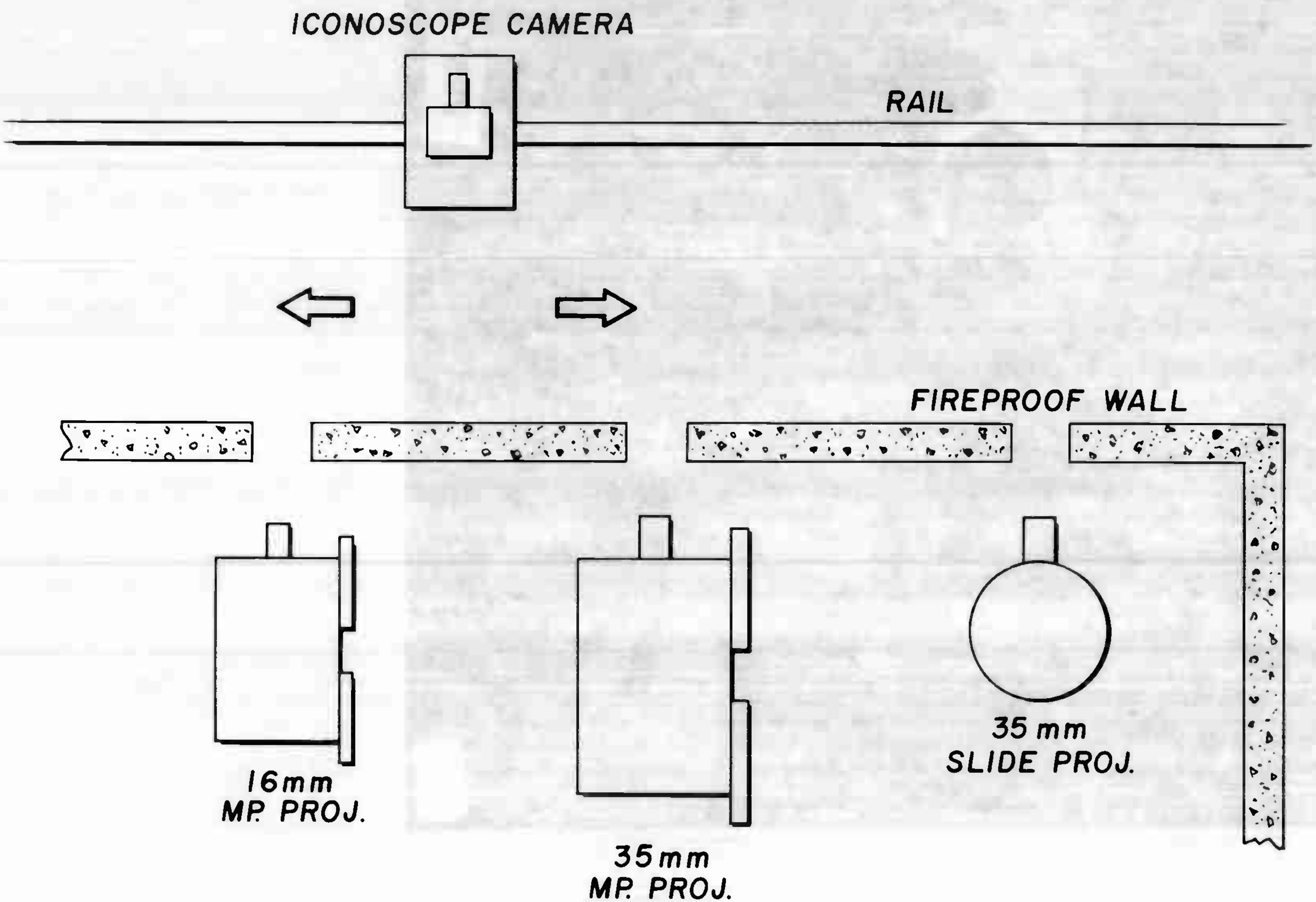
# # #

Norelco
PHILIPS BROADCAST EQUIPMENT CORP.
A NORTH AMERICAN PHILIPS COMPANY
ONE PHILIPS PARKWAY, MONTVALE, N. J. 07645
TEL: 201-391-1000 TWX: 710-990-7301

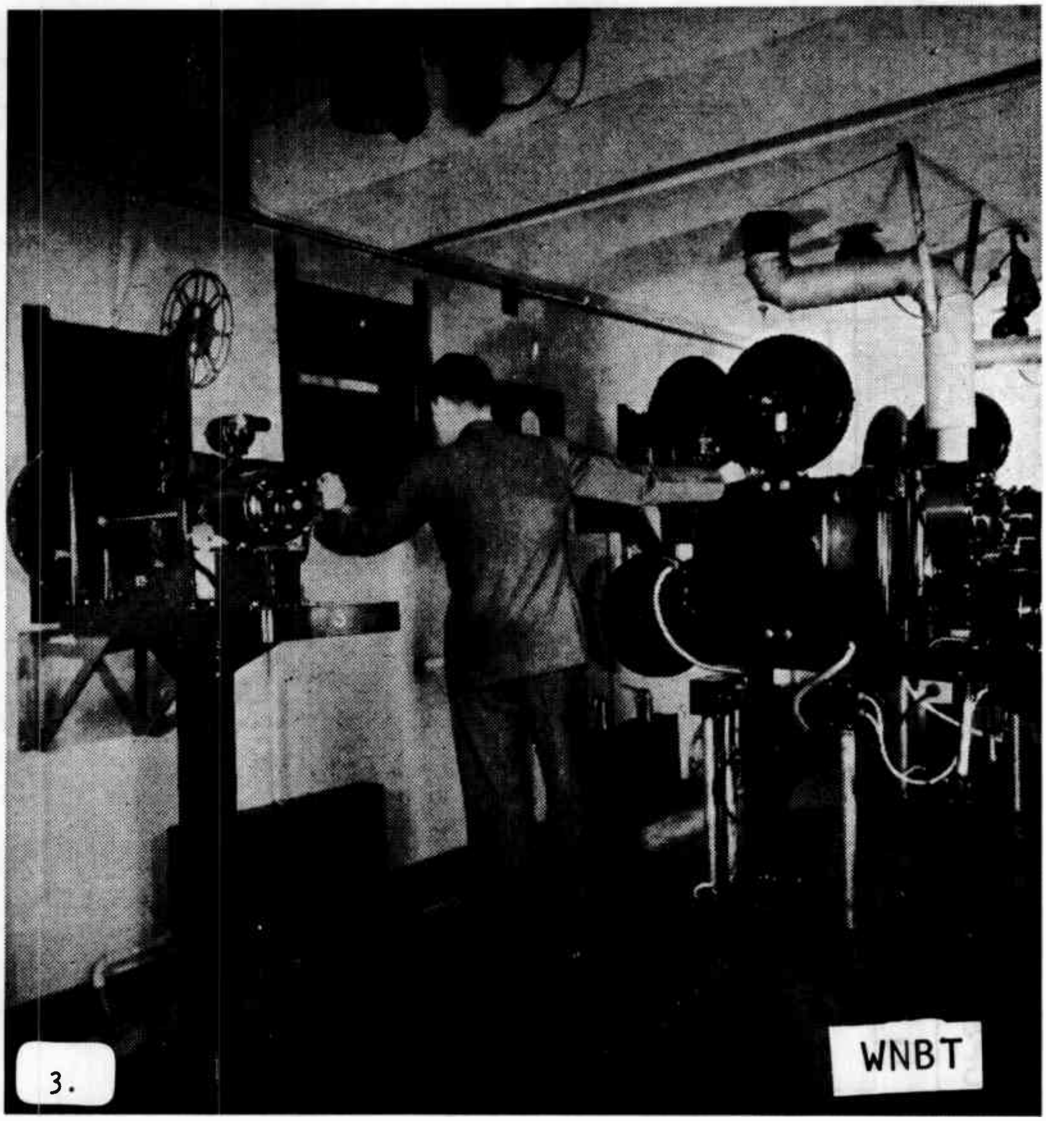

TELECINE SYSTEMS
for the CATV
ORIGINATION CENTER

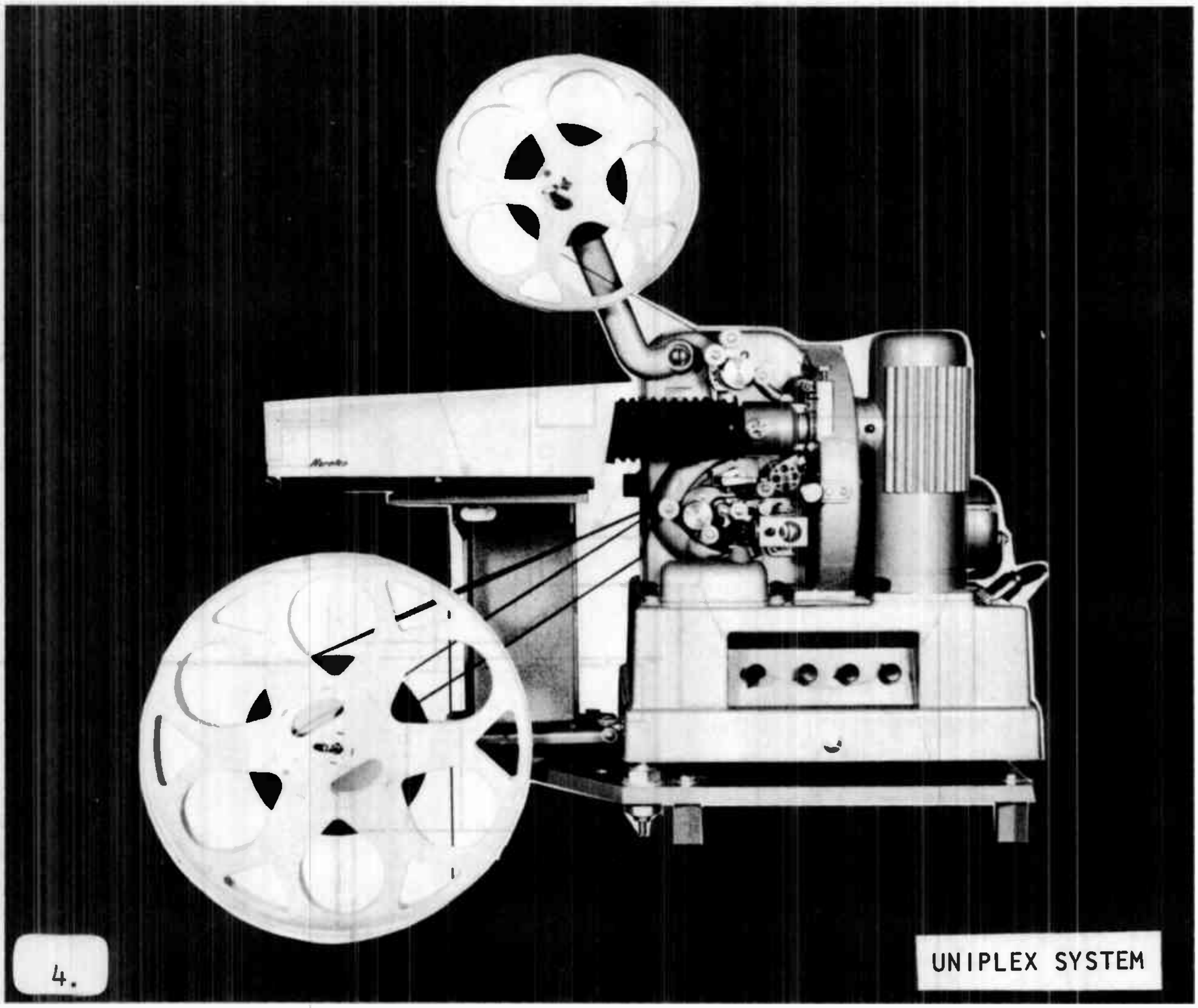


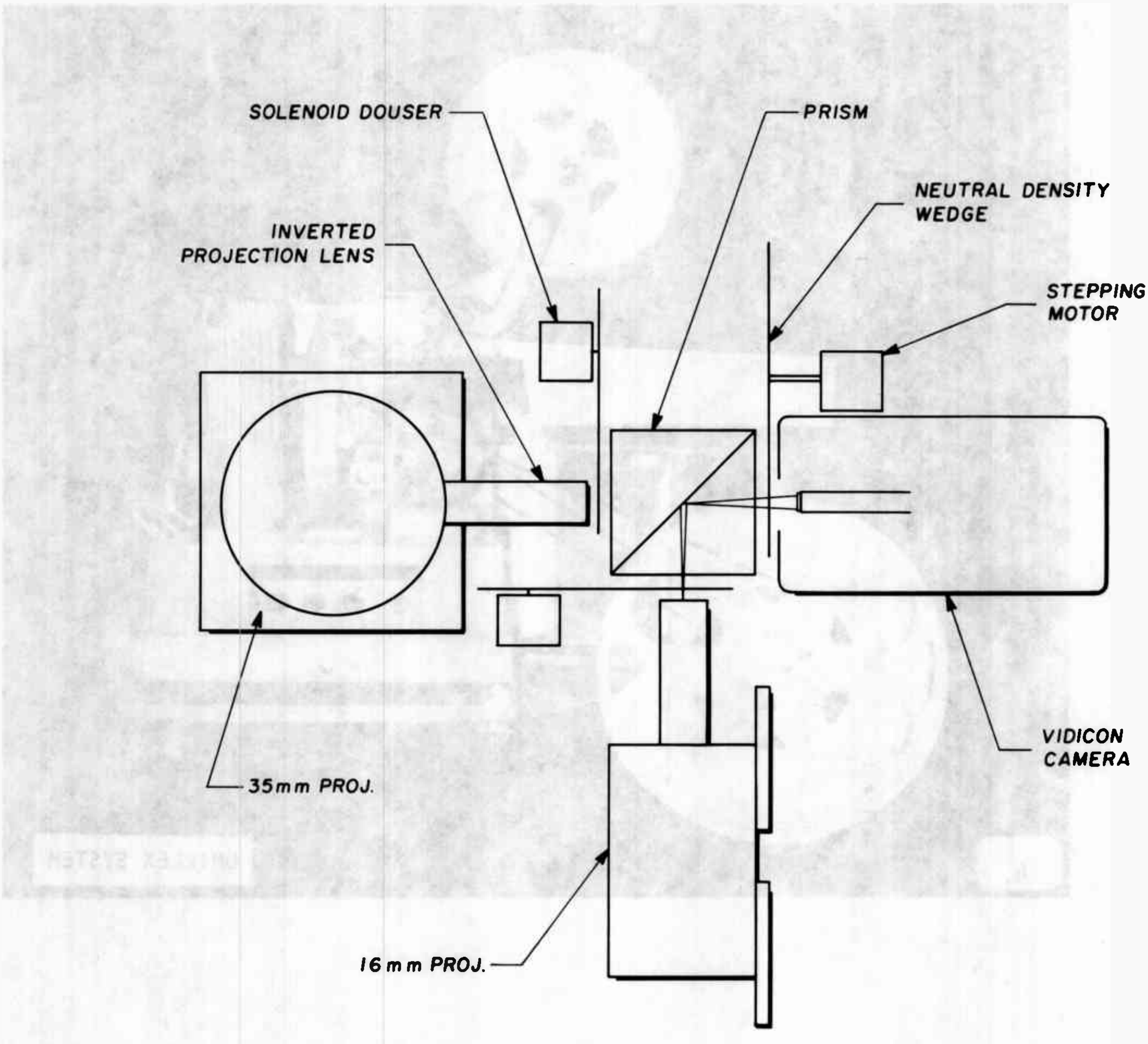
1. ICONOSCOPE PROJECTION SYSTEM



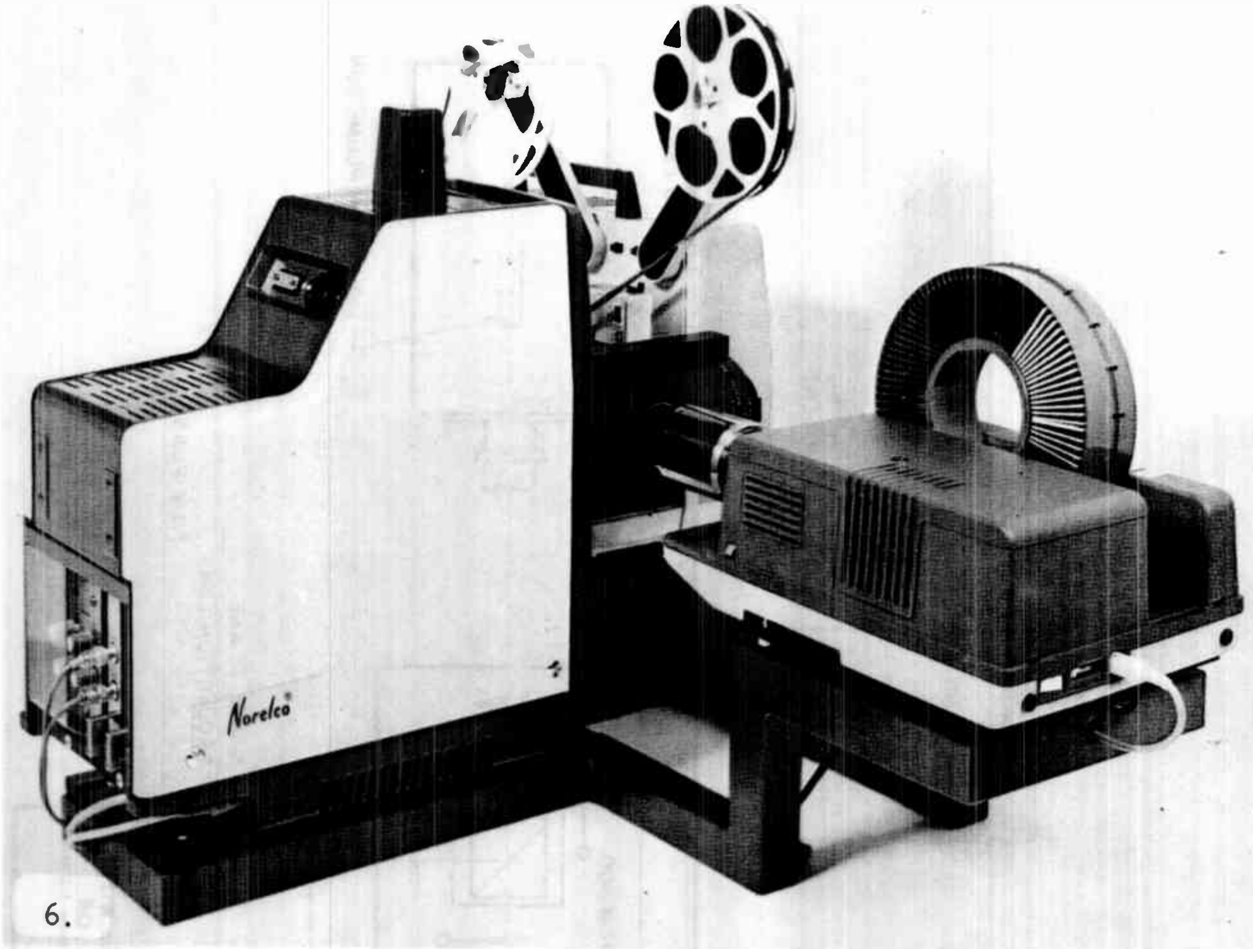
2. MOVING RAIL TELE-CINE SYSTEM


3.
WNBT

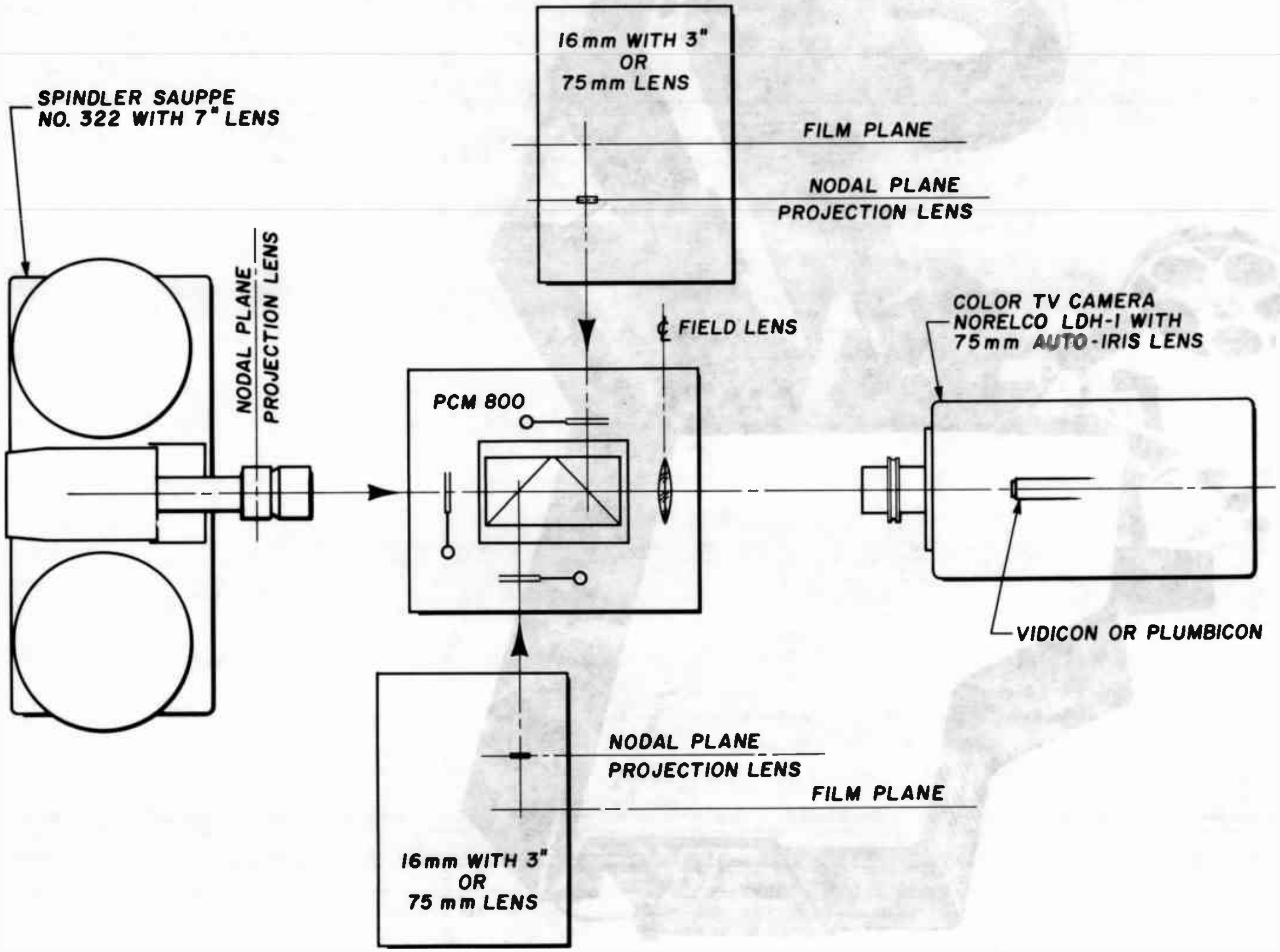

4.
UNIPLEX SYSTEM



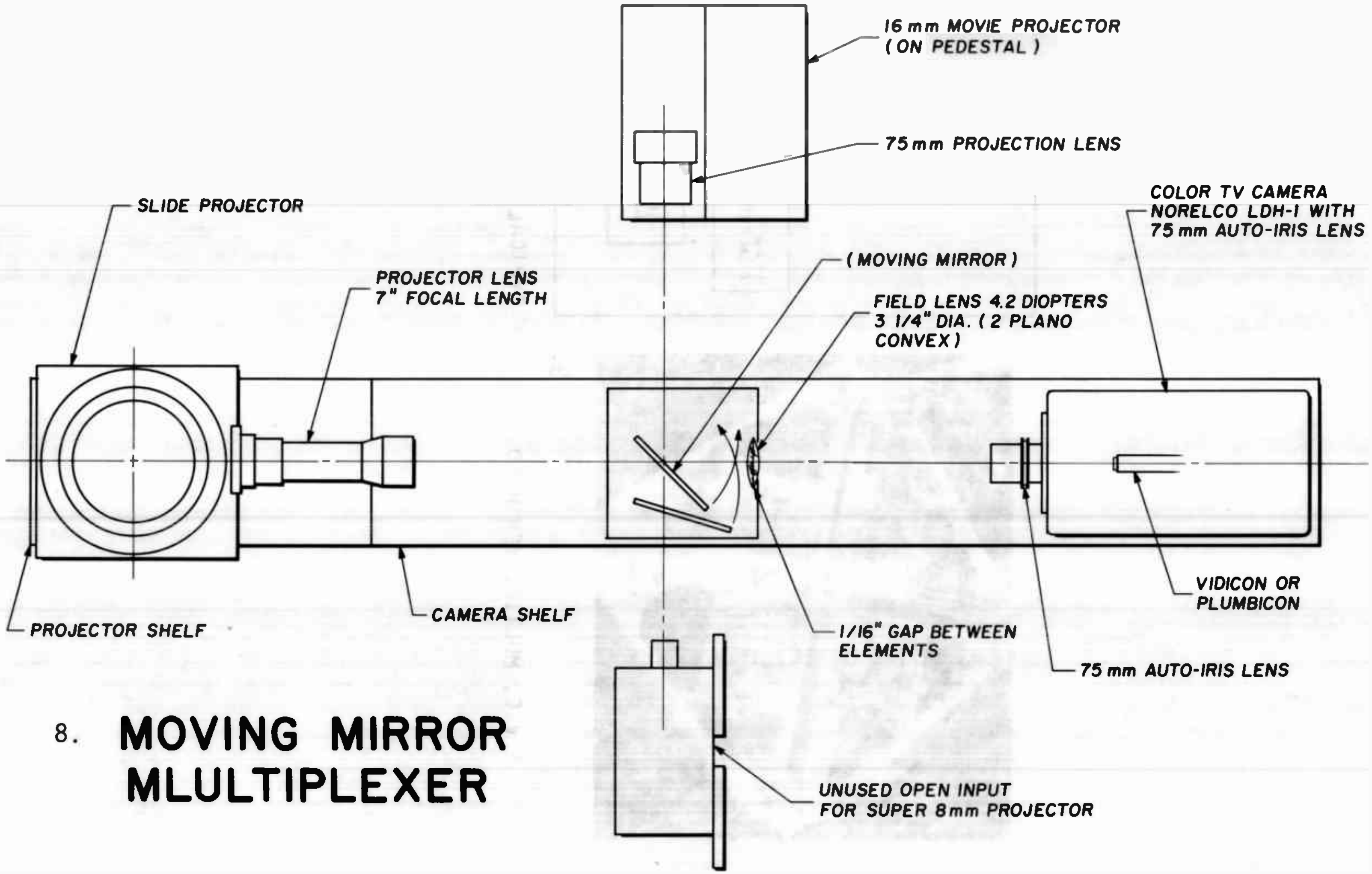
5. DIRECT PROJECTION MULTIPLEX SYSTEM



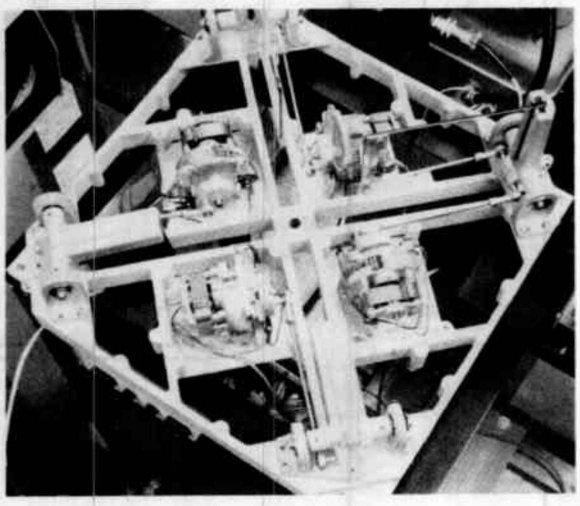
6.



7. **PRISM MULTIPLEXER**

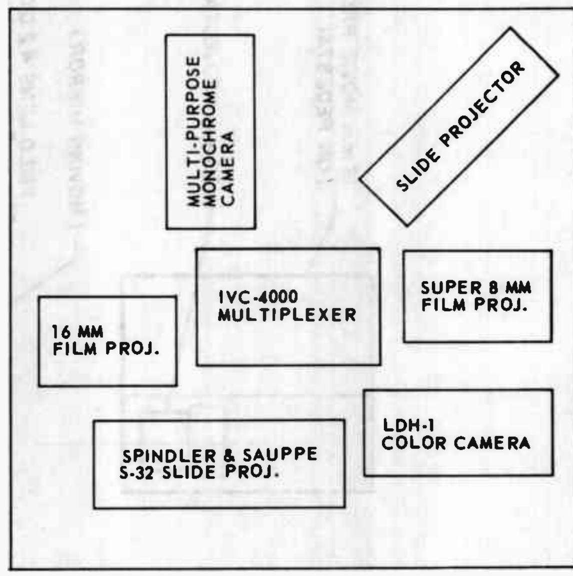


8. **MOVING MIRROR MLULTIPLEXER**

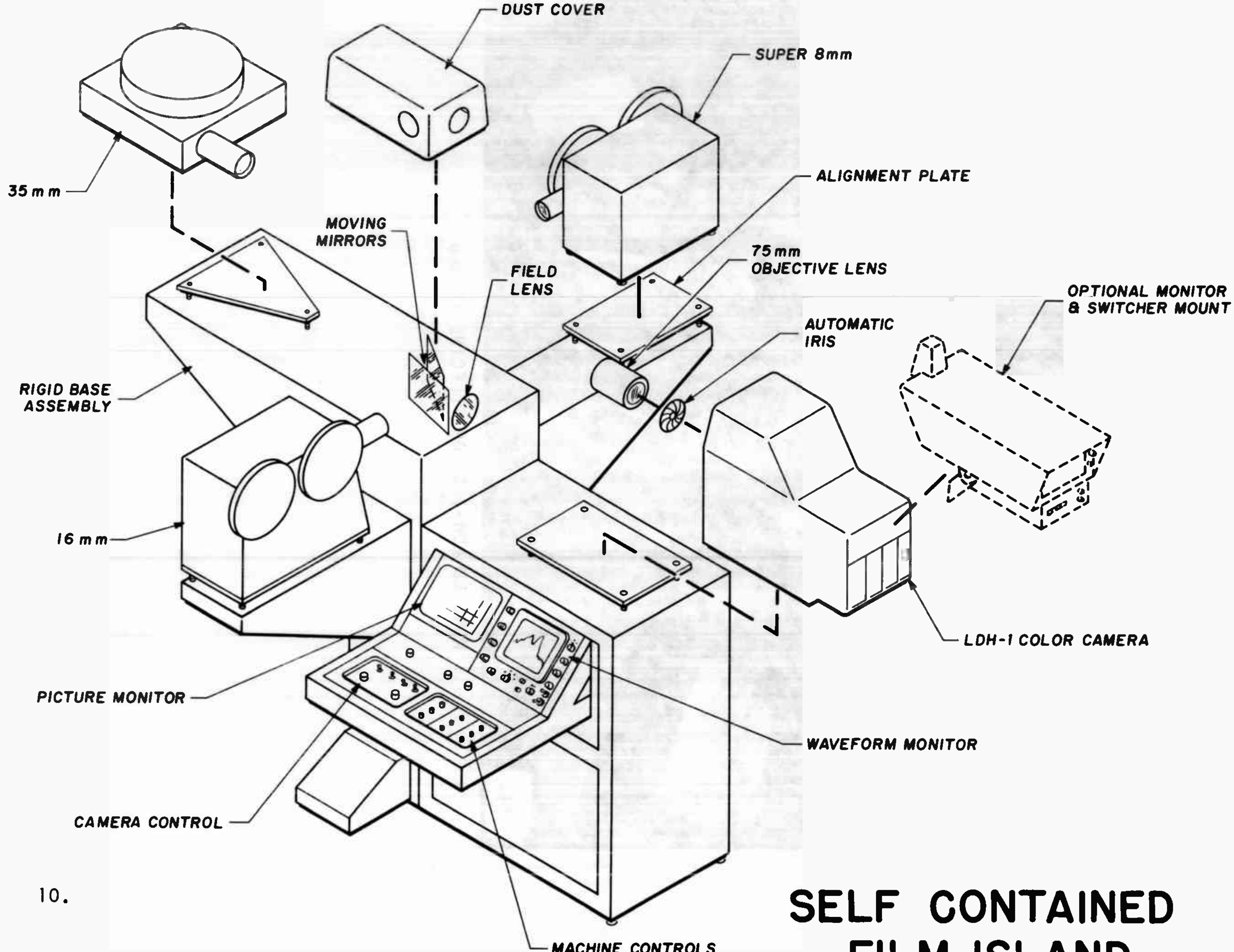


9.

I.V.C. MULTIPLEXER HEAD

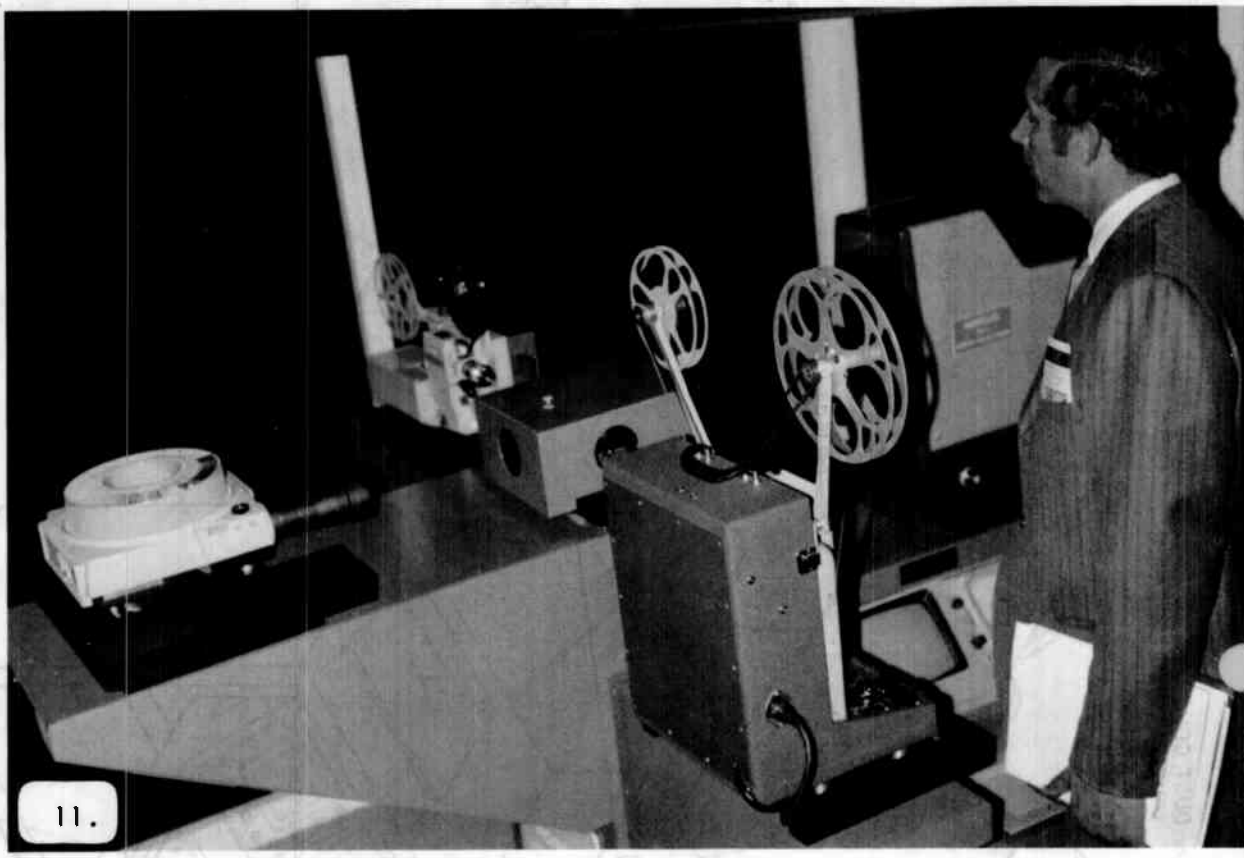


TYPICAL 2-CAMERA TELECINE LAYOUT

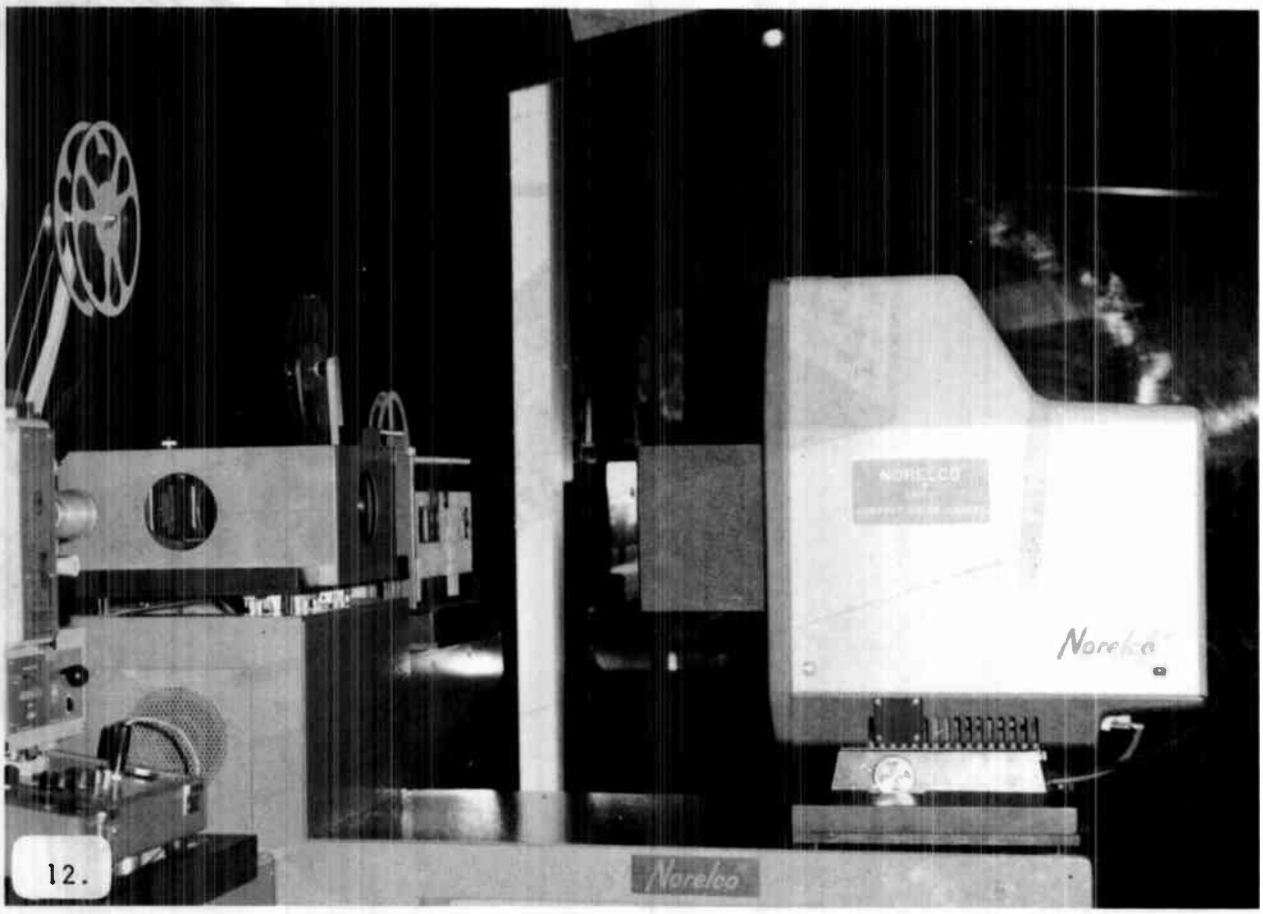


10.

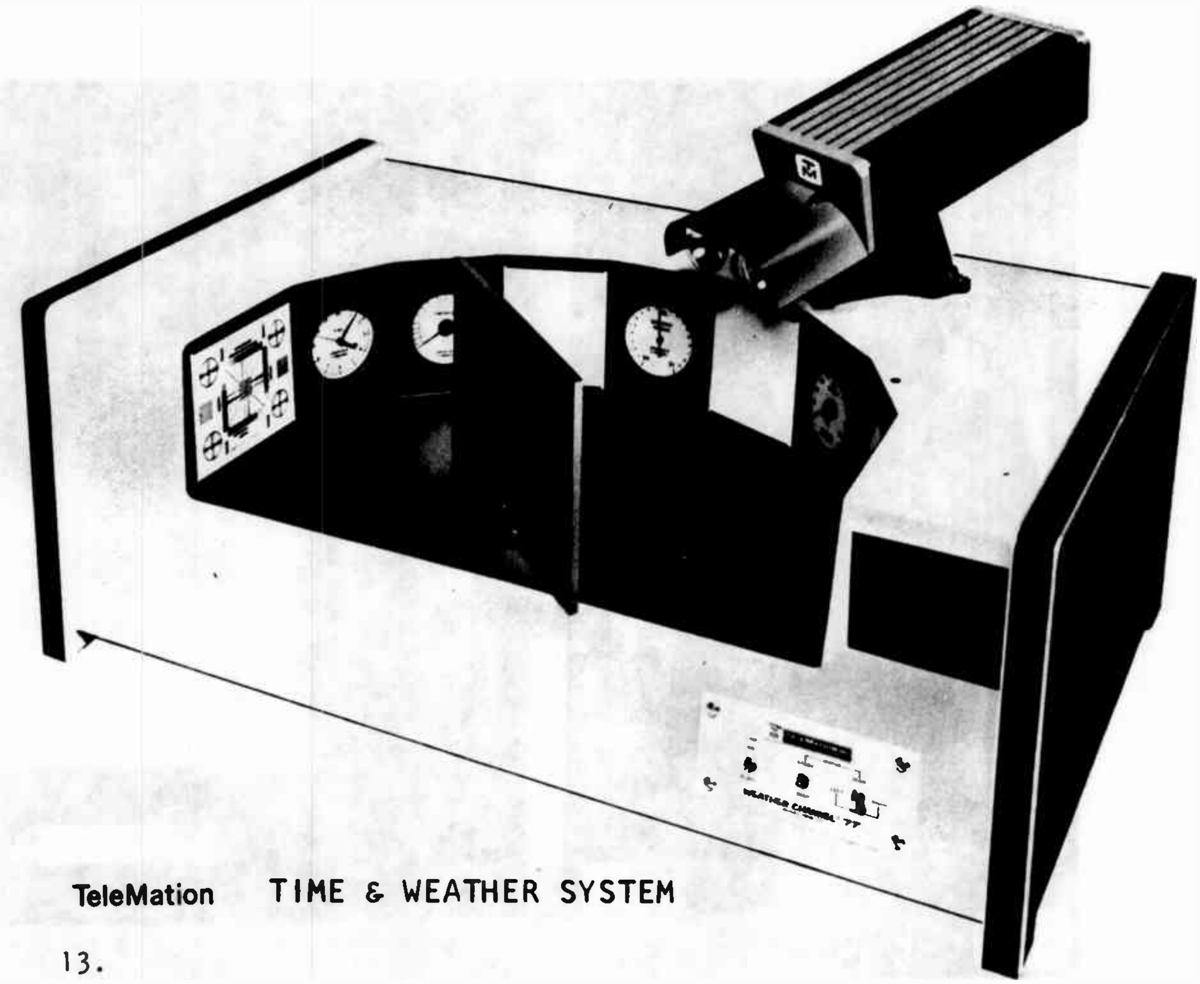
SELF CONTAINED FILM ISLAND



NORELCO LDH-1 COLOR TELECINE ISLAND

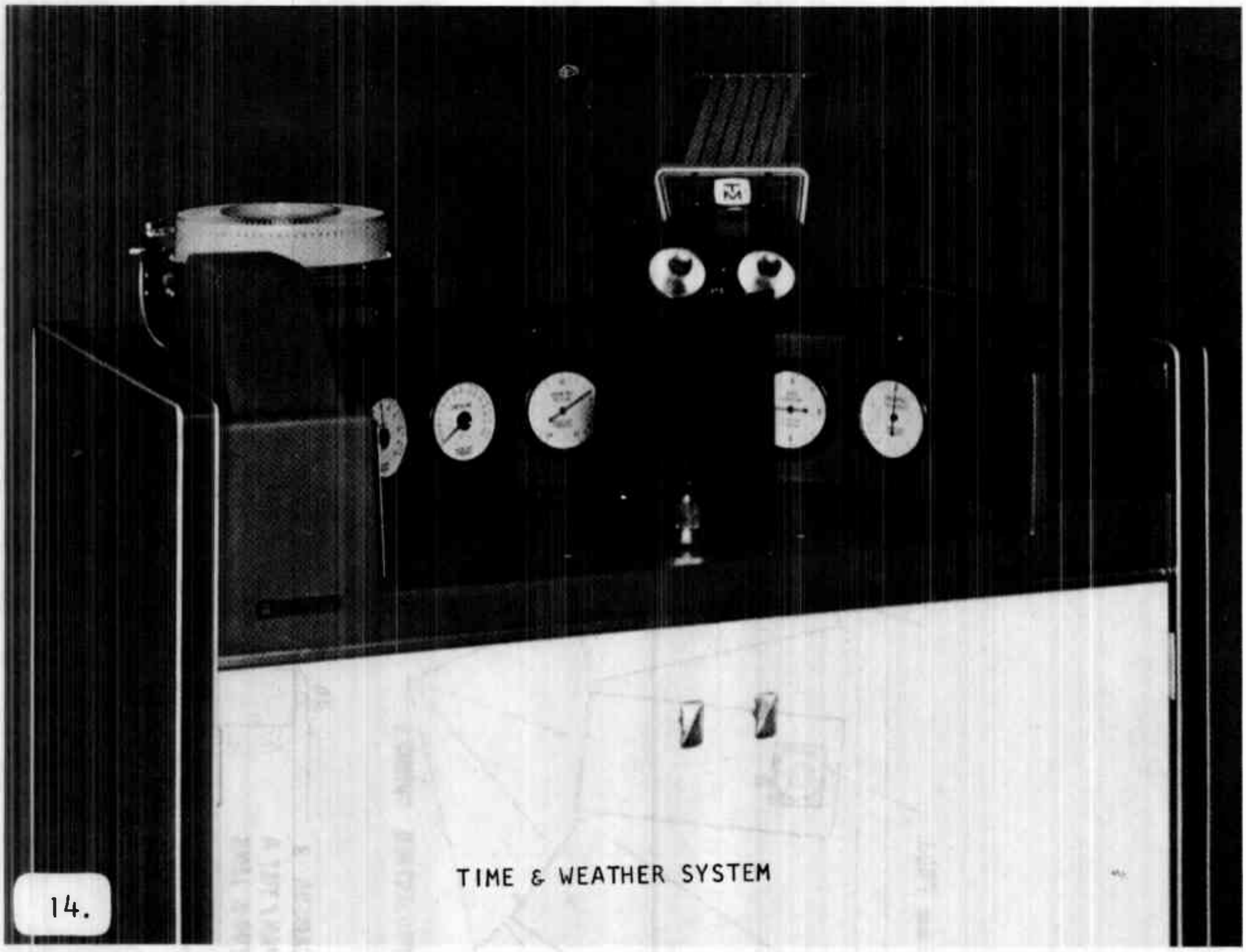


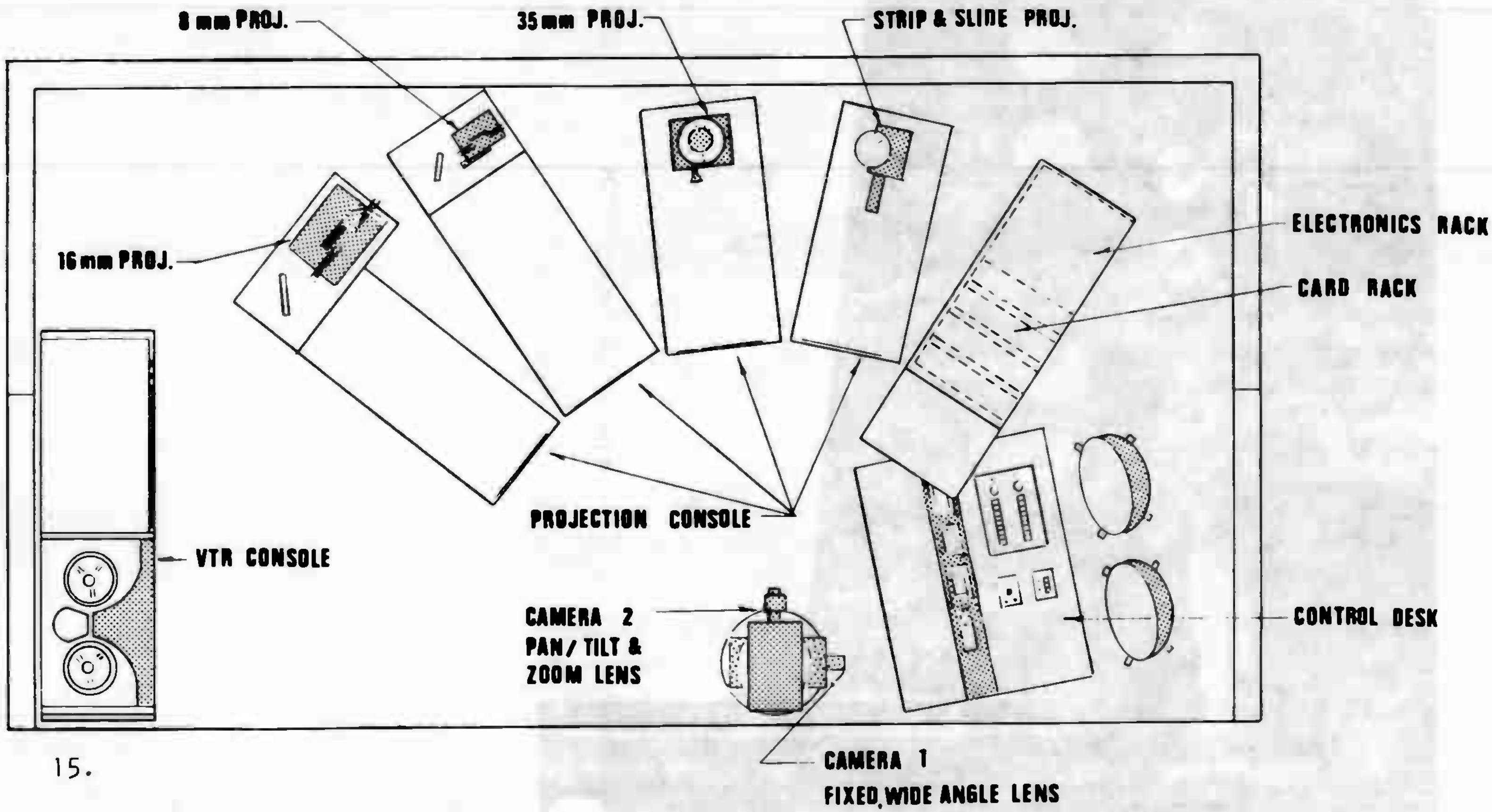
NORELCO COLOR CAMERA IS REMOVABLE FROM
TELECINE ISLAND



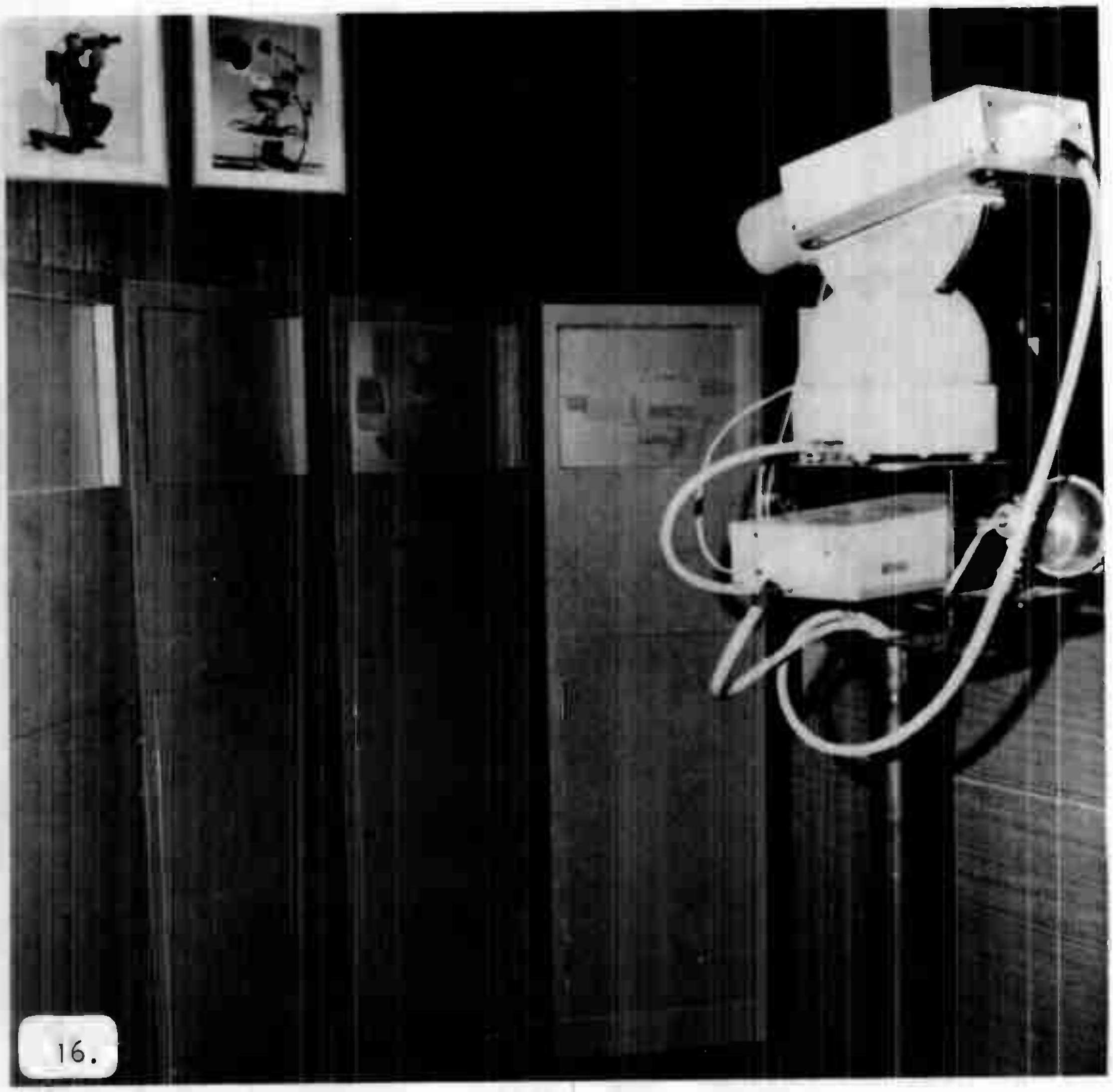
TeleMation TIME & WEATHER SYSTEM

13.

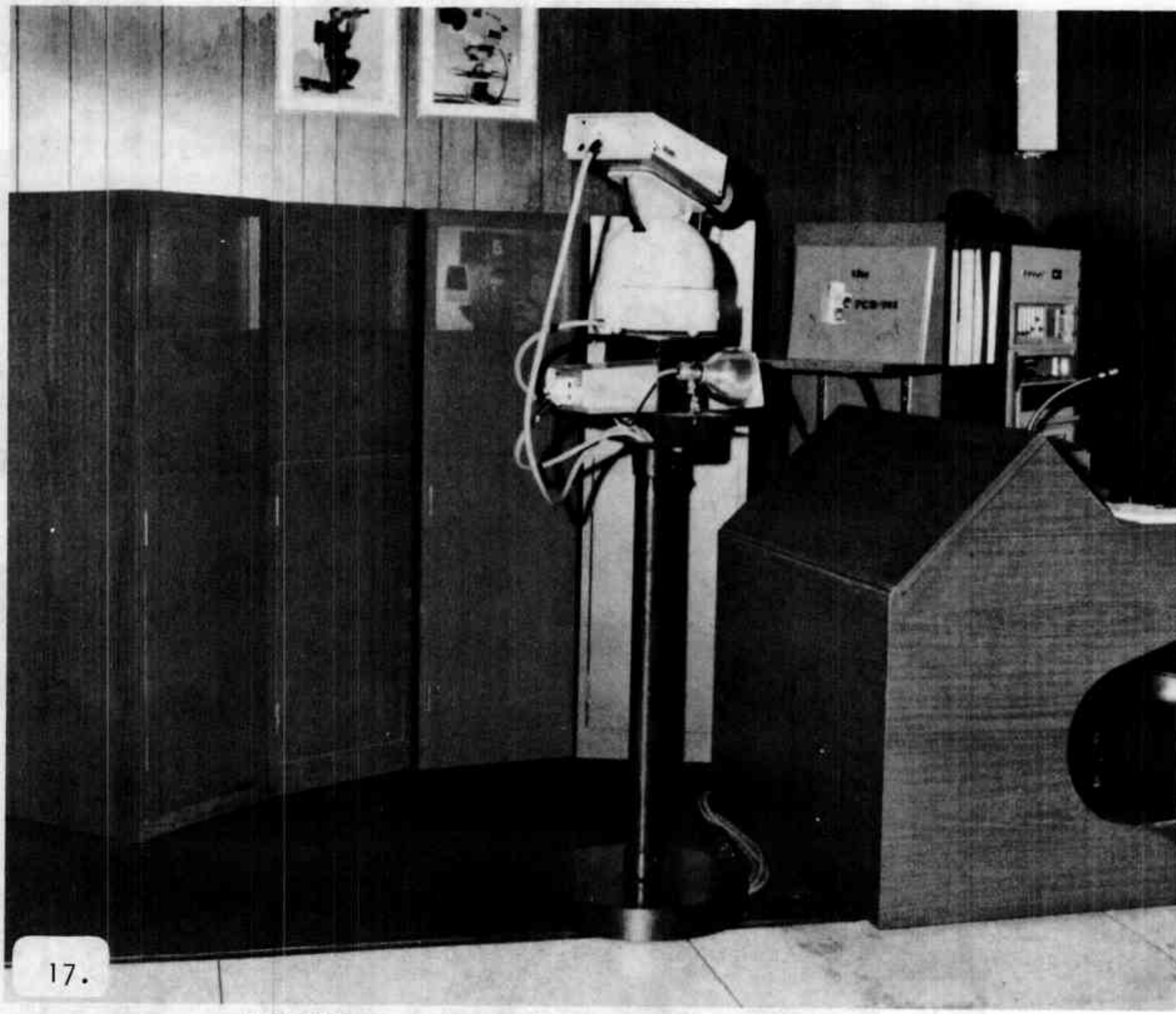

TIME & WEATHER SYSTEM
14.


8 mm PROJ.
35 mm PROJ.
STRIP & SLIDE PROJ.
ELECTRONICS RACK
CARD RACK
16 mm PROJ.
PROJECTION CONSOLE
VTR CONSOLE
CAMERA 2
PAN/ TILT &
ZOOM LENS
CONTROL DESK
CAMERA 1
FIXED, WIDE ANGLE LENS

15.

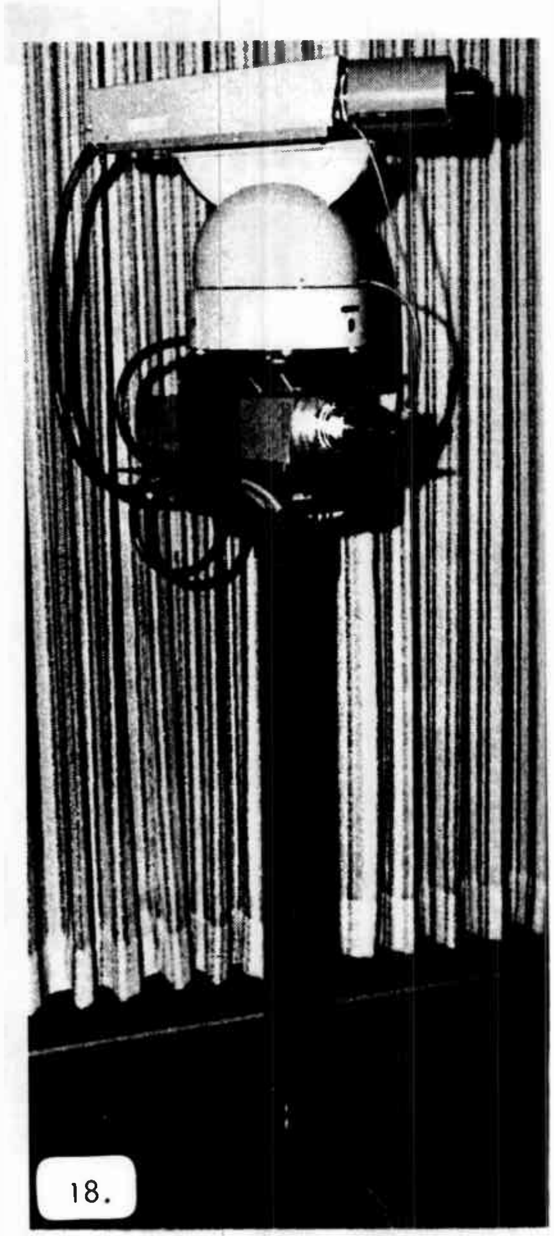


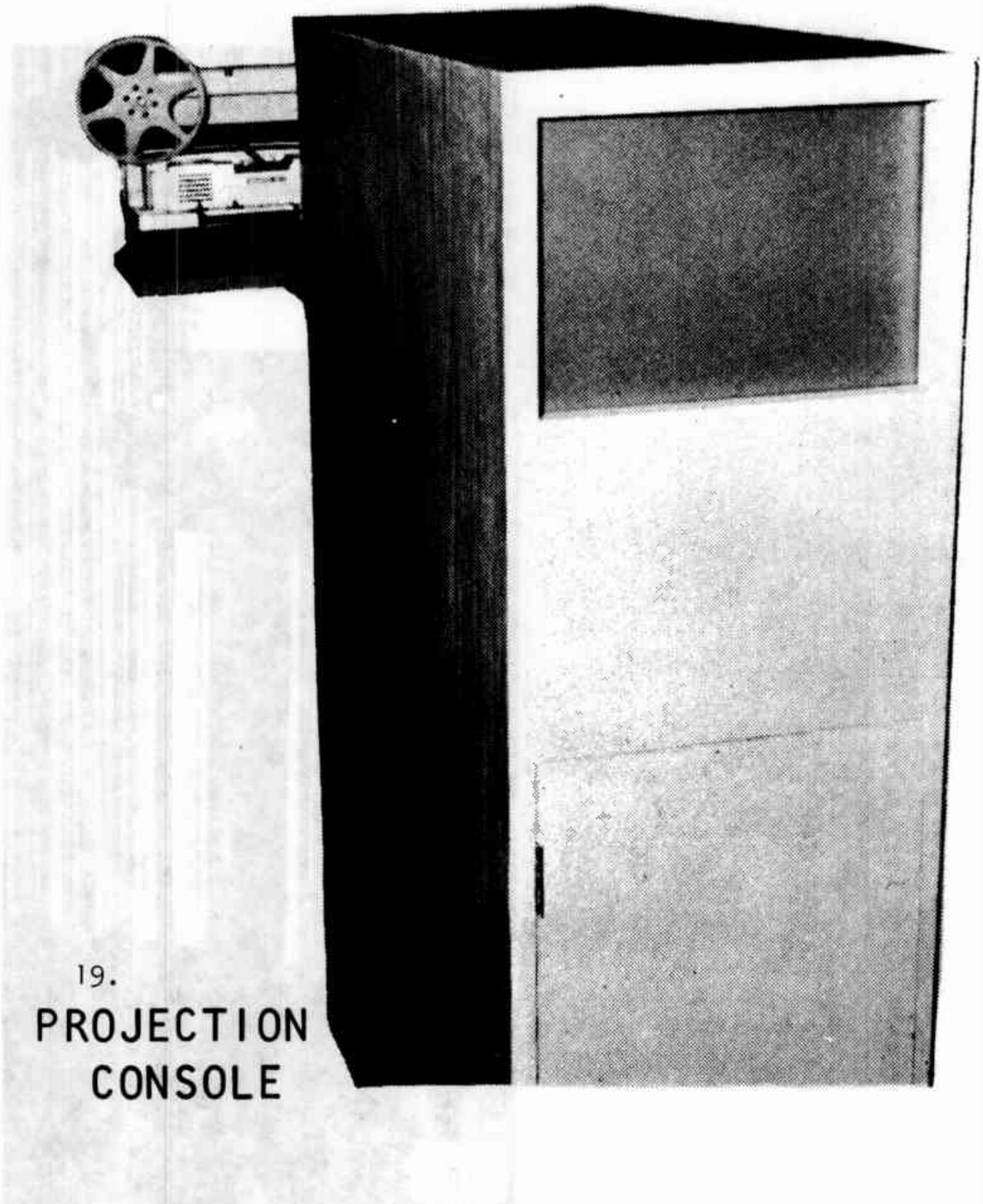
16.



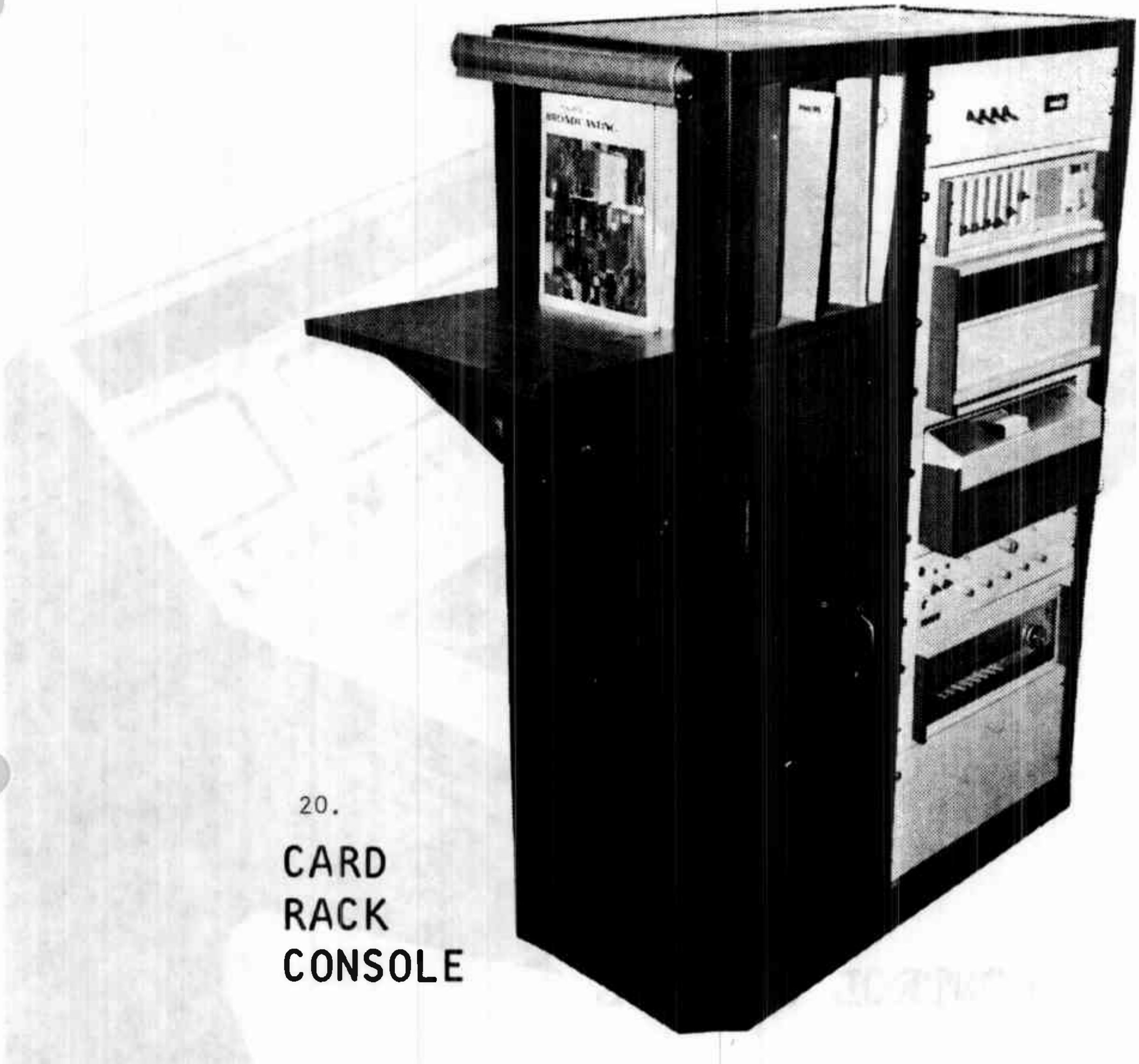
17.

VERSATILE NORELCO "VIDEO DISC JOCKEY"
SYSTEM


18.



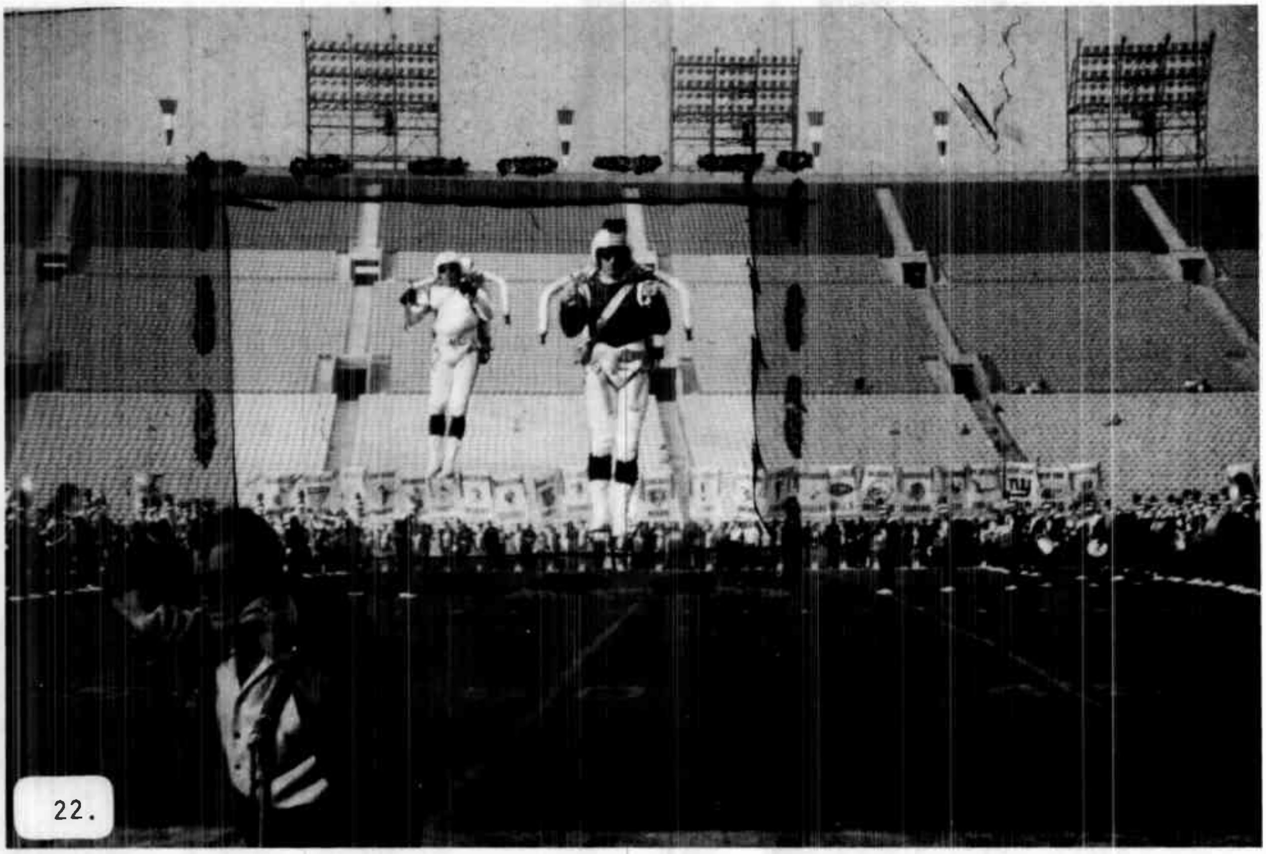
19.
PROJECTION CONSOLE



20.

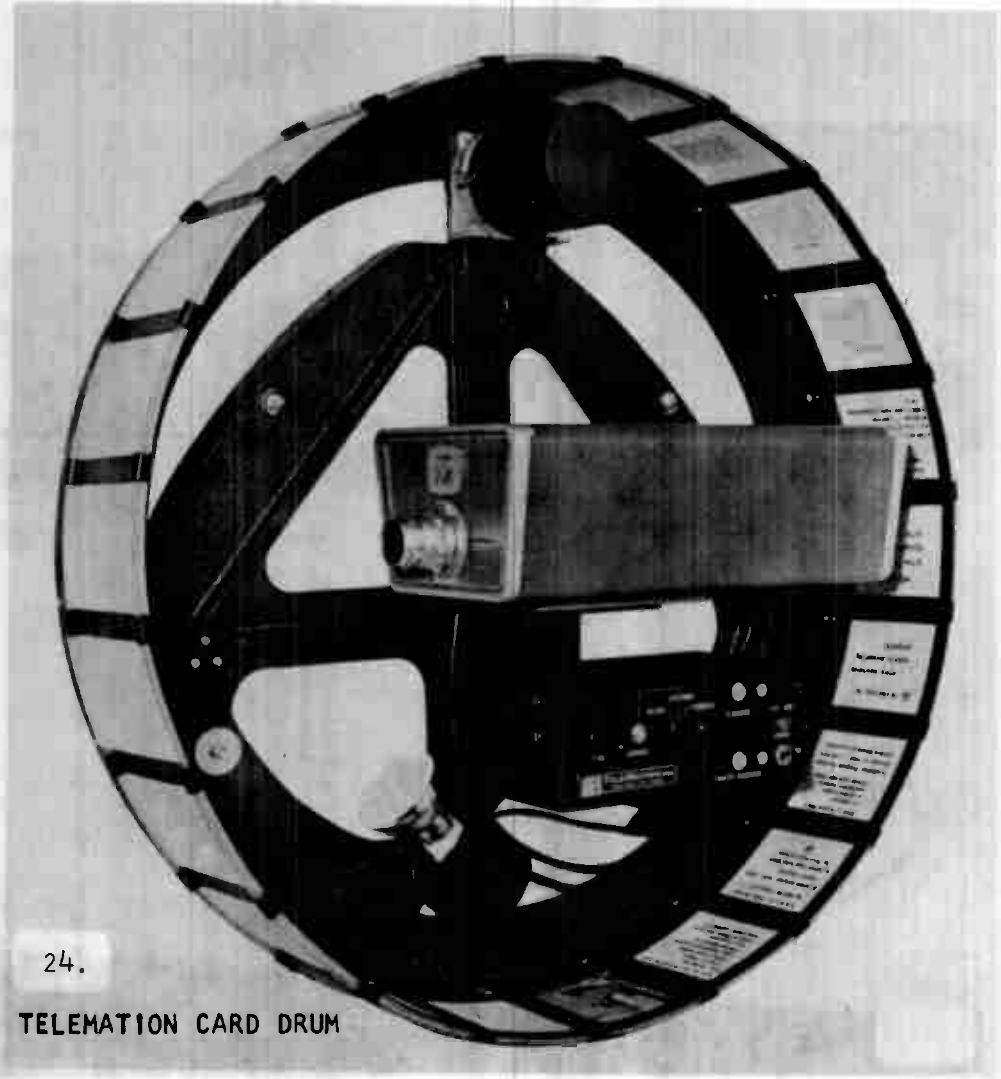
CARD
RACK
CONSOLE

21.



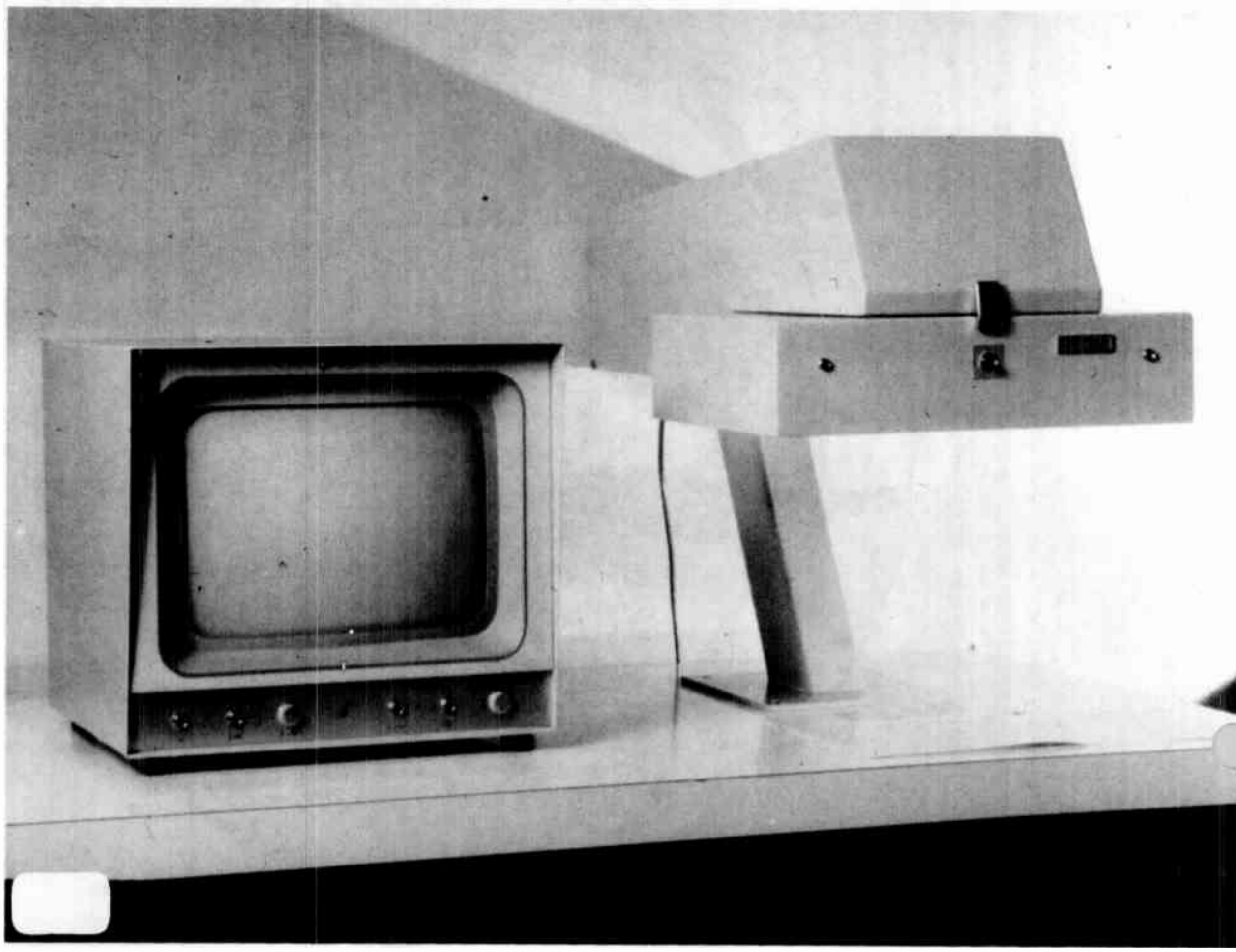
PICKING UP DESIRED PORTION OF SLIDE FROM
REAR-PROJECTION SCREEN

23.



24.

TELEMATION CARD DRUM



NORELCO DOCUMENT VIEWER

Norelco®

ABTO SYSTEM FOR CATV PROGRAMMING

By

Frank Marx
ABTO, Inc.
New York, N. Y.

IT IS WITH A FEELING OF HUMBLENESS THAT I SPEAK TO YOU. WHEN FIRST I WAS HONORED BY YOUR ORGANIZATION TO TELL YOU ABOUT ABTOGRAPHY MY WORDS WERE TO BE DIRECTED TOWARD A HIGHLY TECHNICAL AND ERUDITE APPROACH. PARENTHETICALLY FROM ME, PERHAPS A HIGHLY CONFUSING APPROACH AT THAT. THEN I STARTED THINKING. MY HUMBLENESS IS BECAUSE I HAVE BEEN ALLOWED AND PRIVELEDGED THROUGH THE YEARS TO SEE AND BE A PART OF THE GROWTH OF AM RADIO, FM RADIO, T.V., BROADCASTING, SATELLITE T.V. AND NOW THAT LUSTY AND VOCAL INFANT, CABLEVISION, WHO VERY WELL MAY OUTGROW THEM ALL. DURING EACH OF THESE PERIODS AND ALMOST ANNUALLY, NEW DEVELOPMENTS, FROM WHICH CAME NEW PRODUCTS, HELPED TO NOURISH THE INFANT. TO NAME A FEW. CONDENSOR AND DYNAMIC MICROPHONES TO REPLACE THE CARBON MIKE, VIDICON PICKUP TUBES TO REPLACE THE IMAGE ORTHICONS WHICH REPLACED THE ORTHICONS WHICH REPLACED THE ICONOSCOPE WHICH REPLACED THE FLYING SPOT DISC, THE REVOLUTIONARY TRANSISTORS NOW COMMONLY CALLED THE SOLID STATE INDUSTRY, TRULY BROAD BAND CABLE CARRYING MEGAHERTZ UPON MEGAHERTZ INTO AND CAPABLE OF FROM THE HOME. THIS LIST COULD GO ON AND ON. I WAS FORTUNATE TO HAVE BEEN PRESENT DURING LABOR PAINS AND PARTICIPATE IN THE DELIVERY OF AUDIO TAPE FOR BROADCASTING DURING 1944. ALSO THE 4 HEADED MONSTER WITH THE VORACIOUS APPETITE, VIDEO TAPE IN 1956. THEN LATER THE BABY BROTHER, HELICAL SCAN, PROUDLY SHOWN BY MANY EXHIBITORS AT THIS

SHOW. WHY THE NOSTALGIA AND ISN'T IT BORING? PERHAPS SO AND I APOLOGIZE. NOT REALLY THOUGH. CAUSE DURING THESE SEVERAL LIFETIMES IV'E SEEN MANY NEW TECHNICAL GLEAMS CONCEIVED, GESTATE, LABOR, BE BORN ONLY TECHNICALLY SOUND BUT WHICH DIDN'T REALLY SERVE A NEED. WHEN I FIRST LEARNED OF THE ABTOGRAPHIC PROCESS IN 1965 IT JUST COULDN'T AND INDEED WOULDN'T. I COULD SENSE THE NEED BUT COULD ALL, AND I EMPHASIZE ALL, THE TECHNICAL PROBLEMS BE SOLVED? COULD WE IN FACT USE ORDINARY BLACK AND WHITE FILM TO STORE COLOR INFORMATION? COULD THIS ORDINARY BLACK AND WHITE FILM BE USED IN AN ORDINARY CAMERA, BOTH 35mm OR 2 x 2 STILL AS WELL AS 16mm MOVIE CAMERAS. COULD THIS BLACK AND WHITE FILM, AFTER EXPOSURE, BE PROCESSED AS SIMPLY AND EASILY AS ORDINARY BLACK AND WHITE FILM? COULD IT IN FACT BE PROCESSED IN THE CAN. COULD IT THEN BE VIEWED THROUGH A STANDARD 16mm PROJECTOR AS AN EXCELLENT BLACK AND WHITE IMAGE? COULD THIS FILM BE THEN PROJECTED THROUGH THE SAME PROJECTOR WITH ONLY MINOR MODIFICATIONS AND SHOW COLOR? COULD IT REALLY OR WAS IT ONLY A DREAM. COULD ANYONE HONESTLY EXPECT TO RETAIN ALL THE ADVANTAGES OF BLACK AND WHITE FILM AND YET BE ABLE TO VIEW IT ON A T.V. SCREEN IN FULL NATURAL COLOR? WELL IT COULD <u>REALLY</u> AND IT DOES. IT'S CALLED ABTOGRAPHY. IT'S BEAUTIFULLY SIMPLE IN CONCEPT, BUT EXOTICALLY COMPLEX IN REALITY. THE UNDERLYING PRINCIPLE IS DIFFRACTION. FRAUNHOFER DIFFRACTION IF YOU MUST KNOW.

SLIDE No. 1 -

THIS REPRESENTS A SIMPLE EXPLANATION OF DIFFRACTION. THINK OF THE LIGHT SOURCE AS BEING THE SUN, A POINT SOURCE OF ILLUMINATION, A VENETIAN BLIND REPRESENTING A GRATING, THEN ON THE WALL OPPOSITE THE VENETIAN BLIND WILL BE A DIFFRACTION PATTERN WHICH REALLY IS A SERIES OF IMAGES OF THE SOURCE OF ILLUMINATION. THESE REPLICAS OR ORDERS OCCUR ONLY, AND THIS IS IMPORTANT, ONLY, AT RIGHT ANGLES TO THE SLATS OF THE VENETIAN BLIND OR THE GRATING.

SLIDE No. 2 -

THIS IS AN ARTIST'S SKETCH SHOWING THE WAY AN ABTO ENCODER RECORDS COLOR INFORMATION ON BLACK AND WHITE FILM. THE ENCODER IS IN FACT THREE DIFFRACTION GRATINGS PLACED AT DIFFERENT ANGLES, EACH GRATING REPRESENTING A PRIMARY COLOR. FOR EXAMPLE, ONE SET RED, THE SECOND GREEN AND THE THIRD BLUE. THE ORIGINAL COLOR SCENE PASSES THROUGH THE COLOR TAKING LENSE, THEN THE ENCODER, ON TO THE BLACK AND WHITE FILM. HENCE, THE ORIGINAL SCENE IS PHOTOGRAPHED IN BLACK AND WHITE WITH COLOR INFORMATION RECORDED BY THREE SETS OF DIFFRACTION GRATINGS.

PROCESSING OF THE EXPOSED BLACK AND WHITE FILM IS ACCOMPLISHED WITH NORMAL BLACK AND WHITE PROCESSING METHODS WITH CARE NORMAL ONLY TO REPRODUCING A GOOD BLACK AND WHITE PICTURE.

SLIDE No. 3-

THIS REPRESENTS A STANDARD PROJECTOR, EITHER 2 X 2 SLIDE PROJECTOR OR 16mm MOVIE PROJECTOR, MODIFIED TO PLAY BACK THROUGH A TV SYSTEM IN FULL COLOR, BLACK AND WHITE FILM. NOTE THE LIGHT SOURCE TO THE LEFT OF THE SCREEN. THIS IS A STANDARD XENON ARC LAMP USED TO OBTAIN A POINT SOURCE WITH HIGH BRIGHTNESS. THIS LIGHT PASSES THROUGH THE BLACK AND WHITE FILM WHICH, REMEMBER, REALLY CONSISTS OF THREE DIFFRACTION GRATINGS AT DIFFERENT ANGLES. WHEN LIGHT IS PASSED THROUGH THIS FILM THERE WILL APPEAR WHAT IS KNOWN AS A TRANSFORM PLANE, A DIFFRACTION PATTERN WHICH IS SHOWN IN THIS SLIDE.

SLIDE No. 4-

THIS PATTERN SHOWN ON THE SCREEN CONTAINS IN THE CENTER, ALL OF THE INFORMATION IN THE ORIGINAL PICTURE. FOR CONVENIENCE WE MAY CALL THIS THE LUMINANCE CHANNEL. PLEASE NOTE THAT THERE ARE IN ADDITION TO THIS LUMINANCE CHANNEL, THREE ADDITIONAL SETS OF INFORMATION SYMMETRICAL TO THE CENTER CHANNEL. THESE SETS CONTAIN THE INFORMATION NECESSARY TO RECONVERT THE BLACK AND WHITE IMAGE INTO FULL COLOR.

NOW BACK TO SLIDE THREE. IF AT THE TRANSFORM PLANE THERE IS PLACED AN ABTO DECODER AS SHOWN IN THIS SLIDE, A FULL COLOR IMAGE OF THE ORIGINAL SCENE WILL BE RECONSTRUCTED.

SLIDE Nos. 5 and 6-

NOW MAY I SHOW YOU TWO BLACK AND WHITE SLIDES IN SUCCESSION WHICH ARE PHOTOGRAPHS OF A 2 X 2 HONEYWELL PENTAX CAMERA AND A 70VR 16mm BELL AND HOWELL MOVIE CAMERA. BOTH OF THESE ARE CAPABLE OF PHOTOGRAPHING BLACK AND WHITE AND THE RESULTANT BLACK AND WHITE FILM BEING REPRODUCED IN BEAUTIFULLY NATURAL COLOR.

IF I MADE THIS EXPLANATION TOO SIMPLE I APOLOGIZE. IF IT SOUNDS COMPLEX PLEASE REMEMBER WHAT I PREVIOUSLY SAID, "THE SYSTEM IS BEAUTIFULLY SIMPLE IN CONCEPT BUT EXOTICALLY COMPLEX IN REALITY."

I THANK YOU.

Helical Scan VTR's and the Cablecaster

By: Keith Y. Reynolds
VTR Product Manager

International Video Corporation

The average American Family is exposed to several hours of good quality color programming every day of the week. Eighty to ninety percent of this material is on video tape and originates from the major commercial TV networks, the educational TV network (NET) and the local TV station. If these viewers subscribe to the local cable system and the cable company is originating program material, they expect the same basic quality from the local origination channel that they see on other program sources.

High performance, reliable helical scan video tape recorders are capable of providing network quality color at a reasonable cost so most cable system managers are--or will be--interested in these recorders.

There are several VTR characteristics that are important to the cable-caster.

The first and most fundamental characteristic is the helical scan format. A format must be chosen which satisfies the requirements for color, wide bandwidth, good signal-to-noise ratio, good audio, time base stability and so on. Tape width, 1/4", 1/2", 1" and 2" is a primary consideration.

To date, 1/4" and 1/2" VTR's have not been designed which provide the stability and bandwidth required by the cablecaster. Two inch helical scan VTR's have all but disappeared from the market. This, then leaves the 1" format for the superior performance required for cablecasting. Several 1" formats are available and it is important that the cablecaster pick one that provides the best picture quality as well as one which is popular with the cable industry so that interchange with other cable systems is possible.

International Video Corporation manufactures a full line of 1" helical scan video tape recorders, all of which meet the stringent requirements of the cablecaster. These VTR's vary in price from under $3000 to over $30,000. Tapes made on the low cost VTR's can play on the more expensive recorders and vice versa.

A recent survey revealed that more cablecasters are using color recorders manufactured by IVC than by any other manufacturer. The primary reasons given were reliability and performance.

One important performance specification is video bandwidth. In order to properly record and playback the video bandwidth required for full color recovery and high picture resolution, the VTR's video frequency response must extend from 30 Hz to 5 MHz. A VTR with bandwidth significantly less than this will produce pictures lacking detail.

Video bandwidth is related to Horizontal Resolution. The term horizontal resolution is used to describe the ability of television equipment to reproduce fine detail. As a rule of thumb, with United States television standards, the relationship between resolution and frequency response is 80 lines of horizontal resolution for each 1.0 MHz of frequency response.

Therefor , if the VTR has a video response up to 5 MHz, the horizontal resolution is 400 lines.

If the VTR has a video frequency response of 5 MHz, it is possible to record the entire NTSC color video signal onto the tape. Color recovery, or stabilization, is then a function only of the playback electronics. The advantage of this approach is that you can record color signals with a monochrome VTR and either play the tape back on another VTR that is equipped with color recovery electronics, or purchase color electronics at a later date for updating the monochrome VTR. In either case, the taped program is in color.

Of course video bandwidth alone isn't the only requirement for high quality pictures. It is also necessary to have a VTR with good video signal-to-noise ratio. This is the ratio of amplification of useful information, or signal, to spurious information, or noise, and is expressed in decibels. A good video tape recorder should have a signal-to-noise of at least 42 dB peak-to-peak signal to RMS noise.

A VTR with a low signal-to-noise ratio will reproduce pictures with a noisy or grainy appearance.

All tape recorders introduce time base errors. They are present in audio, instrumentation, quadruplex and helical scan video tape recorders. Time base errors are significant if they cause an observable effect in the picture displayed on the monitor or television set. Various brands of receivers vary in the extent to which they are sensitive to these time base errors.

Video tape recorder time base errors can be caused by capstan servo instability, capstan eccentricity, drum instability and tape tension variations. These errors can be minimized by careful mechanical design as well as by electrical means.

IVC recorders are designed to exhibit very low time base errors. This is accomplished by the incorporation of a number of design features. The small scanning drum, with a diameter of 3.8", produces a relatively short 12" track length which minimizes the effects of tape tension variations. For proper playback, the length of the video scan covered by one pass of the video head must exactly equal the length covered during playback or there will be a discontinuity in the reproduced time base at the time of the transition from one field to the next. Therefore, the shorter the scan length, the less it is effected by tape stretch caused by temperature and humidity variations.

Since the IVC capstan is located ahead of the scanner and meters the tape onto the scanner assembly rather than pulling it around, a tape tension of only 8-12 ounces is required. This also minimizes tape tension errors.

Conservative design and precision construction have minimized the possibility of mechanical imperfections contributing to time base instability.

Although all the parameters mentioned are very important, such things as good differential gain, or the amplitude change introduced by the video circuits; and good differential phase, or the phase change introduced by the video circuits are important too.

Good audio is necessary and it is important to choose a VTR that can reproduce audio frequencies up to 10 KC with minimal distortion and flutter and with maximum signal-to-noise ratio.

Although all IVC VTR's meet all of the requirements mentioned, each model has been designed with certain special features for different applications.

The newly announced IVC-700 Series is designed for the cablecaster who needs good quality, but who must operate on a very low budget. The IVC-700 Series has many of the quality features of the IVC-800 Series which has become the industry standard. They satisfy many system needs since tapes made on the IVC-700 Series VTR's are completely compatable with all other IVC-VTR's. The basic IVC-700 VTR is a recorder/reproducer with 5 MHz bandwidth.

The addition of a $500 color board provides color reproduction. A IVC-700-PB unit is also available. This configuration is a video tape player only. The IVC-700-PB is a valuable addition to any cable system because these units can free up the more expensive record/playback units for production recording schedules, remotes etc.

All IVC-700 Series VTR's are equipped with an advanced design, reliable transport mechanism similar to that used on the IVC-800 Series VTR's. This includes an optional remote control panel which controls all tape motion functions. These include: rewind, fast forward, play, record and stop.

The IVC-800 Series VTR's include several models designed for various special applications. Each IVC-800 model configuration is a rugged, field proven, reliable VTR, designed for monochrome or color operation.

The basic IVC-800A-SM is a recorder/reproducer with slow motion. The IVC-800A has a 5 MHz bandwidth and excellent signal-to-noise ratio. Next in the series is the IVC-820. This model includes the exclusive

Instant Video Confidence feature which allows playback of the video while recording. This is accomplished by locating an "I. V. C." video head in the scanner immediately after the video record/playback head. Annoyances such as head clogging, excessive dropouts and over-deviation can be detected immediately and corrected before the entire program is recorded.

The IVC-825 incorporates a capstan servo which insures precise program timing. In addition to this feature, the IVC-825 uses selected components to provide superior signal-to-noise ratio, lower flutter and better differential phase. This configuration is extremely popular with the cablecaster and others who require superior quality.

The IVC-870 features both assemble and insert editing. Assemble editing is used to produce an uninterrupted program tape from several separate segments. With this type of editing a completely new recording--video, audio and control track is made for each new segment and it is not possible to retain previously recorded information following the end of the assembled segment.

Insert editing is used to insert a new segment into a previously recorded tape without disturbing the information immediately before or after the inserted segment. Typically, it would be used to correct a mistake that has been made in the middle of an otherwise good program, or perhaps used to update a short segment in a pre-recorded program tape. With insert editing the original control track is retained while new video or audio and video are added. Precautions are taken in the video erase system so that previously recorded information either before or after the inserted segment is not disturbed.

The IVC-870 is the most sophisticated video tape editor in its price class. It is a vertical interval editor. This means that when you want to make an edit, the edit logic waits until the vertical interval before the edit can take place. When in the insert mode, the exit splice also takes place during the vertical interval. This results in a disturbance free edit every time since the electronic splice occurs between television fields.

Every cable system using video tape recorders should have at least one good editing VTR to handle program goofs or to consolidate program material on video tape.

The top of the IVC VTR product line is the IVC-900 Series video tape recorder. This VTR was designed from the gound up to be the finest quality helical scan recorder ever manufactured. Performance, such as time base stability, is the best in the industry. Since it meets all FCC and EIA specifications, it can be used as a broadcast recorder. An optional time base corrector manufactured by IVC not only brings the IVC-900 output stability to an undetectable ± 4 nanoseconds, it also permits direct color recovery and permits the VTR output signal to be mixed and faded with camera or other switcher input signals. In addition, for the first time, a helical scan VTR can dub to a quadruplex recorder.

All IVC-900 Series VTR's feature 3-1/2 hour playing time and Instant Video Confidence. A unique tension servo automatically corrects for tension errors during playback.

Three package configurations are available. A cased version, a rack mounted configuration and for the ultimate in operation convenience, an optional console. In the console version a standard IVC-900 Series VTR is mounted on a center pivot, providing complete access for maintenance. An eye level location is provided for a color or monochrome picture monitor, waveform monitor, audio amplifier and speaker, video display switcher and an optional IVC-4102 color time base corrector. Additional 19" rack space is provided below the recorder for other video equipment or tape storage. The basic IVC-900 configuration is a monochrome recorder/reproducer. Additional plug-in circuit board options include an NTSC color processor, a processing amplifier and a color drop out compensator. The IVC-960 includes insert and assemble editing capability. This editor is more sophisticated than the IVC-870 editor since it not only waits for the vertical interval, it also waits for the proper frame before making the edit. This results in a perfect frame to frame edit everytime.

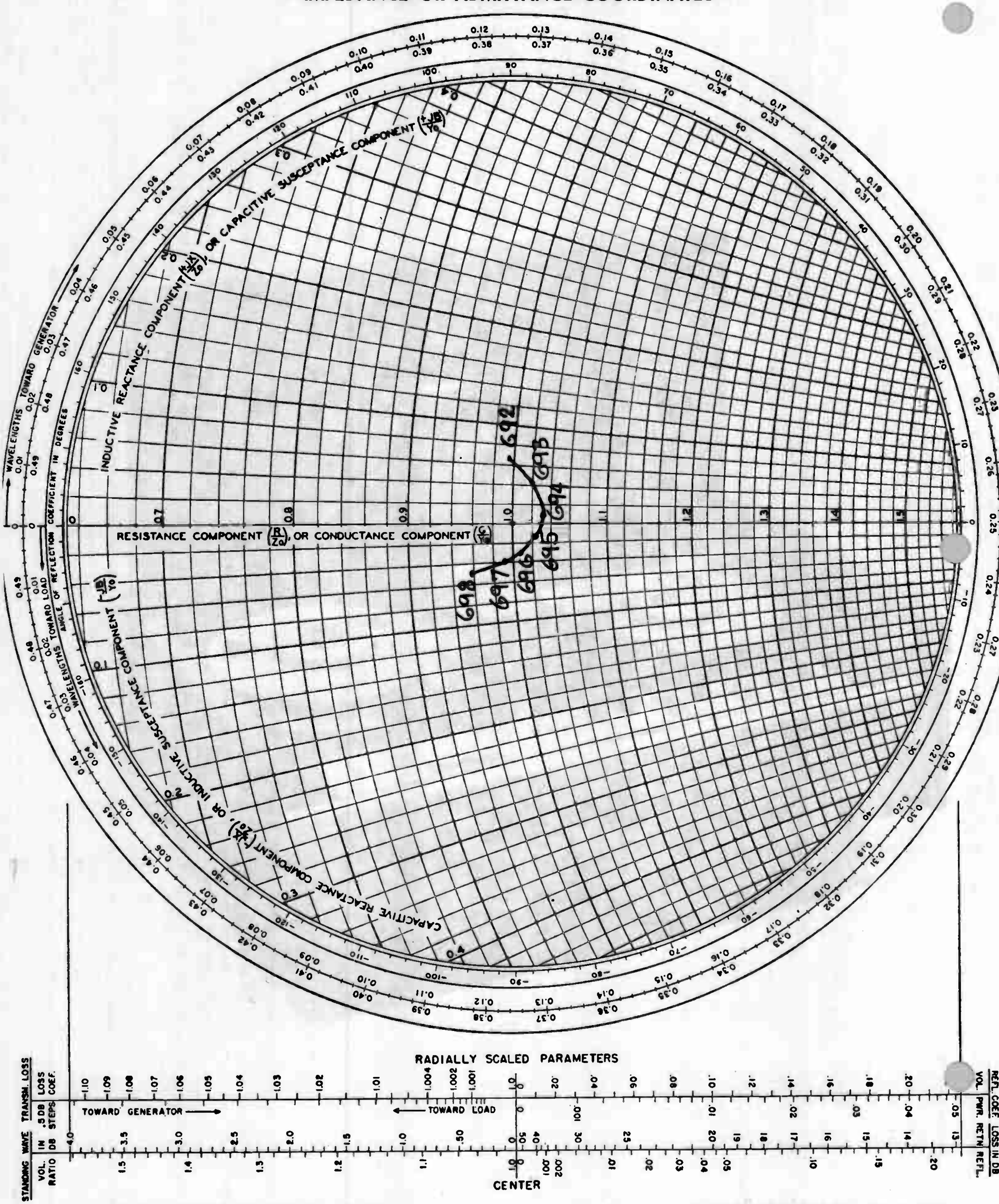
The Cablecaster can use the IVC-900 Series recorders to provide the utmost in picture quality to his subscribers. In addition, an entire evening of color local origination programming can be accommodated on one reel of video tape.

The IVC-700, IVC-800 and IVC-900 Series VTR's all completely compatable with each other. All designed for color. All with state-of-the-art performance specifications. All reliable, and all priced for every budget, large or small and all part of the IVC family of recorders that have become the standard of the cable industry.

* * * * *

NAME	TITLE CHANNEL 51 ZIG ZAG	DWG. NO.
SMITH CHART FORM 5301-7561-NE	GENERAL RADIO COMPANY, WEST CONCORD, MASSACHUSETTS	DATE

IMPEDANCE OR ADMITTANCE COORDINATES



HIGH ENERGY TAPE FOR VIDEO RECORDING APPLICATIONS

H. Lee Marks and
Arden R. Thompson
Technical Service Engineers
3M Company, Magnetic Products Division
St. Paul, Minnesota

Over the past two decades, cable television has grown from small community antenna systems serving remote areas to large systems penetrating all types of communications. As cable television entered the "70's", new demands and opportunities represent fantastic challenges. Demands for program origination and better quality pictures must be met. Advances in technology such as two way cable, and more channels, offer new opportunities. Also, rumbles were being heard concerning improvements in television recording. This news of better things to come seemed to be all encompassing. From a hardware standpoint promises of new and improved video recorders were being backed up by introductions of sophisticated machines for both quadruplex and helical recording. The industry began using a new type of video tape that guards itself against damage. Several announcements and demonstrations have been made concerning revolutionary approaches to the duplication of recorded video material. All this is fascinating and important to our developing industry, but a common denominator that cuts across all of the topics that we have mentioned is the capability of the magnetic recording medium itself.

There have been vast improvements in the media during the last several years. Improvements that took us from what we thought were good black and white pictures, to the well defined, richly colored pictures that each of us expects to see on our monitors today. The low noise oxide introduced in the mid-sixties, coupled with advanced clean running binders, was an important breakthrough moving us toward that excellence that we now take for granted. Because of the improved signal-to-noise ratios attainable with the low noise oxide, multiple generation dubbing was not only possible, but became the accepted way to produce everything from a dog food commercial to a ninety-minute extravaganza. In the close analysis, the oxide on the tape has caused a lot of changes in the television industry, and it appears that these changes are not about to stop.

In exploring new ways to make even further improvements in the electro-mechanical properties of video recording tapes, it appeared that we had gone just about as far as was possible with our present day family of synthetic low noise oxides. If we wanted to see a meaningful improvement in the key recording characteristics of both RF output and signal-to-noise ratio, we would have to enter into some extensive research centered upon modifying the basic oxide particle.

HIGH ENERGY TAPE FOR VIDEO RECORDING APPLICATIONS

After many years of work, and extensive application evaluation, we were ready to announce the result of this basic research. We had succeeded in developing a new family of oxides that offered all the features indicated in the objectives of our tape design engineers. The products in which the new oxides are used are referred to as High Energy tapes because of the higher output that can be derived by proper application of this new recording media.

Since it is generally well known that a higher output can be predicted when the coercive force and remanence of a tape are increased, it was an adjustment in these parameters that made this breakthrough possible. We achieved the needed increase in coercivity and remanence by modifying the composition of the gamma ferric oxide and properly dispersing it in a binder system. A small amount of cobalt has been introduced into each particle of oxide in a manner that allows the control of the resultant coercive force to a pre-determined level. This technology of introducing cobalt into the particle to increase coercive force has been known for years by the chemists in the industry, but results in the past were disappointing in that the introduction of the cobalt detrimentally altered the particle size and shape. This altering of particle size and shape had an adverse effect on the signal retention of the tape, especially when it was heated or flexed. With the development of this new technology, it is now possible for us to produce High Energy oxide that has the same controlled particle size and shape as the gamma ferric oxide. As a result, it has the same signal retention ability as the gamma ferric oxide.

This new oxide technology enables the tape manufacturer to tailor make magnetic tapes with coercive force values from as low as 300 oersteds to as high as 1000 oersteds while maintaining retentivity values in the 1200 gauss range. Because of the ability to control the coercive force in the finished product, tapes can be specifically designed to accomplish a specific purpose.

We could now use this proprietary oxide to develop a family of tapes that would provide immediately noticeable benefits to the user. When used to manufacture video tapes, both improved signal-to-noise ratio and increased RF output are achieved. We are currently producing tapes for both quadruplex and helical recording with coercivities of 500 and 900 oersteds. The 500 oersted version is totally compatible with video recorders that are in use today, and the 900 oersted tape will find use in the field of advanced systems technology. It is interesting to note that the benefits just described were accomplished without the need for the usual technical tradeoffs that plague design engineers. These new High Energy tapes still incorporate the best features of present day tapes in the areas of physical handling, tape wearability and head life.

The classic means used to compare the capabilities of various oxides is the familiar hysteresis loop. An analysis of the loop provides us with three important parameters. These are the saturation value, referred to as B_s; the amount of retained flux, known as B_r; and the amount of energy required to reduce the retained flux to zero, called the H_c. These three properties, as well as the shape and size of the oxide particle, determine the magnetic capabilities of the finished tape.

Here in figure 1, we see three hysteresis loops. The small one represents the pattern seen for conventional video tape, such as "SCOTCH" Brand No. 361. The next largest is a trace of the loop formed by a compatible 500 oersted High Energy tape, and the largest described an experimental 900 oersted High Energy product. The three important points are labeled on each of the three curves. Saturation, or B_s, is seen in the first quadrant in the upper right hand corner. The amount of retained flux, B_r, is seen on the positive vertical axis and the H_c or energy required to reduce the flux to zero appears on the left. In this type of measurement, a great deal can be learned from the shape and size of the curve in the second quadrant between the points B_r and H_c. The amount of area that lies under the curve in this quadrant is a measure of the relative energy available from that oxide for recording.

Note the additional area gained by the two High Energy products. Inspection reveals that the 900 oersted tape yields nearly four times the area of conventional 300 oersted oxides. And the 500 oersted tape encompasses an area that is about twice as large. This extra energy that is available can, of course, be used to good advantage for television recording.

One of the things to investigate in evaluating a new video tape formulation is the amplitude of RF output seen when this tape is played back. There are three sets of curves in figure 2 that illustrate this. The curves next to the 300 oersted label will be used as a reference because they are typical of conventional tapes currently in use for quadruplex recording, such as "SCOTCH" Brand No. 400. Here, represented as a solid line, we see the traditional optimization curve showing the peak being reached at a point slightly above the level that represents 25% of the available RF drive used in recording the tape. The relative output on playback is seen on the scale as reaching 40 units. While this peak level of 40 on the vertical axis is important for making comparisons with tapes with greater coercive forces, noting the shape of the curve is important, too. We see here that the optimization curve rises rather steeply to the peak and then descends with equal steepness.

HIGH ENERGY TAPE FOR VIDEO RECORDING APPLICATIONS

When we compare the optimization curve for the 500 oersted High Energy tape, we immediately notice a 4 db increase in RF output. We notice also that the entire curve is positioned farther to the right, indicating that additional RF drive was used when the tape was recorded. We mentioned that the 500 oersted High Energy tape was compatible with today's recorders. This curve substantiates this, as the entire curve falls well within the available RF drive. The peak, or actual optimization point, falls at about 45% of the maximum drive utilizing a 1.5 mil gap depth. While a new head that has full gap depth requires more drive, the record drivers have more than enough range to easily obtain optimization.

The shape of the 500 oersted curve is quite different than that representing the 300 oersted conventional video tape. It is not as steep and this is a convenient advantage. The operator performing the optimization will notice a broader optimization range making it easire to adjust for the desired maximum. This broadened range also means that RF drive optimization need not be performed as often throughout the life of the video head assembly.

The broken lines in the figure indicate the chroma slope for each of the tapes, this represents the equalization change that is needed to compensate for wear of the video head pole tips. As the tape coercivity is increased, the slope of this line decreases, meaning that less correction is needed to maintain proper equalization. Just as was true when speaking about RF drive, the equalizers, too, would not require adjustment as often and such adjustment would be less critical.

The uppermost solid curve is representative of the 900 oersted experimental product. This tape is not designed to be compatible with recorders in normal use. As can be seen, the RF drive was set at maximum to obtain optimization. The head that was used was specially selected for this test to provide the efficiency needed to attain the optimization point. While we agree that this does not represent normal operating conditions for present equipment, it does clearly demonstrate the rather dramatic 7.5 db increase in RF output that this 900 oersted tape will yield, when compared with the 300 oersted tape that is the standard of the industry today.

The optimization curve is even more broad than it was with the 500 oersted tape and the chroma slope is approaching the horizontal. It is evident that when machines are readily available that will make use of tape in the coercivity range, the need for repeated RF drive and equalization adjustment will be minimal.

HIGH ENERGY TAPE FOR VIDEO RECORDING APPLICATIONS

Signal-to-noise ratio is a key parameter and a much discussed topic when speaking in terms of picture quality. This is especially true where video tape is concerned. Great strides in this direction have been made by camera designers, switching and processing equipment manufacturers and by the builders of the recorders themselves. With the advent of the high band color standard, companies such as ours introduced video tape manufactured with low noise oxide. Master tapes were clean and quiet. So quiet, in fact, that it was now possible to produce a second or third generation dub that looked as good as the master would have looked using the former tape. It wasn't long and multiple generation editing and dubbing was the standard way of doing business.

A meaningful improvement in the signal-to-noise ratio of the recording tape for today's as well as tomorrow's applications is the second very important benefit that is gained with the use of the High Energy oxide. In figure 3, we see a set of curves that, at first glance, look a great deal like the ones in the previous drawing. Once again, on the X axis, we see RF drive indicated in per cent of maximum. On the Y axis, however, we have shown signal-to-noise referenced to optimum conditions for the 300 oersted tape. The peak on the bottom curve, then, is zero db. The improvement in signal-to-noise ratio, when using the 500 oersted tape, amounts to an impressive 4 db. Once again, we should restate that this will be achieved on today's recorders without any modification. All that is necessary is a normal optimization adjustment.

On the same drawing, we have also shown a plot for the 900 oersted tape. With the specially selected head and maximum RF drive, we realize a 7 1/2 db improvement over the reference tape. This, of course, is not a compatible product, but does stimulate the imagination as we look to the future; to a time when machines are designed that can supply the additional RF drive needed to properly record it and sufficient erase fields so that it can be erased and used again.

The additional 4 db gained in signal-to-noise ratio, when using the 500 oersted tape, is particularly advantageous when one considers that many tapes used today are really fourth generation copies of a master. With the aid of the chart in figure 4, we can easily compare several combinations of multiple generation dubbing.

The data shown is for quadruplex recorders, however, helical recorders follow the same pattern. The same relative advantage is realized when High Energy tape is used for multiple generation copies on helical recorders.

HIGH ENERGY TAPE FOR VIDEO RECORDING APPLICATIONS

The first example, labeled Number 1, charts the progression of the four generations using 300 oersted tape in each step. This is the way things are being done now, using conventional video tape. Moving to the right through the first example, we note that the established signal-to-noise ratio of the master on the 300 oersted tape is 50 db. We have placed a circle around that number because it will be used for comparisons with the other examples. As we move into the second generagion that will also be on 300 oersted tape we encounter a loss in duplication of 1.5 db in signal-to-noise. The second generation copy will have a signal-to-noise ratio of 48.5 db. The duplication loss into the thrid generation is again 1.5 db, and the same is true for the fourth generation. This final copy has a signal-to-noise ratio of 45.5 db which is down 4.5 db from the original master.

Look now at the second example. Here, the master and each of the succeeding generations were made on 500 oersted, High Energy tape. With this product, the master reflects the 4 db improvement in signal-to-noise ratio so we begin with 54 db. Each generation of copying will again reduce the ratio by 1.5 db. This results in a fourth generation copy with a signal-to-noise of 49.5 db. When we compare this to the original master recorded on 300 oersted tape, we see only one-half db difference. We have now succeeded in producing a fourth generation copy that is as good, visually, as the traditional master made on conventional tape.

The third example indicates the use of the High Energy tape throughout the mastering and editing steps, but here conventional tape was used for the final fourth generation copies. The first three generations are the same as example Number 2, with 1.5 db duplication loss per step. As we move into the fourth generation, that will be recorded on standard 300 oersted tape, we will encounter a 2 db duplication loss. The net result is a final copy with a signal-to-noise ratio of 49 db. This is an insignificant one-half db down from a final copy made on the new High Energy tape and barely perceptible one db below a conventional 300 oersted master.

The numbers on the chart clearly suggest that for almost all fourth generation copies, it would be wise to master and edit on High Energy tape and economically sound to produce those final copies on traditional video tape. In those instances when the absolute ultimate in signal-to-noise is required, an extra one-half db can be gained by using High Energy tape throughout the entire process for either quadruplex or helical recorders.

Our discussion to this point has centered about the 500 oersted product. We have seen from the previous curves, however, that both RF output and signal-to-noise ratio are greatly improved as the coercivity is increased. Since the High Energy oxide lends itself so well to being tailored to yield a wide range of coercive force, it is our hope that future machine designs will tape advantage of this aspect. For a given application it may be that a system making use of 650 oersted tape would be ideal. For another use, 825 or 435 might render optimum performance. Tape is no longer the limiting factor in the recording process. High Energy tape is a reality. All that is needed now is the hardware to take advantage of this breakthrough.

We say this as a preface to our discussion on the application of High Energy tape to the field of helical video recording. Here, just as with the quadruplex systems previously discussed, increased coercivity of the recording tape has the capability of yielding an increase in both RF output and signal-to-noise ratio.

Figure 5 contains the optimization curves for the standard 300 oersted helical tape now in use as well as two High Energy constructions. Once again, RF drive is plotted along the bottom in terms of the drive that is available and relative RF output appears along the vertical axis. Note that with traditional tape optimum drive is about 50% of what is available. The 500 oersted High Energy tape will require about 70% of the total available drive and would deliver 6 db more RF output. This, of course, is compatible with present day equipment.

We have also shown a curve representing a 700 oersted experimental product. Even with the use of a specially selected video head, we were just able to reach the optimization point. You will notice, however, that the increase in RF output amounts to 8 db. Just as we noticed with the quadruplex examples, as we increase the coercivity the curve becomes more rounded and loses its steepness. This would again mean that optimization adjustments would be less critical and that they would be required less often.

Signal-to-noise ratio is also increased with the higher coercivity tapes. Figure 6 plots RF drive against signal-to-noise for the three tapes being discussed. Using the standard 300 oersted tape as the reference, we see that the 500 oersted compatible product offers an increase of 4 db, and the 700 oersted experimental tape yields a 6 db increase.

These curves, used in the last two figures, were generated on a one inch helical recorder. While this type of machine would not handle 700 oersted High Energy tape without modification, it does an excellent job with the 500 oersted tape. This, however, does not hold true across the complete line of helical recorders. In some cases the signal-to-noise ratio established by the machine electronics is very close to what is possible with traditional tapes. With most half inch recorders, even though we see a significant increase in RF output, the signal-to-noise ratio cannot be improved more than 2 db because of the electronics improvement in signal-to-noise, it is distrubing to note that the signal-to-noise of the tape playback is only 5 db below the EE (electronics-to-electronics) capabilities of the recorder. With the tapes used up until now these shortcomings were not really noticeable, but with the introduction of the High Energy family of tapes we can see that picture quality is seriously hampered by the limitation of the recorder electronics. Now that an improved tape is available we sincerely urge the hardware designers of our industry to develop the equipment to utilize the potential of this new oxide to complete what can amount to a great leap forward in video technology.

A summary of 500 oersted compatible High Energy tape performance on existing helical video recorders is as follows. All helical VTR's will give a noticeable improvement in signal-to-noise ratio (about 2 db) and RF output (about 50%) increase without making any recorder adjustments. Half inch recorders generally show no further signal-to-noise improvement when record drive is optimized for High Energy tape even though the RF output increases because of recorder electronic limitations. One inch recorders generally show another 2 db improvement in signal-to-noise ratio, or a total of 4 db, when record drive is optimized for High Energy tape. The RF output is then double that of conventional tape.

Recorded High Energy tapes can be played back on any recorder without adjustments with full signal improvement. In other words, to realize best performance, only the VTR used for record need be adjusted.

As we look to the future we can see constant attempts at miniaturization and a desire to place more information on a reel of tape. The High Energy tapes that we have been discussing have a greatly improved short wavelength response. This offers the possibility of operating at slower speeds. To many, this ability to operate at a reduced speed signals the gateway to practical video cassette recording. Up until now the drawback has been the need for an overly large cassette, an unduly short program or a serious sacrifice in picture resolution.

To demonstrate the slow speed capability of the three tapes we have been discussing, we modified a recorder with a 13 microinch head gap to run at half the normal speed. Figure 7 compares the results of this test with the same recorder operating normally. Here we see RF output plotted as a function of the recorded wavelength. Our zero db reference point is established at the one-eighth mil, normal operating point for the standard 300 oersted product. This is the vertical line on the left. By reducing the speed to one-half, we are then recording at one-sixteenth mil, and the standard product is seen to be nearly 5 db down in RF output as it crosses the vertical line on the right.

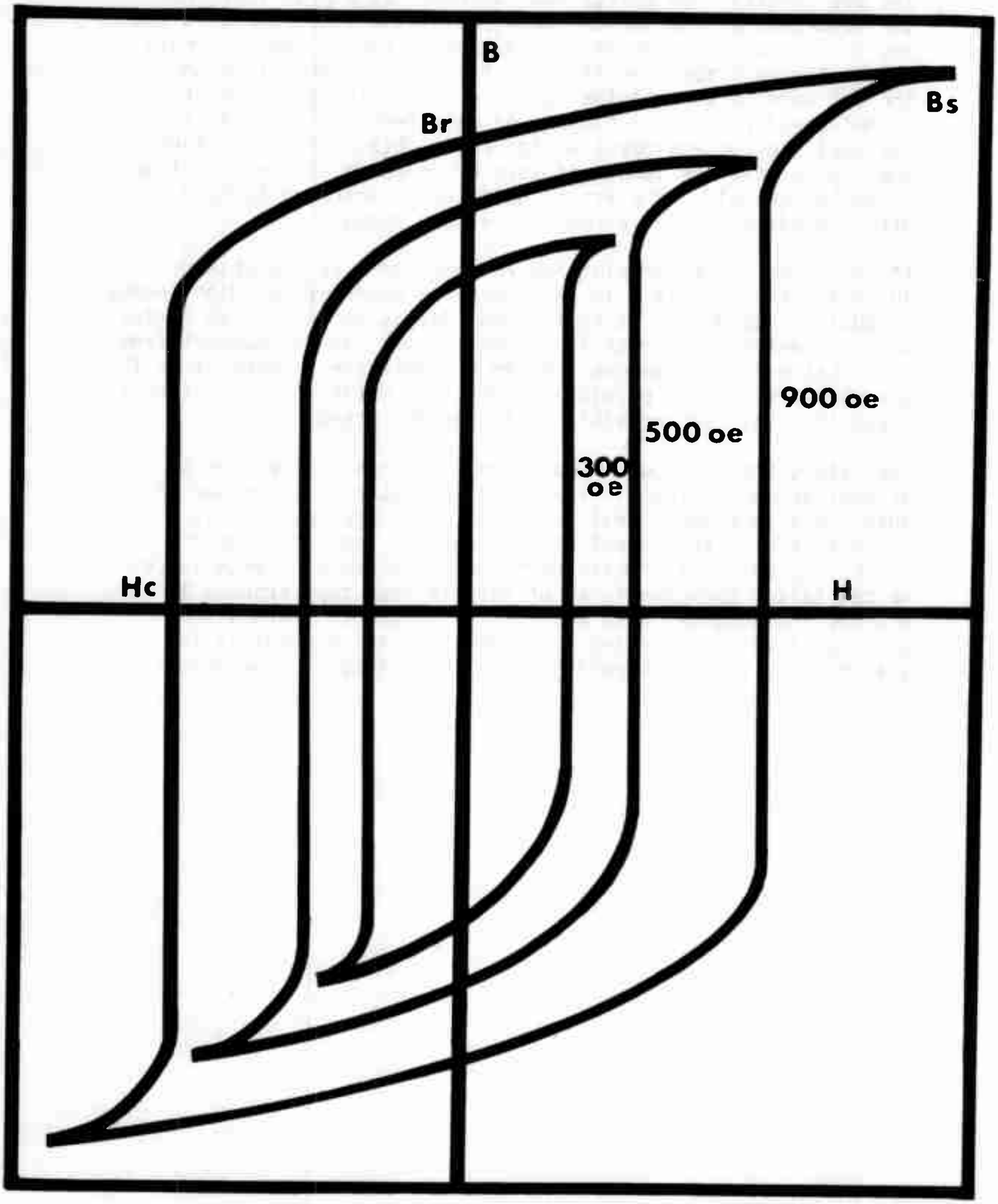
HIGH ENERGY TAPE FOR VIDEO RECORDING APPLICATIONS

The 500 oersted High Energy tape operates at a plus 4 db from the reference at the normal speed, maintains this output at the one-twelvth mil wavelength, and has an output at one-sixteenth mil -- the half speed point -- that is about 2 db better than the 300 oersted tape at the normal speed. Standard tape at normal speed produces a picture of excellent quality. It is now possible for equipment designers to obtain better picture quality on half the length of tape by reducing the head-to-tape speed by one-half. The era of half speed recording is here now with a readily available compatible tape product.

If we follow a similar plot for 700 oersted tape, we observe an interesting result. In this case the experimental High Energy product has an output at half speed that is actually 5 db better than conventional tape at the normal speed. It is apparent from this that not only can one achieve a comparable picture at half speed, but it is now possible to obtain a better picture at half speed than has been possible at the normal speed.

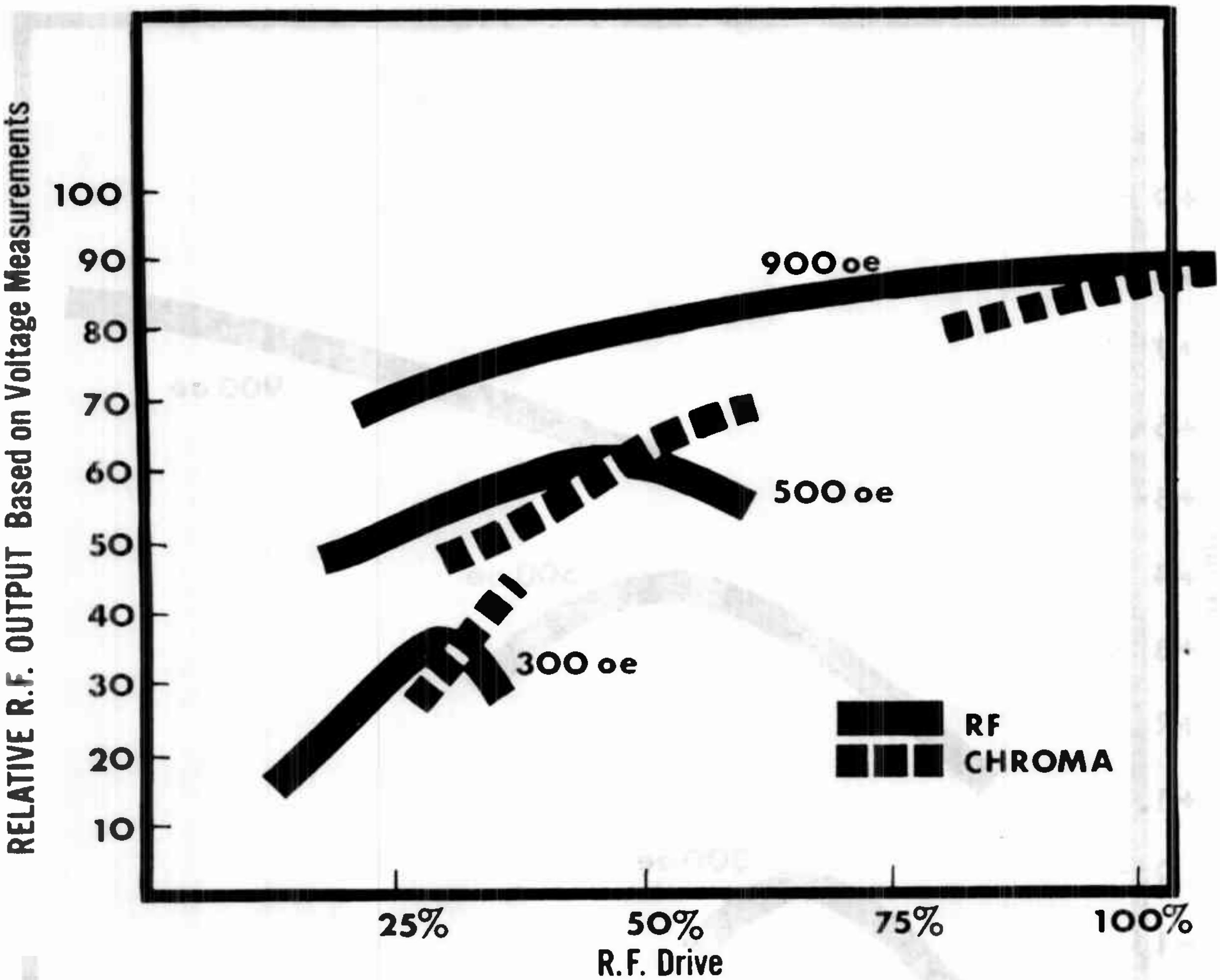
The latest breakthrough in oxide research has equipped us to accomplish many things in the immediate future. Increased RF output and improved signal-to-noise ratios are immediately achievable with the compatible 500 oersted tape and higher coercivity versions promise even further degrees of excellence. We can tailor coercive force of the finished tape product to provide the industry with whatever is needed to improve the quality of video recording. And the best thing about it is that this is not a laboratory dream; the tape is here today.

FIG. 1



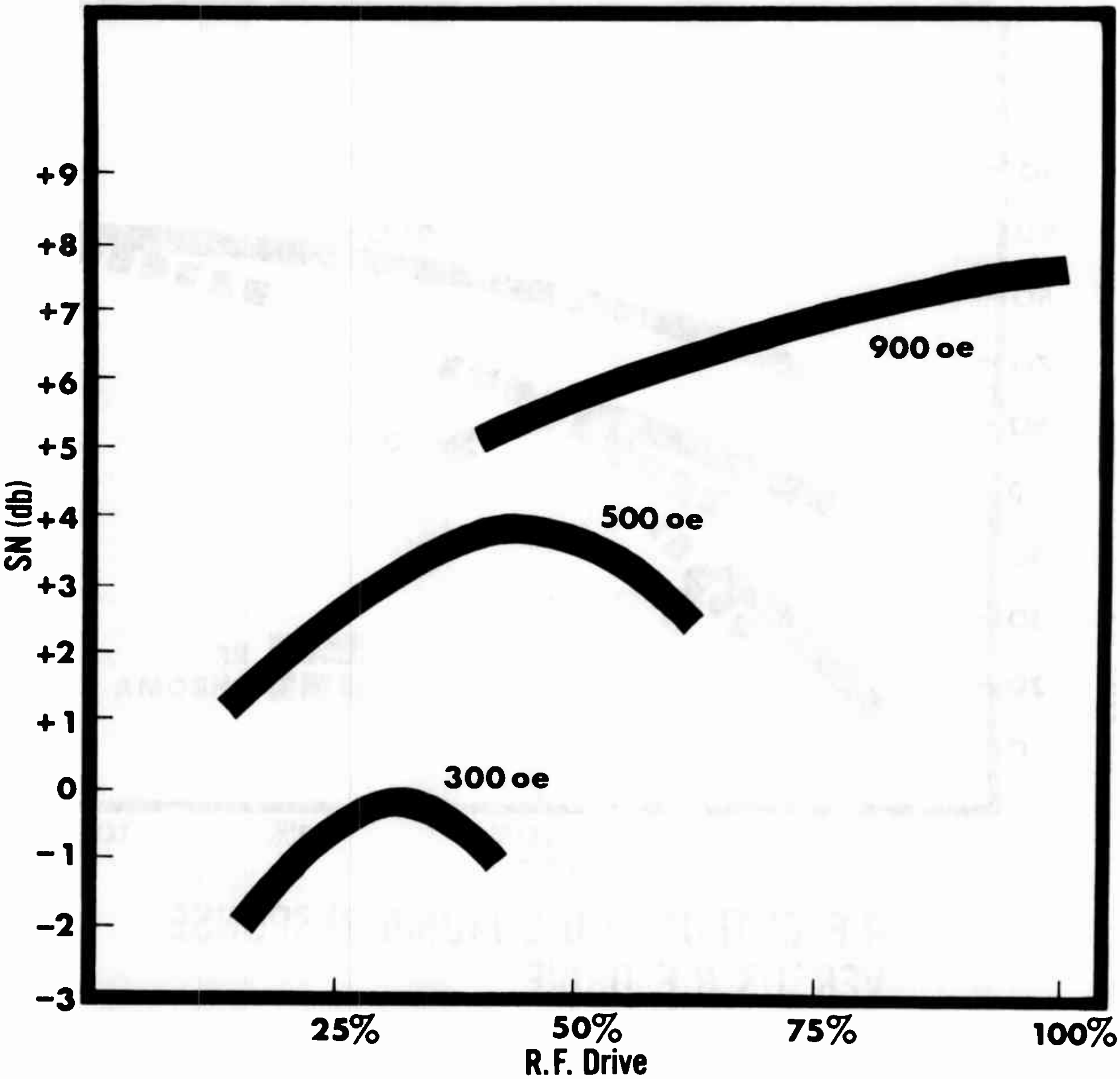
B-H HYSTERESIS LOOPS

FIG. 2



R.F. OUTPUT AND CHROMA RESPONSE VERSUS R.F. DRIVE
QUADRUPLEX

FIG. 3



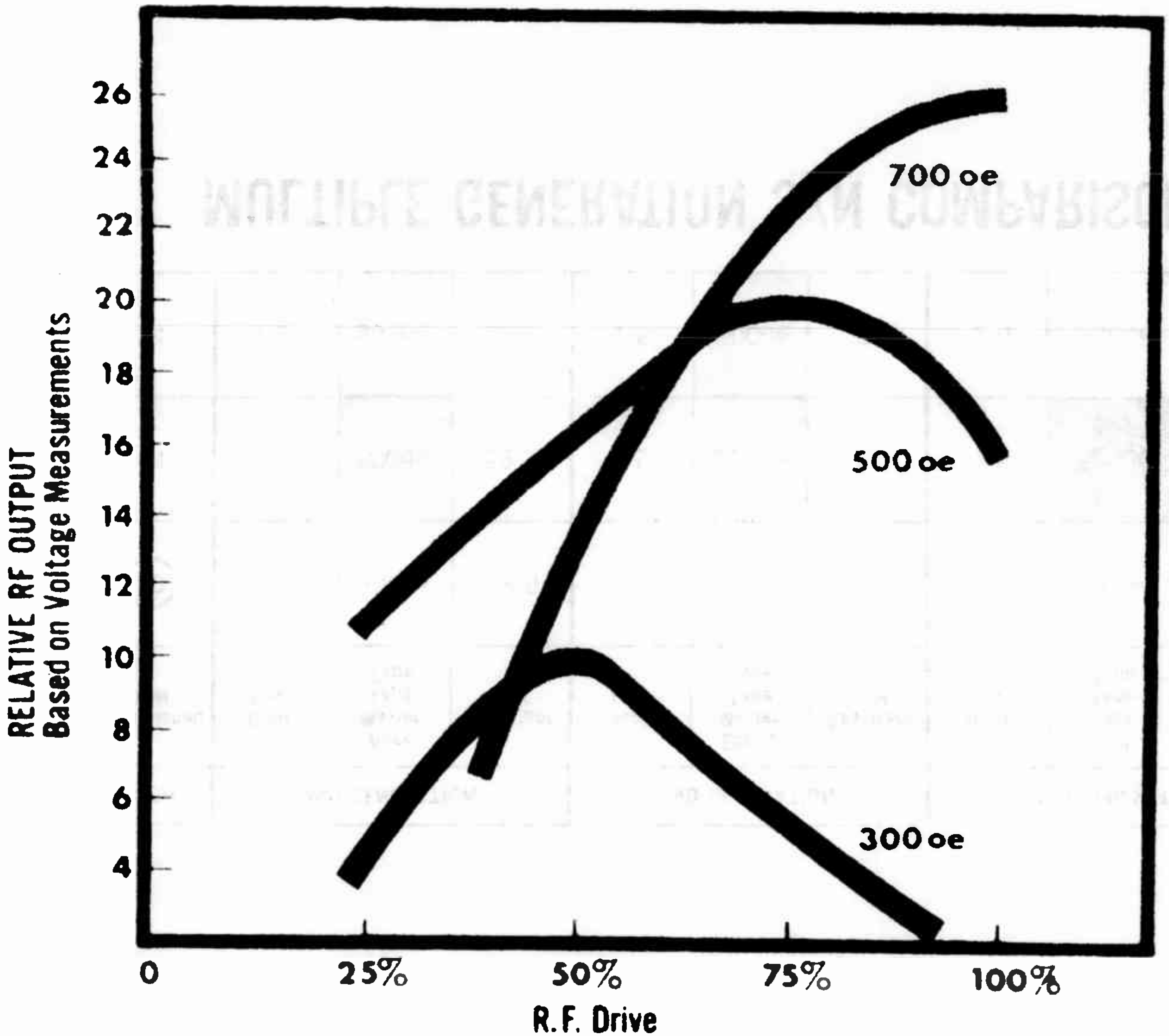
S/N VERSUS R.F. DRIVE
QUADRUPLEX

FIG. 4

	1ST GENERATION		2ND GENERATION			3RD GENERATION			4TH GENERATION			
	Master Tape Type	Established S/N	Dupl. Loss	Work Master Tape Type	Resultant S/N	Dupl. Loss	Edited Master Tape Type	Resultant S/N	Dupl. Loss	End Copy Tape Type	Final S/N	Change From 300oe Master
1.	300oe	50	1.5	300oe	48.5	1.5	300oe	47	1.5	300oe	45.5	−4.5
2.	500oe	54	1.5	500oe	52.5	1.5	500oe	51	1.5	500oe	49.5	−0.5
3.	500oe	54	1.5	500oe	52.5	1.5	500oe	51	2.0	300oe	49.0	−1.0

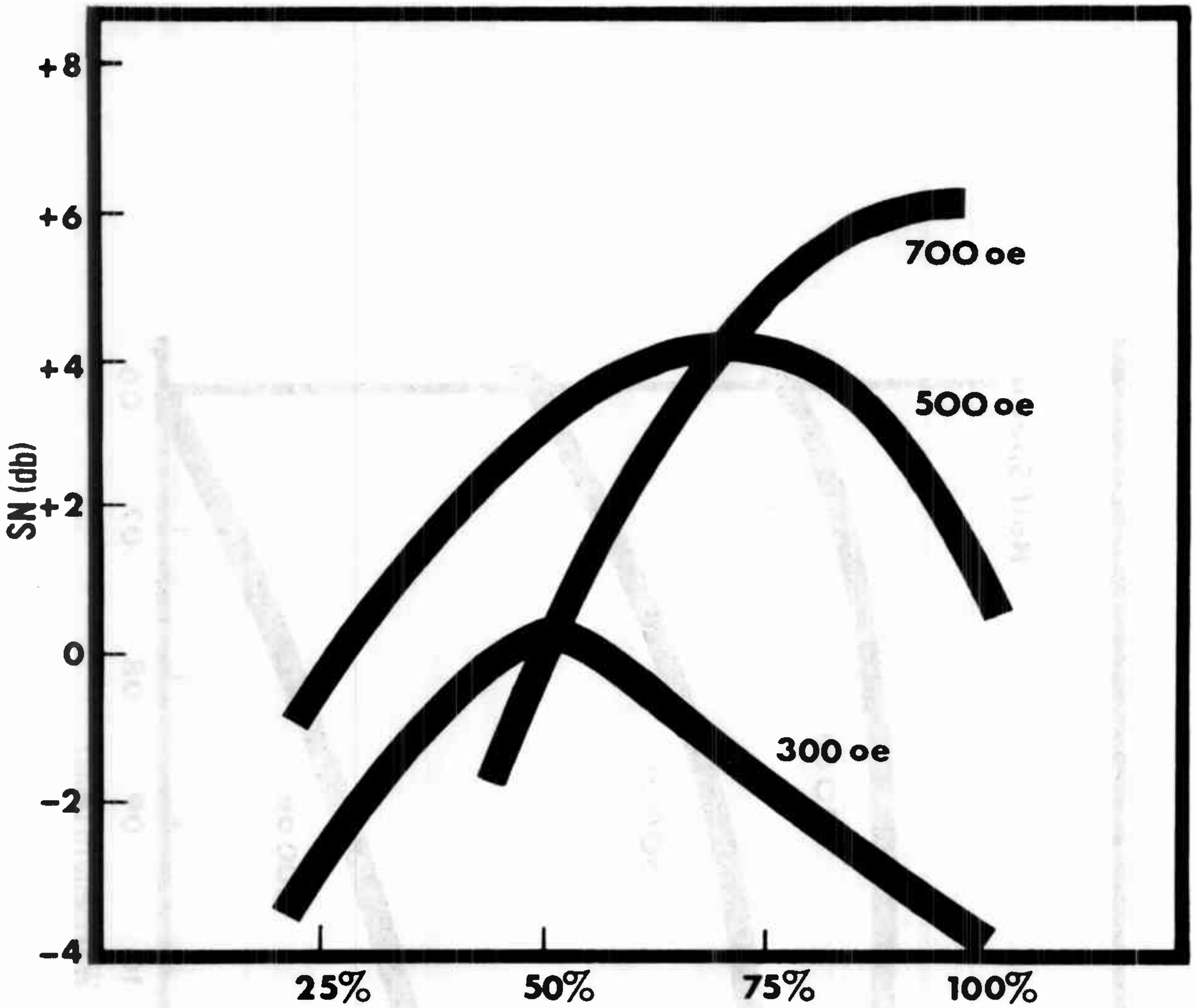
MULTIPLE GENERATION S/N COMPARISON

FIG 5



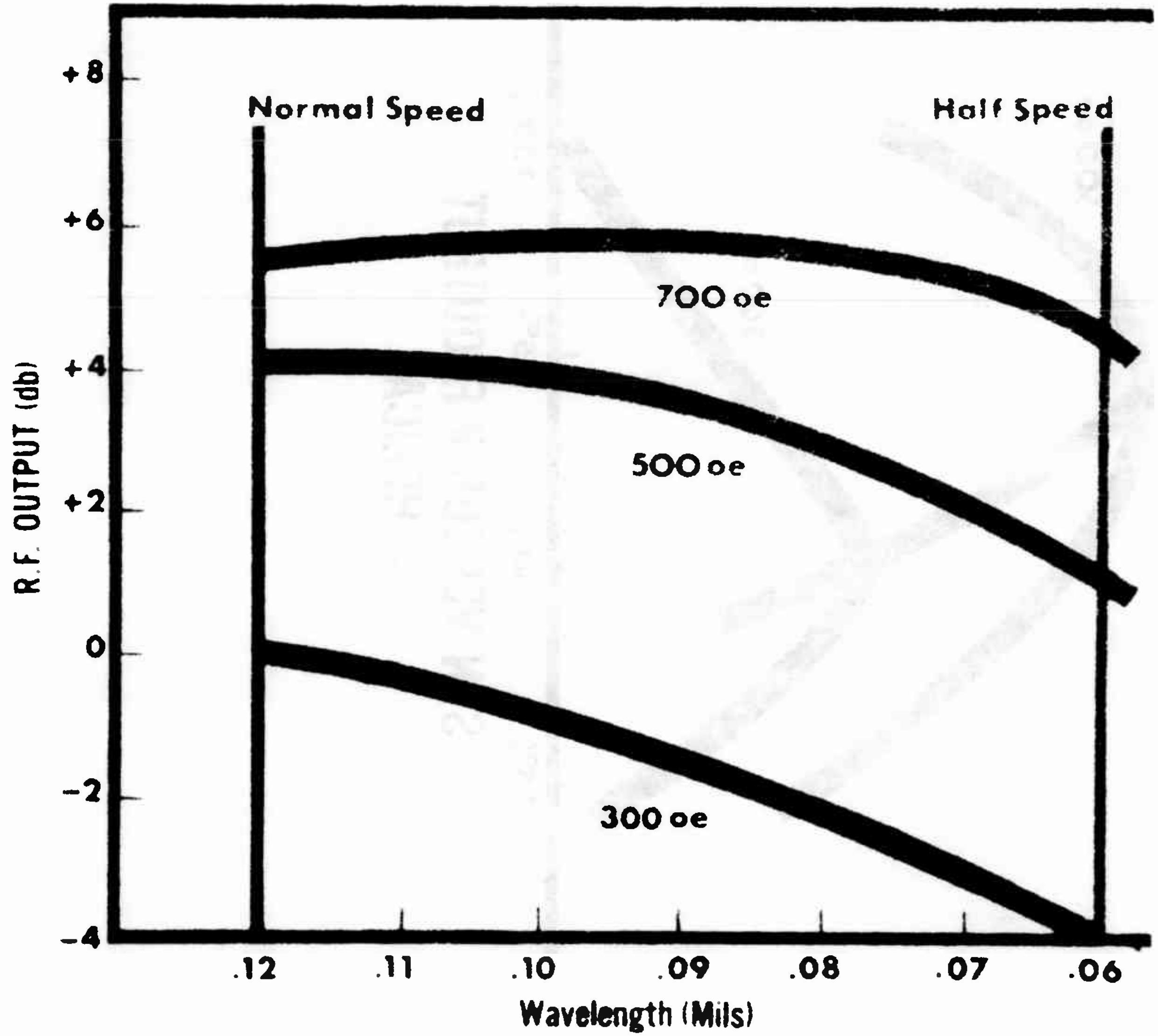
R.F. OUTPUT VERSUS R.F. DRIVE
1" HELICAL

FIG. 6



S/N VERSUS R.F. OUTPUT
1" HELICAL

FIG. 7



R.F. OUTPUT VERSUS WAVELENGTH OPERATING AT 2 SPEEDS

PAPER PRESENTED AT 1971 N.C.T.A. CONVENTION

Washington, D. C.

TeleMation, Inc.

Ronald S. Hymas

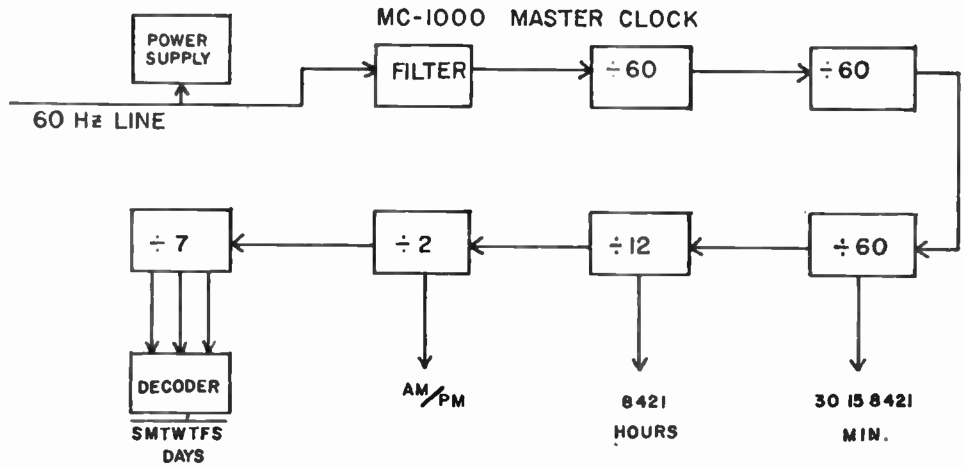
Salt Lake City, Utah

A NEW APPROACH TO ALL-DIGITAL NON-DUPLICATION SWITCHING

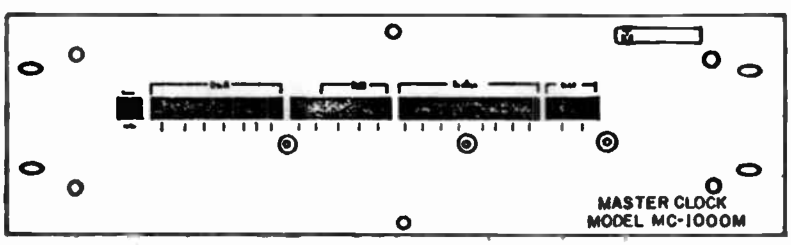
The TMP-1000 electronic programmer is designed to perform repetitive control functions such as CATV non-duplication switching when a schedule is repeated on a weekly basis. The programmer operates on the elasped-time principal. This means that the stop and start times of each event are programmed by the operator, rather than occurring at arbitrary intervals as with pulse-time systems. This permits programming the start and stop of each event to each selected minute throughout the day.

Digital electronics are used in a unique manner in the TMP-1000 to provide the benefits of larger, more expensive programmers that rely on disc, core, or tape storage, while maintaining a price competitive with the more limited pegboard programmers. Another important advantage of this design is in the elimination of moving parts which increases reliability.

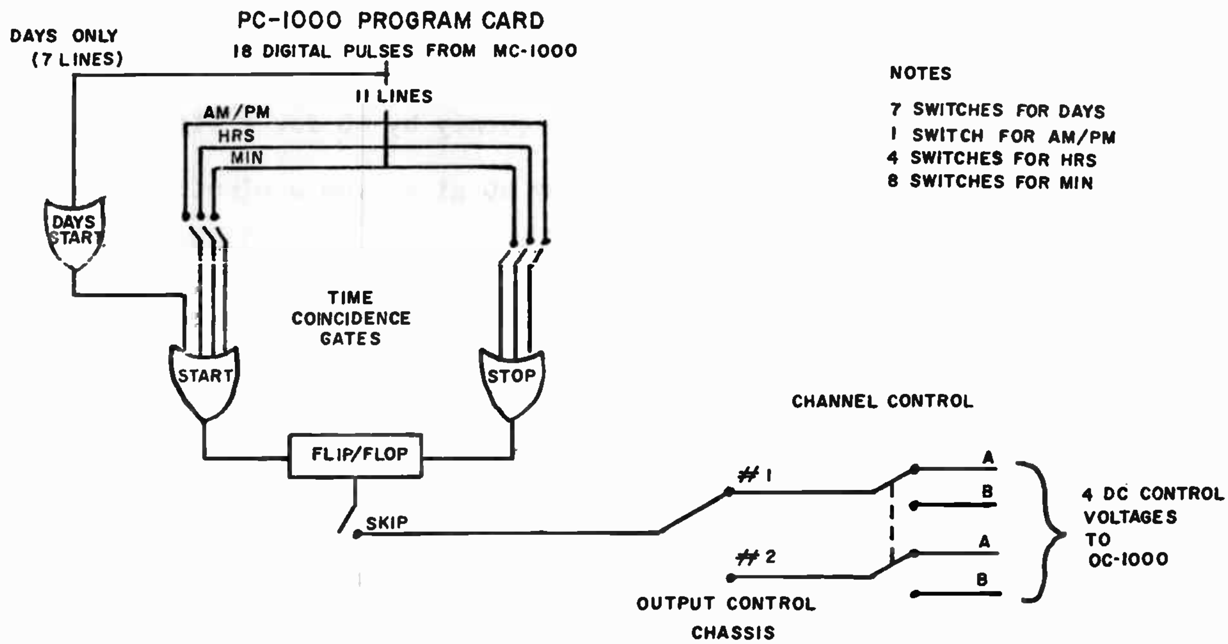
The TMP-1000 system consists of four basic components. They are: The MC-1000M Master Clock that provides timing signals and DC power for the system; the OC-1000 output control with its two-channel control relays; the EE-1000 event expander which expands the event capacity of the OC-1000; and the PC-1000 program control card which contains the programming and memory elements to start, maintain, and stop each event.



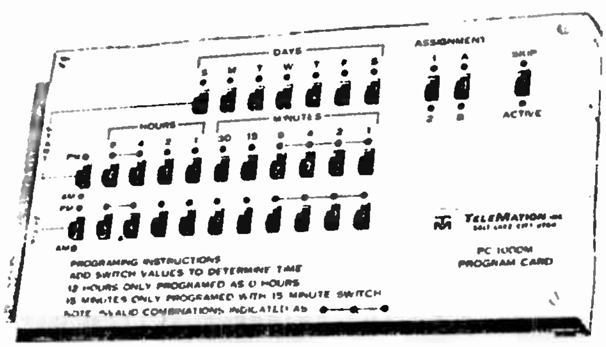
The heart of the system is a digital master clock, Model MC-1000M which counts down from the power line frequency. The frequency dividers are: Divide the power line frequency by 60 for a signal with a period of one second; then a divide by 60 gives you a minute period; a divide by 60 to obtain one hour period, and this frequency divided by 12 to get one-half day period. A divide by seven and decoder circuitry is required to obtain days. The output from the MC-1000 is then routed to the OC-1000 by ribbon wire, then to the PC-1000 Program Control Cards. The front panel controls for the Master Clock are three push-button switches which are used to set the days/hours, minutes, and seconds.



To set real time with the master clock, depress the day/hours control and advance the time to the proper day, AM or PM, and hours. Then depress the minute switch until proper time is indicated in the read out window. The "hold seconds" push-button is used to stop the digital clock in order to match the Master Clock to real time. This also clears the second counters so when released it starts at zero seconds. The indicator to the far left on the Master Clock is used to notify the operator of a momentary power failure; if so, the indicator light will flash and real time must be reset.

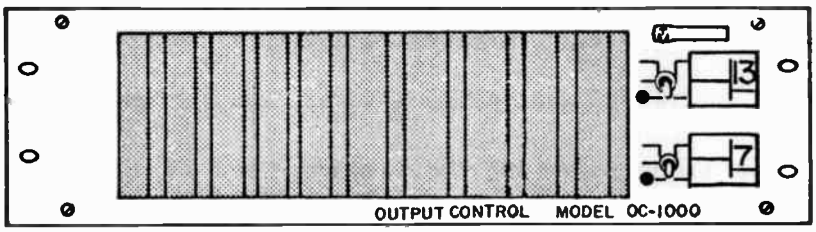


The PC-1000M Program Card controls one complete switching event from start to stop. This card also permits selection of day or days of the week that the switching event will occur. The 18 digital pulses from the Master Clock are routed to the days-only gate through the selected day switch. Eleven lines are then routed to the start time coincidence gates through the selector switches for AM or PM, hour, minutes switches. If one of the programmed days is the same as the day indicated by the Master Clock and the programmed start time is the same as the indicated real time, a pulse is fed to the flip-flop. The flip-flop acts as a storage device, and a DC voltage is then fed to the output control for the appropriate channel switching. This flip-flop will stay in the on condition until a stop time coincidence occurs. At this time the flip-flop will turn off. A pulse from the days gate is not required to achieve a stop time coincidence. A skip feature is built in to eliminate complete program card programming if a particular event requires no protection. If the skip feature is used, a front panel light will indicate to give you a record of the skipped event. An active light indicates on the front panel of the Program Card if a switching event is in progress.



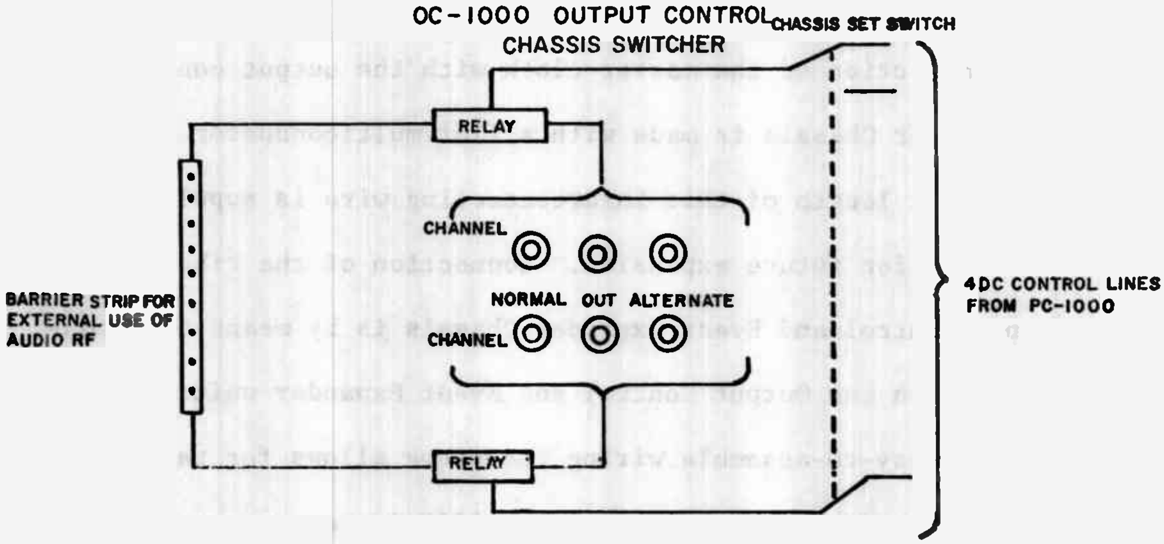
The output from the Program Card can be assigned to any of four different channels, depending on the placement of the assignment switches directs the output of the assigned output control chassis or OC-1000.

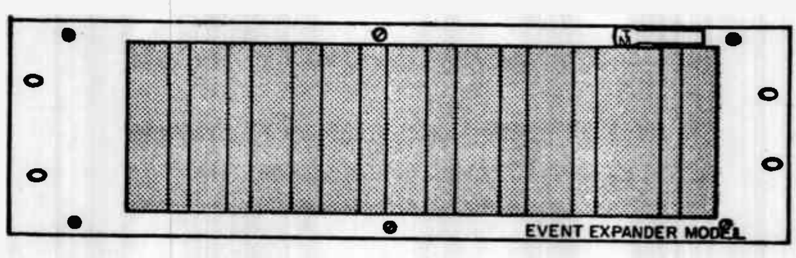
Each OC-1000 provides two channel protection, selected by the "A" and "B" switches. The four DC control voltages from the Program Card are then routed to the appropriate Output Control Switcher for relay switching.



The output Control Chassis, Model OC-1000, provides output switching capability. Front-panel switches are provided to allow operator manual override selection of either the "Normal" or "Alternate" input, or the automatic mode of operation.

The reference guide located by the selector switch gives you a log as to which sources can be switched to the output channel. In the alternate and normal mode these sources are routed to the output channel. In the auto mode you revert back to the program card. Circuitry is provided to directly switch video, with proper termination of the unused input. Additional contacts permit switching associated audio or RF control voltage. Video connection is by means of type BNC connectors, and barrier strips are supplied which switch either internally supplied +24 VDC or may be strapped to switch voltage from an external source. Each output control accommodates up to twelve program cards.





Event Expander Chasses, Model EE-1000, are available to accommodate additional Program Cards when the number of switching events designated to a given output exceeds the card slot capacity of 15 provided to allow a Program Card to be delegated to operate with either output in either of two associated OC-1000 Output Control Chasses. The Event Expander Chassis is a passive device, and may be connected as necessary to extend system event capacity.

Interconnection of the master clock with the output control and the Event Expander Chassis is made with a flat multiconductor ribbon wire. Sufficient length of this interconnecting wire is supplied with the Master Clock for future expansion. Connection of the ribbon wire to the Output Control and Event Expander Chassis is by means of a connector provided on the Output Control and Event Expander units. This convenient and easy-to-assemble wiring technique allows for rapid field connection of the component parts of a TMP-1000 System.

The TMP-1000 System has a capability of system expansion to six OC-1000s and fifty Program Cards which offer 700 switching events weekly for non-duplication.

CALIBRATION OF CROSS MODULATION MEASUREMENTS

STEVE J. KEMPINSKI & JAMES E. FOGLE
C-COR Electronics, Inc.

Cross modulation measurement is an especially important parameter in the determination of CATV system performance. In the industry today several cross modulation test sets are available to fulfill the need to measure cross modulation. However, for accurate measurements these test sets must be calibrated in an accurate and repeatable manner. This calibration is accomplished by the insertion of a known cross modulation level, which is then used as a standard for comparison.

Since detectors used in these signal measurements are basically non-linear devices (which can be approximated with a square law expansion), it becomes essential to have the calibration point near the region of expected cross modulation readings.

When one talks about percent modulation in terms of dB and spectral component levels in dB corresponding to a given cross modulation level, there has usually been a considerable amount of confusion over these terms. Let us attempt to clarify these terms by a look at the facts. See Figure 1. As illustrated by Figure 1, the difference between the NCTA definition and conventional definition of an amplitude modulated wave lies in the way the modulation excursion on the carrier is defined. By equating the two definitions and solving mathematically (see proof in Appendix A) we then can see that M_t (NCTA modulation) is equal to M_c (conventional modulation) plus a correction factor T. See Figure 2. As shown in Figure 2, the factor T is equal to 0 dB at 100% modulation and 6 dB at 0.1% modulation.

Let us first consider several modulation levels using the conventional modulation definition. For a 100% square wave modulated carrier the first spectral component away from the carrier is 3.9 dB below the carrier. See Figure 3. For a 100% CW (sinusoidal) amplitude-modulated wave the first (and only) spectral components are 6 dB below the carrier. It is then apparent that a 0.1% square wave modulated signal has a first spectral component 63.9 dB below the carrier and a 0.1% CW amplitude modulated wave has its first (and only) spectral component 66 dB below the carrier level. See Figure 4.

Now considering the NCTA defined modulation, a 0.1% modulated signal has its first spectral component 69.9 dB below the carrier. It should be noted here that -60 dB cross modulation means that there is 0.1% induced modulation; not that the first spectral component is down 60 dB.

To produce an accurate calibration point, it is necessary to calibrate at very low cross modulation levels (at least 60 dB below the carrier). At this point then one must decide whether to use square wave modulation or amplitude modulation. Since it is difficult to accurately fix a modulation index, the choice of modulation then must be one which is accurate and repeatable.

One way of accurately simulating a low modulation index is to linearly add and envelope detect two CW signals that are closely spaced in frequency. If one of the signals is sufficiently small when compared to the other, then the detected output is the same as that of a conventional amplitude modulated signal having a modulation index equal to the voltage ratios of the two signals.

Consider the addition of two sinusoids of different and arbitrary relative amplitude M:

$$\text{SIN } X + M \text{ SIN } Y = P \text{ SIN } \phi$$

where $P^2 = 1 + M^2 + 2\, M \text{ COS } (X - Y)$

and $\text{TAN } \phi = \dfrac{\text{SIN } X + M \text{ SIN } Y}{\text{COS } X + M \text{ COS } Y}$

The derivation of these relations is shown in Appendix B.

If M = 1, the Sin X + M Sin Y reduces to 2 Cos ½ (X - Y) Sin ½ (X - Y), which is not conventional amplitude modulation. However, under the conditions stated before; that is, a large relative amplitude difference ($M \ll 1$) and close frequency spacing ($X \simeq Y$), then ϕ is approximately equal to X. Expanding the square root of $1 + M^2 + 2\, M \text{ Cos } (X - Y)$ in a Taylor series about 1 yields

$$P = 1 + M \text{ COS } (X - Y) + \text{Higher Order Terms.}$$

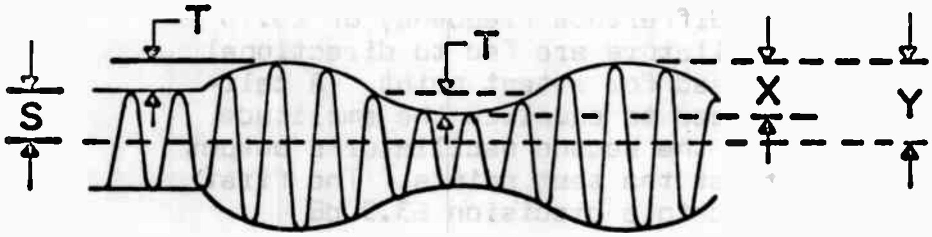
Therefore, for these conditions

$$\text{SIN } X + M \text{ SIN } Y \simeq \left[1 + M \text{ COS } (X - Y)\right] \text{ SIN } X$$

This does not mean that new spectral components have been added by the linear addition of the two sinusoids; it simply means that this linear addition under the above conditions represents a conventional AM signal to a very good approximation.

Since we use this simulated AM signal to calibrate the cross modulation test set, we must include the 6 dB correction factor as shown in Figure 2. The simulated signal must be at the -66 dB level which corresponds with a -60 dB square wave (NCTA) modulated signal. One more correction factor must be considered; that of the audio analyzer used to read the detected signal. Since the audio analyzer is a narrow band device, one must consider the difference between the first side band or spectral component of the amplitude modulated and the square wave modulated signal. Expanding both signals in a Fourier series and comparing the first two spectral components reveals that the square wave modulated signal is 2.1 dB greater than an AM signal for the same modulation index as was previously shown in Figure 3. Therefore, +2.1 dB must be added to the -66 dB calibrating wave. Consequently, a -63.9 dB amplitude modulated signal is equal to a -60 dB square wave (NCTA) modulated signal. Again, looking only at the first spectral components we can see the relationship between the NCTA, conventional, and simulated modulation levels. See Figure 5 for a comparison of these levels.

C-COR has related this theory of calibration to actual operation of a unit which C-COR has built and proven in use for calibration of cross modulation test sets. A block diagram of the C-COR calibrator is shown in Figure 6. Its operation follows the theory described to provide a -60 dB cross modulation calibration point. The calibrator employs two crystal controlled oscillators with a difference frequency of 15.75 kHz. The outputs of both oscillators are fed to directional couplers one leg of which is used for a test point. A calibration on one oscillator is used to equalize the amplitude of that oscillator's output to the second oscillator's output while monitoring both outputs at the test points. The first oscillator's output then is fed to a precision 63.9 dB attenuator (which has been calibrated using a secondary standard). The attenuator output is then fed into a combiner along with the output of the second oscillator. At the combiner output then the signals provide a simulated -60 dB cross modulation calibration reference. This calibrator has proven itself as an instrument for consistent accuracy and repeatability in calibrating cross modulation test sets.

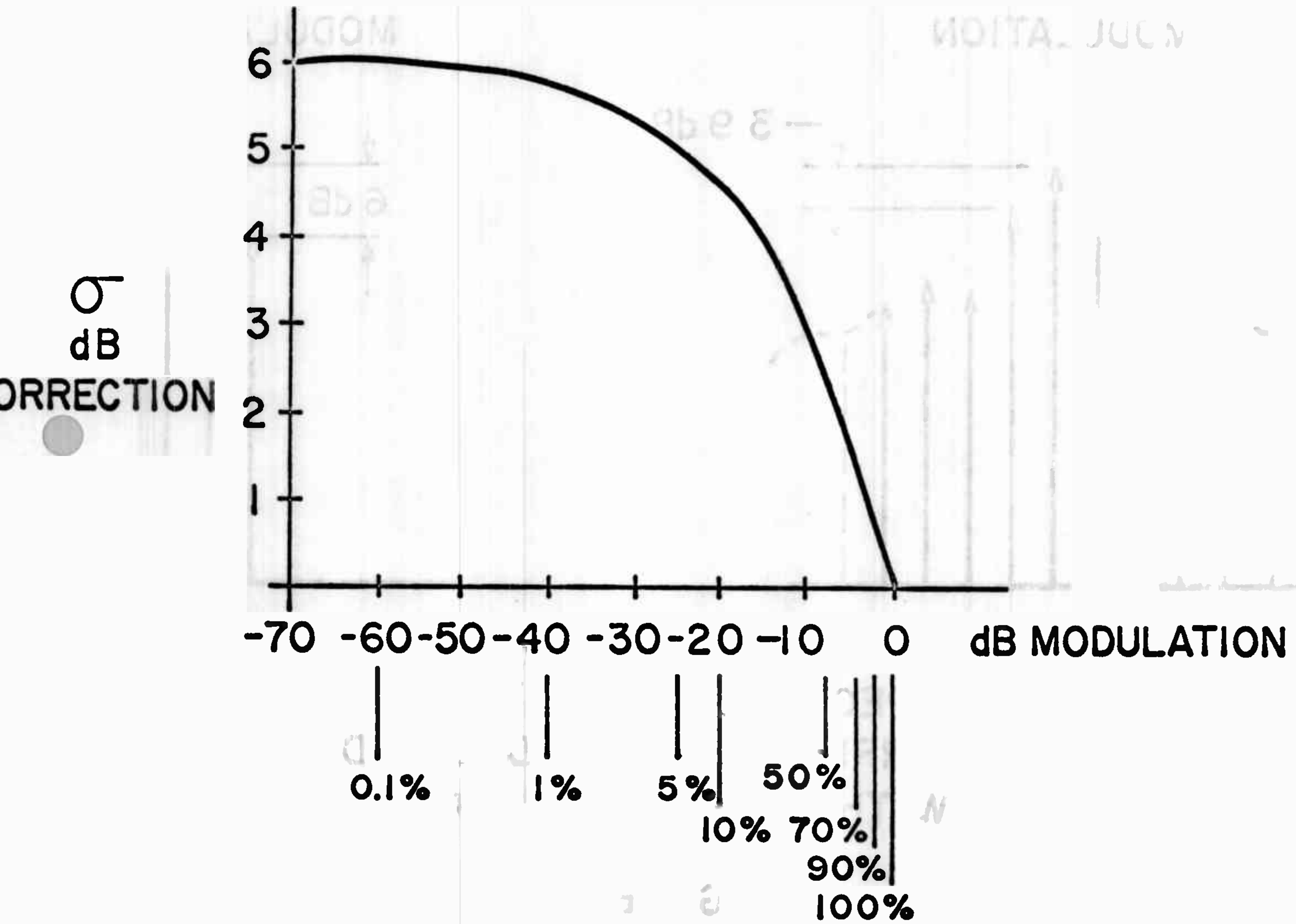


DEFINITION: CONVENTIONAL MODULATION $Mc = \frac{T}{S}$

DEFINITION: TELEVISION OR NCTA MODULATION $Mt = \frac{X}{Y}$

PERCENT MODULATION = $M \cdot 100$

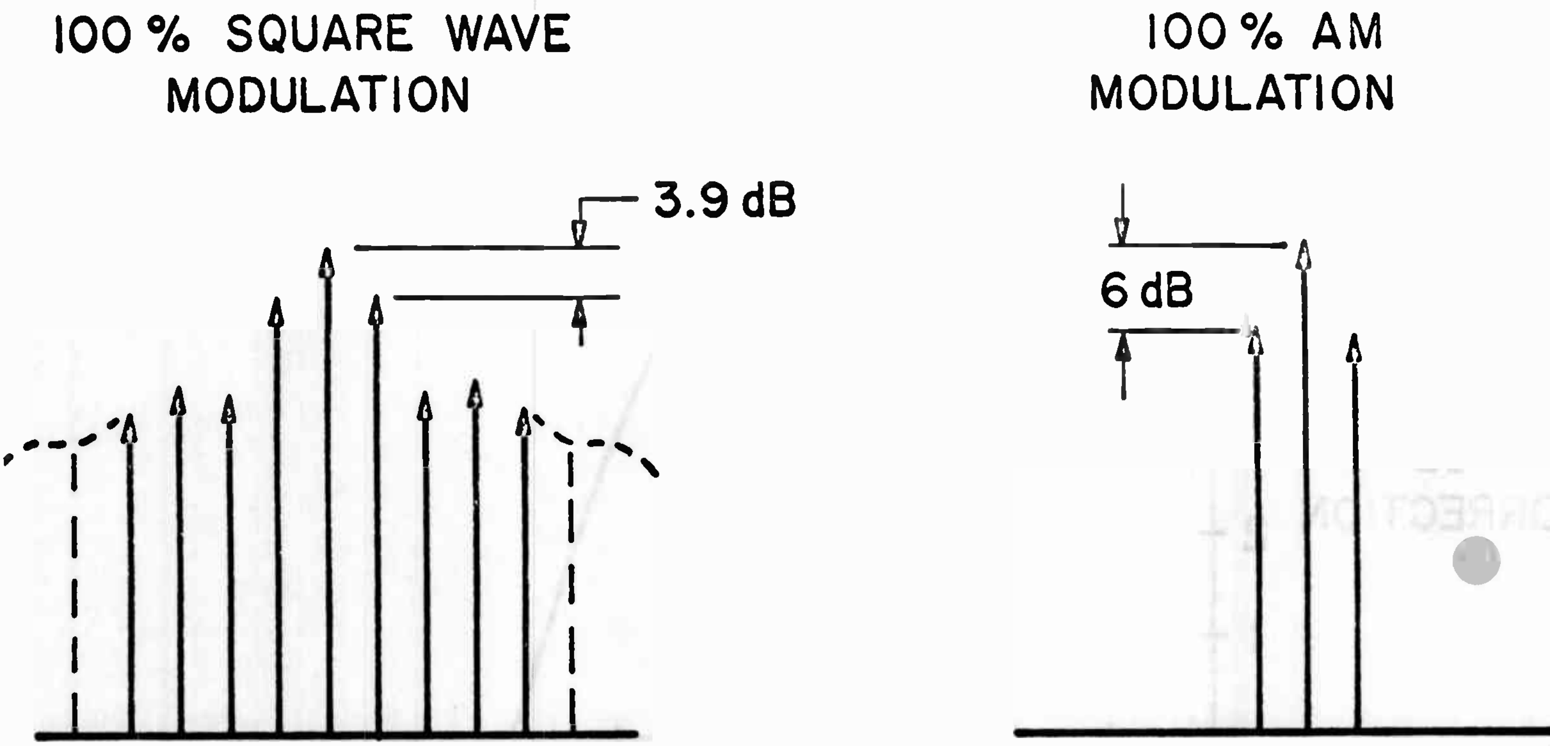
FIGURE 1



MODULATION LEVEL (NCTA)

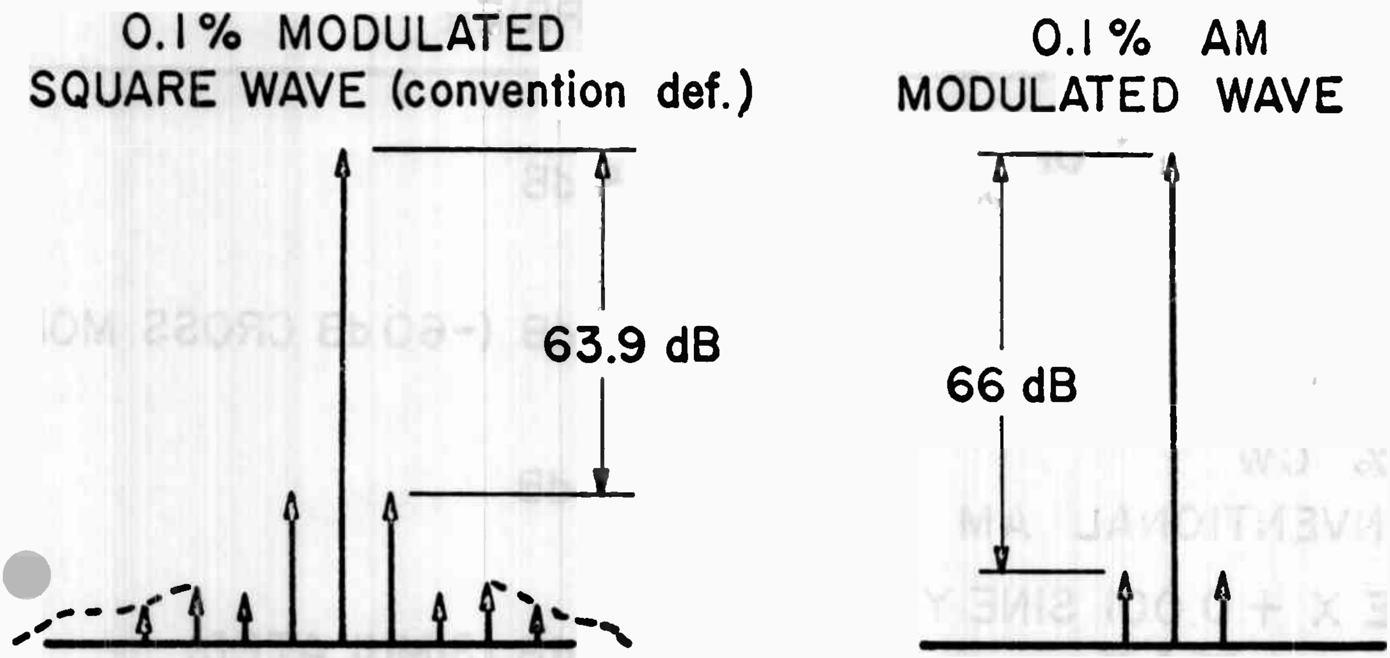
VERSES σ

FIGURE 2



SPECTRAL LINES OF A CARRIER 100 % MODULATED WITH A 15.75 KHz SIGNAL

FIGURE 3

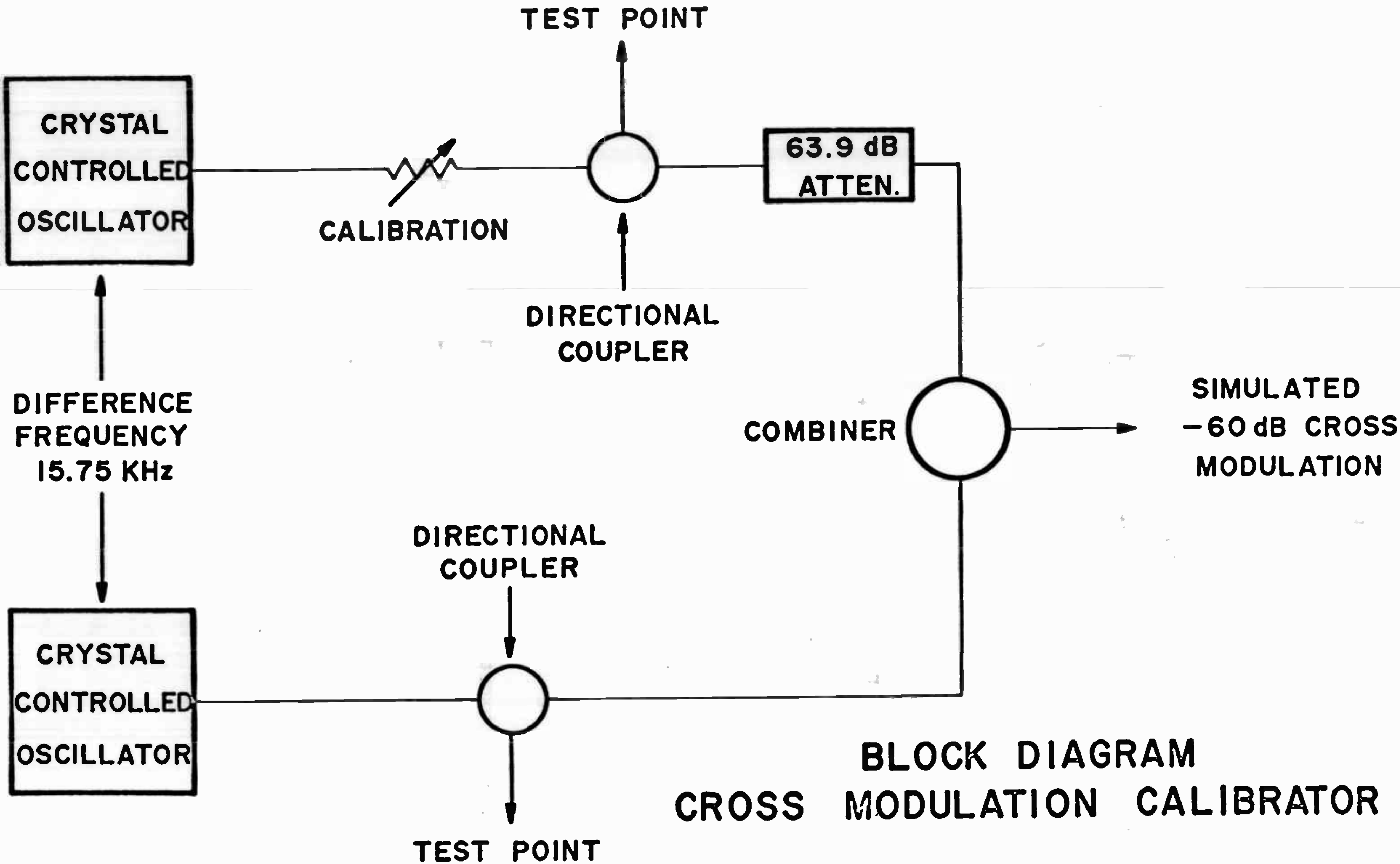


SPECTRAL LINES OF A
0.1% MODULATED SIGNAL

FIGURE 4

	FIRST SPECTRAL COMPONENT LEVEL FROM CARRIER
0.1% CONVENTIONAL PULSE MODULATION	− 63.9 dB
0.1% NCTA PULSE MODULATION	− 69.9 dB (−60 dB CROSS MOD)
0.1% CW CONVENTIONAL AM	− 66.0 dB
$\text{SINE X} + \underbrace{0.001}_{\text{60 dB ATTENUATION}} \text{ SINE Y}$	− 66.0 dB (SIMULATED)
$\text{SINE X} + \underbrace{\text{M}}_{\text{CORRESPONDING TO 63.9 dB ATTENUATION}} \text{ SINE Y}$	− 69.9 dB (SIMULATED)

FIGURE 5



BLOCK DIAGRAM
CROSS MODULATION CALIBRATOR

FIGURE 6

APPENDIX A

Conventional Modulation - $M_c = T/S$ See Figure 1

NCTA Modulation - $M_t = \frac{X}{Y}$

M - Modulation Level = 20 log m

Percent Modulation = 100 x m

Equate the modulation formulas by reference to Figure.

$$X = 2T = Y M_t \qquad T = \frac{X}{2} = S M_c$$

$$Y = S + T = X/M_t \qquad S = Y - T = T/M_c$$

$$M_t = \frac{X}{Y} = \frac{2T}{S + T}$$

$$M_t = \frac{2 S M_c}{S + S M_c}$$

By factoring and cancelling: $M_t = \frac{2 M_c}{1 + M_c}$

Likewise: $M_c = T/S = \frac{X/2}{Y - T} = \frac{X/2}{Y - X/2}$

$$M_c = \frac{\frac{X}{2}}{\frac{2Y - X}{2}} = \frac{X}{2Y - X}$$

Again by substitution

$$M_c = \frac{Y M_t}{2Y - Y M_t}$$

Therefore $M_c = \frac{M_t}{2 - M_t}$

Taking the expression for M_t and expressing in dB yields

$$20 \log M_t = 20 \log 2 + 20 \log M_c - 20 \log (1 + M_c)$$

$$20 \log 2 = 20(.3) = 6$$

Then let $T = 6 - 20 \log (1 + M_c)$

for which the original equation then becomes

$$\underbrace{20 \log M_t}_{M_t} = \underbrace{20 \log M_c}_{M_c} + T$$

$$= T$$

APPENDIX B

$$\text{SIN } x + \text{M SIN Y} = \text{P SIN } \phi \qquad (1)$$

Using trigonometric relationships and considering the addition of two phasors which then becomes

$$e^{jX} + Me^{jY} = Pe^{j\phi}$$

Since this holds identically then,

$$\text{COS X} + \text{M COS Y} = \text{P COS } \phi$$

Thus $\text{TAN}\,\phi = \dfrac{\text{SIN } \phi}{\text{COS } \phi} = \dfrac{\text{SIN X} + \text{M SIN Y}}{\text{COS X} + \text{M COS Y}}$

Then $P^2 = (e^{jX} + Me^{jY})\,(e^{-jX} + Me^{-jY})$

which yields $P^2 = 1 + M^2 + 2M \text{ COS } (X - Y)$

Equation (1) now becomes

$$\text{SIN X} + \text{M SIN Y} = \left[1 + M^2 + 2M \text{ COS } (X - Y)\right]^{1/2} \text{SIN } \phi$$

* For M 1

$$\text{SIN X} + \text{M SIN Y} = \left[1 + \frac{M^2 + 2M \text{ COS } (X - Y)}{2}\right] \text{SIN } \phi$$

$$+ \left[1 + \text{M COS } (X - Y)\right] \text{SIN } \phi +$$

$$\frac{M^2}{2} \text{ SIN } \phi$$

Which equation is like conventional amplitude modulation where M has the same meaning as in amplitude modulation.

If M = 1 $\quad P^2 = 2 + 2 \text{ COS } (X - Y)$

$$\text{or } P = \sqrt{2}\left[1 + \text{COS } (X - Y)\right]^{1/2}$$

$$= 2 \text{ COS } \tfrac{1}{2} (X - Y)$$

and when applied to equation (1), the equation becomes

$$\text{SIN X} + \text{SIN Y} = 2 \text{ COS } \tfrac{1}{2} (X - Y) \text{ SIN } \tfrac{1}{2} (X - Y)$$

Since $\text{TAN}\,\phi = \dfrac{\text{SIN X} + \text{SIN Y}}{\text{COS X} + \text{COS Y}} = \text{TAN } \tfrac{1}{2}(X - Y)$

it follows that

$$\phi = \frac{X + Y}{2}$$

* See No. 3 Bibliography.

BIBLIOGRAPHY

"Information, Transmission, Modulation, and Noise"
Mischa Schwartz
McGraw-Hill, New York, 1959

"Standard Mathematical Tables"
Samuel M. Selby
Chemical Rubber Co., Cleveland, 1965

"A Short Table of Integrals"
B. O. Peirce
Ginn and Company, New York, 1929

"Fourier Series & Boundary Value Problems"
R. V. Churchill
McGraw-Hill, 1963

"CATV Amplifier Distortion Characteristics"
Attachment 2
NCTA-002-0267

IN-SERVICE NOISE MEASUREMENTS ON A CATV SYSTEM

By

Charles W. Rhodes
Manager
Television Products Development

TEKTRONIX, INC.
Beaverton, Oregon

Presented by the author
at the
20th Annual NCTA Convention and Exposition
Sheraton Park Hotel
Washington, D. C.
July 6-9, 1971

Measurement of the signal-to-noise ratio in communications systems is of fundamental importance - both in evaluating performance and in planning preventative maintenance.

In television systems, the signal-to-noise ratio is measured in terms of the peak amplitude of the picture signal and the RMS noise amplitude. The picture signal amplitude with which we are concerned modulates the picture tube. That is, it is the blanking level-to-peak white level not the sync tip-to-peak white, i. e. $\sim$700 mV. Signal level is easily measured with a television waveform monitor.

Noise cannot be measured in terms of peak amplitude. This is because of the statistical nature of noise. That is, noise (being random) has peak amplitudes which vary with time in a random fashion. Theoretically, if one waits long enough, an infinitely large noise pulse will come along. Noise pulses could be several volts in amplitude, but these occur so seldom that they can be neglected.

Experience has shown that the subjective appearance of noise is related to the noise power level. It has long been the practice to measure noise levels in terms of average noise power, thus avoiding the occasional high noise peaks. Noise power may be expressed in RMS volts. Thus, the measurement of noise is simply the problem of measuring power or RMS voltages.

However, this isn't as easy as it may at first appear. In television, we are concerned with noise power extending to 4 MHz. As the noise voltage is a complex waveform, not a sinewave, we cannot measure peak or average voltage and know the RMS value. In communications engineering, the usual approach to measuring RMS voltage, or noise power, is to measure the heating effect produced by the unknown power dissipated in a known load. This can be carried out in the laboratory to very great precision. However, the circuit must be taken out of service for the test.

When one considers the power levels to be measured (a 40 dB S/N ratio = 6.6 mV in 75 Ω = 0.44 microwatts), it is at once apparent that the equipment must of necessity be delicate and perhaps not well-suited for rugged field use. The skill levels required are not generally available outside of laboratories. In short, measurement of RMS noise levels in the field is not practical. Furthermore, even if practical, it requires that the system is taken out-of-service for the test. In the case of CATV systems, this is not at all convenient.

The ideal test scheme permits accurate in-service testing and uses equipment suitable for field usage. In-service testing requires that the noise may be measured in the presence of the video signal, whose power level varies unpredictably. One scheme is to observe the video signal and noise on an oscilloscope. By observing the noise only on a line or two of the vertical blanking level, video information is eliminated quite easily.

On the other hand, the oscilloscope is fundamentally a peak reading instrument - it does not indicate RMS at all. For true "white noise" there is, however, a conversion factor which some observers have developed to relate apparent noise on an oscilloscope to its true RMS value. This factor has been reported as 14 to 18 dB, the higher value being favored.[1-2]

However, aside from the question of the correction factor, a much more serious source of error lies with the variations in observed noise between different observers, changes in the trace intensity on the waveform monitor, and the apparent noise level changes which occur with the changes in the brightness of the room in which the measurement is made. Variations of 6 dB have been reported due to this latter cause alone.[2]

Clearly, where preventative maintenance is to be determined by signal-to-noise level measurements, much greater repeatability in test methods is needed. As CATV system performance may be a matter of litigation, such large margins in the test results is undesirable.

Tektronix, Inc., has developed a new method which eliminates both sources of error. This method is suitable for field usage and in-service testing. It is based upon the comparison of the noise to be measured with a second, known noise source. Here, the observer needs only to make a comparison, not a

[1]L. E. Weaver, "The Measurement of Random Noise in the Presence of a Television Signal," BBC Engineering Monographs (No. 24), March, 1959.

[2]L. E. Weaver, "Television Video Transmission Measurements."

judgment. His comparison will, in our experience, be repeatable within ±2 dB in every case; and will be within 1 dB in most cases. Different observers will obtain the same results, which are independent of the waveform monitor's intensity or ambient illumination. The waveforms obtained are shown in Figures 1a and 1b, page 3. These figures illustrate the basic concept. Figures 2a and 2b show the results of small variations in noise levels.

In any comparison technique, it must be first determined that like is being compared with like. That is, two noise sources should both have similar distribution of energy over the same frequency spectrum.

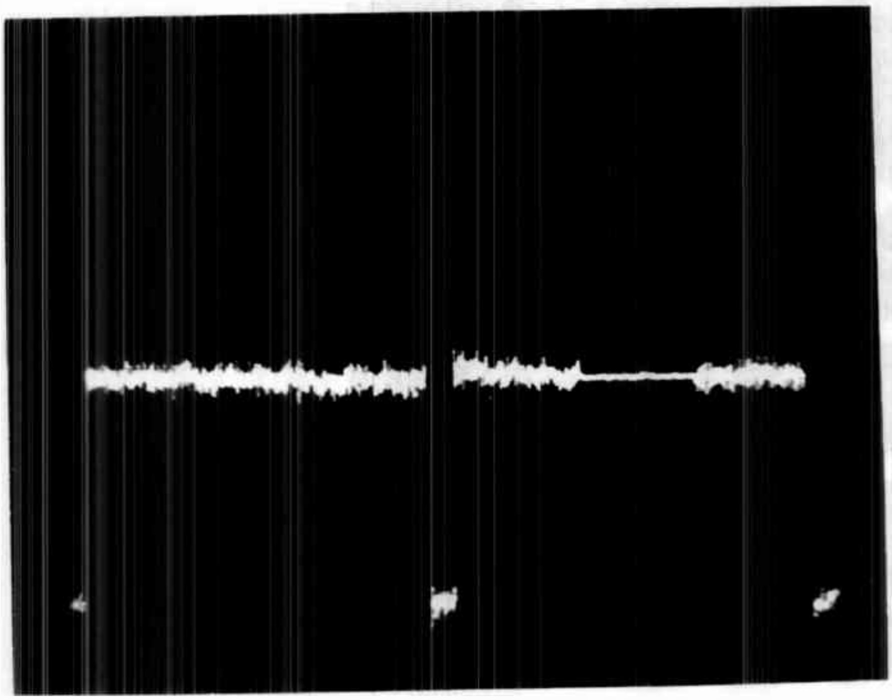
Fortunately, the random noise encountered in CATV systems (which accounts for snow in the picture) has approximately equal energy at all frequencies within the video band. This is called "white noise," and is readily generated by electronic means. Such a noise generator may be calibrated in the laboratory using a true RMS power measuring instrument. The long-term variations in RMS noise power will be small, hence frequent recalibration is not considered necessary. True RMS calibration in the factory avoids the question of the appropriate conversion factor mentioned above, with its spread of 4 dB. The only precaution in this measurement technique is that the noise being measured and the noise it is being compared with have the same frequency spectrum, or nearly so.

In many television systems, the bandpass extends considerably above 4 MHz. This is true of cameras and microwave radio relay links and may also be true of some demodulators. As noise above 4 MHz does not in general degrade the picture, it is desirable to exclude it from any measurements. White noise generators are inherently wideband. Their output includes significant energy above 4 MHz. Modern waveform monitors have only gradual roll-off in frequency above 4 MHz.

A low-pass filter, flat to 4 MHz, then exhibiting very rapid attenuation above 4 MHz, is required. Such filters are readily manufactured for 75 Ω circuits. Their design is given in the CCIR Volume 5 recommendation 451-1. These 75 Ω low-pass filters are essential to noise measurements. The filter must be placed in the measurement setup so that both noise signals are affected by it. A typical measurement setup is shown in Figure 3. The signal source shown is a CATV demodulator. The action of the Tektronix Type 147 is shown functionally in Figure 4.

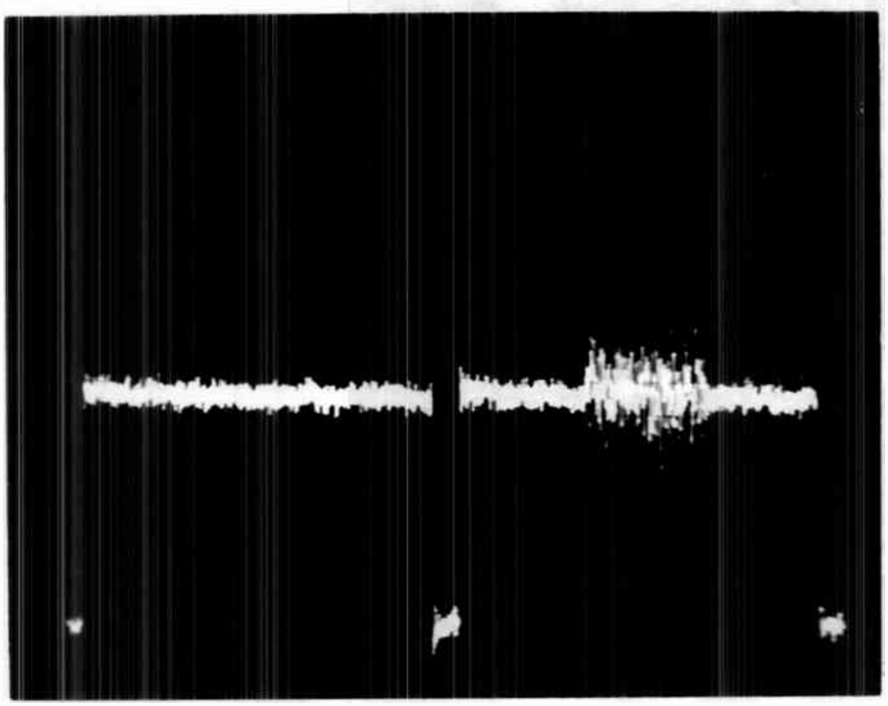
NOISE INSERTION MODE

Noise is deleted from center of chosen test line in vertical blanking interval. Noise from the noise generator in the Tektronix Type 147 is inserted in center of the chosen test line.



Inserted noise is much less than noise on signal

Figure 1a

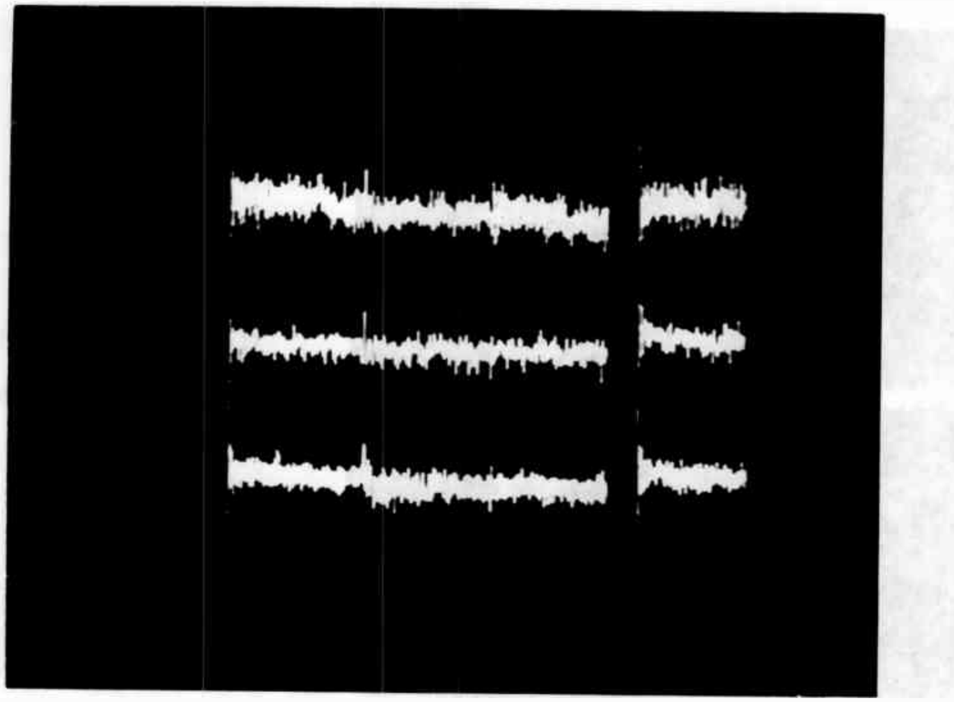


Inserted noise is much greater than noise on signal

Figure 1b

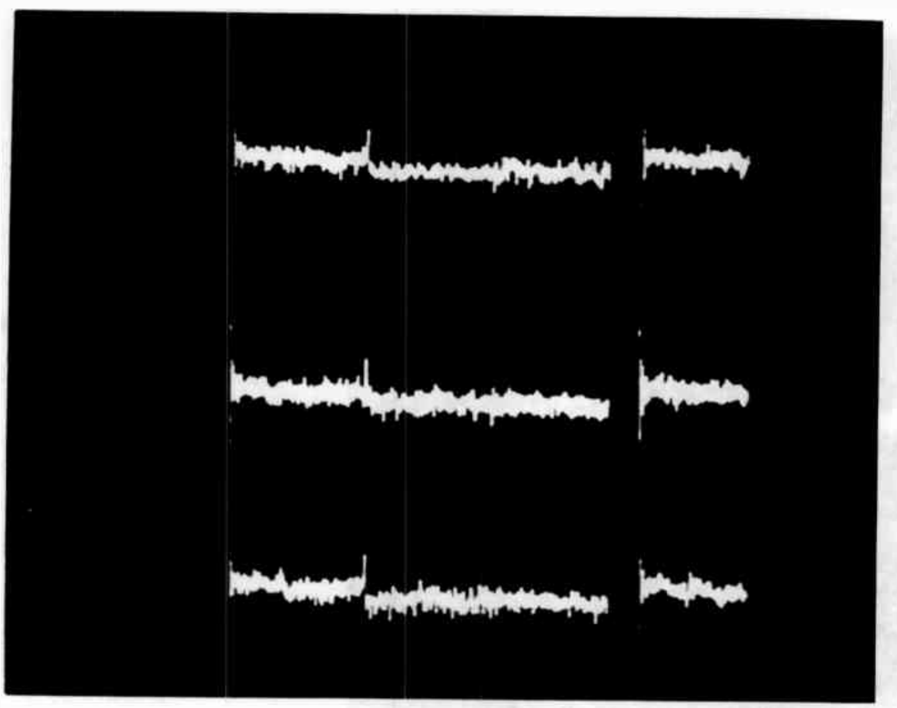
NOISE LEVEL DISCRIMINATION

Waveform Monitor Response - "Flat"
Noise Bandlimited - 4 MHz



± 2 dB

Figure 2a



± 3 dB

Figure 2b

IN-SERVICE NOISE MEASUREMENT

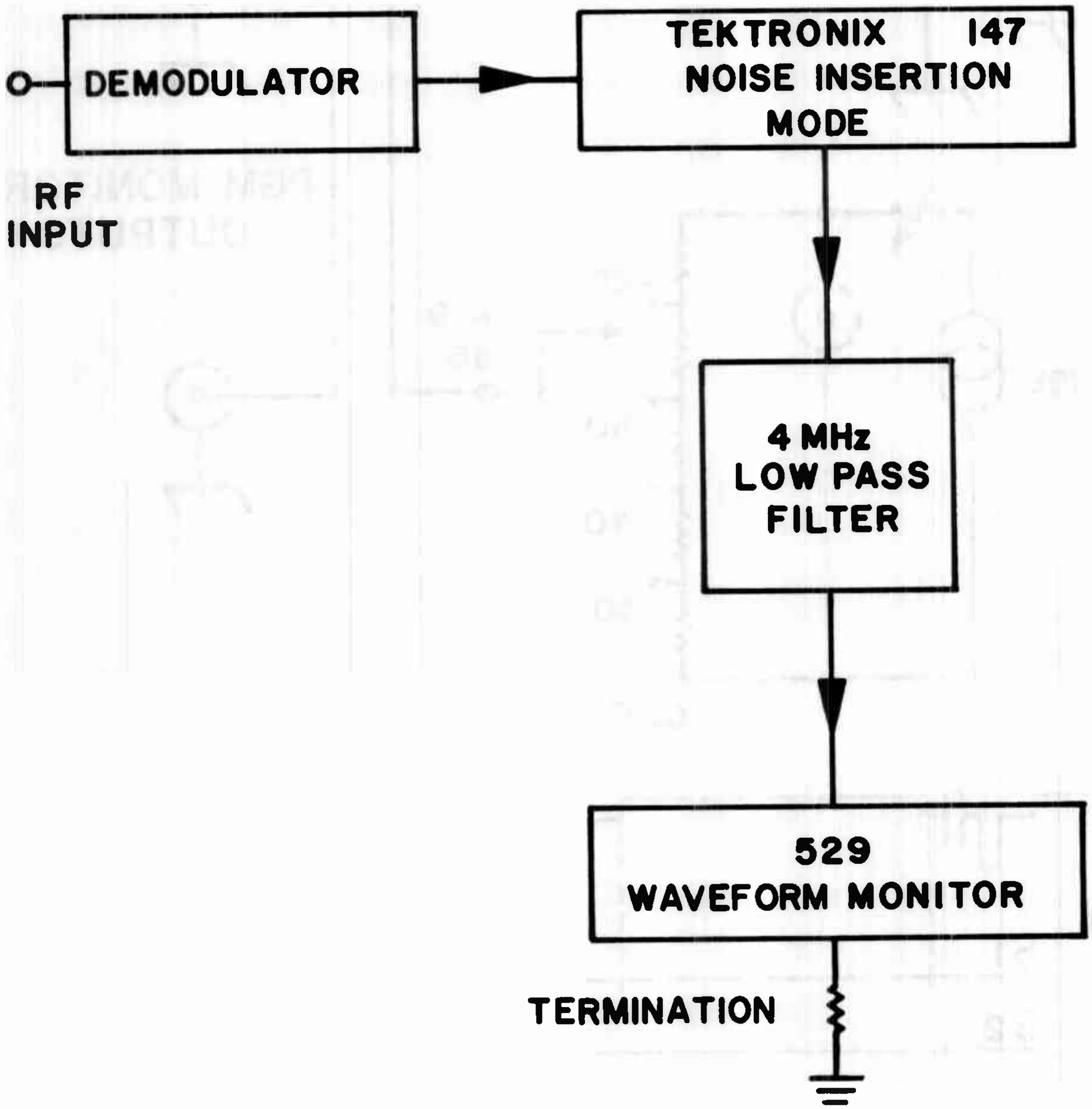
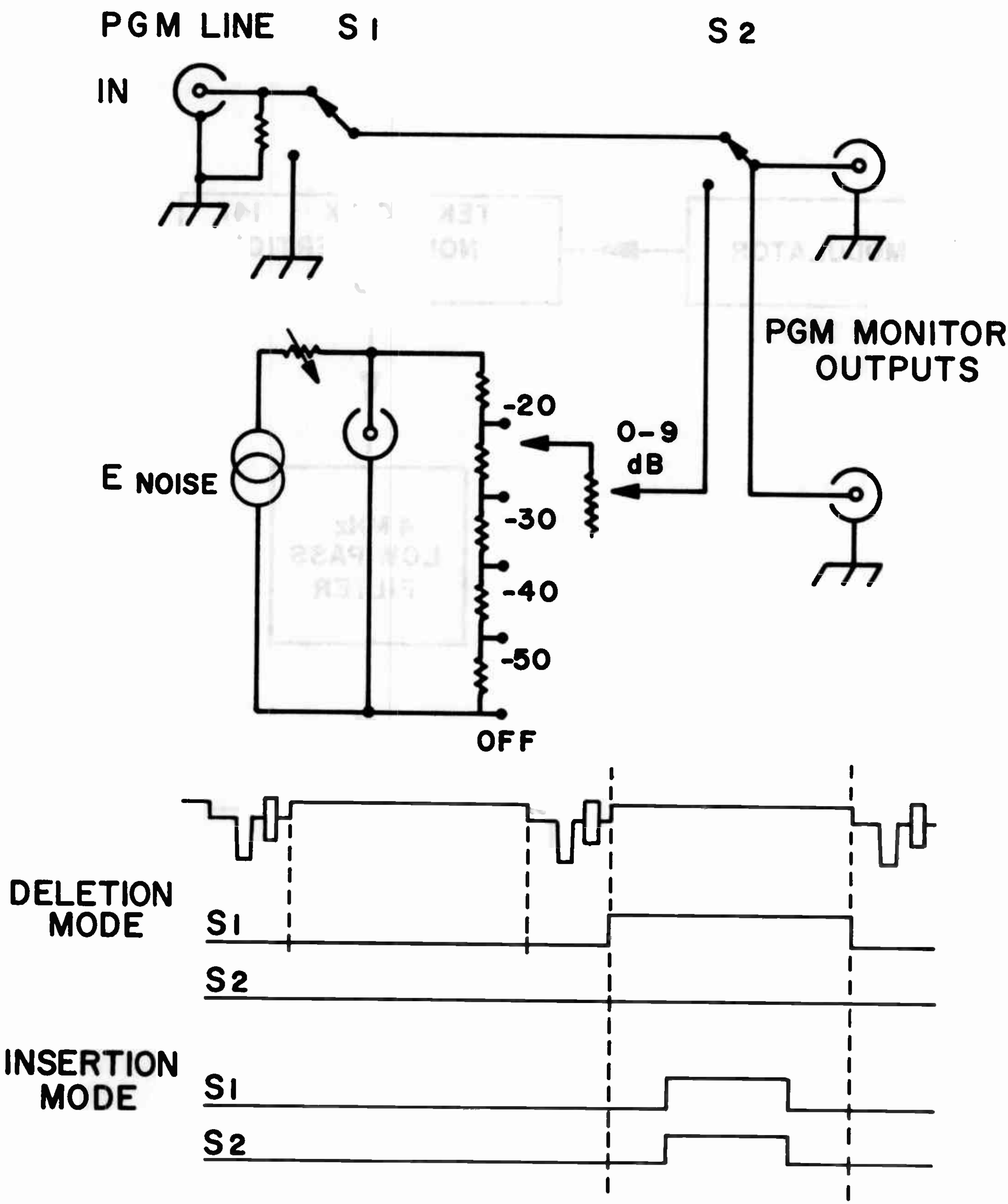


Figure 3



TEKTRONIX 147 NOISE MEASURING PLAN

Figure 4

Switches S_1 and S_2 are, of course, electronic switches. They operate during the chosen noise test line within the vertical blanking interval. S_1 is the deleter switch. When measuring noise, the instrument is said to be in the INSERTION MODE. Then, S_1 disconnects the incoming video signal from the input to S_2 during the middle half of the test line. At that time, switch S_2 substitutes the output of the built-in white noise source for the incoming video signal at the monitor outputs. One of these monitor outputs feeds the 4 MHz low-pass filter which removes all noise above 4 MHz from both incoming signal and locally generated noise. It is essential to terminate the filter at the waveform monitor. The effect of the 4 MHz filter is shown in Figure 5.

In the lower portion of Figure 5, the filter was connected incorrectly between the demodulator output and the Type 147 input. Here, the inserted noise observed on the waveform monitor is wideband, and the system noise (preceding and following the inserted noise) is bandlimited. The difference is much more apparent in viewing the monitor than is shown in the photograph.

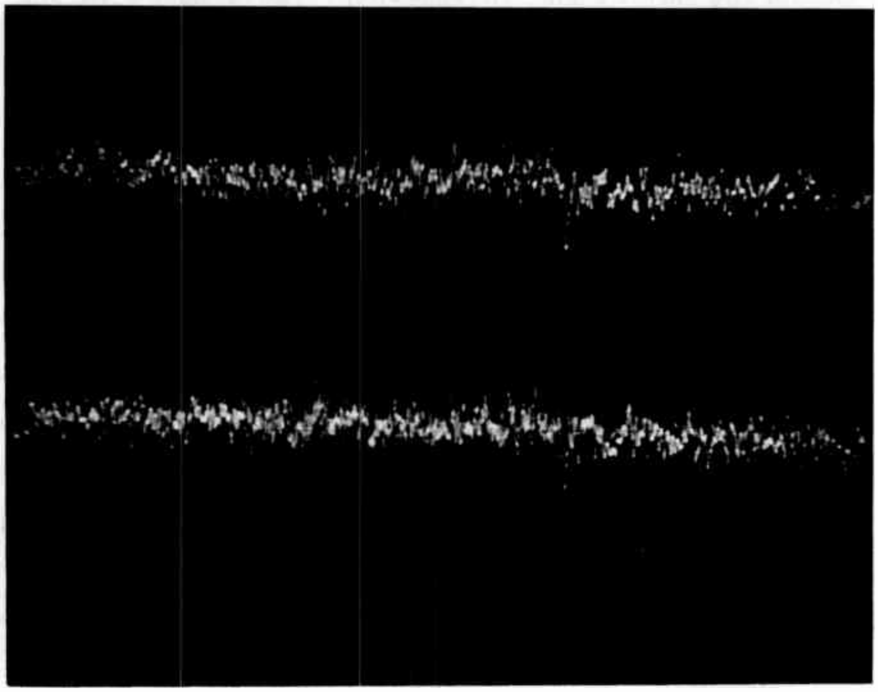
In the DELETION MODE, S_1 operates, disconnecting the incoming video during the entire active portion of the chosen test line. The action of S_1 and S_2 is so timed that no sync pulse or color burst is deleted. S_2 does not operate in the DELETION MODE. Video signals coming from the Type 147 in the DELETION MODE do not have any noise present during the active portion of the test line. This is shown in Figure 6.

The DELETION MODE is used where it is desired to measure the noise which is occurring within a CATV system. For example, at the head end site, where a microwave radio relay is fed baseband video from a demodulator, the Type 147 may delete all noise present at the output of the demodulator. In Figure 7, a 147, operating in the DELETION MODE, is shown connected to the microwave transmitter's video input.

At the output of the microwave link, a second 147 (see Figure 8), is operating in the INSERTION MODE. Noise is measured on the waveform monitor. Of course, the principle can be extended down the cable system to measure noise at the furthest subscribers' drop. This setup was shown in Figure 3.

Line 16 is well-suited for noise measurements. Under present FCC Rules, Line

EFFECT OF 4 MHz BANDLIMITING



Top

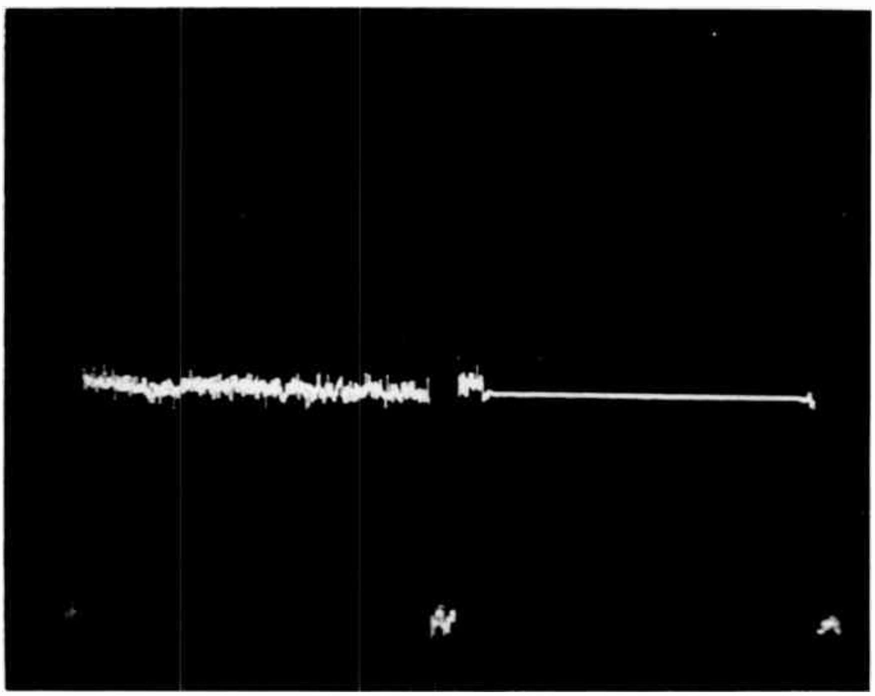
System and inserted noise both bandlimited to 4 MHz and matched at 40 dB.

Bottom

System noise bandlimited to 4 MHz, but inserted noise not bandlimited.

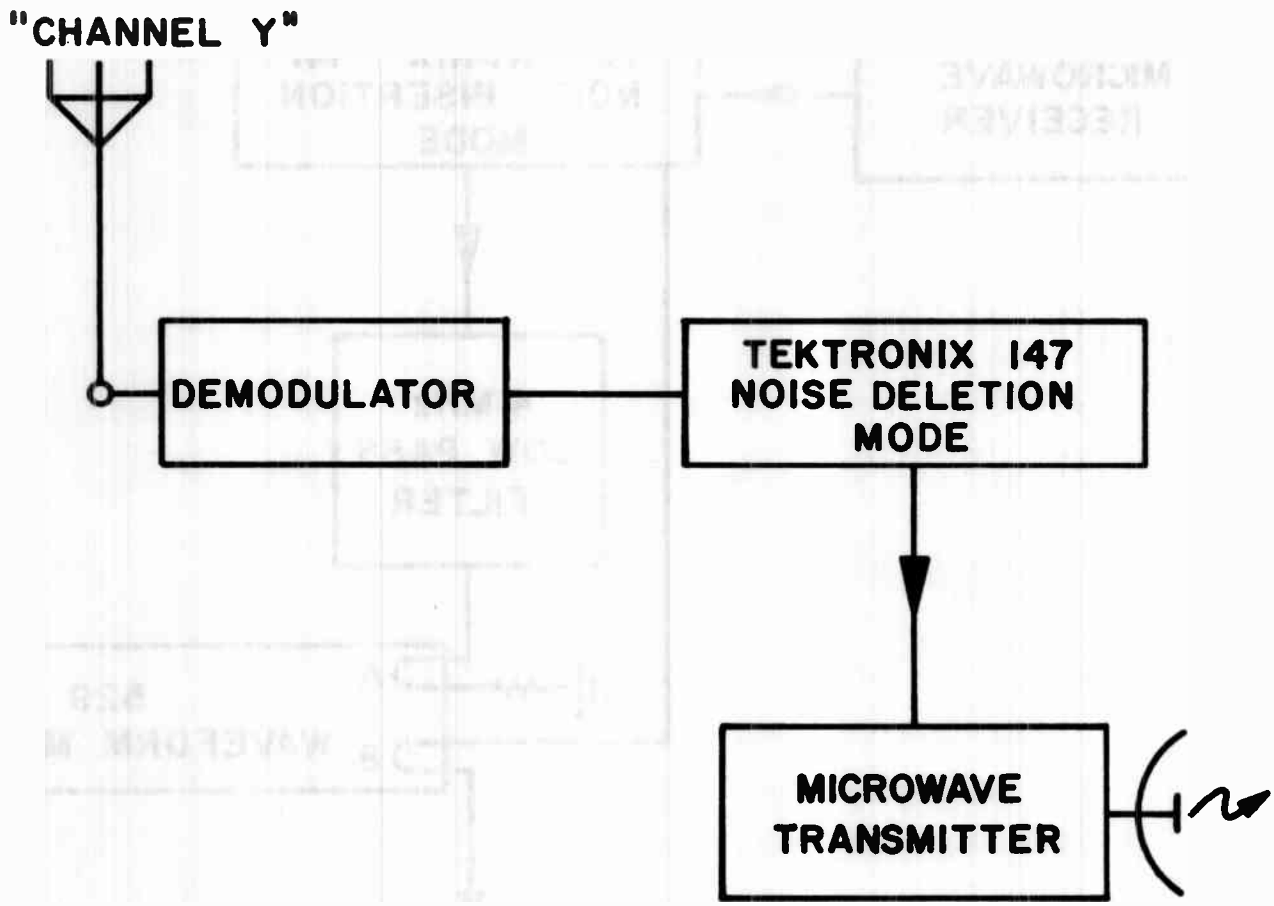
Figure 5

NOISE DELETION MODE



Display shows two successive lines in vertical blanking interval as shown on waveform monitor using the line selector.

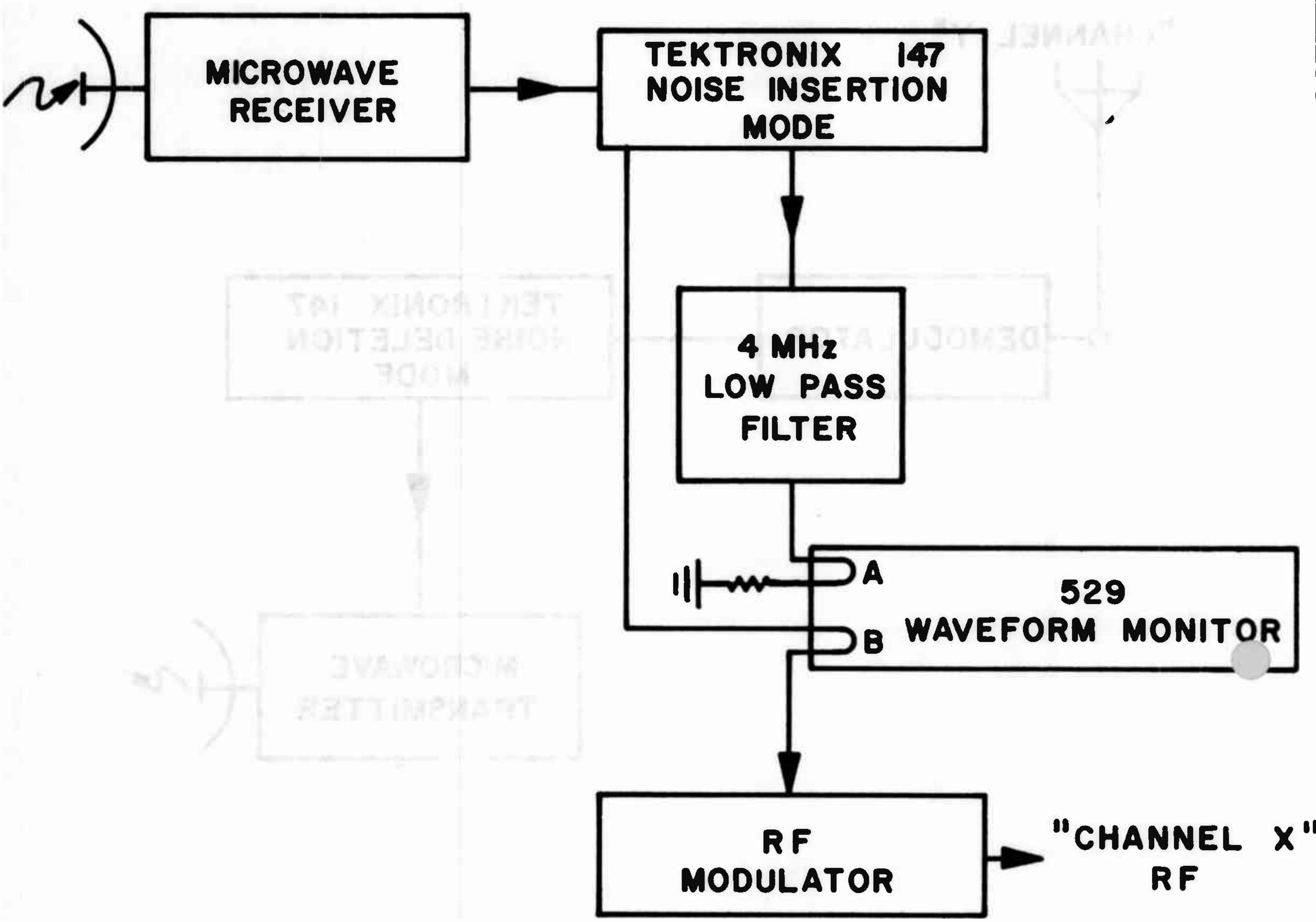
Figure 6



IN-SERVICE MICROWAVE RELAY NOISE MEASUREMENT

VIT SIGNALS MAY ALSO BE INSERTED

Figure 7



IN-SERVICE MICROWAVE RELAY
NOISE MEASUREMENT

MICROWAVE VIT SIGNALS
MAY BE MONITORED

Figure 8

16 cannot be modulated. Lines 17 - 20 may be used for test and other purposes in the near future. Line 21 may carry video at times. Noise levels on Line 21 may be higher than on Line 16 because Line 21 may carry noise from a video tape recorder. Hence, Line 16 is the optimum noise test line for CATV.

The fact that noise measured on Lines 16 and 21 may be different in measuring off-the-air signals is due to the broadcasters' practice of employing video processing amplifiers at the input of the transmitter. These processing amplifiers act as sync and blanking deleters, thereby removing noise distortion which the program sync and blanking have suffered. New sync, blanking and, sometimes, burst are reinserted by the broadcasters' processing amplifier. Noise on Line 16 will usually be deleted, leaving it a quiet line; while noise on Line 21 may not be deleted.

Noise is frequently measured through a noise weighting filter which is designed to attenuate high frequency noise components as the higher frequency noise components are less objectionable in the picture. If all sources of noise had the same power/frequency distribution, noise weighting would not be necessary. Noise in CATV systems is "white noise" and no weighting is necessary. Noise arising in microwave (FM) relay links is not white noise. Its noise spectrum is called triangular (noise rising 6 dB/octave from about 200 kHz).

If all the noise to be measured were "triangular," a filter could be included in the Type 147 noise generator to give triangular noise. However, in practice, the noise level in television signals is not all contributed by the FM portion of the system so a triangular noise spectrum is not suitable. One way to avoid the problem of "triangular" vs "white" noise is to measure the noise using both the FLAT and CHROMA bandpass characteristics of the waveform monitor. The 4 MHz low-pass filter is used in both cases. The two numbers give information about the frequency distribution of the noise being measured. This concept has yet to be developed and field tested. It is offered in the hope that CATV engineers may wish to pursue the matter.

Noise measurements may prove useful in planning preventative maintenance of the system. Routine noise level monitoring at well-chosen points within the system is not enough. Where careful records are kept of performance, the system's long term performance can be determined. Obviously, where noise levels are increasing with time, a condition is located which is going to require correction.

In summary, the noise level of standard 1.0 volt video signals may be accurately measured by deleting the noise on part of a vertical blanking line and inserting "white noise." By comparison, on a waveform monitor the level of inserted noise is adjusted to equal the noise being measured. The noise level is determined from the settings of the calibrated noise attenuator. Bandlimiting is required between the Tektronix Type 147 monitor output and the waveform monitor. The method is especially well-suited to the CATV industry.

AN IMPROVED FREQUENCY MEASURING TECHNIQUE FOR CATV

I. Switzer, P. Eng.
Chief Engineer
Maclean-Hunter Cable TV Limited
27 Fasken Drive
Rexdale, Ontario, Canada

NEED FOR FREQUENCY MEASUREMENTS

Most specifications currently in force or proposed for CATV make some reference to the frequency accuracy and stability of the TV carriers in cable television systems. The specifications usually require carrier frequency accuracies approaching those applied to television broadcast transmitters, particularly in the case of adjacent channel operations.

Television channels processed through doub conversion, heterodyne processors using the same local oscillator for down and up conversion are not changed in frequency. Neither the visual carrier frequency nor the visual-aural intercarrier spacing is changed by such processing. Any frequency errors observed in such a case must have occurred in the broadcasting station.

Television channels converted from one channel to another, either by single or multiple conversion processes or by demodulation and remodulation are subject to possible frequency errors arising the processing system. Intercarrier spacing is usually not affected unless audio is reduced to baseband and remodulated for cable system use.

A convenient and accurate method of measuring carrier frequencies in cable systems has been developed and is described:-

ACCURACY REQUIRED

Broadcast standards for frequency accuracy are +- 1 KHz for both visual carrier and intercarrier. The universal use of intercarrier sound systems in television receivers makes the intercarrier spacing a more important parameter than the aural carrier frequency itself. It is desirable to have an accuracy of at least +- 100 Hz in a measuring system to check carriers specified to +- 1 KHz. This desired 100 Hz tolerance in measurement implies an accuracy of 5 parts in 10^7 or .00005% at 200 MHz. Such accuracies can only be conveniently obtained with digital frequency counter techniques.

VISUAL CARRIER MEASUREMENTS

Digital frequency counters operate by counting the number of cycles of carrier which pass through a gate in a precisely controlled period of time. The gate time is controlled by a counter derived from a "clock" within the instrument. This clock is a precision oscillator whose stablility and accuracy set the precision attainable with the instrument. Very low cost instruments use the power line frequency as a "clock". Better class instruments use temperature compensated or oven-housed crystals as the "clock". The "clock" can be periodically calibrated by comparison with more precise frequency standards. Most digital frequency counters have an upper counting limit of from 10 to 50 MHz. This operating range can be extended by the use of digital pre-scalers or heterodyne converters. Pre-scalers divide the incoming frequency, usually by multiples of ten, reducing the frequency to a range which the counter will handle. Heterodyne converters "translate" the incoming frequency into a range which the counter will handle using local oscillators derived from the counter's own clock.

continued...

Pre-scalers are currently available to handle inputs up to 500 MHz. Heterodyne techniques may be used up to microwave frequencies (tens of GHz). A frequency counter with 1 in 10^7 accuracy and with a 500 MHz range (usually achieved by built-in pre-scaler) is very suitable for CATV use.

Waveform input requirements for frequency counter instruments are quite critical. Higher frequency instruments usually have 50 ohm inputs and require about 100 millivolts of signal. The input signal must be relatively free of non-harmonically related spurious components. Since the counter operates by individually sensing and counting each cycle of carrier there must be enough of each cycle present to trigger the counter circuitry. Trigger sensitivity varies considerably from one model of instrument to another but very few counters will trigger on the highly modulated (80 - 90%) AM television visual carriers. Even if the desired carrier is separated from all the unwanted carriers present (associated aural carrier and other TV channels in the system) the high degree of amplitude modulation prevents proper operation of most digital frequency counters. This paper describes a method of separating the desired visual carrier from the unwanted carriers and reducing the amplitude modulation to a level which most counters will accept.

The desired visual carriers could be separated for counting by using a suitable band pass filter or by using a tunable band pass filter. We find it convenient to use a tunable television demodulator for this purpose, using the selectivity of the demodulator IF section to reject all unwanted carriers. Unwanted amplitude modulation is then removed by a limiter stage. The "limited" IF carrier is then translated back to the original input frequency using a mixer and the local oscillator from the tuner. This is merely double heterodyne conversion using the same local oscillator for both down and up conversions with a limiter stage inserted in the visual carrier IF. The output frequency is the same as the input but unwanted carriers have been removed and the amplitude modulation has been reduced to a level which most frequency counters will accept.

DETAILED DESCRIPTION

A practical prototype of a frequency measurement system of this type has been in use on Maclean-Hunter systems for some time. Figure 1 is a block diagram of the instrument. A Jerrold Model TD demodulator is used as the tuner and IF system. Other demodulators or television receivers can be adapted for this purpose. The TD demodulator has the local oscillator available at a suitable level from a connector right on the tuner. Sufficient local oscillator signal can usually be derived from the tuner by coupling through a small capacitor. The loading caused by the up-converter mixer causes the local oscillator to shift by only 15 KHz. Since the accuracy, and stability of the local oscillator does not affect the output frequency, this is not important. The limiter stage which has been added is fed from the IF test point on the demodulator. It is a Motorola MC1330P integrated circuit, which is designed for use as a low level video detector in television receivers. It also has a limiter section designed to feed AFT circuitry in TV receivers. This output level is adequate for feeding the double balanced mixer which serves as an up-converter. A co-axial switch and two band pass filters are provided to reject the unwanted mixer images. The amplifier board from a small MATV type amplifier was used to amplify the output to about 500 millivolts for driving the digital frequency counter.

continued...

Effectiveness of the limiter was tested by modulating the TV carrier with a 15.75 KHz square wave. Figure 2 shows the modulation envelope of a TV carrier and its associated frequency spectrum. Modulation was set to about 80%. The first modulation side bands are about 7 db below carrier. Figure 3 shows the same carrier after limiting. The modulation envelope shows very little modulation. The associated frequency spectrum shows that modulation sidebands have been reduced by 17 db. The frequency counter accepted the limited carrier without any triggering problems. The 80% modulated carrier would not trigger our frequency counters and pre-scalers properly.

IMPROVEMENTS PLANNED

Some minor modifications are planned. A small "split-band" amplifier will take the place of the switch and band-pass filters. The present "bread-board" arrangement will be miniaturized and built into one of our TD demodulators.

We plan to experiment with a phase-lock loop in the IF which would replace the limiter stage. This would assure that we have a continuous signal available at all times without concern for limiter threshold levels. The present system will not count an overmodulated carrier properly. This may be considered advantageous because we have often detected overmodulated carriers in this way. It is inconvenient if one nevertheless wishes to make a frequency measurement on the overmodulated carrier.

COUNTER ACCURACY

Measurements made in this way are no more accurate than the clock in the frequency counter. We use a frequency standard system which is locked to Loran C transmissions. The Loran C receiver in our laboratory produces a 1 MHz signal which is phase-locked to the pulsed 100 KHz transmissions from the North Atlantic Loran C chain. The Loran C chain is controlled by a caesium beam atomic frequency standard. The Loran C transmission effectively transfers this standard to our laboratory with very little loss in accuracy. This Loran C clock is used to drive the counters in our laboratory and to calibrate counters before use in the field. Similar systems are available which lock to NBS 60 KHz transmissions.

INTERCARRIER MEASUREMENTS

Intercarrier measurements are relatively easy to make, using the same demodulator employed for the visual carrier measurements. Many demodulators have an intercarrier output available at a level suitable for direct counting by a digital frequency counter. Such an output may be easily derived from receivers or demodulators which do not originally have a 4.5 MHz intercarrier output available. The only problem encountered is the frequency modulated nature of this intercarrier sound signal. If the aural modulation can be stopped for the period of the measurement, there is no problem and the intercarrier frequency can be read by normal digital counter technique. If the carrier is modulated (FM), we can only expect to read the average carrier frequency since the counter will actually count the number of aural carrier cycles (actually intercarrier) during a fixed gate time. If the modulation is symetrical around the normal carrier frequency, and if we use a sufficiently long gate time, we will get an accurate measurement of intercarrier frequency. We have found that a 10 second gate time gives good results. With some counters this requires a pre-scaling of the intercarrier to a frequency range in which the counter uses a 10 second gating time.

continued...

The required gating time may be estimated by considering the normal frequency deviation used in TV aural carriers and the lowest modulating frequency likely to be used. Maximum deviation is ordinarily 25 KHz and the lowest modulating frequency is likely to be about 100 Hz. If we considered a "worst case" of square wave modulation by a maximum level 100 Hz square wave, the carrier could be at the deviation extremes for one half of each square wave (.005 seconds). The worst case in gating timing would be a situation in which the gate passed one more swing to one direction than it did to the other. With a square wave modulation to maximum deviation, this would pass about $4.5 \times 10^6 \times 5 \times 10^{-3} = 2.25 \times 10^4$ more (or fewer) cycles than the centre frequency. This 2.25×10^4 is a worst case error and is independent of the gating time. For this error to be less than 100 Hz in a 4.5 MHz measurement, it must amount to less than about 2 cycles in every 10^4 cycles counted. The total number of cycles counted should, therefore, be more than $2.25 \times 10^4 \times 2 \times 10^4 = 4.5 \times 10^8$ cycles. A 100 second gating time would pass this many cycles of a nominal 4.5 MHz carrier and guarantee the desired accuracy. This calculation has been based on worst case extremes and we have found that a 10 second gating time gives very acceptable results.

SUMMARY

A simple double conversion technique permits separation and limiting of television visual carriers so that they can be reliably measured with a digital frequency counter. The double conversion system uses readily available components and can be bread-boarded in a few hours. Frequency counters operating in the desired range of carrier frequencies are essential for practical measurements. Intercarrier measurements are easily made with the same equipment using the 4.5 MHz intercarrier output from the demodulator. A 10 second gating time is usually adequate to average the frequency swings caused by the FM modulation of the aural carrier.

July, 1971

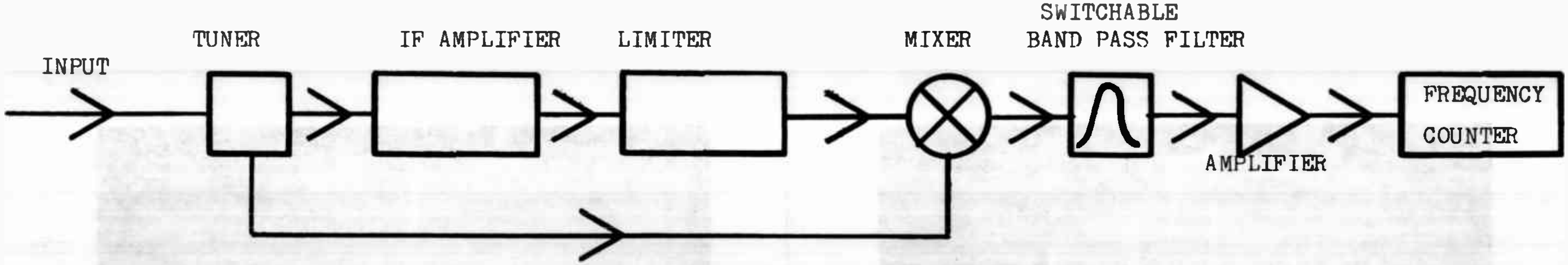

INPUT
TUNER
IF AMPLIFIER
LIMITER
MIXER
SWITCHABLE
BAND PASS FILTER
AMPLIFIER
FREQUENCY
COUNTER

FIGURE 1

80% modulation (15.75 KHz square wave)

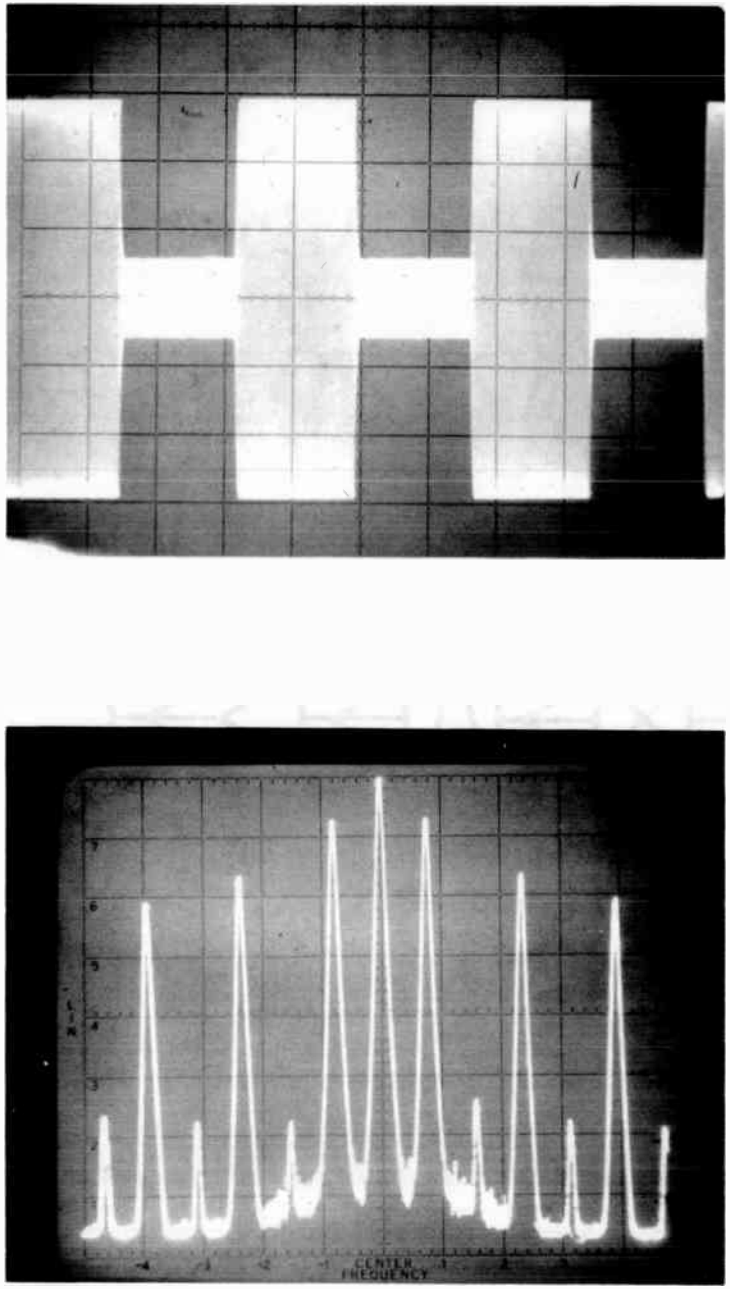


FIGURE 2

after limiting

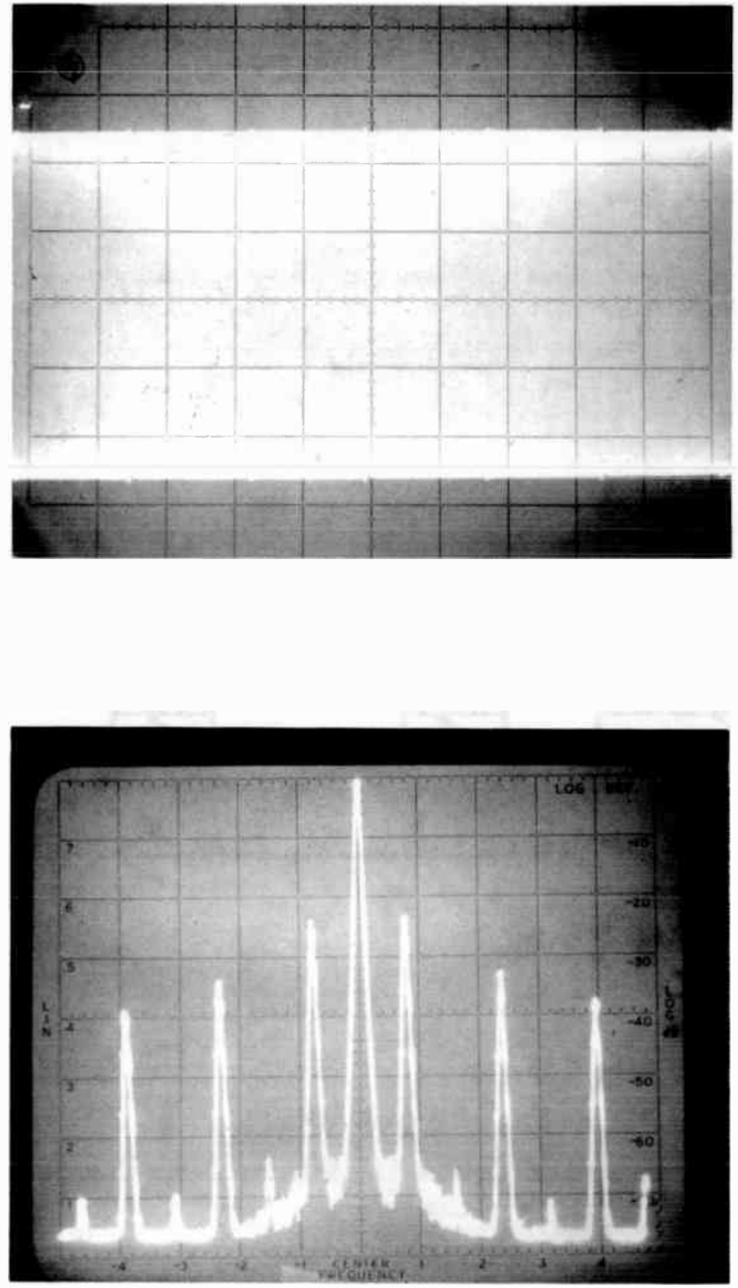
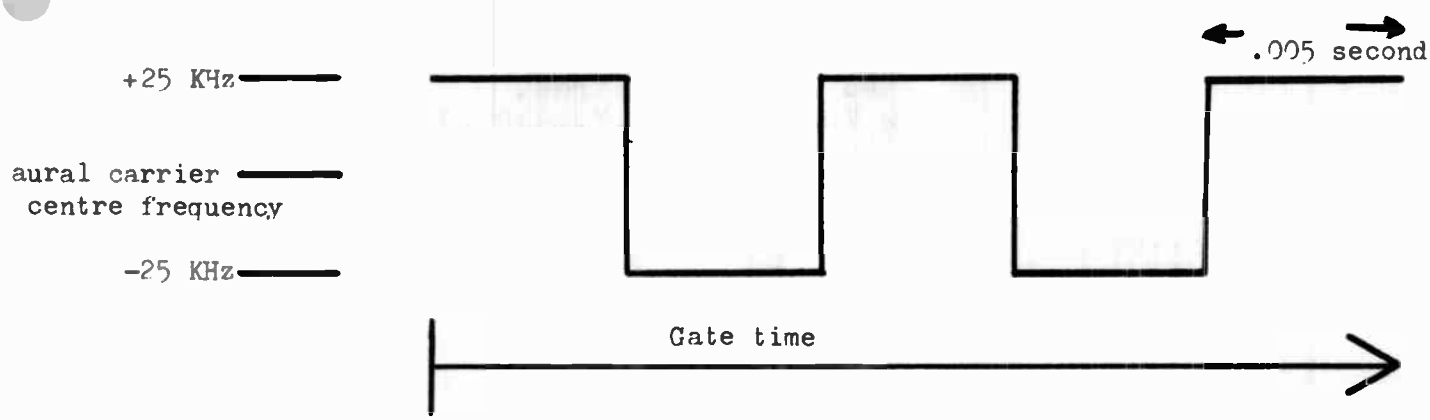


FIGURE 3

10 db/div

20 KHz/div



Idealized FM (100 Hz square wave modulation)

Figure 4

ENVELOPE DELAY, PHASE DELAY, GROUP DELAY, CHROMA DELAY.... WHAT DOES IT MEAN, HOW IS IT MEASURED?

Fred J. Schulz, V.P. CATV Engineering
STERLING COMMUNICATIONS, INC.
43 West 61st Street
New York City, N.Y., 10023

Contents

1. Introduction

The CATV industry is still growing, and in its path to maturity it is becoming more sophisticated technically. While in the early days of CATV it was sufficient to get a picture to the subscribers' TV set one is now confronted with meeting federal specifications. A number of new terms have crept into the CATV engineers vocabulary, some of which may be familiar, some of which may however have been misunderstood. The following presentation focuses on giving simple (and in some instances simplified) explanations of terms such as "envelope delay", "chroma delay", etc. An attempt will be made to explain the effects on picture quality. Appropriate test equipment, test methods and cost are explained. The explanations will be held in simple form so hopefully the average CATV engineer can follow; mathematics will be avoided.

The first part is devoted to the introduction of some necessary fundamental know how, and may be looked upon as a refresher for those already familiar with it.

2. Types of distortion

The function of a CATV system is to bring high quality undistorted pictures to a subscriber's TV set. The CATV engineer is usually familiar with distortions such as: noise, cross-modulation, second order distortion, echoes, amplitude distortion, etc. Cross-modulation and second order distortion are so called non-linear distortions. Amplitude distortion does usually not depend on signal levels; it is called a linear distortion.

Amplifiers and filters may also exhibit phase distortion, another linear distortion. Phase distortion is of prime concern in single channel and studio equipment, and will be explained here, since the CATV engineer seems to be least familiar with it.

3. Phase shift and phase delay

Phase shift is most readily explained with an experiment; let's feed a CW signal into a low pass filter and observe the input and output wave forms on a dual channel oscilloscope:

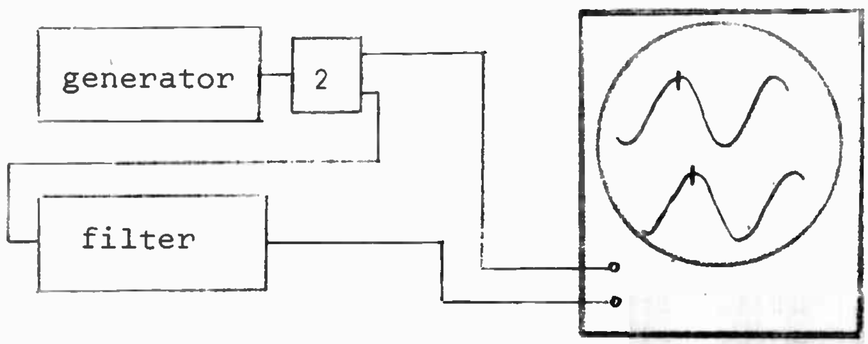


Fig.1

We find that the output waveform is not in phase with the input (the crests of the waves are shifted with respect to each other). We say there is phase shift. In this case the output lags the input wave. Phase shift is measured in degrees. One full cycle of a wave is 360°.

Phase shift occurs in any network containing capacitors and/or coils.

Another way of interpreting this effect is to say that the output is delayed compared to the input signal. Physically this makes sense, since it obviously does take a finite time for the signal to pass through the filter. If we express the phase shift as delay time we speak of phase delay. Phase delay = $\dfrac{\text{phase shift in degrees}}{360 \times \text{frequency}}$

TV waveforms are not as simple as the foregoing sinewave signal, but the basic principle still hold. We should be aware that the phase shift of a wave through a filter is usually not constant as the input frequency is moved through the range of the filter and particularly as the frequencies pass through the cut-off region. If we plot the phase shift versus frequency we may get a curve as follows:

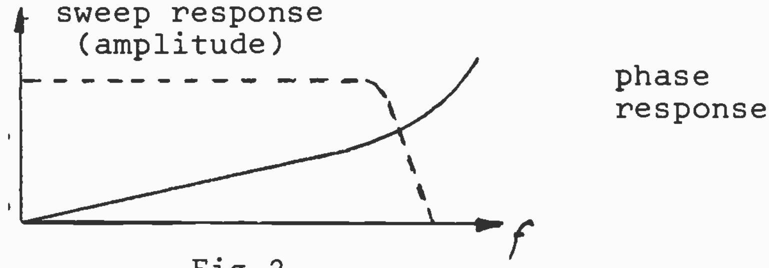


Fig.2

To be more specific we should label the sweep response amplitude response; after all the familiar sweep generator setup measures the amplitude versus frequency characteristic. The phase characteristic is seldom measured, but we believe this will become more common place in the future, particularly for single channel devices.

4. The make-up of TV waveforms

A square wave is a familiar waveform to all of us, if fed into a modulator a series of black and white bars will appear on the screen.

The square wave can be understood better if it is broken down into its components. This is called "Fourier Analysis", but let the word not frighten you, the basic principles can be well understood without the rather advanced mathematics usually associated with it.

Let us feed a square wave through a bandpass filter, one which will just pass the signal equivalent to the fundamental frequency. The resulting output is a sinewave.

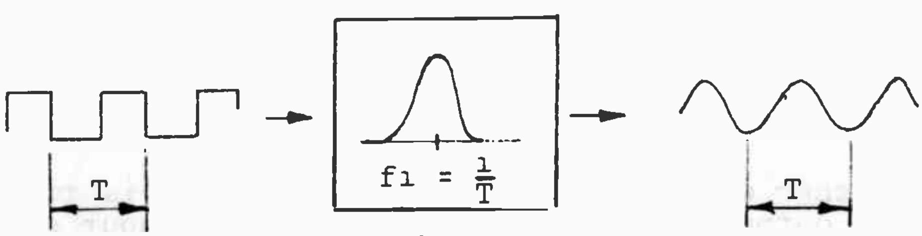


Fig.3

We also get a sinewave output if we feed the square wave through a filter with a bandpass for three times the fundamental frequency.

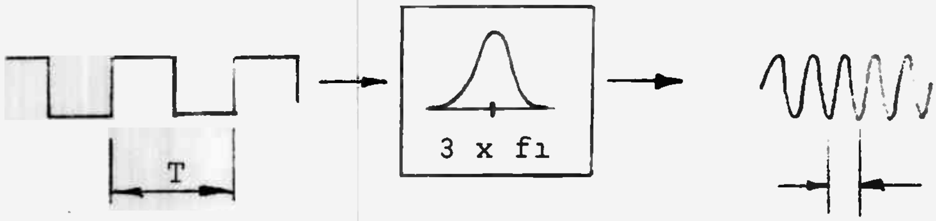


Fig.4

The same will happen if we use a filter for 5 times the fundamental, also for 7 times, 9 times, etc.

We can say that the square wave is made up of a fundamental and all odd harmonics. If the square wave has truly "sharp" corners and vertical sides we will get harmonics at all odd multiples of the fundamental up to infinity. The fundamental is the highest amplitude component, higher harmonics are of decreasingly lower amplitude.

We just "disassembled" a square wave into its sinewave components. Conversely we can reassemble the wave from its sinewave components. Graphically this looks like this:

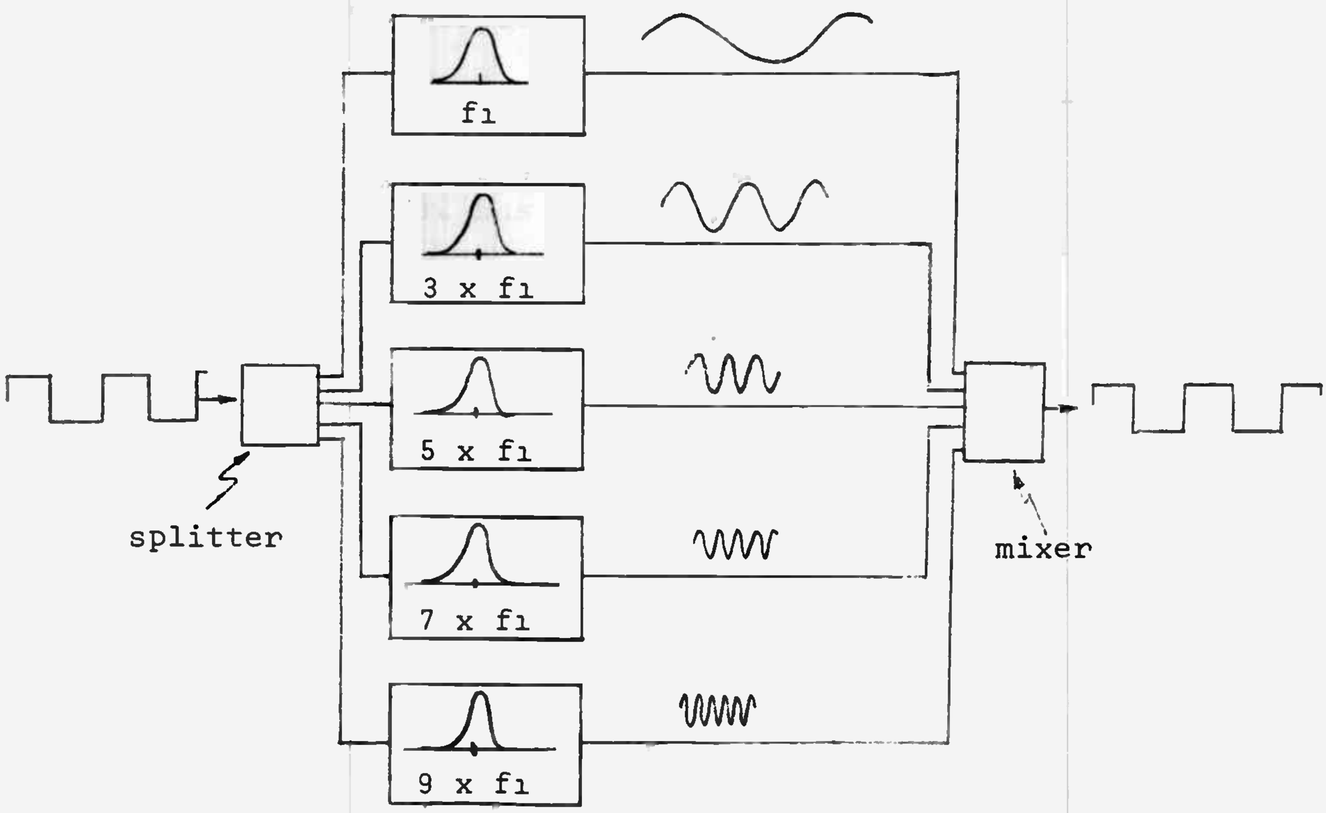


Fig.5

The following picture shows the fundamental and the first three harmonics of a square wave:

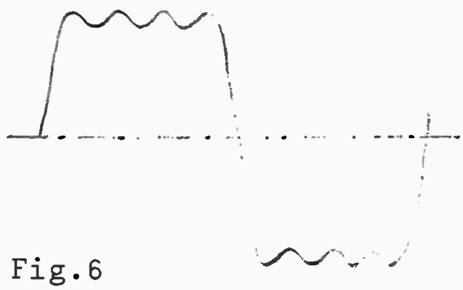


Fig.6

The result is not a very good square wave since one should also add the 9th, 11th and all other odd harmonics to make a true square wave. It should also be noted that a square wave does not contain any even, such as 2nd harmonics. The principle, however, holds.

Any waveform can be made up of harmonically related sinewaves. Another rule worth remembering is:

> " A waveform with very abrupt amplitude changes contains significant components up to many times its fundamental frequency."

<u>5. Waveforms through filters</u>

Let us look at the previous example again, but let us feed the signal through a low pass filter which passes only the fundamental, the 3rd and 5th harmonics, but cuts off the 7th harmonic:

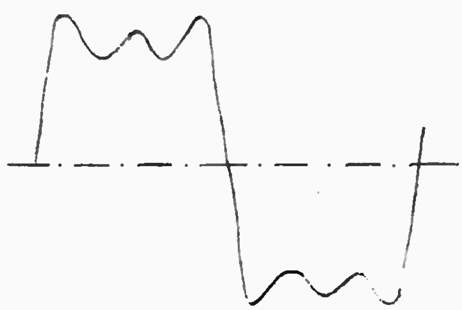


Fig.7

We see that to faithfully reproduce the input waveform one must pass all significant frequencies.

As the next experiment let us pass the signal through a filter which attenuates the 5th harmonic, such as a trap would:

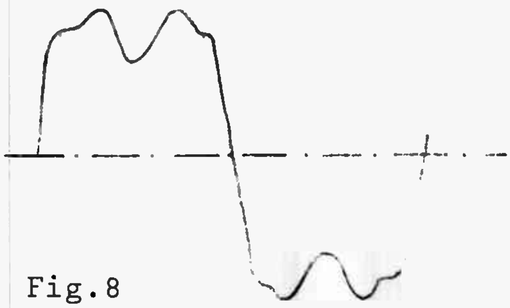


Fig.8

So far we concerned ourselves with changes in amplitude of the various frequency components only.

We indicated earlier that signals passing through a filter also get a change in phase or a delay, and further that not all frequencies may suffer the same delay. Let us pass the sample wave through a filter which shifts the 5th harmonic by 15° and the 7th by 30° with respect to the fundamental:

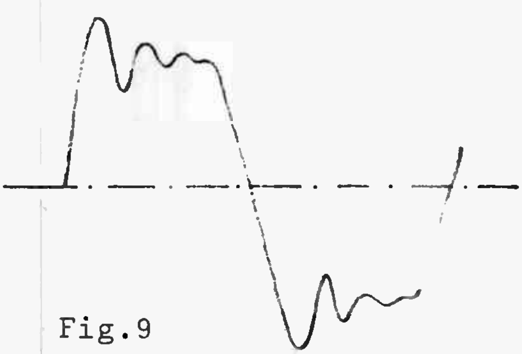


Fig.9

The output is non-symmetrical with a very pronounced ringing. As a further example let us shift the 3rd harmonic by 30°, the 5th by 60° and the 7th by 90°:

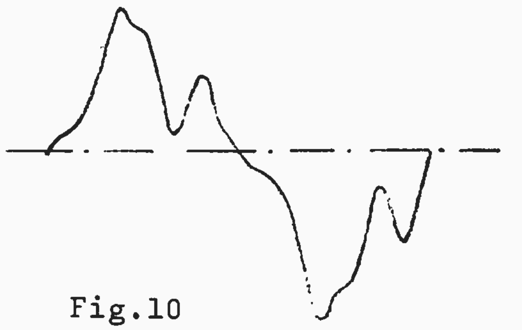


Fig.10

From these examples it is obvious that we must retain the relative positions of the signal components or distortions will result. The delay of the various frequency components, also called a group of frequencies, must be equal for distortion free transmission. If this is not the case we speak of group delay distortion or simply group delay. The group of frequencies, if applied to a modulator, will result in a carrier and associated sideband envelopes. The envelope which contains the modulation must be passed distortion free or we speak of envelope delay distortion. The terms envelope delay and group delay are generally used interchangeably.

For the sake of completeness let us also state the accepted definition of envelope delay:

"Envelope delay is the rate of change of the phase versus frequency curve."

Mathematically expressed:

$$\text{Envelope delay} = \frac{d\phi}{d\omega}$$

Delays are usually so small that they are expressed in microseconds (millionth of a second) or nano seconds (billionth of a second).

The effects of envelope delay result generally in ringing (preshoot, overshoot) producing closely spaced ghosts particularly visible on vertical black/white transitions. Another effect, color misregistration will be treated later.

6. Instruments to measure envelope delay

Envelope delay measuring equipment is built to measure the change in phase a sample signal suffers when passed through a device under test. A block diagram of such an instrument follows:

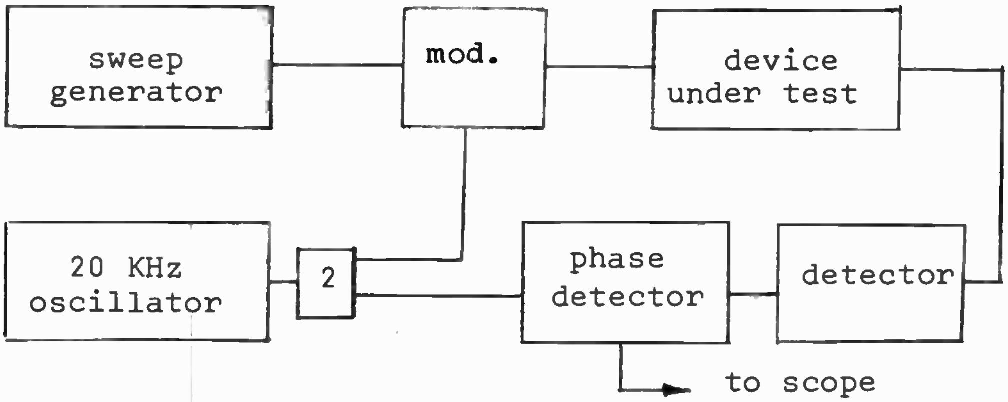


Fig.11

The following is a list of instruments now on the market with approximate prices (the list may not be complete):

1. Rhode & Schwartz - Model LFM 0.1 - 10 MHz	\$6,300.- plus sweep gen. & oscilloscope
2. Wandel & Golterman - Model LO-1 0.1 - 14 MHz	\$17,250.- complete setup
3. Datatek - Model D-700 0.05 - 50 MHz	\$3,200.- plus sweep gen. & oscilloscope
4. RCA - Model BW-8A	\$3,100.-
5. Hewlett-Packard - Model 3700 45-95MHz microwave analyzer (IF)	\$7,500.- complete setup
6. Hewlett-Packard - Model 8405 Vector Voltmeter	\$2,850.-

It should be noted that most listed equipment covers video frequencies only and additional modulators and demodulators must be used to cover RF frequencies.

It is not the purpose of this paper to give detailed information and exact cost of test equipment packages, but here are some comments on the various products.

The Rhode and Schwartz equipment package is by many regarded as the "Cadillac" of delay measuring gear. The full package to perform measurements from video frequencies to 250 MHz costs in excess of $10,000.-. Such a setup is primarily intended for lab use.

The Wandel & Golterman equipment is restricted in its frequency range to video, but can measure envelope delay where transmitter and receiver are separated such as in microwave systems.

The Datatek unit is a relatively new unit on the market and is aimed at the broadcaster since it covers the video and the new IF modulator frequencies. It contains a sync and blanking generator to make measurements in video amplifiers with DC restoration. It is also equipped to measure delay at various average picture levels and features 50 and 75 ohm impedance levels. This unit may find use in some CATV systems.

The HP microwave analyzer is aimed at testing microwave links and accomodates basically a 70 MHz IF frequency range.

The RCA unit is primarily intended for use with TV transmitters, it is one of the older designs.

The Vector Voltmeter needs additional external equipment to make it suitable for swept envelope delay measurements.

The listed equipment is intended to measure delay continuously with appropriate sweep generators. The results are displayed on an oscilloscope similar to the familiar amplitude sweep response. Most instruments allow for the simultaneous display of both amplitude and delay as shown below for a bandpass filter.

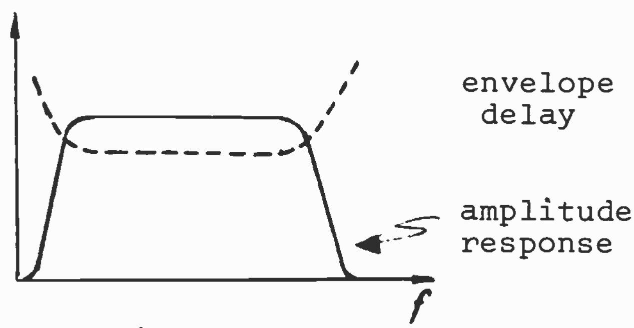


Fig.12

Delay measurements also require very good impedance matching all around; because mismatch causes reflections with resulting ghosts, and ghosts are a delay phenomena also.

To measure delay at RF frequencies one needs a modulator and a demodulator, which by themselves already exhibit some delay. The best modulator demodulator combinations available today have a residual delay of ± 20 nsec. over a 4 MHz video band pass.

7. Chroma delay

A standard color TV picture consists of a high definition black and white picture with a low definition color picture added to it. The color information is carried at the upper end of the video spectrum around a 3.58 MHz color subcarrier. The frequency distribution looks like this:

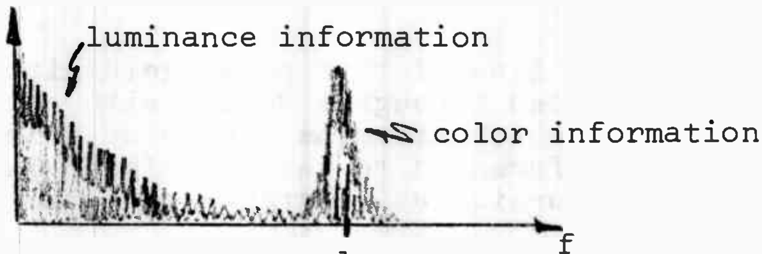


Fig.13

It is important that the color information arrives at the picture tube at the same time as the black and white picture or the color will be out of registration. This error can be called chroma delay. In reality it is simply the envelope delay between the low frequency black and white picture components and the delay of the color information around 3.58 MHz, as shown below:

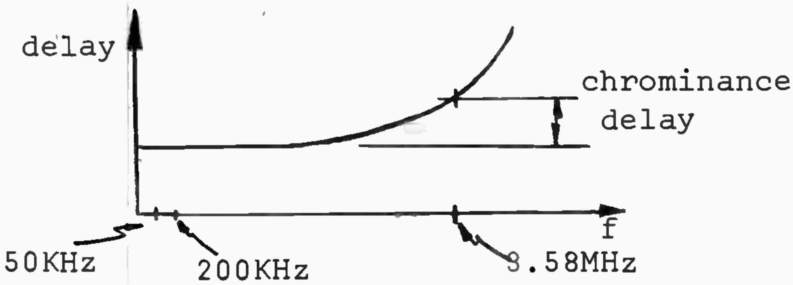


Fig.14

Chroma delay is one of the most visible effects of envelope delay and methods to measure it rapidly have been developed.

The 20T pulse has gained wide acceptance for measuring chroma delay; it is a low frequency pulse modulated with 3.58 MHz color subcarrier signal. Its shape and frequency components are pictured below:

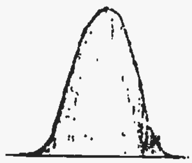


Fig.15

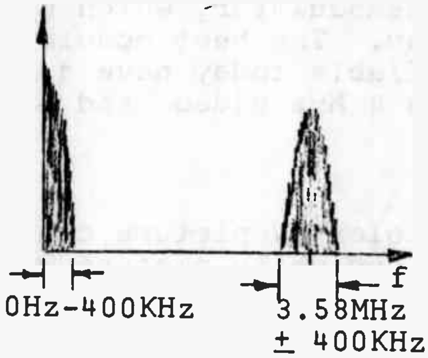


Fig.16

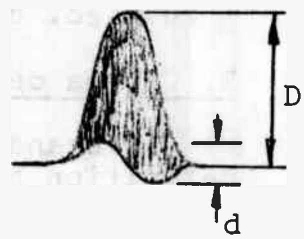


Fig.17

The base line of this pulse gets distorted when the signal is passed through a device with chroma delay. It is possible to determine the delay by measuring pulse height (as referenced to the bar signal level) and the base line excursion using graphs or formulas.

Several manufacturers offer instruments that allow the introduction of delay of opposite polarity and of 3.58 MHz gain/loss to straighten the base line; the introduced delay is then a direct measure of the chroma delay. Instruments to generate 20T pulses cost around $1,500.- usually coupled with generation of other test pulses. The cost of the special receiver described above is approximately $1,500.-. The 20T pulse was originated in Europe and is in wide use there; U.S. networks are not using it yet for transmission over the air.

Tektronix is now featuring a 12-1/2T pulse which yields a wider frequency spectrum around the color subcarrier to be more representative of the actual color information bandwidth and to yield easier computation of the chroma delay from the measured base line excursion.

Tektronix has introduced a way to measure chroma delay using the color bar test pattern. This method makes use of the fact that the chroma signal transition between the green and the magenta bars is easily identifiable because the phase changes 180°, and the luminance changes level as well. The delay can then be measured on a waveform oscilloscope. Luminance/chrominance cross talk effects are also eliminated if Tektronix generator, model 146, is used, since the chrominance and luminance signals are available separately. A scope presentation looks like this:

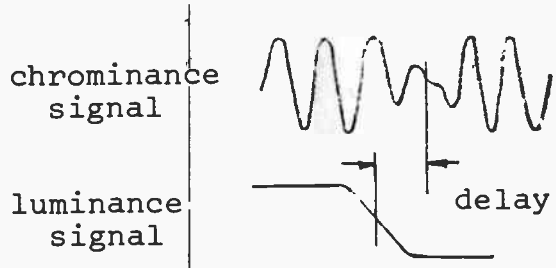


Fig.18

The 20T (or 12-1/2T) pulse measures the "average" delay between the low luminance frequencies and the color subcarrier region. Some people have reported good agreement between 20T pulse measurements and continuous measurements with swept envelope delay equipment, others have found discrepancies. Discrepancies may possibly happen when the delay curve is very non-symmetrical about the color subcarrier. Another effect of non-symmetrical delay is color quadrature cross-talk, which results in color boundary effects.

Color misregistration is also called funny paper effect. Opinions on how much chroma delay is tolerable vary widely in industry. A figure of 200 nano seconds results in a shift of the color by approximately 1/16" on a 23" TV set. At least one CATV manufacturer considers this tolerable. A major test equipment manufacturer feels that 250 nano seconds yields an untolerable misregistration. A member of the Philips research laboratories considers 50 nsec. chroma delay just perceptible under studio conditions. The subject matter is of great importance. Shift of red letters on white background are more readily visible than e.g. blue letters on white. A recent study made by Bell Laboratories, showing color slides on a video monitor to a group of trained observers found that 100 nsec. of flat delay or 180 nsec. of shaped delay was just perceptible. For no objectionable impairment the figures were 260 nsec. for flat delay and 480 nsec. for shaped delay. Shaped delay means delay gradually rising (or falling) from the low frequencies towards the color subcarrier region. Flat delay means constant delay over the subcarrier region; color processors, which separate luminance and chrominance signals may exhibit flat delay.

About the only thing everybody agrees to is that it is highly desirable to keep the delay as small as possible, since delays are additive.

8. Effect of delay

We already treated the special case of chroma delay. Delay effects at other frequencies result mainly in waveform distortions. We saw earlier that a waveform can be distorted by deleting higher frequency harmonics or by delays. A pulse which is representative of an actual picture waveform as produced by the scanning beam in a TV camera, and which does not contain frequency components above 4 MHz is the so called 2T sine squared pulse. This pulse is transmitted by many TV stations as a vertical interval test signal. The pulse is 250 nsec wide at half amplitude. When envelope delay is present, the pulse gets distorted as follows:

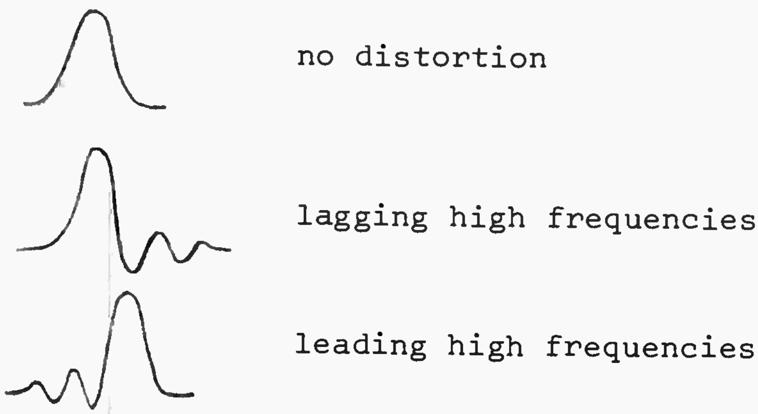


Fig.19

A multitude of distortion patterns are possible. To judge the acceptability of a distorted pulse, a frame or window has been devised, the so-called K-factor graticule.

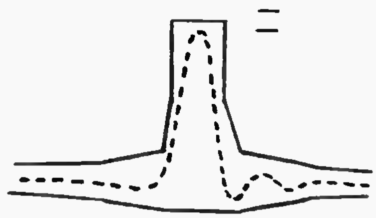


Fig.20

If a pulse is within the outlines of a 2% graticule it is considered very good, 4-6% is acceptable. There is no total industry agreement on the K-factor and a tie-in with actual numbers of envelope delay has not been possible. The K-factor has been treated extensively in the literature.

9. Delay effects in 2-way filters

Two-way filters are in essence a combination of a low pass and a high pass filter with a sweep (amplitude) response as follows (both LP and HP sections shown together).

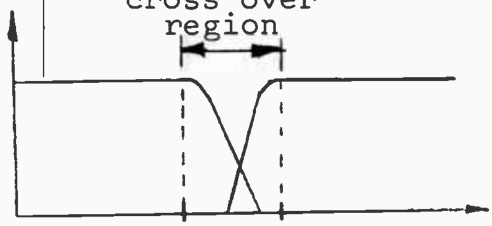


Fig.21

We stated earlier that sharp amplitude response changes are likely to bring delay changes with it. It is easily seen that the narrower the cross over region is made,the sharper the cut-off rate must be. A narrow cross-over region is desired to make the sub-channel return band as wide as possible.

A compromise between usable bandwidth and tolerable envelope delay at the edge channels must be made. There is some specmanship taking place, but most manufacturers feel that 30 MHz is the highest usable sub-channel frequency. Delay effects are cummulative, 50 amplifiers with filters at the input and output result in 100 filter delays all added. If we consider 200 nsec of chroma delay tolerable, each filter cannot contribute more than 2 nsec. The designers of two-way gear are well aware of this problem. To get more reliable measurements one tests a number of filters in cascade, commercially available delay test gear cannot resolve nano second delays very accurately. A fair number of systems have used sub-channels to feed signals back to the head-end by using either Blonder-Tongue model MSVM, Jerrold FCO-47 or similar filters. These filters have a very narrow cross-over region and should not be cascaded in large numbers. A B-T model MSVM was measured at 8 nsec chroma delay at channel 2.

Most of the cross-over filters are of a design with a smooth envelope delay curve so it seems that the chroma delay is a good indication of delay performance. This is not the case with sharp band pass filters however, where the delay may vary in a ripple like fashion.

10. Measured delay curves of some CATV equipment

Fig.22 shows amplitude and envelope delay of a sharp band-pass filter with a trap for the adjacent upper picture carrier. Fig.23 shows a band-pass filter without an adjacent channel trap. It should be noted that the amplitude response over the channel looks reasonably identical for both filters, the delay curves however, do not. The delay distortion below the picture carrier has not received as much attention as the delay at the upper band edge. There seems to be a new awareness of this fact and future equipment designs will take this into account. Delay errors below the picture carrier can produce leading pre-shoot and a following slow approach to final value at sharp video transitions, resulting in a smearing effect on vertical edges.

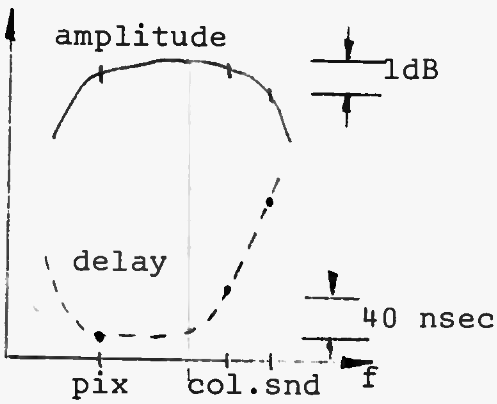


Fig.22

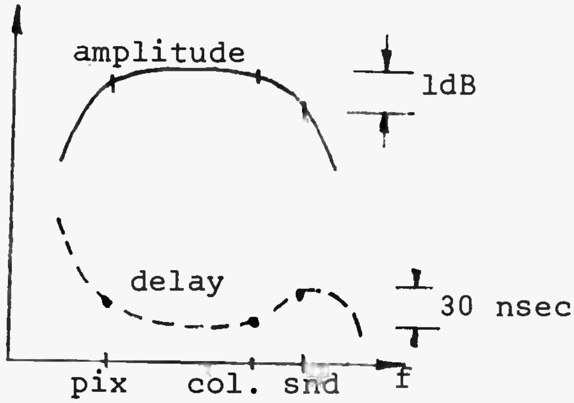


Fig.23

Fig.24 shows the amplitude and delay response of a strip amplifier with less selectivity than the previous band-pass filters. Envelope delay is very small. Fig.25 shows the delay of a narrow band trap tuned for maximum signal rejection (60dB down). Tests on this trap showed a great variation in envelope delay with very small changes in tuning. The same is true for sharp band-pass filters. Test equipment found in the average CATV shop is not good enough to align sharp filters reliably.

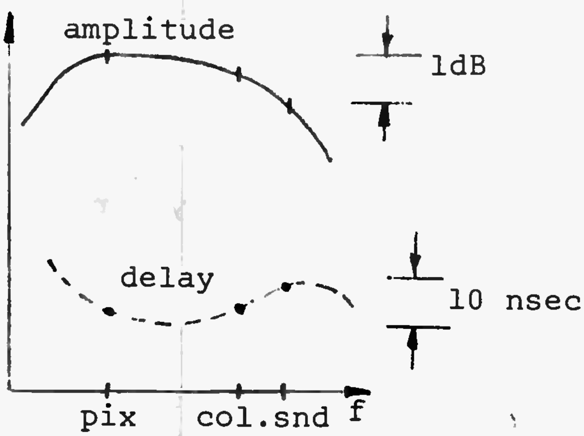


Fig.24

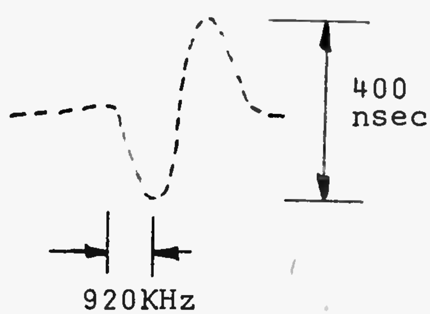


Fig.25

11. The broadcaster and envelope delay

Filters with sharp cut-off have particularly bad envelope delay problems unless compensated for by using extra filter sections. Compensated filters are costlier.

A TV set IF amplifier must be reasonably "sharp" to suppress adjacent channels, it also contains a sound trap, plus traps for the suppression of adjacent channel carriers. The IF does introduce a certain amount of envelope delay. When the currently used color system was proposed by the National Television Standards Committee (NTSC) in the early 1950's, it was proposed to pre-distort the transmitted signal rather than to include costly delay equalizers in every TV set. The recommendations resulted in the currently used transmitter delay curve shown below:

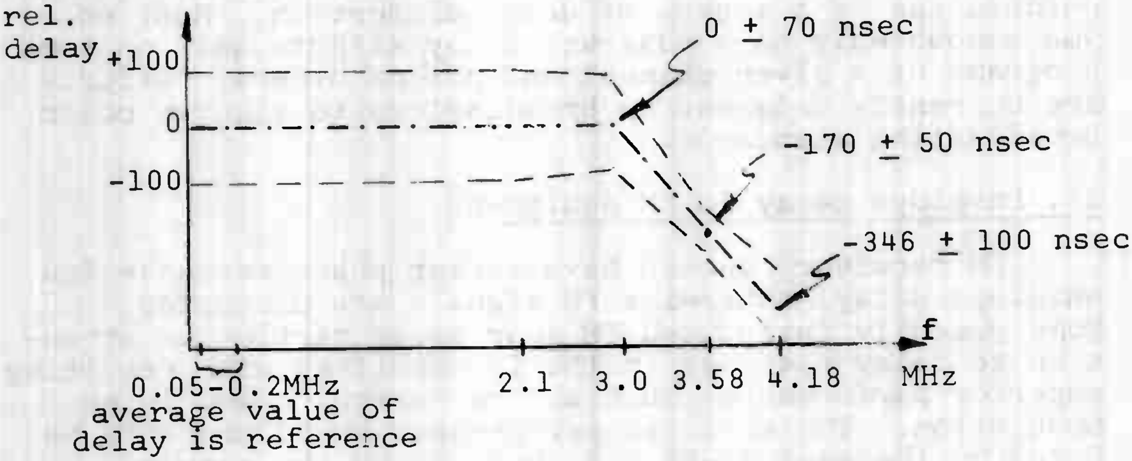


Fig.26

This pre-distortion is exactly the opposite of a "typical" TV set, which has a rising delay curve from approximately 3 MHz to the upper band limit of 4.18 MHz. There were relatively few color TV sets measured to arrive at the so called "typical" receiver delay curve. The response characteristic of a TV receiver is not covered by regulation nor by industry standards. Recent measurements on a number of receivers has indicated a wide range of envelope delay curves. TV receivers are usually designed for a good compromise between selectivity, transient response, color response, cost and other factors. Some people feel that the present transmitter delay curve should be changed; however, until so done one must adhere to it.

A broadcaster is obliged to pre-distort the radiated signal per FCC specs. This pre-distortion is taken care of by type accepted filters and by measurements during the manufacture of the transmitter. Proof of performance measurements, made when a transmitter first goes on the air do not require the measurement of delay. Many broadcasters use adjustable equalizers to make up for delay deficiencies in the transmitters. Equalizers of this kind cost several thousand dollars.

All video signals fed to the transmitter are automatically pre-distorted, however, the signal may suffer delay distortion in the studio or on its way to the transmitter. There are no rules on the maximum allowable delay distortion for signals leaving the studio. It is then perfectly possible that an over distorted signal is transmitted. Color processors used in studios often separate the luminance and chrominance signals with the possibility of introducing delay (or advance) in either luminance or chrominance. Video tape recorders can be a source of delay distortion. Many of you undoubtedly have observed delay effects only on some programs of a given channel and not on others. Efforts are currently underway by broadcasters to tighten color broadcasting standards.

12. Envelope delay in FM equipment

FM receivers should have linear phase response (no envelope delay) otherwise FM signals are distorted. Some recently introduced FM gear payed particular attention to delay response in the IF amplifier with resulting superior performance, such as low harmonics and intermodulation. The achieved performance would probably be noted by the real Hi-Fi bug, but not by the average listener. Present FM head-end gear is designed along more conventional lines with typical Hi-Fi gear performance.

13. Delays in trunk and distribution plants

It was pointed out earlier that delay distortion and rapid amplitude changes such as found in single channel equipment go hand in hand. A CATV plant is wide band and accordingly has little envelope delay. Jerrold showed the following delay curve of an 18-amplifier cascade.

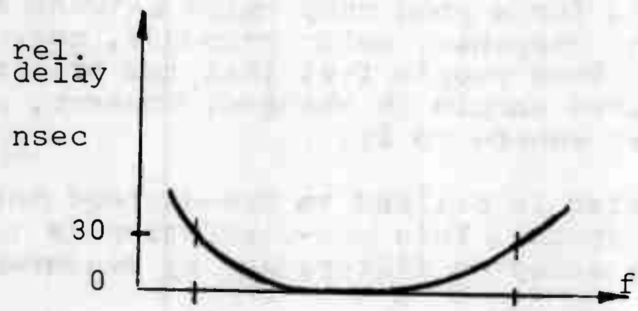


Fig.27

Hewlett-Packard in their appl. note #92 show the delay of a single CATV amplifier as 2 nsec from 54 to 120 MHz, and within 1 nsec from 120 MHz to 216 MHz.

14. Regulations

The proposed technical standards for CATV do not mention envelope delay specificall . The standards however, clearly indicate that the CC wants the CATV system to faithfully reproduce the received signals at the subscriber's set.

The recently enacted Canadian standards require local origination signals to be pre-distorted per DOC (Canadian equivalent of the FCC) specs and that head-end processors must retain the original pre-distortion. Type approval of gear is considered since it is recognized that not every CATV operator will be able to purchase envelope delay measuring gear.

It is my opinion that it is only a matter of time before the FCC will take a similar stand.

Manufacturers will probably be required in the future to certify modulators, demodulators and signal processing equipment as to envelope delay and other types of distortion.

It may be of interest to realize that some TV studio specifications call for ± 25 nsec envelope delay.

15. Summary

An attempt has been made to explain "delays". It should be understood that delays can cause but one of the many distortions a signal can suffer from scene to TV set. For single channel equipment envelope delay measurements are a necessary complement to the more familiar amplitude response. Both amplitude and delay responses must be performed under all encountered signal level conditions.

16. Acknowledgements

Manufacturers of delay measuring and test equipment as well as many people in the CATV industry have been most helpful by giving freely of their time and knowledge. All such help is gratefully acknowledged.

17. Bibliography

1. Radio Engineers Handbook, Terman

2. Television Engineering Handbook, D. Fink

3. Television Systems Measurements, Tektronix 062-1064-00; 1969

4. Rohde & Schwarz; instruction book model LFM envelope delay set

5. Datatek; instruction book model D-700 envelope delay set

6. 1969 NCTA Convention transcript

7. 1970 NCTA Convention transcript

8. Proceedings of the IEEE, July 1970; issue on cable TV

9. Color Television, selections from the Journal of the SMPTE; 1970

10. Subjective effects of delay difference between luminance and chrominance information of the NTSC color TV signal; A.Lessman, Bell Tel, Holmdel; SMPTE meeting, Los Angeles, April 1971

11. Envelope delay in CATV systems; G.Rogeness TV Communications, October 1965

12. Television Signal Analysis; A.T.& T. Long lines dept.

13. Envelope Delay -- the misunderstood phenomena of TV systems; Archer Taylor; IEEE Convention, March 1971

14. Measuring Envelope Delay in Communication Circuits for Digital Data Links; E.Thompson; Electronic Instrument Digest, July 1968

15. Correlation between TV Transmitter Performance Measurement and Picture Quality; T. Gluyas and W. Behrend; IEEE, BC-14, March 1968

16. Chrominance to Luminance Ratio and Timing Measurement in Color Television; C.A.Siocos; IEEE, Vol.BC-14, March 1968

17. Performance Comparison of TV Transmitter RF Demodulators and the Home Receiver; W.Behrend; IEEE, Vol.BC-17, March 1971

18. Measurement of Receiver Phase Characteristics; W.Hand; IEEE, T-BTR 70, Nov.

19. Phase Shift Consideration in TV Broadcasting; M.W.Davies, Datatek

20. A New Low Distortion FM Tuner; IEEE, T-BTR 70, Nov.

21. Hewlett-Packard, Application notes AN77-4 and 91

22. Proceedings of the IRE, Jan. 1954

For Presentation at the NCTA Meeting
July 8, 1971 Washington, D.C.

Subject: Description and Tests on Impact Welded Cable Splices

Authors: William E. Good
Chief Engineer
Heintz Division, Kelsey-Hayes Company
Philadelphia, Pennsylvania

Thomas H. Ritter
Director, Research Laboratory
TelePrompter Corporation
Lompoc, California

Abstract:

A coaxial cable splicing system is described based on the use of cold pressure welding for the center conductor and rebuilding the dielectric and outer portions of the cable.

Good progress is being made in the development of light weight portable equipment which is needed to implement the cable splicing system.

Tests on the completed joints show that the splice is virtually indistinquishable from the cable.

The splice method shows promise for greatly increasing the reliability of coaxial cable systems.

ANTENNA RADIATION PATTERN ANALYSIS

&

CO-CHANNEL PROTECTION

by

Steven I. Biro

B-RO Antenna Head-End Engineering

Princeton, New Jersey

INTRODUCTION

Many CATV technicians, with otherwise well-rounded backgrounds, have been forced in the past and will be required in the future to make critical antenna or antenna-array selections to avoid annoying co-channel interference problems.

This paper has been prepared to clarify:

1. What are the basic terms and classifications of antenna radiation patterns.
2. Why radiation patterns must be taken on the antenna test range.
3. How to analyze antenna radiation patterns.
4. Why radiation pattern irregularities must be given special attention.

BASIC TERMS AND CLASSIFICATIONS OF RADIATION PATTERNS

Co-channel protection is basically an antenna performance problem which is characterized by the antenna specifications. Antenna manufacturers usually publish a more or less complete list of electric parameters of their products, such as antenna gain, input match, front to back ratio, beamwidth, etc. However, this qualitative information is not sufficient for co-channel protection evaluation. For a meaningful QUANTITATIVE evaluation we must have at our disposal the actual radiation patterns, as taken on the antenna test range.

Every antenna has a three dimensional radiation pattern because it is radiating into all angles of space. However, for co-channel evaluation purposes we can limit our investigation to the horizontal (E) plane. The different co-channel offenders arrive from different AZIMUTH ANGLES, thus a vertical radiation pattern would have no meaningful information.

The horizontal radiation pattern of an antenna describes the field intensity of the radiation as a function of the azimuth angle. The pattern may be presented in polar or rectangular coordinates. Polar presentation is preferred for popular publications. This information gives an easy to understand picture of the received or transmitted power distribution. By contrast, the RECTANGULAR radiation pattern permits a presentation of much finer detail including precise dB readings of peaks and nulls.

The radial deflections on the polar and rectangular charts may be arranged in:

* Linear scale
* Power scale
* dB scale.

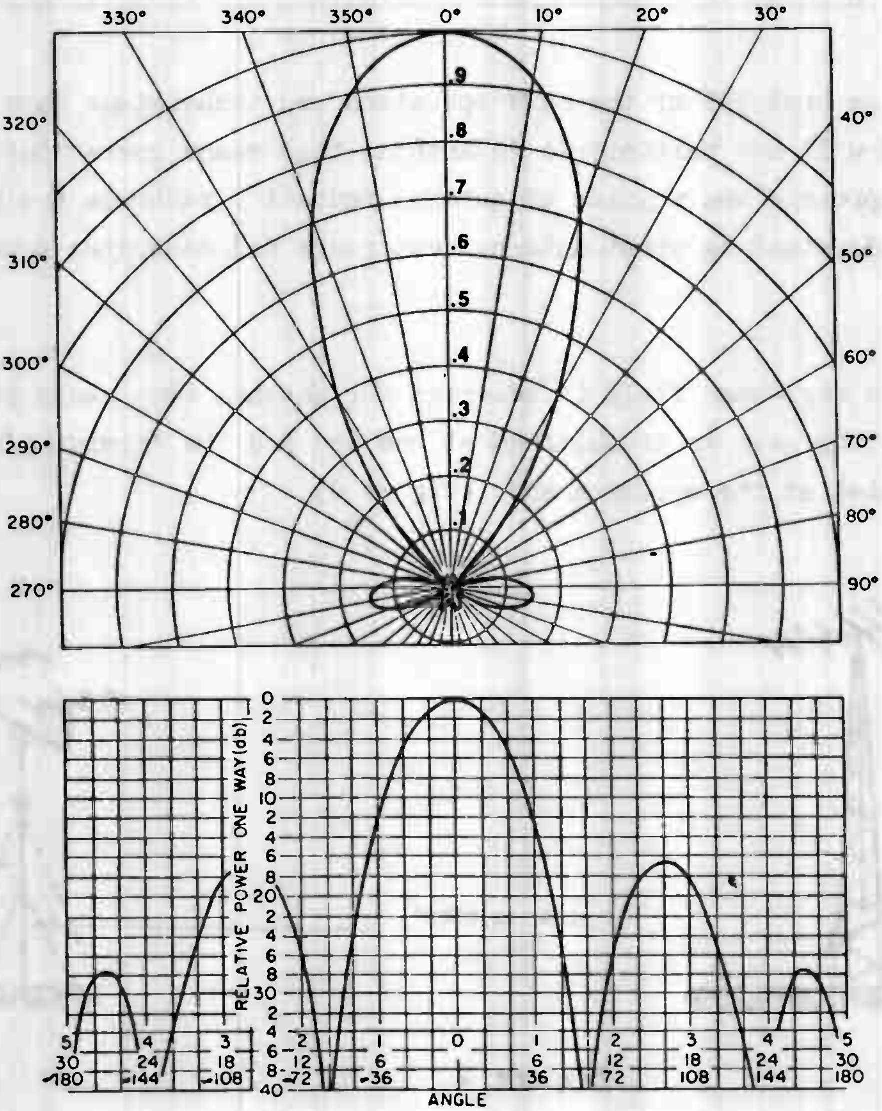


Figure 1

Compare the readability of a polar and horizontal radiation pattern presentation.

The dB scale, containing the logarithmic variations in the received signals, is the most beneficial for the examination of CATV antenna array radiation patterns.

Figure 1 presents polar and rectangular radiation patterns taken from the same antenna. It should be noted that while location, depth, and width of the null at 168^{o} is somewhat fuzzy on the polar pattern, the rectangular pattern offers good readability and accuracy.

ANTENNA TEST RANGE AND RECORDING EQUIPMENT CONDITIONS

We realize that 99% of the CATV operators and technicians have not been involved and will not participate in antenna test range operations. But in order to comprehend the physics of antenna radiation patterns one must have a greater understanding about antenna test range and recording equipment conditions.

Usually a big, open field is selected for antenna test range purposes. The transmitting gear is established at one end and the receiving/recording gear is located at the opposite end. (Figure 2)

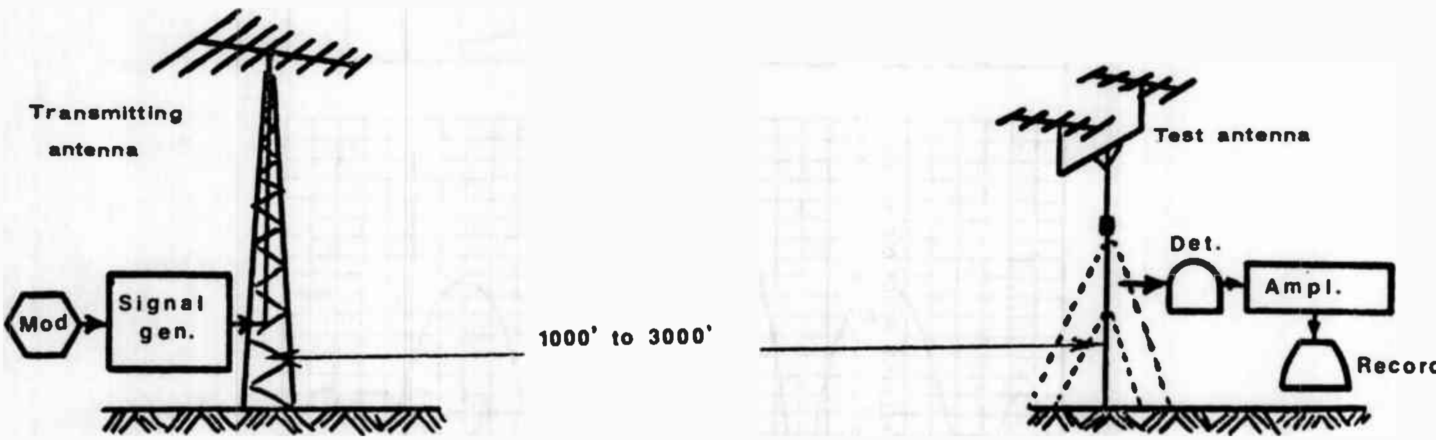


Figure 2

The modulated RF signal is beamed from the fixed high-gain antenna in the direction of the receiving (test) antenna. At the receiving end, the test antenna is rotated either manually or by motor. In both cases the rotor movement is syncronized with the recorder. The detected and amplified signal is processed through the recorder to produce a permanent chart of the radiation pattern.

There are several critical antenna test site conditions which may adversely effect the accuracy of the obtained test information :

* Separation between the transmitting and receiving antennas (1000' to 3000' represents adequate separation)
* Directivity of the transmitting antenna (a minimum of 45° beamwidth is required)
* Height of the transmitting and receiving antennas above ground (50' to 100' is a sufficient height)
* The surface quality of the antenna test range (rough surfaces are preferred).

A combination of the last two conditions contribute to reflection problems, the most serious source of errors. Ground reflection is a function of the surface configuration, type of soil, content of moisture, vegetation, weather, transmitting frequency, polarization, etc. Increasing the transmitting and test antenna heights well above ground and the installation of conductive fences perpendicular to the line of propagation are two practical means to reduce ground reflections.

A number of recording equipment conditions may also contribute to the limited accuracy of the radiation pattern:

* The instability of the transmitter and receiving equipment
* Calibration inaccuracies of the output power
* Problems inherent in the detector characteristic.

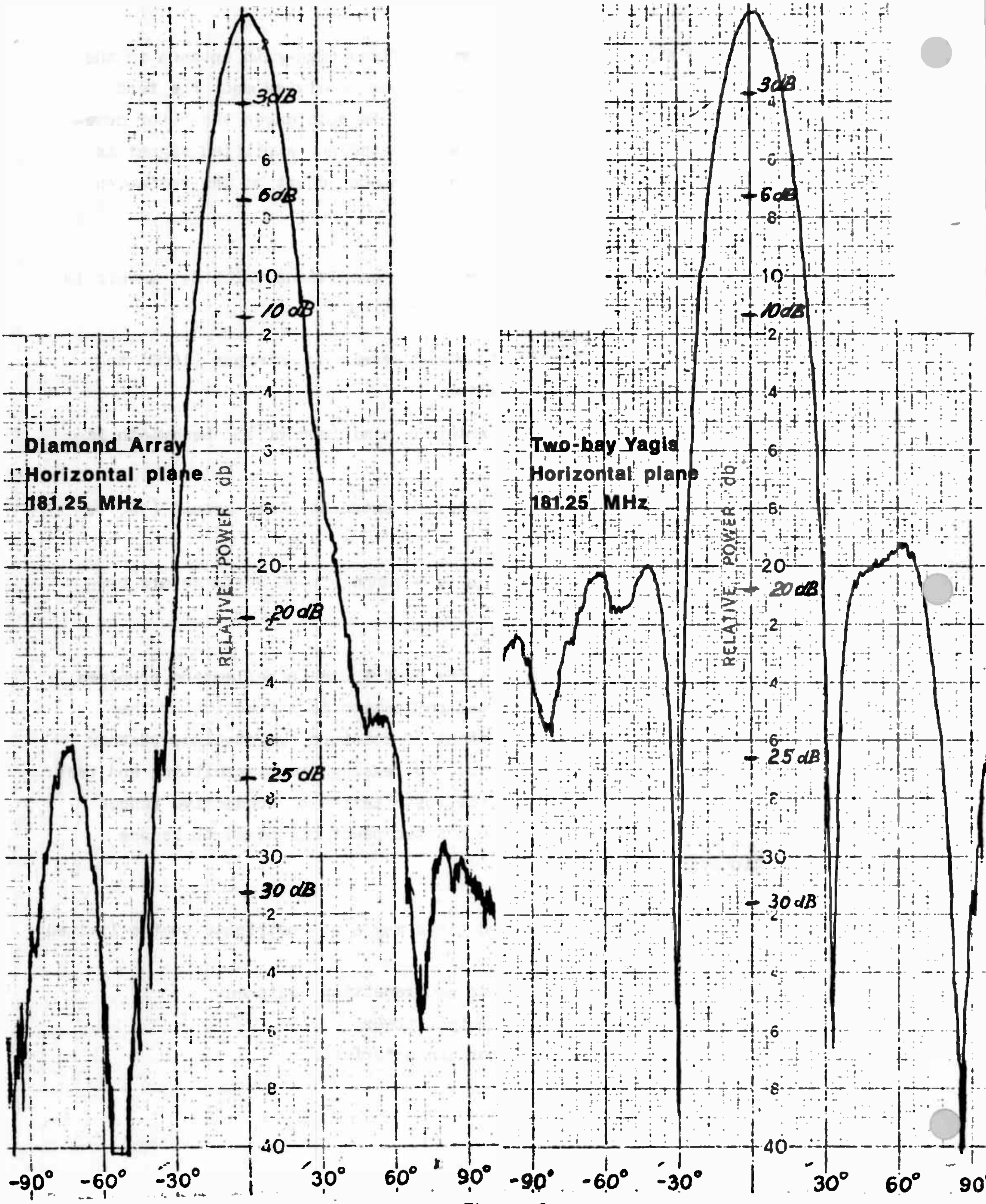

Diamond Array
Horizontal plane
181.25 MHz
RELATIVE POWER db
3dB
6dB
10 dB
20 dB
25 dB
30 dB
-90°
-60°
-30°
30°
60°
90°
Two-bay Yagis
Horizontal plane
181.25 MHz

Figure 3

Since detectors are non-linear devices, the detected signal depends largely on what portion of the characteristic is used for detection. This in turn is a function of the output power of the signal generator, the distance between the transmitting and test antenna, etc.

Good antenna engineering practices dictate the calibration of every chart before starting a series of radiation pattern tests. (See Figure 3) By inserting 3-6-10-20-25-30 dB pads into the transmitter's output, the detected voltages can be precisely marked on the chart. Figure 3 demonstrates the need for calibration. At the -22 dB chart-paper mark the calibration yielded an actaul -20 dB reading. In co-channel protection analysis the -20 to -30 dB region contains the most important segment of the chart, and calibration should not be omitted.

RADIATION PATTERN ANALYSIS

There are a number of paramount factors determining the co-channel protection capability of an antenna-array, all readable from the radiation pattern:

* The exact azimuth angle of the nulls
* The depth of the nulls
* The width of the nulls
* The shape of the main beam.

Potential co-channel offenders should be identified during the signal survey. The azimuth angles of these actual co-channel interference stations may then be determined accurately by a computer run.

Should a fixed structure array be employed, such as a diamond array of log-periodic antennas, its actual radiation patterns must be very closely examined: are the null directions coinciding with the azimuth angles of the co-channel offenders?

The other popular approach is to custom design antenna arrays to force nulls in those particular directions from where the interfering signals are arriving. In these cases actual radiation patterns may prove that the nulls are right on the target, or perhaps a few degrees off. In the latter case a slight reorientation of the tower mounted array may swing the null into the desired position without significantly decreasing the antenna gain.

THE DEPTH OF THE RADIATION PATTERN nulls may also be conveniently identified from a rectangular radiation pattern with a dB scale, enabling the CATV technician to affirm manufacturers' specifications or to discover overoptimistic claims.

Nulls exhibiting 20 dB depth cannot be considered adequate co-channel protection. 40 dB deep nulls are highly desired but seldom demonstrated on actual radiation patterns.

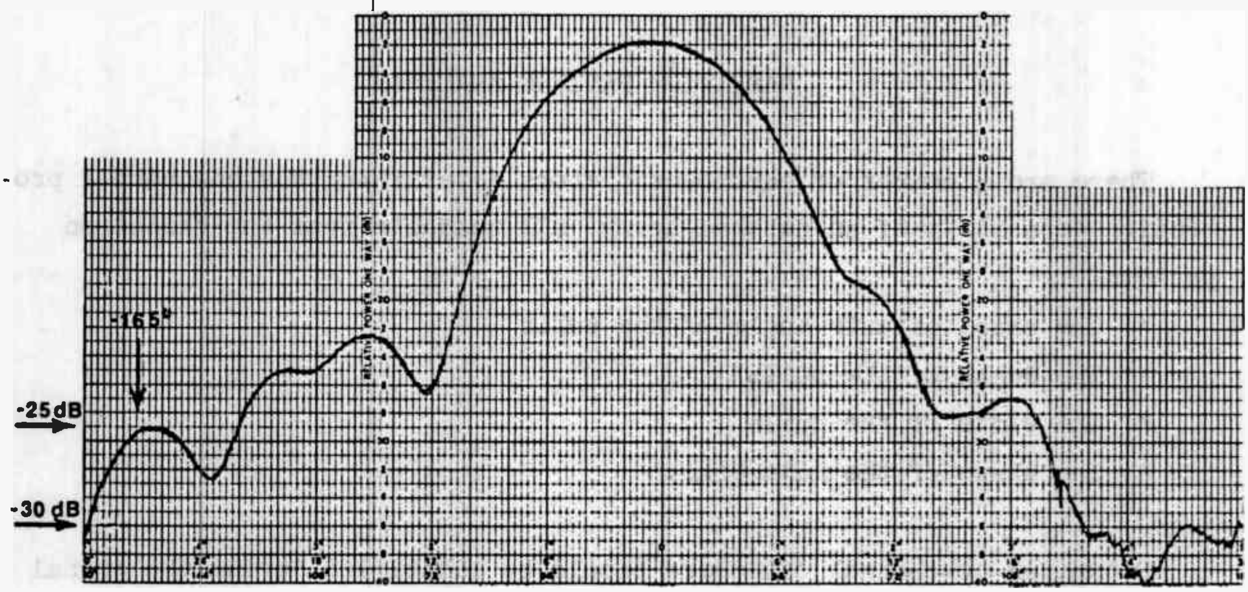


Figure 4

Figure 4 illustrates the need for F/B ratio specifications and radiation pattern comparison. The manufacturer's specifications stated 30 dB protection from the back. The radiation pattern indicates that indeed the diamond quad provides 30 dB protection from 180°. However, the co-channel offender arriving from -165° azimuth--and we can still call this "from the back"--will be attenuated only by 25 dB. This is a 5 dB deviation from published specifications.

THE WIDTH OF THE NULL is an additional important characteristic with which to be concerned. From a rectangular radiation pattern with dB scale, this parameter may be precisely measured at any null location.

Very narrow (1° to 3°) nulls should warn the CATV technician of two imminent problems:

1. It is difficult to orient a tower mounted CATV array with such accuracy under normal working conditions.
2. Under medium to heavy wind conditions the twisting of the CATV tower, combined with the movements of the antenna gates and pipes, could skew the the nulls of the radiation pattern by several degrees, thus significantly decreasing co-channel protection.

Nulls f 5° to 8° width are considered optimum for CATV application.

RADIATION PATTERN IRREGULARITIES

It is not uncommon to encounter asymmetrical radiation patterns. A re-examination of the diamond array pattern and horizontally stacked two-bay pattern (Figure 3) shows a number of asymmetrical features. These include a missing null at -90° on the two-bay pattern, or the development of a broad shoulder on the diamond array pattern at +50°. These are warning signs indicating that either the antenna test range or the constructed arrays have hidden inadequacies. If co-channel conditions warrant the need for extreme caution, the radiation pattern testing should be repeated on a slightly altered test range or with a different mounting in order to identify the nature of the asymmetrical pattern performance.

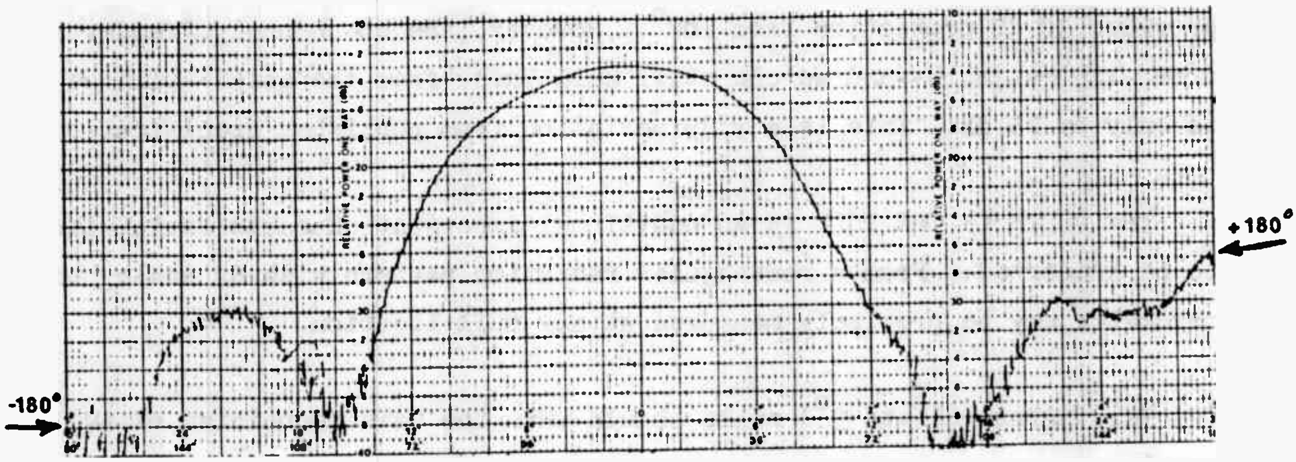


Figure 5

Figure 5 is a classical example of a faulty radiation pattern, not to be accepted for evaluation purposes. The radiation pattern of a log-periodic antenna is presented in this chart. Note that the signal level responses differ considerably at 180°. On the left side, the curve dips to -22 dB, while on the right side it levels off at -13 dB. The resulting 9 dB difference between the left and right side could be a serious impairment of the recording equipment or the result of transmitter/receiver instability.

The frequency of radiation pattern testing is also an important qualifying parameter. Co-channel beats are generated by the video carrier frequencies of two or more stations. Therefore, for co-channel testing purposes, the radiation patterns must be tested on the respective video carrier frequencies. The pattern response may or may not change within a couple of MHz; however, the bearings of the nulls, the depth of the nulls, and their width may shift considerably, warranting on-video-carrier testing.

Antenna arrays mounted on small diameter pipes on the top of the wooden test tower may exhibit perfect radiation patterns with deep nulls. But mounted on metal antenna gates, in the vicinity of a 48" face tower, they may not perform as well. Reflections from the horizontal braces of the tower and the long horizontal pipes of the antenna gates will generate phase sensitive cancellations: filling in the deep nulls in the pattern or causing null-shifts. There is little point for example to publish a "mast mounted" radiation pattern for a diamond array, if the array must be mounted on a CATV tower with 40" to 60" tower face.

CONCLUSION

It has been shown that co-channel protection can be evaluated by analyzing the actual radiation patterns of the array. What often stands in the way of such effective evaluation is the missing information: the properly taken radiation pattern itself. It is up to the CATV operator and technician to ask for and obtain that information.

THE USE OF THE ZIG ZAG ANTENNA IN CABLE SYSTEMS

by

Albert K. Fowler

and

Fernando Beltran

of

R F SYSTEMS, INC.
155 King Street
Cohasset, Massachusetts 02025

(Tel.) 617-383-1200

June 25, 1971

THE USE OF THE ZIG ZAG ANTENNA IN CABLE SYSTEMS

General

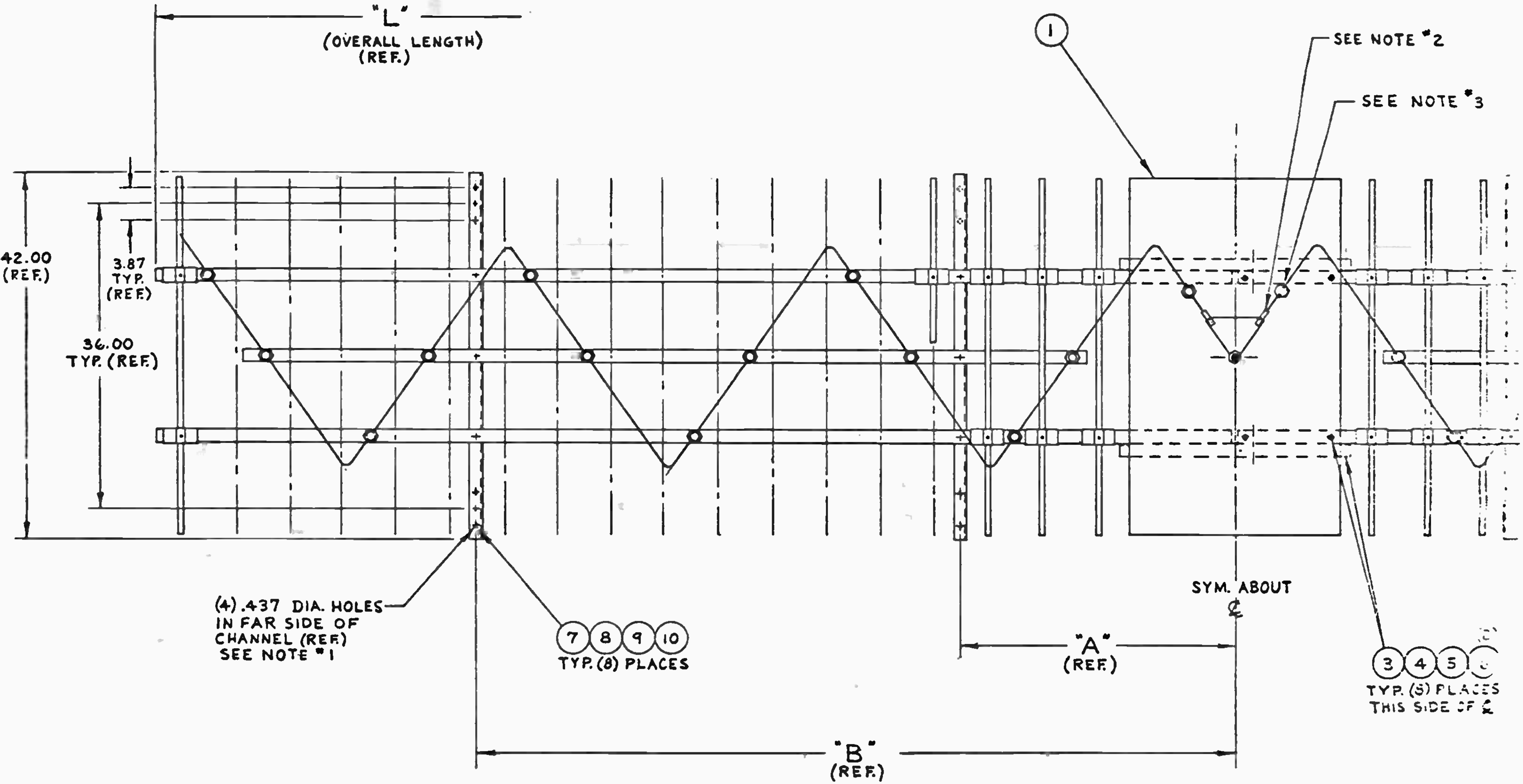
The Zig Zag Antenna falls in the general category of traveling wave antennas, and in particular, those of the leaky wave type, where part of the energy of a wave propagating along a given structure is radiated into space as the wave progresses along the structure.

The antenna consists basically of a rectangular screen or ground plane with one or two zig zag shaped conductors supported by insulators and spaced a fraction of a wavelength from it.

Each conductor forms a "leaky" transmission line with the ground plane. The current along the transmission line decays as the wave travels away from the feed point. By appropriately selecting the height vs distance from the feed point, the aperture illumination for the antenna can be varied. In the case of television receiving the transmitting applications, an approximately uniform aperture illumination is sought in order to maximize the antenna efficiency, and is readily obtained.

Because of the zig zag shape of the radiator, selection for the length of each leg of about half a wavelength at the center frequency of the desired band leads to a phasing condition for the radiation from the individual legs whereby the components from any two consecutive legs add in one polarization plane and cancel in the other, thus minimizing considerably the gain loss associated with the radiation of cross polarized energy.

Because of the characteristic operation of the antenna, the conductor can be short-circuited to the ground plane at the end of the antenna (provided the short-circuit position is properly selected). This will have no significant



"L"
(OVERALL LENGTH)
(REF.)
1
SEE NOTE #2
SEE NOTE #3
42.00
(REF.)
3.87
TYP.
(REF.)
36.00
TYP. (REF.)
(4) .437 DIA. HOLES
IN FAR SIDE OF
CHANNEL (REF.)
SEE NOTE #1
7 8 9 10
TYP. (8) PLACES
SYM. ABOUT
℄
"A"
(REF.)
3 4 5
TYP. (8) PLACES
THIS SIDE OF ℄
"B"
(REF.)

BLANK PAGE

effect in the antenna performance. The common approach is to use the short-circuit; thus, placing the antenna at ground potential at all but the R F frequencies.

Particular Characteristics, Single Panels

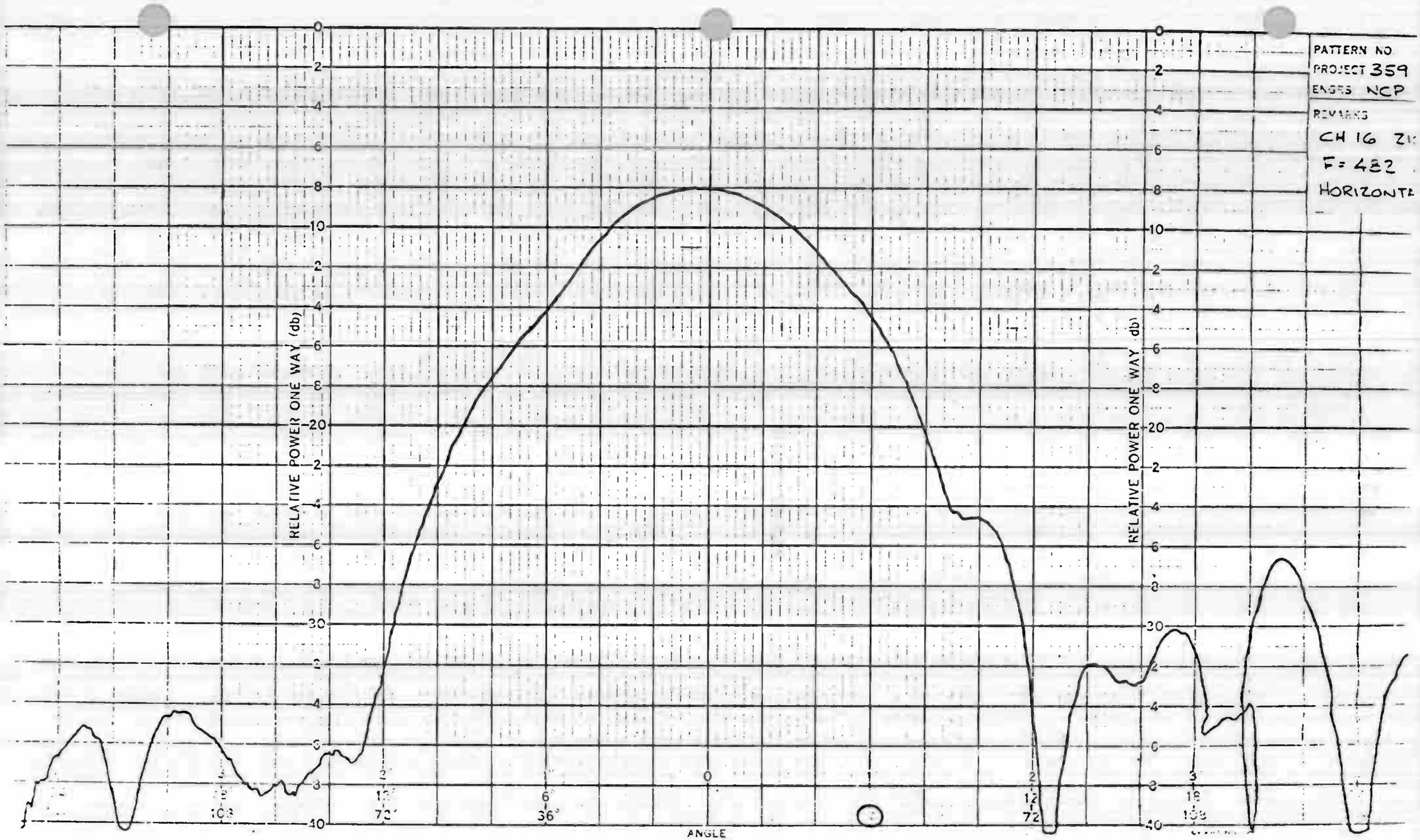
Length. In theory, the antenna can have any desired length, thus meeting any particular gain and/or vertical beamwidth need. For the extreme short case, the antenna becomes just a "small V" above a ground plane. As the length is increased, a point is reached where the energy losses by I^2R effects on the conductor and ground plane can become prohibitive because of the diminished efficiency. Although this could be compensated by the selection of very high quality materials and finishes, the normal procedure is to limit the length to about eight wavelengths, which is done also for mechanical reasons. However, there is nothing really sacred about the eight wavelength limit.

Width. The normal width of the antenna is determined by a trade off between horizontal beamwidth, back radiation, windloading, and weight. The optimum width as far as this point is concerned, falls in the .7 - .8 wavelength region.

Beamwidths. For the nominal sizes used, horizontal beamwidths are consistently in the 66° region and vertical beamwidths--13.5° for the four wavelengths models, 7.2° for the eight wavelength models.

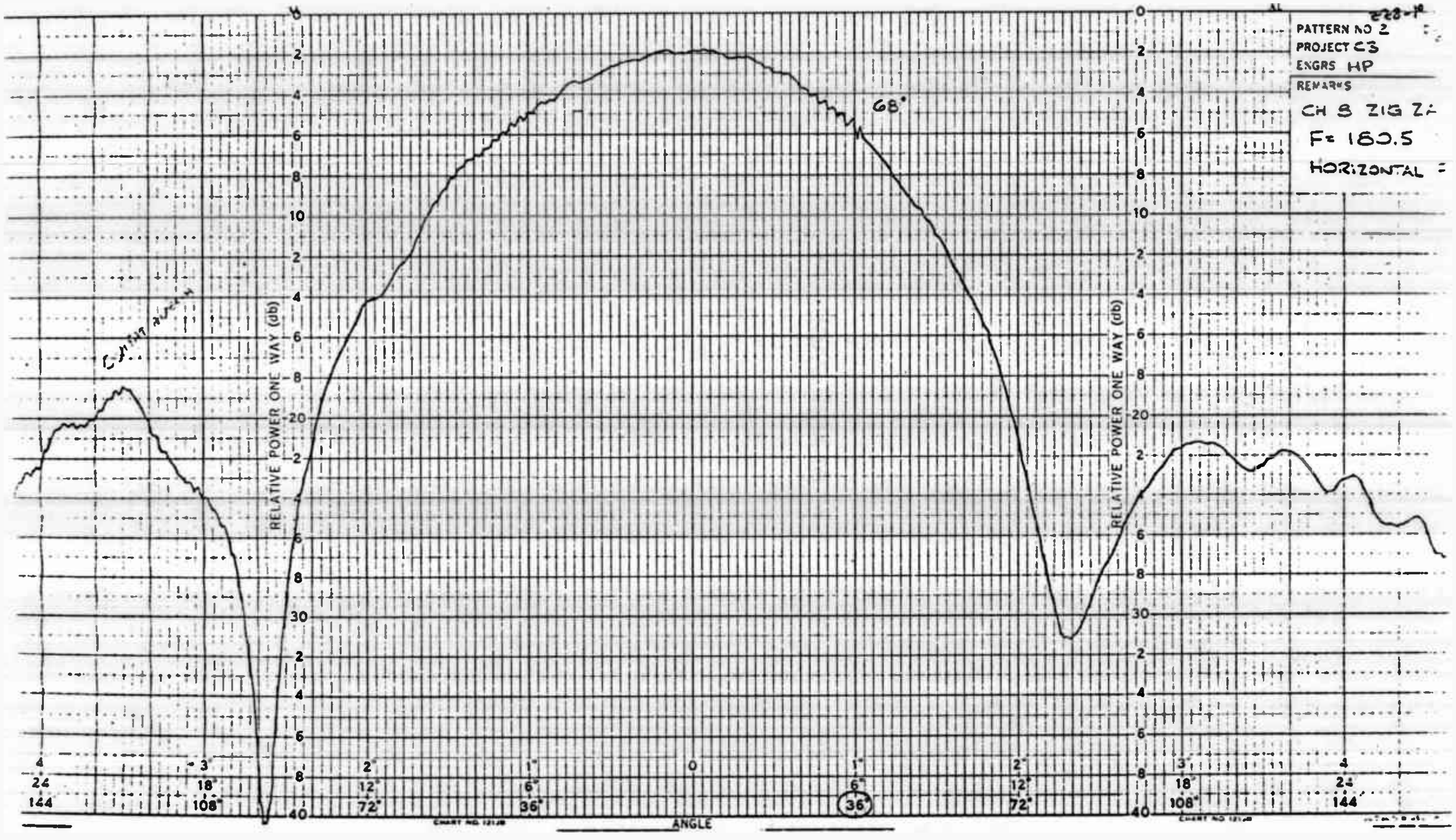
Sidelobe and backlobe radiation. Sidelobe levels in the horizontal plane fall in the -20 db level for the normal widths used. In the vertical plane, a nominal sidelobe level of 13 db, consistent with the uniform aperture illumination sought is obtained. However, these sidelobe levels are subject to improvements or change to fit particular needs, at a trade off in gain.

The back lobe radiation in this antenna falls in the -25 db or less region for nominal ground screen.



PATTERN NO
PROJECT 359
ENGRS NCP
REMARKS
CH 16 ZI
F = 482
HORIZONTA
RELATIVE POWER ONE WAY (db)
RELATIVE POWER ONE WAY (db)
ANGLE
108
72°
36°
0
72
108

BLANK PAGE


PATTERN NO 2
PROJECT C3
ENGRS HP
REMARKS
CH 8 ZIG ZA
F= 180.5
HORIZONTAL
68°
RELATIVE POWER ONE WAY (db)
ANGLE
CHART NO 121-B

BLANK PAGE

Gain. For normal lengths, for which the I^2R losses are not significant, the gain of the antenna varies linearly with the length. Gains of 24.5 (13.9 db) and 49.0 (16.9 db) over a dipole are obtained from the 4 and 8 wavelength single panel antennas, respectively. Increased gains are obtainable by panel arraying and from single panels by parasitic or driven excitation of extra Zig Zag elements located above the basic one.

Return Loss. Return losses for single channel operation in the high VHF region are typically in the 20 db (VSWR $\doteq$ 1.22) region. In the UHF region, single channel return losses are in the 28 db (VSWR $\doteq$ 1.08) region or better.

Bandwidth: Pattern Gain and Return Loss Stability vs Frequency. Provided the return loss is kept within a reasonable bound, the gain stability of the single panel Zig Zag is directly dependent on the stability of its beam characteristics.

R F Systems' current design (4λ & 8λ) exhibit pattern stability over 8% bandwidths. The 20 db return loss is stable over a 4% bandwidth typically.

Perhaps the most general advantage to be stated for the Zig Zag Antenna is its simplicity. What can be simpler than a single wire structure offset from a fixed ground plane? And yet, despite its simplicity, this antenna has everything we want and need in our CATV environment.

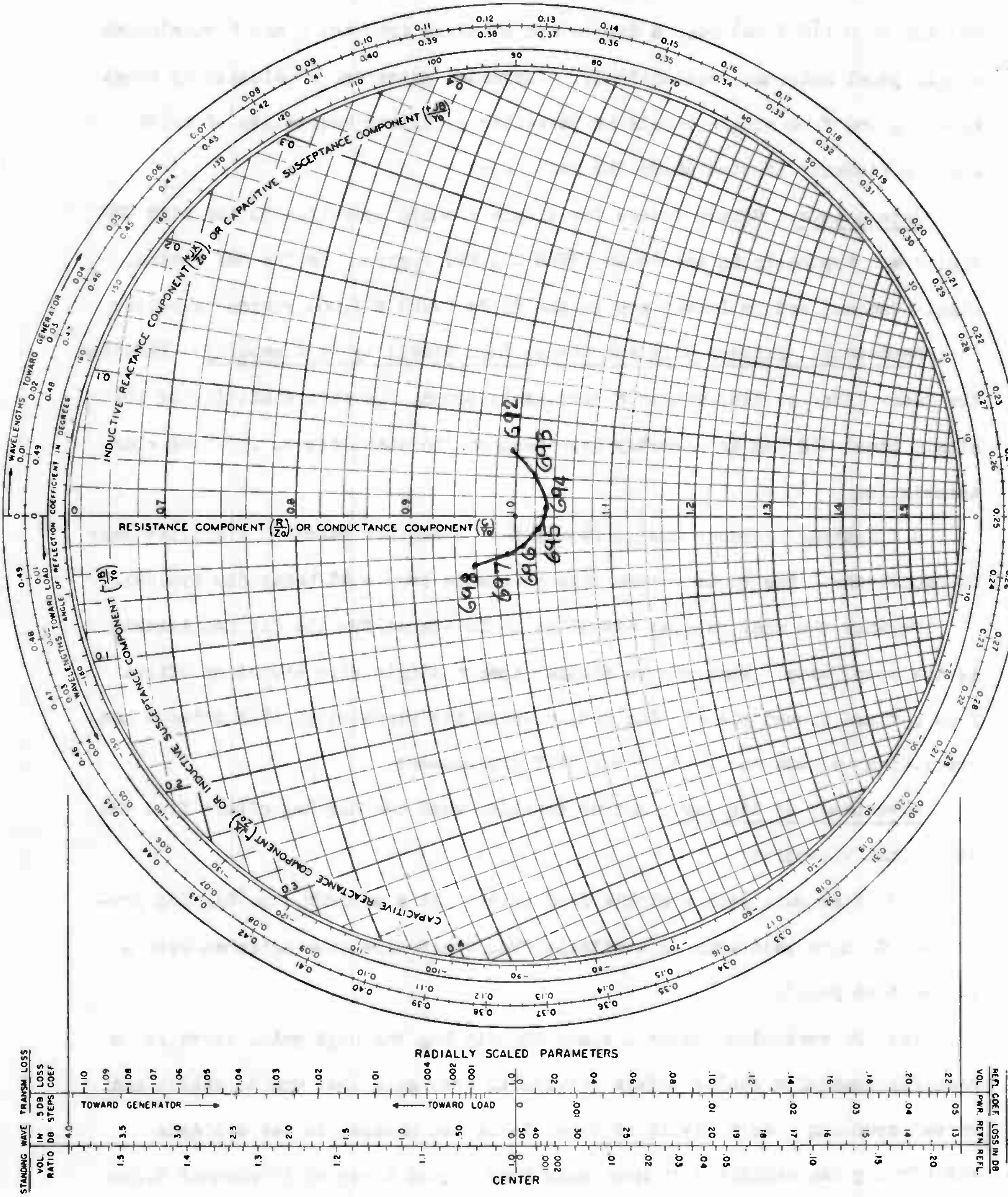
Advantages of Zig Zag. Let us consider what the Zig Zag offers from the electrical viewpoint:

(1) High gain with a single feed point - as a minimum, the Zig Zag provides 6 db more gain than is available from other directive antennas with a single feed point.

(2) No combining losses - since the Zig Zag has high gain, there is no need for combining cables - this results in zero gain loss due to cables and mutual coupling. As a result of this, it is not unusual to see a single VHF 4λ Zig Zag exhibit 3 db more gain than a quad array of 10 element Yagis.

NAME	TITLE CHANNEL 51 ZIG ZAG	DWG. NO.
SMITH CHART FORM 5301-7561-NE	GENERAL RADIO COMPANY, WEST CONCORD, MASSACHUSETTS	DATE

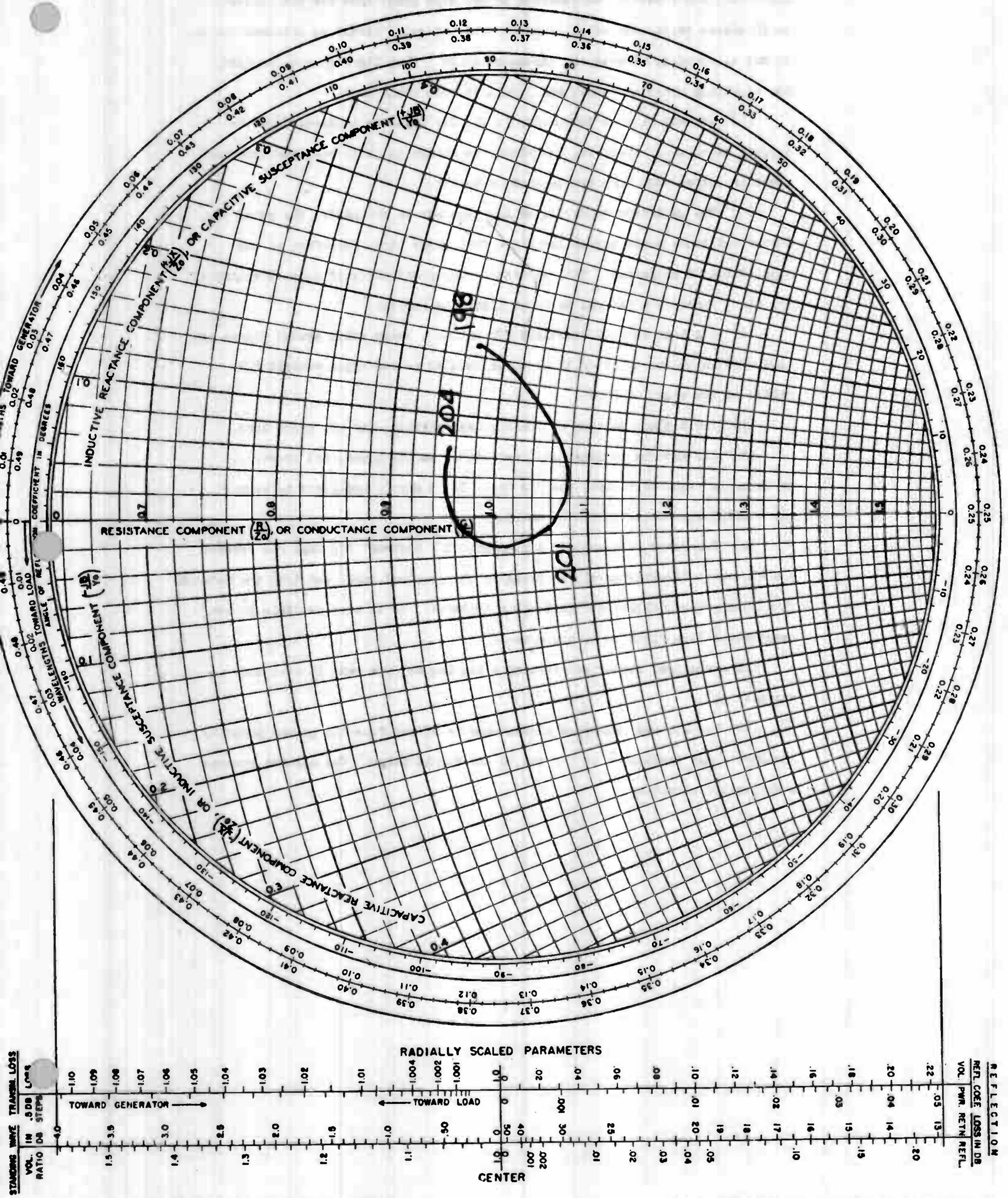
IMPEDANCE OR ADMITTANCE COORDINATES



Electronics- Vol. 17, No. 1, PP. 130–133, 318–325, Jan. 1944

NAME	TITLE CHANNEL 11 ZIG ZAG	DWG. NO.
SMITH CHART FORM 5301-7561-NE	GENERAL RADIO COMPANY, WEST CONCORD, MASSACHUSETTS	DATE 12-5-70

IMPEDANCE OR ADMITTANCE COORDINATES



(3) Lower VSWR - better return loss - Zig Zags are matched in the plant. Since they don't have to be combined to get high gain, they are not subject to impedance variations as is found in array of other directive antennas wherein mutual coupling affects the impedance match. When Zig Zags are combined, the combining lines are short and result in less cable loss.

(4) Characteristics Independent - the Zig Zags are isolated from the support structure. There is, therefore, no change in their beam and impedance characteristics when they are mounted on towers.

(5) The radiating conductor of Zig Zags may be grounded. The outer conductor and inner conductor of the input feed lines are, therefore, at the same AC and DC potential. This eliminates any possibility of induced voltages. It, also, provides a natural path for lightning strikes.

(6) Zig Zags exhibit excellent F/B ratios. Where solid ground planes are used, F/B is on the order of 30 db while tubular or rod types exhibit F/B ratios on the order of 25 db.

(7) The E plane pattern of the Zig Zag exhibits only one major lobe.

(8) The antenna is inherently unbalanced at its input; and therefore, no balun is required to feed the Zig Zag. It is merely necessary to connect the coaxial line directly to the antenna.

(9) Connector problems are minimized. R F Systems' Zig Zags can receive a 0.412 cable directly merely by plugging the prepared cable end into the antenna. Thus, connector problems are entirely eliminated. It is also possible to use pressurized line right up to the antenna.

The mechanical characteristics of a Zig Zag antenna make it even more attractive:

(1) The antenna radiating element may be offset from the ground plane by insulators and terminated at its end to the ground plane. The element becomes a very stiff structure.

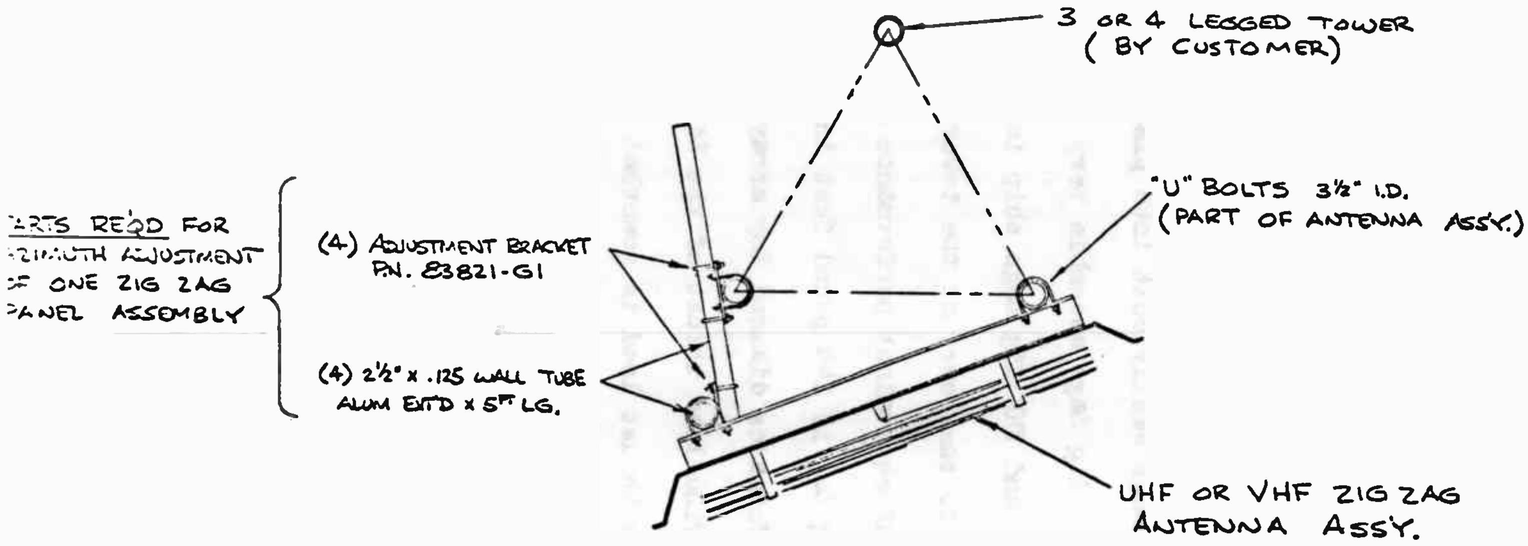
(2) Zig Zags mount directly to the tower structure and no outriggers are needed to support them. They may be either flush mounted to the face of the tower or they may be mounted to one leg of the tower and adjusted by means of an adjustable mounting bracket. R F Systems uses a very simple mounting design as shown in the Figure(p.14). From this figure, it is clear that this mount will provide for orientation of the antenna in any direction depending on the tower leg on which it is mounted.

(3) Zig Zags are not subjected to severe shock and vibration as they are mounted to "hard points" of the tower.

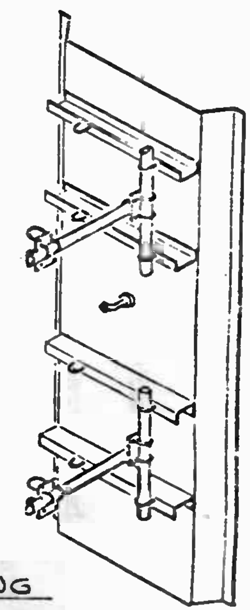
(4) Zig Zags are easy to install. Their vertical form allows them to pass between guy lines very easily. Since the gain of one Zig Zag equals or exceeds the gain of a quad or diamond array, one can easily visualize the efficiency in lifting such an antenna. Zig Zags easily bolt into place, and all the work can be done close to the tower. Zig Zags assemble very quickly. R F Systems' UHF Zig Zags ship in one piece, and VHF Zig Zags ship in two pieces.

(5) Zig Zag wind load torques applied to the tower at the tower interface are considerably less than for other types of equivalent performance antennas. For example, calculated torque for a VHF Zig Zag is 144 pound feet in a 100 mph wind, while an equivalent gain high performance diamond Log array has a calculated torque of 2880 pound feet. The wind load thrust of the Zig Zag is 600 pounds, LP array--420 pounds. While the thrust load is somewhat higher for the Zig Zag, the torque loading is considerably less. For many years, the tower survival was the only criterion in CATV systems; however, today the emphasis is, and must be, on the torque considerations. This change is brought about by:

(a) The greater use of UHF and hence more directive UHF antennas whose beams must be kept on target.



PLAN VIEW



BACK VIEW, SHOWING
ARRANGEMENT OF
ADJUSTMENT BRACKETS

(b) The possible integration of CARS band microwave links in relay service to nearby communities using the CATV tower.

(c) A realization of the signal variation possible with tower twist.

(d) The necessity of holding beams in position to retain co-channel rejection characteristics embodied in the system.

(6) Zig Zags are easy to maintain. The feed point is right in back of the antenna. No climbing in precarious locations is required. Also, the size configuration is such that any part of the antenna may be reached by hand.

(7) The Zig Zag is easily adjustable partly because of the low torque and smaller bending moment since the antenna is close to the tower.

(8) Radiating elements of Zig Zags may be readily covered with fiberglass protective radomes if desired.

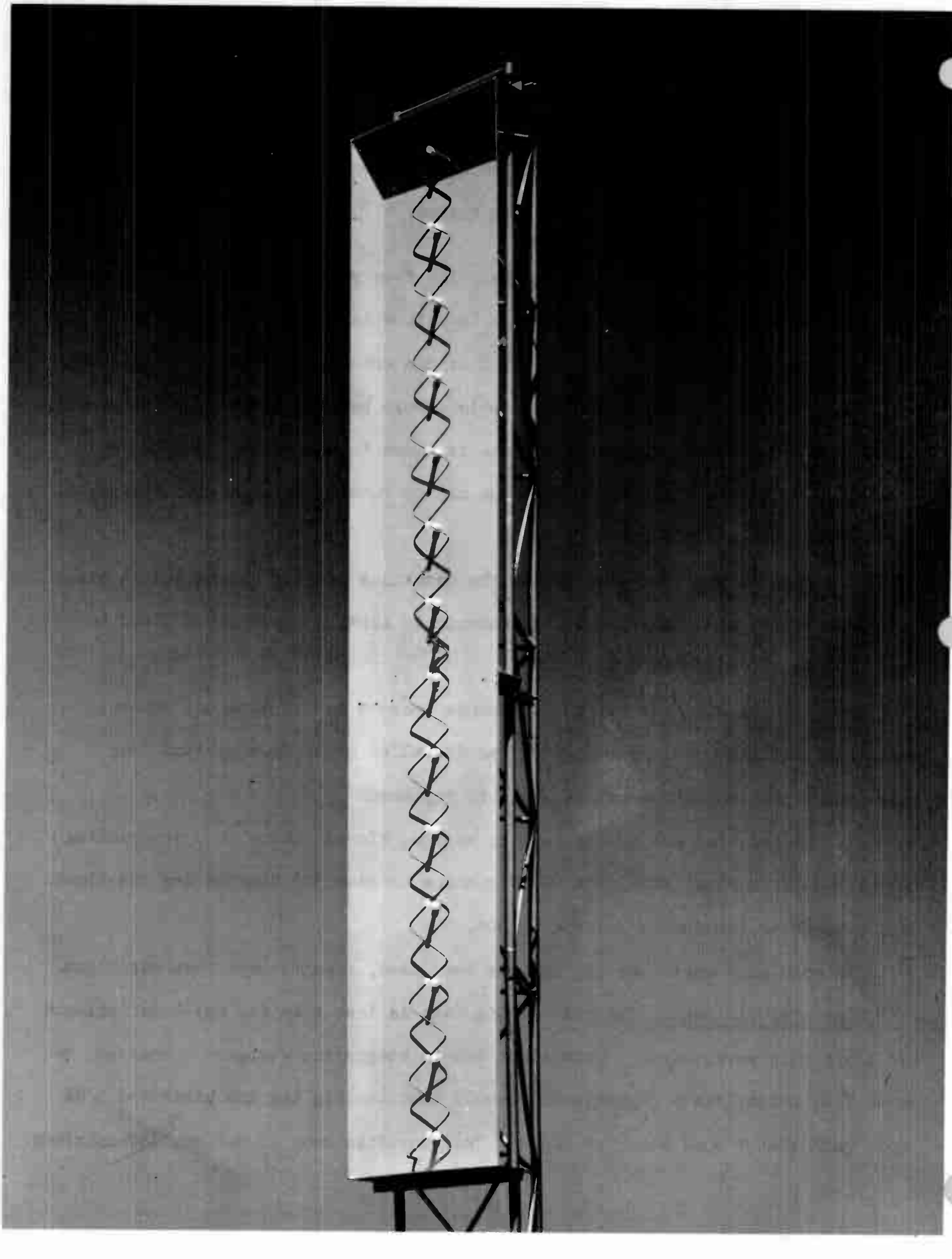
Zig Zags in Use. We have one in the Catskills picking up channel 11 out of New York (95 air miles), and this antenna is serving upper New England and New York State for NORTHCO Microwave.

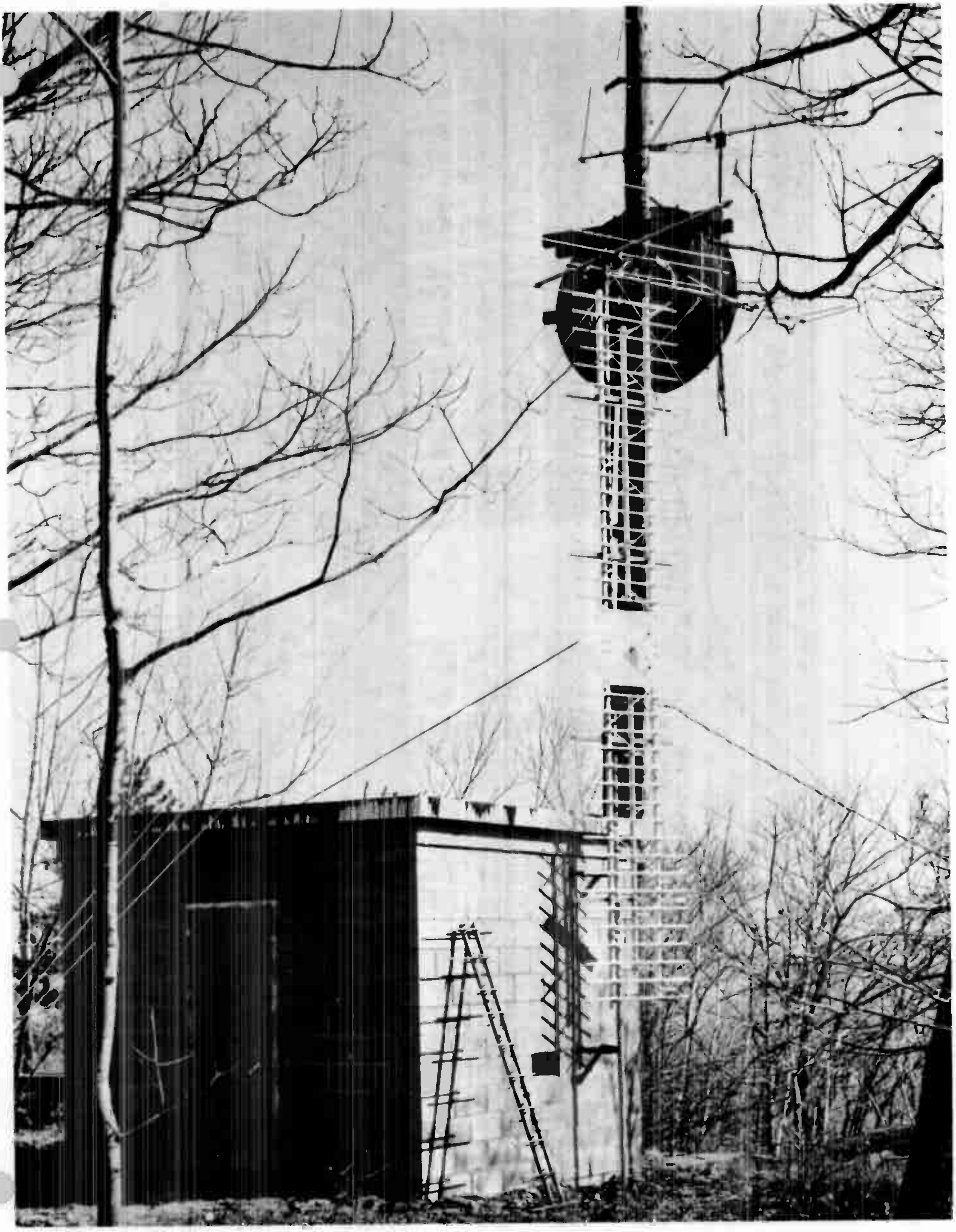
We have supplied several in California where a severe adjacent channel situation existed. When our Zig Zag was installed here, it exhibited 3 db more gain than the quad array of Yagis it replaced.

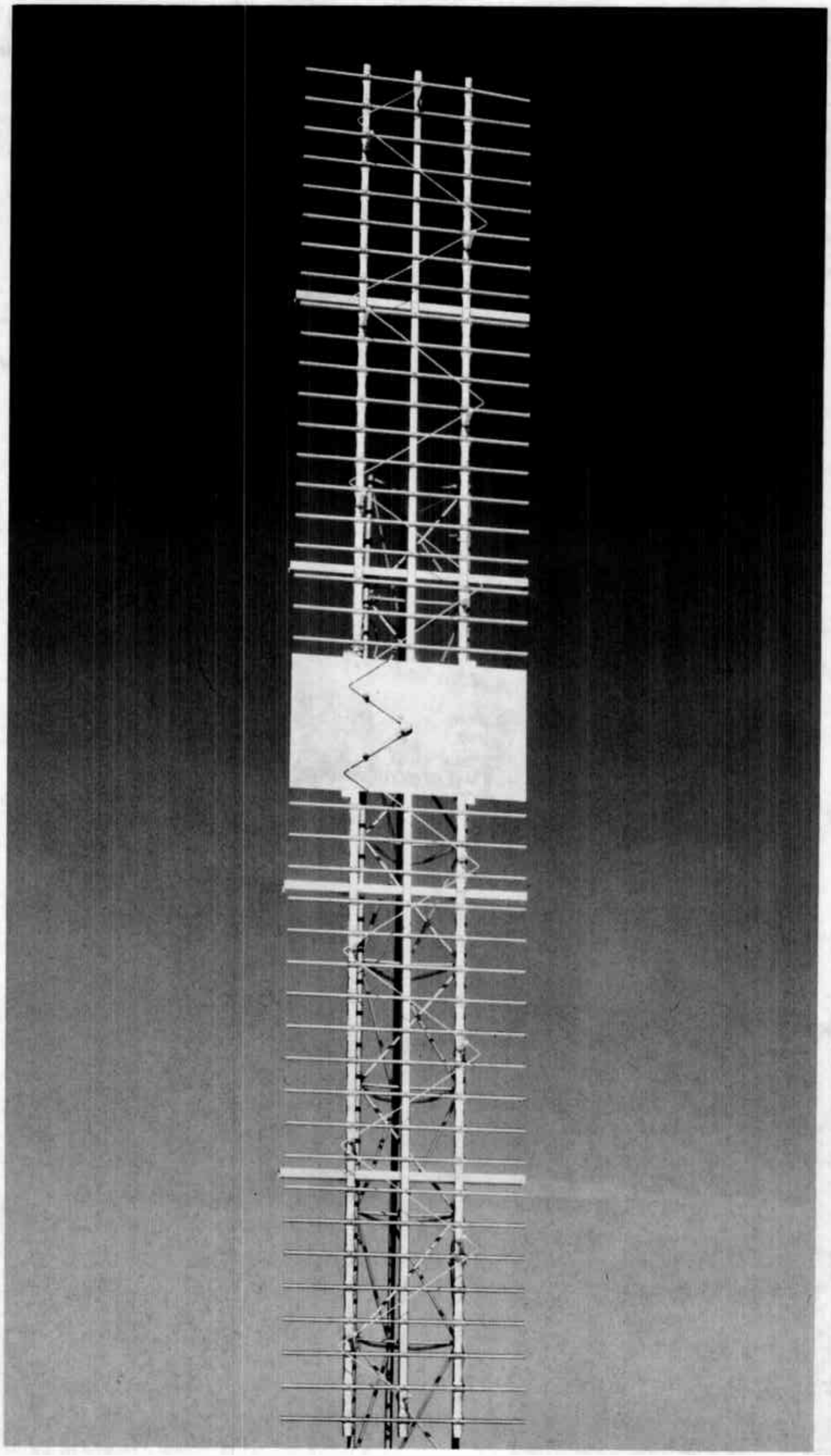
In UHF, several are in use in Fort Meyers, Florida where they are picking up signals from Miami and Tampa (95 air miles to Miami). Results are excellent, and tower wind loading is reduced by 50%.

In each case where the Zig Zag has been used, results have been excellent.

Costs of Zig Zags. The cost of Zig Zags is less than for any other antenna of comparable performance. This seems like a staggering statement; however, we know from actual field replacement results that the Zig Zag has exhibited 3 db more gain than a quad array of Yagis. This verifies some of our earlier opinions.







	Cost	Gain	Cost per db
VHF Zig Zag	$1,040	16 dbi	$65.00
L.P. High Performance Array	1,450	17 dbi	85.00
Yagi 8 Bay Array	1,350	16 dbi	84.50

The savings begin here, but they don't end. The higher tower costs associated with increased torque requirements, the greater amount of time required for installation, increased costs for maintenance are all contributing cost factors that show how truly attractive the Zig Zag is.

LOCATING AND ELIMINATING SOURCES OF POWER LINE INTERFERENCE

W. S. Campbell, P.E.
Manager of Engineering
General Electric Cablevision Corporation

With more and more cable systems being built in industrial, urban areas, and with distant signal importation restrictions reducing the incidence of cochannel interference, electrical noise is becoming one of the most important interference problems at cable system headends.

There are many sources of electrical noise interference. They include automobile ignition, welding equipment, electric fences, neon lights; in fact, any electrical device can cause trouble if it is not operating properly. Even the sun and milky way can, under certain circumstances, degrade a system's signal to noise ratio by 5 to 7 dB.(1,2)

The first step in an electrical noise investigation is to attempt to identify the source from the characteristics of the noise it generates. In fact, a great deal can be told about the source of noise interference by observing its appearance on a television screen, its pulse train on an oscilloscope, duty cycle, time of day of occurrence and any correlation to weather or other local events. For instance, noise that is limited to hours of darkness may be a lighting fixture, noise that increases with the humidity may be high voltage corona, noise that is only present when the local bar is open may be one of their signs, etc. Reference 3 contains an excellent discussion of the pulse characteristics for some representative examples of man-made noise.

In this paper, we will limit our discussion to the electrical noise caused by power lines. The most common signature of power-related electrical noise is the fact that it moves slowly through the television picture in bands. Two bands being characteristic of single phase power and six bands indicating three phase. It is at this point that most system technicians make their first mistake -- they jump to the conclusion that the cause is "the substation northeast of town", "the factory 15 miles south of town" or some other well-known power landmark. The technician makes his second mistake when he drives to this location, hears noise on his car radio and concludes that this must be the source. These two common errors result in wasted time for the utility company engineers as they try to eliminate all noise at that facility and frustration for the technician when his efforts do not remove his interference problem.

First, a search for a problem, any problem, should never be begun by deciding what the problem is and then setting out to prove it. A great deal of time can be wasted down the wrong path if an open mind is not maintained at the very beginning. Second, the car radio technicque wastes time since 1 MHz noise usually shows very little correlation to 100 MHz noise. Also, almost any power device, including probably a third of the poles in town, will radiate measurable noise within about 20-50 feet.

This brings us to Case History Number 1 and a much more efficient, systematic method of locating the source. In this Georgia system, the noise occurred only in channel 6, occurred in two bands moving through the picture and changed radically with rainfall. From this it could be concluded that the source was an outdoor, single phase power device.

The direction of the noise source from the headend was easily determined by using the system's search antenna. In this case the noise was strong enough to use a field strength meter for an indicator. In cases of weaker noise, or noise with a very short duty cycle, the noise peaks can be observed on an oscilloscope. Figure 1 shows the bearing taken from the headend (Triangle 1) and from three other locations, where a channel 6 dipole, field strength meter and compass were used to plot the directions. It is important to take readings from several widely separated locations to avoid being confused by local noise radiators.

Figure 2 shows two additional readings taken within the heavy black rectangle in Figure 1. These bearings pointed to the pole shown in Figure 3, approximately one and a half miles from the headend. The noise at the base of this pole measured +15 dBmV on the channel 6 dipole and varied considerably when the pole was shaken. The wiring configuration (a rather nice vertical antenna) on the pole explains why the noise peaked at one particular frequency.

Figure 4 shows the problem: a lighting arrester with a cracked cap. The power company said that these are notorious noise sources if their seal is broken and any rain water enters. When the arrester was disconnected, the noise ceased.

Case History Number 2 involves a high voltage noise source in Wyoming. Figure 5 shows the same direction finding technique used in Case 1, except that a truck mounted 10 element Yagi was used for the additional bearings because the noise was not strong enough for a dipole antenna. The problem in this case turned out to be dirty insulators on a high tension tower about one mile from the headend.

In this Case, we were lucky: high voltage noise can be very difficult to track down for several reasons. First, it is unavoidable. Good engineering practice allows 2 kw of corona per mile in good weather, with this going to as high as 200 kw per mile in heavy rain. Second, the periodicity of support structures causes standing waves, which, in turn, cause frequency spectra peaks and amplitude peaks at locations removed from the actual source. Third, a high tension line can act as a single wire above ground transmission line (with a characteristic impedance for a typical 500 kV line of about 425 Ohms) and propagate the noise several miles.

The power company themselves can be of tremendous help in locating the problem if approached with courtesy and diplomacy. They are anxious to do this since the generation of electrical noise interference is a public relations problem and, in fact, represents a loss of energy - their product. Their legal responsibility is quite clearly spelled out in Paragraph 15.31 of the FCC Rules and Regulations:

> An incidental radiation device shall be operated so that the radio frequency energy that is radiated does not cause harmful interference. In the event that harmful interference is caused, the operator of the device shall promptly take steps to eliminate the harmful interference.

If the source appears to be a high voltage line, their cooperation in locating the specific component causing the problem is essential. They can help to overcome some of the problems in locating high voltage line noise sources listed earlier by their experience and the use of highly sophisticated test equipment beyond the reach of the average cable system. They usually have access to such devices as sonic corona detectors and optical pyrometers. One optical pyrometer, used to detect overheating components, such as splices with internal arcing and high resistance connections, is so sensitive that it can detect a $3\frac{1}{2}^{\circ}$F rise in temperature in a 2" diameter object 20' away.

If the source of power line interference cannot be corrected, antenna methods similar to those used to reject cochannel must be used. Log periodic antennas and tapered amplitude distribution (diamond) arrays effectively reduce noise pick up from all but the desired signal direction. If the direction finding investigation accurately determined the direction of the noise from the headend, standard Yagi phased array techniques may be employed to create a null in the direction of the noise.

To summarize, use direction finding techniques to locate the source, make a visual inspection with binoculars for loose, dirty or cracked components, and, if necessary, return after dark to look for corona or arcing. If a high tension line is suspected as the source, get help from the experts - the power company themselves.

REFERENCES

1. "Using Sun Noise" by Don Lund, QST, April, 1968.

2. "The Distribution of Cosmic Radio Background Radiation" by H. C. Ko. Proceedings of the I.R.E., January, 1958.

3. "Man-made Noise" by E. N. Skomal, Frequency, January-February, 1967.

CAPTIONS

Figure 1: Four triangulation locations. Location 1 is the headend site where the search antenna was used.

Figure 2: Enlarged view of the black rectangle shown in Figure 1. Large triangles are crossover points from Figure 1.

Figure 3: Radiating pole.

Figure 4: Close-up of lightning arrester. Arrow points to location on cap where a piece has been broken away.

Figure 5: Second noise hunt triangulations. Location number 1 is the headend search antenna.

SPECTRUM ANALYZER APPLICATIONS IN CABLE TELEVISION

I. Switzer, P. Eng.
Chief Engineer
Maclean-Hunter Cable TV Limited
27 Fasken Drive
Rexdale, Ontario, Canada

Spectrum analyzers are bound to find many applications in cable television systems because of their close family relationship to the familiar signal level meter. Signal level meters are heterodyne receivers tunable manually and are usually single conversion receivers, tuned manually, fixed IF bandwidth with a moving coil meter indication of input signal level. Spectrum analyzers are also heterodyne type receivers but have electrically swept local oscillator(s) and usually display the input signals on an oscilloscope type display signal amplitude versus frequency. The more sophisticated versions have logarithmic display over a range of 70 db or more, selectable bandwidths, and very stable sweep and tuning characteristics.

Our company has been using spectrum analyzers for more than four years, principally for observation of signal levels in various parts of the system and for finding and eliminating many sources of spurious signals in cable television systems. Our early spectrum analyzers had 5 KHz bandwidth, tuning range of 1 to 300 MHz in a single display and a 50 db dynamic signal display range. About six months ago we acquired a more sophisticated spectrum analyzer system consisting of a Hewlett-Packard 141T display frame with 8553B RF section, 8552B IF section, 8443A tracking generator/counter, and an 8554L RF section. The 8553B tunes 1 KHz to 110 MHz (in a single sweep if desired) and has a range of IF bandwidths from 300 KHz down to 10 Hz. The associated IF section provides 70 db display (10 db/division) or 16 db of display in a 2 db/division mode. Linear display is also available. The 8554L RF section tunes 1 to 200 MHz but is limited to 300 Hz bandwidth by the less stable oscillators in this RF section. The 8443A which operates with the 8553B RF section adds a tracking oscillator which acts as a sweep generator which frequency tracks with the associated receiver. A built in frequency counter operates with a "marker" on the display to permit 8 digit reading of any desired point on the display. The counter provides 10 Hz resolving power and has an internal clock specified to 3 parts in 10^8 accuracy. Detailed specifications are available from the manufacturer.

TRACKING GENERATOR APPLICATIONS

The tracking generator works only with the 8553B RF head and is consequently limited to a 110 MHz range. We use heterodyne conversion techniques to extend the range to higher frequencies but this can be done only over a narrow frequency range, e.g. one or two TV channels, because of flatness problems in the accessory mixers. Figure 1 is a simplified block diagram of the spectrum analyzer and tracking generator/counter. This combination makes an extremely useful sweep generator instrument. Spurious frequency components in the sweep signal output are ignored by the selectivity of the receiver section. The 70 db dynamic range in the display makes it possible to observe response over a wide amplitude range. This is particularly useful in working with channel band pass filters and with head end processing equipment. The associated counter permits easy direct digital reading of frequency at any point on the display. Dispersion calibration is reliable and this also assists in the examination of cable TV equipment.

continued...

Frequency range of the tracking generator/spectrum analyzer combination can be extended by use of a double heterodyne technique similar to that used in cable TV head end signal processing equipment. A local oscillator of the desired frequency drives two mixers, one acting as an up converter for the tracking generator signal and the other as a down converter to bring the signal back to the tuning range of the spectrum analyzer. The selectivity of the spectrum analyzer looks after image problems. A pad in the input to the splitter assists the hybrid splitter in providing isolation between the two mixers. A combination of good mixer isolation characteristics and good isolation in the splitter hybrid provides adequate overall isolation. Local oscillator drive must be adequate to make up for pad and splitter loss. The local oscillator stability and frequency accuracy affect any frequency measurements made with counter in this system. A laboratory signal generator is adequate for most purposes. Its frequency can be measured separately. For many purposes, we use a special local oscillator which we developed to extend the range of the 8553B RF section to 220 MHz.

We have developed a special purpose heterodyne "block converter" for converting the 110-220 MHz band down to 0 - 110 MHz so that it can be tuned on the 8553B RF section, see Figure 3. The 1 MHz clock signal from the 8443A counter is multiplied up to 110 MHz and used as the local oscillator in a block converter. This 110 MHz local oscillator is also available for use in the double heterodyne range extension system discussed above. At the present stage of development of this converter, the local oscillator is not as clean as we would like for use with the narrowest dispersion and bandwidths available on the 8553B and we may introduce a phase lock loop system to generate a cleaner local oscillator locked to the 110th harmonic of the 1 MHz clock signal.

The double heterodyne system was modified slightly to permit use of cable system carriers as frequency markers in examining the characteristics of a "high performance" channel band pass filter for channel 11. The filter had been ordered to provide maximum rejection of a strong local channel 10 signal. See Figure 4. Cable system carriers were mixed into the input of the channel 11 filter being tested using a hybrid directional coupler. Rejection of channel 10 visual carrier is seen to be only 26 db and channel 10 sound carrier is only about 6 db down! The wide dynamic range visible in a single display makes this a very useful technique for the examination of filters and processing equipment.

An old single channel amplifier strip (channel 11) was selected for demonstrating the use of the tracking generator in checking head end processing equipment. This strip was retrieved from a pile of obsolete equipment. Figure 5 shows the frequency response as observed with the tracking generator and with a conventional sweep generator and broad band detector. The strip is obviously very badly aligned. This is obvious even from the conventional sweep display in 5C. Figure 6 shows results after a preliminary re-alignment.

It is possible to check the alignment of processing equipment by injecting the tracking oscillator signal at reduced level through a directional coupler at the input of the processing unit and recovering it for the spectrum analyzer at the output of the processor. This technique is demonstrated in Figure 7. Generator level has been reduced to about 40 db below visual carrier so as not to interfere with the programme. Beat interference seems barely perceptible at this level. In Figure 7B

continued...

the analyzer gain has been raised and bandwidth reduced slightly to present a greater range of the processor response curve. Response is same as that observed without signals present. Any significant anomalies in processor frequency response can be detected in this way since dispersion range and centre frequency can be changed at will.

The tracking generator range is 10 KHz to 110 MHz and it makes a very good video sweep generator for checking the response of video equipment. It can be used to check the frequency response characteristics of modulators, particularly if a sample of the unmodulated RF carrier is available for use in a product detector system. See block diagram, Figure 8. We have also obtained usable results with the use of an independent local oscillator instead of the modulator carrier, particularly with higher modulating frequencies.

Figures 8B and 8C show the modulating frequency response of an IF modulator used in many of our cable systems. The unmodulated carrier was not available in this case and a signal generator operating close to the carrier frequency was used as the local oscillator. Response is fairly flat to just past 5 MHz.

The tracking generator and spectrum analyzer have been used as the sweep generator and tracking receiver for swept displays of group delay in RF equipment. The basic block diagram is shown in Figure 9. The group delay test set operated on the 20 KHz modulating frequency and group delay was displayed on another oscilloscope. The spectrum analyzer display showed the amplitude response of the system and provided frequency marker information.

SPECTRUM ANALYZER APPLICATIONS

The spectrum analyzer is convenient for investigation of system operating levels and has been used for that purpose by a number of systems for some time. The 8554L head is convenient for this purpose since it will display up to 1200 MHz in a single display. Low and high band may be displayed simultaneously. The 1200 MHz tuning range makes it convenient for use with UHF signals. The 300 Hz IF bandwidth and stability are adequate for most "general purpose" system applications. Co-channel interference can be easily recognized and measured with 8554L RF section. Most intermodulation products can be distinguished with this RF head, except those occurring at "near zero beat". Utility of the spectrum analyzer for distortion product measurement can be increased by use of a set of channel band pass filters as external preselectors or preferably a tunable band pass filter. These external RF preselectors reduce the risk of generating unwanted distortion products in the spectrum analyzer first-mixer.

The special bandwidth and stability characteristics of the 8553B RF section and associated 8552B add some additional applications to the cable TV engineer's bag of tricks. The 10 Hz IF bandwidth, 20 Hz/division dispersion and associated frequency counter make it possible to use the instrument for precise determination of carrier frequencies (to about 10 Hz precision). Low level spurious signals can be observed and "counted". Frequency determination helps considerably in determining the source of a spurious carrier. Many of the characteristics of the 8553B section can be used in the 110 - 220 MHz band by the use of the precision heterodyne converter previously described.

continued...

Figure 10 shows a series of steps in the analysis of a co-channel interference problem on channel 2. Figure 10A shows the entire channel with visual and aural carriers and chroma information. Channel 3 carrier is also visible. In 10B the co-channel components are visible. The channel 2 carrier here operates with zero offset. Co-channels are visible with +and - offsets. The - offset is the stronger and is only 36 db below carrier. In 10C we examine the - offset co-channel more closely. It appears as a single carrier about 10 KHz below the carrier. The component about 6 KHz below the carrier is believed to be an intermodulation product. These observations were made after about 25 amplifiers in Cascade, but are valid with respect to the co-channel component. In 10D dispersion has been narrowed and bandwidth reduced to 30 Hz. Gain has been increased by 20 db. Three separate co-channel carriers are now apparent. In 10E we go to maximum resolving power and show the three co-channel interfering carriers. Their relative level has changed since the previous observation (interval about 5 minutes). Their relative frequency has also changed due to slight drift in the individual transmitters. The centre frequency in 10E has been marked as 55.24003 MHz. The individual carrier frequencies can be interpolated from the 50 Hz/division calibrated dispersion. The drift of the individual interfering carriers can be easily observed on the spectrum analyzer because of the exceptional stability of the analyzer. The analyzer drift can be noted by reference to the associated frequency counter. When used in our laboratory, we reference the counter to a Loran C derived frequency reference which is accurate to at least 1 part in 10^9. In field work, we rely on the crystal-in-oven in the counter which is specified to be about 3 in 10^8 after three hours warm up.

The 10 Hz bandwidth and exceptionally good shape factor permit using the spectrum analyzer to check hum modulation by observing and measuring the 60 Hz and 120 Hz modulation sidebands of the affected RF carrier. This is demonstrated in Figure 11. For demonstration, we used a small 53.25 MHz crystal oscillator energized by a battery. Figure 11A shows the spectrum of the bettery energized crystal oscillator. Figure 11B shows the spectrum after passing through a small MATV type amplifier. The 120 Hz sidebands (full wave power supply) are barely visible at about -70db. Figure 11C shows hum modulation in another small amplifier. Sidebands are about 60 db down. Hum modulation observations of this kind cannot be made on carriers with ordinary TV modulation. The hum modulation sidebands are completely obscured by the sidebands caused by the vertical sync pulse information.

The spectrum analyzer was used to analyze the characteristics of the 110 MHz local oscillator developed for the 110-220 MHz block converter. Figure 12 shows a succession of bservations on this oscillator. Figure 12A some spurious 10 MHz and 1 MHz components. The 10 MHz sidebands are about 70 db down. The 1 MHz components are about 65 db down. Figure 12B shows the 1 MHz sidebands more clearly. A significant noise component in the main carrier is now apparent. It appears to have the shape of the 110 MHz bandpass filter used to separate the desired 110 MHz harmonic component. Figures 12C and 12D show the noise more clearly. This noise level and other spurious products will have to be reduced below 60 db before the local oscillator is satisfactory for this purpose.

A spectrum analyzer is a convenient instrument for calibration of FM deviation using a carrier null technique. Frequency modulation by a sinusoidal modulating frequency can be analyzed in terms of Bessel functions which indicate periodic nulls of the carrier as deviation is increased. The second Bessel carrier null occurs for a modulation index of 5.52007 and a simple calculation indicates that a modulating frequency of 4.53 KHz and deviation of 25 KHz will produce the second carrier null in the case of standard TV aural carrier modulation. To set the FM

continued...

modulation level on a cable TV modulator, a modulating frequency of 4.53 KHz is used and the modulation level increased until the second null is observed on the spectrum analyzer. The nulls are easily seen as the modulation level is increased. A VU or voltmeter can then be used to indicate proper audio level for 100% FM modulation. Figure 13A shows an unmodulated aural carrier. This is not a very good modulator as the unmodulated carrier should show less frequency deviation than is apparent here. In Figure 13B, FM at 4.53 KHz has been applied and modulation level adjusted to the second carrier null. Depth of mull is approximately 25 db. Figure 13C shows the same display at 10 KHz/division dispersion. Figure 13D shows the spectrum of the modulating signal (4:53 KHz). Number and amplitude of distortion products are immediately apparent. Principal distortion product is the third harmonic and it is about 20 db below carrier. The spectrum analyzer can be used for analyzing audio signals above 1 KHz. Note that the occupied bandwidth (to the -40 db points) is about 80 KHz. This is somewhat more than observed on broadcast station carriers. We suspect that most broadcast stations undermodulate somewhat.

The spectrum analyzer can be used to investigate the characteristics of a television modulator by direct observation of the RF spectrum when modulated by sinusoidal modulating signals of controlable frequency. The series of photographs in Figure 14 shows RF spectrum of an IF modulator, of a type often used in cable systems, when modulated by a good quality sinusoidal oscillator. Modulation was set to 80% at 1 MHz video by observing the RF modulation envelope. Modulating Signal was then reduced by 20 db to reduce the harmonic distortion in the modulator. The video oscillator was swept manually over the desired range while the spectrum analyzer swept at quite a fast rate. The display was built up using the storage feature of the oscilloscope and was photographed using a time exposure while the video oscillator was manually swept. Figure 14A shows the spectrum as the video oscillator is tuned from 1 MHz to 10 MHz. This is an IF modulator and the vestigial sideband is the upper sideband. The up-converter will invert the sidebands and remove most of the "out-of-band" components. In Figure 14B, the gain has been increased to bring the sidebands to the top reference line. The vestigial sideband characteristic is not correct. It is not cutting off soon enough. Figure 14C and 14D show this vestigial sideband more clearly. Two photographs have been taken with different exposures to optimize different parts of the display.

A multiburst signal at normal level was used as the modulating signal and the resulting RF spectrum observed. The multiburst used has bursts at 0.5 MHz, 1.5 MHz, 2.0 MHz, 3.0 MHz, 3.6 MHz and 4.2 MHz. The spectrum at video frequency is shown in Figure 14A. The photograph should have shown the 0.5 MHz component at same level as the others. The resulting RF spectrum is shown in Figure 15B. Vestigial sideband is not adequate, as previously demonstrated. A full field multiburst like this should be a good signal for checking the frequency response from a broadcast transmitter right through a cable system.

In Figure 15C the low frequency modulation characteristics are being checked. Figure 15C is a multiple observation with successive modulating frequencies of 50, 100, 200, 300 and 400 Hz. The photograph was taken from the multiple observation on the storage tube. Low frequency sidebands are not symetrical which probably indicate some FM'ing of the carrier at these frequencies.

continued...

Figure 15D was taken to show the resolving power of a good spectrum analyzer. The photograph shows interlace of chrominance and luminance sidebands at about 1 MHz. The signal was a video "saturated colour bar". This observation was made on video components about 2.6 MHz below colour subcarrier. This kind of observation is within the power of the 8554L head since only 5 KHz/division dispersion and 300 Hz bandwidth were used. The high resolution head permits study of the "fine structure" by using the 10 Hz bandwidth.

SUMMARY

A few special applications of the spectrum analyzer and tracking generator/counter have been illustrated. Additional applications abound and the usefulness of these instruments is limited only by the ingenuity of the engineer using them.

How It Works

Both spectrum analyzer and TG/C mate to form a signal-analysis and swept-frequency measurement system that embodies versatility and precision. Basically, the TG/C generates a signal that coincides in frequency with the spectrum analyzer's tuning—and then accurately measures this signal's frequency on an 8-digit counter.

The spectrum analyzer is a triple-conversion receiver with three local oscillators (LO). For wide scan widths, the first LO sweeps while the third LO tunes to a fixed frequency. The second LO, a crystal oscillator is always tuned to 150 MHz. For narrow-scan widths (20 kHz/cm and lower), the first LO phase-locks to a crystal-controlled reference (at 100-kHz intervals) and the third LO sweeps. With a 2-MHz bandwidth, the 200 and 50 MHz IF's are

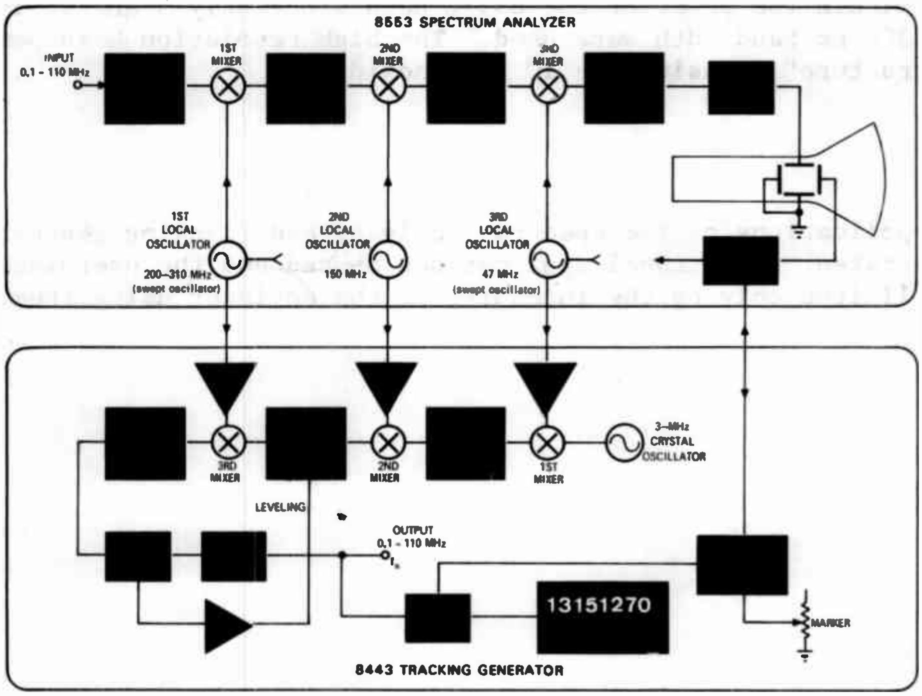


Figure 1 (courtesy Hewlett-Packard)

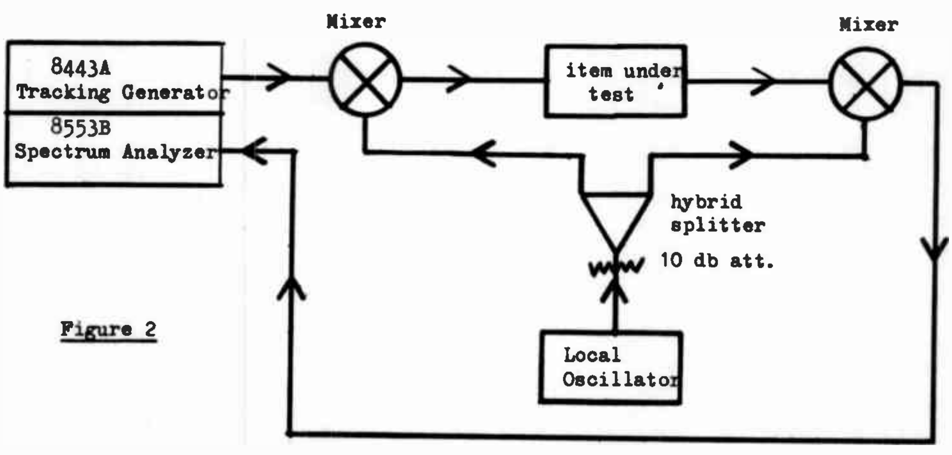


Figure 2

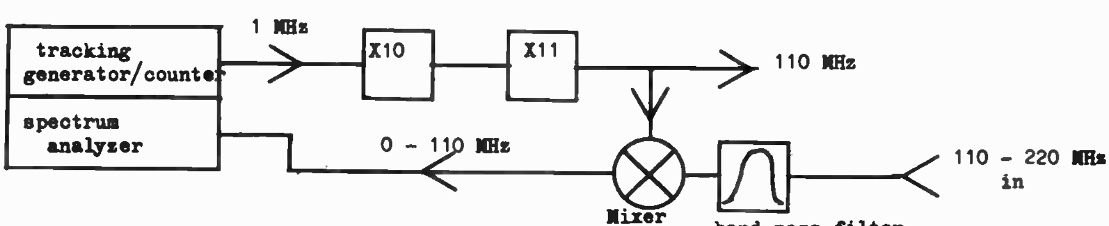
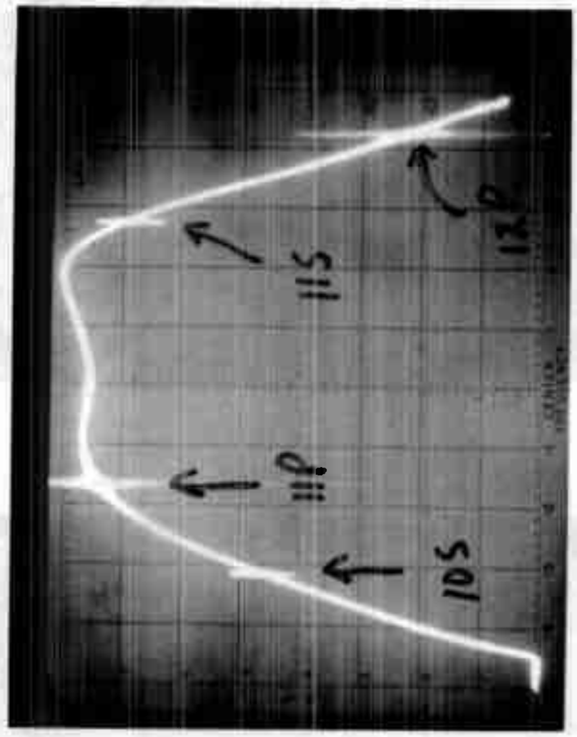
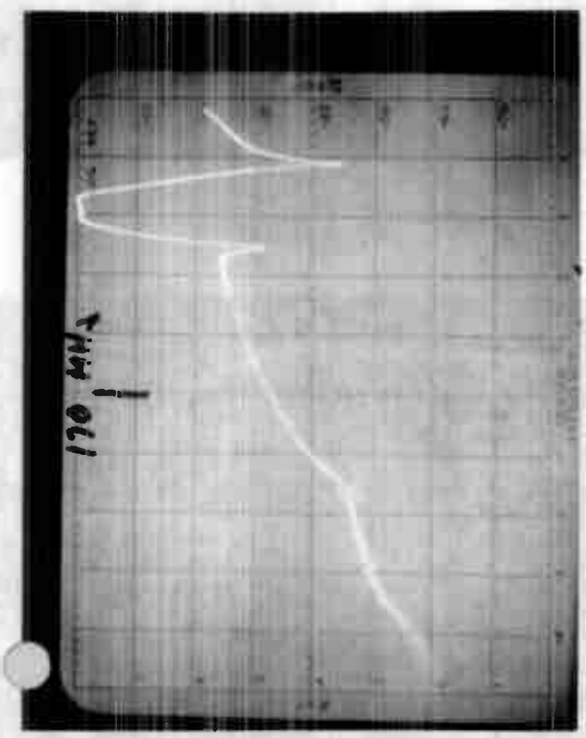
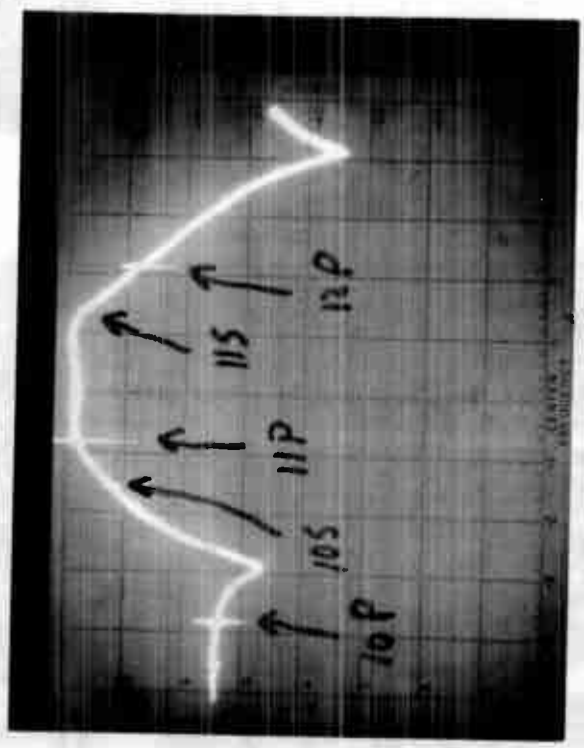


FIGURE 3

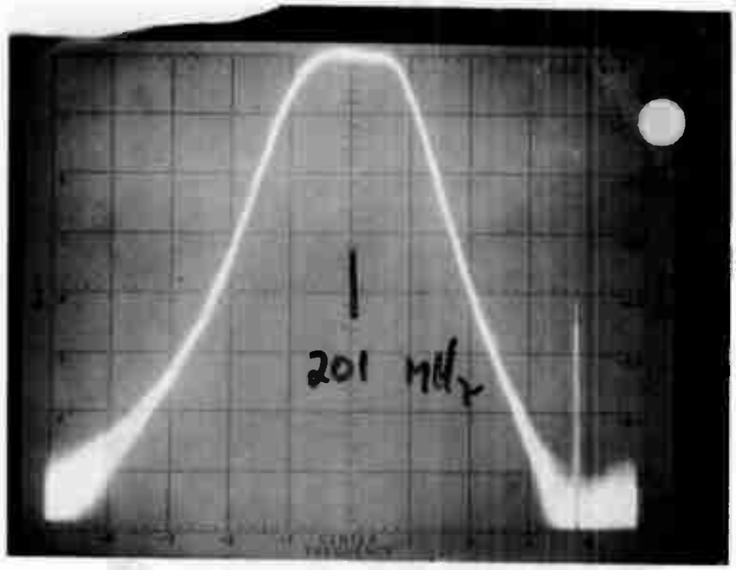

IMAGE
220 MHz
201 MHz


12P
115
11P
105

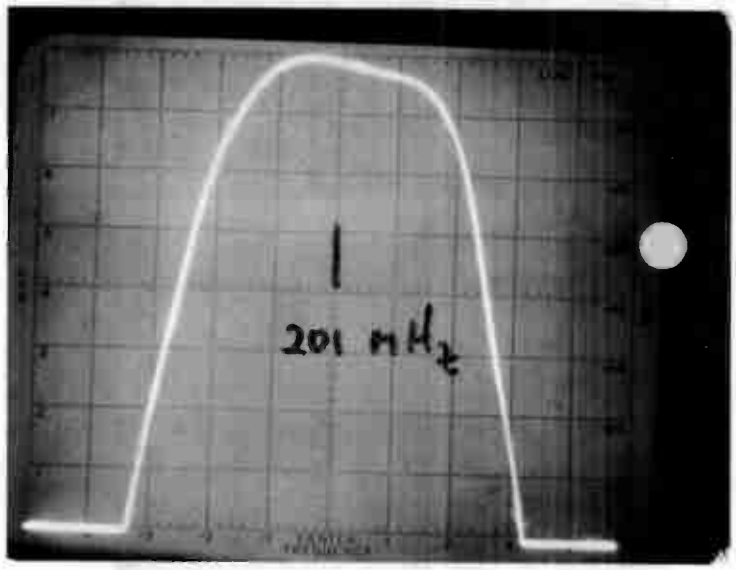

170 MHz

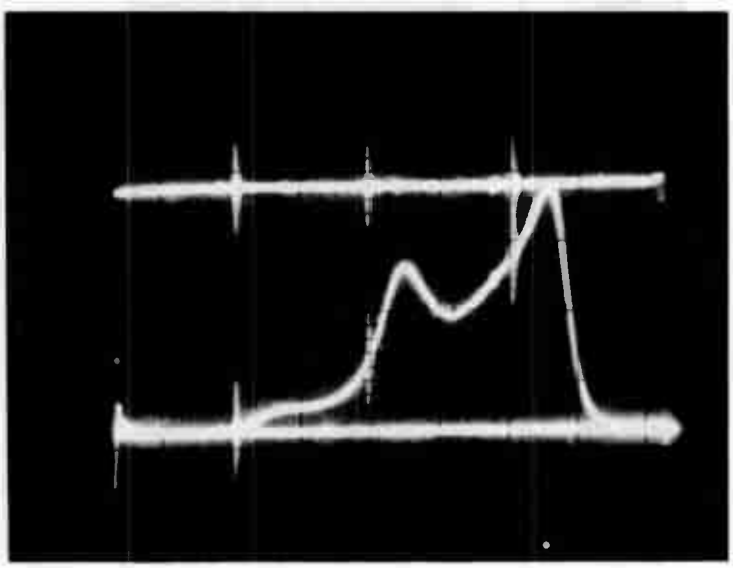

12P
115
11P
105
10P

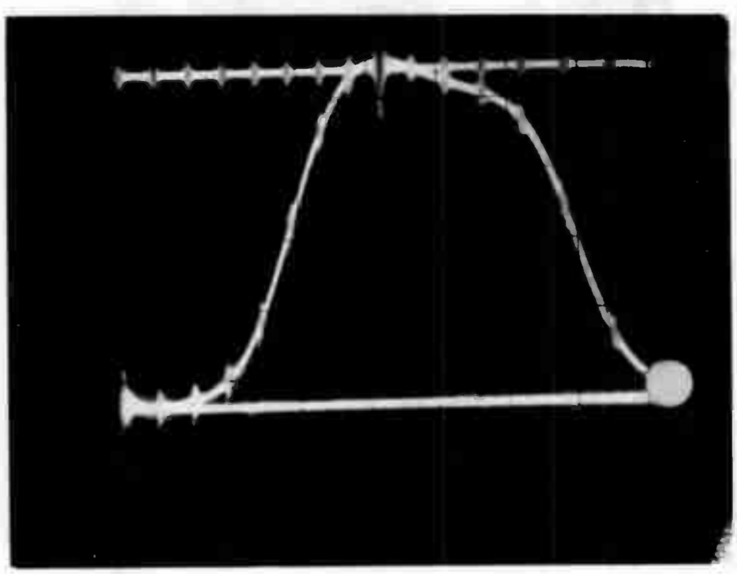

198 mHz

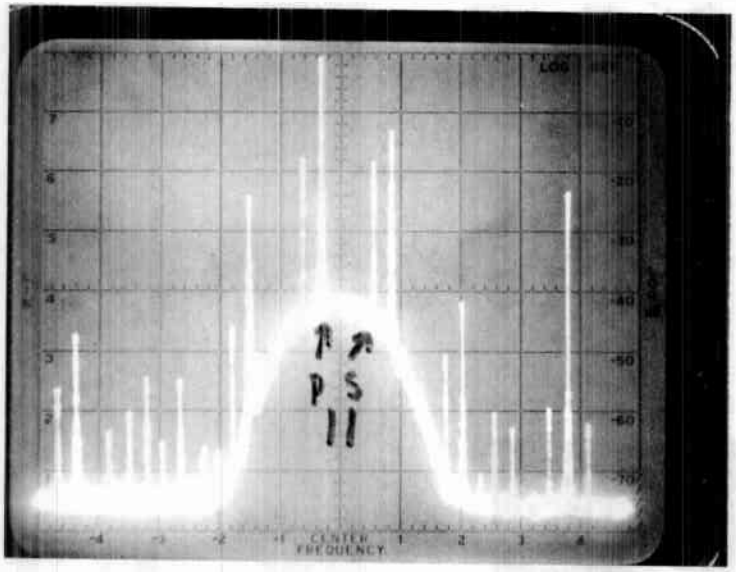

201 mHz

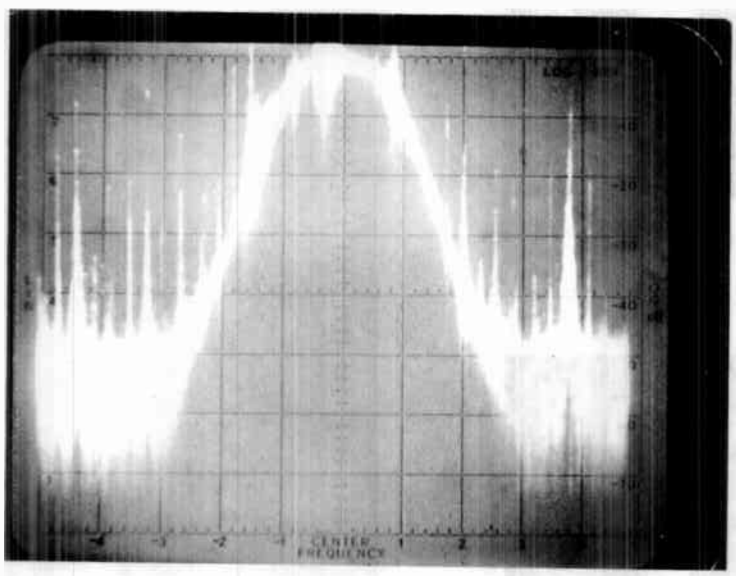

198 mHz

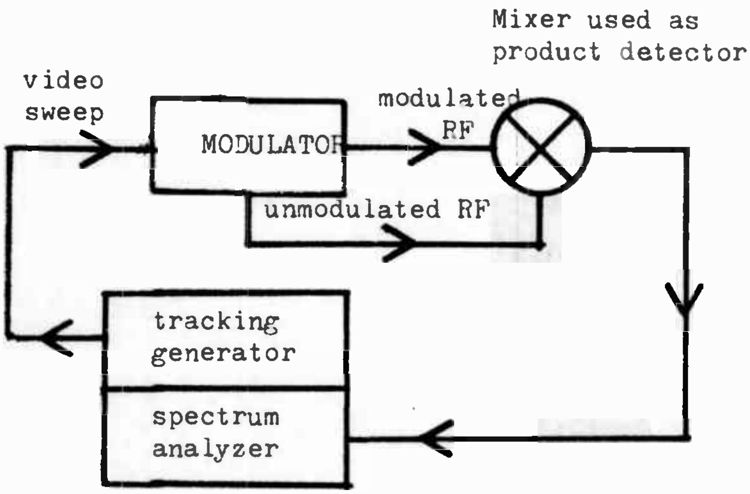

201 mHz

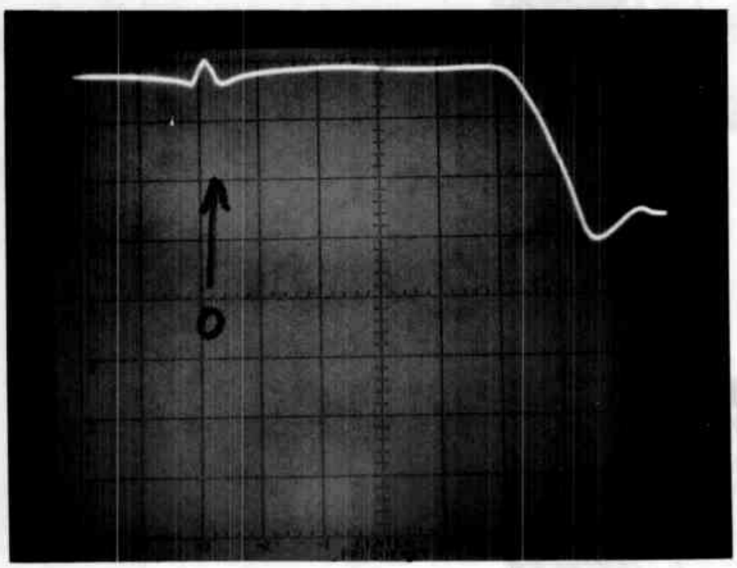


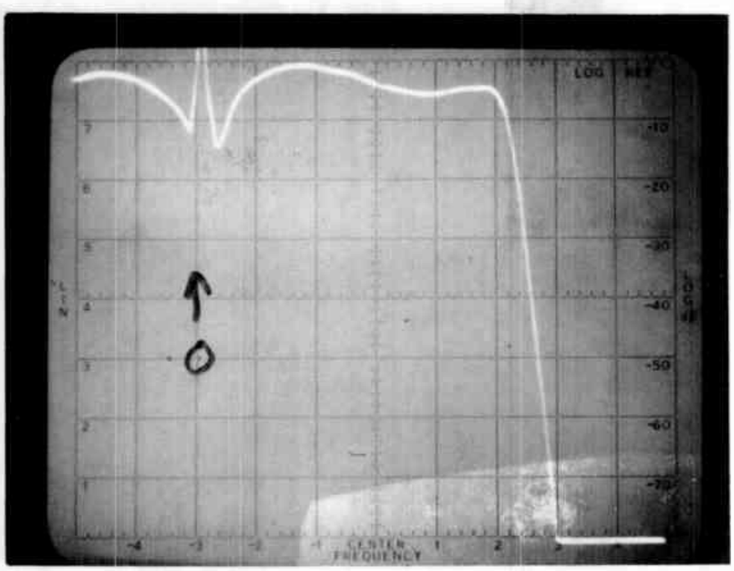


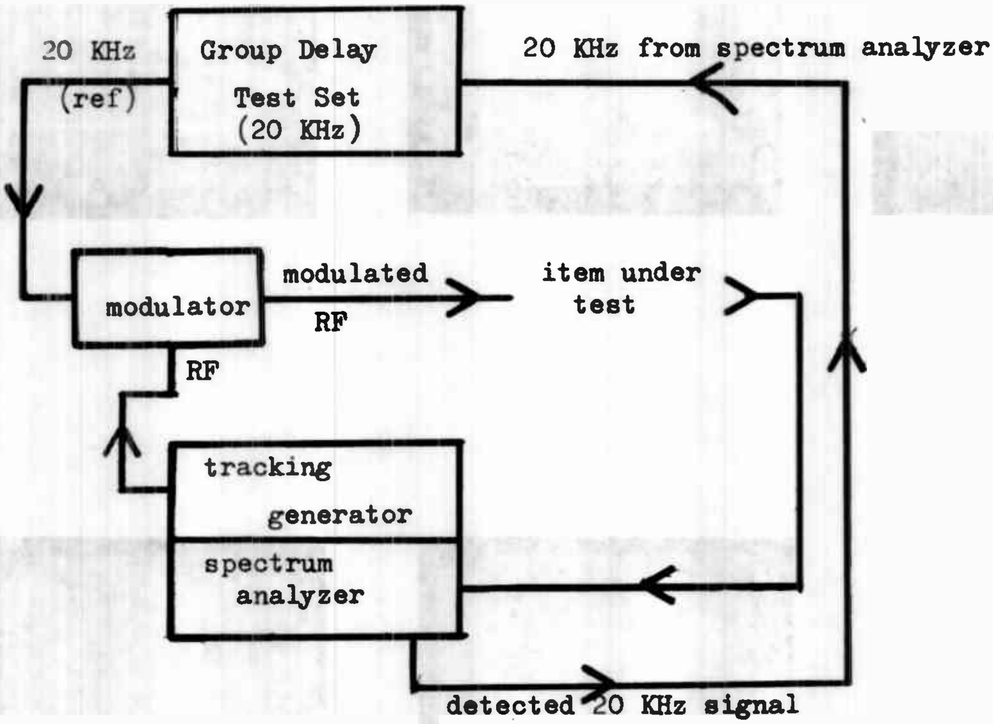

LOG
CENTER
FREQUENCY
P
S


LOG
CENTER
FREQUENCY


Mixer used as
product detector
video
sweep
MODULATOR
modulated
RF
unmodulated RF
tracking
generator
spectrum
analyzer

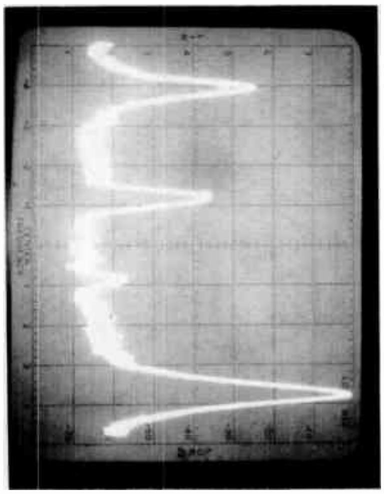

0

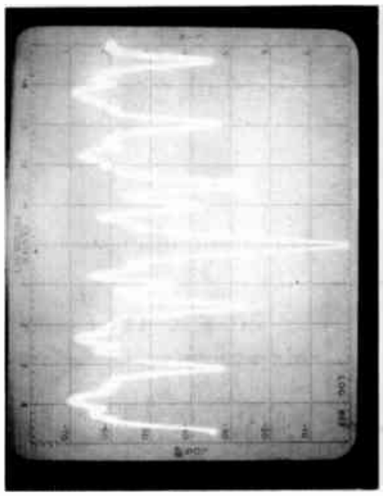

0

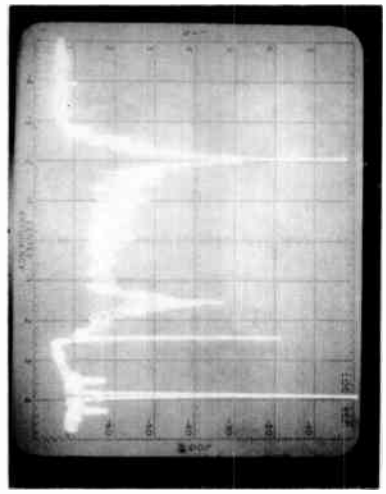


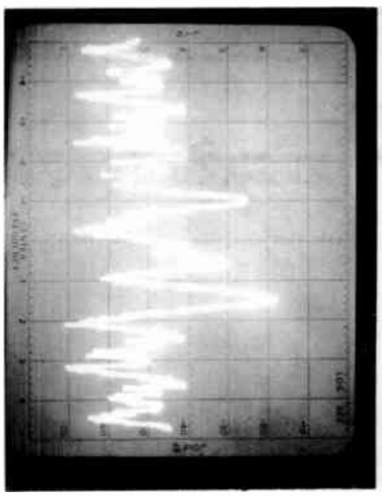
20 KHz
(ref)
Group Delay
Test Set
(20 KHz)
20 KHz from spectrum analyzer
modulator
modulated
RF
item under
test
RF
tracking
generator
spectrum
analyzer
detected 20 KHz signal

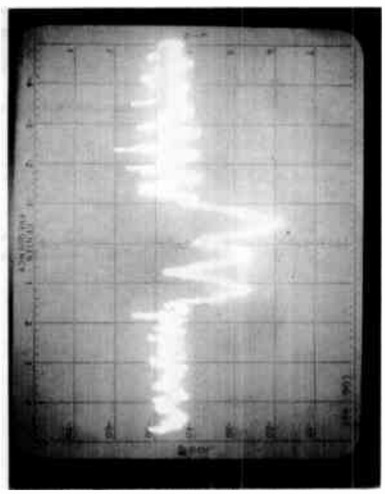
Figure 9

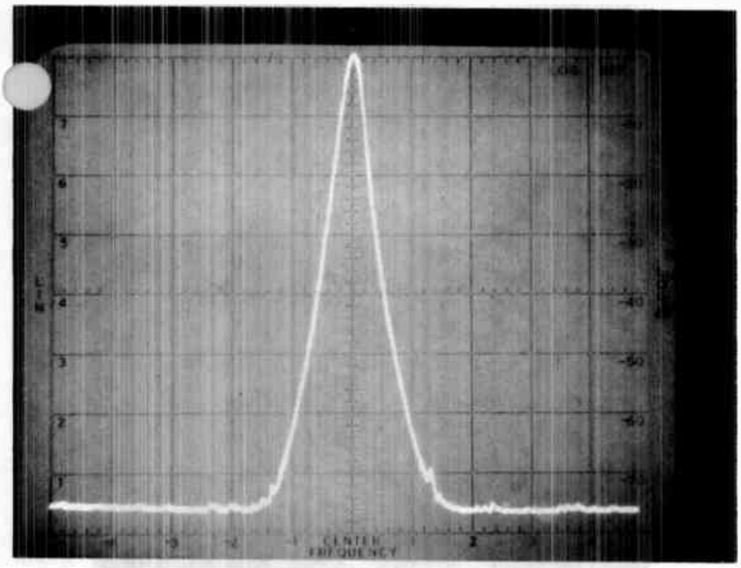


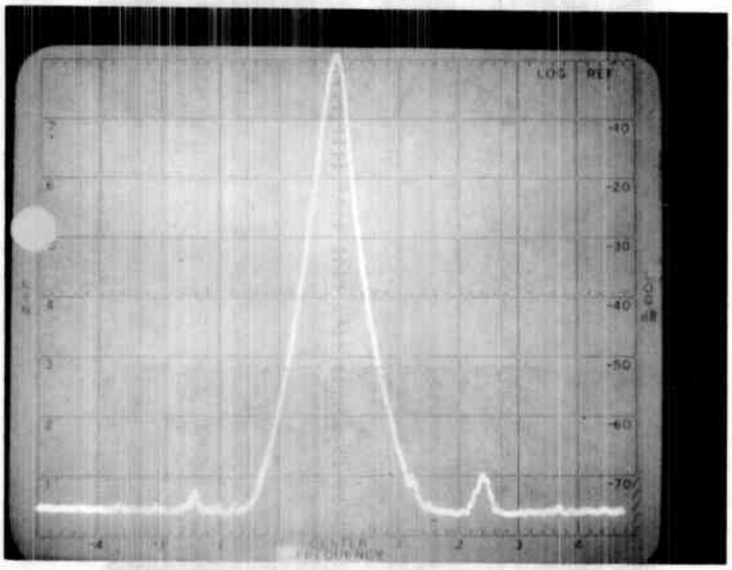


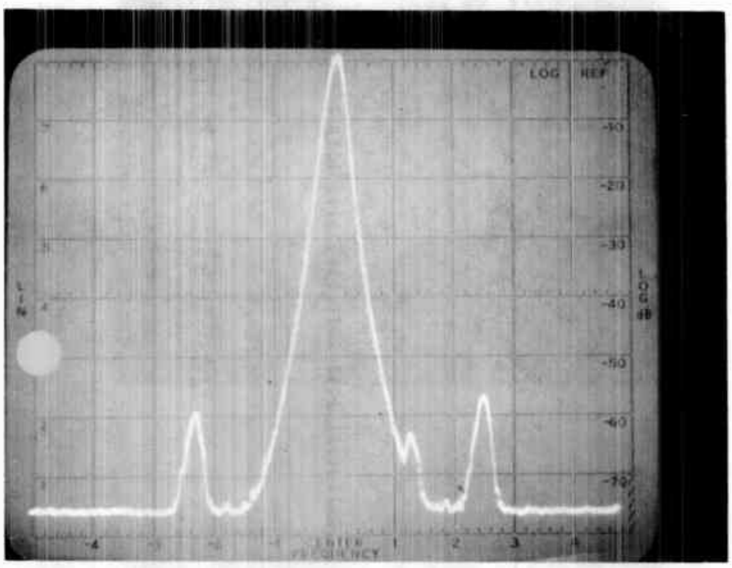


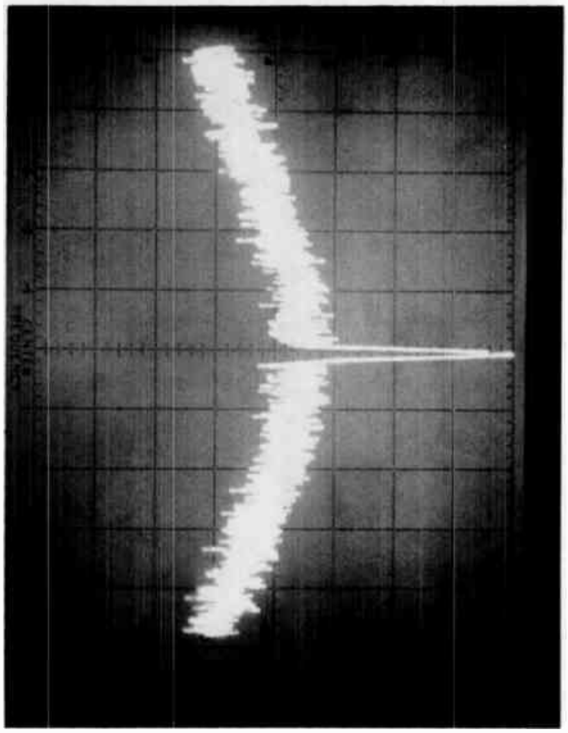


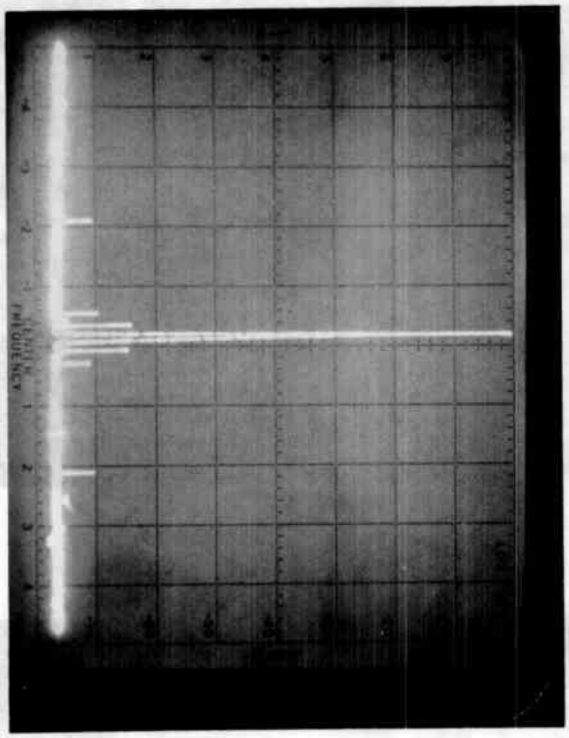


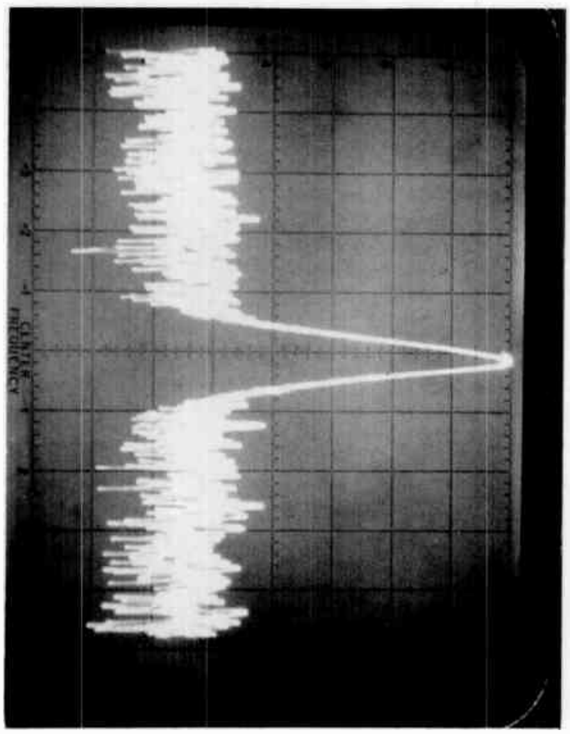

LOG
REF
CENTER
FREQUENCY

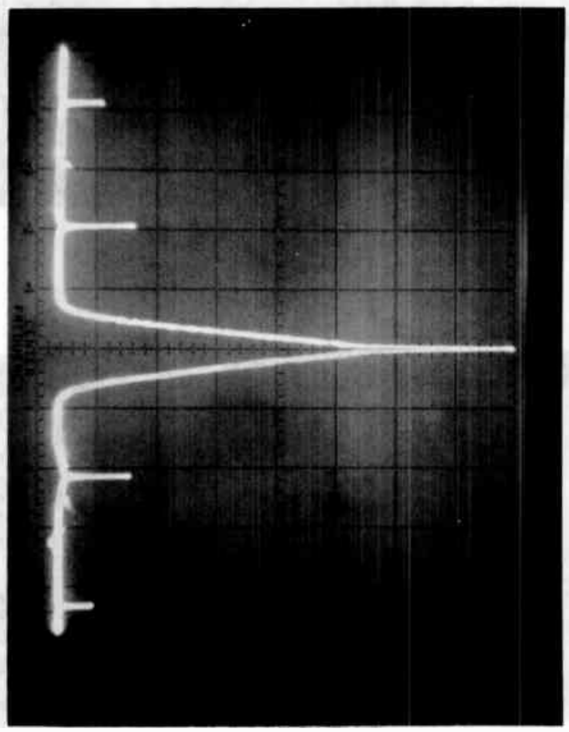

LOG
REF
-10
-20
-30
-40
-50
-60
-70
LOG
dB
CENTER
FREQUENCY

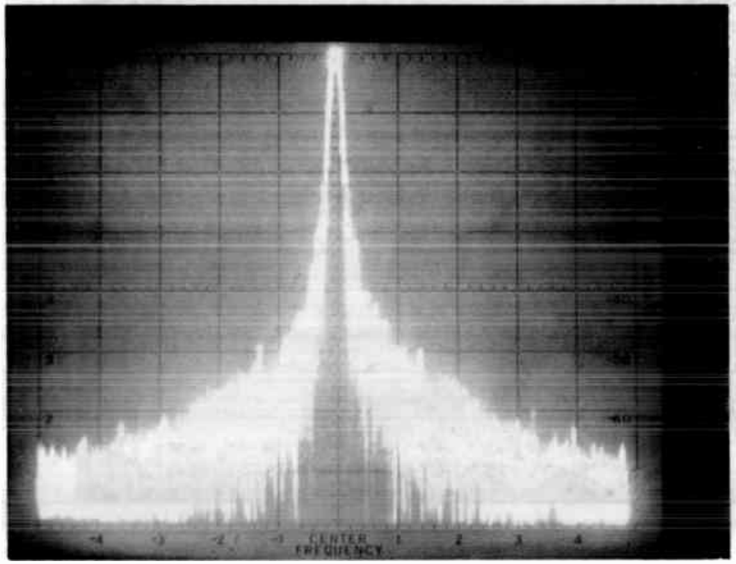

LOG
REF
-10
-20
-30
-40
-50
-60
-70
LOG
dB
CENTER
FREQUENCY

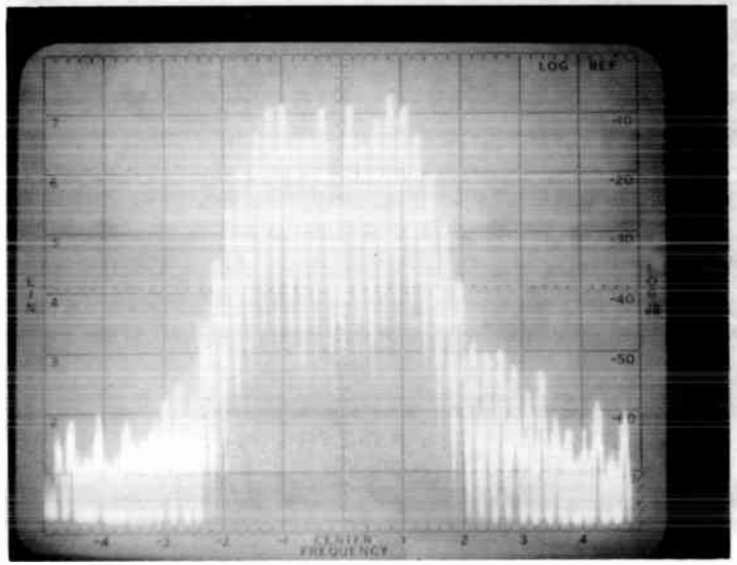


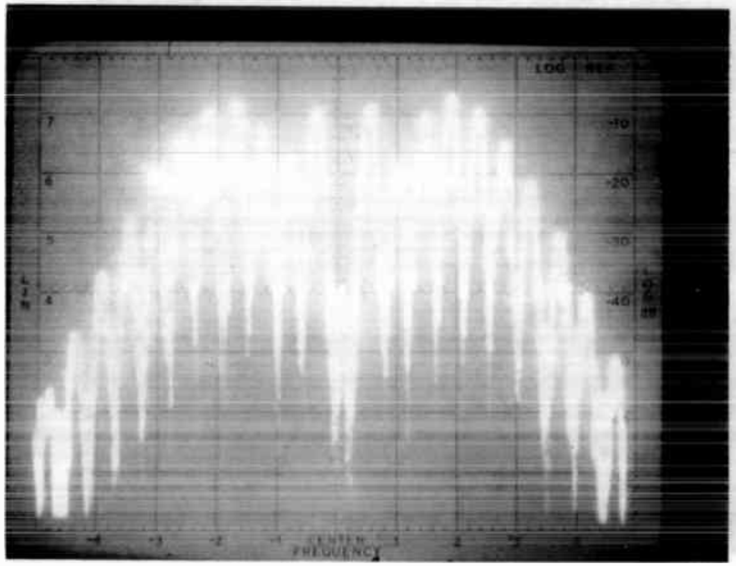


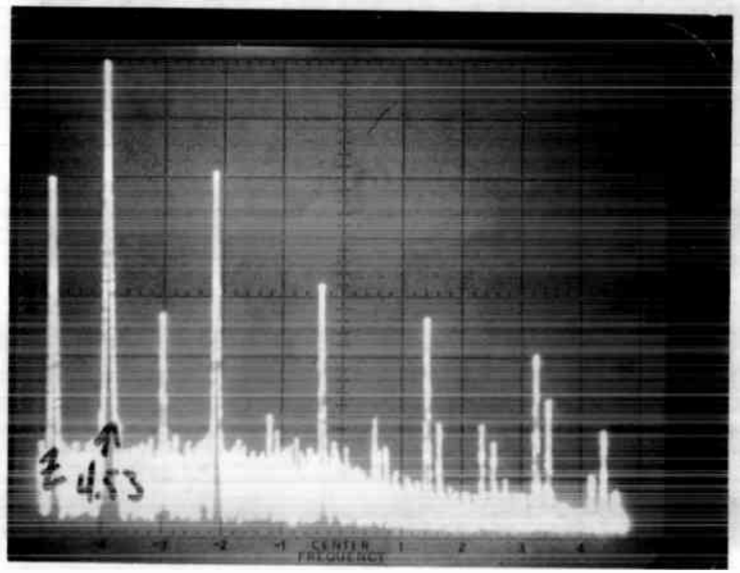


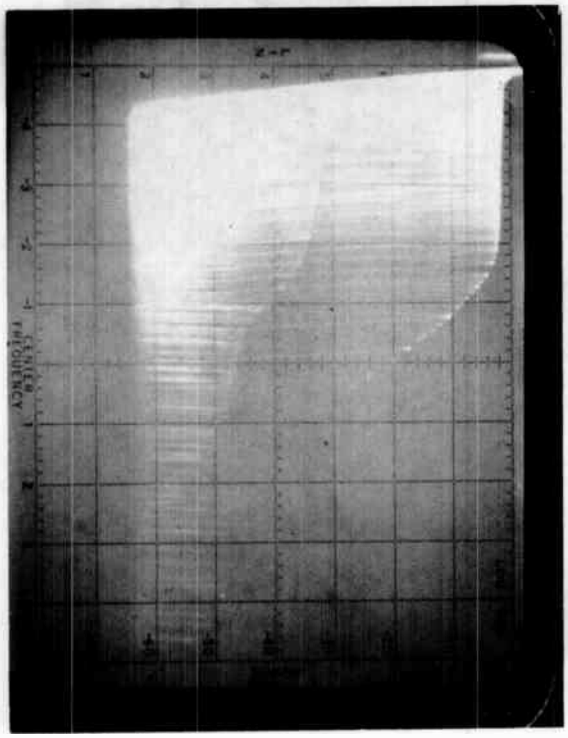


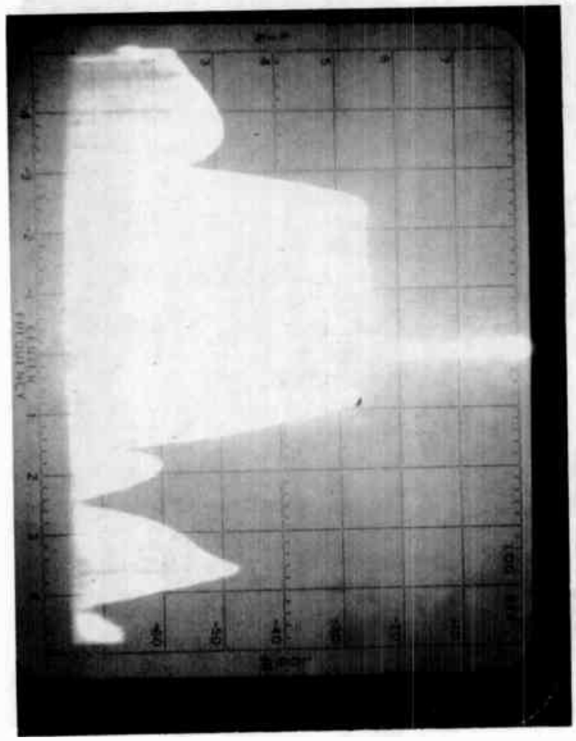

CENTER
FREQUENCY

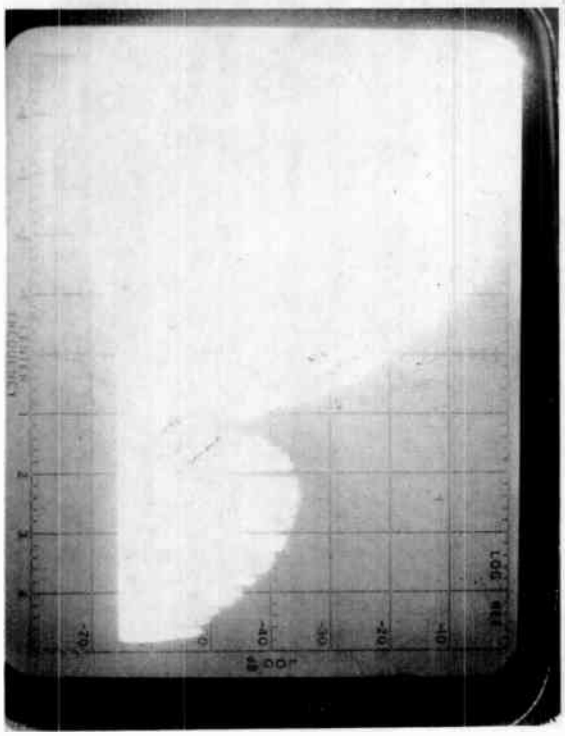

LOG REF
CENTER
FREQUENCY

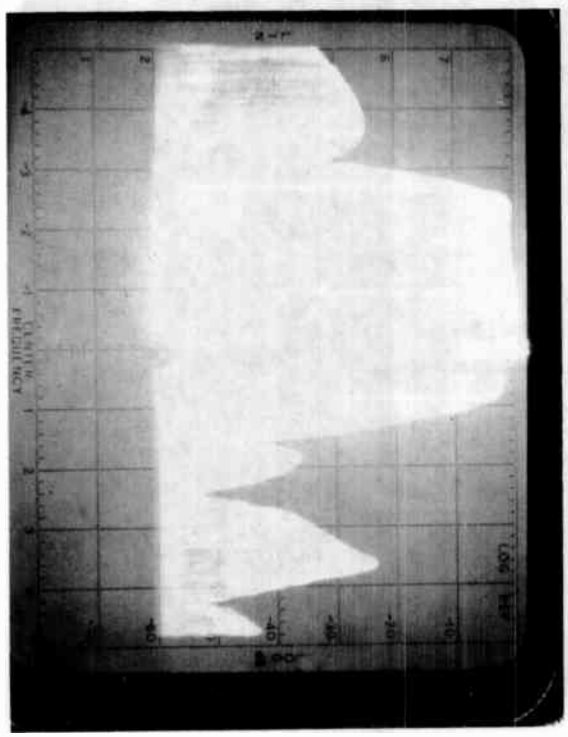

LOG REF
CENTER
FREQUENCY

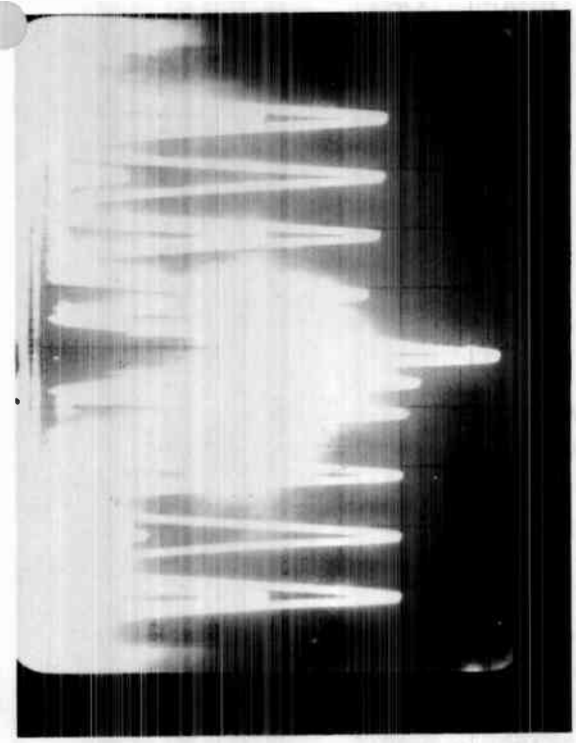

4.53
CENTER
FREQUENCY

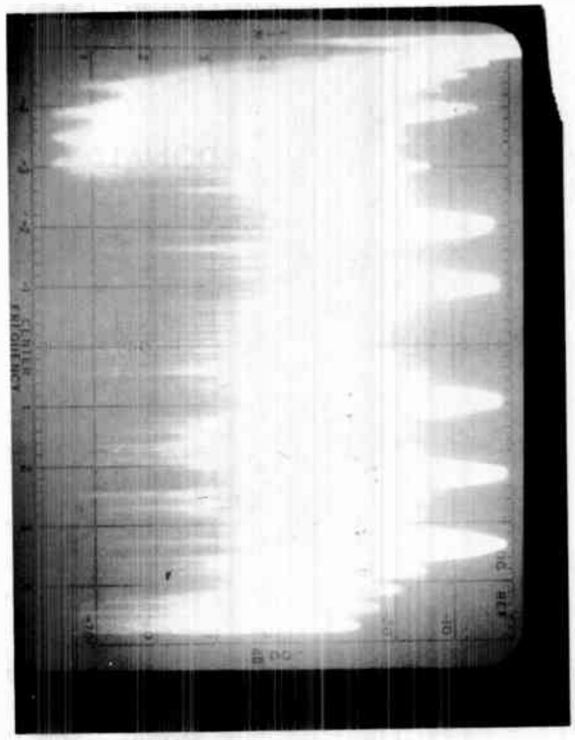


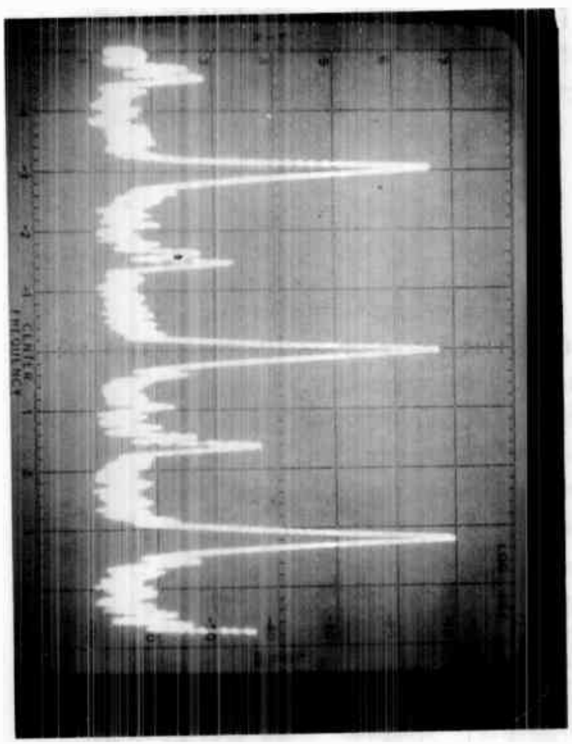


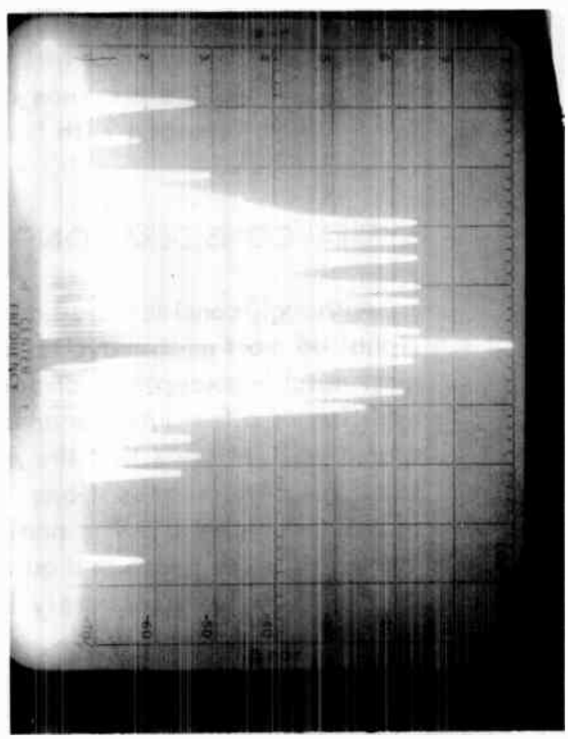












"PCM SUBCHANNELS FOR VIDEO MICROWAVE"

BY

DONALD KIRK and MICHAEL PAOLINI

ABSTRACT

A PCM subcarrier system has been developed which will permit video microwave to carry twenty-four 6 kHz channels along with the normal video signal. The channels may be used directly or split into forty-eight 3 kHz voice channels. The subcarrier system uses a differentially coherent quadraphase approach and has a data rate of three megabits.

The paper outlines the frequency requirements of implementing a subcarrier in the presence of video. Then a system block diagram description is given for the channelizing and subcarrier equipment. Performance curves taken from experimental data are given. These include the error rate performance for the system in the presence of differential phase and gain along with thermal noise.

SYSTEM CONSIDERATIONS

Although considerable baseband spectrum is available above the video signal on most microwave systems, it has remained relatively unused. The most notable exceptions are order wire subcarriers, fault reporting, and the addition of a few FM subcarriers for program channels. The reason for this sparse utilization is that the available spectrum above 5 mHz does not lend itself readily to conventional AM or FM subcarriers operating in the presence of the video signal. The nonlinearities of the microwave equipment, principally the differential phase and gain as well as the second harmonic distortion of the video signal all severely limit the achievable signal to noise performance of such subcarrier systems.

Figure 1-A contains a graph of the relative 15 kHz idebands that are produced on a subcarrier due to differential phase and gain in the microwave system. The presence of these sidebands will show as degraded signal to noise performance for a subcarrier system. The sidebands due to differential gain will limit the performance of an AM subcarrier, and the sidebands due to differential phase will limit the performance of an FM subcarrier. However, if a digitally modulated subcarrier is used, the data stream may be regenerated, and the cross-modulation effects removed. Also, if a phase modulated subcarrier is used and the data stream is recovered by differentially comparing the phase of the subcarrier, then the effects of differential phase can be minimized even further.

If a digitally modulated subcarrier is to be used, some consideration must be given to how many subchannels may be placed in the available bandwidth. For the quadraphase system selected, the available bandwidth was taken to be between 5.0 and 7.0 mHz. This permits a sufficient guard band between the subcarrier and the video on the low side, and on the high side the band edge is sufficiently below the second harmonic of the 3.58 mHz color subcarrier.

To fully utilize the available bandwidth, twenty-four 6 kHz channels were implemented. This number of channels was derived after several considerations. First, a channel should be capable of carrying a 5 kHz AM broadcast station, as this was in fact to be the first application of the equipment. Secondly, a channel should be capable of being split into two 3 kHz channels for standard phone circuitry applications. Therefore, a channel with frequency response slightly above 6 kHz was selected as a basic channel unit. If additional channel bandwidth is required for a specific application, this can be achieved by occupying more than one basic channel unit.

To meet the signal to noise requirements of 55 dB, each 6 kHz channel has its analogue input signal quantized into 256 levels (8 bits). This number of bits allows for a basic signal to quantizing noise of 59 dB. The eight bit code, together with the fact that the 6 kHz channel would have to be sampled at approximately a 14 kHz rate, indicated that each channel would require about 100 kilobits/sec. The quadraphase system selected could readily handle three megabits in the available bandwidth, so a basic channel number for the subcarrier system was established at twenty-four channels.

Once the approximate sampling rate was selected, the question arose as to whether an optimum sampling frequency near 14 kHz would have minimum interference with the video signal. Subjective tests were made by adding an interference frequency in the 14 kHz range to a video signal. It was found that frequencies which were separated from the 15.734 video sync frequency by an odd multiple of one half the line frequency (60 cycles) produced interference "nulls". These points were subjectively much more tolerable than any other frequency inserted at the same level. A sampling frequency of 14.624 kHz was selected. This frequency is thirty-seven (a prime number) times thirty cycles (one half the line rate) below the 15.734 kHz video sync frequency.

A further requirement of the system was to have the subcarrier frequency synchronous with the data rate. To achieve this, a 17.5488 mHz master oscillator was utilized and divided by three to generate a 5.849600 mHz basic subcarrier frequency. The basic subcarrier frequency is then divided by four hundred to obtain the 14.624 kHz sampling rate.

This basic sampling rate times the eight bits per sample determines the individual channel data rate which is 116 kilobits/sec. Since twenty-five channels are used on the system (twenty-four channels plus one channel for system synchronization purposes) the total data rate is 2.9248 megabits/sec.

To insert this information above the video signal, consideration was given as to which type of modulation is best suited to withstand the problems of the microwave system. After a tentative evaluation of several possibilities, a differentially coherent quadraphase modulation system was selected. This approach has several inherent advantages over other possible implementations. Since the detection process for this system is accomplished by comparing the carrier phase difference between two sequential data bits, the effects of differential phase are minimized. This is because the differential phase is occurring at a slow rate compared to the data stream, and although the total phase shift of the subcarrier may be large over a 15 kHz interval, the amount of phase shift between two adjacent data bits is considerably less.

Another advantage of this approach is that since the modulation information is on the phase of the carrier, it may be amplitude limited to remove the effects of differential gain.

The quadraphase approach was implemented instead of binary phase shift keying in order to meet the bandwidth requirements of the subcarrier system. The occupied bandwidth of the system may be limited to 1.5 mHz, which easily fits into the allotted two mHz band above the video.

SYSTEM DESCRIPTION

Figure one shows a block diagram of how the subcarrier system is implemented on a microwave path. The twenty-four 6 kHz inputs are time division multiplexed by the PCM transmitter. The channels are formed into two binary data lines, each carrying data at one half the overall three megabit rate. The PCM transmitter also generates the synchronization information and the carrier source for the subcarrier transmitter. These signals are supplied to the subcarrier transmitter which modulates the data onto the 5.84 mHz subcarrier. The modulated signal is band limited and added to the normal video signal. The composite signal is then supplied to the microwave baseband.

At the microwave receiver, the composite signal is connected to the subcarrier receiver which removes the subcarrier from the video signal, and demodulates the data stream back into two binary data lines. The binary data lines are connected to the PCM receiver which decodes the data back into twenty-four 6 kHz audio channels.

Figure two contains a block diagram of the PCM transmitter. The 17 mHz crystal oscillator is used to derive all of the timing signals, including the 5.84 mHz subcarrier. The basic data rate of one bit per 700 nanoseconds is exactly one fourth of the subcarrier frequency. A single channel occupies four sequential time slots. There are twenty five channel assignments (twenty four channels plus one channel for synchronization) which total one hundred data intervals per 14 kHz sampling interval. The timing generator divides the basic data rate with a seven bit countdown chain which resets on the one hundreth data pulse. The seven bit timing pulses synchronize the indivual channel encoders onto a common pair of data lines.

The block diagram for the subcarrier transmitter is shown in Figure three. The 5.84 mHz carrier source is split into four phase related sources of the same frequency. The signals are at a 90° spacing, and are supplied to the phase modulator. The arithmetic unit cumulatively adds the data bits prior to transmission. This is necessary since the differentially coherent detection process in the subcarrier receiver is subtractive. Although the cumulative addition could have been done in the subcarrier receiver, this is not the optimum location. If the arithmetic unit is placed in the receiver, a single error in the detection process will cause all of the remaining bits in that sampling interval to be wrong. Therefore, the arithmetic unit was placed in the transmitter which has the data stream at a much higher signal to noise ratio and is essentially error free.

The synchronization channel occupys four data time slots as in the normal information channels. During the first two time intervals of the synchronization period, the 5.84 mHz subcarrier is amplitude modulated to an "off" state. This modulation is AM detected in the subcarrier receiver and used to phase lock the local clock in the PCM receiver. During the third time interval 0° phase reference carrier is transmitted alternately (on different sample intervals) with 180° phase carrier. The fourth time interval is used to always transmit 0° reference phase. In this manner, alternate sampling periods are uniquely identified. The third time interval corresponds to a channel split pulse that is used when a 6 kHz channel is split into two 3 kHz channels. Each 3 kHz channel is alternately sampled by the 14 kHz sampling pulse, which effectively divides the 14 kHz sampling rate in half for each channel.

After the data and synchronization information is added to the subcarrier, the modulated subcarrier is band limited to restrict the occupied bandwidth in the microwave baseband. The incoming video signal is also band limited to 4.5 mHz to remove any harmonics which would fall in the subcarrier channel. The subcarrier is then added to the video signal and the composite signal is connected to the microwave baseband.

Figure four contains a block diagram of the subcarrier receiver. The composite baseband signal from the microwave receiver passes through a splitting filter which removes the subcarrier signal from the video signal. The subcarrier signal is then split to drive both an AM detector and a phase detector. The AM detector recovers the synchronizing pulse that occurs during the first two time intervals of the synchronization channel interval. The detected pulse is used to phase lock the receiver clock.

The phase detection process is accomplished by comparing the phase of the subcarrier during the presently arriving data bit to the phase of the subcarrier during the previous data bit. This process is subtractive, as the recovered data stream is the difference between the two bits. To recover the data stream directly, the bits are cumulatively added in the transmitter, so that the difference operation in the receiver produces the data stream directly.

Figure five contains a block diagram of the PCM receiver. The detected AM sync pulse is phase compared with a 14 kHz sampling pulse generated by dividing down the VCXO in the PCM receiver. The VCXO is at 5.84 mHz and has a countdown chain similar to the one in the transmitter. The phase comparator is enabled only during the first two time slots of the synchronization channel. This prevents spurious sync pulses from entering the phase comparator while the remaining twenty four channels are transmitting. To acquire lock, the sync pulse derived from the local VCXO slowly advances in time through the different channels. When the local sync pulse passes through the synchronization channel, the phase comparator is enabled, and lock is achieved.

The 5.84 mHz VCXO in the receiver generates the same timing signals that were available in the transmitter. Individual channel decoders are enabled for a four bit interval corresponding to their correct encoding channel, and the recovered data is decoded into the original analogue input signal.

SYSTEM PERFORMANCE

To evaluate the system performance in the presence of thermal noise and microwave distortion, a pseudo-random sequence generator which could occupy a single transmitted channel was designed. At the receiver, a channel card which was programmed to accept the known sequence was implemented, and an error count was made between the locally generated sequence and the received sequence. It was found that additional channels did not change the error rate performance, with the exception of the two channels adjacent in time to the error test channel. Therefore, the data was always taken with these adjacent channels fully loaded.

A test set was made which would simulate microwave distortion, as well as add thermal noise to the subcarrier signal. Differential gain was produced by amplitude modulation of the subcarrier at a 15 kHz rate. Differential phase was produced by varactor modulation driven by a 15 kHz full wave rectified sine wave which produced parabolic phase distortion similar to that encountered in microwave systems. The test set was checked by using a video test set which uses a 3.58 mHz test signal. Good agreement was observed between the video test set and the sideband predictions of Figure 1-A when measured on a spectrum analyzer.

Figure six contains error rate performance curves for different values of signal to noise with different amounts of microwave distortion. For no microwave distortion, the subcarrier system achieves an error rate of 10^{-5} for a signal to thermal noise ratio of 17 dB. This would mean an individual 6 kHz channel would have approximately one error per second. Experimental results with 5 kHz music channels indicated that less than ten errors per second would pass for an undegraded music channel.

The outside curve of figure six (on the right hand side) is an error rate versus signal to noise curve where diffential phase and gain have been applied to the subcarrier. Differential gain sufficient to produce 20 dB relative sidebands on the subcarrier, and differential phase also sufficient to produce 20 dB relative sidebands were simultaneously impressed upon the subcarrier. This corresponds to approximately 23° of differential phase and 3.5 dB of differential gain. The microwave distortion has the effect of shifting the error rate curve to the right, that is, it makes apparent signal to noise degradation. To achieve a 10^{-5} error rate, the signal to noise had to be increased to 21 dB as compared to 17 dB without microwave distortion. Otherwise, there was no change in the individual 6 kHz channel performance. This indicates the digital system does eliminate the differential phase and gain effects of the microwave system, but must be operated at a slightly higher signal to noise ratio than would otherwise be expected.

For less than 20 dB differential phase and gain sidebands, the error rate curve shifts to the left toward the thermal noise curve. The two inside curves plotted are for 20 dB differential phase sidebands only, and for 20 db differential gain sidebands only.

Prototype equipment has been evaluated on a four hop back to back microwave system, and through a 500 mile heterodyne repeater system. In both cases, an error rate of 10^{-5} was achieved by operating the subcarrier approximately 17 dB below the composite video signal.

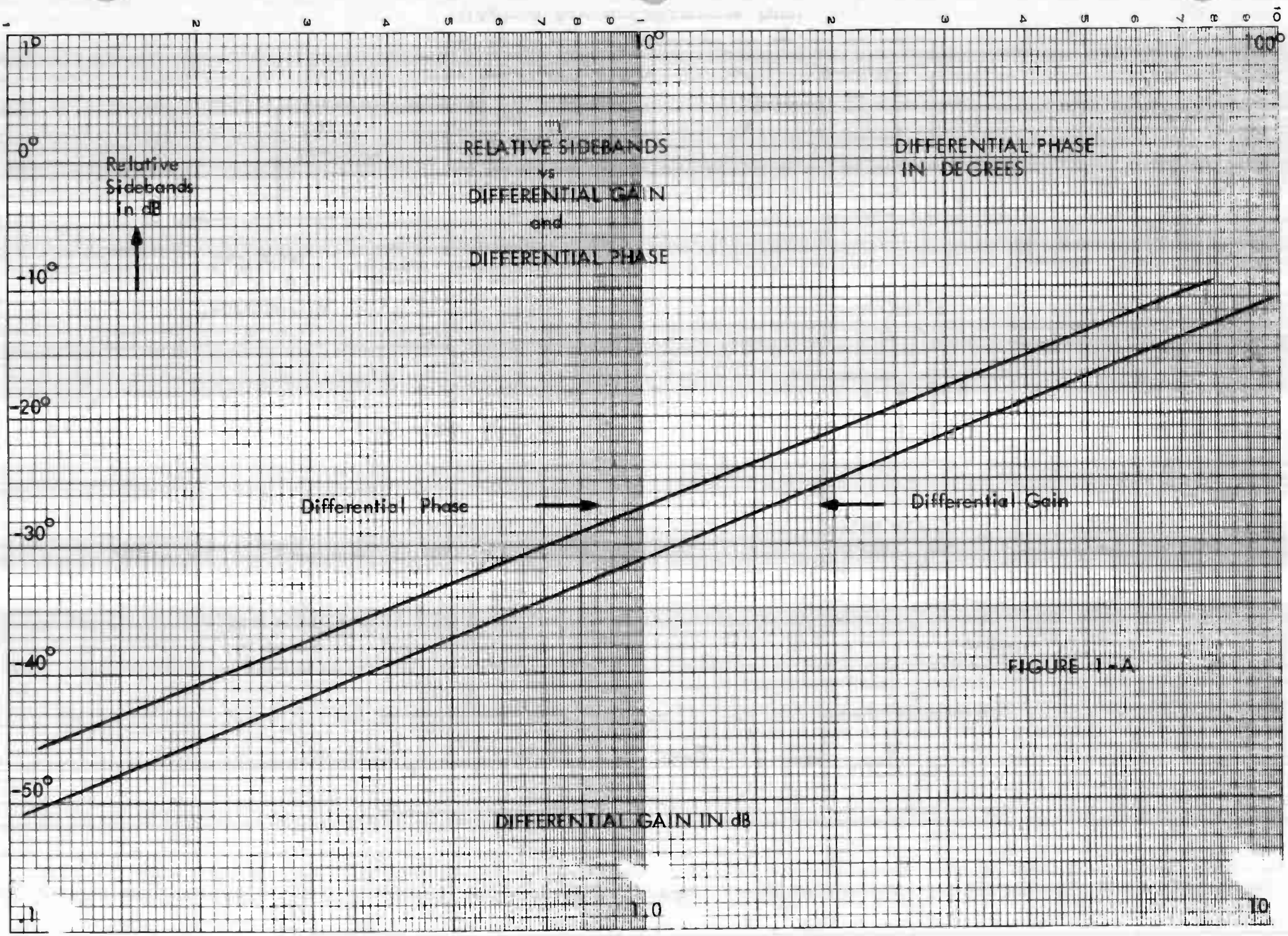

RELATIVE SIDEBANDS
vs
DIFFERENTIAL GAIN
and
DIFFERENTIAL PHASE
DIFFERENTIAL PHASE
IN DEGREES
Relative
Sidebands
in dB
1°
0°
-10°
-20°
-30°
-40°
-50°
10°
100°
Differential Phase
Differential Gain
DIFFERENTIAL GAIN IN dB
.1
1.0
10

FIGURE 1-A

FIGURE ONE

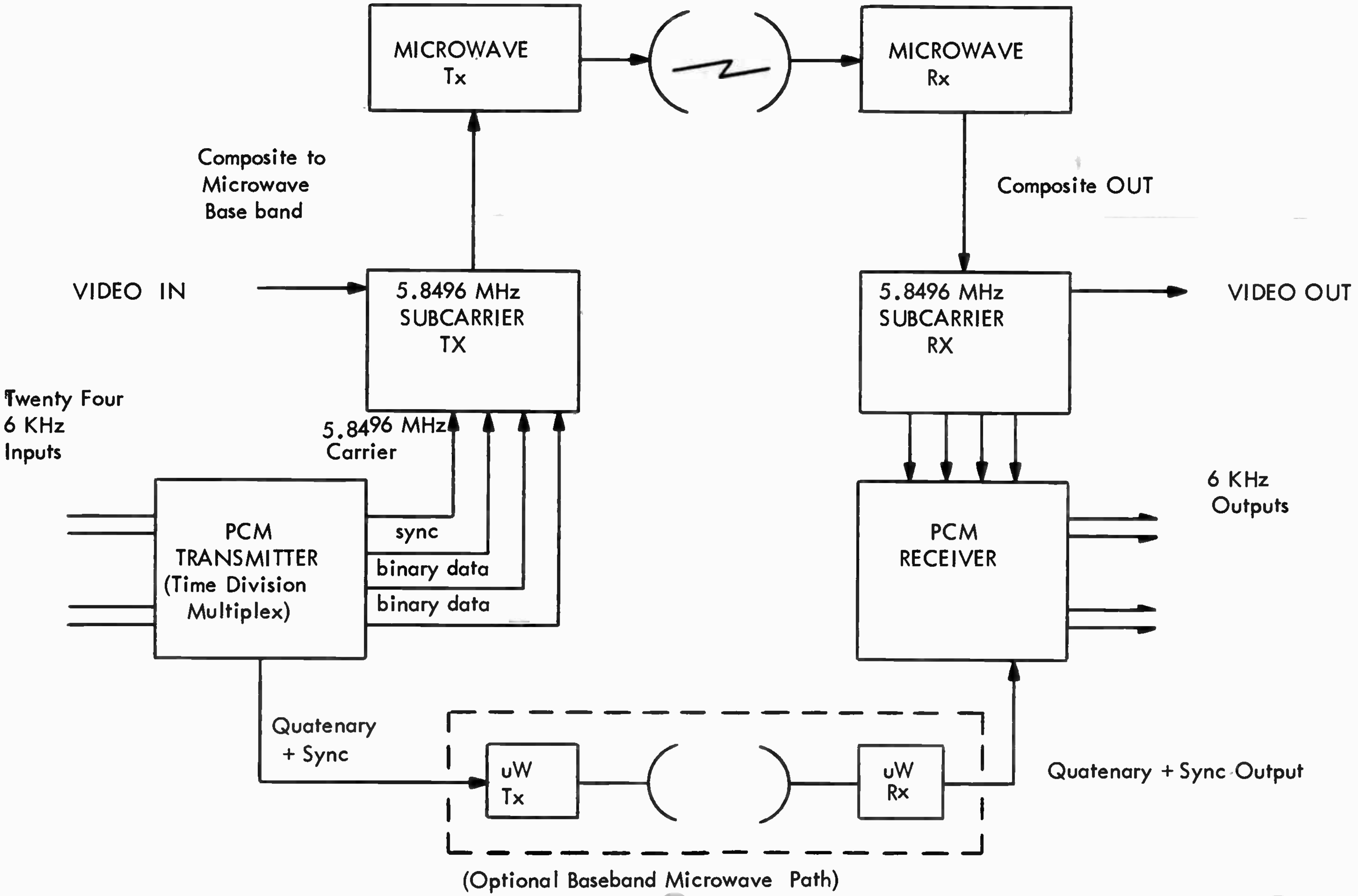
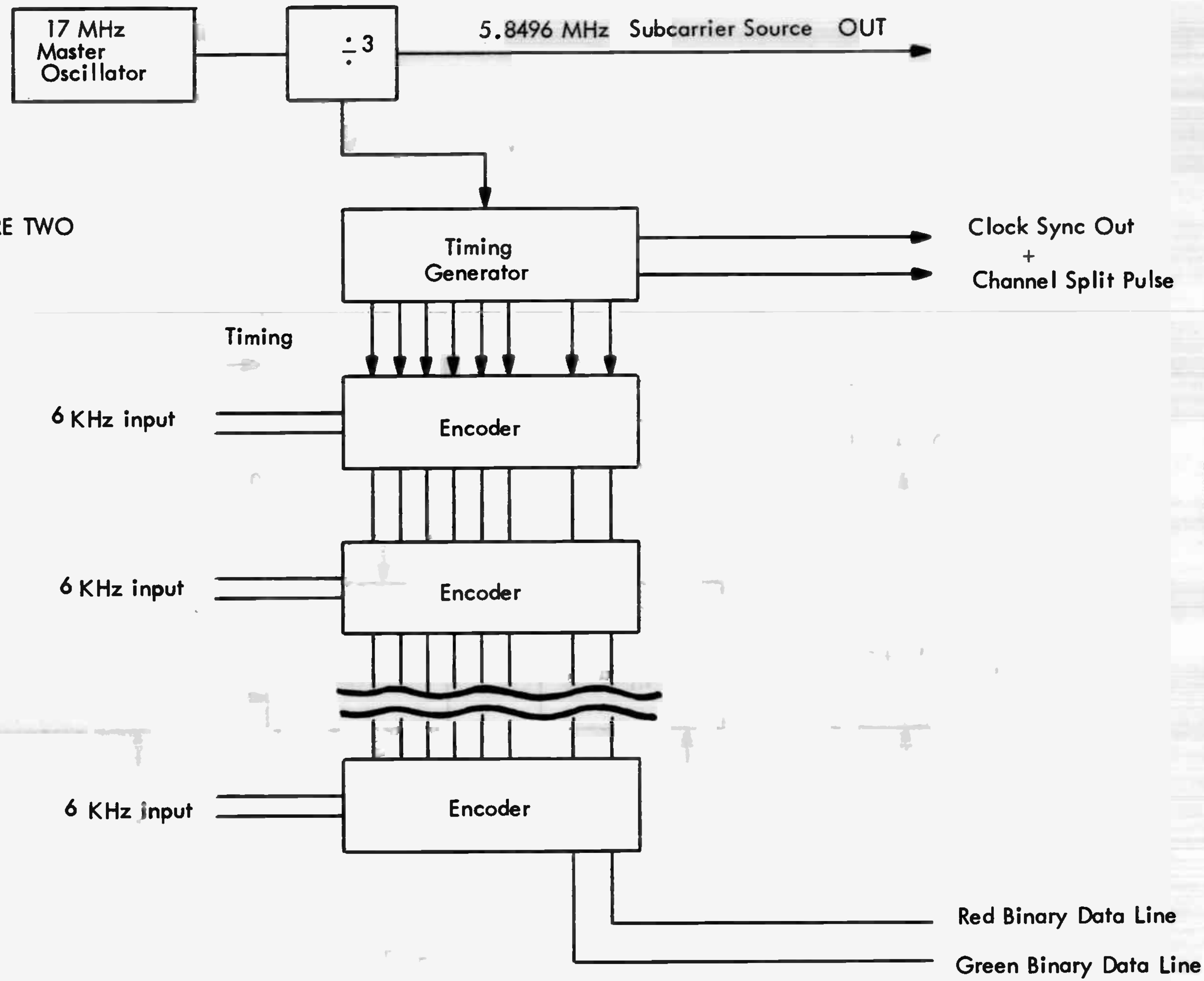
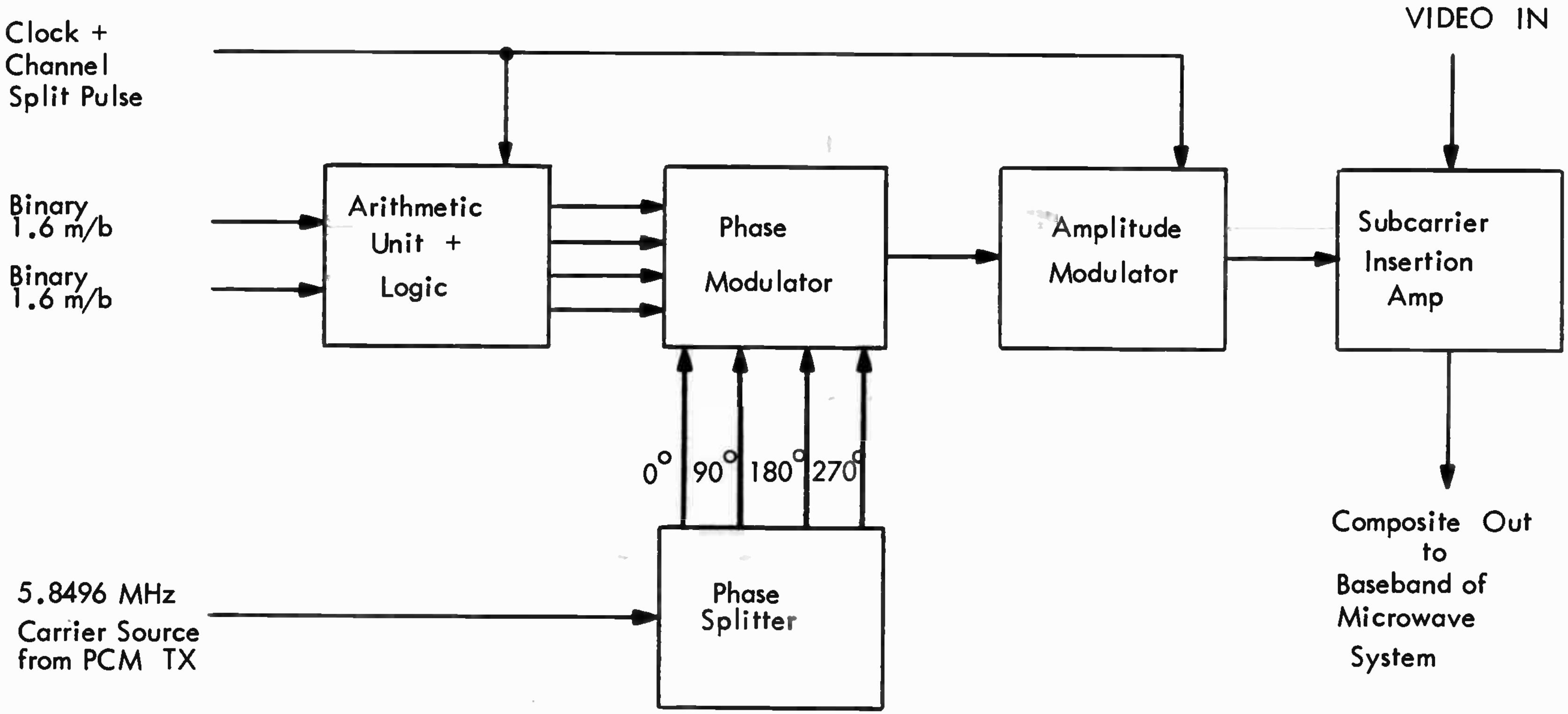

MICROWAVE
Tx
MICROWAVE
Rx
Composite to
Microwave
Base band
Composite OUT
VIDEO IN
5.8496 MHz
SUBCARRIER
TX
5.8496 MHz
SUBCARRIER
RX
VIDEO OUT
Twenty Four
6 KHz
Inputs
5.8496 MHz
Carrier
PCM
TRANSMITTER
(Time Division
Multiplex)
sync
binary data
binary data
6 KHz
Outputs
PCM
RECEIVER
Quatenary
+ Sync
uW
Tx
uW
Rx
Quatenary + Sync Output
(Optional Baseband Microwave Path)

FIGURE TWO



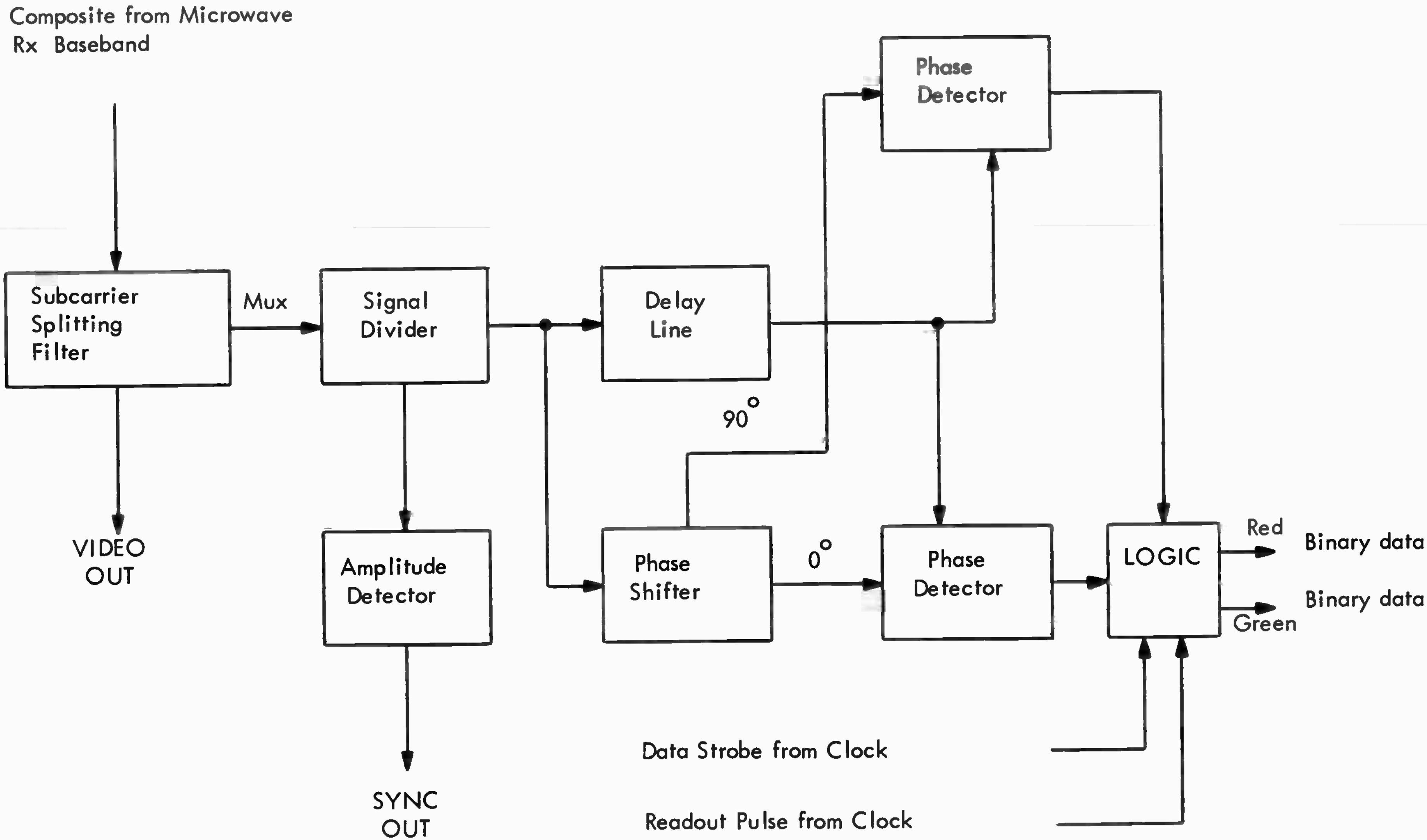
PCM MULTIPLEX TRANSMITTER

FIGURE THREE

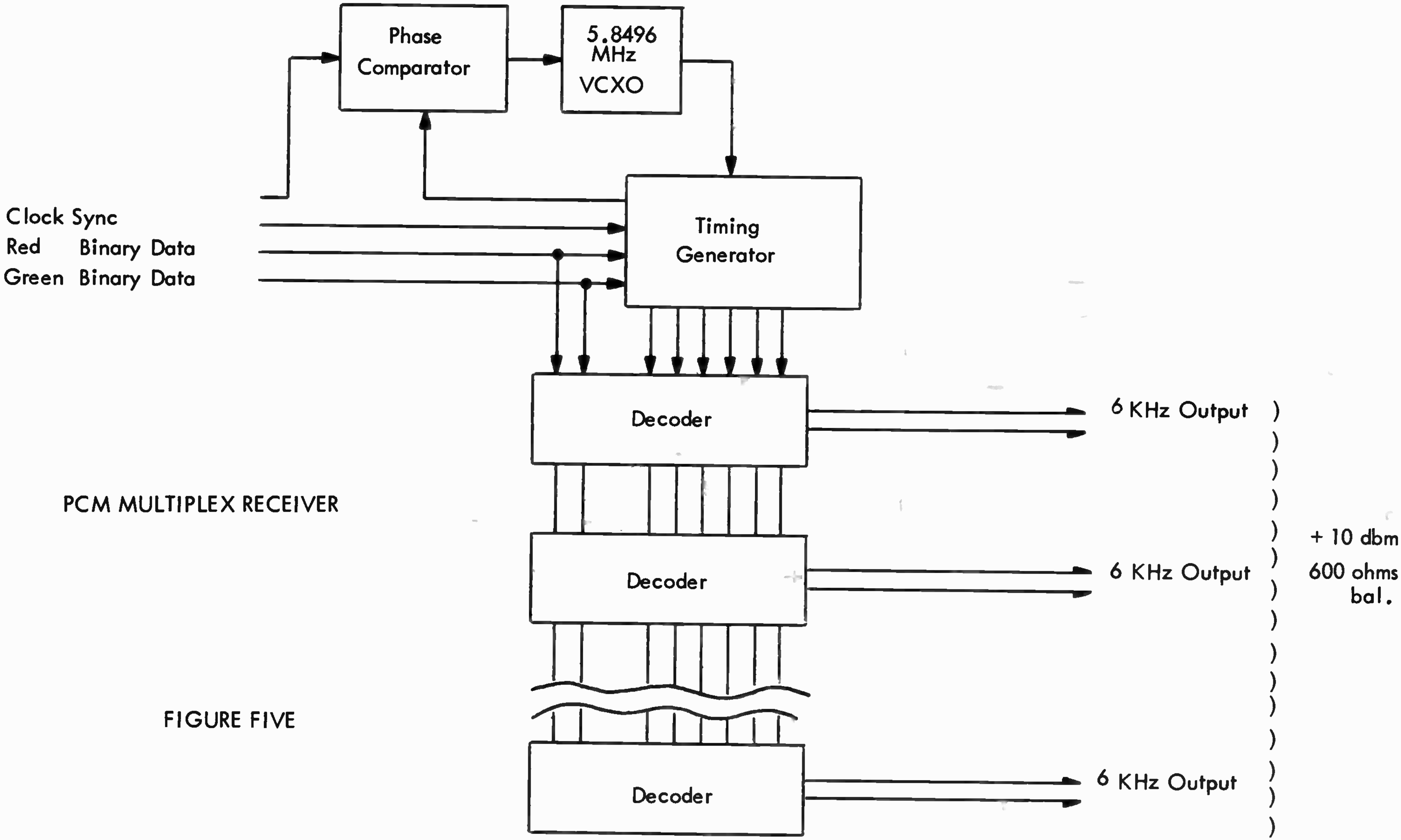


SUBCARRIER TRANSMITTER

FIGURE FOUR



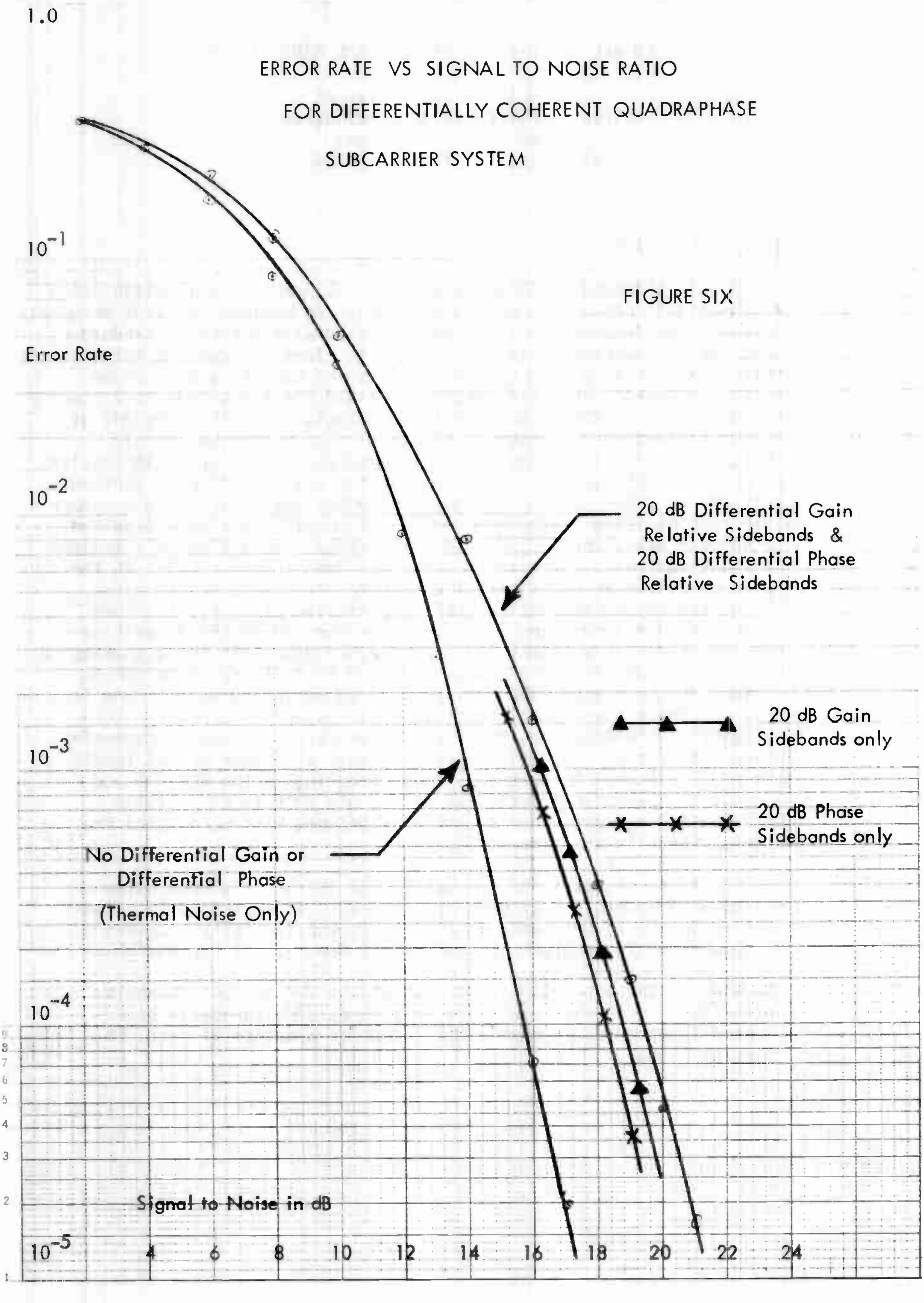
SUBCARRIER RECEIVER



PCM MULTIPLEX RECEIVER

FIGURE FIVE

Harmonic Distortion 2% max.
IM - 60/6000 2% or -34 dB


1.0
ERROR RATE VS SIGNAL TO NOISE RATIO
FOR DIFFERENTIALLY COHERENT QUADRAPHASE
SUBCARRIER SYSTEM
10^{-1}
FIGURE SIX
Error Rate
10^{-2}
20 dB Differential Gain Relative Sidebands & 20 dB Differential Phase Relative Sidebands
20 dB Gain Sidebands only
10^{-3}
20 dB Phase Sidebands only
No Differential Gain or Differential Phase
(Thermal Noise Only)
10^{-4}
Signal to Noise in dB
10^{-5}
4
6
8
10
12
14
16
18
20
22
24

AN ALL SOLID-STATE SSB-AM CARS BAND SYSTEM

E. Guthrie and F. Ivanek
Fairchild Microwave & Optoelectronics
3500 Deer Creek Road
Palo Alto, California 94304

1. INTRODUCTION

Single-sideband amplitude modulation (SSB-AM) is well established as the signal processing method which assures minimum spectrum occupancy. Already four decades ago it became the generally accepted standard of multichannel telephone transmission in the form of frequency-division multiplex, first used on open-wire lines and cables, and later on microwave links. The last decade witnessed the transition to virtually exclusive use of SSB-AM on a world-wide basis in another segment of communications where frequency spectrum is at a premium, namely, short-wave radio telephony. This became feasible after an impressive arsenal of technological solutions for the rather difficult inherent problems of SSB-AM radio transmission became available. The December 1956 special issue of the Proceedings of the IRE on single-sideband techniques makes one of the most interesting readings on this subject. It might come as a surprise to some that one of the articles in that issue describes an experimental 24-channel telephone system using SSB-AM for beyond-the-horizon UHF transmission [1]. Not too long after that, in 1960, came a proposal for the use of SSB-AM on line-of-sight radio relay links [2]. This would quadruple the transmission capacity as compared to the most advanced FM radio relay telephone systems in use today. The main problem to be solved to this end is that of linear power amplification at microwave frequencies. Technological implementation, therefore, came first at lower frequencies where linear power amplifiers are available at higher output levels. SSB-AM 120-channel telephone systems operating in the 400-410 and 420-430 MHz bands were installed in the mid 60's to establish a high-quality commercial telephone link between West Berlin and the Federal Republic of Germany [3].

The first proposal for the use of SSB-AM for TV transmission at microwave frequencies was made in 1959 [4]. It envisaged TV broadcasting in the 12 GHz band as a means of substantially increasing the number of TV programs in the Federal Republic of Germany*.

*In view of the population distribution the VHF and UHF channels offer satisfactory coverage for only three simultaneously broadcasted TV programs in that country and, as a matter of fact, in most of Europe.

Systematic studies and experimental investigations of this problem area have been carried out [5] in the course of which the feasibility of an SSB-AM microwave transmitter has been established [6].

The use of SSB-AM for microwave transmission of TV channel groups intended for CATV distribution started on an experimental basis in 1966 [7]. Frequencies in the 18 GHz range were used and transmission was on a group basis; i.e., the TV channels to be transmitted were multiplexed at VHF frequencies and transmitted with a single, broad-band microwave transmitter (refer to Fig. 2). Experience gained from these experiments and the subsequent development of a new system version for the 12.7-12.95 GHz CARS band [8] were instrumental in formulating the FCC rules for SSB-AM transmission in this band [9]. Thirty six regular and two "auxiliary" channels are assigned. This is the maximum usable capacity of links without intermediate repeaters. If one or more intermediate repeaters are needed, the transmission capacity is reduced to a total of nineteen channels.

The system design to be described in this paper fully conforms with the aforementioned FCC rules [9] and is based on the microwave solid-state technology developed at Fairchild for use in communication systems. As will be shown, the selected system configuration enhances transmission performance, flexibility of use, and reliability.

This paper is limited to the description of the overall system design. Technical data are specified in such a way as to facilitate their use for performance calculations of planned links using generally established procedures. Propagation aspects are treated only to the extent not covered in the existing literature on CARS band systems.

The feasibility of the described SSB-AM CARS band system design was experimentally verified in the Spring of 1970. A system model was since repeatedly demonstrated in the laboratory, simulating link lengths of up to 10 miles. FCC type acceptance tests are in preparation and the first field tests are to be carried out in 1971.

2. CHOICE OF MICROWAVE SIGNAL PROCESSING SCHEME AND SYSTEM CONFIGURATION

The signal processing scheme is selected for the advantages it offers. The reasons for preferring SSB-AM were as follows:

- This is the signal processing scheme with the minimum bandwidth requirement on a per channel basis. The occupied spectrum width in micro-wave CARS band transmission is the same as in VHF cable transmission. The 250 MHz wide CARS band can thus accommodate the entire 50-300 MHz bandwidth envisaged for future cable systems (refer to Fig. 1).

- When planning a radio system which is to be used with an existing cable system, it is advantageous to use the same channel multiplexing scheme in both cases. The SSB-AM CARS band system to be described takes the VHF channels directly from the frequency range required for cable transmission and puts them directly back into the same VHF frequency range (Fig. 1).

- It is always advantageous to use the simplest possible signal processing scheme consistent with the required transmission performance. The straightforward up-conversion/down-conversion scheme of SSB-AM (Fig. 1) is undoubtedly the simplest available.

Accordingly, SSB-AM was selected because it assures, on one hand, maximum spectrum usage and, on the other hand, the simplest possible transition from cable to radio transmission and vice versa.

The main difficulty in implementing analog AM systems, in general, lies in the non-linear transfer characteristic of the transmitter or amplifier output stage [10]. As a consequence, the tolerable amount of non-linear distortion determines the maximum usable power output which is in most cases one or two orders of magnitude below the saturated output power. This is a serious disadvantage of analog AM as compared to all other signal processing schemes which operate at saturated output power levels.

Figure 2 illustrates the most logical first approach to an SSB-AM CARS band link which consists of using a single, broadband transmitter-receiver pair for the simultaneous transmission of several VHF channels. The specific example used in Fig. 2 and for most of the following system considerations is that of a 6-channel head-end link with alternate channel transmission. The case of contiguous 12-channel transmission is treated later. However, all of the following considerations of multichannel transmissions apply irrespective of channel arrangement or transmission capacity.

Since the output power of the transmitter cannot be arbitrarily increased due to technological and economical constraints, the multichannel transmission performance must be considered for a predetermined available transmitter output level. It becomes immediately clear that under these conditions both the signal-to-noise ratio, S/N, and the relative cross-modulation level, -XM, deteriorate as the number of transmitted VHF channels, n, increases.

The deterioration of the S/N ratio with increasing transmission capacity is due to the fact that in a broadband group transmitter the available power output is shared by the simultaneously transmitted signals such that the available power per channel, P_{ch}, becomes

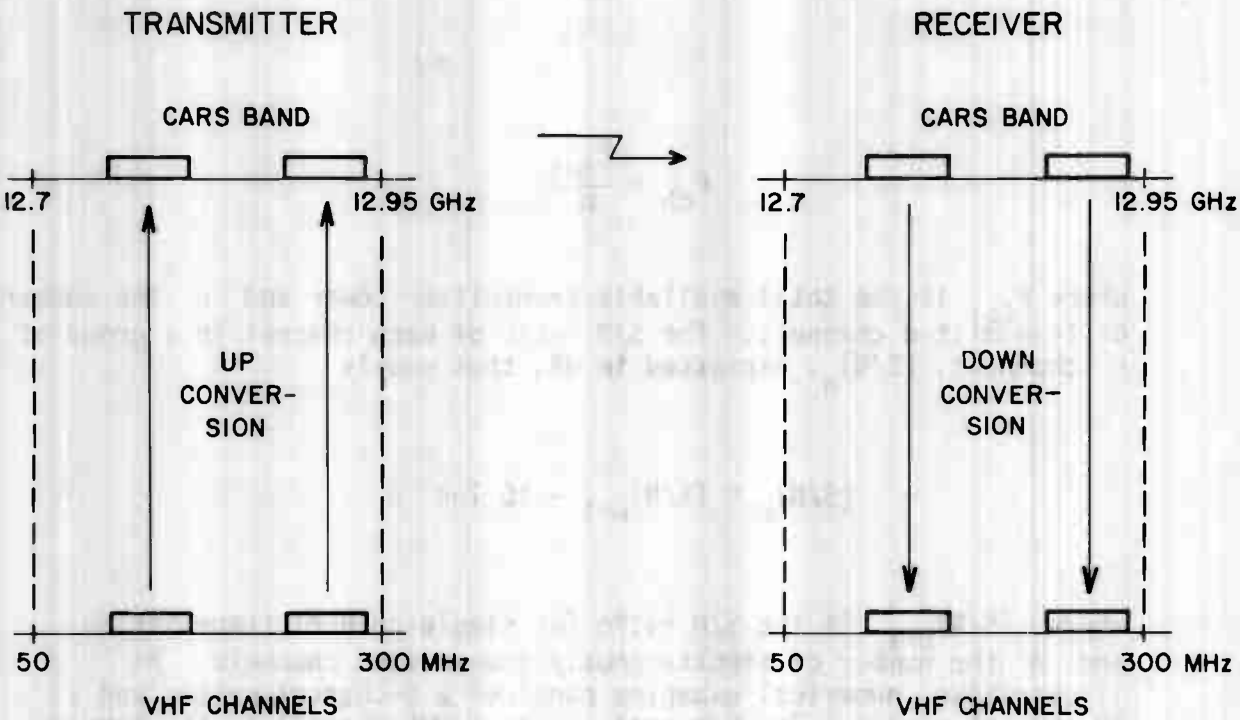


Fig. 1. SIGNAL PROCESSING SCHEME OF THE CARS BAND SSB-AM SYSTEM.

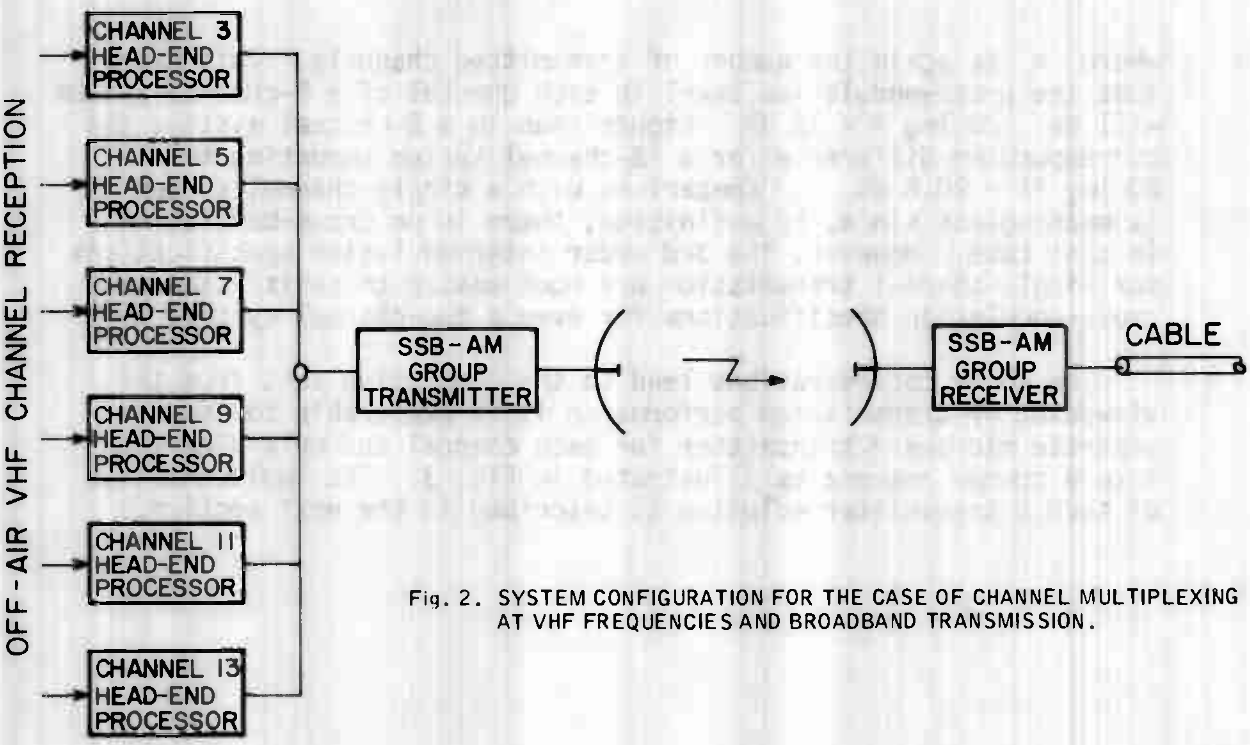


Fig. 2. SYSTEM CONFIGURATION FOR THE CASE OF CHANNEL MULTIPLEXING AT VHF FREQUENCIES AND BROADBAND TRANSMISSION.

$$P_{ch} = \frac{P_{tot}}{n}$$

where P_{tot} is the total available transmitter power and n the number of transmitted channels. The S/N ratio of each channel in a group of n channels, $(S/N)_n$, expressed in dB, thus equals

$$(S/N)_n = (S/N)_{n=1} - 10 \log n$$

where $(S/N)_{n=1}$ is the S/N ratio for single-channel transmission and n the number of simultaneously transmitted channels. As illustrative, numerical examples consider a 5-channel system and a 12-channel system. The S/N ratio in each VHF channel of the former system will be $10 \log 5 = 7$ dB lower than for a single channel system. The corresponding difference for the 12-channel system is $10 \log 12 = 10.8$ dB

The relative cross-modulation level, -XM, expressed in dB, increases with the increasing transmission capacity by the following amount [10]:

$$20 \log (n-1)$$

where n is again the number of transmitted channels. This means that the cross-modulation level in each channel of a 5-channel system will be $20 \log 4 = 12$ dB higher than in a 2-channel system; the corresponding difference for a 12-channel system amounting to $20 \log 11 = 20.8$ dB . Comparison with a single-channel system is meaningless since, by definition, there is no cross-modulation in that case. However, the 3rd order intermodulation specifications for single-channel transmission are much easier to satisfy than the cross-modulation specifications for even a two-channel system.

The above considerations lead to the conclusion that from the viewpoint of transmission performance it is preferable to use a separate microwave transmitter for each channel and multiplex them into a common antenna as illustrated in Fig. 3. The implementation of such a transmitter solution is described in the next section.

On the receiving end there is no need to use a separate microwave receiver for each channel because the group receiver approach, illustrated in Fig. 2, is satisfactory from the viewpoint of both S/N ratio and cross-modulation. The latter is, of course, more critical but the receiver operates at levels which are substantially lower with respect to saturation than is the case in the transmitter. A study based on considerations reported at the 1970 NCTA Convention showed that acceptable cross-modulation levels can be obtained with existing microwave mixer technology [11].

3. SYSTEM BLOCK DIAGRAM

3.1 Transmitter

Figure 4 shows the block diagram of the transmitter. The simplest possible solution has been adopted. There is only one active microwave circuit in the signal path, namely the upper-sideband parametric up-converter which directly delivers the required output power. Such a solution is undoubtedly the most advantageous one from the viewpoint of distortion because it minimizes the number of sources thereof.

The additional important advantage of the adopted transmitter configuration is that it lends itself best to an all solid-state implementation. The source of microwave power, the up-converter pump, is a CW oscillator with output power in the 1.5 - 2.0 W range. It consists of two cascaded silicon avalanche diode (IMPATT) oscillators with 1 W nominal power output each and a DC-to-RF conversion efficiency of better than 5% which is higher than the efficiency of commercially available klystrons in the same frequency range*. The avalanche diodes and the power combining scheme were developed at Fairchild. The power combining efficiency of the composite oscillator is virtually 100%. For a description of these techniques and more details on the obtained results it is referred to publications at the 1969 International Solid-State Circuits Conference [12] and at the 1971 International Microwave Symposium [13].

The advantage of the described transmitter over any other configuration can be fully appreciated only after the available alternatives have been considered in some detail. They all involve power amplification. Unfortunately, non-linear distortion in available microwave power amplifiers for CARS band frequencies, tube or solid state, is by no means lower than in a properly designed high-level up-converter. While it is true that there are several promising approaches for linearizing the tube and transistor amplifier transfer characteristics in the VHF to lower microwave frequency ranges, there apparently is as yet no practical solution available at CARS-band frequencies. This subject matter is, therefore, not treated here and references to publications are omitted.

---

*The second generation up-converter pumps will use GaAs avalanche diodes whose efficiency is around 10%.

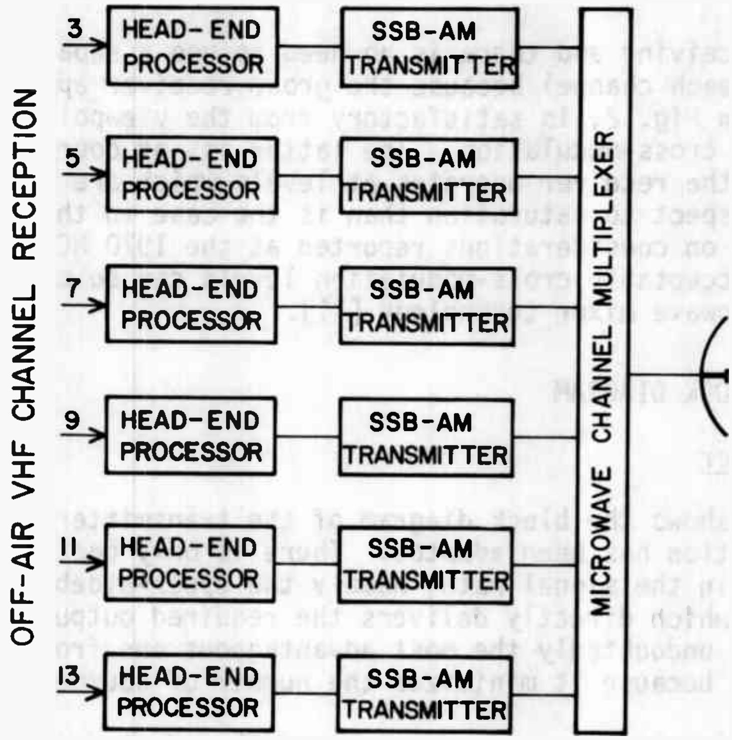


Fig. 3. TRANSMITTER CONFIGURATION WITH CHANNEL MULTIPLEXING AT CARS-BAND FREQUENCIES

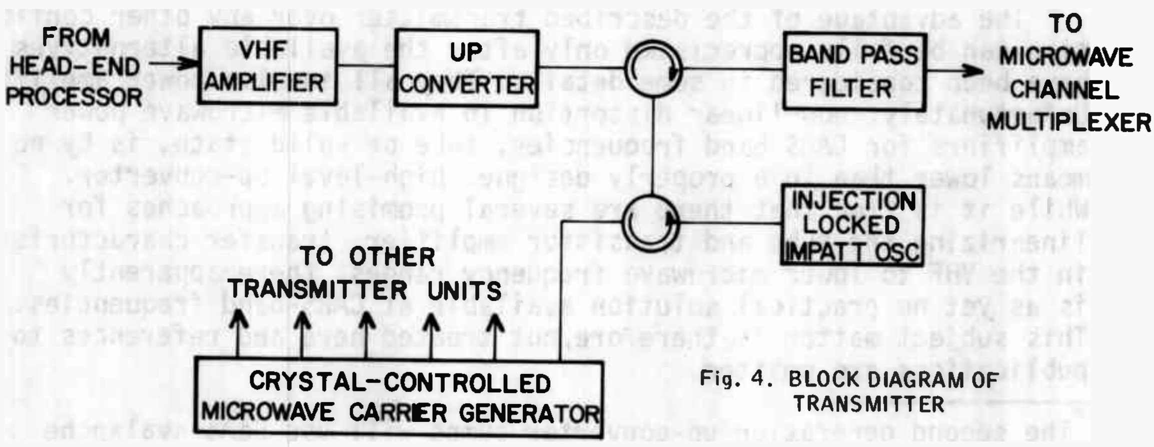


Fig. 4. BLOCK DIAGRAM OF TRANSMITTER

As can be seen in Fig. 4, a crystal-controlled microwave generator is used as the common carrier source for the entire multichannel transmitter group. It consists of a low-power crystal controlled multiplier source, a standard Fairchild product for use in microwave communication systems, followed by an injection locked avalanche diode oscillator which functions as power amplifier. Its output power is split to in turn injection lock all the up-converter pumps of the transmitter group. The purpose of this arrangement is to keep all the up-converter pumps in synchronism, which is indispensable because, as pointed out before, a group microwave receiver is used in the described system.

3.2 Receiver

The block diagram of the group receiver is shown in Fig. 5. It uses a conventional RF head consisting of a band-pass filter, a mixer, and a crystal-controlled multiplier source as local oscillator. Means for establishing synchronism between the latter and the microwave carrier generator of the transmitter, which is needed in the case of locally broadcasted channel transmission, can be added. A pilot signal derived from the microwave carrier generator is then inserted at the transmitting end in the frequency space the FCC reserved for this purpose [9]. At the receiving end, this pilot signal is filtered out and used to control the frequency of the local oscillator.

The receiver of Fig. 5 employs a separate AGC VHF amplifier in each channel. While the concept of a group receiver can be implemented all the way down to the VHF output, automatic gain control on a group basis is likely to prove impractical for many applications. This statement does not refer to problems of AGC circuit design but to multipath propagation effects in the form of frequency selective fading which would manifest itself as an irregular, frequency-dependent and time-varying amplitude distortion over the whole receiver bandwidth or portions thereof. These amplitude variations can amount to several dB. In general, the wider the occupied transmission bandwidth, the more pronounced this effect becomes. The bandwidth of a 12-channel SSB-AM CARS band system transmitting the standard VHF channels, for example, equals 162 MHz or, on a percentage basis, 1.25% approximately. This is by no means negligible as compared to frequency separations of frequency diversity systems operating in the microwave region which exploit the frequency dependency of multipath fading to reduce outage time due to such fading*.

---

*A discussion of multipath fading, published in the Lenkurt Demodulator [14] includes the statement that most frequency diversity systems have frequency separations of 2-5% of the lower frequency.

The problem of frequency selective fading at frequencies above 10 GHz has received very little attention, most likely due to the fact that the most severe fadings, which limit the usable path length at these frequencies, are caused by heavy rainfall. However, there is ample evidence [15,16] that the multipath fading problem in the CARS band is a real one whenever systems of considerable bandwidth are used. Systematic propagation studies would be necessary in order to determine a "safe" upper limit for the usable system bandwidth. An estimate based on the above quoted publications [15,16] leads to the conclusion that the danger of frequency selective fading must not be disregarded for SSB-AM systems occupying a substantial portion of the CARS band frequency spectrum. In practical terms, AGC on a group basis might be sufficiently safe only for small groups of contiguous channels, such as the five-channel group of VHF channels 2-6 (bandwidth: 34 MHz) or even the seven-channel group of VHF channels 7-13 (bandwidth: 42 MHz).

The above discussion, although limited to the SSB-AM system, should not be misinterpreted as being pertinent to this system alone. Severe multipath fading will significantly affect any wideband analog transmission system. The degree of this effect and the most suitable solution of the resulting problems will depend on the particular system. For the SSB-AM system under discussion, it is believed that the receiver configuration of Fig. 5 represents a technically and economically sound solution based on readily available technology. Of course, if signal processing is needed at the receiving site, as well, this can be easily accomplished by using head-end processors instead of AGC amplifiers.

3.3 Contiguous Channel Transmission

So far, the system configuration has been illustrated only in terms of alternate channel transmission (Figs. 2-5). To transmit a group of contiguous signals requires simply connecting two corresponding alternate-channel transmitter groups to a common antenna with two polarizations. The same applies to the receiving end. This solution is illustrated in Fig. 6 for a 12-channel capacity, but the principle applies also to other transmission capacities.

The adopted solution is attractive not only from the viewpoint of microwave channel multiplexing, which would be prohibitively complicated and expensive if a single polarization were used for the entire group of contiguous channels, but also from the viewpoint of suppressing adjacent channel interference due to third order intermodulation products. Figure 7 is referred to for an explanation. It shows the carrier frequencies of channel 10 and their third order intermodulation products as they appear in the CARS band. As can

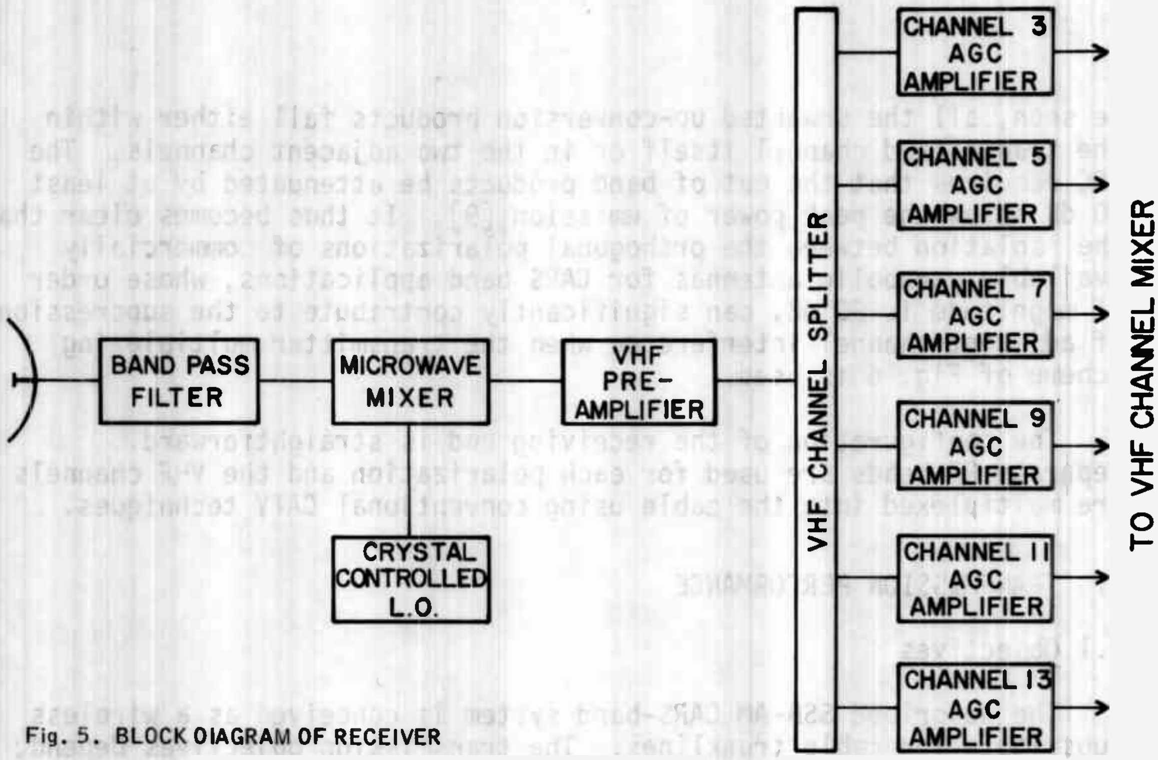
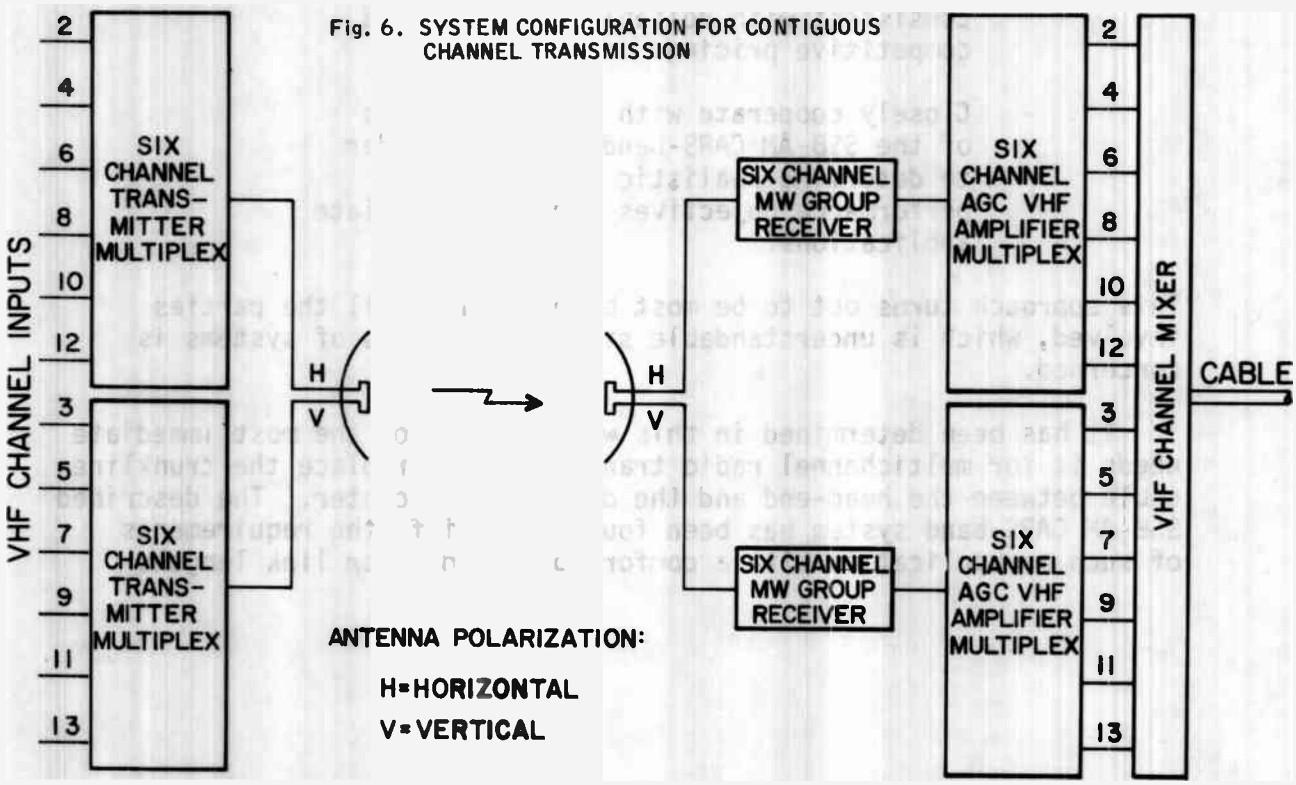


Fig. 5. BLOCK DIAGRAM OF RECEIVER

Fig. 6. SYSTEM CONFIGURATION FOR CONTIGUOUS CHANNEL TRANSMISSION



be seen, all the unwanted up-conversion products fall either within the transmitted channel itself or in the two adjacent channels. The FCC requires that the out of band products be attenuated by at least 50 dB below the peak power of emission [9]. It thus becomes clear that the isolation between the orthogonal polarizations of commercially available parabolic antennas for CARS band applications, whose order of magnitude is 20 dB, can significantly contribute to the suppression of adjacent channel interference when the transmitter multiplexing scheme of Fig. 6 is used.

The configuration of the receiving end is straightforward. Separate RF heads are used for each polarization and the VHF channels are multiplexed into the cable using conventional CATV techniques.

4. TRANSMISSION PERFORMANCE

4.1 Objectives

The described SSB-AM CARS-band system is conceived as a wireless substitute for cable trunklines. The transmission objectives depend, therefore, on the length of the cable trunkline the system is supposed to replace. The thermal noise and non-linear distortion allowance will be proportional to the length of the link in accordance with established cable system planning procedures [10].

The approach taken at Fairchild with regard to transmission performance objectives is twofold:

- Use the most effective system and component design for high transmission performance, consistent with reliable operation and competitive pricing.

- Closely cooperate with potential users of the SSB-AM CARS-band system in order to determine realistic transmission performance objectives for some immediate applications.

This approach turns out to be most beneficial to all the parties involved, which is understandable since a new class of systems is concerned.

It has been determined in this way that one of the most immediate needs is for multichannel radio transmission to replace the trunkline cable between the head-end and the distribution center. The described SSB-AM CARS-band system has been found to satisfy the requirements of such an application with a comfortable margin for link lengths up to 10 miles approximately, except in locations with extremely heavy rainfall which are limited to a few regions of the United States.

4.2 Signal-to-Noise Ratio

The following data are given for a 12-channel link in such a form as to facilitate their use in quick estimates of obtainable S/N values for link lengths of practical interest.

Transmitter output power at antenna terminal, per channel*	10 mW
Receiver noise figure	10 dB
Filter and isolator losses in receiver	2 dB
Feeder looses (transmitter and receiver)	2 dB

A 7 mile 12-channel link equipped with 10 ft. parabolic antennas will be assumed as illustrative example. The net transmission loss between the transmitter and receiver antenna terminals would amount to 45 dB for the case of ideal propagation conditions; i.e., no fading. A 4 MHz receiver bandwidth is used to calculate the ideal noise level, -108 dBm. Performing the straightforward arithmetic operation with these data gives

$$S/N = 65 \text{ dB}$$

which leaves a fading margin of approximately 20 dB for excellent reception (TASO Grade 1). The exact amount of the fading margin depends on whose system design criteria are used.

The quoted S/N performance has been verified in the laboratory using a transmitter-receiver pair whose electrical characteristics conform with the above data. Small horn antennas were used and up to 40 dB of fading was simulated with a variable attenuator.

4.3 Intermodulation

As pointed out before, intermodulation in the single-channel up-converter is the dominant form of 3rd order product interference in the SSB-AM system under consideration. Advice obtained from the Jerrold Electronics Corporation on how to carry out laboratory

*Higher output powers per channel are available for most transmitter configurations with less than 12-channels because of simpler microwave channel multiplexing.

tests of this particular transmission characteristic was invaluable in the absence of a standard test procedure. Three CW signals are used to simulate the color TV signal and sound. The amplitudes of the signals simulating the sound carrier and color subcarrier are -10 dB and -16 dB relative to the signal simulating the vision carrier. The most troublesome in-band 3rd order intermodulation product, V+S-C (refer to Fig. 7), must not be higher than -50 dB relative to the amplitude of the CW signal simulating the vision carrier.

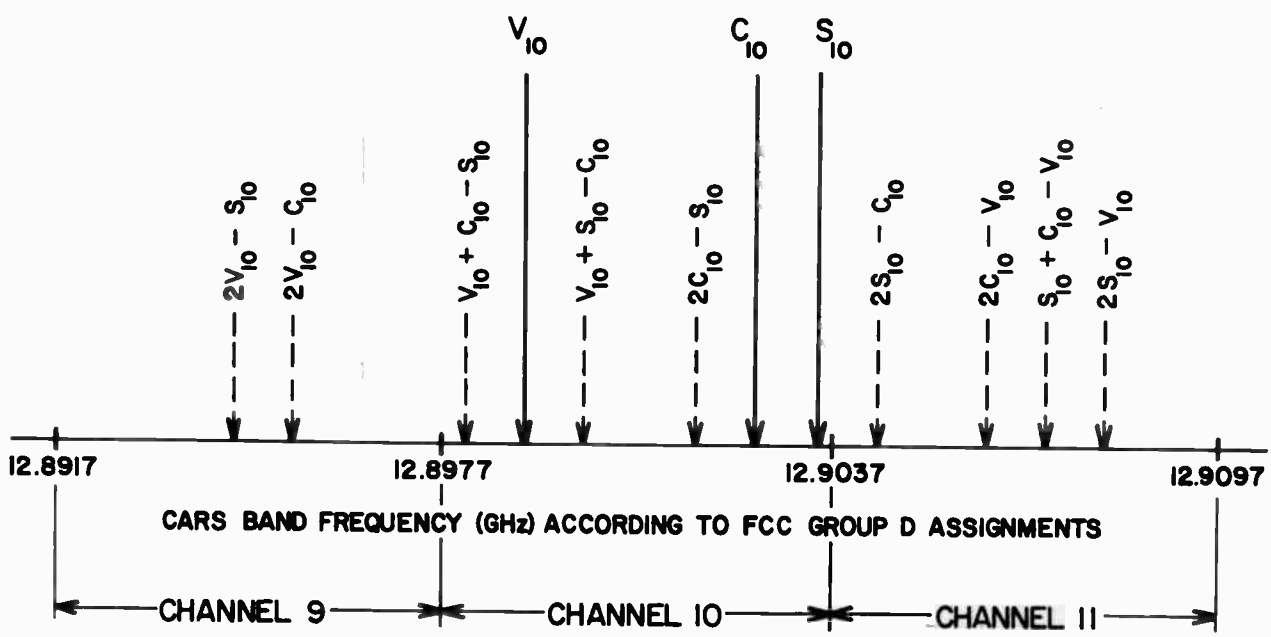
Figure 8 shows the result of this test for channel 10 up-converted into CARS band in accordance with the FCC Group D frequency assignments [9]. As can be seen, all the in-channel 3rd order intermodulation product amplitudes are more than 50 dB below the amplitude of the CW signal simulating the vision carrier. It should be mentioned, at this point, that the suppression of the out-of-band intermodulation products (refer to Fig. 7) which are not seen in Fig. 8 was satisfactory, as well.

V_{10} = CHANNEL 10 VISION CARRIER

C_{10} = CHANNEL 10 COLOR SUBCARRIER

S_{10} = CHANNEL 10 SOUND CARRIER

Fig. 7. THIRD-ORDER INTERMODULATION PRODUCT FREQUENCIES FOR UP-CONVERTED CHANNEL 10



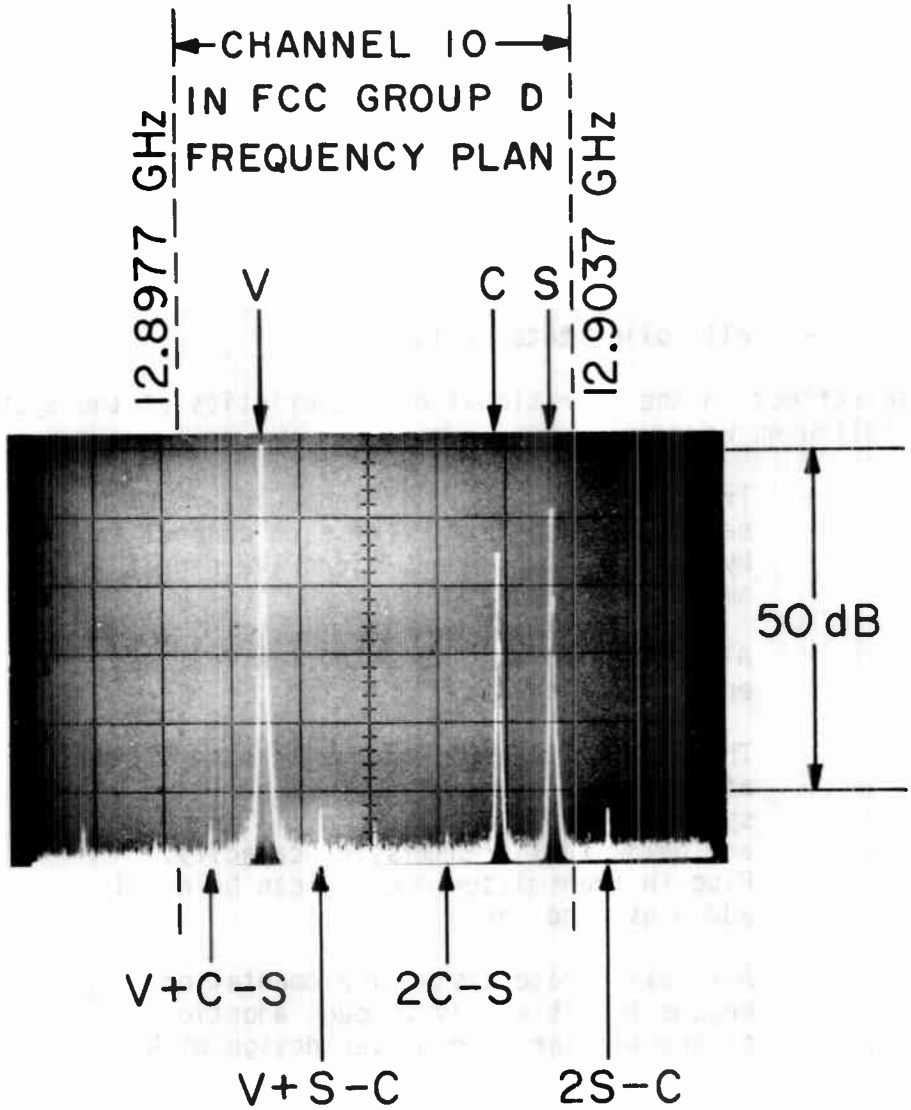


Fig. 8. MEASURED IN-BAND THIRD-ORDER INTERMODULATION PRODUCT AMPLITUDES OF CHANNEL 10 CARS-BAND TRANSMITTER

Of-the-air color TV signals were also used for subjective tests of the transmission performance. No difference could be observed between the quality of the of-the-air signal and the signal passed through the above described experimental link.

5. CONCLUSIONS AND COMMENTS

The main advantages of the described SSB-AM system are in the following design features:

- Channel multiplexing at microwave frequencies,
- simplest possible transmitter configuration, and
- all solid-state design.

These reflect on the operational characteristics of the system in the following way:

- Transmission quality is enhanced by using a separate up-converter for each channel and by avoiding subsequent microwave signal amplification.
- All three aforementioned design features enhance reliability.
- The modular transmitter design offers attractive flexibility and economy in system build-up whenever initial needs are below full transmission capacity. Plug-in transmitter modules can be easily added as needs grow.
- All solid-state system implementation became feasible only through adoption of the modular transmitter design without output power amplification. Avoiding the use of microwave tubes results in substantially lower power supply voltages (one order of magnitude) and in higher DC- to -RF conversion efficiencies which translate into lower power consumption.

ACKNOWLEDGEMENT

The authors deeply appreciate the interest in their development effort demonstrated by fellow engineers from the CATV industry whose comments and advice were of invaluable assistance.

REFERENCES

[1] W. E. Morrow, Jr , C. L. Mack, Jr., B. C. Nichols, and J. Leonhard, "Single-Sideband echniques in UHF Long-Range Communications," Proc. IRE, Vol. 44, No. 12, pp. 1854-1873, 1956.

[2] H. Holzwarth, "Einseitenband-Modulation in der Richtfunktechnik," Nachrichtentechnische Fachberichte, Vol. 19, pp. 3-8, 1960.

[3] D. Leypold, H. Leysieffer, and H. K. Grunow, "Development Problems of Radio Relay Systems Using Single-Sideband Modulation," Nachrichtentechnische Zeitschrift, Vol. 8, No. 2, pp. 68-74, 1965.

[4] K. O. Schmidt, "Einige Betrachtungen zur Schaffung nener Fernsehbereiche," Jahrbuch des Elektrischen Fernmeldewesens 1959, pp. 69-100, Verlag für Wissenschaft and Technik, Georg Heidecker, Bad Windsheim, Federal Republic of Germany.

[5] J. Feldmann, B. Rehfeld, G. Rösseler, and K. Sakowski, "A Study of the Technical Feasibility of Terrestrial Omnidirectional Television Transmissions in the 12 GHz Band," Digest of the 1968 International Conference on Communications, Philadelphia, Pa., pp. 335-344.

[6] H. J. Henn and H. Schnitzer, "Parametrischer Frequenzumsetzer für 12 GHz," Internationale Elektronische Rundschau, Vol. 23, No. 7, 1969.

[7] H. J. Schlafly, "18 GHz Wideband Distribution System Propagation Test," 1967 IEEE International Convention Record, Part 2, pp. 118-126.

[8] N. A. Begovich, and L. S. Stokes, "A Second Generation AML," 19th Annual NCTA Convention Official Transcript, pp. 174-193, 1970.

[9] F.C.C. Docket No. 18452, Amendment of Part 74, Subpart J of the Commission's Rules and Regulations Relative to Community Antenna Relay Stations, November 7, 1969.

[10] K. Simons, "Technical Handbook for CATV Systems," 3rd Edition, Jerrold Electronics Corporation, Philadelphia, Pa., 1968.

[11] E. E. Guthrie, "Evaluation of Intermodulation Distortion in Up-Converters and Down-Converters," 19th Annual NCTA Convention Official Transcript, pp. 667-677, 1970.

[12] F. Ivanek and V.G.K. Reddi, "X-Band Oscillator and Amplifier Experiments using Avalanche Diode Periodic Structures," 1969 IEEE International Solid-State Circuits Conference Digest of Technical Papers, pp. 80-81.

[13] F. Ivanek and V.G.K. Reddi, "High-Power, Low-Noise Avalanche Diode Oscillators," 1971 IEEE-GMTT International Microwave Symposium Digest of Technical Papers, pp. 86-87.

[14] "Multipath Fading," The Lenkurt Demodulator, Vol. 16, No. 11, p. 7, 1967.

[15] S. D. Hathaway and H. W. Evans, "Radio Attenuation at 11 kmc and Some Implications Affecting Relay System Engineering," The Bell System Technical Journal, Vol. 38, No. 1, pp. 73-97.

[16] D. Turner, B. J. Easterbrook, and J. E. Golding, "Experimental Investigation into Radio Propagation at 11.0-11.5 Gc/s," Proc. IEE, Vol. 113, No. 9, pp. 1477-1489, 1966.

AN OPTICAL LINK FOR CATV

by

R. T. Daly and M. G. Cohen

ABSTRACT

This paper studies the technical feasibility of using a free space cascade of optical (laser) links for CATV service. By employing available Weather Bureau visibility statistics for New York City, the effects of optical path attenuation on link reliability are determined. Based upon these results, a link is proposed which will provide 99.9% reliability with a 42 db signal-to-noise ratio for transmission of 25 TV channels plus the FM band. Repeater spacings, required optical powers, detailed configurations, modulation techniques and costs are discussed.

AN OPTICAL LINK FOR CATV

by

R. T. Daly and M. G. Cohen

I. TECHNICAL DISCUSSION

The performance requirements and construction of link elements (transmitter and receiver) will be developed in this section based upon the following assumptions:

(a) The cascaded link elements are identical and are spaced by 80 meters. (80 meters is about the distance between East-West streets in Manhattan, New York City.)

(b) The cascade of links must achieve an overall reliability with respect to weather conditions of 99.9%. That is, for 0.1% of the time the carrier-to-noise ratio at the output terminal of the cascade may be below the minimum design value.

(c) Weather statistics correspond to those of New York City.

The cascade consists of K equally spaced outdoor intervals as shown in Figure 1. Atmospheric transmission path losses are uniform over the entire length of the cascade and correspond to 33 db/1000 ft. This value of optical path transmission is exceeded (on the average) in New York City 99.9% of the time.

As shown, the input to the link is a high-level, noise-free signal. At each stage in the cascade, the carrier-to-random noise power ratio, c/n, (measured at the output of each receiver) decreases, since each square-law photodetector load and associated preamplifier contributes additive white noise which can be treated as thermal noise at the effective noise temperature of the preamplifier. With a noise-free and high-level input signal at the head end of the cascade, the input to the second transmitter has a finite value $(c/n)_0$. At the output of the Kth receiver the carrier-to-noise ratio $(c/n)_K$ will be $1/K\,(c/n)_0$. Expressed in db, $(c/n)_0 = (c/n)_K + 10 \log K$. For a cascade one mile long consisting of 20 intervals, $10 \log K = 13$ db, so $(c/n)_0 = 55$ db is required for $(c/n)_K = 42$ db. This level must be maintained under the assumed optical path transmission conditions.

Before proceeding with a discussion of the equipment configuration, it is necessary to consider the significance of atmospheric transmission. The relation $T_a(R) = \frac{R^2}{R_c^2}$, where $T_a(R)$ = one way path transmission and R and R_c, the range and clear ($T_a = 1$) range respectively, establishes the fade margin required for the system. Statistical visibility data gathered at several U.S. cities for air traffic control planning permits the evaluation of the frequency and duration of the optical path fading[1]. Data given for New York (taken at JFK International Airport) show that over an 80 meter path, a fade of 17 db (referenced to a point in the receiver following the square law optical detector) is exceeded only 0.1% of the time. Thus, with this fade margin, each element of the cascade is within performance specification

99.9% of the time. Additionally, the data support predictions that fading over the cascade is correlated, i.e., the overall cascade availability is the same as that for any element.

With this information, the value R_c can immediately be established by noting that

$$20 \log T_a(R) = 40 \log (R/R_c) = -17 \text{ db}$$

so that for R = 80 meters, R_c = 210 meters.

At the present state of technology, and for the signal bandwidth to be accommodated in this service, the optical transmitter must consist of a cw laser source in the wavelength range between about $1 \mu m$ (near infrared) and $0.4 \mu m$ (visible blue) and an external modulator capable of handling the signal bandwidth.

For the cascade element separation (≈ 80 meters), the relatively high carrier-to-noise ratios required in this service and in the interest of cost, direct square-law optical detection is the practical choice. Depending upon the wavelength region selected, i.e., the laser transmitter choice, two more or less different detector devices can be considered. For those wavelengths corresponding roughly to the visible spectrum ($0.7 \mu m$ to $0.4 \mu m$) the combination of photocathode and electron multiplier (photomultiplier tube) is available. Alternatively, the use of solid state photodiodes for the near IR portion of the spectrum ($1 \mu m$ to $0.6 \mu m$) offers good performance. The lower cost, accurate linearity and excellent performance of available silicon PIN diodes as IR detectors strongly recommends their use, even though link performance may be degraded by a few db.

For a system consisting of a cw laser, optical modulator solid state (diode) detector, optics and electronic circuits, the schematic diagram would be as shown in Figure 2.

It can be shown that the "clear" range, R_c, of a single transmitter-receiver link element, is given by

$$R_c{}^2 = \frac{R^2}{T_a(R)} = \left(\frac{m^2}{(c/n)_0}\right)^{1/2} \left(\frac{\eta_o P_L A_R}{2\Omega_T}\right) \left(\frac{S^2}{8kT_e C_T B B_o}\right)^{1/2} \tag{1}$$

where (1) applies in the case of a system limited by detector/preamplifier thermal noise.

The parameters in Eq. (1) are defined as follows:

$T_a(R)$	=	one way atmospheric path transmission
R_c meters	=	maximum range separation at which performance level will be met with zero atmospheric path attenuation ($T_a(R) = 1$)
R (meters)	=	maximum range for $T_a(R) < 1$
m	=	peak modulation of optical carrier for any single channel signal
$(c/n)_0$	=	electrical carrier-to-random noise power ratio referred to maximum rms channel carrier
η_o	=	system optical efficiency, i.e., lens and filter losses
P_L watts	=	cw laser power generated
A_R (meters^2)	=	clear aperture of receiver
Ω_T (steradians)	=	effective solid angle of projected transmitter beam. $4\pi/\Omega_T$ would be termed "antenna gain" in microwave terms
B (Hz)	=	overall link bandwidth
B_o (Hz)	=	bandwidth of a single individual TV channel
S (amperes/watt)	=	responsivity of the optical detector element
k (joules/°K)	=	Boltzmann's constant
T_e (°K)	=	effective noise temperature of receiver preamplifier, i.e., $T_e = F \times (290)$ °K where F is the preamplifier noise factor
C_T (farads)	=	total capacity shunting the optical detector element

A good approximation to the details of the link can be gained by solving Eq. (1) using some typical values. For the moment we assume that a total of N independent but frequency-contiguous TV channels are to be carried and that the total depth of modulation is adjusted uch that $m = (4N)^{-1/2}$* Other parameter values are as follow

$(c/n)_0$ = 3.2×10^5 (55 db in the receiver circuits for a 20 element cascade)

η_o = 0.7

A_R = 1.3×10^{-2} m^2 (5" dia. optics)

Ω_T = 1.5×10^{-6} ster (2×10^{-3} rad. linear angle or 0.12°)

B_o = 4×10^6 Hz

B = $3/2\, NB_o$

S = 0.4 amperes/watt (for silicon PIN diode at $\lambda = 0.63\,\mu m$)

k = 1.38×10^{-23} joules/°K

T_e = 600°K (3 db noise figure)

C_T = 5×10^{-12} farads

R_c = 210 m

Eq. (1) can be solved, using these values, to give

$$\frac{P_L}{N} = 110 \times 10^{-6} \text{ watts/channel}$$

---

* The choice of this value for m results from a detailed calculation of the modulation scheme and will be published separately.

The value selected for S, above, anticipated that the laser wavelength was 0.63μm radiation from a helium-neon gas laser. Small helium-neon lasers are readily obtainable with power outputs of 3 milliwatts, sufficient to transmit over 25 TV channels.

A value S = 0.2 amperes/watt is appropriate for wavelength λ = 1.06μm corresponding to a YAG laser. Eq. (1) would give, in this case, $P_L/N = 220 \times 10^{-6}$ watts/channel. Small YAG lasers have been built with outputs exceeding 500 milliwatts, which is one hundred times the required level for 25 TV channels.

Because the modulation/demodulation process generates beats among the modulated VHF channel carriers, it is not possible to cleanly transmit more than one octave on a "single" optical carrier. However, using the two orthogonal linear polarization states of a laser beam, two optical carriers can be created. These carriers may be separately modulated and then recombined for transmission. At the receiver, each beam produces its own photocurrents since no demodulated signal can arise from interaction of the orthogonal polarizations. Polarization beamsplitters and recombiners are not the most economical method of providing dual channel operation. It may be possible to employ acousto-optic modulators which act upon only one polarization with two crossed modulators positioned along the beam. Each modulator channel is imposed upon an orthogonal polarization component, with the transmission and demodulation proceeding as described previously.

Using the dual channel technique, substantially all of the presently desired CATV spectrum can be accommodated. Thus, 54 to 108 MHz feeding the first modulator covers channels 2 through 6 plus the FM channels, while 120 to 240 MHz feeding the second modulator provides coverage of channels 7 through 13 plus the non-standard midband and high-band channels A through M, resulting in transmission of a total of 25 TV channels plus the FM band.

II. SAFETY AND ECONOMICS

While there is general agreement as to the potential eye hazard created by intense laser beams in the spectral region from 1.5μm to 0.35μm wavelength, there is, as yet, no solid data as to the flux density levels which can safely be tolerated. At least two issued specifications[2][3] cite as a safe level 5×10^{-5} watts/cm^2 at $\lambda = 0.63\mu$m (helium-neon laser) and 1.5×10^{-4} watts/cm^2 at $\lambda = 1.06\mu$m (YAG laser). From a 5" diameter objective, therefore, about 7 milliwatts from a helium-neon laser and 20mw from a YAG laser will provide this flux level near the transmitter. However, these published values are generally regarded as highly conservative, perhaps by as much as 1000 times, and workers in the laboratory frequently receive higher exposures without apparent effect.

It has been reported that the cost of material and installation for one mile of underground CATV cable in New York City usually ranges between \$10,000 and \$20,000 and in some special cases, as high as \$40,000. Assuming the optical link to be fully equivalent to cable in function and performance, in order to be cost-competitive with cable, each repeater unit must sell for a maximum of \$1,000 (including installation) since 20 repeaters would cost \$20,000. At a higher selling price, the optical link would appear to find application only in special cases, for example, where its capability for quick installation with high recovery value on an abandoned route was important.

An estimate of the component and assembly costs for the types of equipment discussed in Section I shows that the helium-neon system with 25 channel capacity is just possible at $1,000/repeater if production volume were high. The YAG system, on the other hand, would be difficult to produce for under $2,500 - again, if volume were high.

III. RECOMMENDATIONS

The significantly lower cost of a helium-neon laser (about $100, in quantity) compared with a YAG laser (about $1,500 in quantity), is the major contributor to the difference in system cost. The helium-neon system would be an immediate choice on the basis of cost alone, but as the results show, a 3 milliwatt helium-neon laser provides little margin over the nominally required 2.6 milliwatts. Unfortunately, fundamental limitations exist in obtaining higher usable output from this laser unless the cost is significantly increased.

The YAG laser, on the other hand, while its cost is nearly $1,500/unit greater, provides a very significant margin. Thus, compared to a nominally required 5 milliwatts, the YAG can provide, easily, 500 milliwatts. This power excess can be advantageously used in several ways:

(a) Increased weather immunity - a reliability of 99.99% can be obtained with a 10-fold increase in power.

(b) Wider transmitted beam for more tolerance in mounting and aiming is obtained by increasing the projected beam to 3 milliradians.

(c) Greater tolerance to lens dirt, which reduces to a transmission to 70% instead of 90%, costs another factor of 1.8.

With these advantages, a total laser power of 180 milliwatts is required, still leaving a margin for component degradation. In view of these considerations, it is recommended that any system design which aims toward 25 channels utilize the YAG laser. For one or a few channels, however, the helium-neon laser remains the clear choice.

REFERENCES

[1] B. G. King, W. C. G. Ortel and H. J. Schulte, Intl. Comm. Symposium, San Francisco, 1970.

Authors give a useful reduction of data contained in FAA System Res. and Development Serv. Report No. RD-68-49 (Aug. 1968).

[2] A Guide For Uniform Hygiene Codes or Regulations for Laser Installations, The American Conference of Government Industrial Hygienists (1968).

[3] Policies and Practices for Personnel Using Laser Devices, Bell Telephone Laboratories

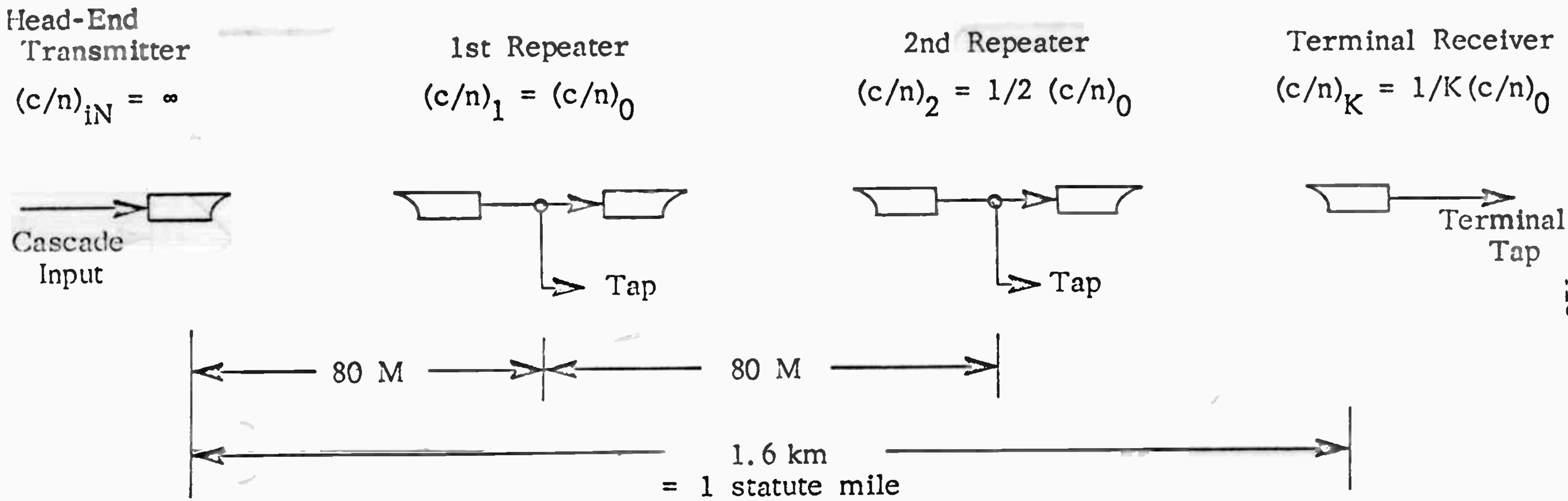


FIGURE 1. ONE MILE CASCADE OF K OPTICAL LINKS

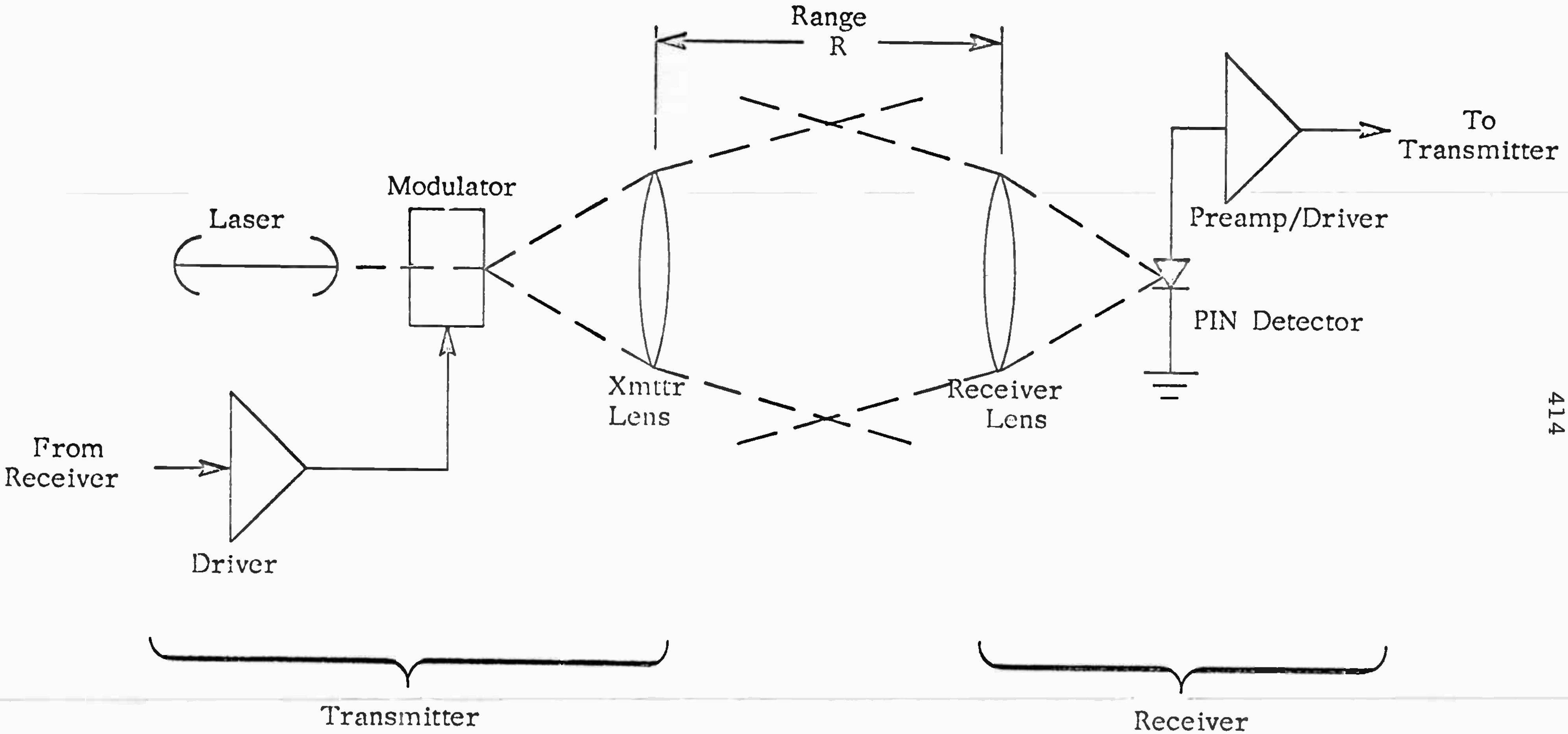


FIGURE 2. SCHEMATIC FOR ONE CASCADE LINK ELEMENT FOR CATV

DESIGNING INTRA-CITY AND INTER-CITY CARS BAND DISTRIBUTION SYSTEMS

By Dr. Joseph H. Vogelman, Sr. Vice President
and
Mr. Kenneth Knight, National Sales Manager
LASER LINK CORPORATION

This paper reports the practical applications of an FCC type approved development for Airlink CATV service.

The purpose of this article is to acquaint the industry with the practical applications of systems which have been filed with the FCC by cable operators and to show the economic and technical performance advantages of this new tool for cable television operators for both inter-city and intra-city CARS Band Distribution.

TWO-WAY MICROWAVE COMMUNICATION

It should be understood that Airlink CATV has two-way communications capabilities. Therefore the first system to be described will be one which we have in the design stage, shown on Figure 1, which we anticipate will be employed on a medical training program involving a medical center with member hospitals. The member hospitals participating will engage in bi-directional, interactive communications.

Figure 1 is a Laser Link System with two-way communications capabilities where the network illustrated shows ten (10) receiving stations, each of which is capable of transmitting back two (2) six megahertz channels in the same band, one of which could be used to provide specialized two-way or party-line communications between the receiving terminals.

In areas of community-wide communications services, specialized functions, such as Fire and Police Department reporting could be multiplexed over the Airlink System to each receiving location from which point it would be transmitted back as composite video to a Laser Link Transmitting Center, where messages could be relayed to Police and Fire Departments. Where such services are localized, each receiving point could serve as a contact with the appropriate local authorities.

THE LASER LINK SYSTEM

In the interest of first understanding the components of an Airlink system, we will review figures 2 to 6. Figure 2 is a block diagram of a cable system employing an air link equipment between the head end and the subscriber distribution system. Figure 3 is the typical configuration of the FCC type approved OLL 12T transmitter mounted on a 4 foot parabolic antenna. Figure 4 is a rear view of the transmitter with the cover removed showing the components. Figure 5 is the typical configuration of the receiver/converter.

Figure 6 is a view of the Laser Link Airlink System transmitter and parabolic antenna atop a tower at the Laser Link Laboratories, Garden City, Long Island, New York.

ACTUAL FCC FILINGS

The typical applications involved in distribution from a head end are:

1. A single head end to deliver multichannel signals to several remote population centers is shown in Figure 7. In this application, three communities at five, six and twenty-one miles will be serviced from an existing head end by three beams from a single transmitter.

2. To get signals over a mountaintop while simultaneously interlinking contiguous areas, the system design of Figure 8 is used. A 6,600 foot mountain hides the receiving site from the head end. This obstacle is overcome by using the mountain peak as a receiving point and simultaneously relaying the signals by means of a passive repeater consisting of two (2) ten foot antennas back to back.

3. The system of Figure 9 is used to economically jump over highways, railroad tressles and waterways. Three (3) sites at 4.6, 9 and 9.7 miles are connected to an existing head end which would otherwise require elaborate, expensive long runs of cable to get under highways and railroads and to go under or around major waterways.

4. Figure 10 shows a layout designed to optimize head end locations while avoiding "dry trunks." In addition to taking the signals from the head end to a new subscriber area, the design provides for future expansion to two additional sites by the addition of an independent amplifier, Type QLL-12TA to the transmitter.

5. In mountainous terrains a single head end on an isolated mountain provides service to many valley communities. The initial configuration provides service to three communities, with growth potential to ten (10) additional locations. One community, because its location is obscured by the terrain is reached by means of an active repeater operating at the intermediary receiving point. (Fig. 11)

6. Airlinks provide the capability to minimize underground distribution in urban areas. Since the subscriber populations are separated by non-revenue producing sections, the underground trunking costs are greatly reduced by the Airlink from the head end to each subscriber center. (Figure 12)

7. Figure 13 is an unusual application where we are taking an existing head end and beaming service to three additional cities, two via directional parabolic antennas line of sight to receiver/converter locations within twenty-five miles; and the third community serviced via a parabolic antenna from head end to a passive reflector on a mountain ridge, and thence deflecting the

signal to a receiver/converter six miles distant. Neighborhood service via input terminals at each localized Laser Link receiver/converter location are a standard capability to make available local community organizations.

This paper will describe systems which have been filed with the FCC which are in the seven categories listed above. It should be understood that in every instance where the Airlink has been applied there is a great economic savings as well as a technical improvement in system performance. Comparisons of typical configurations are shown on Table I. It should be noted by referring to the chart, (Table I), that even a single hop of eighteen miles has comparable signal to noise ratio (S/N) as a high performance cable trunk and we are comparing a $60,000.00 investment for Airlink against $230,000.00 capital cost for a cable system (not counting the annual pole rental charges). For "Seven Directions", with air distance from head end of twenty-five miles, the signal to noise ratio is comparable even for one (1) inch of rain, but the comparison of cost between Airlink and trunk cable at this distance is astonishing - $125,000.00 as compared to $2,226,000.00

All of these savings are achieved while making an improvement in the performance of the system under average weather condition.

FILING FOR AIRLINK CATV

For systems which are overgrown or where inter-city or intra-city Airlink connections satisfy a cable TV operator's requirements, the procedure for placing this system into service is as follows:

A. The cable operator submits his plan to our field engineering group who report on both the technical and economic advantages of the system as it should be applied to specific requirements and the most economic combination of Airlink and cable.

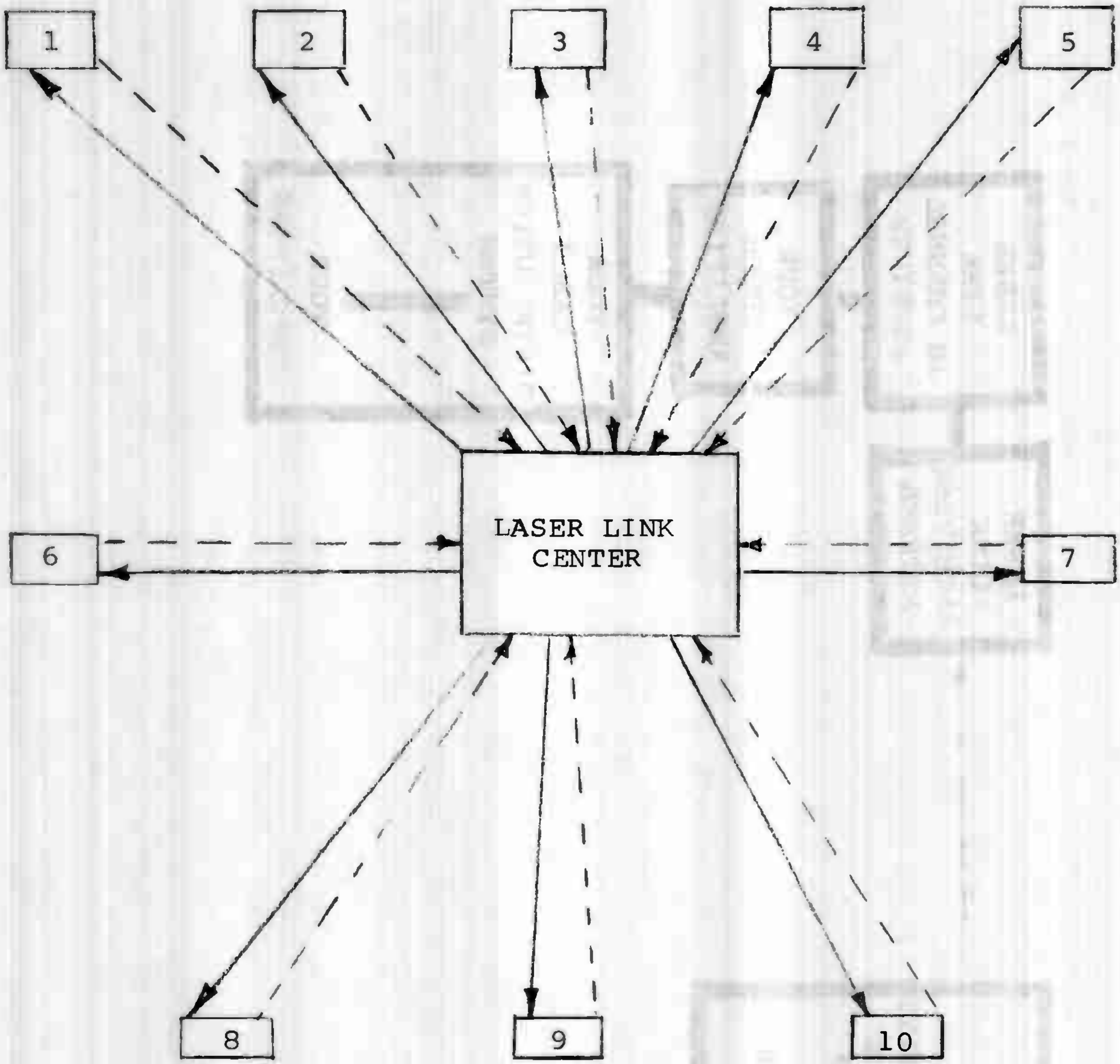
B. The cable operator takes the information received from field engineering and provides the responsive information needed on FCC Form No. 402. On this form, a cable operator is required to show the need for an Airlink service and for use of each channel as well as his planned location for transmitter and receiving sites.

C. Upon accepting the application, the FCC issues a BPCLD Number which acknowledges the suitability of the application for filing. The application is then in line for processing.

D. The FCC studies any possible interference and if all conditions are satisfactory, will issue a construction permit. The application of this system should make the Airlinking of areas with only a few hundred potential subscribers viable and economically sound; open up the urban markets so that the cable operator is not burdened by a leased cable association with the local telephone companies. "Dry trunks", railroad tressles, highways and the burden of obtaining right of way are eliminated to an important extent by the use of Airlink CATV.

The employing of Airlinks opens new markets for cable TV as operators as well as improving the standards in existing over-burdened systems. The equipment in this art has now been Type Accepted and will soon be adaptable for low-cost long haul CARS Band Microwave.

The future is great for those who have the wit and the means to bring new developments like this into early service.



1 CHANNEL

CENTER TO OTHER 10 LOCATIONS

12 CHANNEL

CENTER:

1 - QLL 12 Transmitter - 12 TV channels
10 - Beams 1 per location
10 - Standard Microwave Receivers & Modulators

SATELLITE LOCATIONS:

1 - QLL 12 Receiver - 12 TV channels	Total	10
1 - QLL 12 Receiving Antenna	Total	10
1 - Standard Microwave Transmitter	Total	10

With 11 TV sets at each location all 11 are in continuous communication with everyone else. Possible combinations are:

4 Two Way + 1 Three Way. Up To 11 Party Conference of all locations.

Fig. 1

FIG. 1

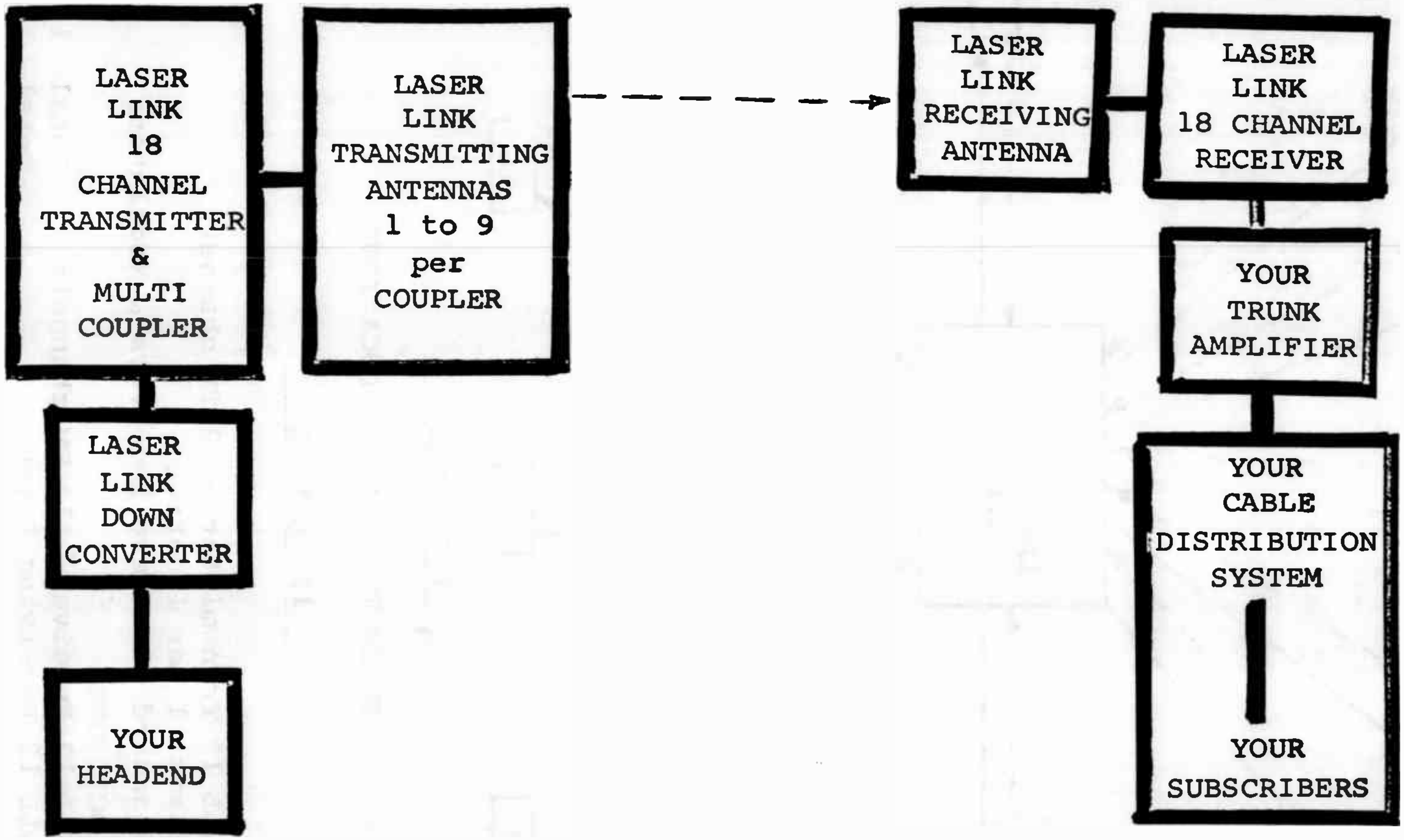

LASER LINK 18 CHANNEL TRANSMITTER & MULTI COUPLER
LASER LINK TRANSMITTING ANTENNAS 1 to 9 per COUPLER
LASER LINK RECEIVING ANTENNA
LASER LINK 18 CHANNEL RECEIVER
YOUR TRUNK AMPLIFIER
YOUR CABLE DISTRIBUTION SYSTEM
YOUR SUBSCRIBERS
LASER LINK DOWN CONVERTER
YOUR HEADEND

FIG.

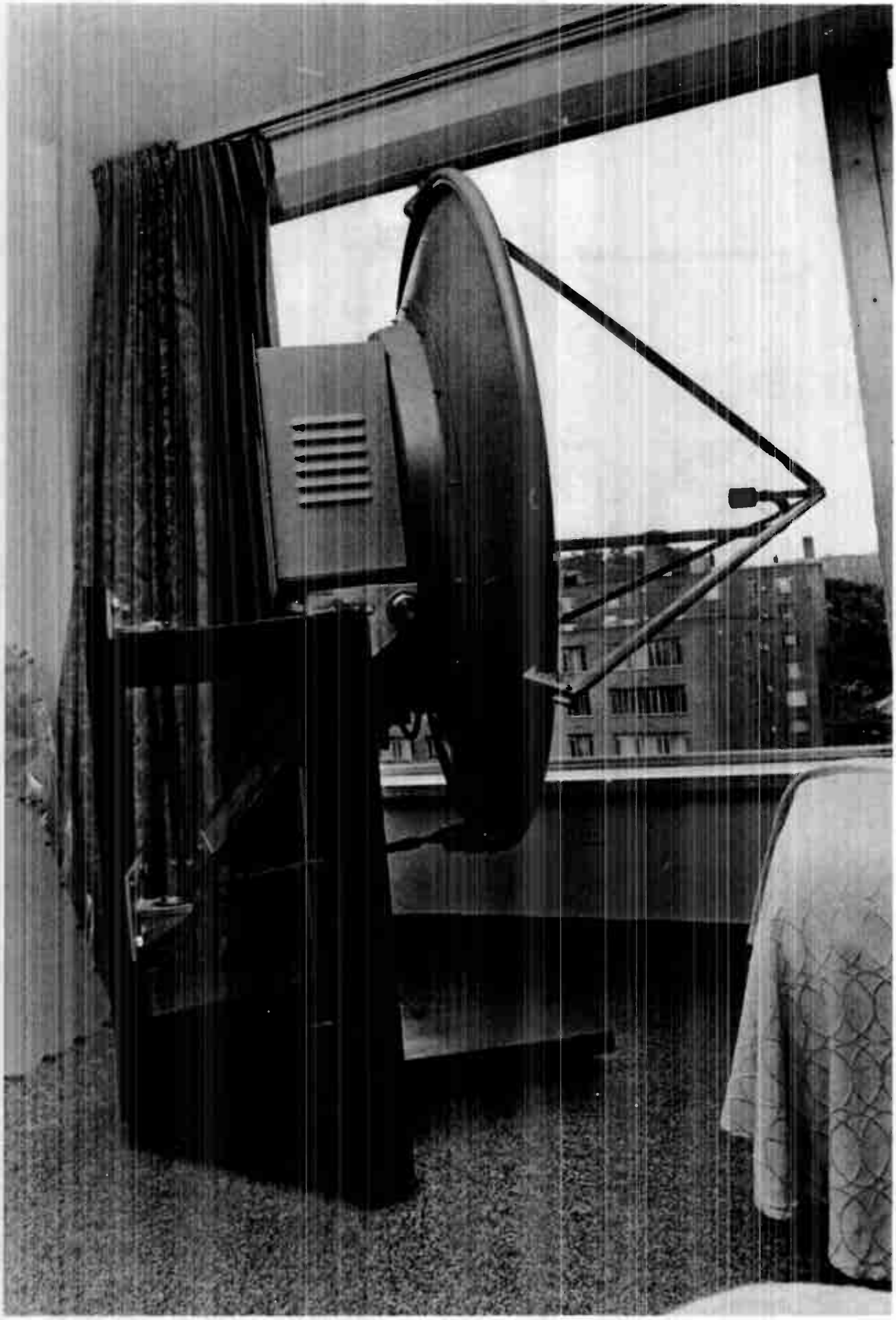


FIG. 3

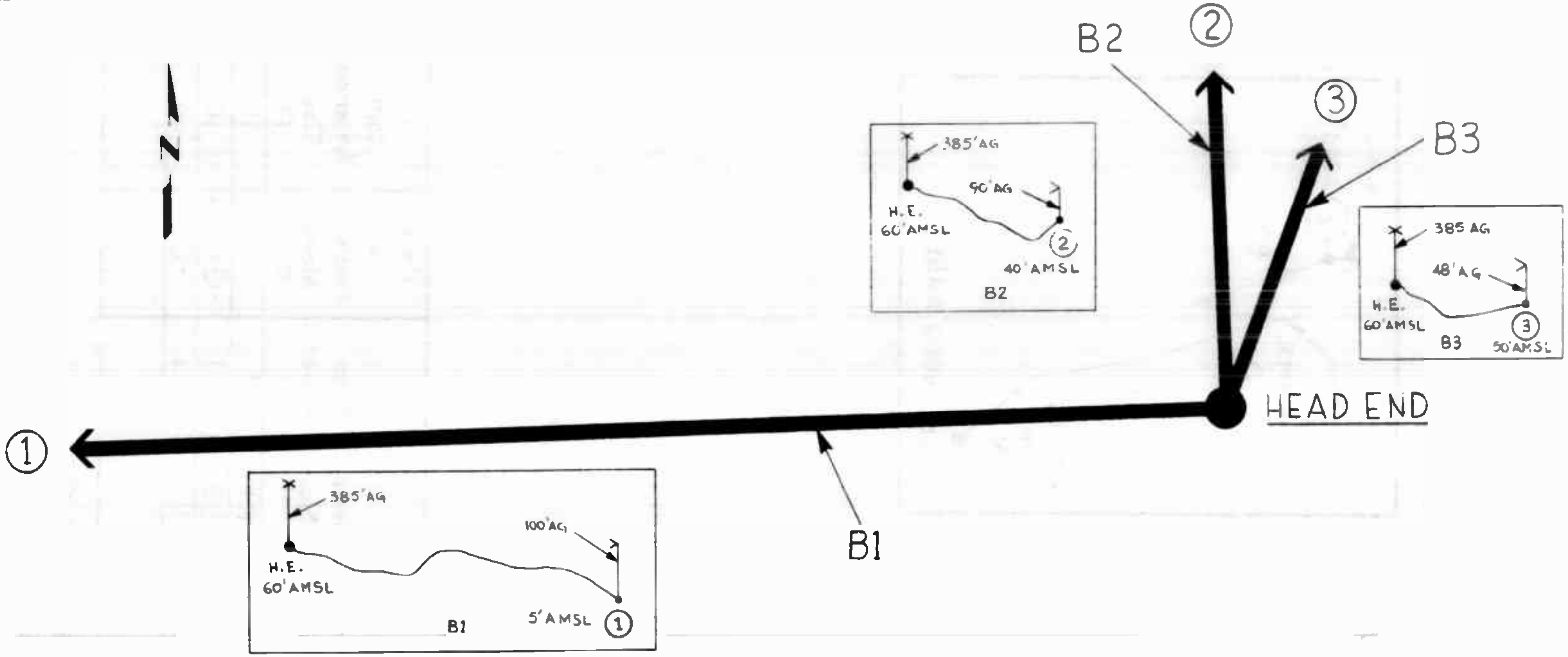
FIG. 4

FIG. 5

The Laser Link cableless CATV transmitting-receiving terminal in Garden City, NY incorporates quasi laser link concept of antenna and parabolic reflector equipment at top. Ba[illegible] view shows transmitter housing containing modulation and amplification components.

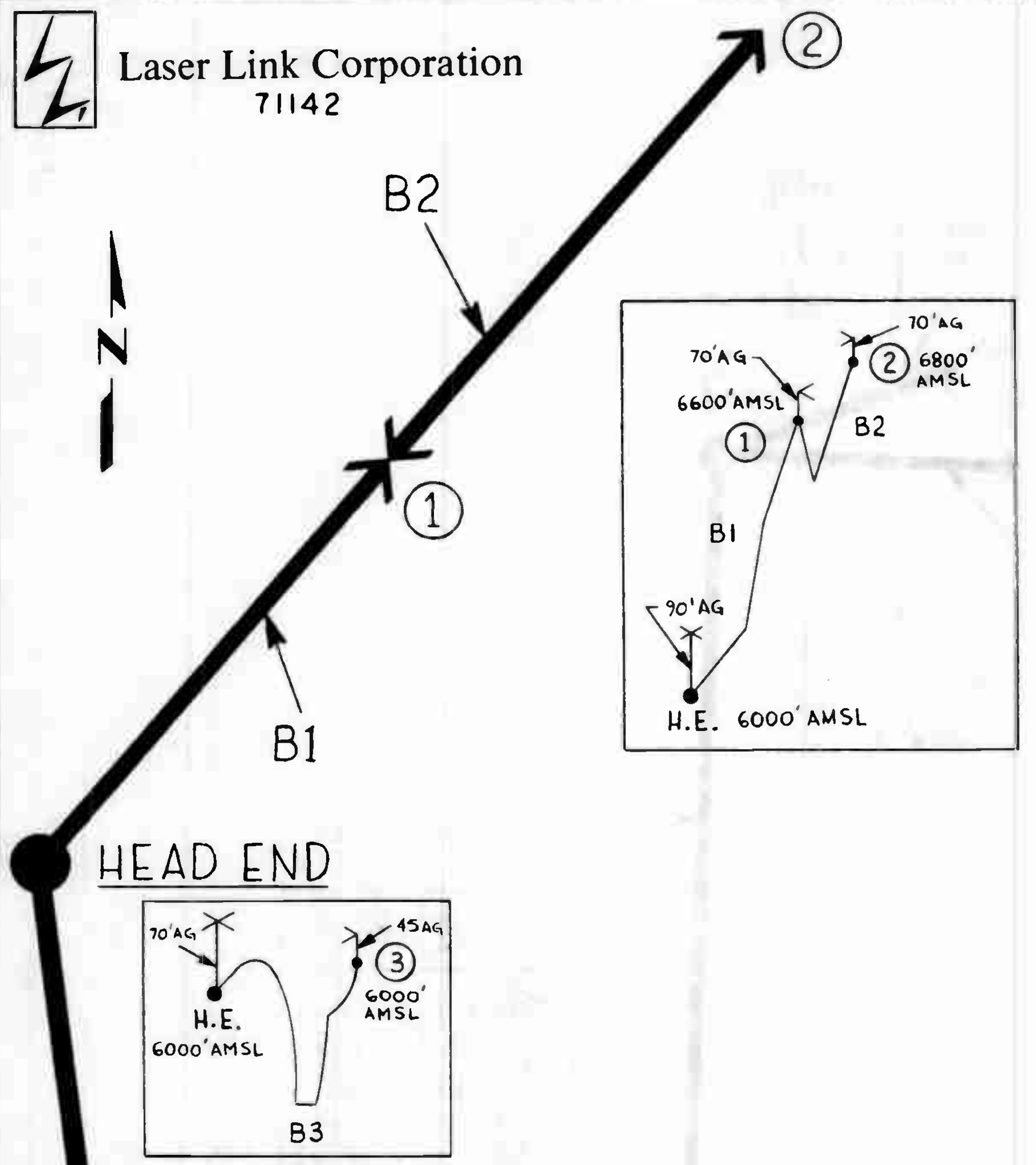
FIG. 6

Laser Link Corporation
71156



Site No.	Location	Miles to Head-end	Beam No.	Beam Power, W	Xmtr. or Rec'vr. Model	Xmtr. Antenna Size	Rec'vr. Antenna Size	Other
1	SMYRNA [illegible]	21	B1	18.0	12RTDA	10	10	–
2	DE[illegible]IA	[illegible]	B2	0.5	12R	4	4	–
3	[illegible]	5	B3	0.5	12R	4	4	–
Head-end	ORANG[illegible] CITY	–	–	19.0	12T	–	–	–

FIG. 7

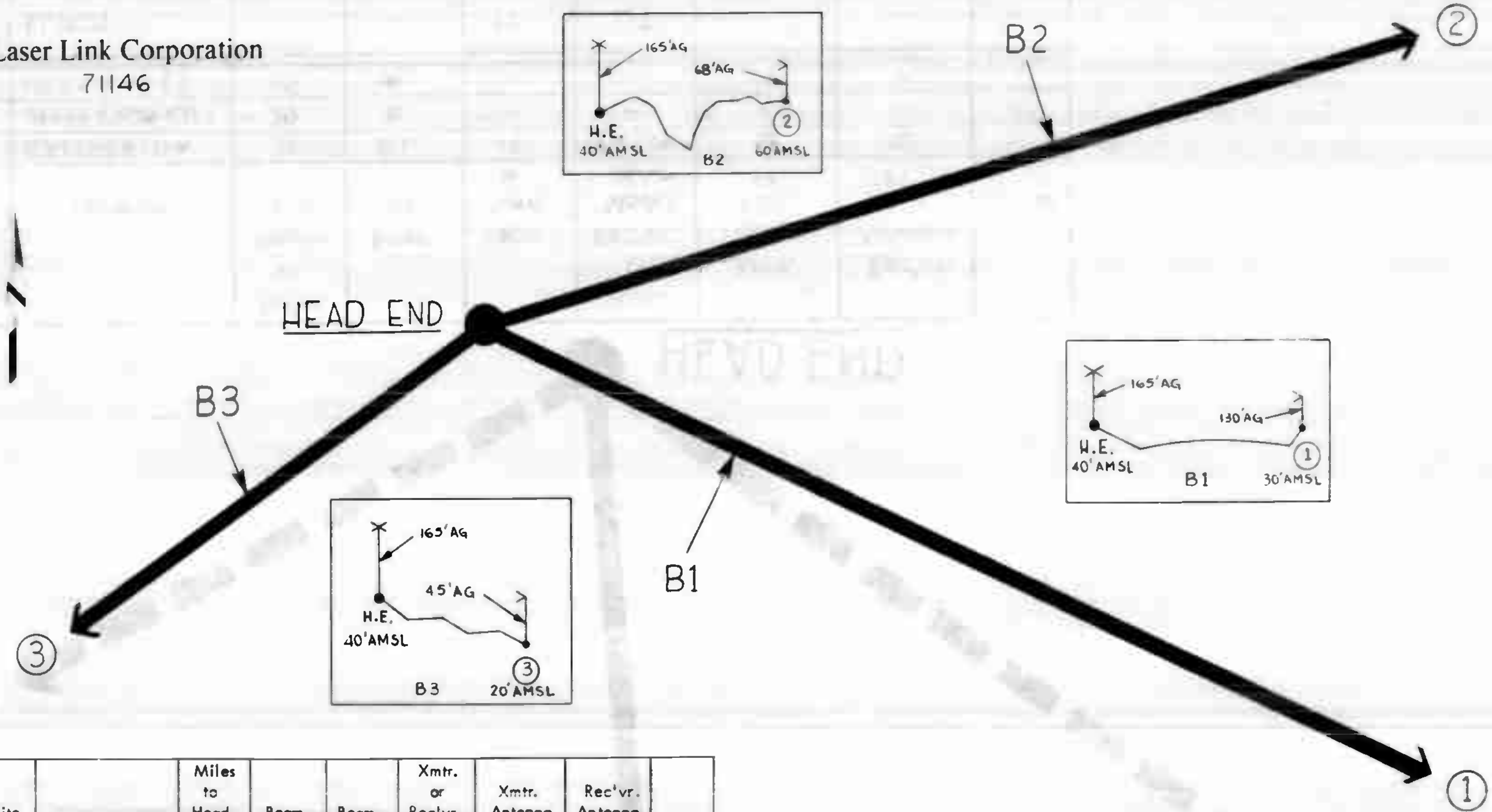


Site No.	Location	Miles to Head-end	Beam No.	Beam Power, W	Xmtr. or Rec'vr. Model QLL-	Xmtr. Antenna Size FT	Rec'vr. Antenna Size FT	Other
1	PALMER PARK	3	B1	15	–	10	10	–
2	RATTLESNAKE HILL	4.5 (1)	B2	(2)	-12RTDA	10	10	–
3	STRATMORE HILLS	4	B3	0.1	-12R	4	4	–
Head-end	COLORADO SPRINGS							

Notes:
1. DISTANCE FROM RELAY SITE NO. 1
2. PASSIVE REPEATER OUTPUT FROM SITE NO. 1
3. RAIN RATE CAPABILITY = 1 in./hr.

FIG. 8

Laser Link Corporation
71146

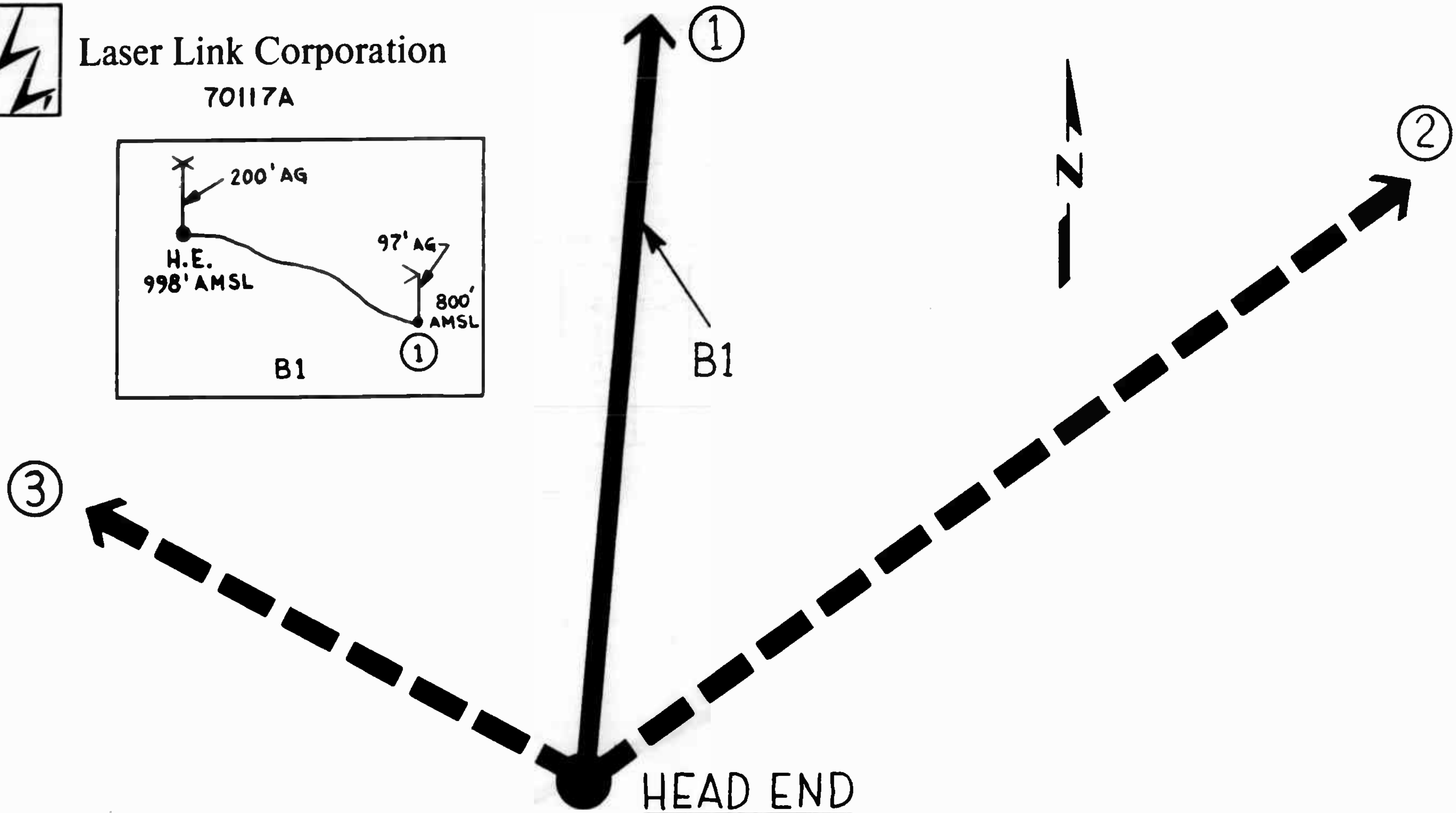


Site No.	Location	Miles to Head-end	Beam No.	Beam Power, w	Xmtr. or Rec'vr. Model QLL-	Xmtr. Antenna Size FT	Rec'vr. Antenna Size FT	Other
1	DESTIN	9.7	B1	4	-12R	10	4	–
2	EGLIN AFB, BUILD. 859	9.0	B2	14 (1)	-12R	4	4	–
3	EGLIN AFB, HURLBURT FLD	4.6	B3	1	-12R	4	4	–
Head-end	WRIGHT	–	–	19	-12T	–	–	–

Notes: 1. PROVIDES FOR EXPANSION CAPABILITY TO NELSON POINT WHEN REQ'D.

FIG. 9

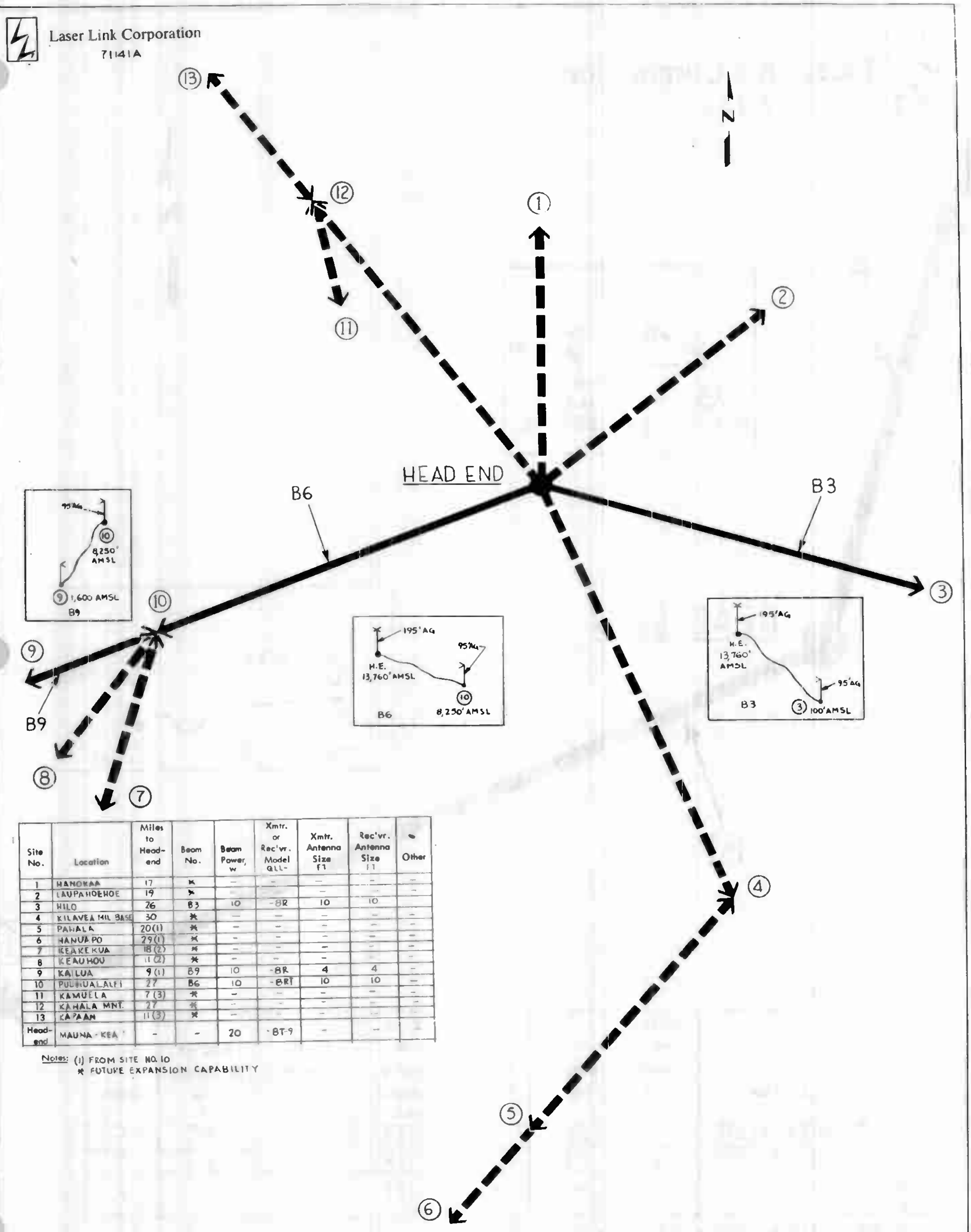
Laser Link Corporation
70117A



Site No.	Location	Miles to Head-end	Beam No.	Beam Power, w	Xmtr. or Rec'vr. Model QLL-	Xmtr. Antenna Size FT	Rec'vr. Antenna Size FT	Other
1	CALIFORNIA	21	B1	19	12RTDA	10	10	–
2	JEFFERSON CITY	29	*	–	–	–	–	–
3	VERSAILLES	15	*	–	–	–	–	–
Head-end	ELDON	–	–	19	12T	–	–	–

Notes: RAIN RATE CAPABILITY = 1 in/hr
* FUTURE EXPANSION CAPABILITY

FIG. 10

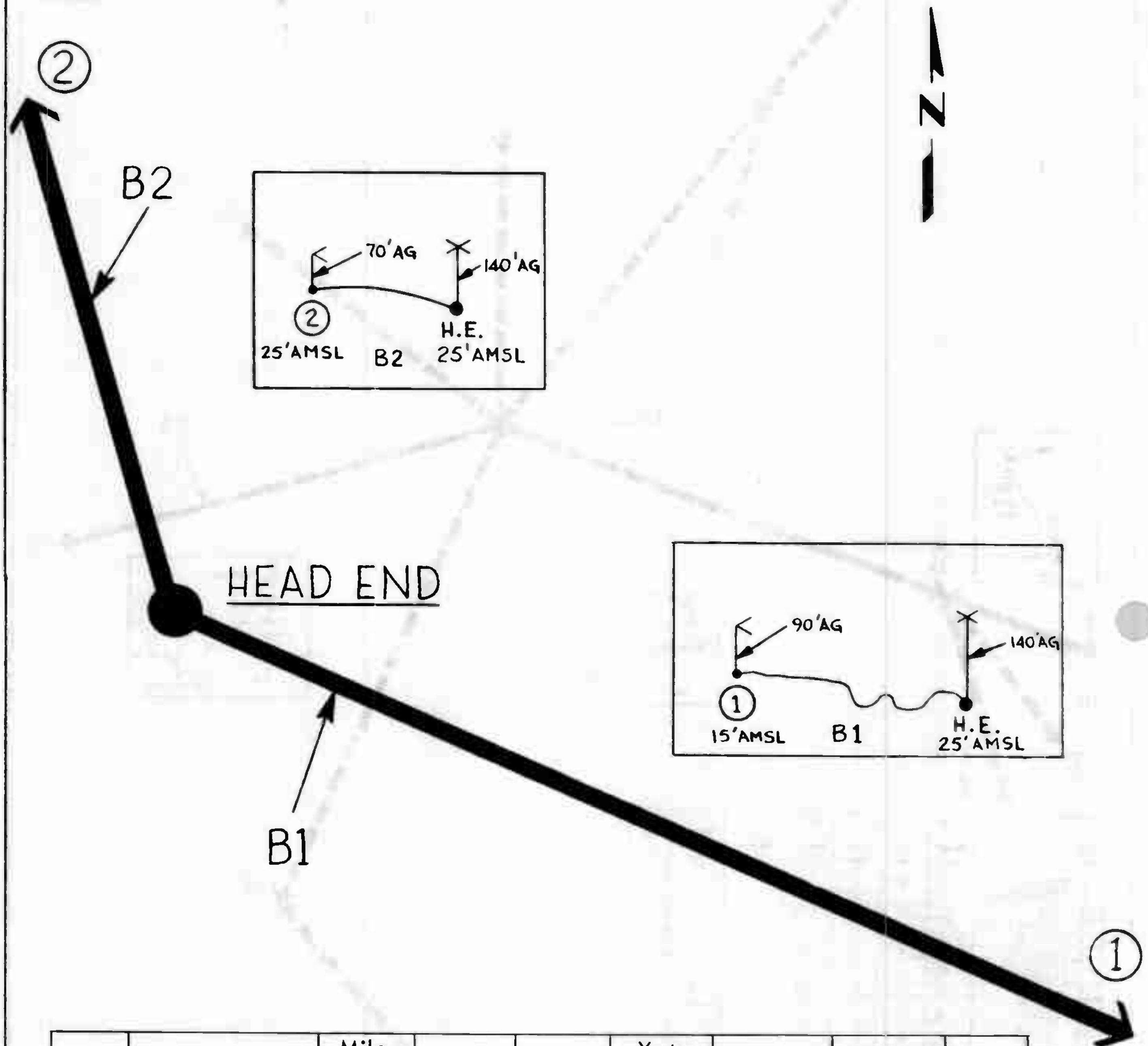


Site No.	Location	Miles to Head-end	Beam No.	Beam Power, w	Xmtr. or Rec'vr. Model QLL-	Xmtr. Antenna Size F1	Rec'vr. Antenna Size F1	Other
1	HANOKAA	17	*	–	–	–	–	–
2	LAUPAHOEHOE	19	*			–	–	–
3	HILO	26	B3	10	-8R	10	10	
4	KILAVEA MIL BASE	30	*	–	–	–	–	–
5	PAHALA	20(1)	*	–	–	–	–	–
6	HANUAPO	29(1)	*	–	–	–	–	–
7	KEAKEKUA	18 (2)	*	–	–	–	–	–
8	KEAUHOU	11 (2)	*	–	–	–	–	–
9	KAILUA	9 (1)	B9	10	-8R	4	4	–
10	PULHUALALEI	27	B6	10	-8RT	10	10	–
11	KAMUELA	7 (3)	*	–	–	–	–	–
12	KAHALA MNT.	27	*	–	–	–	–	–
13	KAPAAN	11 (3)	*	–	–	–	–	–
Head-end	MAUNA-KEA	–	–	20	-BT-9	–	–	–

Notes: (1) FROM SITE NO. 10
* FUTURE EXPANSION CAPABILITY

FIG. 11

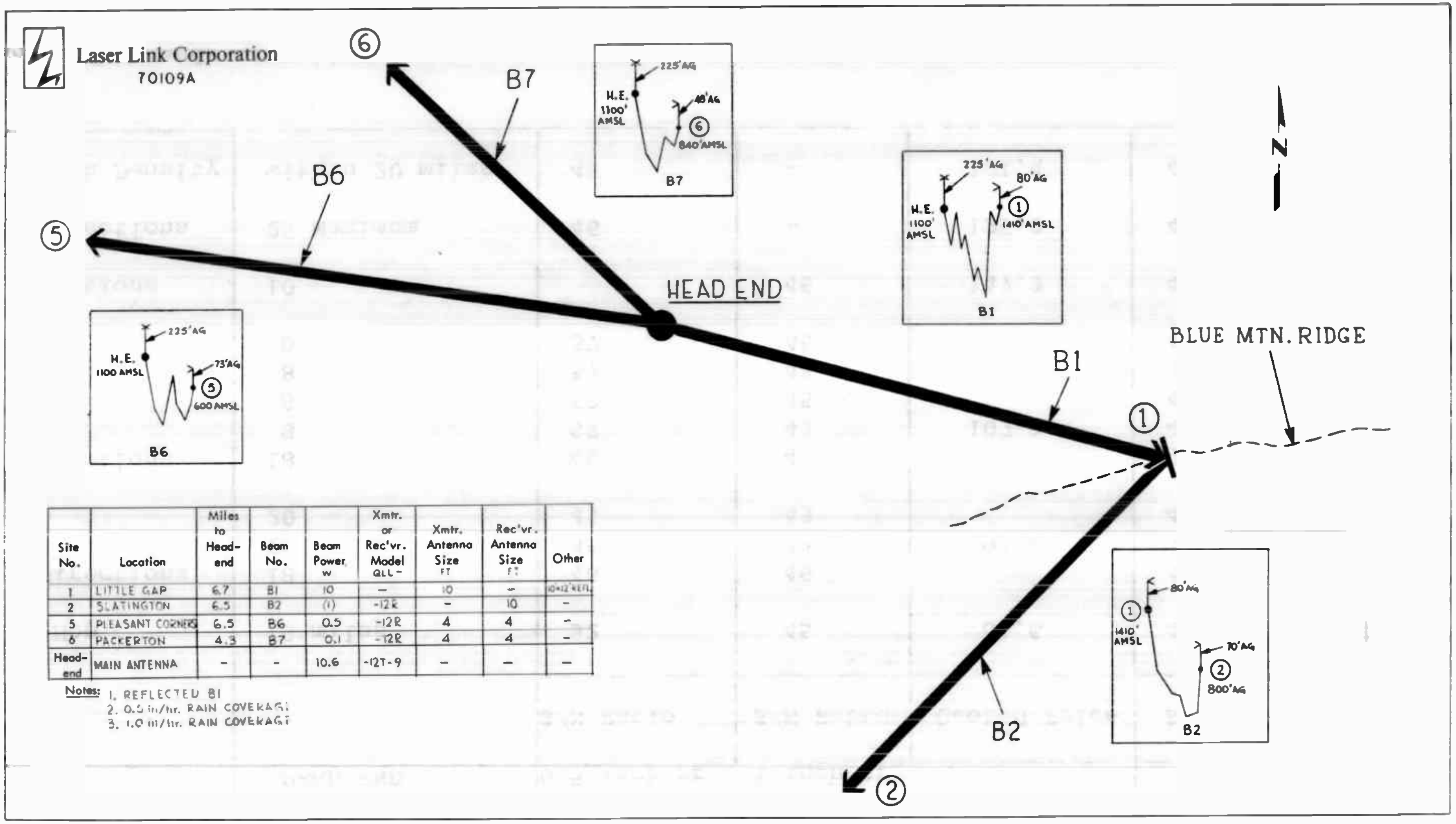
Laser Link Corporation
71143



Site No.	Location	Miles to Head-end	Beam No.	Beam Power, W	Xmtr. or Rec'vr. Model QLL-	Xmtr. Antenna Size FT	Rec'vr. Antenna Size FT	Other
1	FLOWER BLUFF	9	B1	5	-12R	4	4	–
2	N.CORPUS CHRISTI	4	B2	1	-12R	4	4	–
Head-end	CORPUS CHRISTI	–	–	6	-12T	–	–	–

Notes: RAIN RATE CAPABILITY = 1 in/hr

FIG. 12



Site No.	Location	Miles to Head-end	Beam No.	Beam Power W	Xmtr. or Rec'vr. Model QLL–	Xmtr. Antenna Size FT	Rec'vr. Antenna Size FT	Other
1	LITTLE GAP	6.7	B1	10	–	10	–	10×12' REFL.
2	SLATINGTON	6.5	B2	(1)	-12R	–	10	–
5	PLEASANT CORNERS	6.5	B6	0.5	-12R	4	4	–
6	PACKERTON	4.3	B7	0.1	-12R	4	4	–
Head-end	MAIN ANTENNA	–	–	10.6	-12T-9	–	–	–

Notes: 1. REFLECTED B1
2. 0.5 in/hr. RAIN COVERAGE
3. 1.0 in/hr. RAIN COVERAGE

FIG. 13

TABLE I

COST COMPARISON OF LASER LINK AIRLINK AND TRUNK CABLE

TYPE	AIR DISTANCE FROM HEAD END	AIRLINK FOR VARIOUS RAIN RATES 0.5 inch/hr	1 inch/hr		HI PERFORMANCE CABLE TRUNK		
		S/N Ratio	S/N Ratio	Quoted Price	S/N	Capital Cost	Pole Rental
Single Hop	18 miles	52	45	61.6	45	230	3
Three Directions	18	46	46		45		
	20	45	43	94.8	44	742	10
	20	45	43		44		
Five Directions	18	49	46		45		
	8	57	45	107.3	49	638	8
	8	57	45		49		
	8	57	45		49		
	8	57	45		49		
Ten Directions	10		46	147.3	48	1198	16
Seven Directions	25 Maximum	46	-	125.2	44	2226	28
Urban High Density 100 Sites	within 20 miles	46	-	101.4	42	2500	35

Costs in Thousands of Dollars:

Excellent pictures requires more than 42db channel S/N

SPECIALIZED TEST EQUIPMENT FOR CATV DISTRIBUTION MEASUREMENTS

George P. Dixon & Thomas F. Kenly
C-COR Electronics, Inc.

INTRODUCTION

Historically, the test equipment used in setup and trouble-shooting of the CATV distribution system has evolved from the early days of little or no test equipment to today's practices of adapting laboratory type equipment for field use plus a continually growing use of low priced signal level meters. It is true that test equipment manufacturers have recently "discovered" CATV and produced a rash of 75 ohm units. Now it is possible to put together an impressive array of test equipment and study in detail a system amplitude, phase and delay transmission characteristics, providing one can keep the equipment operating long enough and can cope with a lot of other practical problems associated with getting around and tapping into a CATV distribution system.

Over a period of years the authors have been "witness to" or participated in field excursions where the Ritual of a "count down" was observed to make sure that all of a multitude of pieces were safely stored aboard a vehicle before departing. More often than not it has been normal for a critical piece of gear to be left behind or to find that transportation vibration has killed some thing crucial to completion of the appointed task. The frustration of these experiences can be matched only by the problem of trying to interpret data taken on equipment with built-in errors, which mask the significance of that data.

These experiences have lead to belief that there is a crying need in the industry for a quality specialized test set capable of making basic field measurements with reliability and precision required by today's standard of performance. The authors contend that such a basic instrument makes much more economic sense than elaborate time domain reflectometry and spectrum analyzers which certainly have their place at today's level of sophistication.

In retrospect, it is somewhat surprising that the economics advantages of such test equipment have not been properly recognized. The true cost of errors and delays due to test equipment problems can be staggering. Hundreds of dollars per day in labor wasted, vehicle charges, customer aggravation - these items add up quickly to pay for a $2,000.00 item, which can save down time or prevent errors. Utility companies and the military have long recognized the heed for "test sets" specifically designed to "set up" and adjust complicated systems in a rapid and foolproof manner. Perhaps the authors draw an unfair comparison with manufacturing where it has become normal to review such expenditures for tooling in terms of labor saving dollars. Certainly if this were done, the demand for such test equipment would have been much stronger.

GENERAL

With this previous discussion as background, it can be stated that this paper will describe a test set designed and slated to be produced on a "limited edition" basis at C-COR for the express purpose of making the "nuts and bolts" measurement of signal level, noise, and distortion throughout a CATV system. The major economic motivation in our case is the potential improvement in efficiency in our own Systems Engineering Department.

In addition, certain specialized production test units constructed and used by C-COR will be briefly discussed. Some of these represent the forerunner of the circuitry used in the test set; others are shown because they illustrate the similarity between field test and production test or may have some value around a maintenance laboratory.

A review of some of these factory test units, designed and built at C-COR will follow in the succeeding paragraphs.

FACTORY TEST EQUIPMENT

Some of the problems associated with factory testing are very similar to those encountered in the field. For instance, one of the most critical is the frequent calibration of selective RF voltmeters and the radio and frequent measurement of things like noise figure at spot frequencies. To facilitate these operations, we have constructed two basic test units. The first shown in Slide I is a Level Calibrator, which is simply a stable multiple signal source that is periodically calibrated by the Quality Control Department. Test personnel plug their meters into the calibrated ports for frequent calibration at commonly used levels but are not able to tamper with the calibrated unit. This latter statement is a recurring theme in this kind of testing.

A related item is a Switchable Fixed Tuned Converter shown in Slide II. This unit, where used in conjunction with a noise figure meter, provides quick and foolproof measurement at a number of spot frequencies. Adequate filtering is provided to avoid spurious responses. Likewise, levels at spot frequencies can be quickly measured without turning or adding calibration factors. Finally, the converter provides an acceptable means of extending the frequency range of other equipment.

As a matter of interest, it is worthwhile to take a quick look at some other pieces of specialized test equipment. A Cross Modulation Test Set of modular construction (Slide III) where an attempt has been made to design a self-contained work station, which is occupied for some 16 hours a day. The Hum Modulation Test Set and the Lightning Test Set shown in Slide IV and Slide V illustrate units built to fill a need not met on the commercial test equipment market.

One important point to be made at this stage is that many items similar to those shown can be constructed in an equipped CATV laboratory, if they have reasonably ingenious personnel and (1) learn to seek out "circuit modules" available commercially and (2) modify commercially available instruments.

CATV DISTRIBUTION TEST SET

As was previously mentioned, the test set evolved from circuitry which was initially designed for production test and from a prototype built for preliminary evaluation. This prototype is pictured in Slide VI. General characteristics of the revised unit now being designed are shown in Figure 1 with data on the feasible tests included in Figure 2.

Block diagrams of the internal components of basic test set and the transmitter unit are shown in Figures 3 and 4.

APPLICATION

For use by technical personnel in balancing, aligning, trouble-shooting, monitoring, evaluating performance before serious deterioration of distribution.

PHYSICAL

Self-contained, MIL quality with regard to ruggedness - suit-case format for airline travel.

ELECTRICAL

"Secondary standard" type stability with wide calibrated operating temperature range (-20, +120° F). Calibration where possible controlled by transmitter at antenna site.

Sensitivity sufficient to look at cascading effects. Internal modular construction, for repair and calibration check.

GENERAL CHARACTERISTICS CATV DISTRIBUTION TEST SET

FIGURE 1

SIGNAL LEVELS

Typical selective voltmeter usage except that no compensator knobs are needed. "Panoramic" operational mode to provide ready view of relative levels on six channels.

SIGNAL-TO-NOISE

An internal amplifier with 6 dB noise figure to make feasible measurements at low signal levels.

IM PRODUCT & SPURIOUS SIGNALS

Capable of measuring -60 dB under CATV conditions.

HUM MODULATION

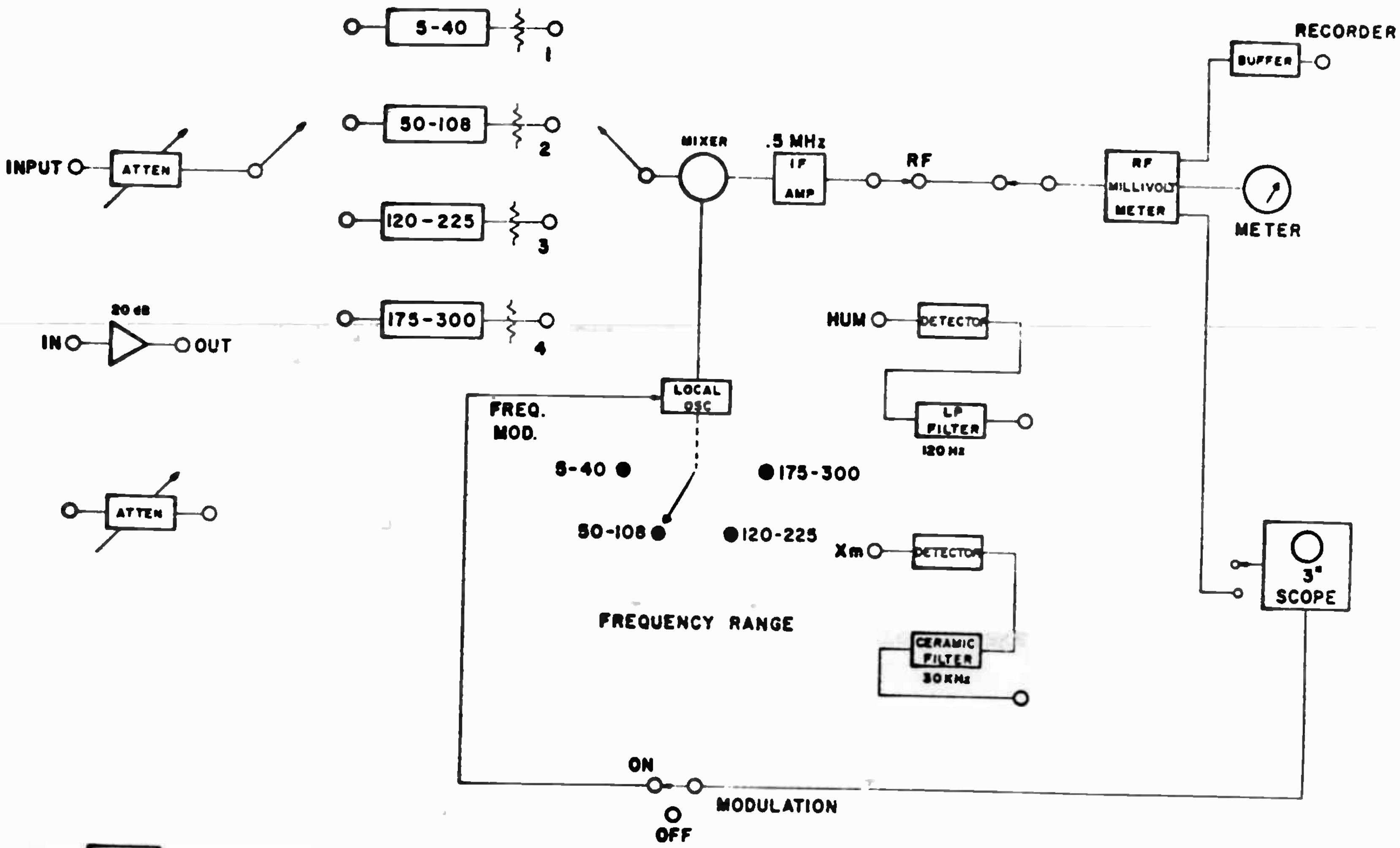
At least -60 dB (.1%).

CROSS MODULATION

A relative measurement which can be related to -60 dB in a multiple channel system.

SOME POSSIBLE TESTS USING CATV DISTRIBUTION TEST SET

FIGURE 2



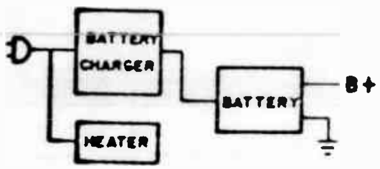


FIGURE 3

BLOCK DIAGRAM OF
CATV DISTRIBUTION TEST
SET

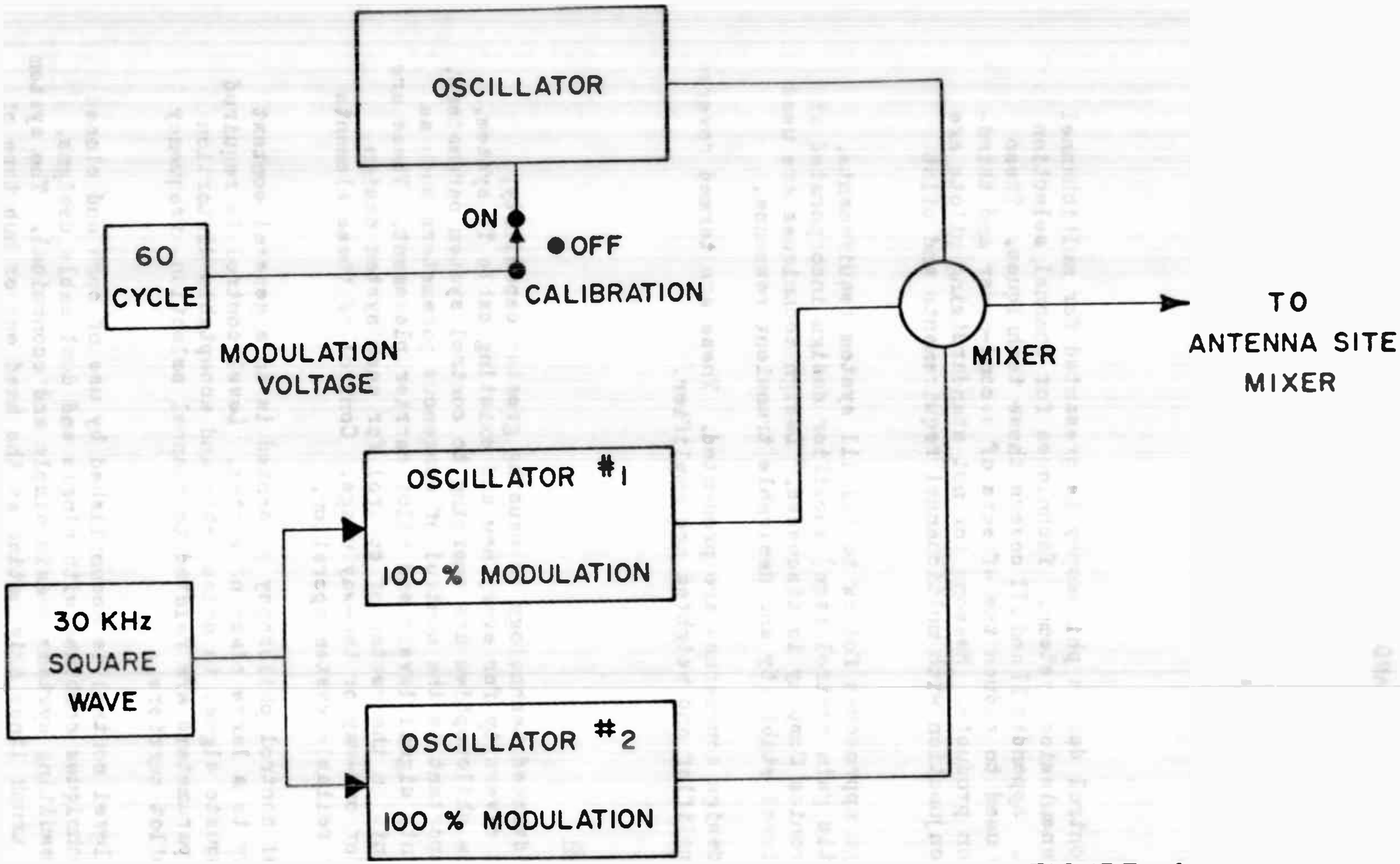


FIGURE 4

TRANSMITTER FOR CATV DISTRIBUTION TEST SET

LEVEL CONTROL CONCEPTS FOR MULTICHANNEL AND TWO-WAY SYSTEMS

James R. Harrer
Senior Research Engineer
Anaconda Electronics Co.
Anaheim, California

ABSTRACT

System level control design philosophy is presented for multichannel and two-way transmission systems. Techniques for channel selection are introduced. Appendix II and III covers these techniques. These techniques are used to reduce the effects of second-order and third-order distortion products. Reasons for not standardizing pilots are clarified in conjunction with multichannel requirements and pilot placement.

Amplifier design approaches follow to fulfill system requirements. A novel automatic gain control (agc) amplifier design incorporated at Anaconda Electronics Company is discussed. Design techniques are used which provide level stability and desirable transient response.

New amplifier design approaches are presented. These are termed reverse gain control amplifier and weighted agc amplifier.

I. INTRODUCTION

Today new and advanced technology is causing greater capability, flexibility and diversity for every new and existing cable TV system. Consequently new philosophies are emerging to control system parameters. Particularly important is the control of exogenous parameters such as channel placement, signal levels and pilot carrier placement. These are essential elements in the vector of control for each system design whether it is for one-way or two-way usage. Control of these elements is required for reliable system operation.

The system level control philosophy presented is in a general context so it will apply to a large class of system. Level control is required to maintain adequate signal to noise ratio and acceptable distortion levels. These parameters are related to channel selection, frequency response, and pilot carriers.

Two-way system level control is accomplished by use of open and closed loop control techniques combined with single and dual cable designs. This way, the resulting systems remain simple and economical. The system with short haul trunk lines originating at the head end or hub type of system uses reverse gain control amplifiers. For long haul trunk lines dual cable is used with agc amplifiers and combining networks.

II. LEVEL CONTROL DESIGN PHILOSOPHY

A properly designed system, be it one-way or two-way, has safety margins built in to maintain adequate signal to noise ratio and distortion at suitably low levels. These safety margins are required to accommodate variations in amplifier performance with input signal level variation, temperature, inaccuracies in desired amplifier placement, and amplifier control settings (gain and equalization). The input signal level variation at a particular amplifier is due to the frequency response of the preceding amplifiers being temperature sensitive as well as the attenuation of the preceding cables being a function of temperature. Cable attenuation in decibels is described by

$$A = q_o + q_1 f^{\frac{1}{2}} + q_2 f \qquad (1)$$

where f is frequency and the other terms are a function of temperature and a particular manufacturer. The optimum amplifier design in terms of noise figure, distortion, load capacity, gain distribution and other costs will not be considered here. A conjugate gradient optimization algorithm can be used in such a design. References for conjugate gradient techniques are [1] and [2].

The fundamental problem here is the control of amplifier output levels. The need to control these levels is readily seen from equations (2) and (3) for signal to noise ratio and cross modulation respectively [3].

$$10 \log(S/N)_m = S - G - F_{db} - 10 \log KTB - 10 \log m \qquad (2)$$

$$XM_m = XM_R + 2(S_R - S) - 10 \log(N_c - 1) - 20 \log m \qquad (3)$$

where
S = amplifier operating output in dbmv
G = amplifier gain in db
The other terms are defined in Appendix I. These equations, in a less general form, have been used in earlier papers [4],[5]. Second order distortion terms may be a factor as well as other third order products. Appendix II and III discusses distortion and channel selection respectively. For a particular channel allocation design, a means of evaluating intermodulation distortion is given by

$$IM_m = IM + (S_R - S) - 10 \log m \qquad (4)$$

where
IM_m = intermodulation at the output of the mth amplifier in cascade

IM = intermodulation at the output of a single amplifier

S_R = amplifier reference output in dbmv

S = amplifier operating output in dbmv

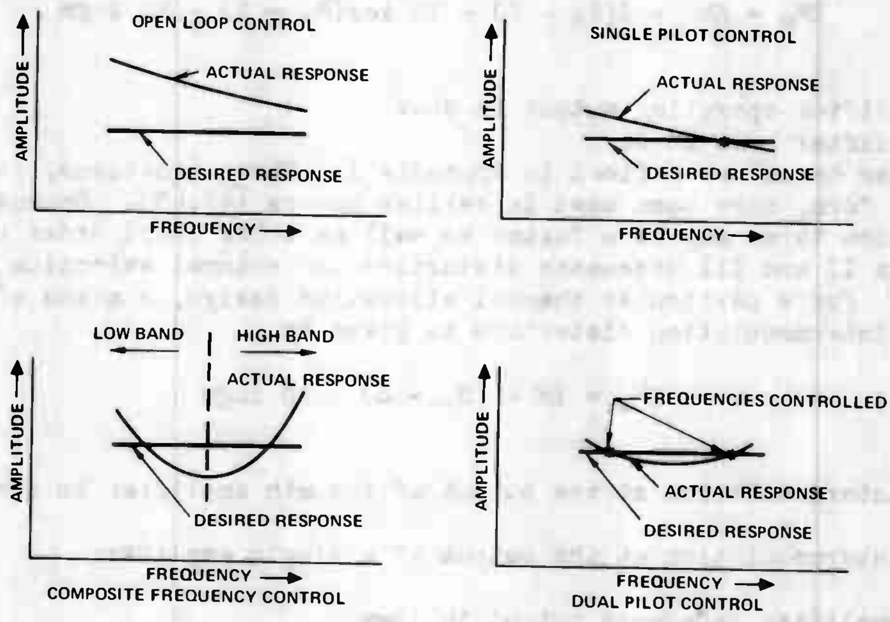
These equations are for what is termed a "well behaved amplifier" [5]. Furthermore, they assume all amplifiers have the same distortion and noise properties. Additionally, all amplifiers are supposed to have equal gain and output levels. Tests, over temperature, must be conducted to correlate computed results, from these equations, with actual test data.

Once correlation is completed, bounds on the system performance can be established from these equations. Thus, minimal standards of performance for signal to noise ratio and distortion are assured provided the output levels are controlled.

A suitable technique of level control advocated is the combination of open and closed loop control in the form of thermally compensated and agc amplifiers respectively. The ratio between the number of thermally compensated amplifiers and agc amplifiers in a cascade depends on the system noise and distortion requirements as they relate to temperature range and cascade length.

III. LEVEL CONTROL TECHNIQUES

The level control techniques presently used in one-way systems are reviewed in Figure 1. The shortcomings of open loop control and single pilot control are reviewed graphically. Any control scheme consisting of more than two carrier frequencies can be defined as composite frequency control. Usually the response is averaged over two bands of frequencies. In dual pilot control one pilot usually controls the amplitude at a single frequency while the other pilot controls the degree of equalization based on the amplitude at another frequency.



LEVEL CONTROL TECHNIQUES (CASCADE RESPONSE)

Figure 1

IV. CONTROL TECHNIQUE SELECTION

Since manufacturing tolerances exist between cables and uncertainties in response flatness exist with placement, temperature, taps, splitters, etc., an adjustment capability must be provided in at least some of the trunk line amplifiers. This further complicates the level control problem since we demand response stability with temperature changes for the multitude of adjustment possibilities.

With the amplifier frequency response changes over temperature reduced as well as practical, the next step is to select an agc approach with corresponding pilot placement which will provide for adequate level control. Also, pilot carrier amplitude and its effect on distortion must be considered and the pilot carrier(s) controlled must be representative of the process. This can be done by placing the pilot carriers at usable frequency band edges or within the band as shown in Figures 2 and 3. Here, frequency response, over temperature changes, is shown to be related to pilot carrier placement.

For a limited bandwidth and a short haul trunk line, thermal compensation combined with single pilot control may be adequate. Proper application of equations (2), (3), and (4) in conjunction with the channel selection techniques of Appendix III will generally answer this question.

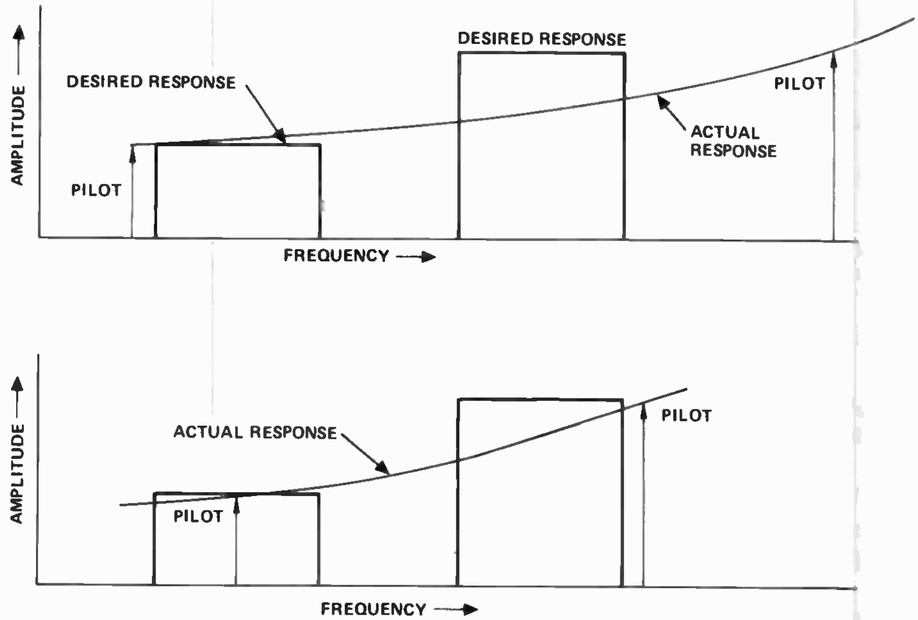
Since every equipment manufacturer's trunk line equipment has a different frequency response with temperature the techniques used or required for adequate control are different. Also for different systems with varying channel and bandwidth requirements it may be necessary to have pilot carrier frequency flexibility for improved level control.

There are also different points of view concerning dual, composite and modulated pilots within the industry.

Pilot carrier frequency standardization could unnecessarily limit system performance. Furthermore, present designs could be obsoleted by standardization rulings. Any plans to standardize pilots will have to satisfy individual system requirements in terms of bandwidth and channel selection.

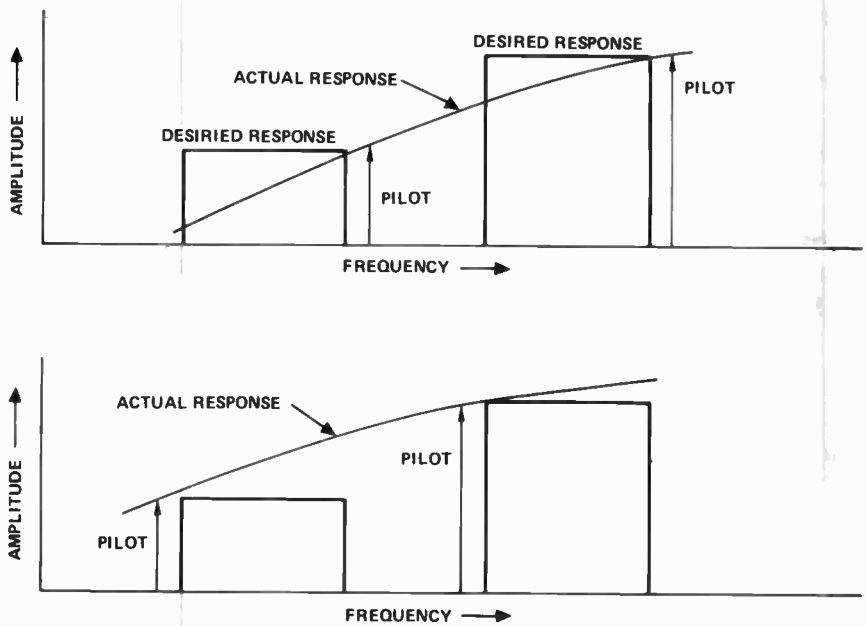
V. TWO-WAY SYSTEM LEVEL CONTROL HIERARCHY

A level control design philosophy, consisting of open and closed loop control techniques, can be applied to the reverse direction of a two-way system. Equations (2), (3), and (4) do not generally apply for the reverse direction. A correction noise term related to number of subscribers is required in equation (2). The information coding techniques incorporated will affect the system distortion requirements. Also access techniques to reduce queueing and prevent overload conditions are needed. Level control techniques may be considered independent of these factors. This viewpoint is pursued here.



PILOT SELECTION EXAMPLE (CASCADE RESPONSE)

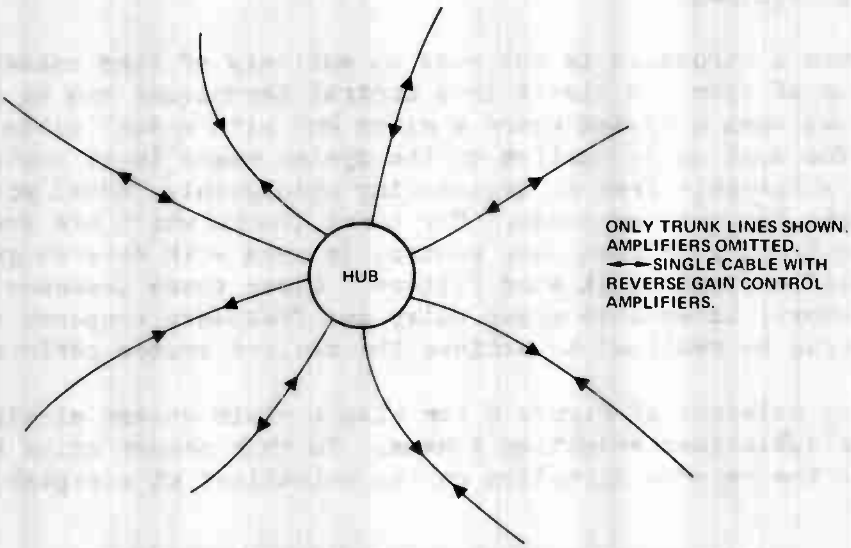
Figure 2



PILOT SELECTION EXAMPLE (CASCADE RESPONSE)

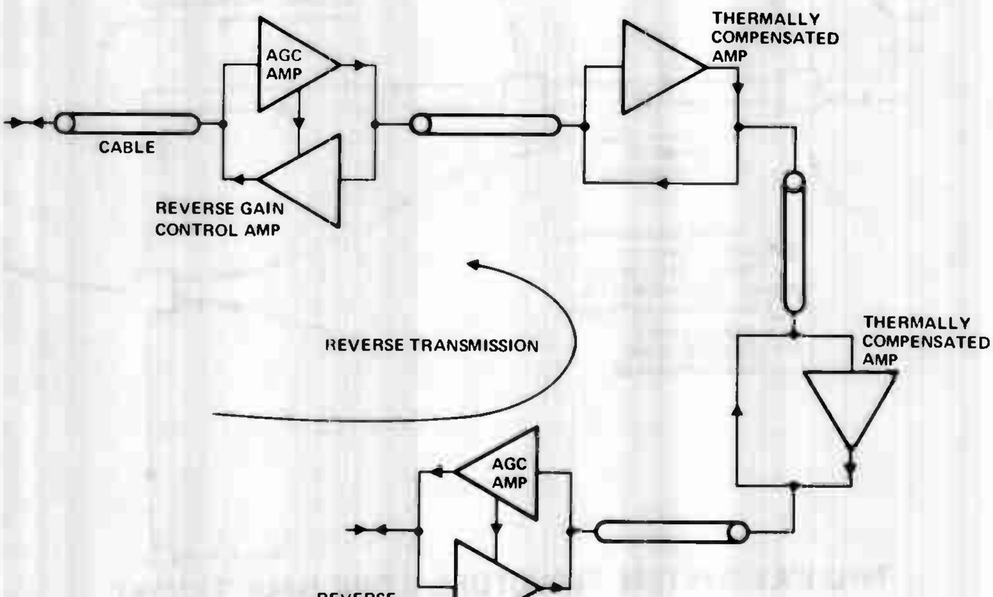
Figure 3

For short haul trunks or a hub type of system, open loop control can be applied. This approach is indicated in Figures 4 and 5 where reverse gain control amplifiers are used to control the gain.



TWO-WAY SYSTEM STRUCTURE (HUB SYSTEM)

Figure 4



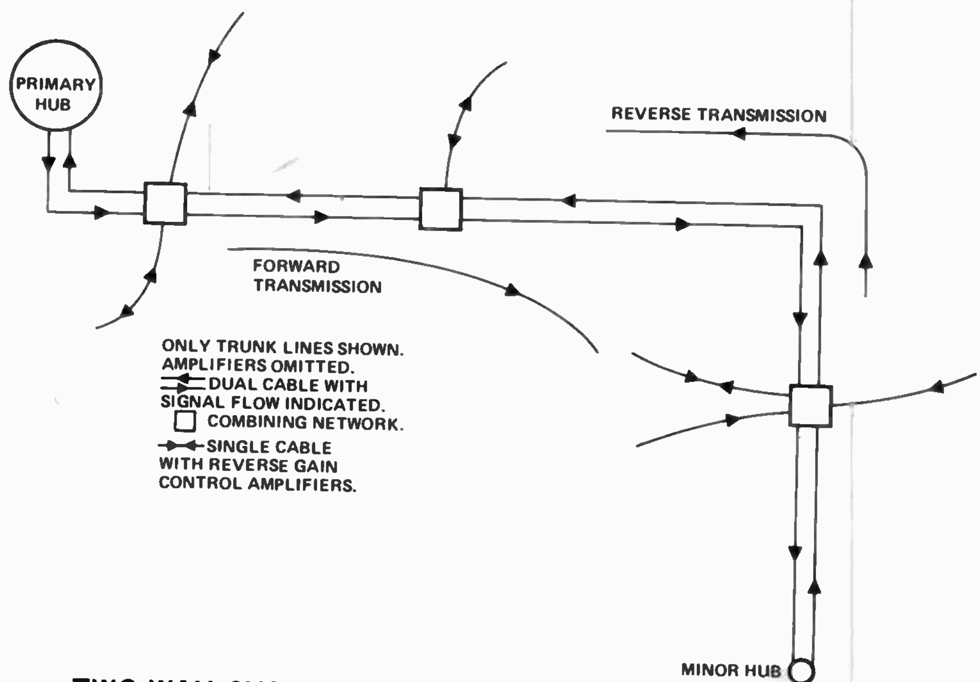
TWO-WAY COMMUNICATIONS WITH REVERSE AMPLIFIERS

Figure 5

Figure 5 illustrates this concept where the split band filters are omitted for simplicity. Reverse gain control amplifiers are used as needed and their gain is controlled by the agc amplifiers in the forward direction. Since this is open loop control its application is limited and for a long haul trunk a minor hub with a pilot carrier generator is required.

Since a system's structure is not made up entirely of long cascades, a combination of open and closed loop control techniques can be applied. Figure 6 shows such a system where a minor hub with a dual cable is provided. The dual cable portion of the system makes level control more easily achievable from an engineering standpoint. Added cost is the price paid for this approach. For short trunks which are branches of this long trunk line open loop control is used with reverse gain control amplifiers and split band filters. Since these cascades are relatively short, acceptable group delay and frequency response characteristics can be realized to achieve the desired system performance.

The combining networks of Figure 6 can also contain access electronics as part of a subscriber selection scheme. In this manner noise at the head end for the reverse direction can be maintained at acceptable levels.



TWO-WAY SYSTEM STRUCTURE (LONG HAUL TRUNK)

Figure 6

A savings in cost may be realized by exploiting the system map to find a hub type of structure where reverse gain control amplifiers can be utilized and long haul trunk lines avoided. This oould also result in improved performance with a possible cost reduction for the forward direction. Due to the simplicity of the reverse gain control amplifier the major cost factor is the additional size of the housings and the addition of two-way filters. This is small compared to the extra cable, housings, level control electronics, and powering circuitry for the dual cable system. Clearly, a cost reduction is achievable using the reverse gain control amplifiers.

As two-way system design requirements become better defined, systems and manufacturers with flexibility and capability will be adaptable to the needs of the industry. Existing single cable systems that can incorporate two-way transmission will be needed. New system layouts incorporating dual cable will have insurance for future two-way usage. For these reasons a combination of open and closed loop control techniques are needed.

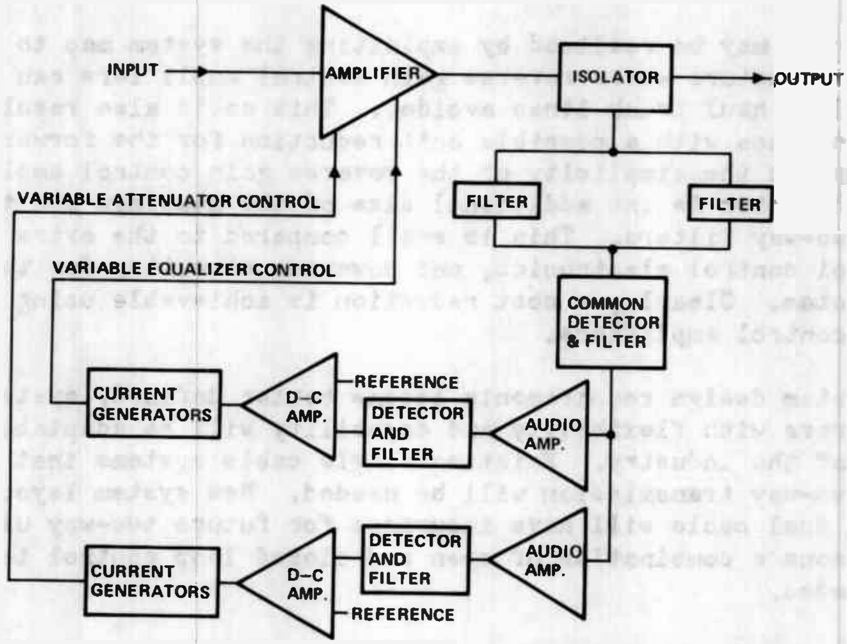
VI. ONE-WAY AGC AMPLIFIERS

Some of the hardware required in a one-way multichannel cable system is a dual pilot agc trunk line amplifier and a agc distribution amplifier or line extender.

The agc trunk line amplifier utilizes a dual modulated pilot and advanced design techniques to achieve long term stable operation and desirable transient response.

A block diagram explaining the design is presented in Figure 7. Here the signals from the two parallel bandpass filters enter a common averaging detector and filter. Economy and additional filtering of channels adjacent to each pilot carrier is achieved in this manner. At the detector output the unfiltered frequencies are designated f_1 and f_3. They are the modulating frequencies for the pilot carrier frequencies f_2 and f_4. Thus, low level d-c detection schemes requiring extremely stable components and references are avoided. Additionally, the audio amplifiers have bandpass responses for the frequencies f_1 and f_3. The signals at the audio amplifier outputs are large in amplitude compared to the signals out of the common detector. Now large signal detection follows and the resulting signals are compared to their appropriate references. The remainder of the diagram is fairly self explanatory with the exception of the isolator. This block consists of a stable low loss magnetic component which couples the amplifier output, at a reduced level, into a low distortion cascode amplifier.

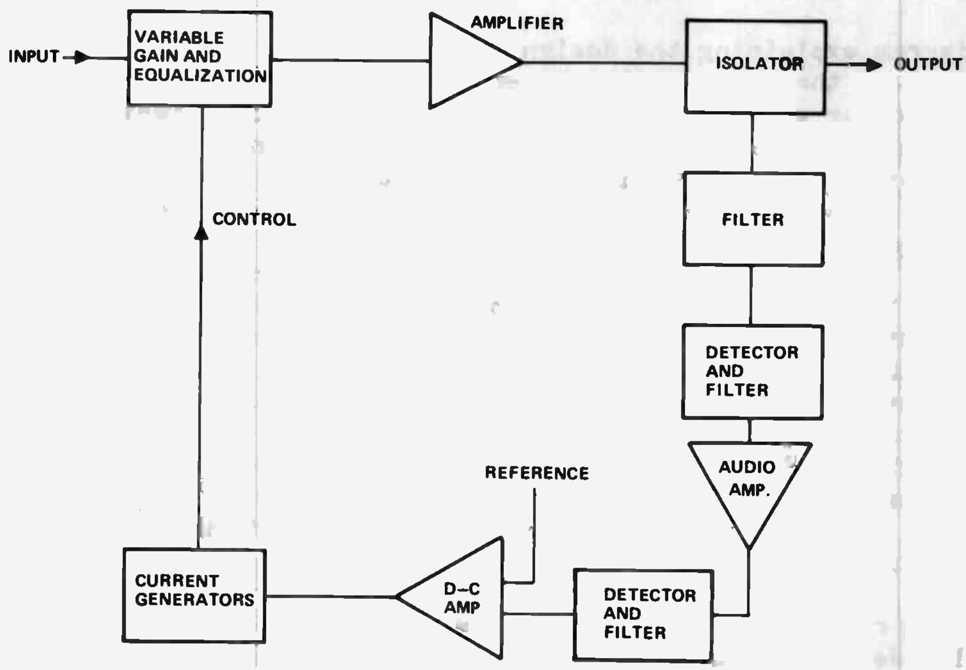
The transient response design is realized using state variable techniques. The detailed design formulation is found in Appendix IV.



AGC TRUNK LINE AMPLIFIER

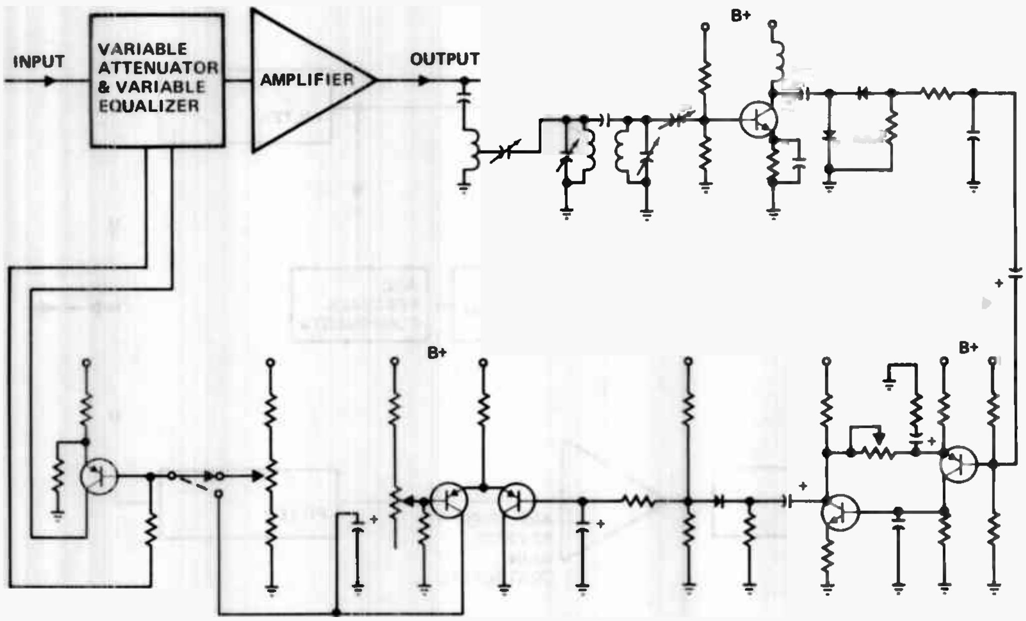
Figure 7

Since the agc line extender cascadability requirements aren't as stringent as those of the trunk line its design is compact while using only one modulated pilot carrier. This block diagram is in Figure 8; and Figure 9 shows the associated feedback circuitry.



AGC LINE EXTENDER

Figure 8



FEEDBACK CIRCUITRY FOR AGC LINE EXTENDER

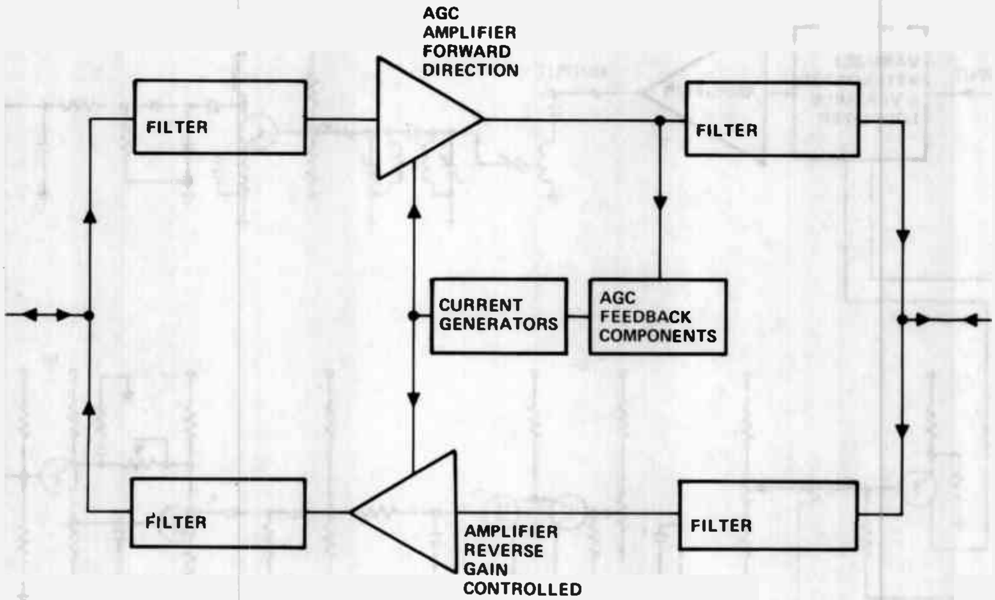
Figure 9

VII. NEW DESIGNS

A reverse gain control amplifier and weighted agc amplifier are new designs for level control applications.

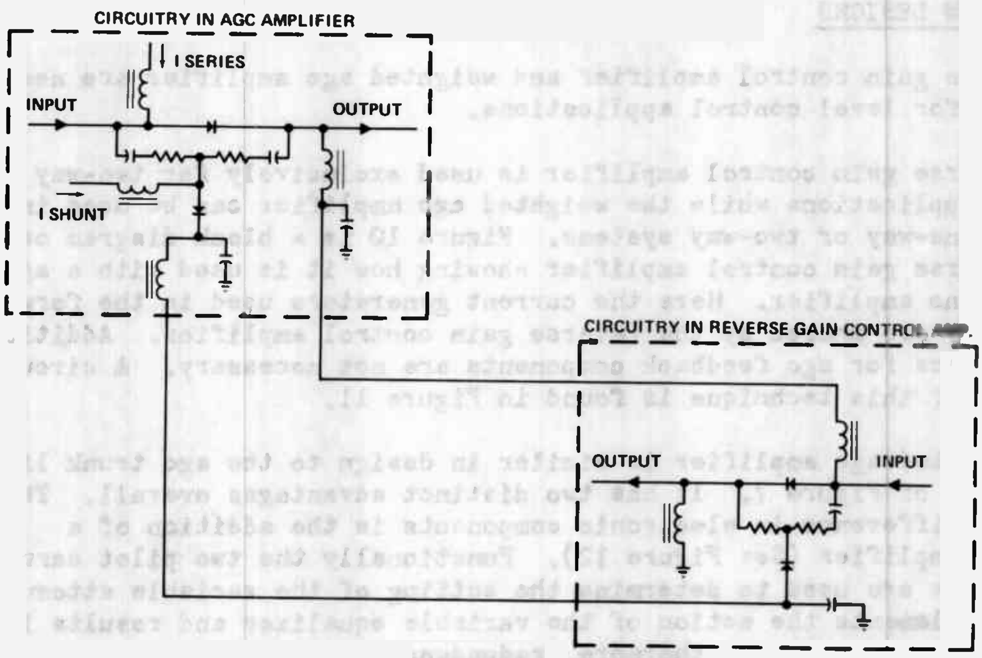
The reverse gain control amplifier is used exclusively for two-way system applications while the weighted agc amplifier can be used in either one-way or two-way systems. Figure 10 is a block diagram of the reverse gain control amplifier showing how it is used with a agc trunk line amplifier. Here the current generators used in the forward direction are shared by the reverse gain control amplifier. Additional electronics for agc feedback components are not necessary. A circuit example of this technique is found in Figure 11.

The weighted agc amplifier is similar in design to the agc trunk line amplifier of Figure 7. It has two distinct advantages overall. The primary difference in electronic components is the addition of a summing amplifier (See Figure 12). Functionally the two pilot carrier amplitudes are used to determine the setting of the variable attenuator. This complements the action of the variable equalizer and results in an extended agc range. Furthermore, redundancy is built into this design. For example, if one pilot carrier is interrupted some level control is maintained. In comparison with conventional designs, a pilot loss will result in no control and either the amplifier gain or equalization will go to its maximum value.



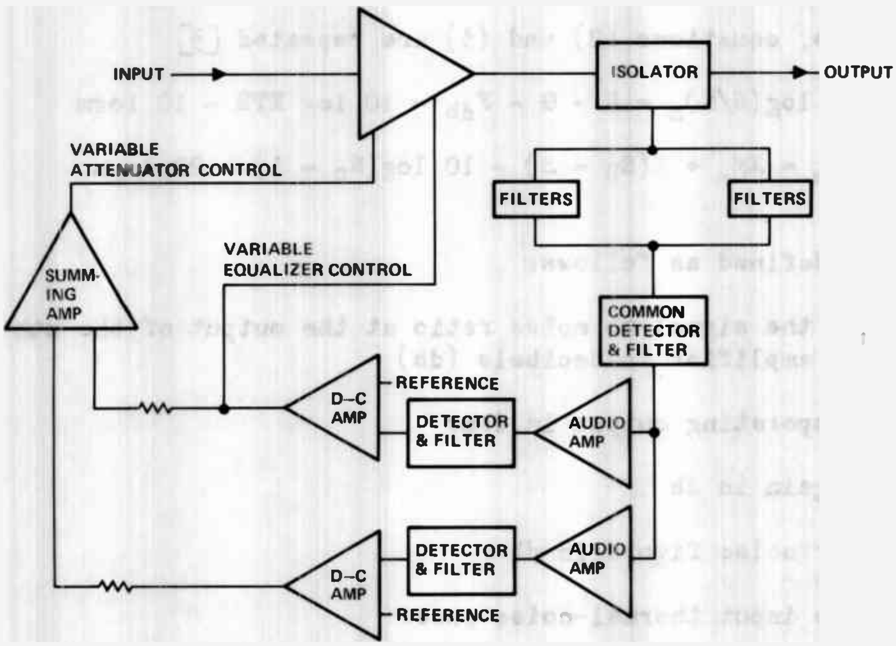
TWO-WAY COMMUNICATIONS WITH REVERSE GAIN CONTROL

Figure 10



CIRCUITRY FOR REVERSE GAIN CONTROL

Figure 11



WEIGHTED AGC AMPLIFIER

Figure 12

VIII. SUMMARY AND CONCLUSION

System requirements as they relate to level control have been emphasized. Additionally, level control philosophies were presented for both one-way and two-way systems. Finally, hardware descriptions were included for completeness.

The need for design techniques to minimize the total system cost while maintaining adequate performance was inferred in the Two-Way System Level Control Hierarcy section. Procedures of this nature do not exist for the less complex problem of one-way systems. Such procedures could determine parameters such as head end location(s) as well as cable routes and equipment requirements.

APPENDIX I

Definition of Terms

For convenience, equations (2) and (3) are repeated [3]

$$10 \log(S/N)_m = S - G - F_{db} - 10 \log KTB - 10 \log m \qquad (2)$$

$$XM_m = XM_R + 2(S_R - S) - 10 \log(N_c - 1) - 20 \log m \qquad (3)$$

The terms are defined as follows:

$10 \log(S/N)_m$ = the signal to noise ratio at the output of the mth amplifier in decibels (db)

S = amplifier operating output in dbmv

G = amplifier gain in db

F_{db} = amplifier noise figure in db

KTB = available input thermal-noise power

m = the number of amplifiers in cascade

XM = 20 log(% normal modulation) / (% imposed modulation)

XM_m = cross modulation at the output of the mth amplifier

XM_R = cross modulation at the output of a single amplifier measured for two carriers at the S_R reference output magnitude

S_R = amplifier reference output magnitude in dbmv

N_c = number of channels in the system

APPENDIX II

Distortion Analysis

A Taylor series expansion is used to describe the nonlinearities in an amplifier output signal [6], [7]

$$e_o = \sum_{j=1}^{\infty} a_j e_{in}^j$$

The resulting second order and third order product terms are well known for $e_{in} = A\cos\alpha t + B\cos\beta t + C\cos\gamma t$.

For e_{in} consisting of n sinusoids at frequencies $f_1, f_2, \ldots, f_n$ a matrix $A_1 = (a_{ij})$ is defined where $a_{ij} = f_i + f_j$. References for matrix techniques are [8], [9], and [10]. Similarly a matrix $A_2 = (b_{ij})$ is defined where $b_{ij} = f_i - f_j$. The diagonal elements of A_1 are all the second harmonics generated and the elements from either above or below the diagonal are the sum frequencies of each pair of input frequencies. For A_2 the trace is zero and the off diagonal terms are the difference frequencies.

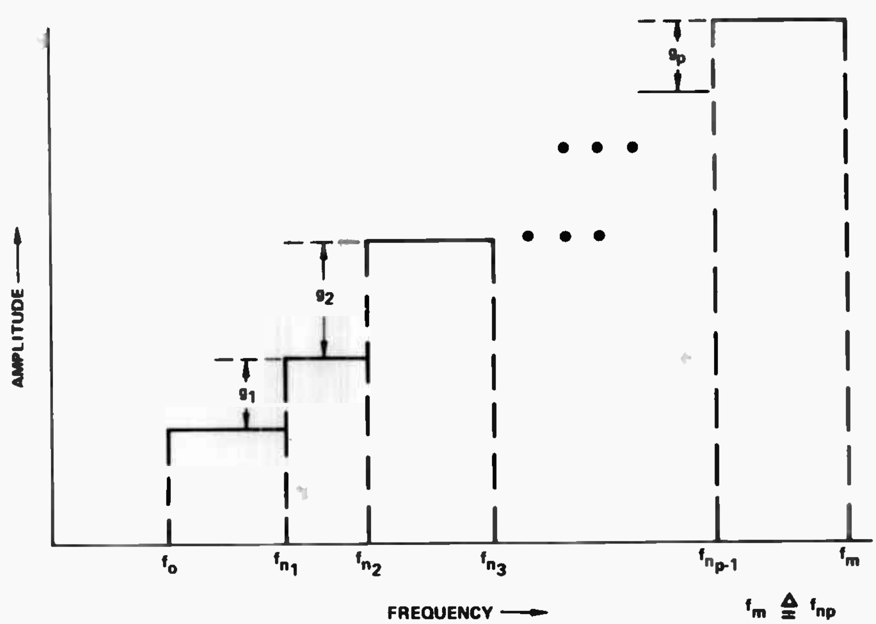
The third order product terms are three types; $3f_i$, $2f_i \pm f_j$ where $i \neq j$, and $f_i \pm f_j \pm f_k$ where $i \neq j$, $i \neq k$, and $j \neq k$. Appropriate matrices can be defined to analyze the resulting distortion terms.

Computer analysis programs have been written for general system designs using the above techniques.

APPENDIX III

Channel Selection

For a split band system corresponding to $p = 3$ in Figure 13 the carrier frequencies selected are within the frequency intervals (f_o, f_{n1}) and (f_{n2}, f_m). Here $f_i, f_k \in (f_o, f_{n1})$ and $f_j, f_l \in (f_{n2}, f_m)$. The index set



GENERAL MULTICHANNEL SYSTEM

Figure 13

I_1 contains i and k. Similarly $j,l \epsilon I_2$. The number of carriers selected is n where n is the number of members in the sets I_1 and I_2.

The intermodulation sum frequencies must satify the following requirements to remain outside of the intervals (f_o, f_{n1}) and (f_{n2}, f_m).

$$\left.\begin{array}{l} f_{n1} < f_i + f_k < f_{n2} \\ \text{or} \\ f_i + f_k > f_m \end{array}\right\} \text{ for low band carriers}$$

$$f_j + f_l > f_m \qquad \text{for high band carriers}$$

$$f_i + f_j > f_m$$

For the intermodulation difference frequencies the requirements are:

$$|f_i - f_k| < f_o$$

$$\left.\begin{array}{l} f_{n1} < |f_j - f_l| < f_{n2} \\ \text{or} \\ |f_j - f_l| < f_o \end{array}\right\} \text{ for high band carriers}$$

$$f_{n1} < f_j - f_i < f_{n2}$$

or

$$f_j - f_i < f_o$$

The requirements for the $2f_q \pm f_r$ terms cannot be satisfied in general. Here $q,r \epsilon I_1 \cup I_2$. The $2f_i - f_k$ term and $2f_j - f_l$ terms will fall at carrier frequencies for uniform video carrier frequency placement. The $2f_i - f_j$ and the $2f_j - f_i$ terms can be selected to reduce build up of distortion products at a particular frequency.

The desired requirements for the other terms are:

$$f_{n1} < 2f_i + f_k < f_{n2} \text{ or } 2f_i + f_k > f_m$$

$$2f_i + f_j > f_m$$

$$2f_j + f_i > f_m$$

$$2f_j + f_l > f_m$$

Requirements can be established for the $f_q \pm f_r \pm f_s$ terms and the $3f_q$ terms, where $q,r,s \epsilon I_1 \cup I_2$.

It is not possible to satisfy all of the requirements simultaneously for a particular system. What can be done is to weigh most heavily those distortion terms which are characteristic of a particular system. For example, if the a_2 coefficient dominates in $e_o = \sum_{j=1}^{\infty} a_j e_{in}^j$ then the second order product distortion requirements are the major consideration.

APPENDIX IV

State Variable Design

The agc trunk line amplifier of Figure 7 is described by two differential equations of the form

$$\ddot{y} + b_1\dot{y} + b_oy = d_1c_1 + d_2x$$

$$\ddot{x} + a_1\dot{x} + a_ox = e_1c_2 + b_2y$$

where

y is the high frequency pilot amplifier output amplitude

x is the low frequency pilot amplifier output amplitude

c_1 is the reference signal for the variable attenuator control loop or gain loop

c_2 is the reference signal for the variable equalizer control loop or equalizer loop

Now define the following state variables:

$$x_1 = x$$

$$x_2 = \dot{x}$$

$$x_3 = y$$

$$x_4 = \dot{y}$$

State variable techniques can be found in [11], [12].

The system is now formulated in a state variable description and is compactly described by

$$\dot{x} = Ax + Bu$$

where

$$x = \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix}$$

$$A = \begin{bmatrix} 0 & 1 & 0 & 0 \\ -a_0 & -a_1 & b_2 & 0 \\ 0 & 0 & 0 & 1 \\ d_2 & 0 & -b_0 & -b_1 \end{bmatrix}$$

$$B = \begin{bmatrix} 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & e_1 \\ 0 & 0 & 0 & 0 \\ 0 & d_1 & 0 & 0 \end{bmatrix}$$

$$u = \begin{bmatrix} 0 \\ c_1 \\ 0 \\ c_2 \end{bmatrix}$$

The two poles in the equalizer loop are termed w_1 and w_2 expressed in radians per second and are determined from $a_1 = w_1 + w_2$. The loop gain here is determined from $a_0 = w_1 w_2 + K_1$ where $K_0 = K_1/w_1 w_2$ is the open loop gain of the equalizer loop.

For the gain loop, $b_1 = w_3 + w_4$ and $b_0 = w_3 w_4 + K_3$ where $K_2 = K_3/w_3 w_4$ is the open loop gain of the gain loop. Here the two poles are w_3 and w_4.

The desired transient response design can be computed by solving for x with appropriate values for the elements in the matrices A and B.

REFERENCES

[1] A. E. Bryson Jr., Y. C. Ho, "Applied Optimal Control". Waltham, Massachusetts: Blaisdell Publishing Company, pp. 237-240, 1969.

[2] D. G. Luenberger, "Optimization by Vector Space Methods". New York: John Wiley and Sons Inc., pp. 294-297, 1969.

[3] C. A Collins and A. D. Williams, "Noise and Intermodulation Problems in Multichannel Closed-Circuit Television Systems". AIEE Trans. (Communication and Electronics), vol. 80, pp. 486-491, November 1961.

[4] J. R. Palmer, "CATV Systems - Design Philosophy and Performance Criteria as the Basis for Specifying Equipment Components". IEEE Transaction of Broadcasting, vol. BC-13, No. 2, pp. 57-68, April 1967.

[5] O. D. Page, "CATV Transmission System Design for Reliable Year-Round Operation". IEEE Transactions on Broadcasting, vol. BC-15, No. 4, pp. 80-88, December 1969.

[6] V. C. Rideout, "Active Networks". Englewood Cliffs, N.J.: Prentice-Hall Inc., pp. 230-235, 1960.

[7] Members of the Technical Staff Bell Telephone Laboratories, "Transmission Systems for Communications". Winston-Salem, North Carolina: Bell Telephone Laboratories, Inc., pp. 237-243, 1970.

[8] Richard Bellman, "Introduction to Matrix Analysis". New York: McGraw-Hill, 1960.

[9] P. M. Derusso, R. J. Roy, C. H. Close, "State Variables for Engineers". New York: John Wiley and Sons Inc., 1965.

[10] B. Friedman, "Principles and Techniques of Applied Mathematics". New York: John Wiley and Sons Inc., 1966.

[11] J. T. Tou, "Modern Control Theory". New York: McGraw-Hill, 1964.

[12] M. Athans, P. L. Falb, "Optimal Control". New York: McGraw-Hill, 1966.

CAN COAXIAL CABLE COPE WITH THE CATV SYSTEMS OF THE 70'S?

John C. Fan, Mgr., Research & Development Copper Clad Aluminum Wire
Frank A. Spexarth, Mgr., Communication Industry Products

Introduction

At a time when the cable television industry is absorbing such sophisticated new technologies as laser link and microwave transmission, it may seem unusual to suggest taking another look at a tool as familiar and comfortable as the coaxial cable. Unusual, that is, until you consider the demands likely to be made of this cable during the remainder of the 1970's.

Most observers predict that penetration of cable television into the top 100 cities during this decade will stimulate dramatic changes in both your services and systems. There is talk of 24, 48, 64, or more channels. You will be called upon to transmit not only video signals, but also data and facsmile reproductions. Two-way communications is likely. Average system size will jump from approximately 100 miles of cable per city to as much as 4,000 miles per city.

Such growth places heavy demands on the technical resources available to you. Utilization of laser link and microwave technology is crucial to providing economical service to large metropolitan areas. Yet even such advanced equipment will not eliminate the need to wire with coaxial cable in any system of the foreseeable future. In fact, it is the basic system you know today which will be called upon to provide the many new services upon which your industry will grow. There is little doubt that more sophisticated electronics hardware will become available as your industry requires it. The question is, can your cable keep pace?

The nature of a cable television system makes this a crucial question because noise-to-signal limitations are principally a function of the cable. The most effective way to improve system efficiency is to use cable with lower signal loss rather than to depend on high gain amplifiers which unavoidably are limited by attenuation characteristics of the system's cable. Thus, as the state of the art in active equipment improves, the electrical properties of the coaxial cable become even more significant to the system owner. This paper examines factors which must be considered in producing cable with low signal loss characteristics.

Attenuation

The coaxial cable is itself a system, a combination of materials fabricated together to transmit RF signals efficiently. Basically it is made of two metal conductors separated by an insulating (dielectric) material. (Figure 1) Attenuation, the loss of signal strength from one end of a cable to the other, is unavoidable and a function of eight variables: frequency, impedance, RF resistivity of the outer conductor, diameter of the outer conductor, RF resistivity of the center conductor, diameter of the center conductor, the dielectric constant and the power factor of the dielectric. (Figure 2) Only a few of these variables, however, can be altered in CATV cable to reduce attenuation.

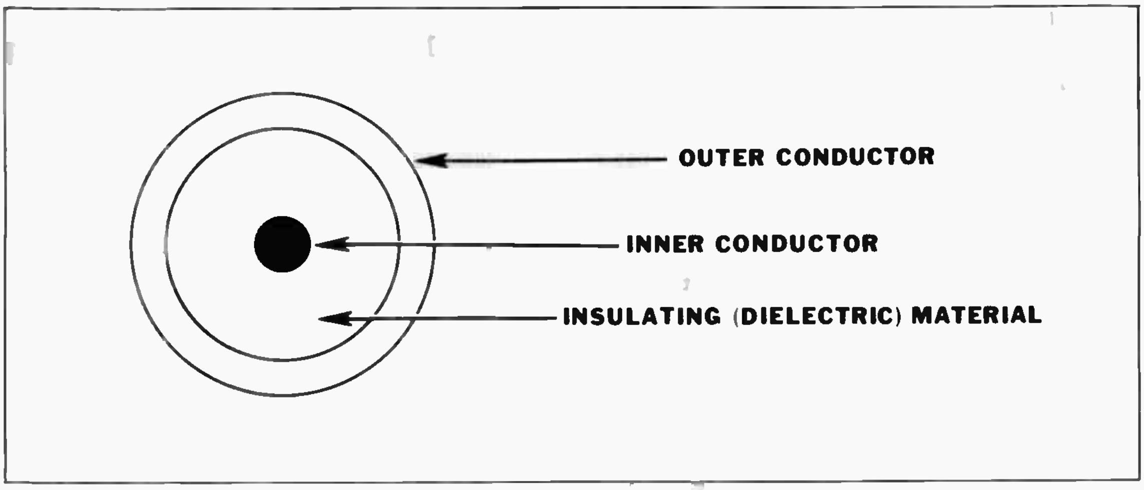


FIGURE 1

The basic attenuation formula:

$$\alpha = \underbrace{0.660 \times 10^{-3} \frac{\sqrt{\varepsilon f}}{Z_o}\left(\frac{\sqrt{R_1}}{d} + \frac{\sqrt{R_2}}{D}\right)}_{\text{Conductor Loss}} + \underbrace{2.77 \times 10^{-6} f \sqrt{\varepsilon} \tan \delta \frac{\text{dB}}{100 \text{ ft}}}_{\text{Dielectric Loss}}$$

FIGURE 2

Frequency (f)

Frequency currently is restricted to the 54 to 212 mhz band by the capability of the television receiver. However, plans are being made to employ the 5 to 300 mhz band to provide other capabilities such as 2-way communications.

Impedance (Zo)

There are two widely accepted cable impedances in use today, 75 ohm and 50 ohm. The two were developed to fulfill distinct needs: transmission with minimum attenuation and transmission of maximum voltage.

In designing coaxial cable for minimum attenuation, the optimum ratio of conductor diameters is determined from the attenuation equation as derived in detail by Dummer and Blackland . (Figure 3)

The conductor loss:

$$\alpha_c = 0.660 \times 10^{-3} \frac{\sqrt{\varepsilon_f}}{Z_o} \left(\frac{\sqrt{R_1}}{d} + \frac{\sqrt{R_2}}{D} \right)$$

For minimun αc with air dielectric:

Z_o = 75 ohm with $\frac{D}{d} = 3.5$

FIGURE 3

In designing coaxial cable for maximum voltage rating (required, for instance, in microwave radar applications) the equation is as shown in Figure 4.

The peak voltage:

$$V = \tfrac{1}{2} E \, d \log_e \frac{D}{d}$$

where E is the voltage gradient with a cable spacing.

To achieve maximum V:

$\frac{D}{d} = 2.72$ thus $Z_o = 50$ ohm

FIGURE 4

Since for cable television transmission the principal concern is low attenuation, 75 ohm has been selected as the industry standard.

Outer conductor resistivity (R_2)

In CATV, aluminum is used almost exclusively for outer conductors since it provides the most suitable technical/economic selection of materials available. Outer conductor resistivity, therefore, can be considered a constant.

Outer conductor diameter (D)

The size of outer conductors has been fixed at various standard diameters to allow flexibility and interchangeability for connections and equipment hook up. This, too, may be considered a constant.

Dielectric (ε and tan δ)

Efficiency of the coaxial cable dielectric can, and does, change since the dielectric effect can be reduced by lowering the density of the insulating foam to approach an electrically optimum air dielectric. Foamed polyethylene, and more recently foamed polystyrene are the most common dielectric materials.

Center conductor diameter (d)

When lower loss dielectrics are used and the outer conductor size is not changed, as in the case of CATV coaxial cable, then the diameter of the center conductor must increase to improve performance.

Center conductor resistivity (R_1)

Copper clad aluminum and copper are the standard materials in use today. Due to the inherent characteristics of RF signals which are transmitted only on a conductor's surface, the RF resistivity of copper clad aluminum and solid copper are identical.

Cable Engineering

With the need for larger systems, improved cascadability and reduced system cost, cable designers are turning to dielectric materials having lower loss and lower density. Inherent in these changes however, is a reduction in the supporting capability of the dielectric. This creates a problem because there is a simultaneous need for larger--and therefore heavier--center conductors.

The solution to the dichotomy is found in copper clad aluminum wire--a material already used widely by your industry in current cable designs. Two inherent physical properties of copper clad aluminum provide the basis for this solution.

Weight

Because copper clad aluminum is 40% lighter than copper it effectively reduces the tendency of a center conductor to "drift" in the dielectric during its service life, thus preventing impedence discontinuities and shorts.

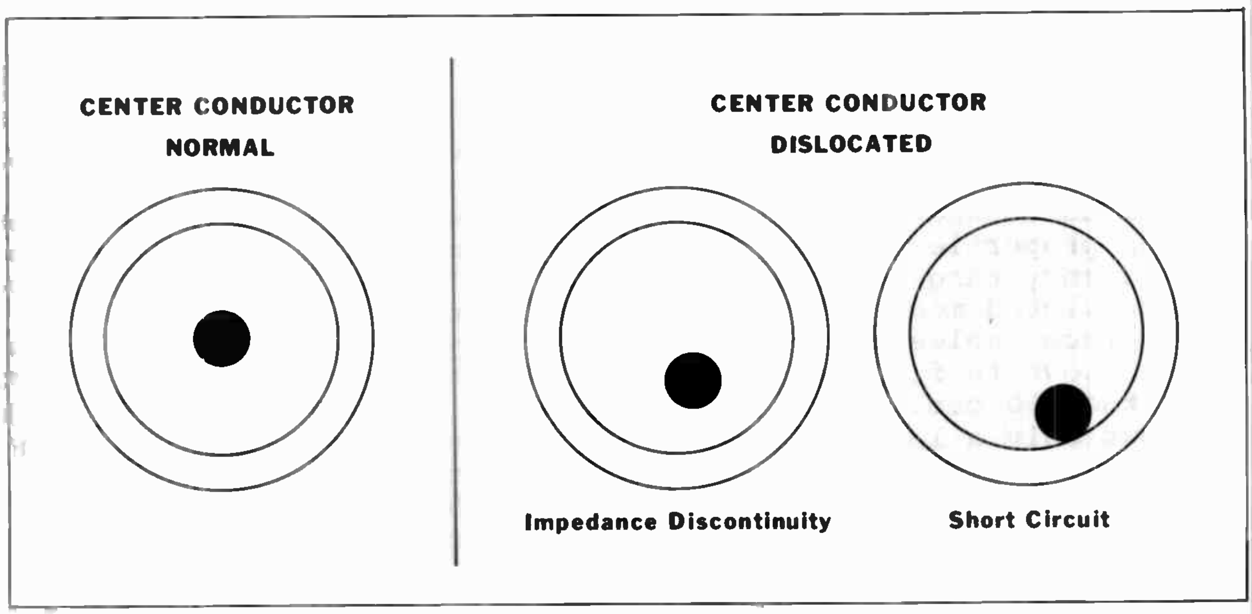


FIGURE 5

Bendability

In the installation of a CATV system, coaxial cable has to be formed into many bends. The bend may cause some impedance distortion if the center conductor is dislocated in an eccentric position within the cable. This can be caused by the resistance of the conductor to the bending forces.

Results of bending force tests verify that copper clad aluminum requires less force to bend or form into different shapes. It therefore reduces the chance of impedance discontinuity due to migration of the center conductor into the dielectric at the bend. The tests were performed with the bending fixture (Figure 6) mounted directly on a tensile testing machine to measure bending forces accurately. The comparison of the annealed copper conductor to annealed copper clad aluminum conductor is shown in Figure 7.

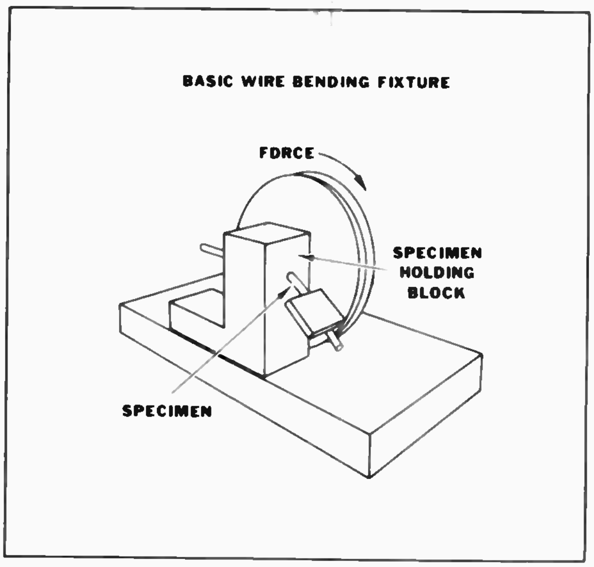


FIGURE 6

RELATIVE BENDING FORCE OF ANNEALED COPPER AND COPPER CLAD ALUMINUM CONDUCTORS

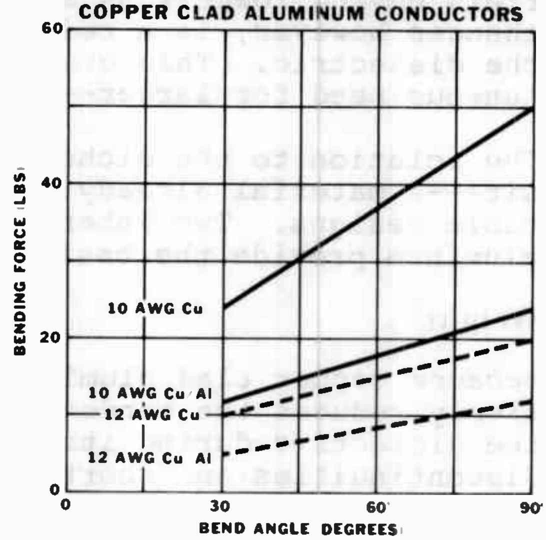


FIGURE 7

Frequency

With the predictable expansion of the usable frequency range to 5 to 300 megahertz in use in the '70's, the question comes to mind as to whether or not there will be any change in the attenuation properties of copper clad aluminum, especially in the lower frequency range. With the help of cable manufacturers, data was accumulated measuring the attenuation of copper versus copper clad aluminum cables using a foamed polyethylene dielectric. The results are shown in figures 8, 9, and 10. Note that copper clad aluminum in the 750 cable is equal to copper at the 500 khz frequency and shows only a loss of 10% attenuation as low as 50 khz. In the 500 and 412 cable with copper clad aluminum the attenuation is equal at 1 mhz and shows a 10% loss at 100 khz compared to copper. With the application of lower density, lower loss dielectrics, then, copper clad aluminum center conductors can be utilized for lower frequencies as the industry requires it. Copper offers no attenuation advantages over copper clad aluminum based on either current or expected demands in frequency range.

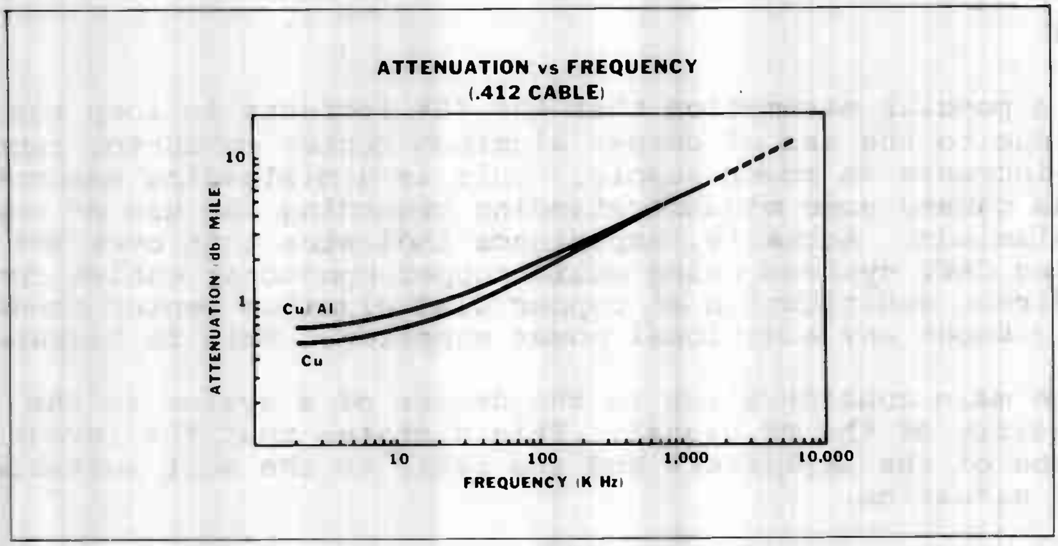


FIGURE 8

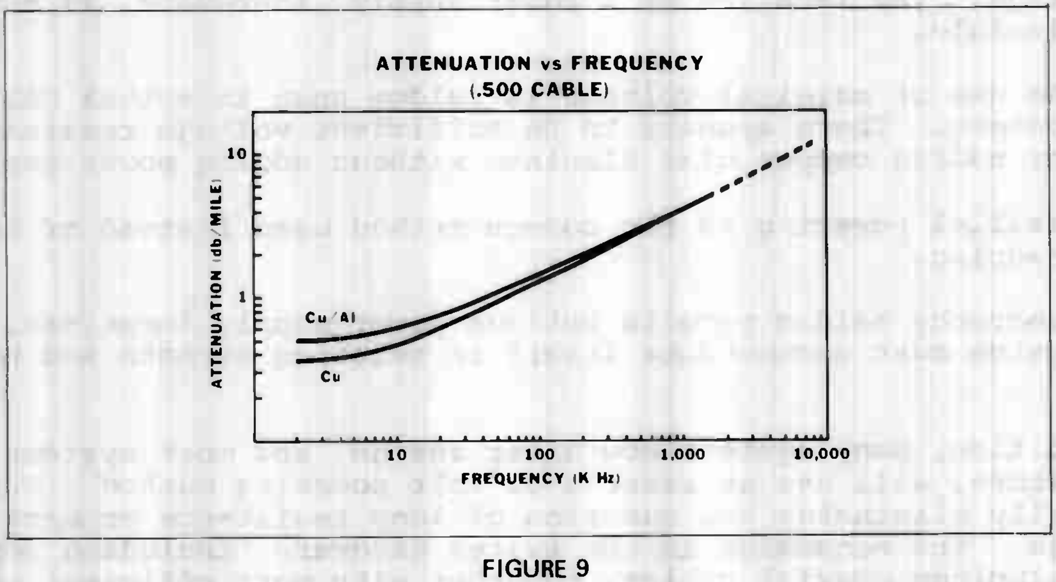


FIGURE 9

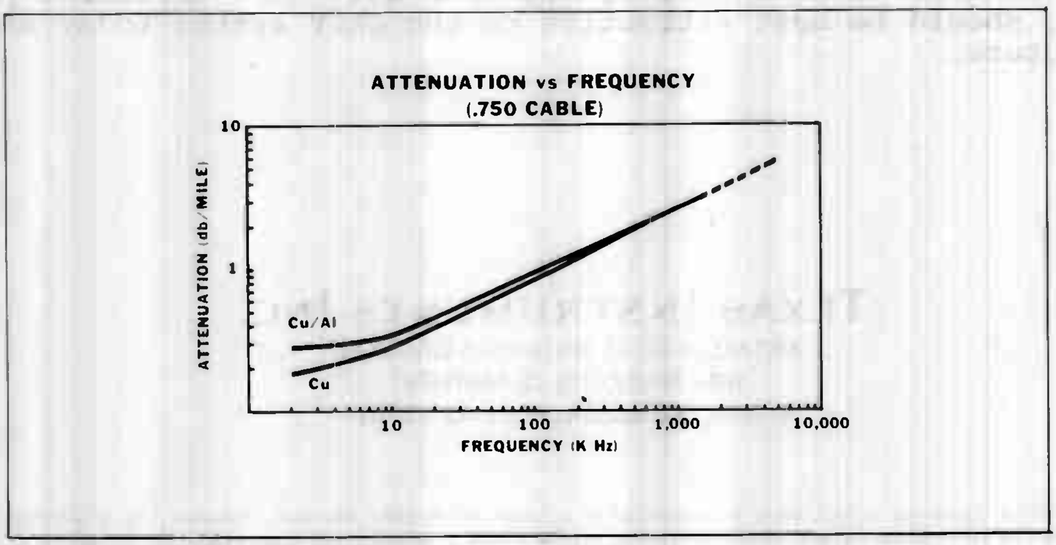


FIGURE 10

Power

It is a popular assumption that the 40% increase in loop resistance due to the use of copper aluminum center conductor requires a 20% increase in power supply. This is a misleading assumption and has caused some misunderstanding regarding the use of copper clad aluminum. Actually, experience indicates that over 80% of existing CATV systems using solid copper conductor cables could make direct substitution of copper clad aluminum center conductor cable without any additional power supplies. This is because:

1. The main consideration in the design of a system is the quality of the RF signal. This dictates that the layout be made of the amplifiers and the cable to the most suitable RF situation.

2. Cable powering is normally considered after this basic layout stage. The location of a power supply, therefore, is extremely flexible.

3. The use of marginal voltage is seldom seen in actual CATV systems. There appears to be sufficient voltage remaining for adding copper clad aluminum without adding power supplies.

4. Parallel powering is the common method used instead of series powering.

5. Geography seldom permits optimum power supply locations. The system must accommodate itself to existing streets and buildings.

In addition, many systems now under design, and most systems of the future, will use at least a 60 volt powering method. This virtually eliminates the question of loop resistance or marginal voltage. The economics in the system hardware, including copper clad aluminum coaxial cables, together with more efficient power usage, should be most attractive to the CATV system today and in the future.

TEXAS INSTRUMENTS INC.
METALLURGICAL MATERIALS DIVISION
WIRE PRODUCTS DEPARTMENT
ATTLEBORO, MASSACHUSETTS 02703

Bulletin Number 516-TB97-671

Printed in U S A 1K

DYNAFOAM COAX COMES OF AGE FOR CATV

written and presented by:

John Arbuthnott, Jr., P.E.
NCTA National Convention
Washington, D. C.
July, 1971

SUBSIDIARY OF Insilco
TIMES Wire & Cable Co.
Wallingford, Connecticut 06492. Tel (203) 269-3381
Phoenix, Arizona 85005 Tel (602) 278-5576

INTRODUCTION:

Two years ago, Times Wire and Cable introduced a new low loss, high efficiency, semiflexible coaxial sheath cable designed primarily for use in Cable Television Systems. Since that time over three thousand miles of cable has been manufactured, delivered on site and installed. This paper is to further inform the industry about this, to our mind, important developement.

WHY SEARCH FOR LOWER LOSS CABLE?

CATV Cables are designed primarily to transport signals from one point to the other as efficiently as practical. In the typical Cable Television System, how well this is accomplished, all other things being equal, can be judged by a comparison of cable loss versus dollar cost.

What we are saying is that an increase in the efficiency of the cable is of no value if its cost increases at a rate equal to or greater than the rate of increase of efficiency. A convenient way to make this judgement is to multiply the cost of the cable by the attenuation. If a substitute cable, analyzed the same way, shows a smaller number it is possible to achieve a more cost effective system by its use.

A further stimulus to the developement of lower loss cable has been the desire to go to longer trunk runs. It is presumed that in these cases the economics are governed by front end location and construction costs rather than the less complicated analysis cited above.

This is best illustrated by assuming a trunk run designed on 22 db spacing and 36 amplifiers in cascade. The possible length of run is tabulated below.

JT-1750 (Polyethylene)	15 miles
JT-2750 (Dynafoam)	20 miles
JT-21000 (Dynafoam)	25 miles

The maximum length of run can of course vary with design criteria, but the comparison is still valid.

In summary, lower loss cables are developed to achieve overall reduction in system construction and maintenance cost.

DESIGN CONSIDERATIONS:

Dynafoam cable was developed with the intention to offer the system designer lower loss for the installation dollar and to increase the length of usable trunk run where, for one reason or another, it might be required; without having to resort to air dielectric cables, where pressurization costs can eat up any original economies attained.

Examination of the general formula for cable loss

$$\propto \frac{0.0174}{Ln\ D/d}\left(\frac{0.414}{d}+\frac{0.525}{D}\right)\sqrt{Ke}\ \sqrt{F} + 2.78\ Tan\ \delta\ \sqrt{Ke}\quad F$$

indicates that greater efficiency can be achieved by reduction of Dielectric Constant.

Furthermore when one considers that

$$Zo = \frac{60}{\sqrt{Ke}}\ Ln\ D/d$$

it becomes apparent that the diameter of the inner conductor (d) must be made larger to maintain the proper impedance. This of course leads to a further reduction in cable attenuation.

Dynafoam cable accomplishes this by taking advantage of the greater foamability of Polystyrene over Polyethylene. Where Foamed Polyethylene limits the Dielectric Constant to values of 1.55 or greater, it is possible to achieve values of as low as 1.20 by using foamed Polystyrene.

For purposes of comparison the following table compares the overall diameters of cable having substantially the same attenuation against the insulation used.

Dynafoam	Foamed Polyethylene
0.340	0.412
0.412	0.500
0.500	0.750

Figure one shows the attenuation values of all Dynafoam cables versus Frequency from 10 MHz to 1000 MHz.

Simplified formulae are tabulated below for calculating the attenuation of all Dynafoam Cables.

$$JT\text{-}2340\ \propto = 0.1010\ \sqrt{F} + 0.00074\ F$$
$$JT\text{-}2412\ \propto = 0.0827\ \sqrt{F} + 0.00060\ F$$
$$JT\text{-}2500\ \propto = 0.0671\ \sqrt{F} + 0.00051\ F$$
$$JT\text{-}2750\ \propto = 0.0444\ \sqrt{F} + 0.00040\ F$$
$$JT\text{-}21000\ \propto = 0.0336\ \sqrt{F} + 0.00040\ F$$

When it is considered that the major cost of cable is material and that the amount of material in a cable is a function of at least the square of the diameter it becomes obvious that a smaller cable having the same attenuation as one that is larger will lead to greater economy.

MECHANICAL CONSIDERATIONS:

When first designed, the Dynafoam line was set up using the same mechanical criteria as the older Alumifoam Cables except that the inner conductors were adjusted to achieve the 75 ohm Characteristic Impedance required.

Subsequently it was found that the cables, particularly JT-2500 and JT-2750 were subject to mechanical change upon installation.

It was found that the 1/2" and the 3/4" cables had a tendency to flatten when bent on small radii.

The problem existed because the polystyrene air mixture used for insulation gives far less physical support than polyethylene foam. A bending jig was designed, Figure two, which maintains the circularity of the cable during bending.

Additionally it was found that JT-2500 and JT-2750 had some tendency to kink as it came off the reel. This problem, related to the same reduced support by the insulation, was effectively solved by increasing the wall thickness of the aluminum sheath. In both cases it was found that the problem was solved by a relatively minor increase in Aluminum Sheath wall thickness of only 0.005".

The following table shows the mechanical dimensions of Dynafoam Cable.

Cable	Inner Conductor	Insulation	Outer Cond.	
Type	O.C.	O.D.	Wall	O.D.
JT-2340	0.075	0.300	0.020	0.340
JT-2412	0.092	0.362	0.025	0.412
JT-2500	0.114	0.440	0.030	0.500
JT-2750	0.172	0.666	0.042	0.750
JT-21000	0.227	0.890	0.055	1.000

INSTALLATION EXPERIENCE:

At the present time installations of Dynafoam Cable have been made in approximately thirty states ranging from Idaho to Florida. The cable has been supplied with and without jacket for aerial installation, and both flooded, jacketed and armored for underground installations.

As a matter of course, because the cable design represented a departure from what installation crews have been used to, several installations were checked out thoroughly, including return and insertion loss measurements both prior to and after installation.

It can be reported that, if installed with a reasonable degree of care and if the installer refrains from pulling around sharp corners, uniform cable prior to installation will be uniform after it is installed. The same can be said of foam Polyethylene cables.

What constitutes a careful method of installation is governed by the particular characteristics of the job at hand. Each man on the job can probably think of ways to install the cable without damage and we can not offer hard and fast rules for such a varied problem. We can offer some general rules that will help. I might add that these suggestions apply to the more conventional Aluminum Cables as well as to Dynafoam.

1. Some method of reel braking should be available.
2. Care should be taken to lead cable into the installation without excessive wall pressure.
3. Cable should not be pulled around right angle bends.
4. Cable pulling tensions should not be exceeded.

Some studies have been made to determine aging characteristics for Dynafoam cable. These studies, made on actual installations consisted of return and insertion loss measurements performed on installed cable after two years of service life. In no case was any deterioration in either transmission efficiency or cable uniformity noted.

Our studies have disclosed no indication of the various postulated possible faults which might develope.

1. We have found no indication of cracking dielectric. The material used in Dynafoam is sufficiently flexible for the task.
2. We have found no evidence of inner conductor wandering.
3. Insertion loss measurements after 2 years installation indicate no moisture absorption by the cable.
4. We have found the cable to react predictably to temperature changes.

ECONOMIC FACTORS:

In order to estimate the economic advantages of Dynafoam cable an analysis was performed using the following assumptions.

1. 100 mile system.
2. 70 miles of JT-1412 or JT-2340.
3. 15 miles of JT-1500 or JT-2412.
4. 15 miles of JT-1750 or JT-2500.
5. Substitution of the more efficient cable would not lead to a significant reduction in the number of amplifiers used in the system nor require any excessive variation in cost of installation.
6. Cost savings are based on Times Wire and Cable published price date for 100 mile quantities.

	Alumifoam	Dynafoam
Cost of 70 miles of JT-1412	$26,900.00	
Distribution JT-2340		$22,900.00
Cost of 15 miles of JT-1500	7,520.00	
Sub Trunk JT-2412		6,500.00
Cost of 15 miles of JT-1750	16,650.00	
Trunk JT-2500		9,350.00
Total Costs	$51.070.00	$38,750.00
Savings	$12,220.00	

FOR JACKETED SYSTEM:

	Alumifoam	Dynafoam
70 miles JT-1412-J	$31,200.00	
JT-2340-J		$27,800.00
15 miles JT-1500-J	9,130.00	
JT-2412-J		7,690.00
15 miles JT-1750-J	18,700.00	
JT-2500-J		10,950.00
Total Costs	$59,030.00	$46,440.00
Savings	$12,590.00	

CONCLUSION:

It can be concluded that after over 2-1/2 years of installation experience and after more than three years prior experience in the factory and laboratory, Dynafoam cable represents a progressive step forward in the developement of better, more efficient cable system designs.

It offers the user basic economies for the construction of normal plant and in certain instances, where long trunk runs are required, a method of getting the best signal possible to remote areas.

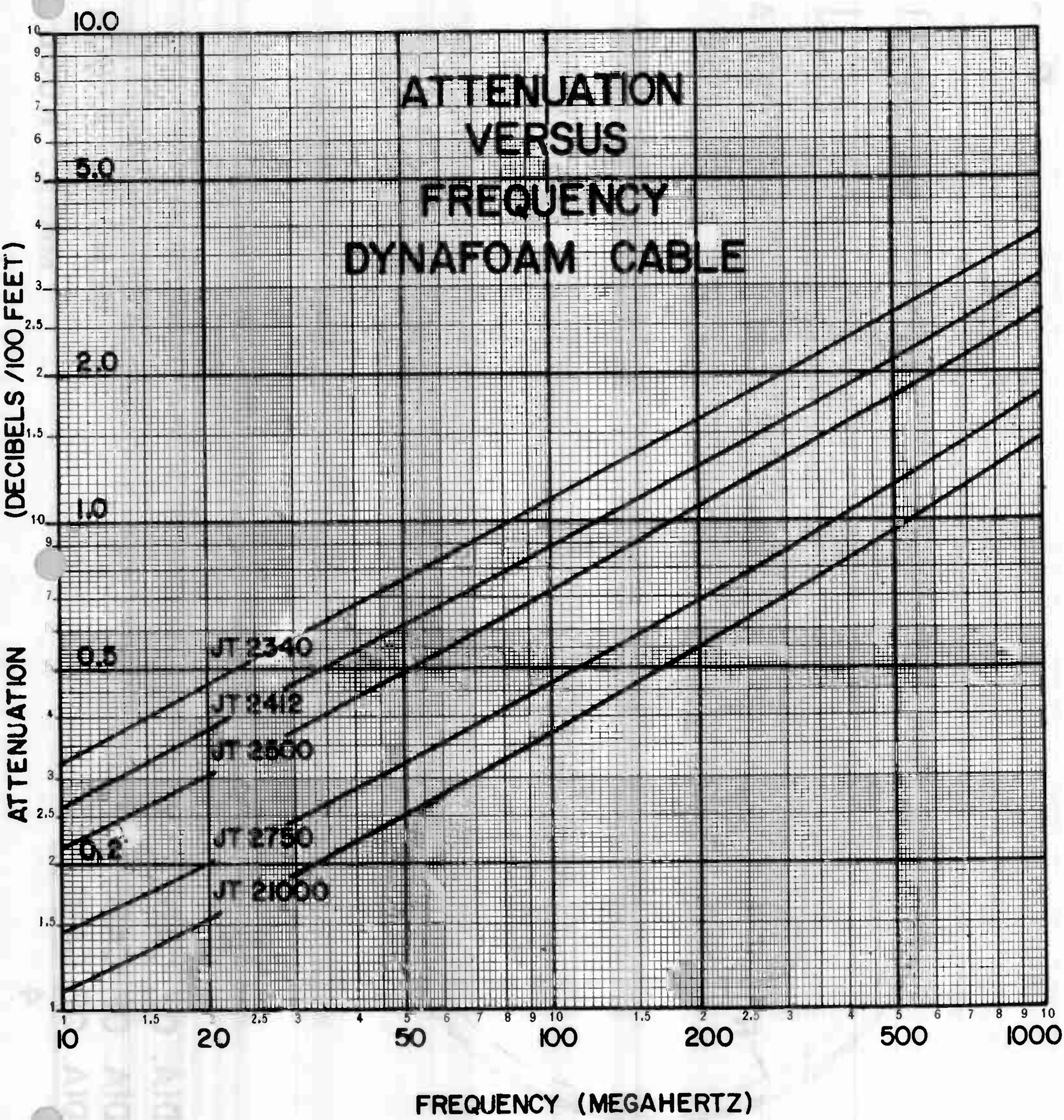
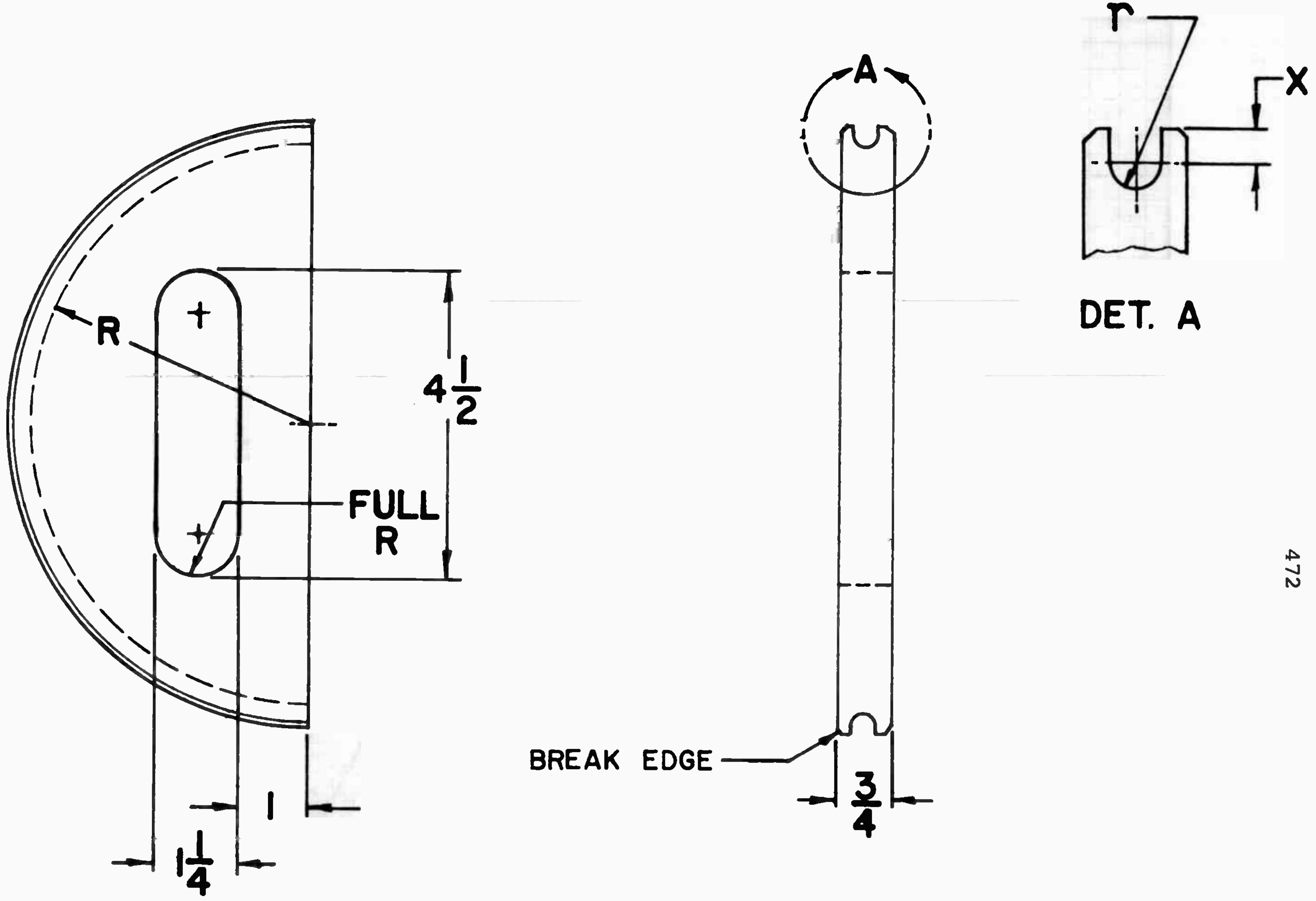

ATTENUATION
VERSUS
FREQUENCY
DYNAFOAM CABLE
JT 2340
JT 2412
JT 2500
JT 2750
JT 21000
10.0
5.0
2.0
1.0
0.5
0.2
10
20
50
100
200
500
1000
ATTENUATION (DECIBELS /100 FEET)
FREQUENCY (MEGAHERTZ)

Fig. 1

Fig. 2



R = DIA. OF CABLE X 12

r = DIA. OF CABLE + .010

$X = \dfrac{\text{DIA. OF CABLE}}{4}$

BENDING ARBOR
MAT'L. WOOD

TWO-WAY CATV SYSTEMS PERFORMANCE

by ANDREW W. BARNHART

JERROLD ELECTRONICS CORPORATION

Presented at

NCTA SHOW

July 9, 1971

by Andrew W. Barnhart

Senior Project Engineer

Jerrold Electronics Corporation

TWO-WAY CATV SYSTEMS PERFORMANCE

Andrew W. Barnhart, Senior Project Engineer
CATV Development
Jerrold Electronics Corporation

I. INTRODUCTION

The advent of full two-way cable systems has generated many claims as to the various services made possible. To evaluate the full potentialities for two-way communication in a given application the correct design approach must be selected and the resulting performance estimated. There are several performance trade-offs unique to two-way transportation that must be considered in system design and specification.

There are many specifications of importance to two-way systems. This paper will be concerned with the three major performance criteria -- carrier-to-noise (C/N), cross-modulation (XM), and group delay -- and how these are expected to vary with the system size, crossover frequency, and channel loading. Many systems are considering two-way operation, each with its own specific requirements. This leads to many different two-way configurations, including multiple cable approaches, each suitable for a particular type of application. It is beyond the scope of this paper to treat all of these configurations; rather several specific two-way CATV transportation designs will be reviewed and the resultant system performance estimated. Many of the design values used for these systems were arrived at employing considerations discussed in a previous paper "System Considerations in the Design of a Two-Way Transmission System" cited in Reference 1.

II. SINGLE CABLE SUB SPLIT

A. SYSTEM DESCRIPTION

This elementary cable two-way TV system employs a single cable trunk and a single feeder. The frequency spectrum is split below Channel 2 with the return information, which is destined for the headend, occupying the band 5-30 MHz. The outgoing signals at Channel 2 and above are distributed to the subscriber using the conventional assignments. A diagram of the system showing the layout of trunk and feeder stations is given in Figure 1. The operating principles of this configuration and several of the equipment design considerations are treated in some detail by Reference 1. This approach is an economical choice for applications requiring only a limited return bandwidth. Equipment for a two-way system of this configuration was designed and tested, the performance of which will be described in the first example. The outgoing system employs push-pull amplifiers designed for 27-channel operation utilizing the 12 standard VHF channels, 9 channels in the midband region, and 6 supers above Ch 13 in the region 216-260 MHz. Figure 2 illustrates the spectrum utilized. The feeder return and the trunk return amplifiers are also push-pull and are assumed to be located at every outgoing location. It is convenient to rate the return equipment in terms of TV channel capability although a large part of the spectrum may be occupied by data. The trunk return amplifiers are rated for four TV channels. It is felt by the author that this is a conservative method of rating because of the XM loading effect of data will be much less than a TV channel.

When the feeders are used to gather the return information, it is unlikely that any one feeder will have a significant percentage of the total return spectrum. It is tempting to rate the C/N and XM of the feeders on the basis of a single TV channel. However, some mathematical difficulties arise when considering single channel XM. In this presentation the feeder is rated for two TV channels which implies that a single TV channel may be returned via the feeder -- for community service or on-the-spot coverage -- and the cumulative effect of the rest of the data on the feeder is less than or equal to that of another TV channel. Table I gives the performance that can be expected of these amplifiers.

B. SYSTEM TOLERANCE

With the equipment performance defined, it is possible to estimate the performance of a typical CATV system that includes two-way as a part of the design. Assume a system of the following characteristics.

Total Cable Bearing Strand	350 miles
Feeder-to-Trunk Ratio	4
Maximum Trunk Cascade	25 amplifiers
Total Number of Trunk Amplifiers	250 amplifiers
Maximum Feeder Cascade	2 amplifiers
Total Number of Line Ext. (3.6/mile)	1250 amplifiers
Channel Capacity Outgoing	27 channels
Channel Capacity Return Trunk	4 channels
Channel Capacity Return Feeder	2 channels

The design goal for the distribution is -54 dB XM. This may be achieved with the levels assumed in Table 2. They are based on equal contribution between the bridger and each line extender amplifier. The outgoing trunk amplifier level is determined in the usual manner -- halfway between the XM and C/N limits. The levels for the return amplifiers were selected to put the return system halfway between XM and noise. The XM is determined using the maximum cascade, and the noise is determined using the total number of return amplifiers that return signals on a given cable. This aspect is discussed in Appendix A. The level of the return feeders is also designed on an optimum cascade basis as is the trunk -- in contrast to the design method for the feeders. Table 2 summarizes the levels used and the performance of each group of amplifiers. The performance of the outgoing and the return systems can be estimated using the performance given in Table 2. The outgoing C/N will be nearly that of the trunk 43 dB, and the XM will be -51.4 dB (-63, -65, -67). The return system will have 43.5 dB C/N (45 and 49), and -66 dB XM (-69, -77). Although there are a large number of return feeder amplifiers (1250), their operation at optimum cascade level +45 dBmV enables them to have 4 dB better C/N than the return trunk.

Multiple Return Trunk:

Figure 3 is a symbolic representation of a CATV layout where the headend is shown between two roughly equal areas. Consider the case where the return trunks from each area are not combined but are brought into the headend separately. Two benefits occur: 1. If the return levels were to remain the same, a 3 dB improvement in C/N would occur because only half the number of return amplifiers would add noise to a given cable. 2. Twice the return bandwidth is available because signals can be selected from either cable. This results in a complete return system performance of -68 dB XM and 45.5 dB C/N. The worst case round trip performance -- a signal gathered by the return feeders at the maximum trunk cascade and then turned around at the headend and distributed to the farthest outgoing subscriber -- would be -50.2 dB XM and 41.1 dB C/N representing a 1.1 tolerance improvement due to the use of the return split. These performances are summarized in Table 3.

System Size:

In tolerance calculations for the outgoing trunk only the maximum cascade is required. However, for the return trunk and return feeder amplifier performance both the maximum cascade and the total number of amplifiers to be served by a single cable must be known. For a proposed system the total number of return amplifiers may be estimated from the estimated strand miles using feeder-to-trunk ratios and amplifiers-per-mile.

Thus, when considering two-way for a given application, both the maximum cascade and the system size should be estimated.

Alternate Return Amplifier Spacing:

Although the maximum single span loss at 31 MHz is only 6.6 dB, inclusion of flat losses within the station and those due to trunk cable splitting will increase the return module gain requirement to a range of 11-16.5 dB. The average single span return gain assumed previously was 14 dB. A return amplifier at every other trunk station requires a gain of 20-31 dB. Assuming a nominal module gain requirement of 25 dB for alternate spacing, the same output capability and noise figure, this return amplifier would have 11 dB less tolerance than the "amp every" station. However, since there is half the number of return amplifiers adding XM and noise, the net result is a return trunk system with 5 dB less tolerance. A return feeder level matchup problem may occur at trunk stations where the return amplifier is "missing" because the required insertion level will be one span loss higher.

C. FILTER CONSIDERATIONS

Two-way operation is obtained by frequency splitting with filters. Gain flatness, stability, and isolation requirements will determine the required filter amplitude responses (see Reference 1). For these considerations it is desirable to make the filter "look like a cliff". However, this type of amplitude response implies very large group delay and chroma delay near the cutoff frequencies. In fact, higher stopband rejection, better passband match, and narrow guardband all imply higher group delay. Even the type of filter response selected (i.e., Butterworth, Elliptic) is of importance. A quantitative treatment of these factors on group delay variations is given by Reference 2.

Amplitude Requirements:

The amplitude requirements for the trunk line filters are given in Figure 4. The contiguous type high/low split filter (equal 3 dB cutoff frequencies) cannot be used as the 6 dB per filter isolation will be insufficient to prevent oscillation with the trunk amplifiers installed in the station. The 44 dB filter floor requirement is sufficient to keep the amplitude gain ripple to less than ±0.03 dB resulting from closed loop feedback effects. Filters for this requirement were designed and built with nominal cutoff frequencies of 45 MHz for the high pass section and 35 MHz for the low pass. Practical considerations of alignment and amplitude rounding near the cutoff limit the use in cascade to 49 and 32 MHz respectively.

Group Delay Requirements:

In color TV transmission it is not the group delay as such that is troublesome but rather the variation of group delay over the TV channel bandwidth that is of concern. Chroma information modulated on the color subcarrier may arrive at a different time than the luminance information modulated on the PIX carrier. This time differential is termed chroma delay and results in color misregistration and blurring. Chroma delay and how it occurs from amplitude filtering is explained in Reference 1.

Two questions are of direct concern: How much chroma delay can be tolerated? and How much will a given system produce? The former question requires a subjective evaluation. This has been answered in part by a recent study under laboratory viewing conditions and is cited in Reference 3. The delay introduced by the CATV transportation system falls in the "shaped delay" classification of this reference, and from Figures 1 and 6 we may draw the following conclusions from the expected comment for "expert observers" viewing of color TV monitors: 1. at 500 ns of chroma delay most would find the reception impaired but none would find it "definitely objectionable". 2. at 230 ns most would find a perceptible effect but none would find it even "somewhat objectionable".

Filter Chroma Delay:

The measured group delay response of the pair of high/low split filters used in the trunk station is shown in Figure 5 (Curve 2). Table 4 gives the chroma delay for these filters for the worst case channels. For the 25-amplifier cascade these filters will introduce -155 ns (-6.2 ns x 25) of chroma delay in Channel 2, 435 ns in T10 (25 MHz PIX), and 158 ns of chroma delay in T9 (19 MHz PIX). Channel 2 was deliberately favored over Channel T10 in terms of chroma delay by the selection of cutoff frequencies for two reasons -- color TV on Channel 2 is a definite requirement in most applications whereas it is not for T10, and it is relatively simple to delay equalize T10 at the IF frequency since it will be returned to the headend. The Channel 2 group delay that is delivered to the subscribers can be halved by including +77.5 ns of compensating chroma delay at the output of the Channel 2 processor at the headend.

Group delay scales inversely with the cutoff frequency. It is, therefore, possible to calculate the group delay and chroma delay that these filters would have if they had been designed for different dutoff frequencies (see Reference 2). The actual high/low cutoff frequencies are 45/35 MHz. The calculated values of group delay are plotted in Figure 5, and the calculated values of chroma delay are listed in Table 4 for the measured filter data scaled to the cutoff frequencies of 41/32 MHz, 48/37.4 MHz, and 51/39.6 MHz. It is observed that the raising of the high pass cutoff frequency to 51 MHz in order to obtain more return bandwidth nearly doubles the chroma delay in Channel 2.

D. CASCADE PERFORMANCE

A complete line amplifier cascade of the above design with cable and a.c. powering was tested. Tracings of the swept group delay performance are shown in Figure 6. Chroma measurements in individual channels are listed in Table 4. The chroma delay measurements of the 9-amplifier cascade for Channels T9, T10, 2, 3 and 4 are in excellent agreement with the expected values based on the individual filter measurements. For these channels the system chroma delay is determined by the filters used. At frequencies above 200 MHz there is a slight group delay rise caused by the amplifier response rolloff past 260 MHz.

In the return amplifier system a pronounced rise in group delay occurs below 10 MHz causing significant chroma delay. This is not due to the high/low split filter, but can be attributed to the return amplifier and a.c. choking. The return amplifier employs many capacitors, both bypassing and interstage coupling. Although the amplitude response is flat at 5 MHz, there is a pronounced rolloff at 3 MHz which generates this group delay behavior. The a.c. bypass chokes used in power inserters and trunk stations also have the same effect.

Figure 7 is tracings of the swept amplitude response of the 9-amplifier cascade employing standard amplifiers and equalizers. The peak/valley is considered satisfactory as no special "mop ups" were required to obtain the performance. As expected, there was no evidence of any gain ripples due to closed loop feedback.

E. SUMMARY

The system configuration can achieve broadband two-way communication on a CATV network. The required trunk and feeder stations have been built and tested, the resulting performance has been projected to a two-way system comprising 350 strand miles. It provides 27 outgoing channels, 12 of which are the standard V's; the return bandwidth can provide one TV channel and 19 MHz of data. Since the passive components, i.e. power inserters and directional taps, are also available, the results indicate that this two-way system is viable with today's technology.

III. SINGLE CABLE MID-SPLIT

A. SYSTEM DESCRIPTION

The next system to be considered has the same configuration (Figure 1) as the previous but employs a frequency split in the midband (Figure 2). Fourteen TV channels are available for outgoing distribution, and 14 channels + 9 MHz of data are available in the return path. This spectrum utilization provides two important advantages-much greater return bandwidth is available and the wide range provided for the filter crossover results in low envelope delay distortion.

Because only the 7 high VHF channels are available for distribution to a standard TV set without converter, this system must be regarded as special purpose. It can be used independently for private channel communications for either video or data by the school, civil, or business communities; or it can be used in conjunction with a regular one-way CATV plant to provide both private channel communications and two-way capability for all subscribers.

B. SYSTEM TOLERANCE

The performance of the mid-split approach will be calculated employing the previous 350-strand mile system example. The total number of return amplifiers adding noise is halved as in the previous example, by using two return cables near the headend. The amplifiers used in this system have the ratings listed in Table 5, and their operating levels were selected in the same manner as for the sub-split. The lower channel loading of the outgoing plant results in better tolerance than the previous example, and the low round trip XM allows sufficient for distribution systems such as schools that will utilize private-channel capability. The increased channel loading on the return path requires a better quality amplifier, and for systems of this size it may be desirable to consider an additional return cable.

C. CASCADE PERFORMANCE

Equipment for this configuration was built and tested in a 15-amplifier cascade that includes all cable and a.c. powering. The chroma delay was expected to be minimal because it varies inversely with the square of the filter cutoff frequency. Figure 8 includes tracings of the swept group delay for the outgoing and return paths and lists the chroma delay of the worst case channels. Channels 6A, 6B, 6C can occupy what is normally the FM band. The rise of group delay below 10 MHz is caused by the amplifiers and a.c. chokes which results in Channel T7 having larger chroma delay than any other channel, although this delay is not likely to require delay equalization. The chroma delay of the standard VHF channels is so small as to be inconsequential in a 25-amplifier cascade.

Figure 9 shows tracings of the amplitude response for the complete 15-amplifier cascade. This response is satisfactory as it was obtained by employing only the normal amplifier and equalizer adjustments. The peak/valley of the return path is attributed to the equalizer error which was of an early design.

D. SUMMARY

This approach provides a viable solution to systems that require large two-way communication bandwidth of high quality. The return channels may be distributed either on the outgoing path for private use or on the regular CATV system for public viewing. The resultant low value of chroma delay will not be of significant concern for CATV transportation.

IV. MULTIPLE CABLE APPROACHES

A. DUAL TRUNK, SINGLE FEEDER.

This system employs two trunk cables, with trunk stations at congruent locations, and a single feeder cable. With reference to Figure 10 trunk cable A is one-way only and uses the outgoing frequency spectrum of 54-260 MHz for carrying 27 channels. The A cable distribution is two-way carrying the 54-260 MHz spectrum from the A trunk in the outgoing direction, and returning 5-30 MHz from the subscriber locations to the B trunk station.

The B trunk cable is the mid-split two-way system previously considered. The 5-30 MHz portion of the B return spectrum is used by the A feeder return signals which are coupled over to the B station from a high/low split filter in the A station. The 30-108 MHz portion of the B return and the B outgoing have limited access and exit.

This approach has the following features:

Public Service: (full distribution)	54-260 MHz	27 Ch	Outgoing
	5-30 MHz	1 Ch + 19 MHz	Return
Private Service: (limited access)	174-260 MHz	14 Ch	Outgoing
	30-108 MHz	13 Ch	Return

The signals carried on the "A" cable suffer minimal chroma delay distortion in that the filters are only used in the feeders.

The high crossover frequency of the "B" cable filters result in low envelope delay distortion compared to the low frequency equivalent used in the "A" cable feeders.

Using the previous 350-strand-mile example the performance of this approach can be estimated. The private system will have the same performance as listed in Table 5, -56.5 dB XM and 42.7 dB C/N. The A system will have the same performance as in Table 3. The performance of a round trip channel using the B return trunk and distributed by the A system will be -49.4 dB (-63 and -51.4) XM and 41.3 dB (46 and 43) C/N.

The worst case path is the round trip "public service" TV channel that is gathered by the A return distribution and B return trunk and sent out the A outgoing system. Its performance would be -49.1 (-79 and -49.4) XM and 40.9 (51 and 41.3) C/N.

B. DUAL TRUNK, DUAL FEEDER

The last example is a dual trunk, dual feeder system. In this approach the A cable is a conventional one-way CATV system. The B cable is a full two-way system with 5-108 MHz trunk return, 5-30 MHz feeder return and 174-260 for the outgoing trunk and feeder.

This system has all of the advantages of the previous example with the feature of the additional channel capacity of the B outgoing distribution which is available to the subscriber by means of an A-B switch. In many cases enough channels would be available (19) by means of the switch that set converters would not be required for standard grade service.

Return:	5-30 MHz	1 Ch + 19 MHz	Public
	30-108 MHz	13 Ch	Private
Outgoing:	54-260 (A)	19 Ch	A-B switch only
	174-260 (B)	42 Ch	with converter

The tolerance of this system is the same as the previous example. (The B outgoing distribution is slightly better than A because of lower channel loading.)

REFERENCES:

1. H. B. Marron and A. W. Barnhart, "System Considerations in the Design of a Two-Way Transmission System", NCTA Official Convention Transcript, June 1970.

2. A. W. Barnhart, Group Delay Variations of Selected Filter Prototypes, Masters Thesis, University of Pennsylvania, Dec. 1970.

3. A. M. Lessman, Subjective Effects of Delay Difference Between Luminance and Chrominance Information of the NTSC Color Television Signal, Bell Laboratories, Homdel, N. J.

4. K. Simons, Technical Handbook for CATV Systems, Jerrold Electronics Corporation, Hatboro, Pa.

APPENDIX A

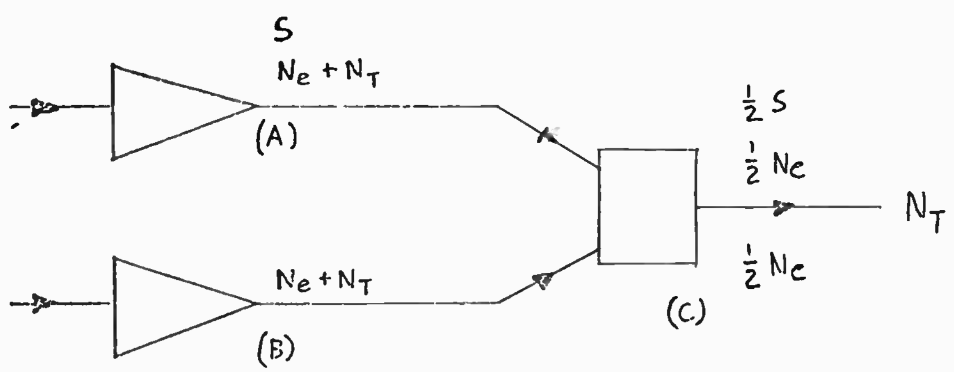
NOISE GATHERING EFFECT

Cable TV transportation systems are operated at unity gain; a signal introduced anywhere into the system, which is in the system bandwidth, will be maintained at approximately its original level. The output noise generated by any particular amplifier will also be transported by the system and maintained at its original level, and therefore the noise of all amplifiers returning signals to a given point will be present at that point. Since random noise adds in terms of power, the total noise will be the power sum of the noise output of each amplifier.

The noise referred to in the above discussion is the excess noise output, N_E, produced by the amplifier. Thermal noise, N_T, is ever present and does not build up. This is illustrated by the following example. Consider two trunk amplifiers whose outputs are combined by use of a 3-dB splitter, with a signal at the output of one amplifier having power S. The C/N ratio at this point (A) will be $S/(N_e + N_T)$. The C/N ratio at the output of the splitter (point C) will be $S/(2N_e + N_T)$. The excess noise at the output of the amplifier is usually at least a thousand times greater than thermal noise. We can thence say that the impairment in C/N ratio by combining two amplifier outputs is

$$\frac{(C/N)_C}{(C/N)_A} = \frac{S/(2N_e + N_T)}{S/(N_e + N_T)} = \frac{N_e + N_T}{2N_e + N_T} = \frac{1000+1}{2 \times 1000 + 1} = \frac{1}{2}\,\frac{1001}{1000.5} \doteq -3\text{ db}$$

and therefore the total noise can be considered to be the sum of the noise output of the two amplifiers.



Amplifier	Operational Gain	Noise Figure	Output Capability for -57 dB XM	
Outgoing Trunk	23 dB	10 dB	+48 dBmV	27 Ch
Outgoing Bridger	28 dB	12 dB	+47 dBmV	27 Ch
Outgoing Feeder	24 dB	12 dB	+42.5 dBmV	27 Ch
Return Trunk	14 dB	8 dB	+52 dBmV	4 Ch
Return Feeder	16 dB	8 dB	+58 dBmV	2 Ch

SINGLE CABLE SUB-SPLIT AMPLIFIER PERFORMANCE

Table 1

Amplifier Group	Operating Level dBmV	Number For XM	Cascade XM dB	Number For C/N	System C/N dB
Outgoing Trunk	+31	25	-63	25	43
Outgoing Bridger	+43	1	-65	1	62
Outgoing Feeder	+39.5	2	-57	2	59.5
Return Trunk	+32	25	-69	250	45
	+31	25	-71	125*	47
Return Feeder	+45	2	-77	1250	49
	+44	2	-79	625*	51

*Return Split Assumed

Sample Calculations (Ref. 4):

$$\text{XM Trunk Out} = XM_1 + 20 \log C = \left[-57 - 2\,(48 - 31)\right] + 20 \log 25 = -91 + 28 = -63 \text{ dB}$$

$$\text{C/N Feeder Return} = C - N - 10 \log C = +45 - \left[-59 + 8 + 16\right] - 10 \log (1250) = 45 + 35 - 31 = 49 \text{ dB}$$

SINGLE CABLE SUB-SPLIT AMPLIFIER TOLERANCE

Table 2

SYSTEM	XM	C/N
Outgoing Trunk and Distribution	-51.4	43.0
Return Trunk and Feeder	-66.0	43.5
Complete Round Trip	-50.0	40.2
Return Trunk and Feeder/2 Return Cables	-68.0	45.5
Complete Round Trip/2 Return Cables	-50.2	41.1

SINGLE CABLE SUB-SPLIT SYSTEM TOLERANCE

Table 3

Channel	Chroma Delay of Trunk Station Filters with Varying Cutoff Frequencies: High/Low (MHz)				Chroma Delay of 9-Amplifier Cascade	Chroma Delay Feeder Amp.
	41/32*	45/35	48/37.4*	51/39.6*		
T7	2.2	1.4	0.9	0.6	-90	<1
T8	5.3	3.1	2.1	1.4	∼0	1.0
T9	10.4	6.3	4.4	3.1	58	2.6
T10	46.9	17.4	11.1	7.7	155	6.8
2	-4.2	-6.2	-9.2	-12.3	-55	-4.6
3	-2.8	-3.4	-4.0	-6.1	-31	-2.4
4	-1.9	-2.3	-2.7	-3.0	-21	-1.2

*Calculated Values

SUB-SPLIT CHROMA DELAY (NANOSECONDS)

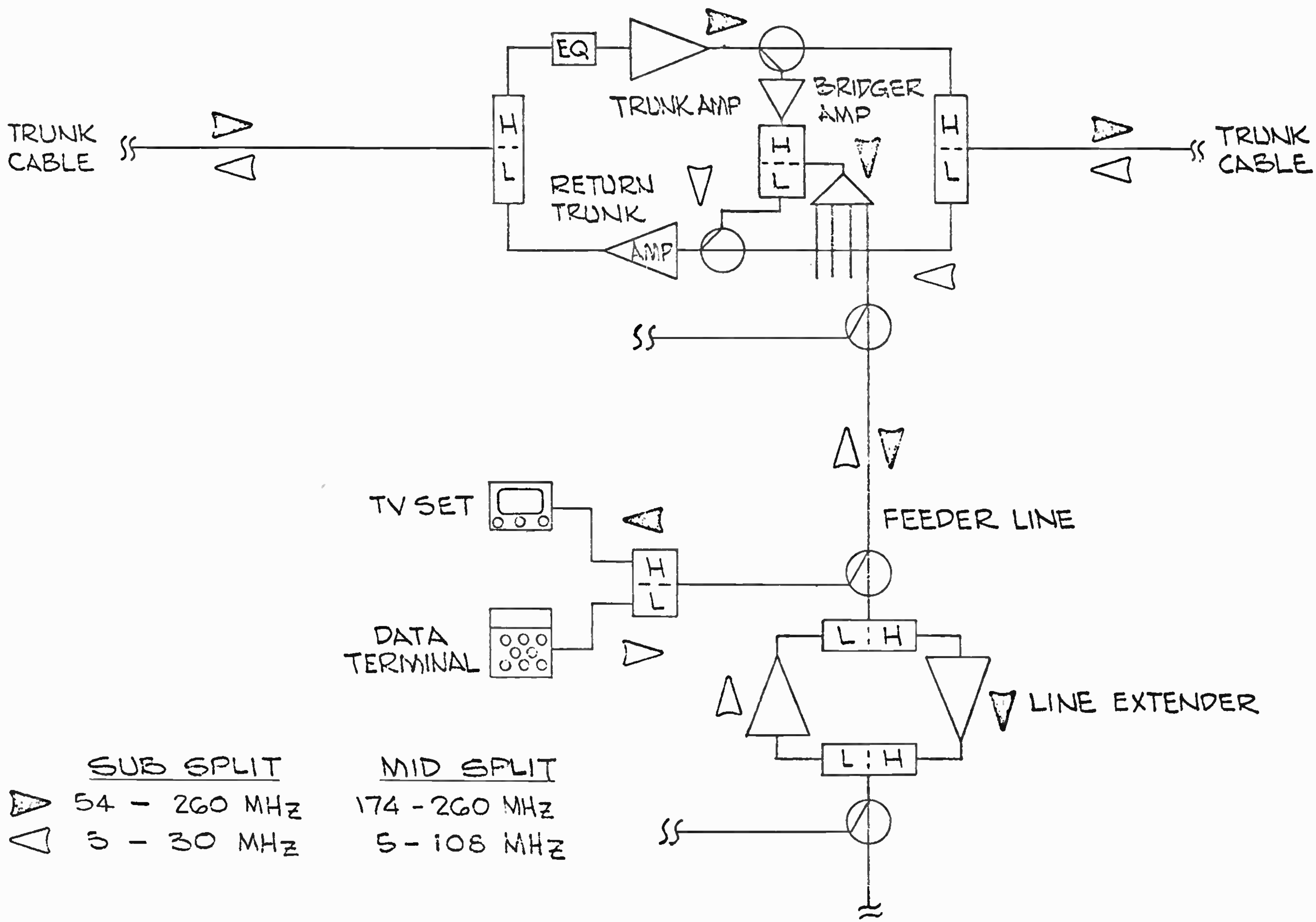
Table 4

Amplifier	Level dBmV	S_{MAX}* dBmV	Gain dB	NF dB	Cascade	Noise Total	XM dB	C/N dB
Outgoing Trunk	33.5	+50	23	10	25	25	-62	45.5
Return Trunk	35	+52	19	8	25	125	-63	46.0
Round Trip							-56.5	42.7

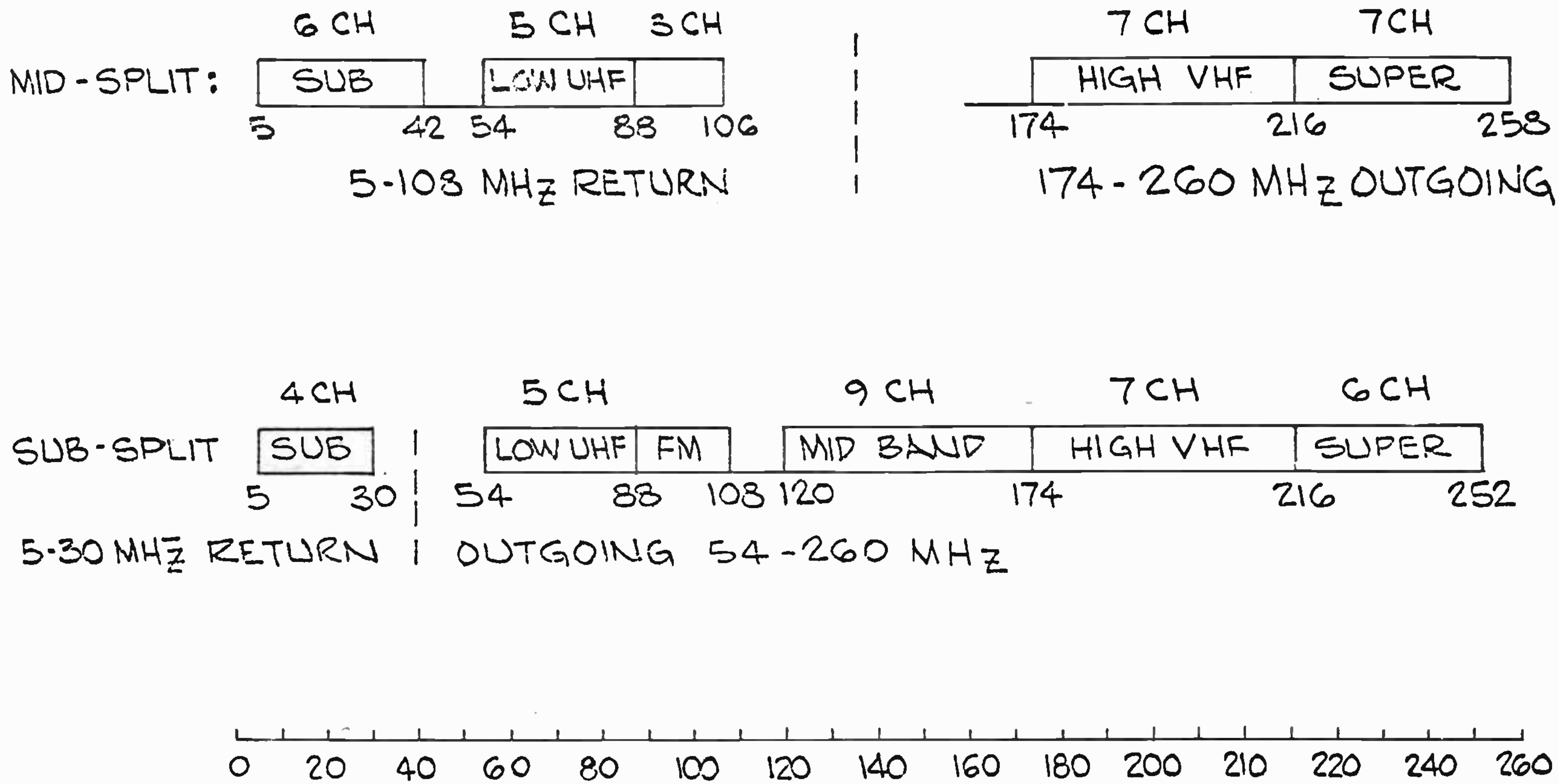
*Output Capability for -57 dB XM for 14 Ch $\begin{cases}\text{Low Band for Return}\\ \text{High Band for Outgoing}\end{cases}$

SINGLE CABLE MID-SPLIT AMPLIFIER PERFORMANCE

Table 5

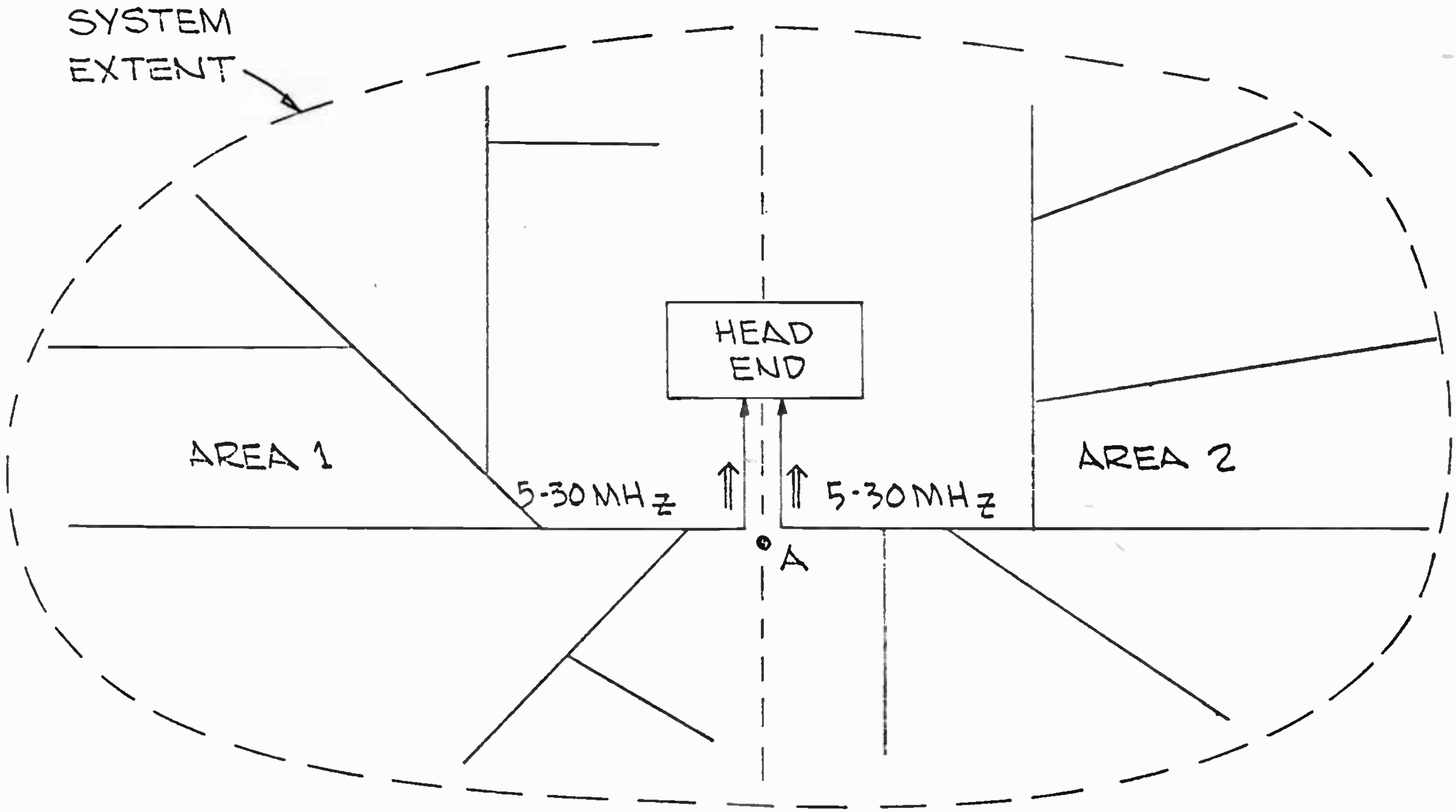


TRUNK STATION & LINE EXTENDER LAYOUT
FIGURE 1



SPECTRUM UTILIZATION OF SINGLE CABLE SYSTEM

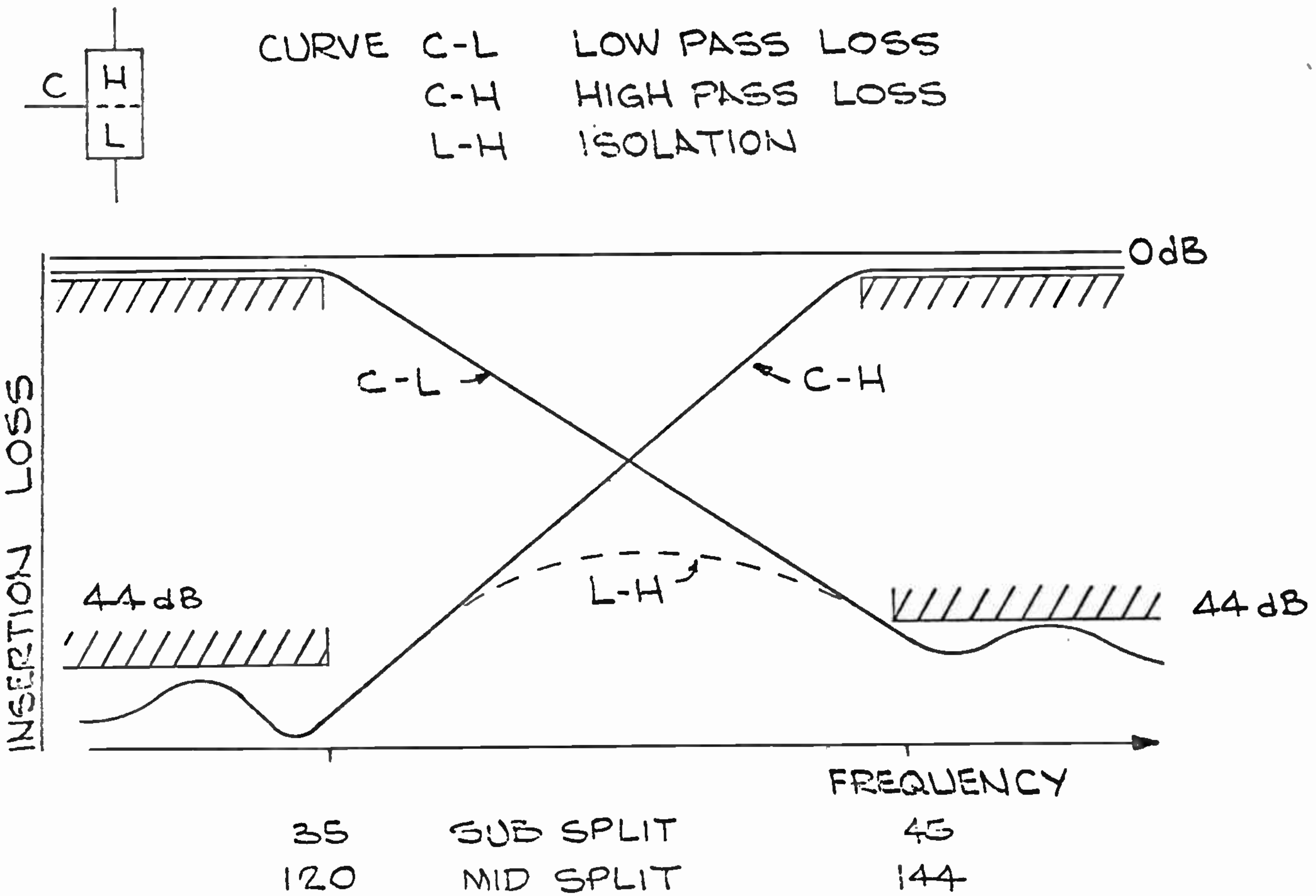
FIGURE 2



If two return cables are employed from point "A" to the Head End, and the areas are approximately equal, the C/N will be 3 dB better than if the return cables were combined at "A".

SYSTEM EMPLOYING MULTIPLE RETURN CABLES

Figure 3



FILTER AMPLITUDE REQUIREMENTS
FIGURE 4

GROUP DELAY OF HIGH/LOW SPLIT FILTERS
IN SUB-SPLIT TRUNK STATION

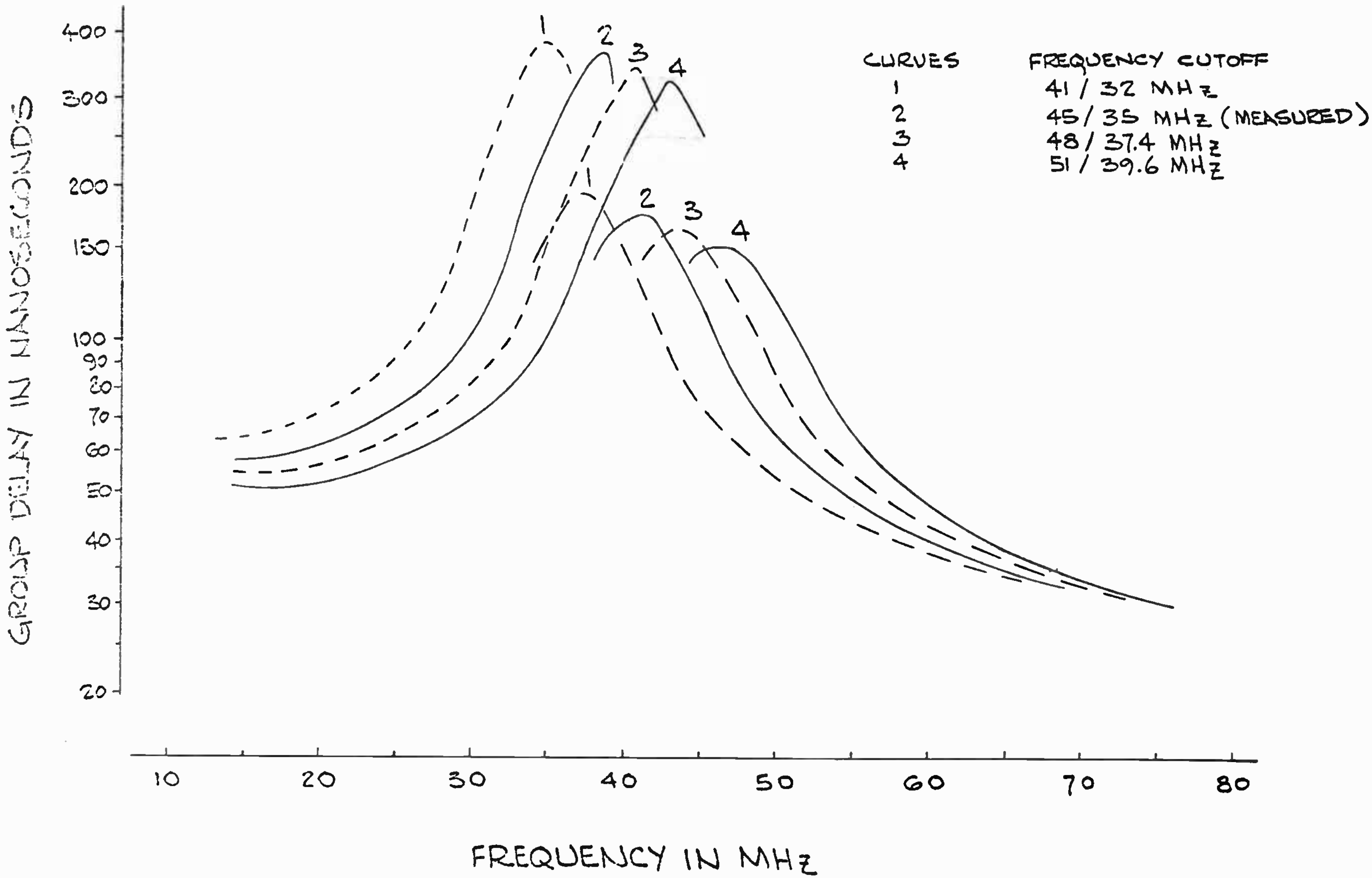
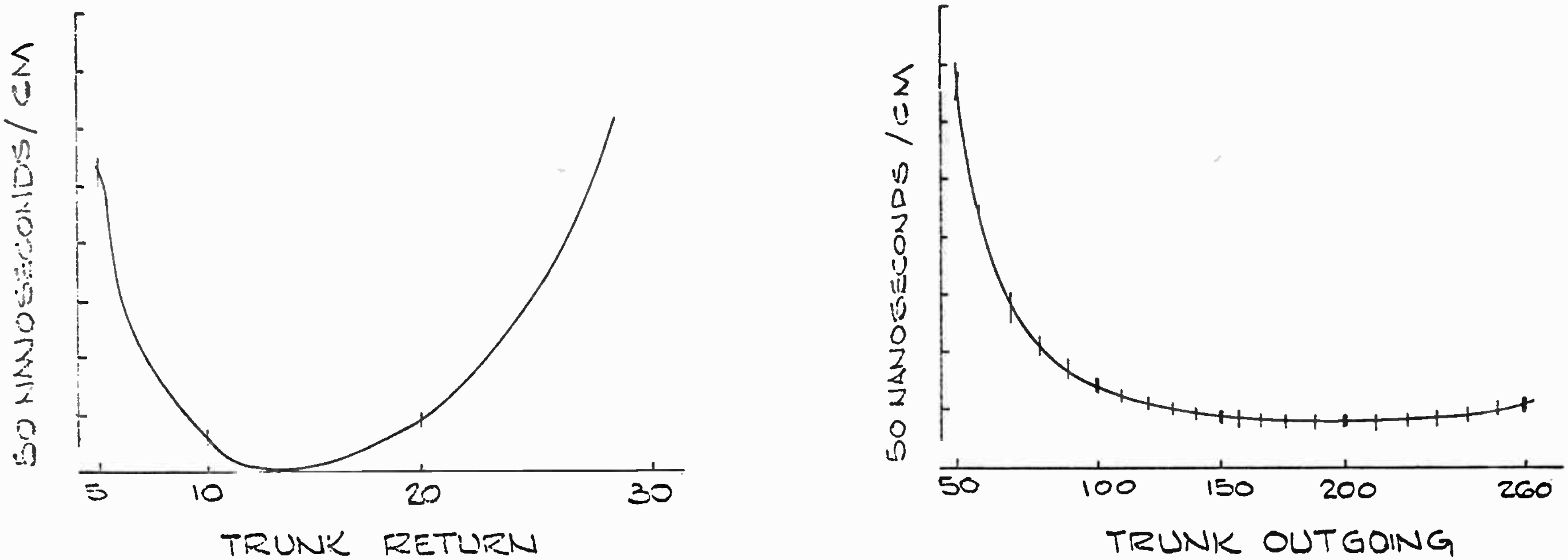
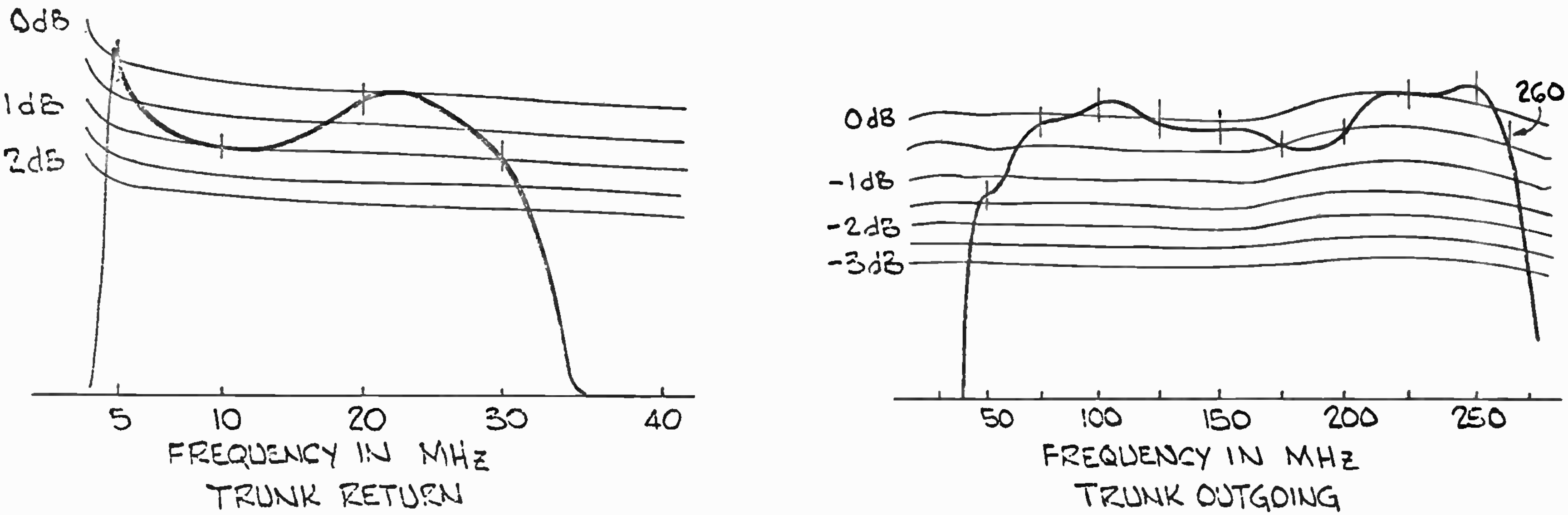


FIGURE 5

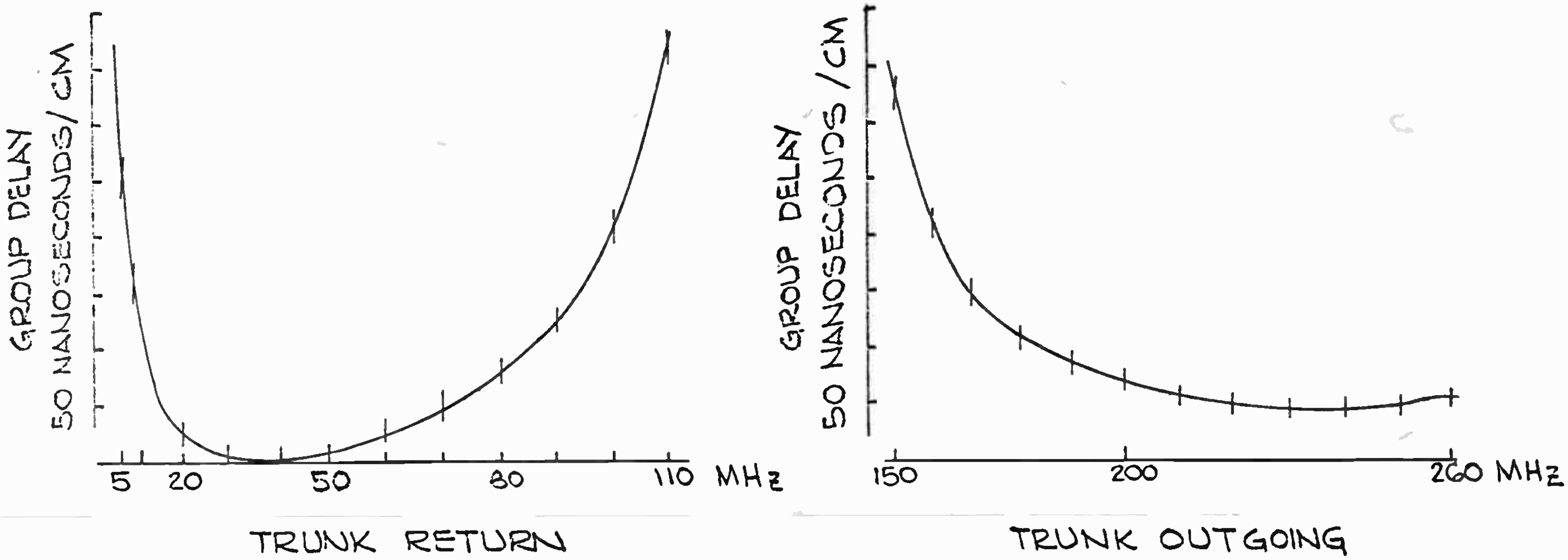


RELATIVE GROUP DELAY FOR COMPLETE CASCADE OF 9 TRUNK STATIONS (SUB-SPLIT)

FIGURE 6



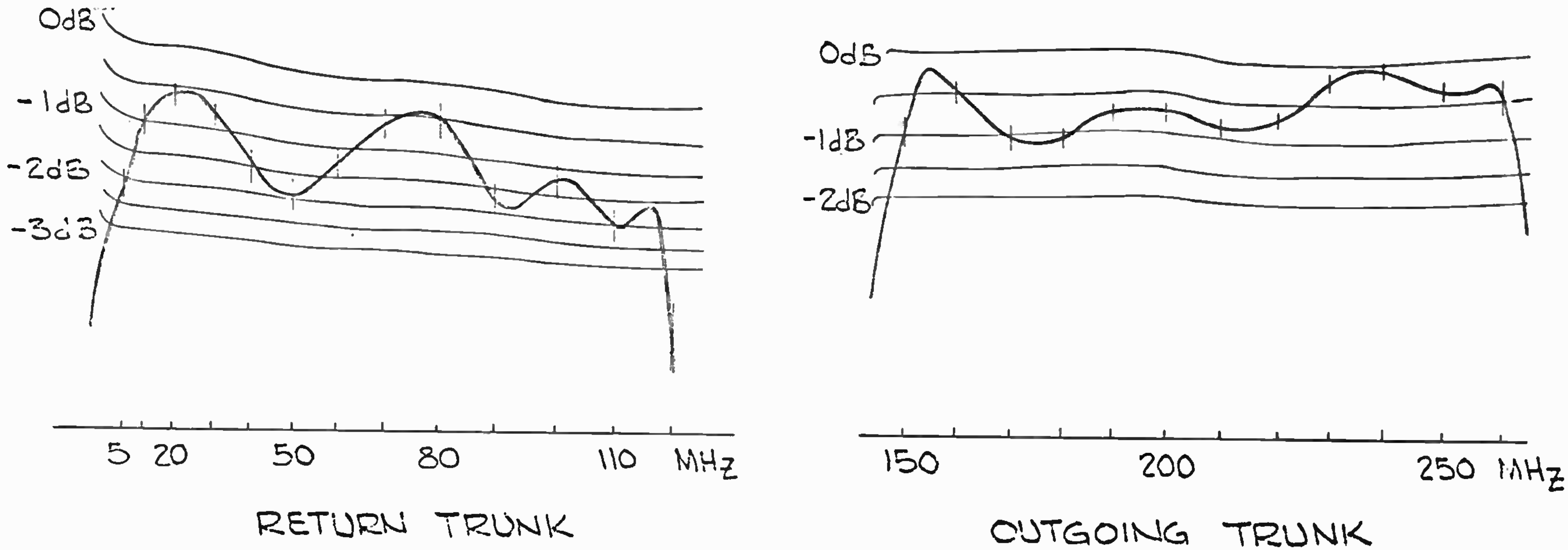
AMPLITUDE RESPONSE OF 9 AMPLIFIER CASCADE
FIGURE 7



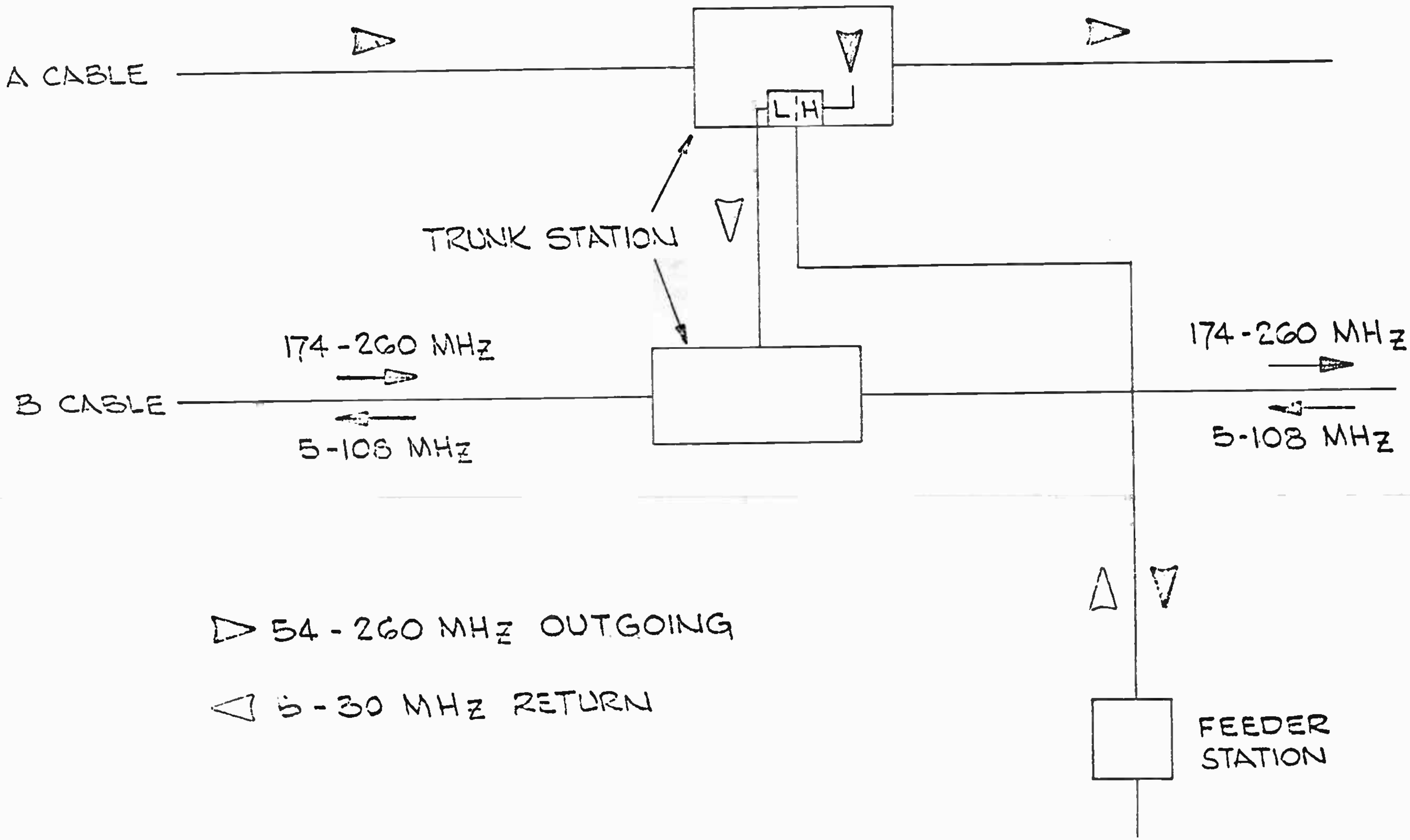
Channel #	T7	T8	T9	5	6	6A	6B	6C	7	8
Chroma Delay, nanoseconds	135	40	11	12	15	23	32	50	13	9

GROUP AND CHROMA DELAY 15-STATION CASCADE

Figure 8



AMPLITUDE RESPONSE 15 AMPLIFIER CASCADE MID-SPLIT
FIGURE 9



DUAL TRUNK SINGLE FEEDER SIGNAL FLOW

FIGURE 10

Security Alert
A Two-way Digital Communications System

Marvin Roth, Senior Engineer
Scientific-Atlanta, Inc.
Commerical Communication Div.

INTRODUCTION

For years CATV has provided a one-way communications system. Many people have proposed an increase in the services offered to the subscriber by providing two-way communications utilizing the CATV distribution system. The uses and applications of such systems are limited only by one's imagination. The technical problems of two-way data communications system have been solved; hardware has been developed and is now available. Scientific-Atlanta's Security-Alert system is such a system.

The Security-Alert two-way data communications system was developed primarily for use in monitoring and reporting the condition of many remotely located transponder units (subscriber stations) to a centrally located interrogation unit (central station). The information to be communicated is digitally encoded and modulated on an FSK (Frequency Shift Keyed) carrier and transmitted over the CATV cable distribution system.

The system consists of a central station (to be located at the headend or some central distribution point), the transmission path, (the CATV distribution system), and the subscriber stations (one unit for each subscriber).

A few of the many applications include the monitoring and status reporting of:

1. Home fire and intrusion alarms
2. Monitoring on-off conditions of remotely located equipment
3. Telemetering equipment to measure parameters such as voltage, current, power levels, temperature, pressure,etc.
4. Monitoring and reporting locations of faults along the CATV distribution line

The system can be easily modified to provide the capability for additional applications such as:

1. TV tuner monitoring and polling
2. Opinion polling
3. Mass audience participation game-playing
4. Remote control of equipment and machinery

SYSTEM DESCRIPTION

Security-Alert is an automatic sequential polling system. (Figure 1) Five bits of binary coded information (32 different messages or alarms) can be received by the central station from each of 8,192 subscriber stations. The output of the system is a printed record showing any change of status of alarm (message) from the subscriber stations. Refer to Figure 2. The information which is recorded by the digital printer contains:

1. A five digit OCTAL coded address
2. A two digit OCTAL coded alarm (message)
3. The time of day when the alarm (message) was received

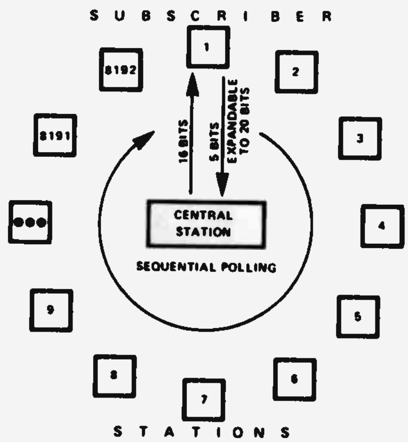


Figure 1 Sequential Polling

ADDRESS CODE	ALARM CODE	TIME HR/MIN
11657	04	1156
10615	07	1021
01253	25	0907

1ST Alarm occurred at 9:07 A.M.
Subscriber 01253 reported a Code 25.

2ND Alarm occurred at 10:21 A.M.
Subscriber 10615 reported a Code 07.

3RD Alarm occurred at 11:56 A.M.
Subscriber 11657 reported a Code 04.

Code 40 = Power Failure
Code 41 = Data Failure
Code 42 = False Alarm

All other Codes are assigned by the user.

Figure 2 Recorded Output

Fail safe provisions have been incorporated within the system. If a subscriber station is polled and an answer is not received within a reasonable time period, the system interprets the nonresponse and a "power failure" code is printed out for that subscriber station's address. A positive response must be received, or a power failure printout occurs. This feature can be used to easily locate equipment failures along the CATV distribution line as well as locating faulty subscriber units. Two other fault location indicating codes are also automatically interpreted and printed out when they occur.

The speed of transmission and processing information is of utmost importance in communications systems carrying information which may mean the difference between life and death, such as reporting fires. Security-Alert was designed with this thought in mind. The system cycle time (the time it takes to sequentially poll, examine, and report the response of 8,192 subscribers) is variable. The system is an adaptive one. For a fixed bit rate, and a time division multiplex system the cycle time depends on:

1. The total number of active subscriber stations.
2. The distance of each subscriber station to the central station
3. The number of alarm/messages and change of status of alarm/messages.

For example, let us consider the case of 8,192 subscriber units whose average distance from the central station is ten miles (20 miles round trip). If no alarms exist, the cycle time would be approximately five seconds. For each change of status of alarm/message, the cycle time would be increased by 0.5 seconds (the time it takes to print out the message).

Means have been provided in the basic system to easily change the system capacity. Two bits (four unique combinations) are not used in the basic system but are available in the interrogation word. These two bits can be used to:

1. Increase the maximum number of subscriber units sending five bits of alarm/message information from 8,192 to 32,768.
2. Increase the number of alarm message bits received from 8,192 subscriber units from 5 bits to 20 bits (1,048,576 different combinations).
3. Combinations of the two extremes of the above.
4. The two extra bits can also be used as command or instruction words to cause an event to occur at any subscriber station (such as remotely turning equipment off or on).

BASIC OPERATION

The Security-Alert system operates on a master-slave principle. The master unit is the central station. All of the subscriber stations are slave units. Each subscriber station is assigned and programmed to recognize a unique binary coded address word. A subscriber unit is capable of transmitting information only after it has decoded the input address code, compared it with the preprogrammed address and recognized it as its own address. Refer to Figure 3.

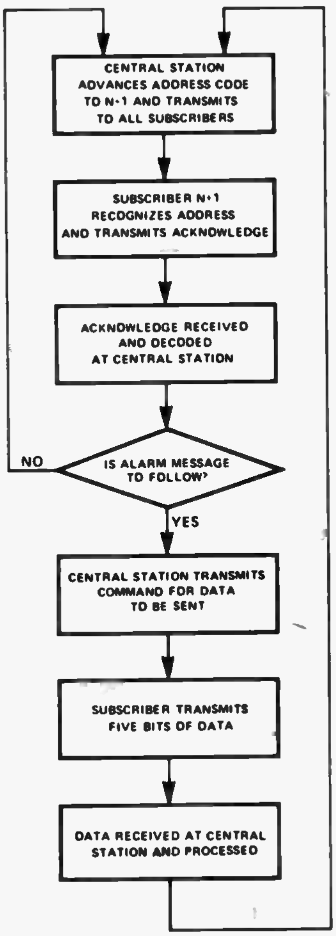


Figure 3
Flow Diagram of Basic Operation

The address code is transmitted by the central station to all subscriber stations. The subscriber station which is pre-programmed to recognize that unique address replies with an acknowledgement pulse. This acknowledgement pulse is coded to indicate whether an alarm message exists or not. If there is no alarm message the central station advances the address by one count and transmits the new address to all subscriber stations. If an alarm message is received the central station transmits a command causing the answering subscriber station to transmit a five bit binary word which contains the alarm message. This two-step method of alarm reception was chosen to decrease system cycle time. If no alarms are reported, only one bit is transmitted in the reverse direction. Five bits are transmitted only when an alarm condition exists. After the central station processes the alarm message the address word is advanced one count and the next subscriber station is interrogated.

CENTRAL STATION

The central station produces all timing and control signals used by the system. The timing signals are transmitted along with data to all subscriber units. The transmission of these timing signals eliminates the need for timing oscillators and complicated circuits to phase lock the incoming data in each subscriber station.

The central station is comprised of four major subsystems (refer to Figure 4). A digital clock provides a visual display of hours, minutes, and seconds. It also provides the proper signals representing hours and minutes for recording on the digital printer.

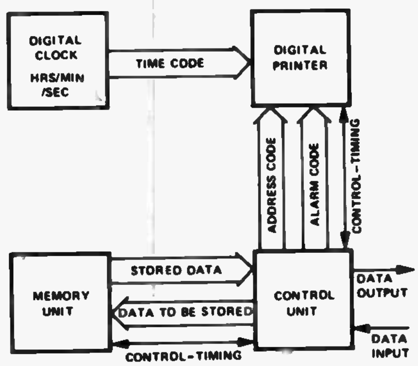


Figure 4
Central Station Block Diagram

The digital printer is the primary output device. As previously discussed, it prints the alarm code, the address code, and the time of day automatically upon command from the control unit.

The control unit provides all timing and control signals, transmits an interrogation word to all subscriber units, receives the subscriber station's reply, processes the information and causes an output when required.

The memory unit provides eight bits of storage for each of the 8,192 addresses. Addresses can be manually assigned in memory. If an address is assigned it is transmitted. If the address is not assigned, the control unit does not transmit that address code. The address register is advanced and the next address is processed. The memory is nonvolatile and remembers the last alarm printed for all addresses. The data in memory is compared with the input data and a printout occurs only when the incoming alarm for a particular address is different from that previously recorded and memorized. The system senses and prints a change of status of alarm rather than an alarm. It is obvious that this increases system speed by preventing the same information from being printed more than once.

Since the central station controls the entire system, let us start with the generation of an interrogation word and follow the signal as it travels to and from the subscriber station.

INTERROGATION WORD

The "interrogation word" is a polling command which is simultaneously transmitted to all subscriber stations. It contains data composed of 16 bits of binary coded information as well as timing signals. The data portion of the interrogation word is produced by generating a 13 bit binary code address word and applying these in parallel with three other bits to a parallel-to-serial converter. The output of the parallel-to-serial converter is a 16 bit NRZ (Non Return to Zero)word. Refer to Figure 5.

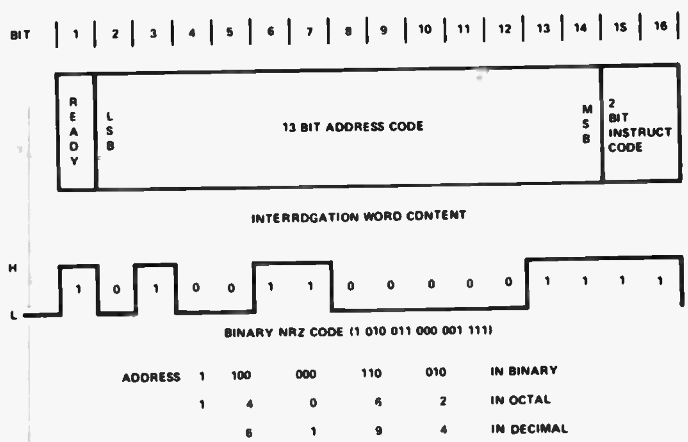


Figure 5 Interrogation Word

The first bit is used to ready all subscriber units by resetting a counter in each unit. The next thirteen bits contain the address code. The last two bits are reserved and can be used to issue instruction commands, to increase the maximum number of subscribers, or to increase the number of alarm/message bits from the subscriber.

The binary coded NRZ word has timing signals added to it by a bi-phase encoder. The output of the bi-phase encoder is then modulated and transmitted.

Figure 6 shows a binary NRZ code.

each clock pulse transistion. Data and timing information are combined and transmitted on one continous pulse train.

The clock rate of both Ø1 and Ø2 is 160 KHz. The data is derived from Ø2 producing a bit rate of 160,000 bits/second. Since the interrogating word contains sixteen bits, the length of the interrogation word is 100 microseconds. Since the bi-phase code consists of the interlacing both Ø1 and Ø2, the maximum transmission modulation rate is 320 KHz.

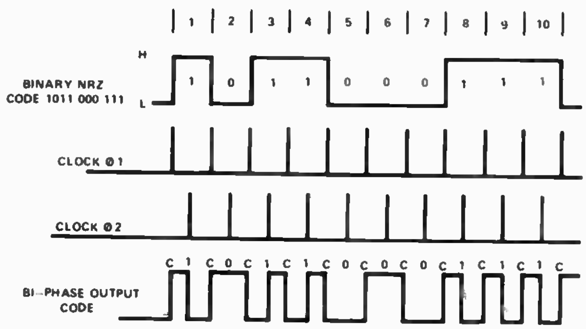


Figure 6 Bi-Phase Encoder Timing Diagram

Ten bits are shown for simplicity. A binary "one" is represented by a high level, and a binary "zero" is represented by a low level. Timing information such as the data rate is not contained in this code. To identify the binary code it is necessary to know the data rate so the word can be examined and the code understood. By adding timing signals to the binary NRZ code through an encoder as shown in Figure 7, a bi-phase code is generated.

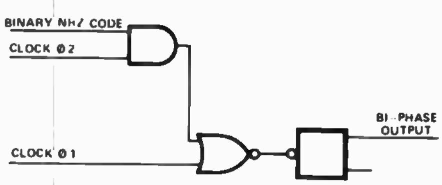


Figure 7 Bi-Phase Encoder

By examing the bi-phase code shown in Figure 6, it can be seen that the levels of "high" and "low" are meaningless and that data and timing information is contained in the transistion between the high and low levels. For each clock pulse Ø1 a transistion occurs. When the input data is high a transistion occurs at a clock pulse Ø2 and when the input data is "low" a transistion does not occur. The clock pulses occur at a regular interval, the clock period. The data always occurs half way between

FORWARD TRANSMISSION PATH

The bi-phase binary encoded interrogation word modulates an FSK (Frequency Shift Keyed) transmitter. Refer to Figure 8. A binary "one" is transmitted at a frequency of 113.9 MHz and a binary "zero" is transmitted at a frequency of 111.1 MHz. The two frequencies are generated by precision crystal controlled oscillators.

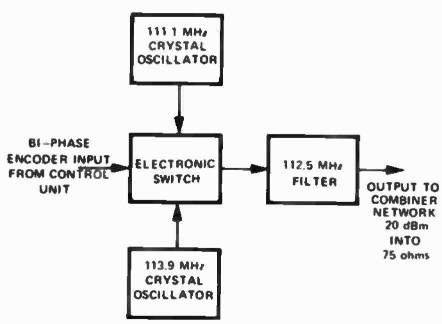


Figure 8
112.5 MHz Transmitter Block Diagram

The output of the oscillators are passed through bandpass filters with very steep slopes to keep unwanted sidebands out of other channels. Available power at the 75 ohm output terminals is +29 dBmV. This will be at least 15dB below the normal level of TV signals at the combiner output. The modulated interrogation word is added with the TV signal in a combiner network and travels down the normal CATV distribution

system to each subscriber unit. The input range of the receiver in the subscriber set can vary in signal strength from -10 dBmV to +15 dBmV and still be within its operational range.

Propagation delay along the distribution system is an important parameter in calculating system cycle time (refer to Table 1). It consists of cable delay and delays through the various amplifiers and various amplifiers and passive devices along the distribution line. As a rule of thumb, a delay of 8.3 microseconds per mile is used when calculating system cycle times.

Table 1

FORWARD PATH PROPAGATION DELAY FOR INTERROGATION WORD	
INTERROGATION WORD LENGTH	100 MICRO SEC
FIXED TRANSMITTER-RECEIVER-DECODER DELAY	30 MICRO SEC
CABLE DELAY (INCLUDING 4 AMPLIFIERS/MILE)	8.3 MICRO SEC/MILE

SUBSCRIBER STATION

Refer to Figures 9 and 10.

The subscriber drop is always a single cable carrying two-way information, It enters the subscriber station unit where the input signal is split. Half of the signal is made available through a type "F" connector to provide signals to a TV set or other device. The digitally modulated signal passes through a passive frequency selective "tee" network and then into a 112.5 MHz receiver. The input sensitivity of the receiver is between -10 dBmV and +15 dBmV. The receiver consists of three stages of tuned amplification followed by a broadband limiter. The output of the limiter is fed to a discriminator circuit and the output level of the discriminator is sensed by a level detector which reproduces the transmitted bi-phase binary encoded word. The digital signal is then fed to a decoder and the timing signals are separated from the data contained in the bi-phase coded input word.

The first bit (always transmitted as a one) resets all counters and readies the transponder for more data. If a noise pulse were to provide this bit all subscriber stations would be inactive but ready, and would still interpret the first bit of the transmitted message as a ready pulse and not as data. Only a burst of noise having the same word length as the interrogation word would be interpreted as a transmission.

The timing pulses are counted in a binary counter located in the address comparator. The preprogrammed address is gated out and compared bit by bit with the input

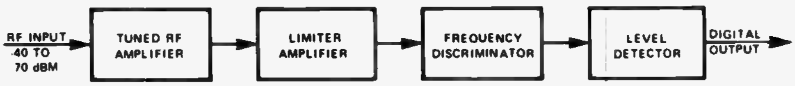


Figure 9 112.5 MHz Receiver

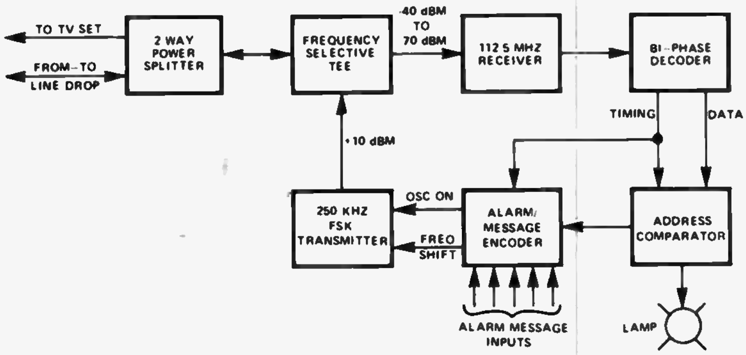


Figure 10 Block Diagram Subscriber Station

data. As soon as a subscriber station recognizes one bit difference between the input data and the preprogrammed address, it resets itself and waits for the next interrogation word. The one station which recognizes all input bits as being identical with its own pre-programmed address sets a bistable circuit. This causes two events to happen. A lamp on the front panel of the subscriber unit turns on signifying this particular subscriber station is being interrogated. This provides a self-checking feature at the subscriber station.

At the same time the station's alarm message inputs are examined. If no alarm conditions exist (signified by open circuits to the five alarm message inputs) the 250 KHz FSK transmitter is instructed to turn on and transmit a 275 KHz signal for approximately 125 microseconds. If an alarm message exists (closure of one or more alarm message inputs) the transmitter is turned on and a frequency of 225 KHz is transmitted for approximately 125 microseconds. The signal is referred to as the acknowledge word and it is transmitted into the subscriber drop cable through the frequency selective tee network and power coupler.

The central station interprets the reception of 275 KHz as a no-alarm message and proceeds to advance the address register and interrogate the next subscriber station (see Figure 11). If the received signal is 225 KHz, then five 12.5 microsecond data strobe pulses spaced every 100 microseconds are transmitted sequentially to all subscriber stations. Only that subscriber station whose address had just been recognized allows the data strobes to be gated through to the alarm message encoder. The encoder converts the five input message code to a serial binary string of "ones" and "zeros." The 250 KHz FSK transmitter is turned on for a period of approximately 525 microseconds, and the transmission is FSK modulated between 225 KHz and 275 KHz by the data contained in the serially coded alarm message. The central station processes this information and then interrogates the next subscriber unit.

If two units in a time division multiplex system which uses one cable attempt to transmit at the same time and at the same frequency they will interfere with each other. A failure in one of the subscriber stations which would cause the transmitter to be turned on continously would render such a system useless. To prevent this, a simple fail safe feature has been incorporated in the 250 KHz transmitter. In the event of a failure of this type, the oscillator stage will turn itself off and remain off until the failure condition is corrected.

When this station is interrogated by the central station a "power failure" code will be printed out at the central station and the problem will be brought to the attention of the system operator.

Signals are available within the transponder to decode the two instruction word bits. These are used for optional features of the system.

REVERSE TRANSMISSION PATH

The acknowledgement pulse and the alarm message word are FSK modulated and transmitted in the reverse direction. A binary "one" is transmitted at a frequency of 275 KHz and a binary "zero" is transmitted at a frequency of 225 KHz. The power available at the transmitter output is +60 dBmV into a 75 ohm load. The input range at the receiver end is between +10 dBmV and +30 dBmV.

The system was designed for use with either a single cable or with a separate reverse transmission cable. The single cable system will require all components in the distribution system to be bi-directional. In an existing distribution system it may be desirable to install a separate low cost reverse transmission cable (RG59) instead of replacing all un-directional components. The loss along the cable (RG59) at the frequency of 0.25 MHz is approximately 20 dB per mile. To keep the signal level along the line above the minimum detectable level at the receiver, inexpensive low frequency amplifiers and combining networks are available. Since the loss per mile is low, fewer amplifiers would be required in the reverse than in the forward direction.

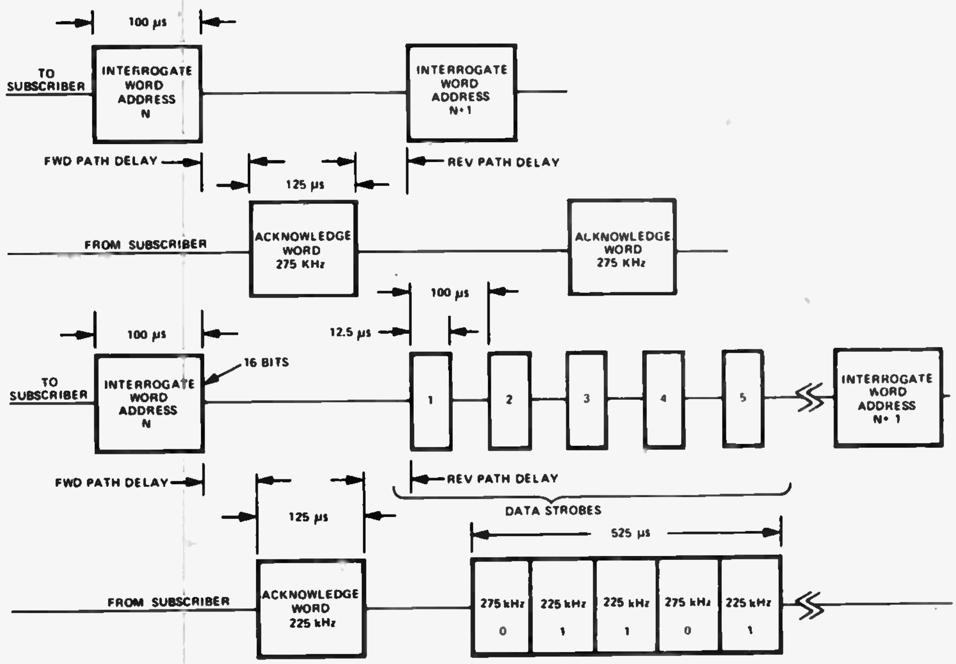


Figure 11 System Timing Diagram

The cable drop to the subscriber is always a single cable independent of the single or dual cable system.

In calculating the cycle time the forward transmission path propagation delay due to the cable and the components in the reverse transmission path must be taken into account. These are given in Table 2.

Table 2

REVERSE PATH PROPAGATION DELAY FOR ACKNOWLEDGEMENT WORD	
INTERROGATION WORD LENGTH	125 MICRO SEC
FIXED TRANSMITTER RECEIVER PROCESSOR DELAY	120 MICRO SEC
CABLE DELAY (INCLUDING 4 AMPLIFIERS/MILE)	8.3 MICRO SEC/MILE

DATA RECEPTION AND PROCESSING

The modulated acknowledgement pulse and alarm message which are transmitted in the reverse direction are received at the central station and applied to a 250 KHz, three-section Butterworth filter (see Figure 12). The filter outputs to a 250 KHz receiver which is composed of a limiter amplifier, a frequency discriminator, a level detector,

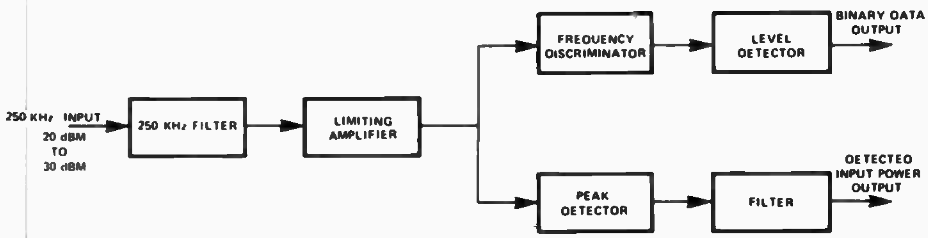


Figure 12 250 KHz Receiver & Filter

and a carrier presence detector. The input to the discriminator circuit and carrier presence detector is held constant by the limiter amplifier as the input signal level varies from 3 millivolts to 30 millivolts. The carrier presence detector provides an output (a binary "one") whenever a signal (either 225 KHz or 275 KHz) is received. The frequency discriminator and level detector provide a binary "one" only when the input signal frequency is 225 KHz. The two digital outputs are applied to the data processing portion of the control station.

Figure 13 shows a block diagram of the control unit. The control unit is normally automatic in operation; however, an operator may take control of the system manually. All timing signals are derived from a 1.28 MHz crystal controlled master clock oscillator. The output of the oscillator is divided down to provide the required timing signals. All signals (input, printer, manual commands) which are asychronous in nature are synchronized with the master clock before being processed. This may delay data processing up to one clock period, but the delay is small compared with other system delays.

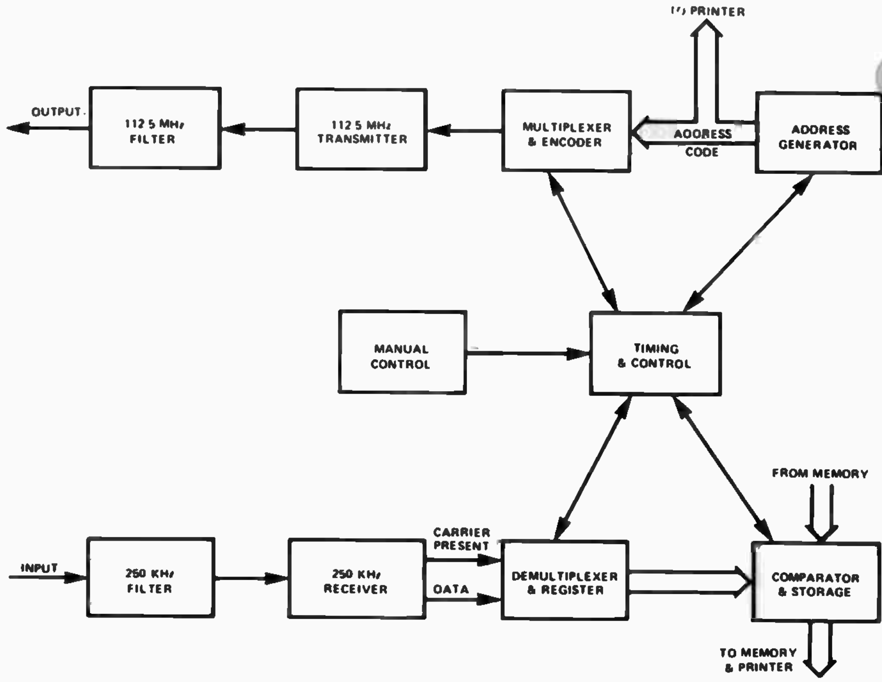


Figure 13 Control Unit Block Diagram

ADDRESS GENERATOR AND MULTIPLEXER

A block diagram of the address generator and multiplexer is shown in Figure 14. The 160 KHz clock Ø 2 is applied to a 13 bit binary counter through NAND gate 1. The second input to NAND gate1 consists of inhibit functions derived in the timing and control circuitry. When data is being processed the address counter is prevented from being advanced. The address counter will advance only when both inputs to NAND gate 1 are high. Right after the advance of the address counter, the timing and control circuitry cause an inhibit function to occur until the data received from the new address is processed.

The timing and control circuits also provide inhibit functions to NAND gate 2. This gate sets a bistable circuit which allows the 160 KHz clock (Ø 2) pulses to be applied to a four-bit binary counter. The 16th count of the counter is detected and bistable circuit 1 is reset, and remains reset until the next uninhibited clock pulse is allowed to set it. The four output lines of the counter are applied, to and control the single output line of a 16 line to 1 line multiplexer. The 16 lines of input consist of the 13 bit address code and three other bits entered in parrallel. The bits are sequentially gated out of the multiplexer on the output line a bit at a time, as controlled by the 16

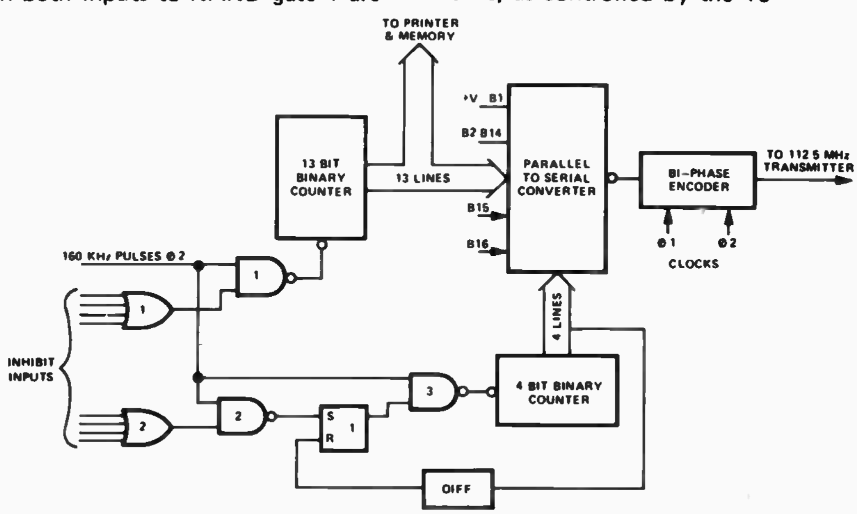


Figure 14 Address Generator & Multiplexer

combinations of the four bit control lines. The sequential single line output is applied to the bi-phase encoder and then to the 112.5 MHz transmitter.

DEMULTIPLEXER AND DATA REGISTER

The 250 KHz receiver provides two output signals. One output signal occurs when a carrier signal of either input frequency is present. The second output signal is the detected data (refer to Figure 15). At the end of the transmission of an interrogation word, a pulse is generated by the timing and control circuitry that sets a bistable circuit starting a clamped time delay circuit. The time delay is set for the maximum round trip propagation delay time of the system. If a signal is received before the end of this period then the bistable circuit is reset and the input data is examined by NAND gates 1 and 2. A binary "one" is decoded by gate 1 as a "no alarm" message. A binary "zero" is decoded by gate 2 as an alarm message. The output of NAND gate 3 causes code 40 to be recorded and stored in memory if a signal is not received before the end of the time delay period, and if Code 40 (power failure) has not been previously printed for this address.

If the data received contains a "no alarm" message it is compared with data stored in memory. If a "no alarm" message was not previously stored in memory code "00" is printed out. If the received data was decoded as an alarm message then the data strobe generator is actuated and five sequential data strobes are transmitted to the answering subscriber station. The subscriber station will reply with a five bit binary coded message. When this signal is received the data trigger generator is actuated and five sequential triggers are generated. The triggers are used to sequentially gate the serial input data into a serial-to-parallel converter. Since the timing of the triggers is based on the reception of the data word, each bit will be read in and stored at the proper time. At the end of the fifth trigger a "cycle count trigger" is generated. The output of the serial-to-parallel converter (the data register) will hold the stored five bit input data word until the next data word is received by the system.

ALARM COMPARATOR (Figure 16)

When an alarm is detected the message is examined three times to prevent the processing of a possible false alarm. The five bits of input data are compared with the message previously stored in memory for the address being interrogated. If the output of Comparator 1 is a binary zero (an equal condition) at the time the "cycle count trigger" occurs, the timing and control circuitry cause the address generator to advance, and the next address is interrogated. If the output of Comparator 1 is a binary one, it is gated with the "cycle count trigger" in NAND gate 1 and bistable 1 is set. This causes one input of NAND gate 2 to go high and also causes the five bit input data word to be stored and held in a five bit "latch" circuit. The timing and control circuitry then cause the same address to be interrogated for a second time. The second set of five bits of input data is compared in comparator 2 with the first set of data previously placed in storage. If the two sets of data are not equal bistable two is placed in the set state. The same address is interrogated for a third time at the end of the "cycle count trigger". The third set of input data is compared with the stored first set in comparator 2. Bistable 2 is set if the comparison indicates a "not equal" condition.

Each time the cycle count trigger occurs, a modulus 3 counter is advanced one count. After the third trigger the two

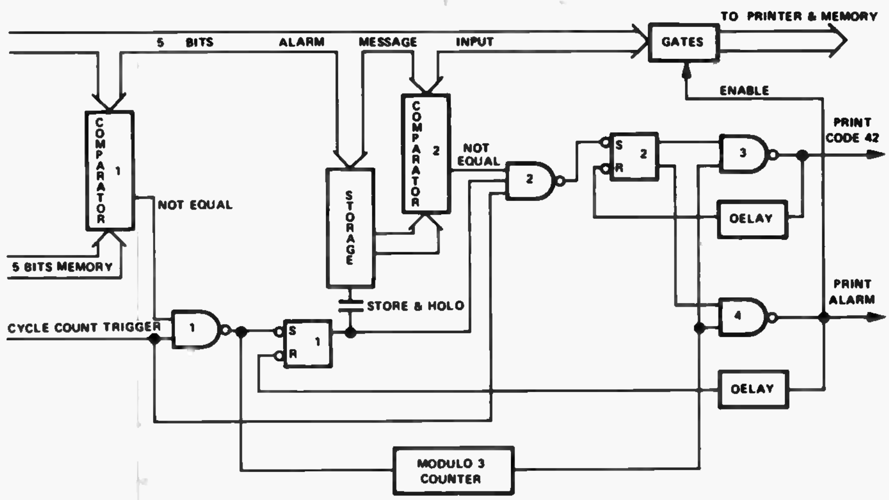


Figure 16 Alarm Comparator

gates NAND 3 and NAND 4 are strobed. If the input data was identical three consecutive times then gate 4 causes a "print alarm" command to occur. The five bit coded message stored in those data registers is printed by the recorder and stored in memory. A code "42" (false alarm) is printed if the data was not identical three consecutive times as sensed by gate 3 and stored by bistable 2. After printing the bistable circuits are reset and the timing and control circuitry cause the next address to be interrogated.

APPLICATIONS

Transponder Data Inputs

The five data input lines to the transponder are coded a binary-coded octal. Data input one represents $(01)_8$; input two represents $(02)_8$; input three represents $(04)_8$; input four represents $(10)_8$; and input five represents $(20)_8$.

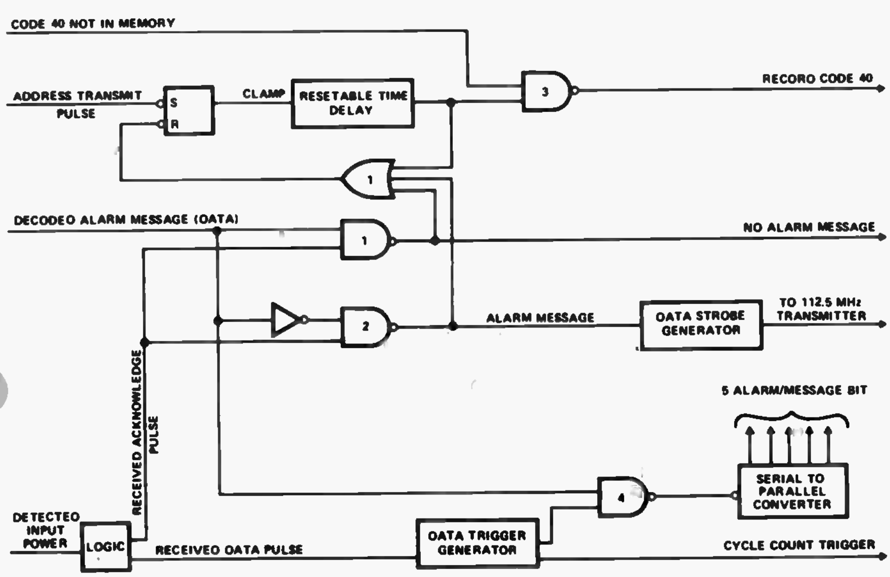


Figure 15 Demultiplexer & Data Register

The switch inputs are normally open contacts. Figure 17 shows a block diagram of five input switches S1—S5.

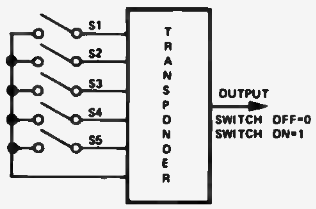


Figure 17
Five Independent Switch Inputs

Table 3 shows all possible combinations of the five switches. An "O" represents an open switch contact (an "off" condition) and a "1" represents a switch closure (an "on" condition). When all switches are off the transponder will transmit a $(00)_8$ code. When all switches are on the transponder will transmit a $(37)_8$ code. All other combinations are shown in the transmittal code column of Table 3.

Table 3 Transponder Input Codes

SWITCH	S1	S2	S3	S4	S5		TRANSMITTED CODE
LINE \ CODE	01	02	04	10	20		
1	0	0	0	0	0		00
2	1	0	0	0	0		01
3	0	1	0	0	0		02
4	1	1	0	0	0		03
5	0	0	1	0	0		04
6	1	0	1	0	0		05
7	0	1	1	0	0		06
8	1	1	1	0	0		07
9	0	0	0	1	0		10
10	1	0	0	1	0		11
11	0	1	0	1	0		12
12	1	1	0	1	0		13
13	0	0	1	1	0		14
14	1	0	1	1	0		15
15	0	1	1	1	0		16
16	1	1	1	1	0		17
17	0	0	0	0	1		20
18	1	0	0	0	1		21
19	0	1	0	0	1		22
20	1	1	0	0	1		23
21	0	0	1	0	1		24
22	1	0	1	0	1		25
23	0	1	1	0	1		26
24	1	1	1	0	1		27
25	0	0	0	1	1		30
26	1	0	0	1	1		31
27	0	1	0	1	1		32
28	1	1	0	1	1		33
29	0	0	1	1	1		34
30	1	0	1	1	1		35
31	0	1	1	1	1		36
32	1	1	1	1	1		37

GENERAL APPLICATIONS

The five data inputs may be used in two different ways. Each of five independent functions may be monitored to indicate an on-off condition. All combinations of the five independent inputs can be uniquely identified by the octal code as shown in Table 3. The switches represent inputs such as S1 for smoke or heat detection, S2 for intrusion detection, S3 for a "panic" alarm indicator. If fire occurs, code 01 is transmitted. If an intrusion occurs code 02 is transmitted. If fire and intrusion occur simultaneously then code 03 is transmitted.

The five data inputs may also be used to monitor 32 discreet levels of one input variable as shown in Figure 18. A remotely located transducer monitors a varying parameter. The analog output of the transducer is converted to binary-coded octal in an analog-to-digital converter. The range of measurements can be resolved into 32 discrete steps.

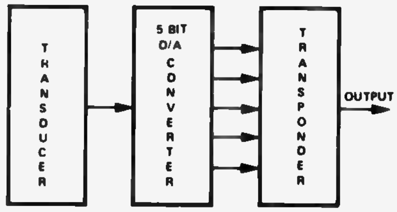


Figure 18 Using the Transponder For Monitoring One Input Parameter in 32 Discrete Measurement Levels

With optional circuitry (a multiplexer) the system can be expanded to transmit twenty bits of data. The increased system can be expanded to transmit:

1. Twenty independent on-off switch closures (Figure 19)
2. 1,048,576 discrete levels of one independent variable (Figure 20)
3. Combinations of the two above extreme cases.

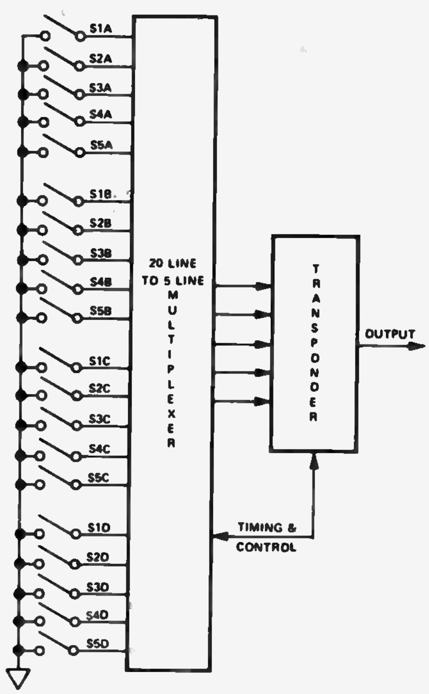


Figure 19 Using the Transponder for Sensing 20 Independent Switch Inputs

This is accomplished by using bits 15 and 16 of the interrogation word for byte control. There are four possible states of the two bits and each byte contains five bits of data. The subscriber station is interrogated four times to receive the twenty bits of data.

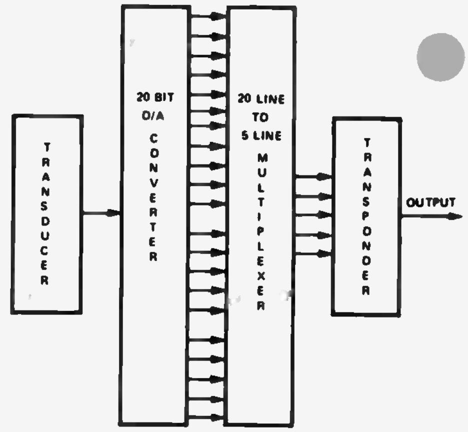


Figure 20 Using the Transponder For Monitoring One Input Parameter For 1,048,576 Discrete Measurement Levels

CONCLUSION

CATV distribution systems can be adapted for two-way data communications. The first type of communication system to be used will probably be a "polling" system such as the Security-Alert system discussed within this paper.

This system is available and can be used to increase the services offered the subscriber.

Probably the first application of this system will be used to monitor and sense remote events such as fire and intrusion alarms. The system can monitor any switch closure and can also be adapted to monitor time varying parameters such as voltage, current or power. As more services are required by the subscribers the system can be expanded and adapted for uses such as:

1. Polling (program tuner and opinion)
2. Game playing
3. Remote control
4. Educational purposes
5. Information retrieval
6. Special program selection
7. Subscriber remote turn on - turn off service
8. Distribution system fault locating and reporting.

The future of two-way data communications utilizing the CATV cable promises to be an ever expanding field.

TOCOM SYSTEM

BI-DIRECTIONAL CABLE TELEVISION

INFORMATION AND CONTROL TRANSMISSION SYSTEM

Presented by

WILLIAM F. (BILL) OSBORN

CAS MANUFACTURING CO.

IRVING, TEXAS

ABOUT THE AUTHOR

Bill Osborn graduated from Texas A&M University in 1957 with a BSEE after serving for several years as an Army Officer. He is a Professional Registered Engineer and a member of Tou Beta Pu, Eta Kappa Nu, Texas Society of Professional Engineers and Rotary International.

After graduation, Mr. Osborn worked for Sandia Corporation and was responsible for establishing a secondary standards laboratory for the AEC. He then joined National Data Processing Corporation in Dallas and was involved in the design of one of the initial automatic banking and check sorting systems. In 1962, Mr. Osborn joined Arps Corporation as Vice President of Engineering. During his tenure with Arps he was responsible for the development of logging tools for the oil industry.

Mr. Osborn has been involved in numerous projects, including automation and control systems, instrumentation systems, computer systems, and communication and broadcast systems. Mr. Osborn is the inventor of several patents relating to instrumentation and the oil industry.

INTRODUCTION

TOCOM is the NOW TOTAL CATV COMMUNICATIONS SYSTEM developed by CAS Manufacturing Company. Bi-Directional Flow of information on a single cable, particularly the ability to transmit information from the subscriber to a central receiving point and to transmit control information to each subscriber location, is the end product of the TOCOM System.

TOCOM is a broad band, single cable, bi-directional CATV Communications System providing conventional 26 channel forward transmission, a 26 channel converter receiver, a crystal controlled subscriber identified digital transmitter, built into the converter, a hub located computer interface interrogator and master computer memory bank.

TOCOM is the vehicle to provide home protection systems, pay television, surveys for television rating service, controlled television channels, meter reading, amplifier level monitoring, and instant "subscriber response" polls, via automatic computer read-out and billing. Remote use of computers from the home and narrow band picture phone are possible future uses. Providing any one service would not economically justify a total communications system. Providing all services is an open door to profitably increasing subscriber revenues.

TOCOM SYSTEM - BI-DIRECTIONAL CABLE TELEVISION INFORMATION AND CONTROL TRANSMISSION SYSTEM

The TOCOM system consists of three primary elements - a Central Data Terminal, a Bi-directional coax amplifier system, and a large number of Remote Transmitter Receiver units. In general, the TOCOM system has the capability of transmitting from the Central Data Terminal, interrogation information to one or more selected Remote Transmitter Receivers. This causes the Remote Transmitter Receiving unit or units that have been interrogated by the interrogation signals to sample certain data and to transmit this information back to the Central Data Terminal, with all signals being transmitted on a single coax cable.

The system as it is presently designed, though expandable, has the capability at any Remote Transmitter Receiver location of interrogating seven words of information, each word containing 16 bits. In the present system, the seven words of 16 bits are so coded to return certain specific information; however, the seven words of 16 bits could be coded to return any information so desired. In addition to being able to obtain the interrogated information, the system also has certain other capabilities which will be discussed later in this paper.

The system as it is presently designed and presently coded at each Remote Transmitter Receiver location, will interrogate the following information. Referring to Figure 1, the system can determine if there is a fire, ambulance or police alarm activated at the location; it can determine to what channel the set is tuned; it can determine if the selected Pay TV channels have been authorized by the User; it can determine what opinion the user has (in conjunction with video signal the user is asked a question, he then will make his selection by pushing one of three buttons on the Remote Transmitter Receiver, thus indicating that his opinion is NO - YES, - or NO OPINION). Also the system can determine if the TV set is on or off. In addition the Remote Transmitter Receiver unit, when connected to kilowatt hour meter, gas meter, water meter, or any other such type of device, can automatically read the meter or meters. In addition to being able to determine the specific information mentioned above, the system in conjunction with a digital computer that is located at the Central Data Terminal, can disable or enable select remote units, can determine where faults occur in the line, and determine if any specific Remote Transmitter Receiver unit has failed.

For the future of the system, with very little modification, we see the capability of not only interrogating information from the remote locations, but also the control of devices at remote locations. For example, to turn on or off heating system or air conditioning systems at a given time, we can feed the cat, wake up a person, turn on the coffee pot, or any number of things that would be desirable to have control of from a Central location on an automatic basis. In general, the system has the capability of control and interrogation of remote units be they located in a CATV system or an industrial complex. It is possible with very little modification for the system to interrogate more information if desired. For example, we can include parity bits for reliability purposes, we can measure analog signals, we can increase the number of words and bits, and if necessary, we can increase the sample rate considerably over and above the rate the system is now presently operating.

The system, as it is now operated, has the capability of controlling one thousand Remote Transmitter Receivers per group with the capability of 30 groups, that is 30,000 Remote Transmitter Receivers on each trunk line and further the capability of handling in effect any number of trunk lines. So in general we may say that the system, as designed, has the capability of handling roughly 120,000 – 180,000 Remote Transmitter Receivers. This is a round number; we can control considerably less or considerably more, if necessary, but we feel from a practical standpoint this large number is really in excess of what will be necessary on any one particular system. The speed of the system is such that to sample 1,000 Remote Transmitter Receivers, or up to 180,000 Remote Transmitter Receivers, will only require 30 seconds. What this really amounts to, is that we will sample on a simultaneous basis, more than one Remote Transmitter Receiver. It requires approximately 30 milliseconds to sample one Remote Transmitter Receiver, obtaining from that Remote Transmitter Receiver, one 16 bit word. We can readily see that if we sample more than one Remote Transmitter Receiver at any one time then, in effect, our sample rate goes up such that we still require 30 milliseconds per word sample but sampling more than one Remote Transmitter Receiver at any one time enables us to go up to the sample rate of 180,000 Remote Transmitter Receivers in 30 seconds. This can be seen by referring to Fig. 2, whereby a Central Data Terminal is controlling N number of trunk lines with up to 30 groups of Remote Transmitters on each trunk line and each group on each trunk line containing up to one thousand Remote Transmitter Receiver units. You will notice in the Fig. 2, that from the Central Data Terminal, we are indicating that we have information flow to police, fire, ambulance, power company, etc. In general, what this indicates is that from the computer located in the Central Data Terminal, on command from the computer based upon information received from the Remote Transmitter Receivers, we can automatically alert the police dept., fire dept., ambulance company; also, we can send data to the power company, water company, etc., such as to meter readings, etc.

In order to understand how this system operates, referring to Fig. 3, there is an indication of the format of the transmission of the system. The Central Data Terminal transmits interrogation information to the remote transmitter receivers with selected frequency coding in the 50 megacycle range. This information is received at each Remote Transmitter Receiver, operated on accordingly, and then transmits information back to the Central Data Terminal in the 6 to 30 megacycle region. The transmission back to the Central Data Terminal is as follows: Each group of Remote Transmitter Receivers on each trunk line is assigned a specific frequency; for example, 10 megacycles or 10.8 megacycles, 12 megacycles, 13.2 mgc., 14.7 mgc. (I might add that these frequencies have been selected such that harmonics fall in between the upper channels such that we don't end up with birdies in the video system.) Referring to Fig. 3, the operation or interrogation of any one Remote Transmitter Receiver unit is as follows: The Central Data Terminal transmits a master reset signal. This causes the remote transmitter receivers throughout the system to come to what we refer to as the initial state or reset state. We then transmit an ID Enable signal. This enables all the remote transmitters in the entire system to receive an ID code, which is 10 bits long, which is then transmitted to all of the Remote Transmitter Receivers. Each Remote Transmitter Receiver decodes these signals and, depending upon how it is decoded, in each Remote Transmitter Receiver, reacts to a particular ID code. For example, Remote Transmitter Receiver No. 1

in Group 1, and No. 1 in Group 2, and No. 1 in Group 3, etc., would all have the same ID code. When a Remote Transmitter Receiver receives it's code, it then, in effect, enables itself to say "OK I am the particular remote unit you are talking to, please send additional information." At this point, the Central Data Terminal transmits an additional signal which identifies the particular word that we would like to have interrogated from the Remote Transmitter Receivers which have received and identified themselves from the previous ID code. At this point, the particular switches, turned-on transistors, or whatever device we are interrogating, are enabled, or in effect, the information from these units, is transferred into the Remote Transmitter Receiver and at this point we then transmit 16 data shift bits from the Central Data Terminal. This causes the 16 bits of information which have been, in effect, brought into the Remote Transmitter Receiver from the combination ID code and word code and are caused to be shifted out, or in effect to be transmitted to the Central Data Terminal. The actual transmission is caused by the 16 bits turning on or off the appropriate 6 mghz oscillator, to 30 mghz oscillator, that is contained in the Remote Transmitter Receiver. This information is received at the Central Data Terminal and operated on accordingly.

In order to better understand the operation of the system, referring to Fig. 4, is a block diagram of a Remote Transmitter Receiving unit. At the remote unit, the information in the 52 mgc region and up is in effect bypassed through a by-pass filter and transmitted on to a conventional 26 channel converter which converts a particular channel, that is Ch. 2, 4, 6, 8, whatever it may be, to Ch. 12 and is transmitted to the users TV set. The 50 mgc interrogation information is brought to an RF section which is a portion of the Remote Transmitter Receiver unit. Here the interrogation information is decoded in such a manner as to cause the appropriate information to be sent either the ID register, the word code register, or the data register. As previously explained, the ID register, when it recognizes its particular code enables the output remote transmitter. In addition, the word code enables a particular set of switches or devices to which we are interested in interrogating, i.e., the alarm, channel numbers, etc. This information is transferred into the data register and then, in conjunction with the 16 shift pulses, operates on a transmitter such that the 6 to 30 mghz, whatever the transmitter frequency happens to be, is returned back down the co-ax to the Central Data Terminal.

At this point I would like to add a few comments regarding the features of the system which we feel are unique. One is in reference to the opinion polls. Located on the front panel of the remote transmitter receiver are 3 push buttons labelled No - Yes - or No Opinion. The sequence of events of operation of these switches is as follows: From the video portion of the program a viewer is asked a particular question - what is his opinion about this or that - at this time the Central Data Terminal transmits a particular code to each Remote Transmitter Receiver which, in effect causes the opinion circuits in all Remote Transmitter Receivers to be reset. The purpose of this is such that as each Remote Transmitter Receiver is interrogated, it will be necessary for someone to have pushed the opinion button, just prior to the time that the opinion poll is taken. The purpose behind this is to not obtain an opinion from every set but only those that are properly activated by one of the users. Following this sequence of events a little further, the time has just occurred where we have sent the reset information to each opinion circuit in each Remote Transmitter Receiver; the viewer has been asked the question, and at this time let's say for example he pushes the Yes Opinion button. Assuming a moment later, he decides No, I really meant No, then at that time he pushes the No button, this will cause the internal circuitry to, in effect, reset his Yes Opinion and to set his No Opinion, hence the person who has given his opinion has a short period of time to change his mind if he so desires. Also I would like to emphasize the condition that resetting this opinion circuit enables us only to obtain the opinion from people who actually activated the opinion circuits and not obtain an opinion that was, in effect, set by a child two hours before the program occurred. Referring again to Fig. 4, there is a certain portion of the remote transmitter receiver which is marked test. The purpose of this portion of the system is to enable the Central Data Terminal to send out certain selected information to each remote transmitter whereby we may in one condition disable every remote transmitter receiver throughout the system; we can, secondly, enable every Remote Transmitter Receiver on the system, or we can, by transmitting an identification code, along with a separate code, selectively enable or disable each respective remote transmitter unit. I will not get into the details of this but, from a maintenance point of view, this can be extremely helpful in operating on the system, if and when failures occur.

The Remote Transmitter Receiver units are so designed that the maintenance personnel, if a remote transmitter receiver fails, can in a matter of a very few moments change out a Remote Transmitter Receiver and have a new one in operation. To accomplish this simply required one to disconnect the coax coming into the unit from the CATV system, to disconnect the cable running to the antenna input on the TV set, and the connectors going to the remote alarm units, water meter, etc. The maintenance personnel simply reverses this process and has to do one other item, that is to place three wires that are in the remote transmitter receiver digital section to certain pins which, in effect, identifies that particular remote transmitter receiver with a particular identification code. Now, in most systems where it is necessary to, in effect, have an identification code, requires the soldering or connecting of as high as 48 to 64 wires in the proper location. We have devised a system here whereby only three wires need to be soldered in place. Further, the system is simple enough that anybody that can subtract can accomplish this very readily. I will not get into the details of this at the moment but I would like to emphasize that the system is designed to accommodate not only the user but to facilitate maintenance, of the system. In regard to the maintenance and repair of the systems, in reference to the Remote Transmitter Receiver unit, the console at the Central Data Terminal is so designed that a Remote Transmitter Receiver unit that has failed can be brought into the console, plugged in and it can be immediately determined if the RF section or the digital section of the remote transmitter receiver has failed. Depending upon which area of the unit has failed, there is a cook-book routine which can immediately isolate which portion of the system has failed and the repair technician can take the appropriate action at that time.

Referring to Fig. 5, which is a block diagram of the Central Data Terminal, the Central Data Terminal consists of really three major elements. 1. The Central Data Processor, 2. a Hard Wire Controller/Display system and the RF system, and of course, the normal

TV head-end system. There has been extreme care put forth into the design of the Central Data Terminal in order to obtain maximum use of equipment, ease of maintenance, ease of operation, etc.

The system, under normal operation, would be controlled from the Central Data Processing unit as follows:
The Central Data Processer tells the Hard Wire Controller, I would like to have the information from certain remote transmitter units whose ID code is such and such and I would like to receive words 1, 2, 3, 4 or whatever it may be. The Hard Wire Controller at this point takes over, and with this information, actuates the 50 mghz RF transmitter which sends out the interrogation information to the remote transmitter receiver. The information is returned then from the appropriate Remote Transmitter Receiver units and is brought into the display portion of the system. At this time the Hard Wire Controller tells the computer, I have the information - come get it. At this point then the Central Data Processor will bring in the 16 bit words from each remote transmitter receiver which was interrogated and then operate on this particular information as it so programmed.

Now, I would like to emphasize that the system was designed to operate normally on this basis, such that the Central Data Processor then has the maximum amount of free time to do other functions, such as bookkeeping, statistical analysis, etc.

However, it is possible to operate under two other modes of operation. The second is what we call the direct mode. In this type of operation, the Central Data Processor bypasses the Hard Wire Controller and directly controls the 50 mghz RF transmitter system, and can control the head-end system and the display system directly. Under these conditions, the Central Data Processor will then cause the 50 mgc RF transmitter to send out the interrogation pulses, the information will be received back and the Central Data Processor then obtains the information from the Display portion of the system. This design is to enable operation of the system if for some reason the Hard Wire Controller were to fail.

The third mode of operation of the system is a semi-manual mode. In this mode of operation an operator can take entire control of the system by going to the console, operating certain switches, which will indicate to the system that he desires to interrogate a particular Remote Transmitter Receiver and he desires certain information to be returned from that Remote Transmitter Receiver. This semi-automatic mode was designed into the system such that, in effect, the system could go off-line from the computer; monitor, for example, the alarm conditions on a continuous basis and leave the Central Data Processor free for other purposes so desired. In addition it gives a back-up if the Central Data Processor were to fail.

By using a Central Data Processor, i.e., a digital computer in the system, it is possible to do any number of things with the data received. In effect, we open up a pandora's box as far as capabilities. For example, the Central Data Processor can;

1. detect when an alarm condition occurs, and via an automatic system call the fire dept., police dept., or ambulance company and alert them to the fact that there is a fire, burglary, or whatever it may be at a specific location. In addition,

in the case of a fire, some additional information may be transmitted to the fire department. For example, we may alert the fire department that the fire is at a Paint Factory, an Old Age Home, or a Hospital and is a particularly critical situation. Or, for example, it may alert the police dept. that there is a burglary occurring at a jewelry store which would require a little more haste than if it were a warehouse containing newspaper.

Further, with the use of the Central Data Processor, we can determine any number of different types of statistical information. For example, in reference to opinion polls, we can determine by area who had what opinion. For example, does the south side of town have a different opinion than that of the east, north, west, etc. Since we are able to determine on a real time basis to what channel each set is tuned and whether the set is on or off it is easy to determine a TV rating type poll. For example, how many people are watching program A, how many are watching program B. I might add at this point, though we can't guarantee that certain people are watching the TV set but we can determine the TV set is turned on and tuned to a specific channel. It is quite feasible that by knowing this, and by use of the opinion poll portion of the system, we could determine more definite information. We could transmit an opinion poll asking people to respond by asking people to push the yes button if two or more adults are watching the program or push the no button if children under 12 are watching the program, etc. In reference to Pay TV, since we can determine who is turned to what channel on a real time basis, and that the Pay TV authorization switch is turned on we can automatically control Pay TV as far as billing. If customer 741 in Group 1 turns on his switch and turns to Ch 13, which is a Pay TV channel at 10:30 in the morning, then we will know within 30 seconds of when he turns his set on and we will know within 30 seconds of when he authorized and tuned to the Pay TV channel, and likewise we will know within 30 seconds of when he changed to a different channel and can, via the computer, automatically bill him for that particular Pay TV portion of the program.

In addition, with the ability to read the kilowatt-hour meter, water meters, etc., and in conjunction with the digital computer, it is possible for us to read the meters, simply store the raw date, transmit this data to the power company, water company, etc. or to calculate the bills, punch these out on punch cards, similar to what all of us receive in the mail every month. In effect, handle this portion of the reading of the meters and automatic billing in any way that the power company, water company, etc. so desires.

In general, and briefly speaking, it is possible, using the Central Data Processor, to operate on information in most any way we so desire. To bring this information out on telephone lines to remote locations, to another computer, or we can bring information out on punch tape, type it out on a teletype, we can put it out on disc memory, or mag tape, or punch cards. In effect, almost any manner or method that is so desired by the customer or by the operator, whichever the case may be.

I might further add that by programming the computer, it will act as a very powerful maintenance tool. If we interrogate certain Remote Transmitter Receivers, and we do not get any information back from a selected group, by proper programming we can readily determine that the probability is we have a line failure at a given point.

Likewise, it is true that if we interrogate a certain Remote Transmitter Receiver and have been unsuccessful in receiving any return signals from that unit, it is fairly obvious that that Remote Transmitter Receiver is malfunctioning. We can pinpoint this, and print out on a teletype and say to a repair man that the Remote Transmitter Receiver at 1701 Main Street has failed, or whatever the case may be. Further down the line we see the possibility and probability of placing Remote Transmitter Receivers along the coax system and monitoring such things as the AGC, the amplifier's gain, etc. Monitoring these measurements to determine if they fall within certain limits or detect changes such that if we see any type of failure we can alert the repair people, have them change out the failing amplifier, etc., before it actually fails.

Regarding the economics of the system, it is our opinion that with the extensive capability of this system, we feel that the economics are such that a good profit can be received by the operator in using the TOCOM system. For example, that the public is very ready for an effective, automatic, burglar alarm - fire alarm type system, because, in effect, we can monitor everybodys house that is on the system every 30 seconds and determine if they have a fire, burglary, etc. The TOCOM system is designed to readily accept the appropriate output signals from most fire alarms, burglar alarms, etc., or we can provide the system.

We feel that the ability to obtain opinions is an excellent revenue source from two points of view. 1. There are large quantities of money spent daily obtaining opinions from people - what kind of soap do you use, etc. Our system can easily be expanded - or used as it is to obtain such information. We can obtain this information, operate on it, and bring it out in a useable form in a matter of minutes where by in most systems the information is days, weeks and in some cases months old before it is ever reduced to a useable form. In regard to the opinion poll, we feel that this can be used effectively in the psychology of people in the effort to put the Remote Transmitter Receivers in every home. For example, if housewife A watches an opinion program every day at 10:30 and she is giving her opinions, you can bet that housewife B next door is also going to have to have a Remote Transmitter Receiver unit in order for her to give her opinion as is housewife A.

From the point of view of Pay TV, we feel that this is the first system that is not only economical but useable in regards to an effective pay TV system. Keeping in mind that we know on a real time basis, who is watching what and when. Further knowing who is watching what and when, it gives us for the first time an effective TV rating service. This portion of the system alone should, properly used, bring in considerable revenue to the operator of a TOCOM system.

I believe that it is essential that it be kept in mind that the TOCOM system, although it is presently designed and built to monitor specific functions, does have the capability of interrogating literally any information at remote points and transmitting this information back to a Central Data Terminal. We have given considerable thought to the various uses of this system, as applied to the CATV business, however, I feel sure that as time goes on, other uses will be brought to our attention and I am sure, as the system is designed, it can be easily modified to accommodate these needs.

I would like to further add that the TOCOM system, in addition to use in the CATV industry has a large potential in other areas, such as automation of oil fields, pipe lines, utilities, power plants, water plants, factories; any place where it requires the control of elements at a remote point from a control console. The TOCOM system has the advantage over presently used systems, if for no other reason than the ability to run one coax cable in lieu of running literally hundreds of twisted pair of telephone cables as is now the common situation.

In reference to the cost of the system, we have not at this point determined hard-set costs for the Remote Transmitter Receiver or Central Data Terminal, etc. However, we feel that the Remote Transmitter Receivers, which do include the converters, will cost in the neighborhood of $100.00 each (approximately) and will vary from that value up or down, depending on quantities. In reference to the cost of the Central Data Terminal, this cost can range anywhere from probably $80,000 and up, depending on the requirements, and in general will be dictated a great deal by the number of people to be controlled or interrogated and to the amount of programming necessary to program the processor in order to accomplish the functions desired by the operator.

SYSTEM CAPABILITY

GENERAL: INTERROGATE SEVEN SIXTEEN BIT WORDS FROM EVERY REMOTE UNIT.

PRESENT SYSTEM DETERMINES:

1. FIRE
2. AMBULANCE
3. POLICE
4. CHANNEL NUMBER
5. PAY TV AUTHORIZED
6. OPINION CONTROL WITH RESET CONDITION
7. SET ON/OFF
8. KW-HOUR METER READING
9. GAS METER READING
10. WATER METER READING
11. DISABLE OR ENABLE SELECTED REMOTE UNITS
12. FAULT ISOLATION

FUTURE:

1. CONTROL OF DEVICES AT EACH REMOTE LOCATION
2. MONITORING OF LINE CONDITION
3. IN GENERAL - CONTROL OR INTERROGATION OF REMOTE LOCATIONS

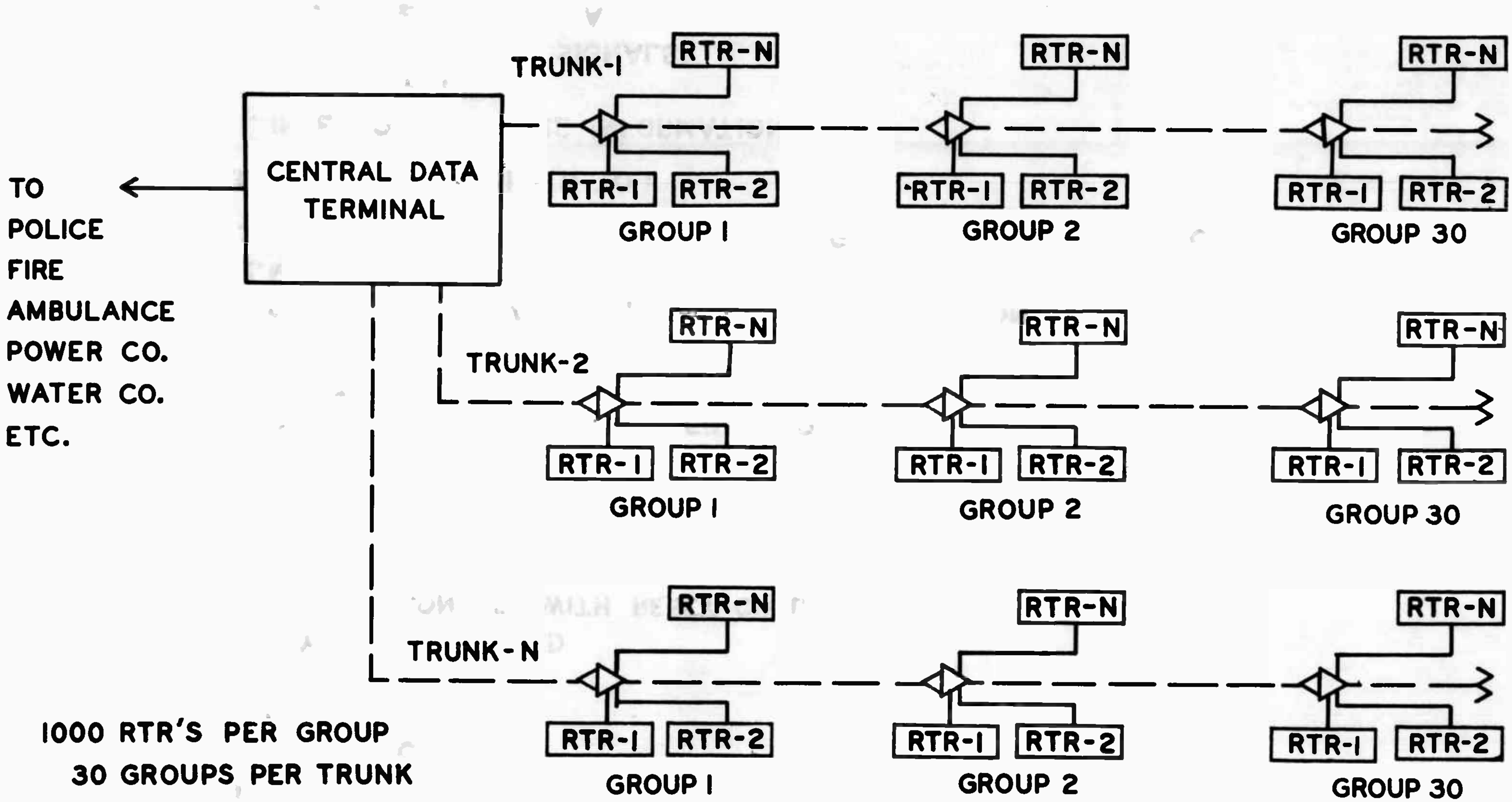
SYSTEM CAN EASILY BE MODIFIED TO:

1. INTERROGATE MORE INFORMATION
2. INCLUDE PARITY
3. MEASURE ANALOG SIGNALS
4. INCREASE SAMPLE RATE

FIGURE 1

TOCOM

SYSTEM BLOCK DIAGRAM

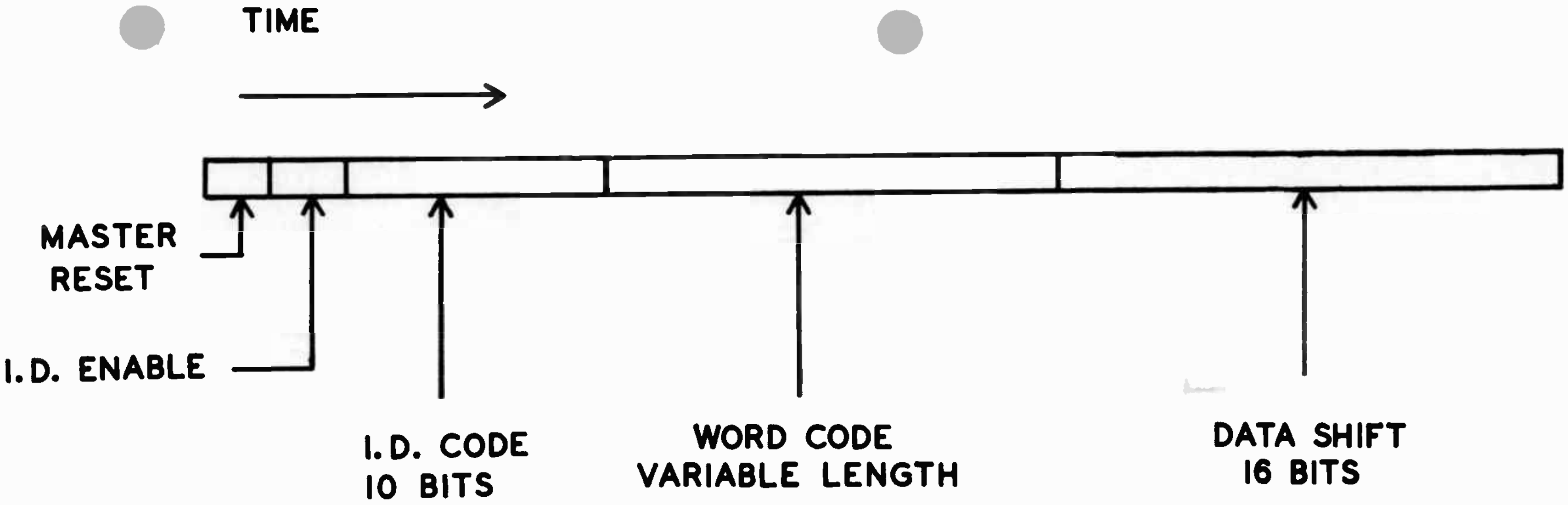


1000 RTR'S PER GROUP
30 GROUPS PER TRUNK
N TRUNKS

TOTAL RTR CAPACITY = 180,000

TOTAL INTERROGATION TIME 30 SECS.

FIGURE 2



SIGNAL FORMAT

FIGURE 3

TOCOM

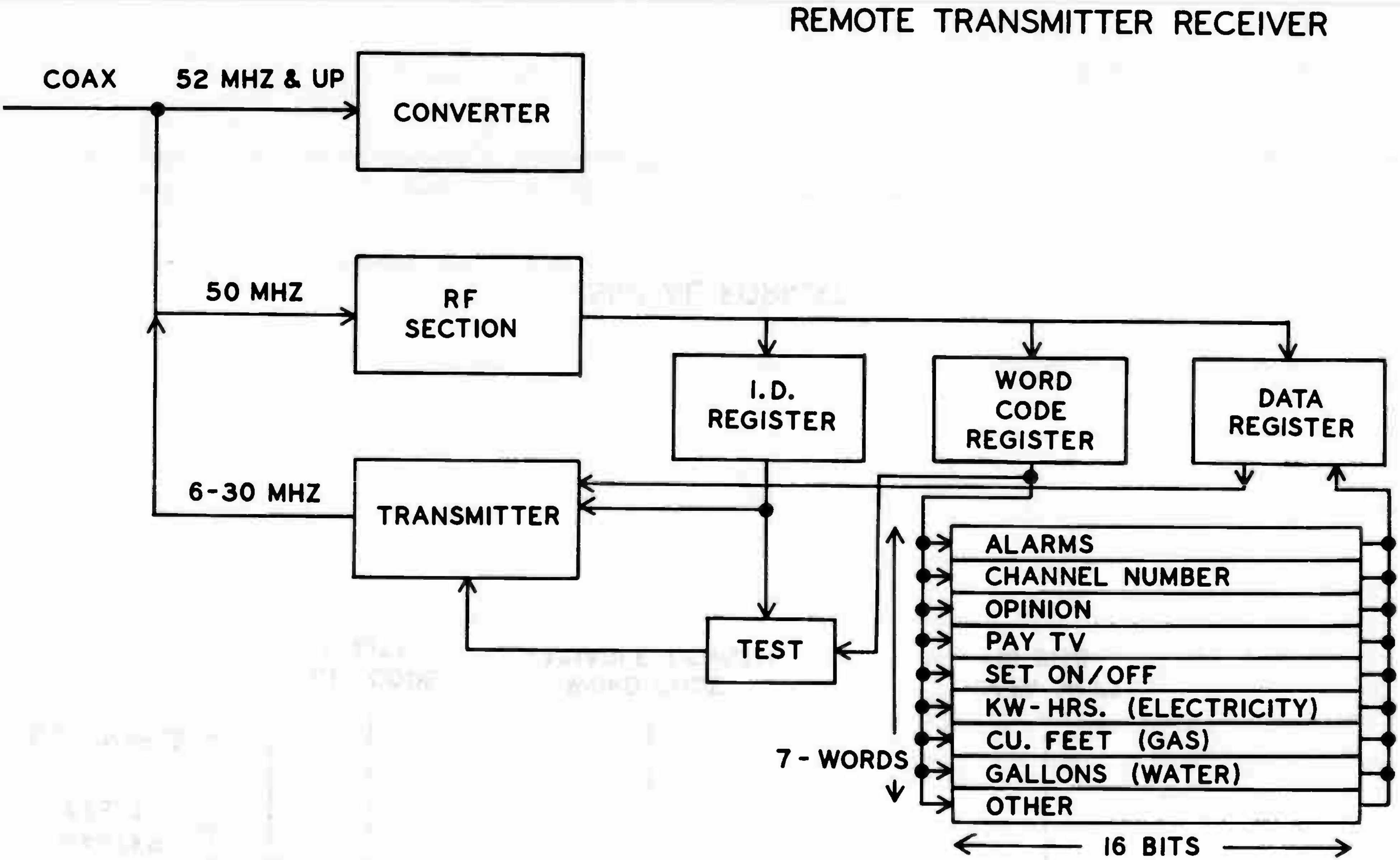


FIGURE 4

TOCOM

528

CENTRAL DATA TERMINAL

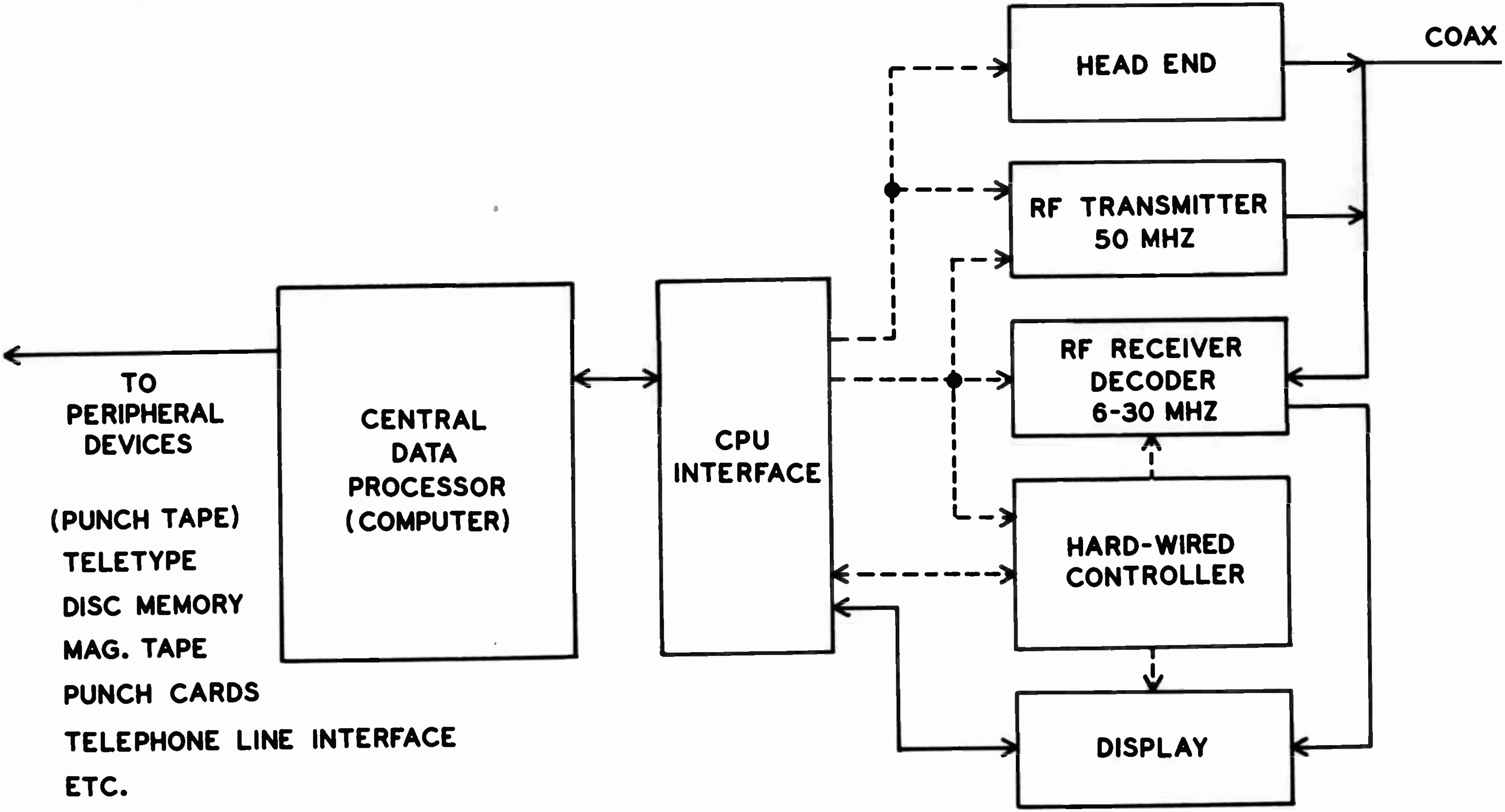


FIGURE 5

TOCOM

A PRACTICAL APPROACH TO BI-DIRECTIONAL SYSTEMS

by

Perry L. Schwartz

MONMOUTH COMMUNICATIONS SYSTEMS

Presented at the
1971 NCTA Convention
Washington,D.C.

A PRACTICAL APPROACH TO BI-DIRECTIONAL SYSTEMS

by

Perry L. Schwartz

INTRODUCTION

In recent years there has been considerable discussion of Bi-Directional CATV systems. Most of these disucssions have directed themselves to a particular approach and spent most of the time innumerating the information and services that could be carried by the system.

I have spent considerable time in analyzing the various methods of providing Bi-Directional Transmission. The two techniques which become obvious are Dual Cable and Single Cable with diplexing filters. The techniques are not new or revolutionary, but simply show that today's system owner can build a good quality two-way system at minimal cost.

REVIEW OF VARIOUS TECHNIQUES

1. Closed Loop

In a closed loop system the system feeds out from Head End and physically returns to it in one continuous path (fig.1). This usually preclueds that the feeder system is not Bi-Directional. Needless to say this technique is extremely costly and sometimes impossible, due to available continuity.

2. Single Cable

A single cable technique, which I will discuss in more detail later, requires diplexing filters and sub-band amplifiers (fig.2). When using standard diplexing filters considerable care is required in design because a cascade of any length (10 or more) will cause bandwidth shrinkage.

3. Converters

This technique usually requires large and costly installation and the converter itself must be mounted within an outdoor enclosure. In addition to this, this system will usually utilize a single cable or dual cable technique for signal transmission. In some cases a multitude of cable are required with large switching centers and specialized converters at the home.

4. Dual Cable

A Dual Cable system is basically two separate systems connected only at the Head End and at the subscriber's home. This describes a total Dual Cable system; however, as I will discuss later, by carefully selecting feeders the Dual Cable technique becomes a versatile Bi-Directional system.

BI-DIRECTIONAL TRUNK:

Single Trunk Cable: It appears at first look that the single cable trunk Bi-Directional system would be to most, desirable from an operator's point of view. This is probably the case for existing single cable CATV systems. In order to upgrade the existing single cable system, a diplexing filter package can be used, which enables a system operator to make this conversion at a minimal expense. It should be noted however, that little is known at this point about the differential time delay of a single cable Bi-Directional system. In addition to the time delay question, the added noise of the sub-band amplifiers in the return loop must be added to the total signal-to-noise ratio of the Uni-Directional system.

Single Cable System - Diplexing Filters: By means of the diplexing filters and sub-band amplifiers, you can convert your existing CATV system to a Bi-Directional Trunk system. The package (fig.3) utilizes low loss diplexing devices, and a sub-band amplifier. The sub-band amplifiers utilize an automatic gain control to compensate for temperature changes in the coaxial cable below 54MHz.

DUAL TRUNK BI-DIRECTIONAL SYSTEMS:

The Dual Trunk method of providing a Bi-Directional transmission system is at this point in time, the most desirable. The features of a dual cable Bi-Directional system are:

1. Trunk Integrity - Adding devices to any trunk line can only degrade picture quality and add noise.
2. Band-Width (Channel Capacity) - When using a two cable system, it would be possible to carry as many channels in the forward direction as in the reverse direction.

Dual Cable : When constructing a new system using dual trunk cable the most desirable method would be to use a standard broadband push-pull 54-300 MHz amplifier in the forward direction, and an amplifier capable of 15 to 90 MHz for the return loop (fig. 4). It should be noted that return amplifiers are not needed at every location if the cable is the same in both forward and return loops. It can be shown that with careful design a return system using 0.500 cable and 90 MHz amplifiers on the return trunk is not very much more expensive than the basic uni-directional system. It should be noted that the return amplifier could be replaced by a trunk amplifier (54 - 300 MHz) and provide full return channel capacity. Alternately, the return amplifier could be a 6 - 90 MHz amplifier and provide added return channels below 54 MHz.

A unique feature of a system of this type is that the frequency range of 15 - 40 MHz can be used for return signals from selected feeders while the band from 54 - 90 MHz can be used for return signals originating along the trunk (fig.5).

BI-DIRECTIONAL FEEDER SYSTEMS

All of the techniques described above can utilize the standard line extender for Uni-Directional feeder systems. Under some conditions, it may be necessary to provide a return signal from a feeder leg. This return path can be provided by means of a diplexing filter and sub-band amplifier (fig.6).

This system utilizes a standard line extender coupled with diplexing filters and a return sub-band (15 -40 MHz) amplifier. It should be noted that sub-band amplifiers are not needed at every station. The reason diplexing filters can be used so easily at these stations is that in a feeder system, the cascade does not exceed a maximum of 4.

In a Bi-Directional Feeder system the available bandwidth would allow for both video transmission and data; however, it does not appear to be feasible at this time to transmit video through all the passive devices because of the amount of input energy required. (fig.6) If a picture were to be transmitted from the home on a time-shared basis signals of the order of +60 dbmv would be required. At the present time I know of no RF modulator in the band below 40 MHz that can produce this type of output at a cost attractive to this application. Therefore, if only data is transmitted from the home, considerably less bandwidth is required, and much looser specifications can be tolerated on the return amplifier and filters.

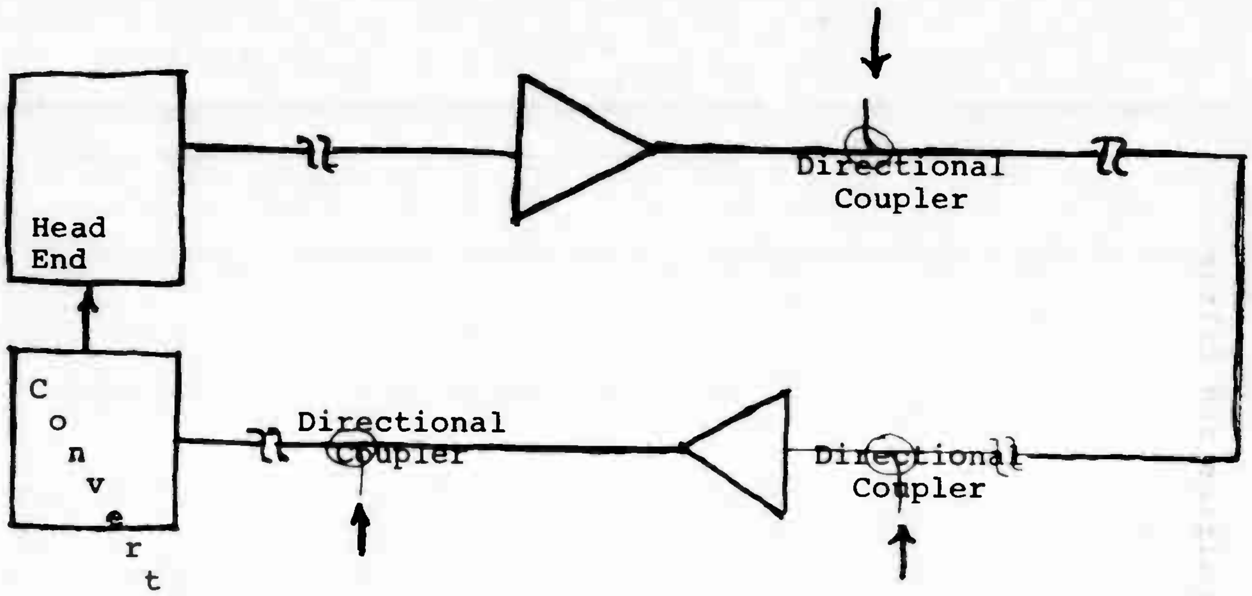


Figure 1 Closed Loop System

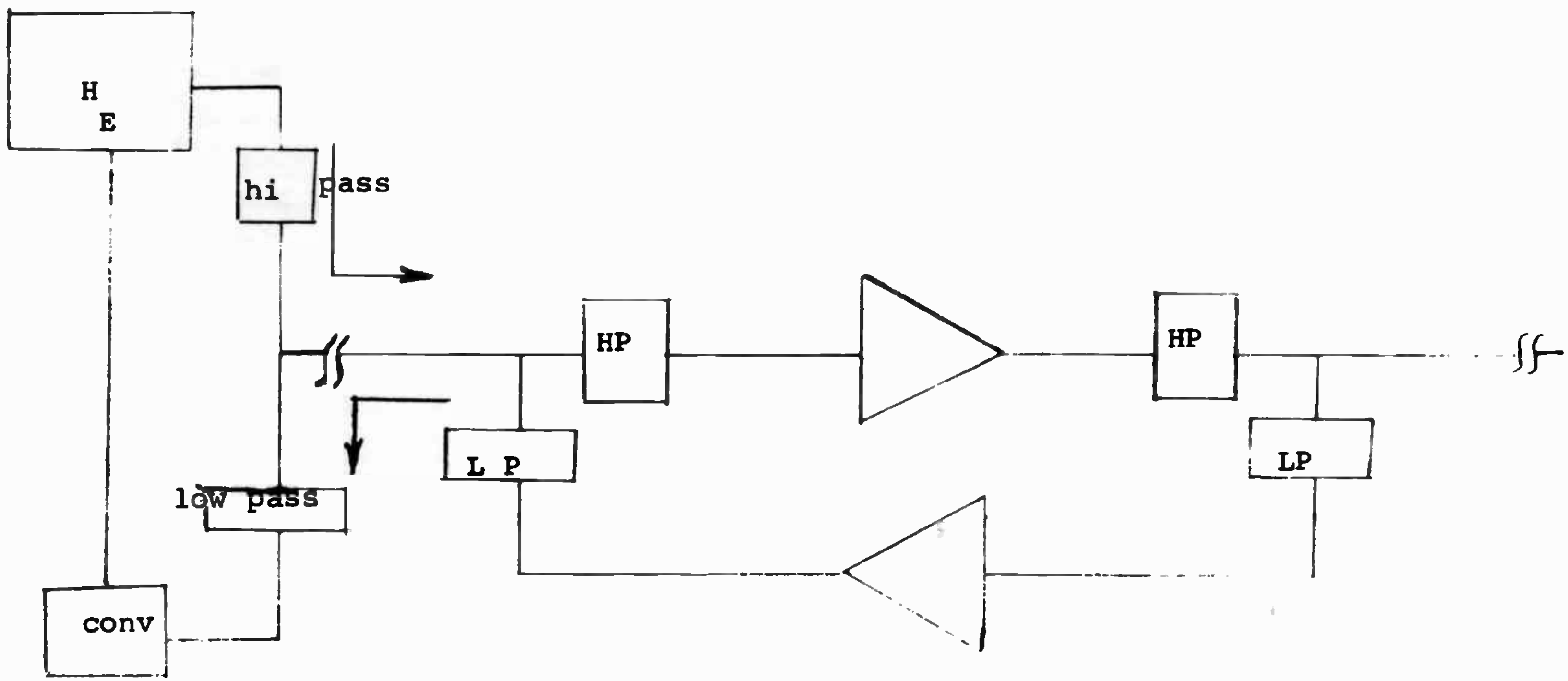


Figure 2 Single Cable System using standard diplexing filters

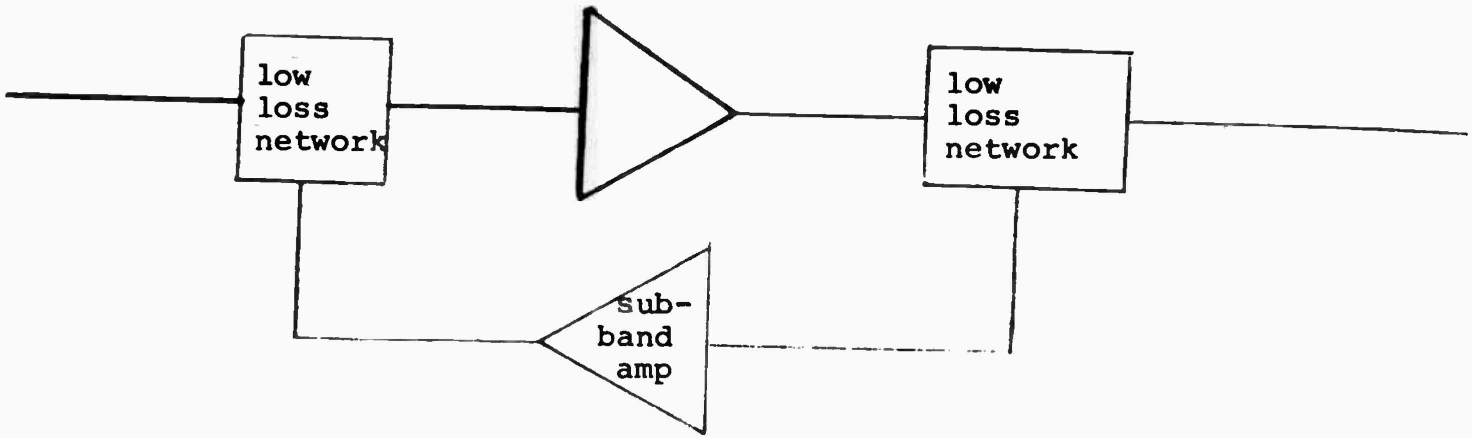


Figure 3 Single Cable System using loss filter networks

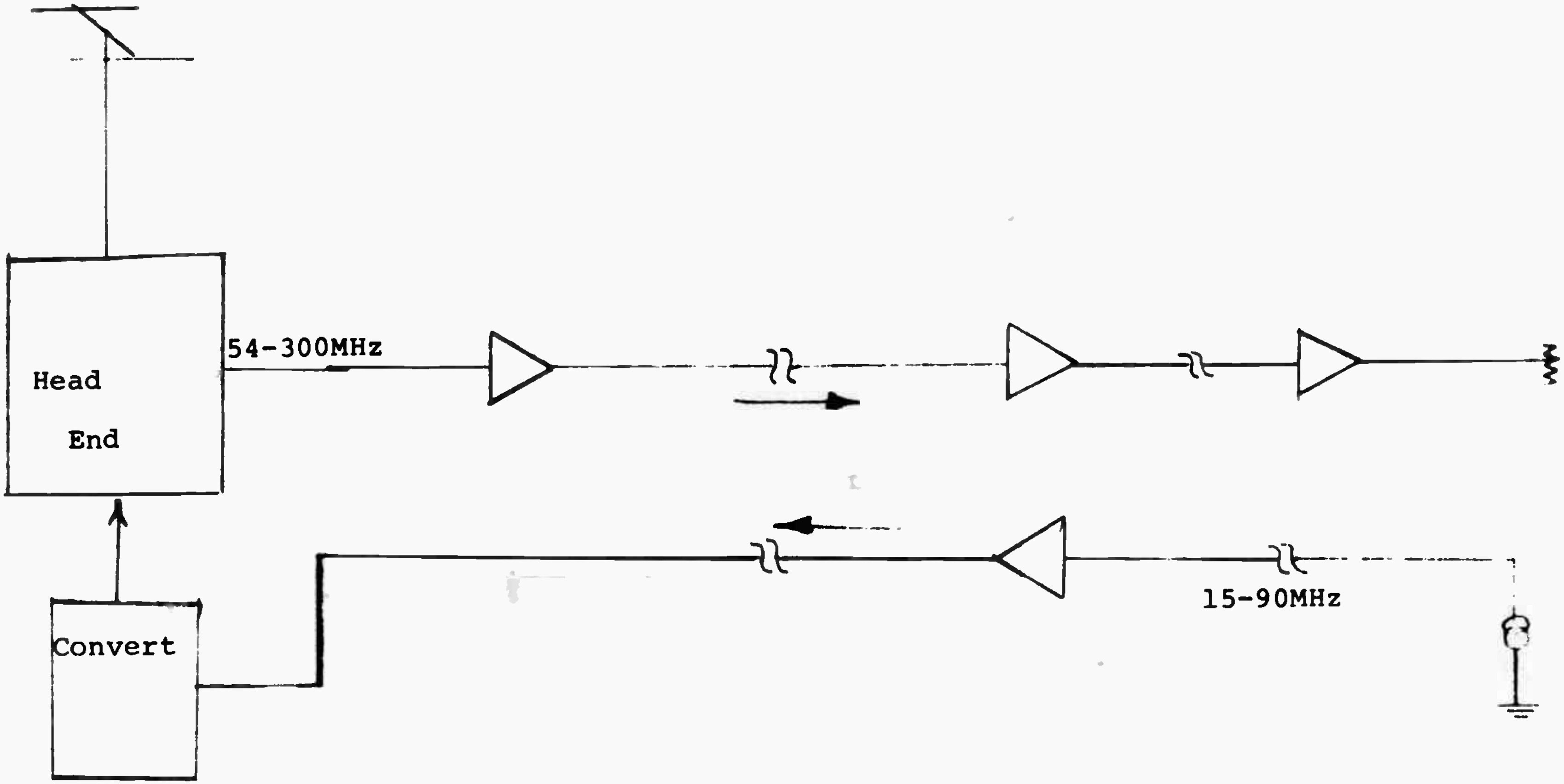
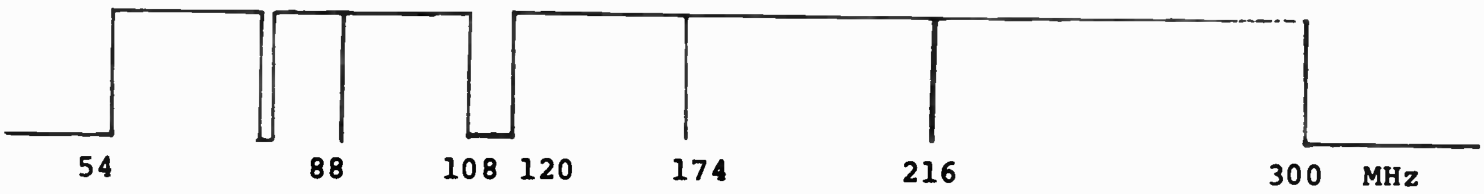
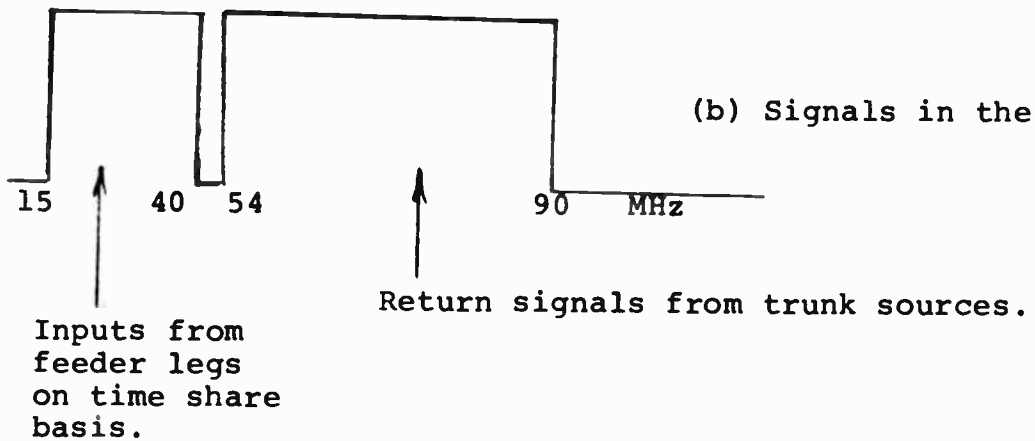


Figure 4 Dual Cable Bi-Directional System



(a) Signals in the forward direction



(b) Signals in the return direction

Figure 5 Band Pass of Dual Cable Bi-Directional System

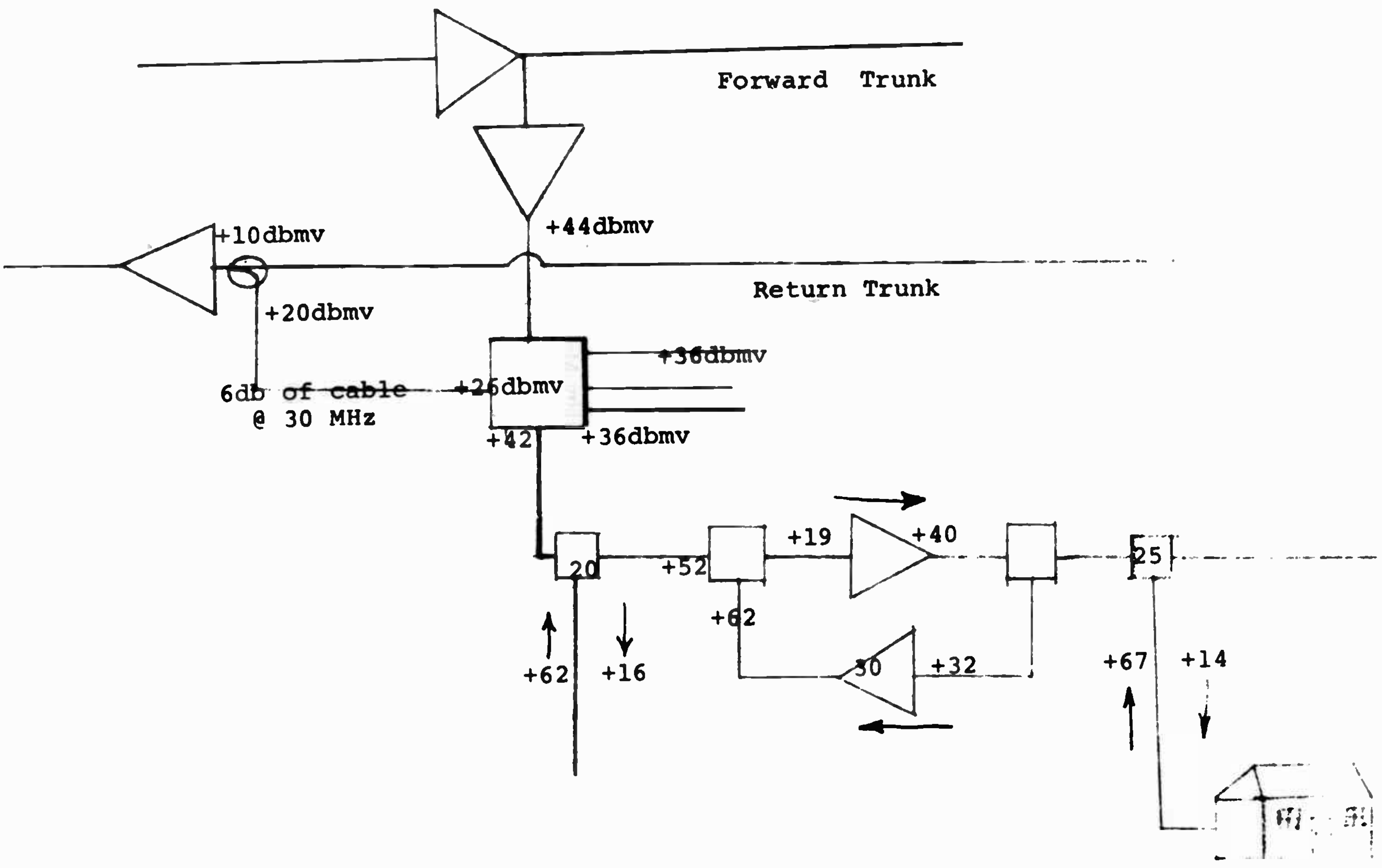


Figure 6 Bi- Directional Feeder System

FUTURE PROMOTION OF THE CABLE TV SYSTEM APPLICATIONS

Hitoshi Honda, Naoki Homma, Yoshiyuki Yamabe and Toshio Shinbo

OKI Electric Industry Co., Ltd.

Tokyo, Japan

SUMMARY

The cable TV is expected to play an important role in the near future as a major medium of live data transmission in the nation-wide or a confined "information society".

In order to meet such tomorrow's demand, the cable TV total system which has four capacity and their applications as follows, was developed.

1) Multi-channel Transmission: Full channel of 4FM, 12TV and etc.
2) Various Purpose Information Service :
   Local origination, Video transmission by light emitting Device, Video Responce System, Electronic newspaper by Facsimile and etc.
3) Wide Aerial Distribution :
   Multi-cascaded trunk line amplifiers by Metropolitan Cable Television standard.
4) Bi-Directional Communication :
   ITV Telephone using lower sub-channel.

INTRODUCTION

In Japan, small community antenna TV systems have been existing from about 10 years ago. NHK started to retransmit TV signals by means of UHF band wireless TV repeating system and VHF band cable TV system for helping poor TV reception in isolated areas.

Now in large cities, they can't receive clear color pictures because of gohst phenomena due to higher buildings increasing rapidly.

At first, Tokyo Cable Vision Foundation built the technical standard of Metropolitan Cable Television (MCT) system and equipments, and then they are beginning construction in large cities, such as Tokyo and Osaka.

In this process, near future, they are planning of an Information society by making cable TV system to be a transmission media.

This paper discribes the possibility of realizing simultaneously, the following four items with a CATV system :

1) Multi-channel transmission
2) Various purpose information services
3) Wide aerial distribution
4) Bi-directional communication

The system and its comprising equipment are based on the MCT standard and that of NCTA as well.

Various applications, such as optical transmission link using light emitting devices, electronic newspaper transmission by a high speed facsimile and bi-directional communication using ITV telephone, were tried with the system.

CONSTRUCTION OF AN EXPERIMENTAL TOTAL CABLE TV SYSTEM

Fig. 1 shows the experimental system composition where the four transmission services mentioned above are realized. This experiment was carried out at Shibaura area with high field intensity of Tokyo Metropolis. TV and FM signals received through VHF and UHF broad band log-periodic antennas are brought to the receiving terminal equipment, and then they are processed in bandwidth or converted to aother channel so that unoccupied adjacent channels can be used.

Local originating programs, facsimile, data communication, ITV telephone, pilot carrier, etc. are delivered on unoccupied channels or vacant frequency band, mixed with retransmitted TV signals, and then they are sent on to the distribution networks.

Those multiplex signals go through each ten of trunk cables and trunk amplifiers, and then they are dropped into the terminal equipment such as TV receivers, radio receivers along the distribution networks.

Bi-directional communication services take place between the head end and third trunk amplifier, and one channel of color ITV telephone and one pilot signal are transmitted toward reverse direction, using a band for reverse transmission services.

MULTI-CHANNEL TRANSMISSION

First requirement of cable TV subscribers will be "more channels". To satisfy the desire, the head end equipment are built so that each signal can be processed at a time and the total twenty signals are transmitted. The head end equipment are consisting of rack mounted type receivers and modulators, as shown in Photo. 1. The forward direction band (70 – 250 MHz) has eleven channels of color TV (seven of retransmission, one of U-V conversion and three of local origination), one of facsimile, four FM (two of retransmission and two of local origination and two of pilot carrier used for trunk amplifier's ALC and ATC.

The transmission frequency allocation and head end output spectrum are shown in Fig. 2 and Photo. 3.

The reverse direction band (20 – 60 MHz) having one channel of TV and one of pilot carrier, is shown in Photo. 5. Thus, number of total transmission signals of both forward and reverse directions comes up to twenty. In order to realize this multi-channel transmission, the unique techniques of RF and IF BPF concept are applied for head end equipments, utilizing, signal processors for retransmission or channel conversion.

As the video signal is interfered with the audio carrier of adjacent down channel, the received signal is separated into video and audio in IF band (19.5 MHz), and the audio level is processed to be about 15 dB down compared with video carrier at RF output. In addition, input and output of the signal processor are connected to each helical resonated type BPF, which further improves the passband characteristics. Consequently, the total spurious level is attenuated to -70 dB or less compared with transmission signals.

In consideration of the reliability, the hybrid IC's developed by OKI are applied actively. In VHF band, MN series tantalum thin-film hybrid IC Amplifiers are used; in UHF band, microwave strip line circuits are applied for the wide band receiving mixer. Head end equipments are standardized for optimum design. An UHF band receiving unit of signal processor is shown in Photo 2.

VARIOUS PURPOSE INFORMATION SERVICES

In the second place, it must be considered about contents of multi-channel transmission. With the image of future cable television system in mind, an experimental transmission system is developed such as light telecommunication, electronic news paper, video response and ITV telephone system.

Symplified optical transmission

In the experiments, imaginating the case where the cables can't be laid between the head end and the studio separated by a river or buildings, a symbplified optical transmission system is applied as an example of wireless link system. As illustrated in Fig. 3, light emitting and photo diodes are used. The video signals are transmitted from the studio to the head end by pulse code-light modulation and lens convergent technique.

Video response and data transmission

In the future, subscriber's TV set will display many kinds of data when home terminals are linked to a computer through a cable TV system.

In this cable TV system experiments, subscriber's CRT displays the results of various questions and calculation from the key board of OKI-SCOPE, which is capable of taking memories out of OKITAC 4300 mini computer.

In addition, simultaneous directives are accomplished by using the data communication equipment.

As the results, it is confirmed that various traffic informations, shopping servics, etc. can be realized.

CATV—Facsimile transmission

Cable TV systems will also help in coping with the increasing labour cost in mail delivery system and also in satisfying the needs for quick delivery of news paper and mail. In this connection, it is considered that home facsimile systems are applied for cable TV distribution network.

In this experiments. 7th channel is used for facsimile transmission. The 7th channel is not available for normal TV transmission in Tokyo area because the 7th and 8th channel are overlapping partly in their channel allocations. Therefore the 7th channel is used for the transmission of high speed facsimile newspaper via Cable TV System. Modulate-Demodulation configuration of facsimile is illustrated in Fig. 5. Output spectrums of head end and that of 190 MHz Modulated signals are shown in Photo 6 & 7. The spectrum which is received after ten cascaded trunk amplifiers are shown in Photo. 8. Fig. 6 is a sample of a facsimile news paper received at home terminal (1/4 of actual size).

WIDE AERIAL DISTRIBUTION

From the stand point of cable TV enterprise, it is natural that they want the system to be extended and number of a subscribers to be increased. The trunk amplifiers is developed, which have functions of bi-directional and multi-channel transmission, based on MCT specifications.

In this experimental system, ten trunk amplifiers and ten drums of cable TC-10C TC-10CAF (Fujikura wire), are used. Coaxial cables are constructed by foamed polyethylen aluminum pipe. Fig. 7 shows the characteristics of distortion (2nd &3rd harmonic level of 90 MHz) after ten cascading amplifiers. Frequency allocation of Japan is different from that of U.S. In Japan the frequency range of higher TV channels twice as high the range of lower TV channels. The sum or differente beats between lower and higher TV channels generated in an amplifier fall in related TV channels. For this reason, the second harmonic distortion characteristics must be particularly improved.

Photo. 9 & 10 show the developed trunk amplifier. The latter is of underground type and techniques of undersea seismograph are applied in it, and so has complete waterproof construction. The system design chart is shown in Fig. 8. The trunk amplifiers have more than several tens of cascadability. Fig. 11 shows inter and cross modulation characteristics of trunk and bridging amplifiers.

Bi-DIRECTIONAL COMMUNICATION

In order to make the cable TV system of today applicable also for the bi-directional communication services of tomorrow, each unit of repeater equipment such as amplifier and filter units are optionized as shown in Photo 9 (b). This concept is based on the system design philosophy that the reverse direction transmission is realizable from the subscriber's terminals as illustrated in Fig. 9. Fig. 10 shows the characteristics of the dividing filter used for bi-directional truank amplifier.

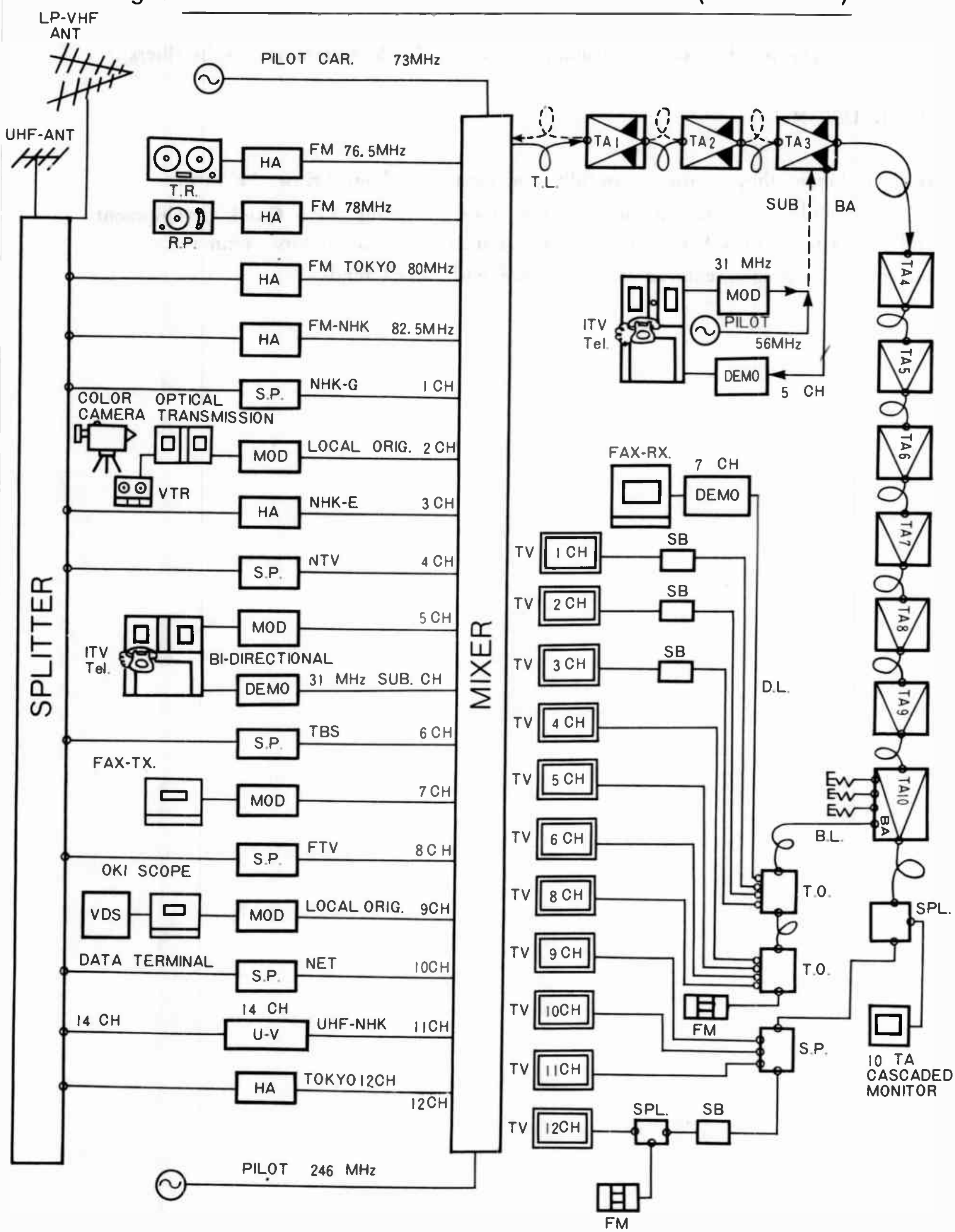
It is required that the envelope delay value be as small as possible (i.e. below 2.5 ns per channel), so that the phenomena of color shift may not occure due to multiple cascade. The echo loss occured in the loop of bi-directional amplifier is higher than 50 dB in passband, and 30 dB in the boundary area of both bands of forward and reverse direction.

In this experimental system, bi-directional services are demonstrated within three repeating section and color TV telephone shown in Photo 12 is used for end equipment. Photo 11 shows the distribution equipment such as tapoff and safety box (Border line of responsibility between CATV system and subscribers).

CONCLUSION

Now in Japan, they consider carefully and earnestly about "How the future CATV should be. They are now in the cradle including VP. Quick development and enlargement of software and video terminals for total picture communication systems are strongly required in accordance with social tends.

Fig. 1 CABLE TV SYSTEM EXPERIMENT (IN TOKYO)



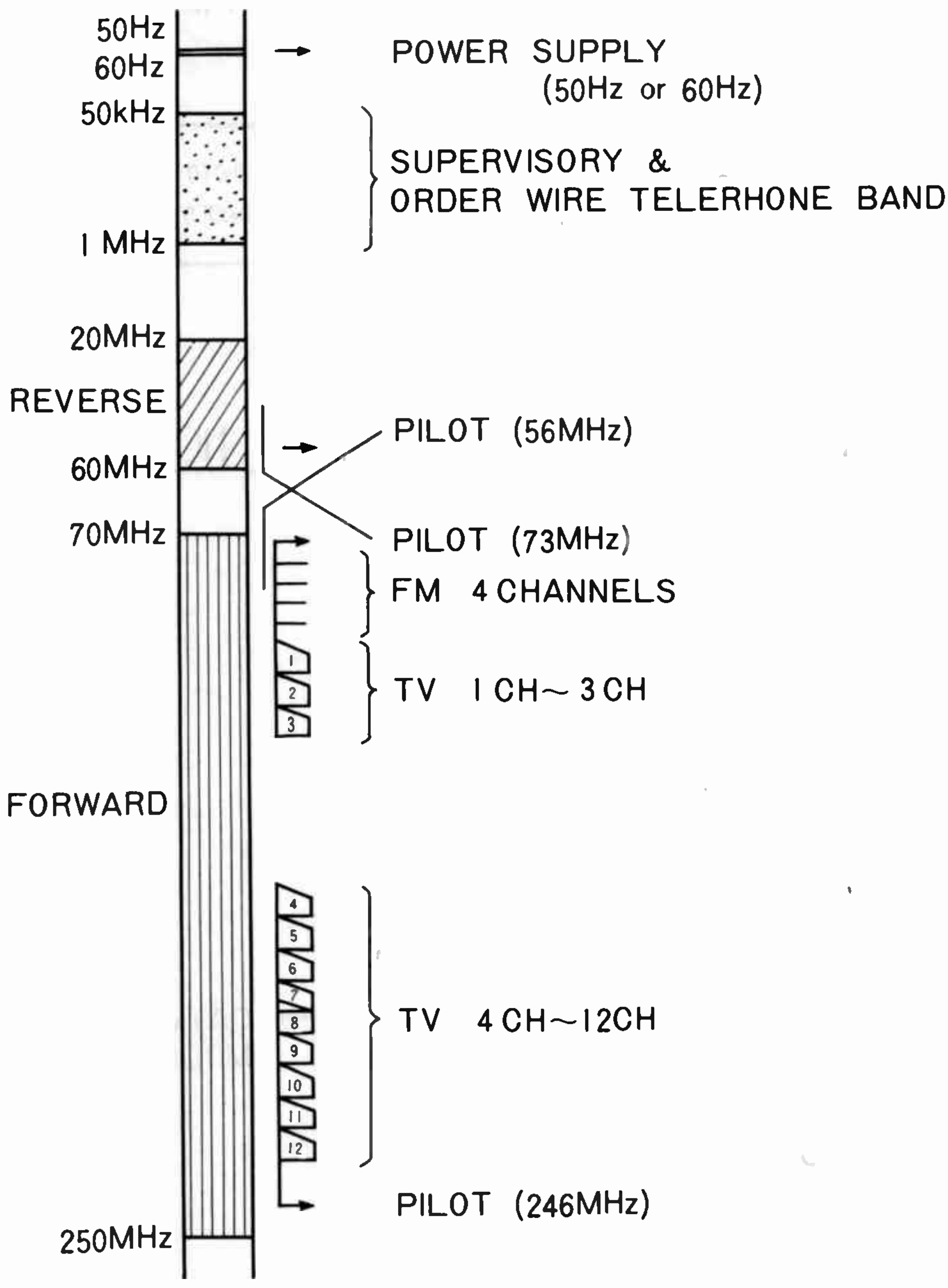


Fig. 2 FREQUENCY ALLOCATIN OF BI-DIRECTIONAL CATV SYSTEM

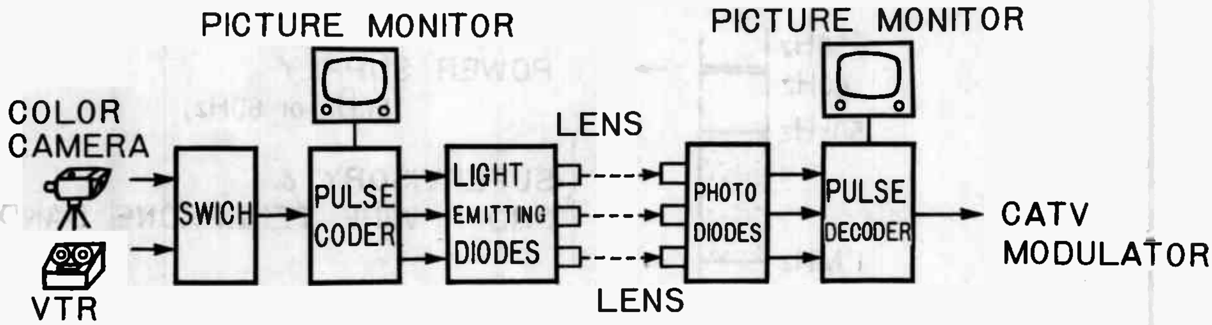


Fig. 3 OPTICAL COMMUNICATION LINK

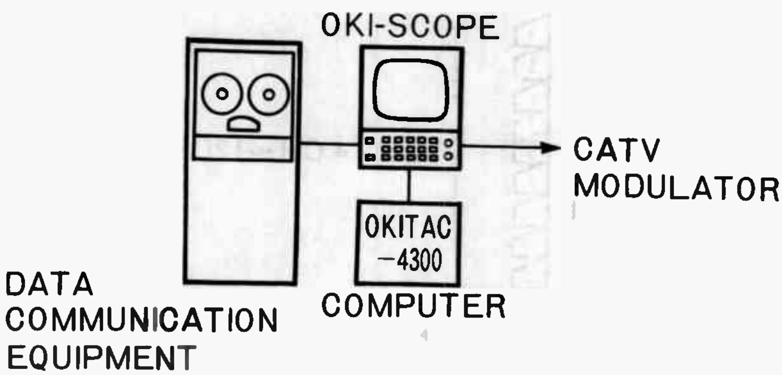


Fig. 4 VIDEO DISPLAY & DATA TERMINAL

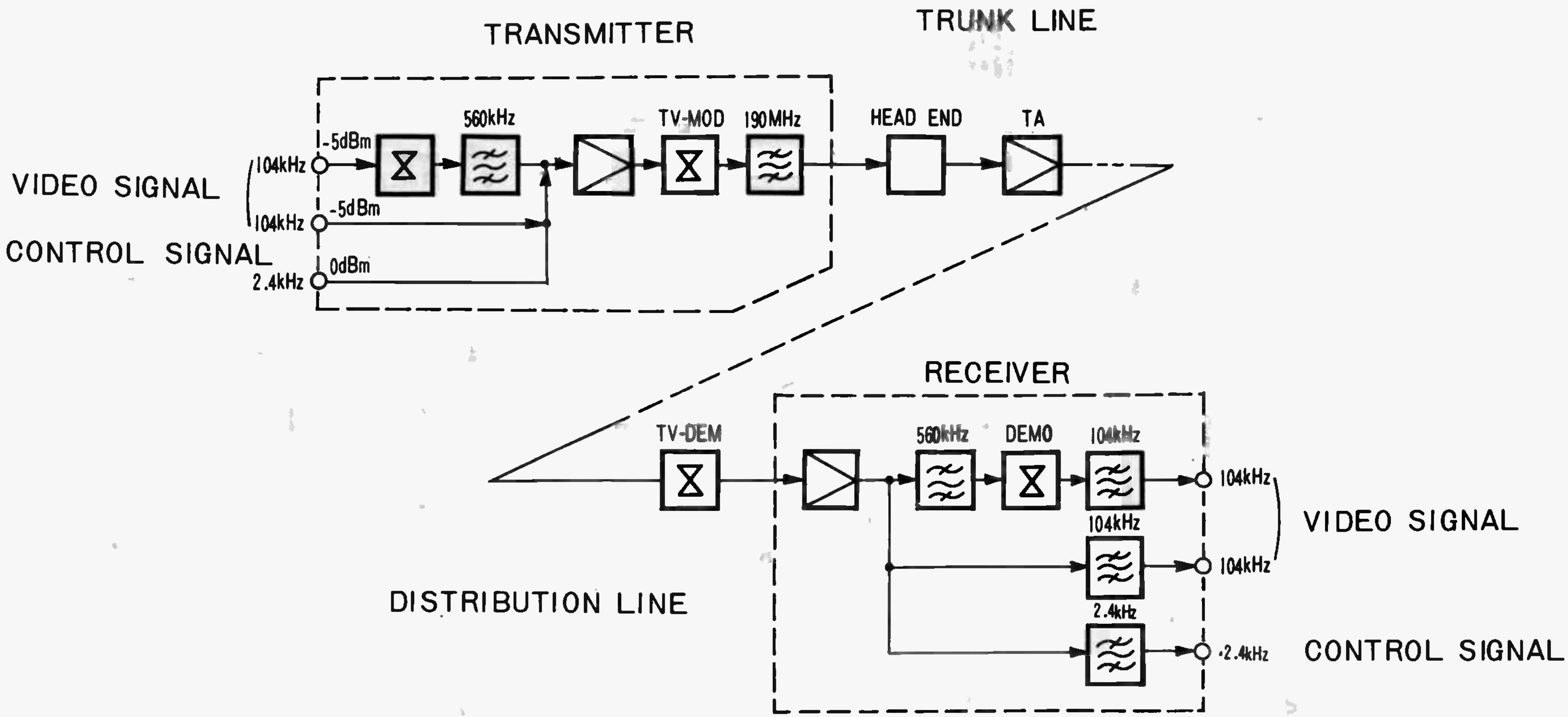


Fig. 5 CATV-FACSIMILE TRANSMISSION SYSTEM CONFIGURATION

讀賣電子新聞

THE YOMIURI SHIMBUN

CATV・宣伝特集号

11月30日(月)−12月3日(木)

ボタンを押せば最新ニュース

ケーブルTVシステム

沖と藤倉・電興のCATV新技術

双方向通信や光伝送

情報化社会に貢献する

ファクシミリ専門メーカー

読売の長期連載「東京をどうする」

破滅か、再生か

激増する脱出希望組

20年後、東京を分散

官庁街も富士山ろくへ

Fig. 6 CATV-FACSIMILE RECEIVED PAPER (SIZE 1/4)

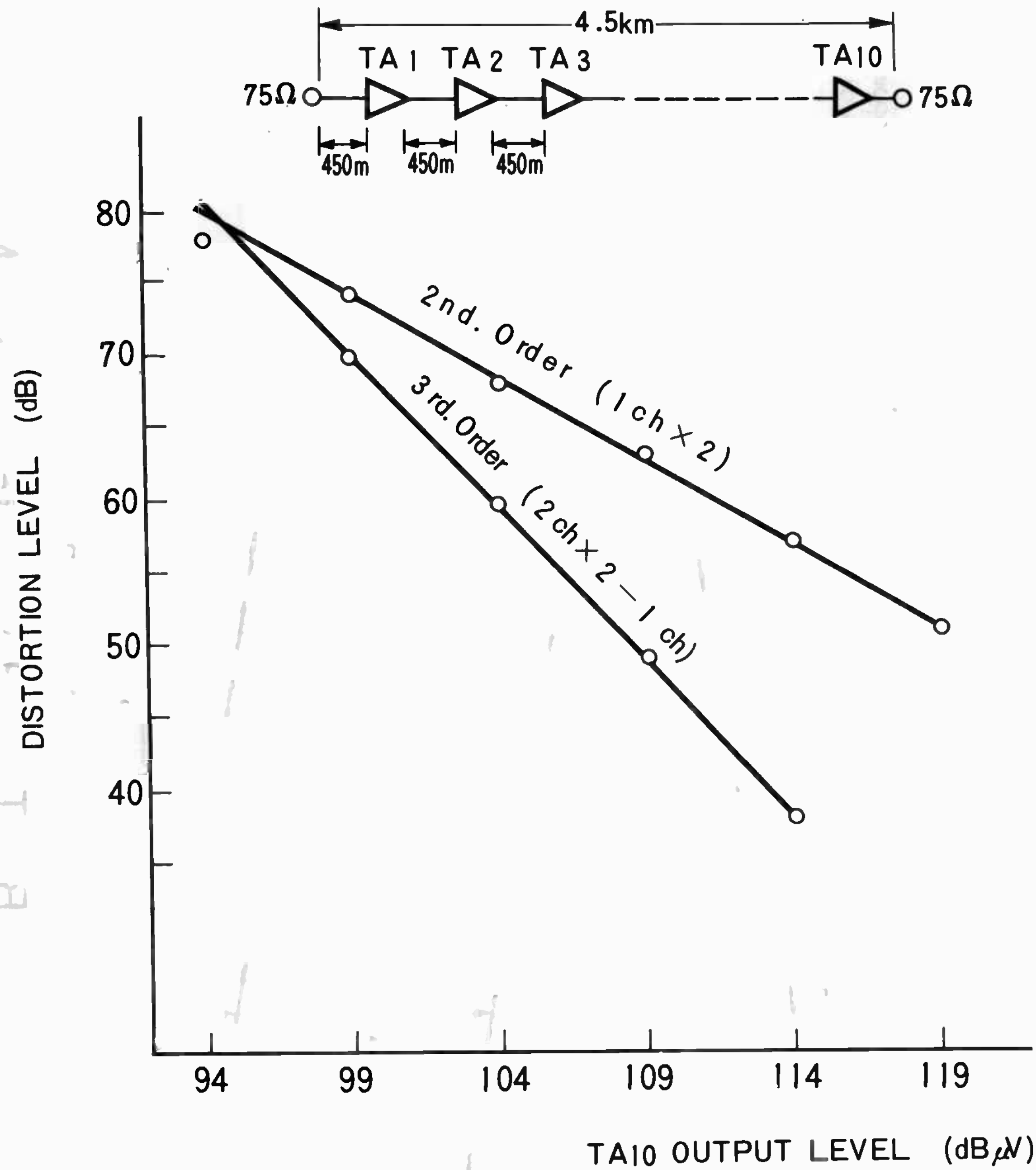


Fig. 7 MEASURED DISTORTION CHARACTERISTICS FOR 10 CASCADED TRUNK AMPLIFIERS.

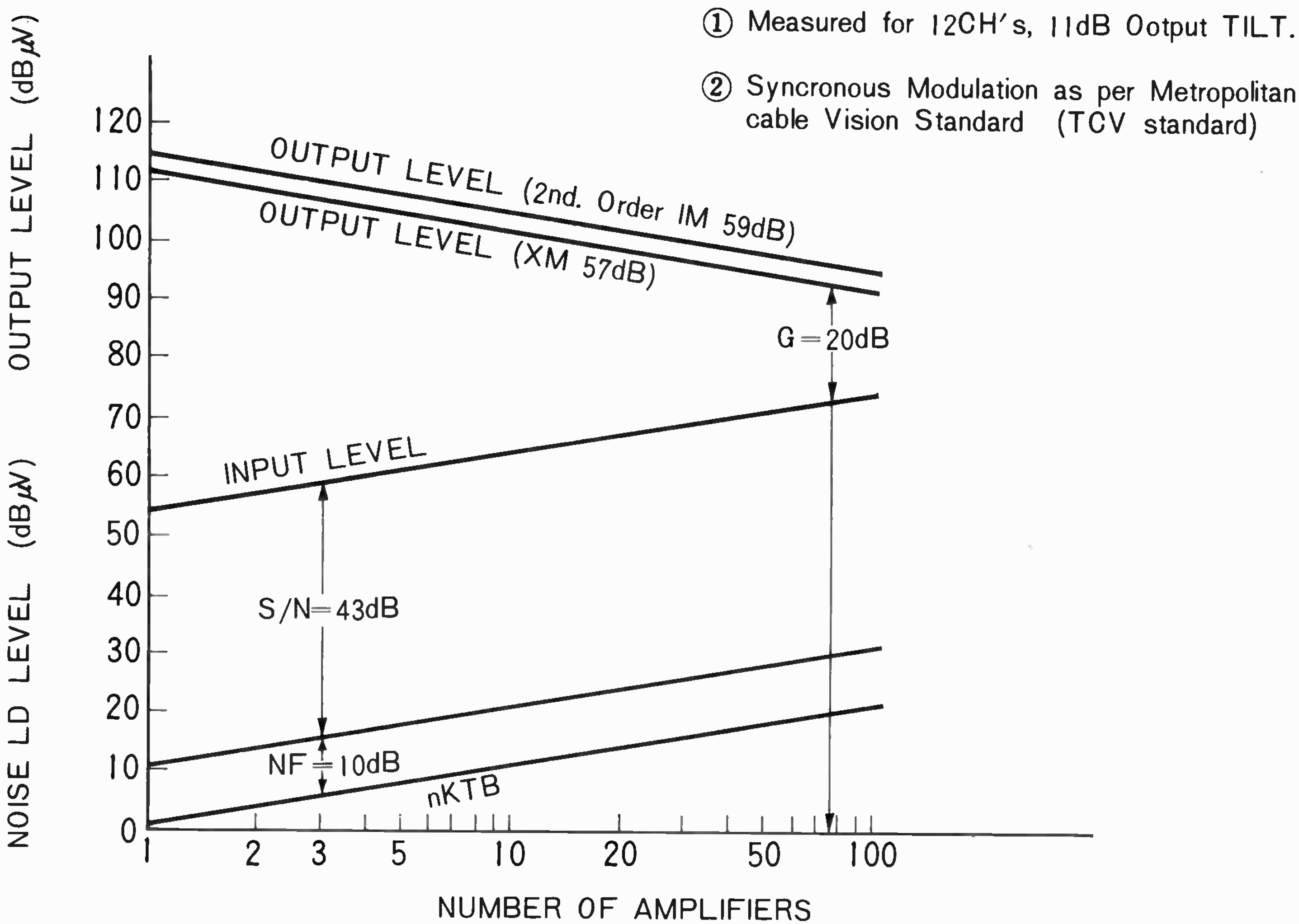


Fig. 8 CASCADABILITY CHART OF SYSTEM

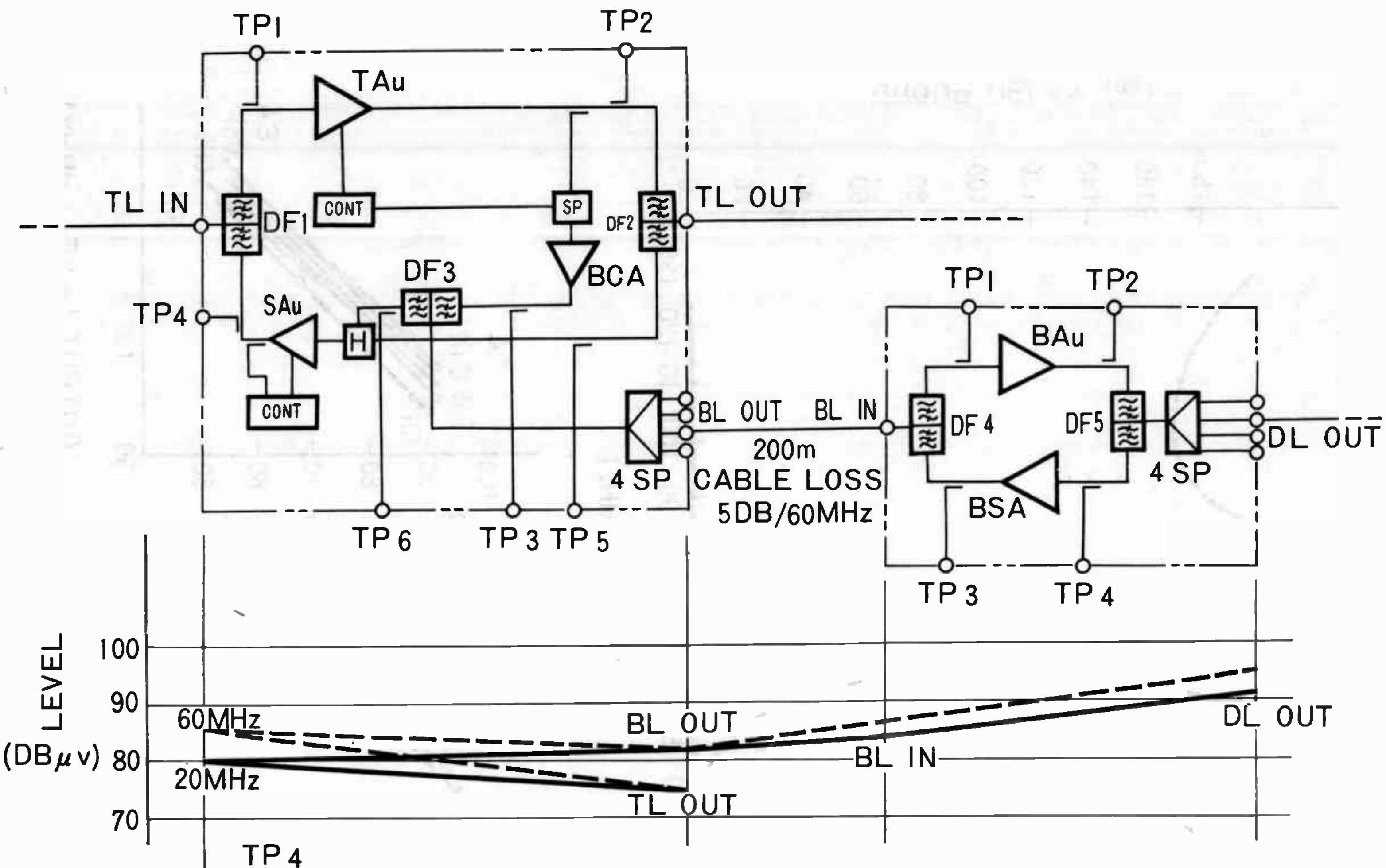
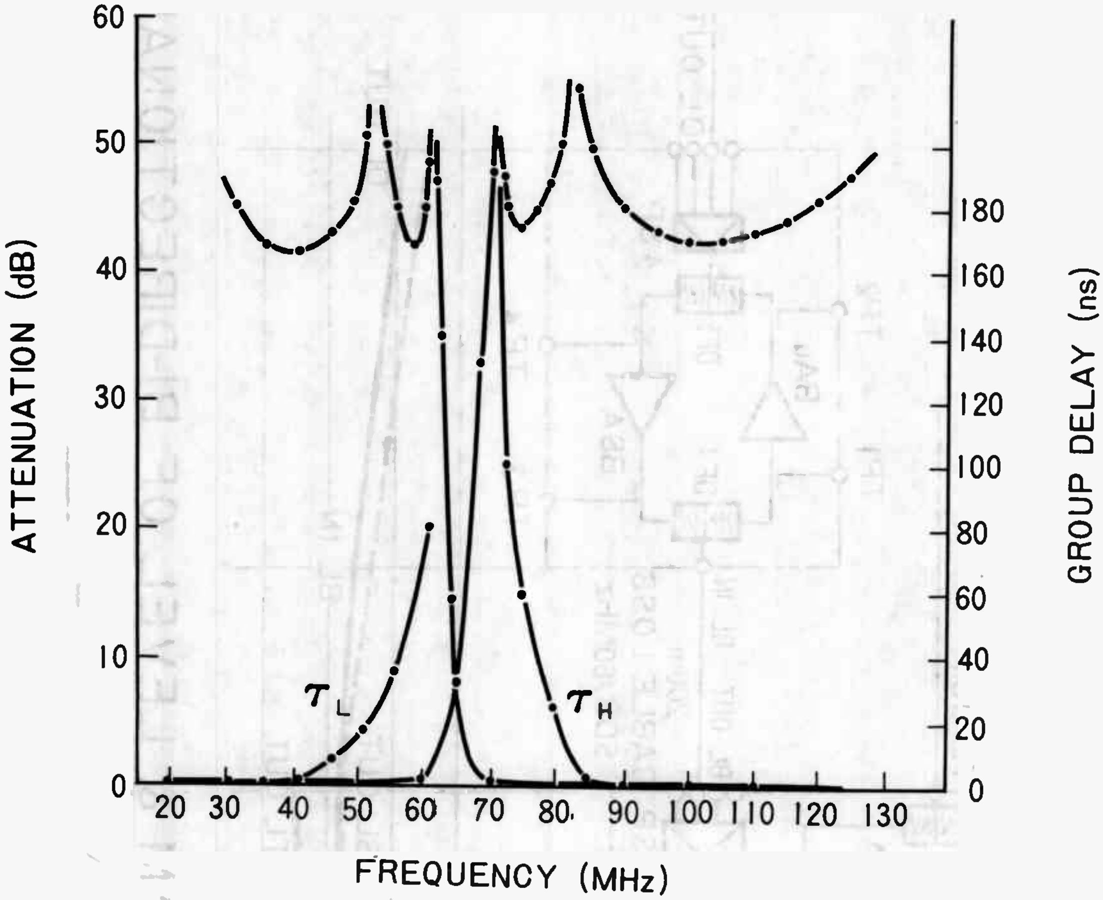
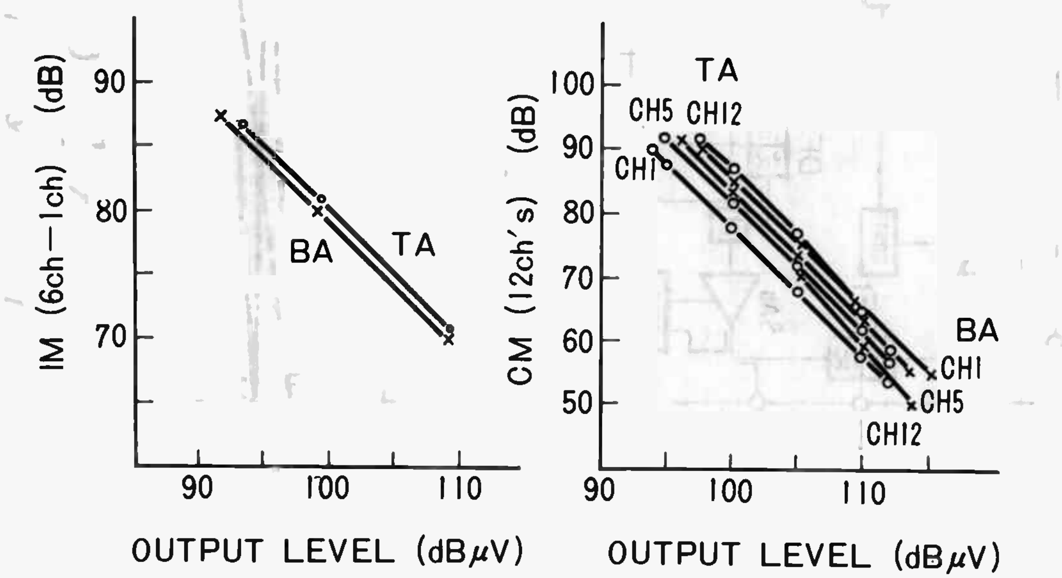


Fig- 9 BLOCK DIAGRAM & LEVEL OF BI-DIRECTIONAL TRUNK & BRIDGING AMPLIFIER

Fig.10 DIVIDING FILTER CHARACTERISTICS





Fiq.11 MEASURED INTER & CROSS MODULATION VERSUS OUTPUT LEVELS FOR TRUNK & BRIDGE AMPLIFIER.

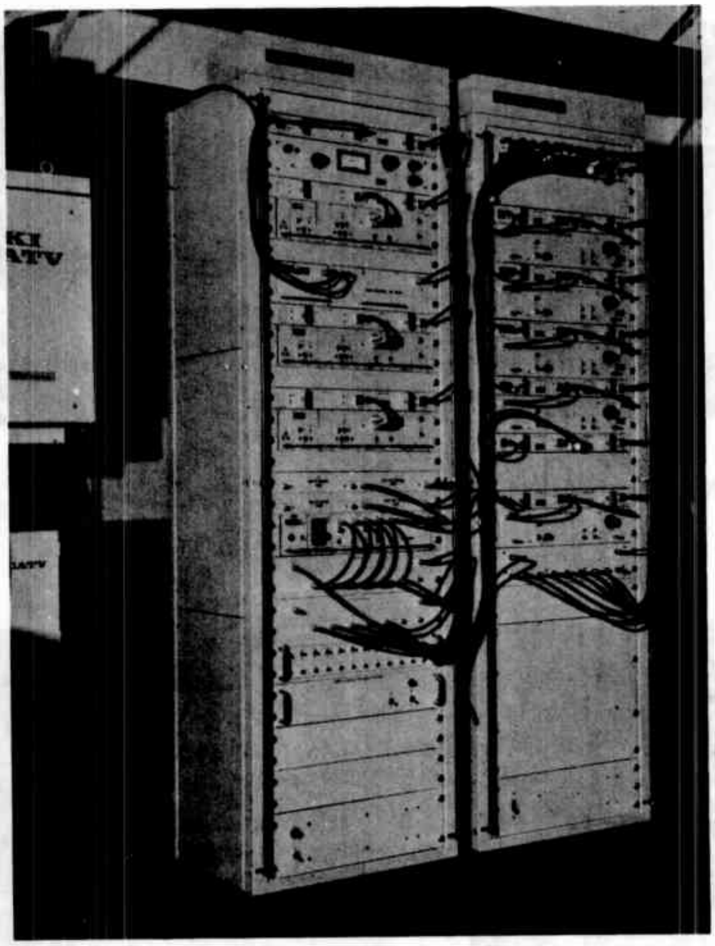


Photo 1

HEAD END EQUIPMENTS WITH FULL CHANNELS

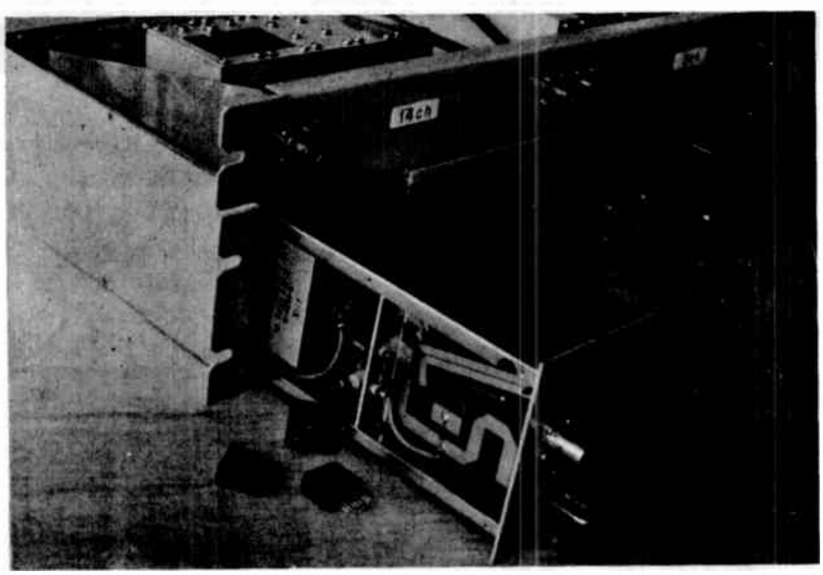


Photo 2 UHF RECEIVING UNIT OF IC DESIGN SIGNAL PROCESSOR, UHF MIXER USING MICROWAVE-IC & VHF AMPLIFIER USING TANTALUM THIN-FILM HYBRID- IC

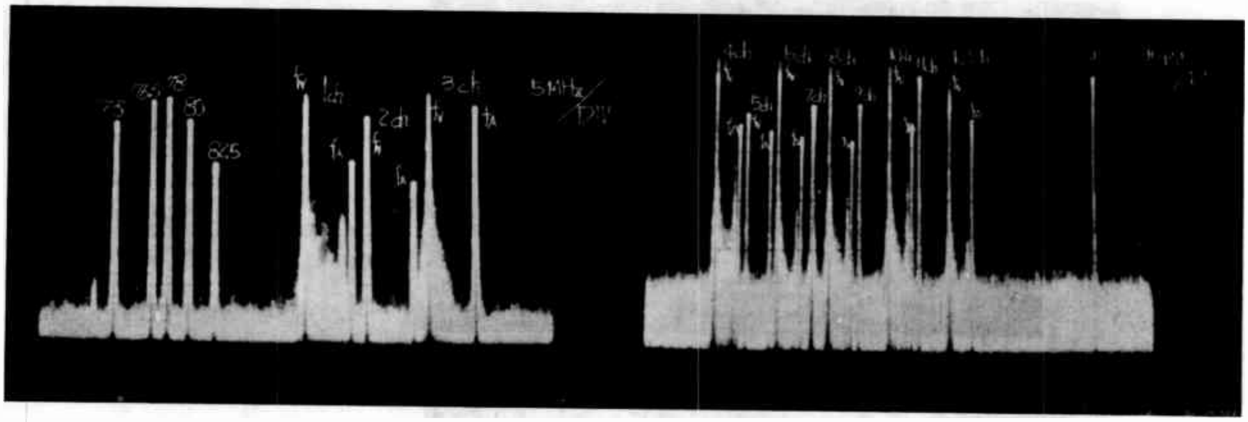


Photo 3 FREQUENCY SPECTRUM OF MULTI-CHANNEL TRANSMISSION AT HEAD END OUTPUT

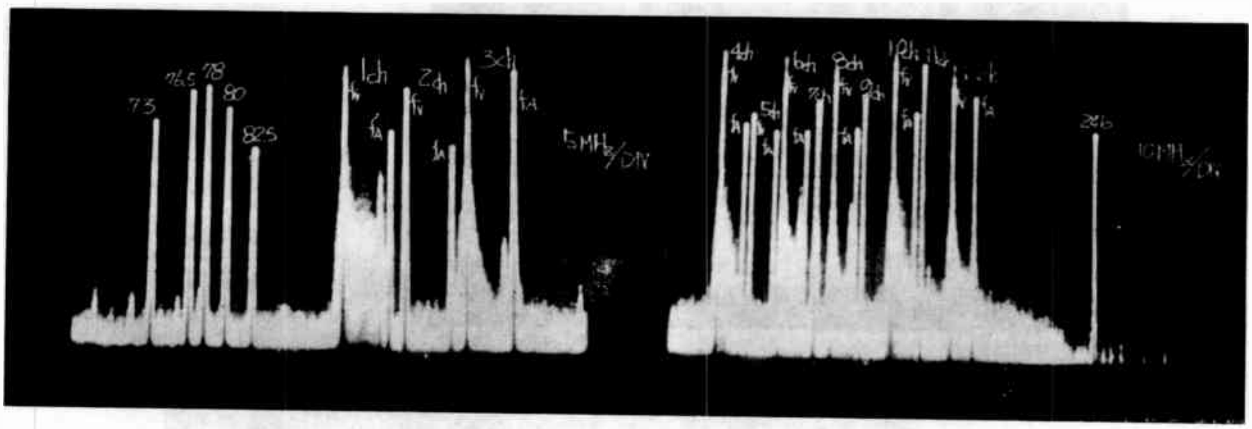


Photo 4 TRANSMISSION FREQUENCY SPECTRUM AT DROP TERMINAL (AFTER 10 CASCADED TRUNK AMPLIFIERS)

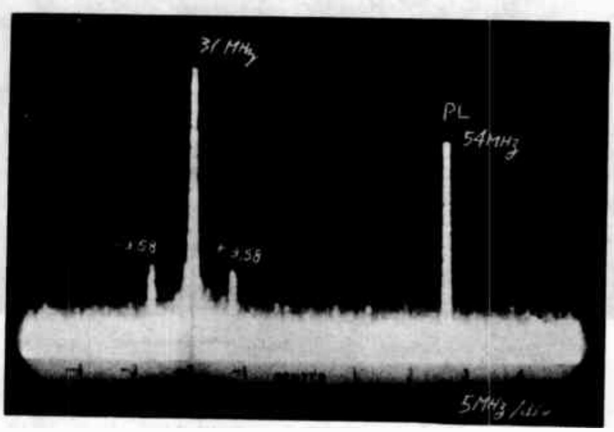
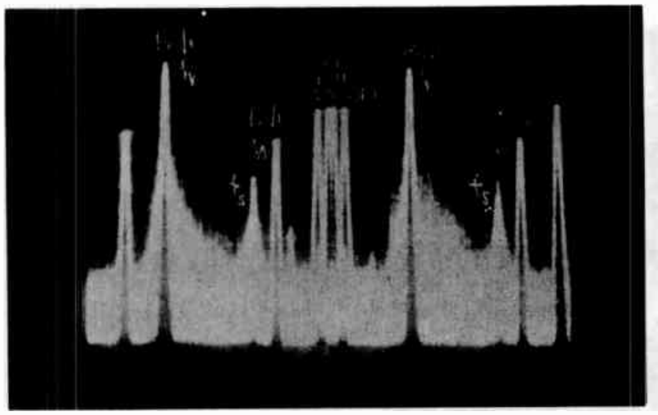


Photo 5 REVERSE BAND FREQUENCY SPECTRUM (31 MHz: Video carrier of color ITV)



V: 10 dB/div.
H: 2 MHz/div.

Photo 6 FREQUENCY SPECTRUM OF HEAD END OUTPUT.
Facsimile signal is inserted in empty narrow CH.7 between CH6 and CH8.

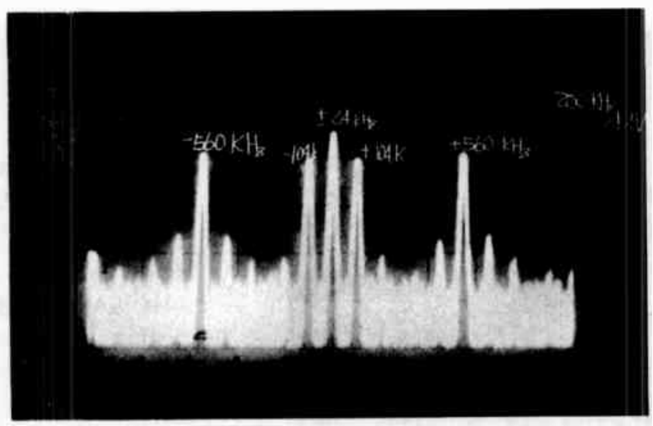


Photo 7 MODULATED FACSIMILE SIGNAL SPECTRUM AT HEAD END OUTPUT

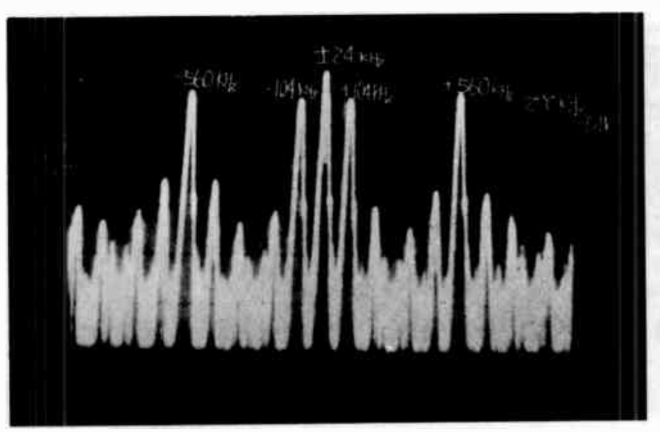
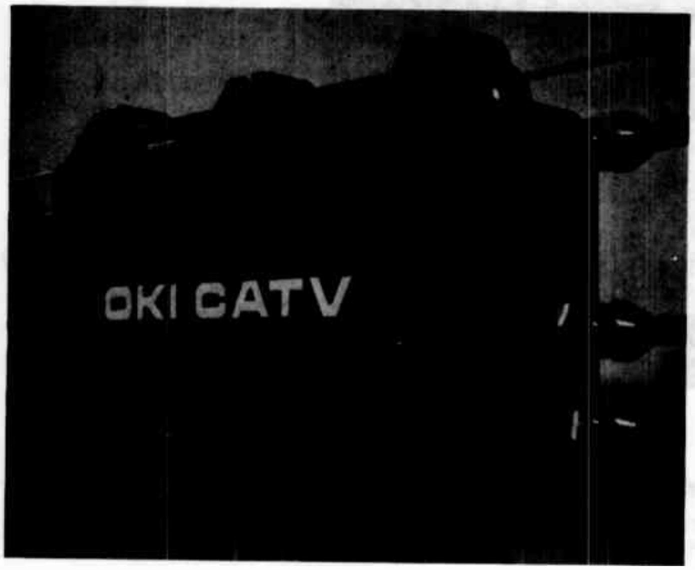
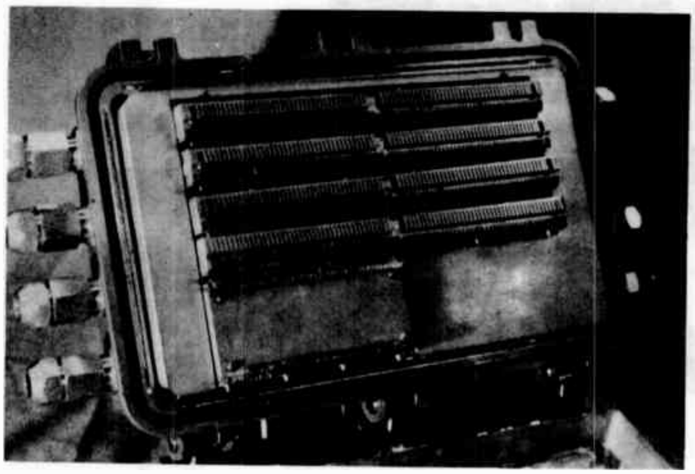


Photo 8 TRANSMISSION SPECTRUM AFTER 10 CASCADED TRUNK AMPLIFIERS



(a)



(b)

Photo 9
FEATURE OF BI-DIRECTIONAL TRUNK BRIDGE AMPLIFIER.

Plug-in unit is a signal processing equipment, such as TAU, ALC/ATC, BAU, SAU, & PSU

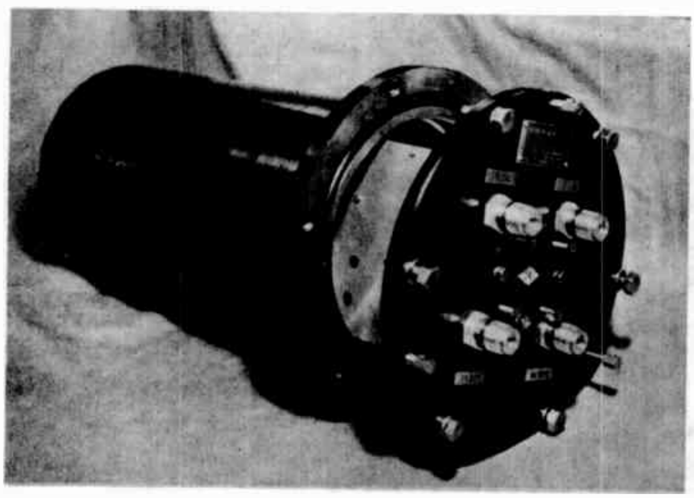


Photo. 10
UNDERGROUNDED TYPE TRUNK BRIDGE AMPLIFIER

Photo 11

CONFIGURATION OF DISTRIBUTION SYSTEM—TAP OFF & SAFETY BOX

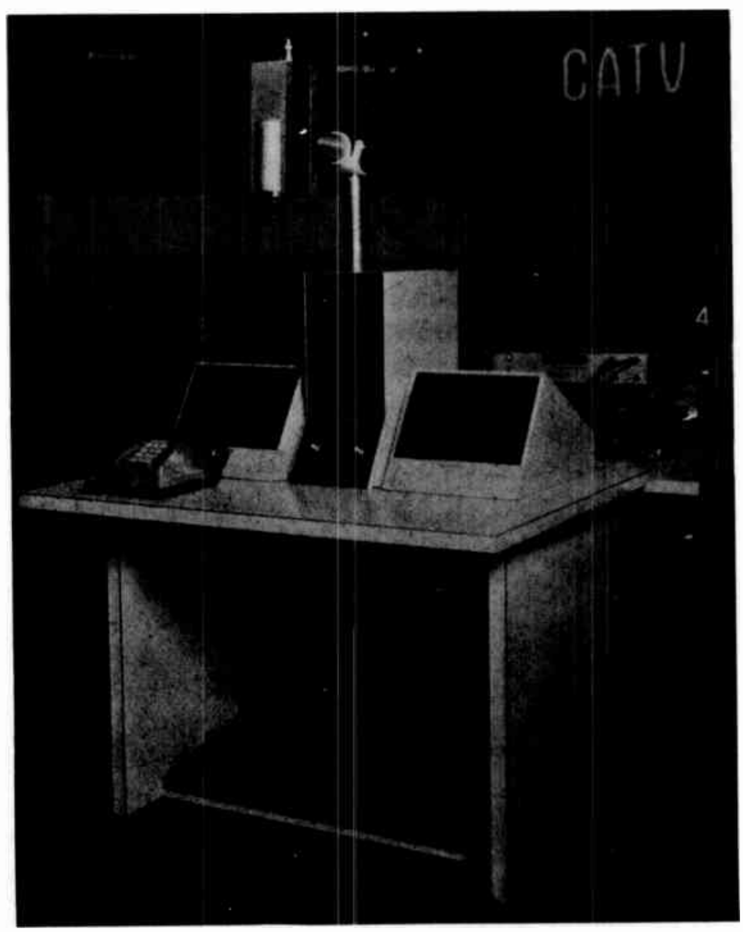


Photo 12

BI- DIRECTIONAL TERMINAL—ITV TELEPHONE EQUIPMENT

"FEDERAL REGULATION & COPYRIGHT"

Speakers

Harry M. Plotkin, Esq.
Arent, Fox, Kintner, Plotkin & Kahn
Washington, D. C.

John P. Cole, Esq.
Cole, Zylstra & Raywid
Washington, D. C.

John D. Matthews, Esq.
Dow, Lohnes & Albertson
Washington, D. C.

Bruce E. Lovett, Esq.
American Television & Communications Corp.
Washington, D. C.

Gerald Phillips, Esq.
Phillips, Nizer, Benjamin, Krim & Ballon
New York, New York

Moderator

Gary L. Christensen
General Counsel
NCTA, Washington, D. C.

Gary L. Christensen -- Those of you who have been in the industry have known that for 22 years now, as we are entering our second generation, we face the same problems. Just as they were problems in 1949 and '50, we have the same problems of regulation and copyright today.

The panelists that are here with us today have been closely associated with the growth of the CATV industry and have participated in many, if not all, of the regulatory processes that have characterized the nature of the industry since its very inception.

You'll recall that as an infant industry we started out with little regulatory problems but as we grew and as the industry changed those regulatory problems also changed and also grew. We started with municipal regulation. That blossomed into some attempts at state regulation and when we were able to stave those off it blossomed into attempts at Federal regulation, which we have been subjected to since 1966, and there are some who have said that there has been a freeze, either partial or total, since Federal regulation was put into effect.

It appears now that that freeze is about to thaw and we are to observe the change in the industry that such a thaw will bring about and the primary areas of concern which will be discussed by this panel today. They are primarily the origination of programs by CATV systems, the importations of distant signals to enable us to grow in the major television markets, the elimination of the footnote 69 restrictions that will plague most of the future industry, and those continuing and pesky problems related to copyright.

In this connection we're very fortunate to have with us some of the views of the other side, the copyright proprietors. Perhaps the best way to introduce the panel is to choose the subject which probably has the most attraction and has caused most recently the most troublesome analysis of our industry's future. That particular problem or particular opportunity is, of course, the origination of programs by CATV systems.

To talk with us about that today we have Mr. Harry M. Plotkin, a partner in the law firm of Arent, Fox, Kintner, Plotkin & Kahn, and the attorney who tried the appeal in the Midwest Video versus FCC case which determined that the FCC did not have the jurisdiction or authority to impose the mandatory origination rules.

Harry M. Plotkin -- Thank you, Gary. It's good to be back again on this panel.

I thought I'd spend a few minutes bringing you up to date on where the litigation stands and then try to spend the balance of the time I have in the direct presentation to tell you what I think the significance of the court case is and why it is important for the industry to persevere in the stand that we've taken on the mandatory origination case.

As you know, the Commission, by rule and regulation, provided that all CATV systems with 3500 or more subscribers should, commencing with April 1, be required to serve as a local outlet by cablecasting and to have available local production facilities so that local people could utilize the cablecasting facilities.

Midwest challenged this matter before the Commission and, when we lost, we took the matter to court. We went back to the Eighth Circuit where we had taken the original case challenging the rules and regulations of the Federal Communications Commission. We were a little bit more fortunate this time. The Commission the first time around had said that it's necessary to regulate CATV because CATV is an ancillary service and therefore it ought to fit into the rules and regulations that the Commission is authorized to promulgate with respect to broadcasting and it is, therefore, important that CATV should grow in such a way that it should complement, supplement, broadcasting and not wreck broadcasting.

This was the basis upon which the Supreme Court did sustain the jurisdiction of the Commission in the Southwestern case.

As part of that original philosophy, the Commission had started off with the notion that CATV was an ogre, that it was a parasite, it carried the signals of broadcast stations and, in the process, grew fat by carrying the signals and it would devour the host. So the Commission not only undertook to regulate the signals that could be carried and the number of signals that could be carried but at the outset showed a great deal of hostility to CATV systems even originating programs on a voluntary basis.

The Commission was hostile to the idea and in those few instances where the Commission did authorize the origination of programs undertook to prevent CATV from being able to afford to do so by forbidding them to have commercials associated with origination.

Then in a tour de force the Commission decided, well, not only is the carrying of local programs, the origination of programs by CATV desirable but it ought to be mandatory and from an attitude of hostility to optional origination the Commission proceeded to compel origination for all systems with 3500 or more subscribers.

It did, in the process, say we'll let you carry a certain amount of commercials but there was a threat even in that. They said you can't carry commercials the way broadcast stations carry them only at the beginning and the end of programs and at natural breaks.

And, while the Commission, at least for conventional origination, said that you can carry any sort of programs, they very clearly intimated that, if CATV were really successful in their origination, if the teeny, weeny broadcast station with 3500 subscribers really succeeded in putting on the kind of programs that might wean away some viewers from the regular commercial stations, that the Commission might very well consider limiting the type of programs that CATV could originate.

We took the matter to court. We took the matter to court for two reasons.

One -- We thought that there's just nothing in the Communications Act that authorized the Commission to compel a CATV system to originate; that whatever power the Commission has over CATV is the power to adopt rules ancillary to its responsibility with respect to broadcasting and we just failed to see how compelling CATV systems to originate programs was in any way ancillary to broadcast regulation. Indeed, it was quite the antithesis because, to the extent that CATV systems did succeed in originating programs, it would compete with broadcasters, not mitigate the competition.

And, secondly, we took the matter to court because an order requiring a system of 3500 to originate can be a back-breaking burden. True, the Commission said that at the outset we will not adopt specific rules and regulations telling you how many programs you should originate and what quality they should be but that's the camel getting the nose in the tent. Even that little bit is a very extensive financial burden for CATV systems.

But, knowing the propensity of the government, once it gets started on a regulatory role, to expand its functions, it was pretty clear that sooner or later the Commission would really control this entire industry by the type of rules and regulation it would adopt with respect to the type of programs it would originate.

So we took the matter to court and in the court the Commission tried to justify its jurisdiction, first, that these rules and regulations were really ancillary to their broadcast jurisdiction. It was a lame effort that even the Commission itself abandoned very early in the game.

Then they announced that really the basis upon which the Commission can compel mandatory origination lies in the fact that the Commission confers a benefit upon CATV systems by permitting them to carry programs from either local or distant stations and, since they confer a benefit, the Commission has the authority to withhold that benefit or condition the benefit upon requiring CATV systems to originate programs.

In other words, if you want to start off in the business of being a reception service, since that requires FCC permission, since that's subject to FCC jurisdiction, they can compel you, either to go out or business or, as the condition of staying in business, that you start really operating a broadcast station.

They might just as well have said you should also operate a volunteer fire department, or a post office department. God only knows we need a post office service in some of our communities a lot more than we need another broadcast station.

The Court of Appeals agreed with us that the Commission did lack jurisdiction to compel us to originate programs. Voluntary origination is one thing; compelling is another thing.

The matter now stands that the Commission does have 90 days within which to ask the Supreme Court for certiorari. Normally before the Commission can go to the Supreme Court, they have to persuade the Solicitor General of the United States, Department of Justice, to join with them in the petition for certiorari to the Supreme Court.

There is reason to believe that this may not be as easy as the Commission thinks because the Department of Justice has not been at all receptive to the anti-competitive position that the Commission itself is adopting with respect to CATV. The attitude of protectionism that the Commission has as its principal function is to protect broadcast stations first and then let CATV have some modicum of freedom.

The Department of Justice, even in the Eighth Circuit filed a brief that, while they didn't come out four-square against the Commission's ruling, didn't give them any comfort either.

I should point out that in this type of case, even if the Solicitor General does not join in the petition for certiorari, the Commission itself does have the right to go to the Supreme Court direct without the participation of the Department of Justice. From a litigation point of view, their chances of getting certiorari are very poor, if the Solicitor General does not join in the petition for certiorari.

The Commission has made the decision to ask the Solicitor General to join in certiorari but to date no announcement has yet been made.

But what's important about the fighting in this case is that it's important that the Commission be stopped in its tracks on its theory that it can condition your right to go into the CATV business upon your doing something positively that the Commission thinks is in the public interest. If that power is sustained, the power of the Commission over all of your activities becomes almost boundless.

Take any area of pay TV. The Commission has shilly-shallied back and forth so far as broadcast stations are concerned as to what stations can do so far as pay programs over the air are concerned. If they have the power to say that since we can confer a benefit on you, in return for your carrying broadcast signals we won't permit you at all to go into pay TV, because pay TV will siphon away programs from regular commercial television, the Commission has already tentatively stuck its oar in the water by proposing to apply the same rules and regulations to pay TV by cable as they do to pay TV over the air.

In our Eighth Circuit case we challenged the Commission's assertion of jurisdiction there because they did not comply with the rules and regulations set forth in the Administrative Procedures Act for promulgating pay TV rules.

The Commission will probably pull back those rules and regulations and start over again but they've already served notice that their benefit-conferred theory leads there.

There's another thing. The Commission, as part of its package, is going to require a certain amount of public access channels that in return, say, for every CATV channel you must have one public access channel. Without commenting upon the desirability or undesirability of such a proposal, because I think all CATV systems do look forward to the day of public access channels, if the Commission can condition your being in the CATV business upon your doing something with respect to origination of programs, the same theory can also lead them to hamstring you, to tie you hand and foot on what you can or cannot do on those public access channels.

The hubris of the Commission that is involved really in this benefit-conferred theory, they say we are going to compel you to originate programs and then they say we even have the authority in compelling you to originate programs to make sure that you don't sell commercials. They haven't done that but they said they have the jurisdiction.

The same way that, if their jurisdiction is confirmed by the courts, that if they do have this benefit-conferred theory, they'll say we'll force you to expand your system to make sure that you have a public access channel, that you spend all the money to have a public access channel and then you won't decide what you're going to do with those public access channels, you won't decide how you're going to do it; we'll decide what you do or what you don't do.

And how will we decide it? We'll decide that you use it in such a namby-pamby way to make sure that you are not a threat to the conventional broadcasters. This is really what we're fighting about, the whole exercise of Commission jurisdiction that once they get their fist in on benefit-conferred they can control every single one of your activities on every single one of your channels. Now that's the fight we're fighting.

<u>Gary Christensen</u> -- You see sometimes a case that one would think deals only with originations goes a great deal further than just that simple subject.

Probably the most horrendous and most trying issue before the CATV industry and before the FCC is how and whether to allow the importation of distant signals into the 100 largest television markets.

Perhaps one of the most vigorous advocates of the CATV industry in attempting to get the authority to import those markets has been John P. Cole. He is the senior partner of the law firm of Cole, Zylstra and Raywid and there have been times when some people have accused Jack of letting his enthusiasm for advocacy carry him away and he has been gently cautioned from time to time even by so renowned a figure as FCC Chairman Dean Burch.

I'm sure that Jack will have his usual stylistic speech with a good deal of information for all of us.

John P. Cole -- Mr. Moderator, ladies and gentlemen. It's a tough act to follow the luncheon address, because I think that was a major speech in CATV's history.

My topic this afternoon is not a new one. Indeed, it is shopworn and when measured relative to the age of the cable television industry the subject of distant signals could reasonably be characterized as archaic.

Ironically, I was first privileged to appear on your annual convention program in 1958, some 13 years ago, and the subject of my talk then was Microwave and Distant Stations. The 1958 convention was also here in Washington. So you see I've come a long way.

There's nothing really new or innovative on this matter and I for one will be surprised, even shocked, should there be a new novel observation on this subject today or henceforth.

We heard talk then, as we continue to hear today, of the threat to so-called free TV. Nonetheless, of all the matters which we treat as well as those of which we have treated in cable's long, litigious history, the heart issue is importation of distant signals.

No subject has caused more concern or even tears, both real and fake, either to the parties involved, to the regulatory agency and even to the Congress of the United States. There is no more emotionally charged question and with the possible exception of Federal-State relationships in the regulation of this industry, there is no more critical issue before us today.

Because, if distant signals are authorized and if this policy is effectively to be implemented, and I must emphasize the word implemented, this industry is on its way to a communications explosion or, in the vernacular of the day, a revolution. Perhaps we could call it the cabling of America.

If the distant signal problem is resolved fairly and rationally, the other important issues I think will begin quickly to fall in line and cables will begin to criss-cross this country at a rate which I dare say will double the size of this industry every two years for a number of years to come.

I wish this afternoon that I could confidently forecast for you that you as an industry have at last turned the distant-signal corner. Certainly there are favorable indications that this might be a reasonable prognosis. But seeing, I'm afraid, is believing. I pray, on this score, that any hesitancy on my part preventing me from telling you that the day has already arrived or is in any event just around the corner results from my own condition of paranoia created by years of promise and expectation but very little actual performance.

Last month on June 15 the Chairman of the FCC made a stimulating, forceful appearance before a committee of the Congress, the U. S. Senate, and he set forth a plan which, if ever activated in the fashion presented, will fairly, equitably and realistically open the door for development, full development of your technology.

His presentation, supported there and then by a majority of his fellow Commissioners, constitutes no small accomplishment in your regulatory history. Because, while there has been for some time now a continuous flow of lofty commendation and recognition of this industry's potential to meet the public's increasing communications needs and while these observations have come from the most prestigious of organizations, including a special presidential task force on communications, the U. S. Department of Justice and others, the FCC by itself has heretofore kept the lid tightly clamped on cable while joining only verbally and always cautiously and obviously reluctantly with those who foresee not the present potential but the future potential.

Now, for the first time, however, the regulatory agency is talking about rules, as opposed to proposed rules, and the actual benefits of distant signals, as opposed to past emphasis only upon the preservation of free TV. If those of us in this Capital City are entitled to view, as we often do, television programs coming from Baltimore stations, then why are not residents of, for example, Philadelphia or Boston or even Dayton equally entitled to view signals coming from New York City and vice versa?

Or, despite the availability of what today is elementary technology, is the happenstance of a little geography to serve as a shield for the more fortuitously located broadcaster against all forms of competition?

The obstacles preventing such viewing have long ago been conquered but, unfortunately, your government, through its appropriate arms, has frustrated and in fact prevented the application of this technology to the public's true convenience.

The truth of the matter is that today we are confronted not with a technical problem nor are we confronted with any real problem of business or broadcast economics. The merits of this prolonged debate have long ago been subordinated to the practical considerations of political power. The issue flat and simple this afternoon is political. The very obstacles standing in the way of the orderly development of the cable industry as an effective nationwide communication service are thoroughly of a political nature.

The question in my mind now is whether these political considerations will prevail over those of service to the public and technological advancement and by this I don't mean to imply that political considerations will or even can prevail indefinitely, for virtually all observers, including myself, are persuaded that the tide of cable communications cannot now be turned aside.

It can, however, as our recent history has so forcefully borne out, be delayed or frustrated.

The single issue uppermost, I think, in all of our minds is not whether new, enlightened cable rules will be adopted but rather, and only, when will they be adopted.

Now I have referred to the favorable development within the FCC and in my judgment it does constitute a very significant turn under an enlightened, determined and, I think some people might say, stern Chairman.

In fairness, however, I must give equal time to some foreboding or perhaps I should say potentially foreboding developments now in the wings.

First -- I am gravely concerned, despite loud proclamations to the contrary, that the Congress will impede and delay meaningful rule changes. Indications and rumblings of this possibility occur on a daily basis and there are those in Congress who are influenced greatly by those who seek to retard or frustrate cable development. One of the easiest methods of causing such delay would be to hold protracted congressional hearings while at the same time pressure is applied to the FCC to hold up on the effectiveness of any rule changes and there are those of your more able, more practical and effective opponents working feverishly towards this very objective.

In line with Senator McClellan's talk, I am equally concerned at this stage of cable's evolution with the recent creation of a brand new presidential study group because, for the life of me, I cannot see what constructive purpose can possibly be served at this late hour, and particularly at this auspicious time, by such a study and I am troubled by the feeling that I suspect its primary purpose may be to deter for a time full implementation of a modern communications policy.

It is perhaps only a coincidence that the study group was appointed at the very hour that the FCC manifested its intent at long last to act but I know that certain of my broadcaster friends are overjoyed by this announcement and I further know that the strategy of the cable suppressionist is no longer to defeat or kill CATV, because that's impossible, the strategy must now be to delay its entry into the major markets by keeping the issues boiling on as many political treadmills at once as possible.

I think by nature I'm a skeptic and a worrier, even a hypochrondiac, and while I hope that all of my apprehensions are soon proven to be ill-founded and even a little bit imaginary, I am confident that we will know in the immediate future whether my fears bear any substance.

It is reliably rumored that the Commission will present to the appropriate representatives of the Congress in just several weeks now at the target date of July 25 its final written proposal for opening up at long last distant signals into major markets. Therefore, these new policies and rules should be, if everything goes well or even reasonably well, the law of the land certainly by the early fall. That is, unless my fears have some substance.

I tell you I will be the happiest man in this room if my skepticism is proven to be unfounded and I wish I could shed that skeptic nature.

Thank you so much for inviting me back to address you. I hope you enjoy your stay in Washington. It is a much nicer place in October.

Gary L. Christensen -- The next speaker is going to talk with us about the footnote 69 restrictions, that is, the rules prohibiting the carriage of signals under circumstances where the CATV system is located in a market where signals of two major markets overlap.

He has been a practitioner before the FCC for many, many years. He is a partner in the law firm of Dow, Lohnes and Albertson and is a familiar face to all of you who attend our meetings with any regularity.

John D. Matthews -- As Gary indicated, I've been asked to discuss with you today what is perhaps the greatest anomaly in the existing or proposed CATV regulations and I include in the proposal the interim decisions which Chairman Burch reported to the Senate Subcommittee two or three weeks ago. I'm talking about this so-called footnote 69 situation.

You are all aware, of course, that this refers to the Commission's 2-1/2 year old policy, not a rule or regulation, but a policy which originated with the December 13th, 1968, so-called Black Friday the Thirteenth, interim procedures which prohibit the carriage of overlapping Grade B signals from one major market to another. Those of you located in the East are particularly aware of the insidious effects of this policy.

From one obscure footnote in the Commission's 1966 Second Report and Order on CATV Regulation, this discriminatory, highly restricted and devastating policy has blossomed somehow into a national telecommunications prohibition which, by analysis, has deprived some 8 million present and potential CATV subscribers from receiving television signals to which they would otherwise be entitled under the Commission's 20-year-old table of allocations and its predicted contour regulations. Particularly, as I have indicated, in the eastern section of the country, this policy has done as much, if not more, in my opinion, than any other during our 4-year freeze period to stifle the installation of new CATV systems.

A computer study, for example, of the effect of the proposed footnote 69 codification in the 29 overlapping markets in the top 100 markets shows that a population of 8,135,660 people would receive far less CATV service under the proposed rules than they would have under the regulations established in the Second Report and Order.

Now, given the magnitude of this policy's adverse impact, one would think that its supporting rationale would be substantial and convincing but when one looks to those which have been proffered in justification all that appears are the hackneyed old litanies of injury to UHF and unfair competition.

Once again, as has been so frequently the case with CATV regulation, rhetoric has successfully replaced reality. For example, it is said that it would be unfair competition to allow cable to equalize signals of different strengths such as City Grade versus Grade B. But how real is this competition they are talking about? Have any studies ever been done on the effect of differences in signal quality on viewer choice of program content?

Faced with competing program choices, does the average television viewer really consider seriously a marginal difference in signal quality involved? I doubt it. I think it is very likely that where signals are generally available off the air the theoretical differences between City Grade and Grade B contour are less relevant influences on viewership than the content of the program.

If one station is carrying a program a viewer wants to watch, he will watch it, regardless of the comparative signal quality of a closer station. The presence of cable will not produce any noticeable effect on the quantity or quality of this pre-existing competition on an off-the-air basis.

The Commission has also offered the need to preserve its allocation policy as a justification for the footnote 69 policies. But here again, the reality of actual signal reception should override such theoretical considerations. The Commission's apparent assumption is that the often marginal increase in off-the-air signal quality which would accompany full carriage of all Grade B signals will somehow transform and convert the viewing public's loyalties so that they will begin to think of themselves as citizens of several communities, thus destroying the effectiveness of allocations policies.

But the responsibility for preserving and serving the goals of the allocation policy lies with the broadcasters. They are the ones who are obligated to serve community needs and interests.

Viewed in this light, then, footnote 69's relegation of communities in these overlapping market situations to second class status represents a clear rejection of, rather than the protection of the Commission's allocation policy.

Given the particularly weak nature of footnote 69's rationale, its complete denial of reality and the extent of its adverse impact, I strongly urge immediate abandonment of this patently offensive policy. CATV systems, regardless of their location, in or out of major markets, should be allowed to carry all Grade B signals. There is simply no rationale for continuing footnote 69's discriminatory, deferential treatment for the major markets and its abolition would be no more than logic and consistency demand.

Since footnote 69 has never seen the light of day as a formally adopted regulation, the Commission could, without further ado, abolish it legally in favor of the policy I've suggested above. While it would be by no means a complete solution to the present plight of the CATV industry, its small manufacturing companies and the American viewing public, such outright elimination of footnote 69, so easily accomplished, would at least be some evidence of the Commission's good faith in attempting a constructive accommodation of CATV into the overall national telecommunications scheme.

Realistically speaking, however, such a drastic departure from old and established policy seems unlikely. Thus we note in his recent statement before the Senate Commerce Committee Chairman Burch indicated that the Commission had declined to accept the simple, and to my mind, eminently logical use of the Grade B Contour as the standard for CATV carriage in the overlapping markets situation. However, most significantly, the Chairman's statement did reflect an important recognition of footnote 69's underlying absurdity and evidenced a predisposition to develop some sort of a standard based on actual viewing patterns. In particular, it was most heartening to hear him state, "If a signal is being viewed significantly off the air in a community, we feel that it should also be available to cable subscribers in that community."

Now, while this does not represent the best course, which would be an outright abandonment of any restrictions, still that statement holds out some hope for a far more rational and realistic policy than we have had in the past. In his remarks the Chairman suggested several possible replacements for the present footnote 69 policy.

One was use of a 60-mile, rather than a 35-mile zone. However, Chairman Burch indicated that a fixed mileage zone approach may have been rejected by the Commission saying, "Whatever the administrative difficulties involved, in our judgment we must take actual viewing into account, not simply some line on a map."

Interestingly, the arbitrary 60-miles zone was rejected, even though implicit recognition was given to the fact that a 60-mile figure could benefit UHF stations, which we all know do not usually have the wide area coverage of VHF stations.

The two main approaches now apparently under serious consideration by the FCC are use of net weekly circulation and use of audience share and, while these approaches do not solve all of the problems of overlapping major markets, they do offer some relief for an up-till-now intolerable situation.

My office recently did a study of the additional signals which could be carried by CATV systems in the core cities of footnote 69 major markets under a 60-mile standard, and also using a standard based on net weekly circulation. The study yielded some very interesting results.

For example, under these proposals, either of them, there would be no relief in two important situations: New York-Philadelphia and San Diego-Los Angeles. Further, the increase in allowable signals in other situations is also not as great as one might expect, although in general choice of any one of the proposed standards provides a far better approximation of predicted Grade B coverage than the present concededly unrealistic 35-mile zone.

The 60-mile standard provides the greatest increment in signals, sometimes even more than the Grade B standard, although the differences between using that standard and a 5 to 24 per cent net-weekly circulation standard is not as substantial as you might initially think.

Further, as the standard increases to 50 per cent net-weekly circulation, the number of signals which could be carried in the overlapping markets decreases substantially. A 5 to 24 per cent figure generally produces some correspondence with predicted Grade B coverage, we discovered.

Most of the disparity occurs when you are dealing with UHF independents, which really do suffer with their generally smaller contours.

For example, in the San Francisco-Sacramento-Stockton situation, use of a 60-mile standard would bring all of the San Francisco stations into Sacramento and/or Stockton, as would, for the most part, use of a Grade B signal. But if a 5 to 24 per cent net-weekly circulation figure is used, you are down in those markets to the network affiliates and the VHF independents.

The same thing happened in Providence-Boston, where use of a Grade B or 60-mile standard bring all of the Boston stations into Providence, but use of a net-weekly circulation eliminates one independent at the 5 to 24 per cent level and both of them at the 25 to 49 per cent level.

A very realistic modification of any proposal based on viewership to cure this anomaly and to help out UHF would be to build in some kind of coat-tail provision into the viewership standard.

For example, a second choice to the proposal of simply allowing carriage of all Grade B signals would be replacement of the current footnote 69 rules with a provision to the effect that any CATV system located in one major market area could carry the signal of a television station from another major market if that station places a predicted Grade B Contour over the community in question, and enjoys a net-weekly circulation of 5 to 24 per cent in the county in which the CATV community is located.

Further, in order to equalize the competitive situations of UHF stations vis-a-vis their VHF competitors in the same market, when a VHF station becomes entitled to carriage on a CATV system according to that formula, any UHF independent from the same market would likewise automatically be entitled to carriage, regardless of its contours or audience.

Finally, waivers allowing additional carriage, within the channel capacity of the system, of course, would be granted, if a station could equalize that carriage of its signal and establish that it was necessary to equalize its competition with other VHF stations in its own market.

This compromise formula would thus depend in large part on actual viewership and hence would offer some relief in the overlapping market situations. Our study shows that this would allow increased carriage in the Baltimore-Washington, San Francisco-Sacramento-San Jose, Providence-Boston-Manchester, and Toledo-Detroit situations, to name a few.

At the same time, the coat-tail provision for UHF I've suggested offers some protection, indeed some positive help to the UHF stations which have continually begged for protection.

I might add parenthetically that the resultant increase in allowable signals which would be possible under my proposal accords with the Commission's recent apparent recognition that major market competitive situations can tolerate more signals than the smaller markets. Thus, the distant signal policy mentioned by Chairman Dean Burch is three plus one for the smaller markets, three plus two plus two in markets 51 to 100 and three plus three plus two in markets 1 to 50.

At this point then, we can summarize the situation as follows. We can certainly applaud the Commission's apparent planned departure from its past footnote 69 stance. Whatever the problems which may accompany the new resolution of the problem, the shift of the Commission is apparently to look at actual viewership and does represent a beginning of a more realistic approach to the problem of overlapping major markets.

Use of the simple Grade B Standard would be, of course, the optimal resolution to a situation which, after all, should not have ever been a problem in the first place. But if the Commission will not go that far, at least it is apparently going to allow us a little more leeway than we have had in the past with these overlapping market situations. I most strongly urge the Commission to eliminate or significantly liberalize this ridiculous footnote 69 policy as rapidly as possible.

Gary L. Christensen -- Our fourth speaker today has been closely associated with the subject on which he's going to talk. During the past four years, as you know, NCTA had had a copyright committee which has attempted to seek out possible solutions to the copyright impasse so that the industry could get on with its growth and so that we could all benefit from what we hope will be a communications explosion.

In the connection of either Counsel to that committee or as a member of that committee and as General Counsel of NCTA Bruce Lovett has contributed significantly to the deliberations of that committee. The subject that he will talk about today is naturally, then, copyright with some reference, I think and hope, to the problems of non-duplication or exclusivity as it's known in the copyright law.

Bruce E. Lovett -- As Gary has indicated, I've been involved in trying to work out copyright solutions over the past four or so years and have learned more about copyright than I ever set out to learn, I can tell you that.

This culminated in a remarkable development recently and to indicate how remarkable it is let me put it in proper posture. At NCTA one of my purposes in life was to fight copyright to the death most of the time. That has changed a little bit but that's the kind of adversary situation we were in. I was always anti-copyright.

I've just been elected as trustee of the Copyright Society of the United States, I want you to know, which is the most remarkable thing that has ever happened to me. I'm sworn to uphold copyright now, so you may view me with a jaundiced eye.

Let me just refer to a few of the principles of copyright with which I have become somewhat familiar over the past few years. The right to copyright protection comes from the Constitution of the United States. The theory is that persons who have created intellectual works need protection of those works for a period of time as an incentive to creativity.

I want to stress the concept of incentive and the concept of creativity.

The purpose is not to confer monopolies for the sake of assuring maximum remuneration but instead to provide a means for insuring an opportunity for remuneration so that persons who are creative will be inspired to continue to create.

As a consequence of this, while copyright is a form of protectionism, and that's the way it's spoken of, certainly protectionism is not an end in itself. The last Comprehensive Copyright Act was written in 1909 and essentially this is the law under which we function today.

The 1909 Statute was the body of law which was at contest in the case of United Artists v. Fortnightly. I'm sure you'll recall this case which was one of our major victories when the CATV industry was successful in the Fortnightly case in June of 1968. The case had been at various stages of pretrial and trial for over 6 years. The Supreme Court decided that CATV carriage of over-the-air broadcast signals did not constitute a performance under the copyright laws of the United States.

There were two footnotes in that case indicating that the court did not address the questions of whether: one, microwave carriage of broadcast signals would make a difference in terms of what constituted a performance; and, also, did not decide whether a CATV system which originated programming was such a different type of animal that possibly it should be treated differently.

The two footnotes indicate that the court did not address these questions. They were not at issue in the case.

Both of these issues are involved in the case that is presently in the courts in New York and that's the CBS-TelePrompTer Case. I understand that's scheduled for trial in October of this year. Now while I personally feel that our chances of winning that case are better than even odds, I would like to point out that if the CATV industry loses that case, in either the area of microwave or in origination, it would have a tremendously adverse effect on the CATV industry, unless a legislative solution to copyright has been worked out. The Fortnightly case may turn out to be a Pyrrhic Victory alone.

It's an extremely important law case to our industry because, if it were decided that if you used microwaves to carry signals and this made you totally liable for copyright, it would effectively foreclose any microwaving of signals to any CATV system throughout the nation, unless you worked out a legislative solution.

Or, if they decided that in the area of program origination by virtue of the fact that you originated programming it made you a different type of animal and would submit you to total copyright liability, it would mean there would be no more program originations on cable television systems anywhere in the country, unless, as I have said, a legislative solution were worked out.

Let me depart from the legalities and talk a little bit about the equities involved in the copyright issue. We entered into the negotiations with copyright proprietors, primarily the motion picture producers, in 1967. Now our position at that time was different from the way it is today. The negotiations were begun just after the first copyright bill was considered by the Congress, the first copyright bill having a CATV provision. This was HR-2512.

The CATV section of that bill contained tremendously complicated and very pervasive provisions as related to CATV. It was essentially a regulatory bill, more than a copyright bill. It covered distant signals. It covered all kinds of exclusivity, that is, protection for local broadcast stations. It provided that CATV systems could not originate programming without incurring full liability for copyright and was generally completely restrictive of CATV.

I consider the failure of that bill to be beneficial to CATV and to the public. I was very fearful that that bill was going to have some success in the House and was very happy when it fell apart.

It would have had the effect of freezing CATV forever in legislation. It was an extremely bad provision.

After HR-2512 died, the CATV industry was in the position of anticipating the possibility of total copyright liability. We were looking at no legislative solution that would be reasonable.

A United States District Court in the Fortnightly case had decided that we were liable for copyright, and this had been confirmed by the Court of Appeals. So we were in the position of looking at total copyright liability and it was in this posture that we began our negotiations with the copyright proprietors. We were looking through the wrong end of the tunnel at that time.

Then there came the Supreme Court ruling in Fortnightly which changed drastically our posture. We did a switch over night. After the Fortnightly case, in 1968, the CATV industry could have said, "We're not going to pay any copyrights, we're not going to discuss it with you anymore. We'll wait and see what happens in that other law case, the CBS case, before we'll negotiate again."

We didn't do that. We took up right where we had left off and continued negotiating with the copyright proprietors. I think that makes us guys with white hats, but there are other reasons for it. One of the primary reasons for it was the FCC had given innumerable indications that it felt that the CATV distant signal problem was not going to be resolved until there was the possibility at least of a companion copyright solution and in large measure this was based on the fact that a number of people at the Commission who were in substantial positions there were of the opinion that we should fall under the umbrella of copyright. Now because of the FCC attitude, and this attitude carries over into other areas -- it's a sort of a general attitude that probably CATV should pay copyrights -- we have continued the negotiations.

If I may digress for a moment, I regret that the FCC tried to influence those negotiations, in my opinion, and I refer specifically to retransmission consent provisions of December of 1968, because that was nothing less than an attempt by the Commission to vitiate the Fortnightly case, a decision of the Supreme Court of the United States, and I'm here to tell you they effectively did it. They effectively wiped out that case.

I won't dwell on that because we seem to have had a possibility of a change in the regulatory atmosphere, so I will leave that.

As you know, the FCC is working on new proposals and, as a matter of fact, most of us in the industry are nervously awaiting some imminent action by the FCC which we hope will break the freeze in the top 100 markets which has existed for about 5 years.

Now assuming for purposes of our discussion today, assume that the FCC will in its near term change its rules, where does this leave the CATV industry in terms of the copyright problem? Based on Chairman Burch's statement before Senator Pastore on June 15, I am under the impression that the FCC will leave the resolution of copyrights up to Congress.

Previously they had taken the position that we would not get distant signals unless it was a trigger provision which would mean that the regulations wouldn't go into effect until the copyright bill was passed. They have dropped that posture and they say, "We're going to worry about the regulation of the distant signal problem and just leave copyright up to the Congress."

What does this mean we should do? Should we wait and see? Should we volunteer to pay copyrights? Should we move toward the resolution of this problem or walk away from it?

I think those questions have already been answered and I agree with the answers because, as you know, NCTA has now entered into an agreement with representatives of the motion picture industry, the copyright proprietors. The agreement contains provisions with respect to the numbers of distant signals which can be brought in to all of the television markets of the United States. It contains provisions providing for virtually total protection of copyrighted material in the top 50 television markets of the United States, the so-called exclusivity provisions. It contains provisions for payment of money by all CATV systems in the United States for copyright and for a methodology of collection and disbursement of those funds.

It also contains grandfathering provisions to insure that no existing CATV system will in any way have a loss of or reduction of service from what they presently provide. Now I would like to repeat that the grandfathering provisions cover service. There is no grandfathering on payment but there will be exemptions for small systems and an ascending scale of payment so that the larger systems, the newer systems, the ones to be built theoretically in the top 100 markets will carry the brunt of the copyright payments.

As you know, the agreement was submitted to the FCC for study. We have no official reaction of the FCC to the concepts expressed in the agreement.

I guess I will have to note here that Commissioner Johnson did not think much of the agreement and he expressed this in a statement of his recently.

But, as far as what the total Commission thinks of it, I do not know, and I don't know what the fate of the agreement will be under those circumstances, because it does have such things as distant signal provisions in it.

I will say that the agreement does comport in every way with the statement of Senator McClellan. He set up certain things that would have to be involved in a copyright settlement and the agreement in every way comports with that.

I do think the agreement represents a milestone. It's an example of how two adversary factions can reconcile their differences through the process of discussion and negotiations. It's taken a long time but the problems of trying to reach a copyright resolution in the CATV area had the most, as far as I'm concerned, complicated and difficult problems of it of anything I've ever seen.

During our negotiations, we spent half of our time making sure that everybody understood what the issue was on the table because they were that complicated. So I consider this to be quite a milestone.

I will conclude by suggesting that the CATV industry should continue to direct close attention to the copyright problem and by exercising the same type of responsibility that has led to this present agreement and has characterized all of our discussions to try to resolve this issue.

Senator McClellan said that there was a season for study, a time for debate and a time for action. I think it's time for action in the copyright area, no matter what the FCC does. I will say that the agreement that was reached was intended in no way to delay what the Commission is doing. As you all know, what we want and we want now is the resolution of the distant signal problem, no matter how it comes.

But I do think we must face the copyright problem squarely and put it behind us as soon after the FCC acts, assuming it will, as possible.

Gary L. Christensen -- Now you know why the panel today is entitled "Federal Regulation and Copyright." The reason is that the two are very closely intertwined and the breakout of one depends upon the breakout of the other.

In the course of the negotiations between the cable television industry represented by NCTA and the copyright or motion picture copyright proprietors, the motion picture industry, there were various conflicts that developed, complications, if you will, and the motion picture people were ably represented by an attorney who is a partner in the firm of Phillips, Nizer, Benjamin, Krim & Ballon. You'll recognize at least the name of Phillips and probably the name of Nizer, who was the attorney who represented United Artists in the United Artists v. Fortnightly case.

Gerald Phillips was the able counsel who represented the seven major motion picture studios who participated in the negotiations during the last four years and we would appreciate, and I'm sure you will appreciate hearing from Mr. Phillips as to his views from the side of the motion picture copyright proprietor.

Gerald Phillips -- During the past four or five years I have been at so many meetings with Gary and Bruce that when I see them together here I think I'm at another negotiating session. You certainly have been well represented by such counsel as Gary and Bruce and Walter Schier.

Perhaps we have followed the adage: If you can't beat them, join them. I believe this is the fourth convention that I have attended. At first my associates and I felt like spies in your ranks when we went to Boston but that feeling has disappeared. Originally the freeze had an effect upon us as well as you.

We were invited by your committee so that we could learn to understand your industry, how it operates, your hopes and ambitions and with each year we have learned to have greater respect for your operations and your industry. Each year we have felt more at home coming to your convention and today some of our companies are actually members of your Association. That's progress.

Now we are meeting after an historical accord has been reached between our two industries as to what we both feel would be a fair compromise for copyright legislation and FCC regulation. I agree with Bruce that I believe our accord fits well within the guidelines stated by Senator McClellan at lunch today.

A new era of cooperation has begun. We hope that it will long continue. We will endeavor to see that this accord is made into legislation and regulation. We will dedicate ourselves to that.

Originally I think we were considered more like competitors of yours but in truth we are your suppliers and without our product CATV could not exist.

At our first meetings it was decided that both sides of the table needed to be educated and have we educated each other for four long years. I think we ought to get doctorate degrees. But two important lessons have been learned by each of us.

We, the copyright owners, the program suppliers, have come to appreciate that CATV will some day very soon become our very important customers. Our industry in times of crisis, and we are in a time of crisis, has always come up with a new customer. In the theatrical field it was the drive-in theaters and then it was the television industry and I'm sure we will look back in a few years and realize that the cable industry has helped us to survive and get out of this precarious position we're in today.

Your industry likewise has come to appreciate the fact that, if you are to survive, the program suppliers and the properties that it has must be protected, that the economics of motion picture production and distribution and the economics of TV programming require a healthy syndication market.

That we cannot make motion pictures today for just the theatrical field or perhaps even for the theatrical and network field, that we must have a healthy syndicated market, a market where the local stations buy our product and are, to some degree, protected in their purchase.

Thus both our industry and CATV, I believe, have come to the conclusion: Don't kill the goose that laid the golden egg. It was this fact that helped to bring the parties together. Like all compromises, it will be criticized on all sides but I do believe it will help CATV grow, get into certain of the larger markets and will help to permit the program suppliers to survive.

In order to reach an agreement, the vital and difficult problem of fixing the compulsory royalty license fee was temporarily postponed. It was agreed that we would work on that problem during the next 60 days. The program suppliers felt that they first had to have an agreement as to what systems would pay.

Originally we took the position that the CATV systems in the top 100 markets should not get a compulsory license for distant signals but should negotiate for products like any other user, as the theaters and as television negotiate for their product. But we have compromised this position and have agreed that in all markets CATV should have a compulsory license.

We also originally took the position that there must be some measure of exclusivity in all markets. In our agreement, we have agreed that only in the top 50 markets should there be exclusivity protection. So that we have come a long way in trying to compromise our position with the CATV industry.

But now that we have agreed as to these issues, we will shortly begin to try to agree upon a fair compulsory fee to be paid by all systems for copyrighted programs to be inserted into a copyright bill. After a period of 3 years a Federal tribunal will take hearings and determine what the future schedule should be.

The task before us is to compute the amount of damage or loss to the copyright owner from the importation of distant signals, which must result from the fractionization of the TV market, and the loss due to the destruction of exclusivity in all but the top 50 markets, and also the value of the commercial use of the program to the TV system.

The FCC task force and I believe all think-tanks and all those who have discussed what a compulsory license fee should be have agreed that the importation of distant signals will cause a fractionization in the market and that, as a result, stations will endeavor to pay less license fees.

The difficult task is to quantify this loss and perhaps do it for the next three years and thereafter look at it once again, for it is generally agreed that the copyright owner must be compensated for the loss which will result in the fractionalization of the audience.

Take, for example, a three-station market. Is there any question that the audience will not be the same for a station when instead of having to compete for its audience with two other stations it perhaps will have to compete with a CATV importing three distant signals?

Before the advent of television -- before the advent of CATV -- a station in licensing product believed it would obtain the picture and have exclusivity for the run of their license for its market.

In markets below 50 a CATV under our accord could import distant signals and the station would have no exclusivity.

Put yourself in this position. I visualize in not too many years CATV will want to originate and have a pay cable system. If you pay a large amount for a program to originate in your market, will you pay the same amount if you know that the local television station may show that program the night before you play it? Won't you, if you buy it, seek exclusivity over the local station? And, if you can't get exclusivity over the local station, then you will not pay as much as you would if you were able to obtain exclusivity and the problem of exclusivity will be yours in the future as much as it is to the local station today.

The damage done by the importation of a distant signal is the same whether the program is originated by CATV or it comes over the air.

CATV must recognize that the program suppliers must be compensated for the loss of their fractionalization and the loss due to exclusivity. A reasonable royalty must be paid for the commercial retransmission of all signals, whether they be distant or local. Your industry has made it clear in public statements that you agree that you should pay for all signals.

The necessity of your helping to preserve the program suppliers will, I am confident, permit us to structure a royalty schedule which will compensate our industry for the loss that we will suffer as a result of the destruction of exclusivity and fractionalization.

We hope that the issue will be: What is fair both to buyer and seller, to CATV and to copyright owners and not be compared to the present day where you pay nothing and in the future you'll have to pay.

<u>Gary L. Christensen</u> -- Perhaps some of Gerry's remarks will let you understand why the negotiations that we entered into were so difficult since, even having agreed in principle on the basic elements of what is to be under the compulsory license, this still leads us into a good deal of conflict when we consider the prospect of negotiating fees. What we buy and what we get for the money that we pay is a very significant factor when we are to negotiate the amount of the fees.

I think we do have a little time for questions. I would like to throw it open to the panel, first, to ask any questions that they wish of any other member of the panel.

DISCUSSION

Bruce E. Lovett -- The predicate for the couple of questions I have is that as I sit on the panel today I find there's a remarkable difference between this panel and some of our panels of a few years ago and the main difference, as I can discern it, is we're all talking about compromise. As Jack Matthews said it's because we're all so tired, but that's all we're talking about is compromise and I've been involved in nothing but compromise for the last five years and I'd just like to postulate something.

The question I want to ask and I'll start with Jack Matthews is: Are we really being compromised to death? And I can think of no better area to ask the question than the footnote 69 area. You already have non-duplication protection. Why in the devil is that not enough? Why do you need a significant viewing standard in order to determine whether or not you can receive signals on CATV that are available probably on rabbit ears in the market? Why is that a fair compromise and why is it necessary for us to compromise a principle that I think is so obvious in the footnote 69 situation?

John D. Matthews -- It isn't a fair compromise. Footnote 69 is a stupid rule. There's no reason for it, never has been. You can go up on the Hill and say to a congressman or senator, if you're on a cable system in Chevy Chase, you can't watch the Baltimore signals and he'll say, "The hell you say. I can get it off my rabbit ears right now." It's just a crazy rule but just as Emerson said that consistency was the hobgoblin of small minds I guess compromise is the hallmark of practical, pragmatic, realistic men.

We're stuck with the policy and the Commission is bound and determined not to eliminate it evidently but to liberalize it and what I attempted to do today was to come up with a realistic solution which would free up most of the very difficult areas that this has affected in the country.

I feel the same way Jack does. We've been in the position of having a Hobson's choice on a lot of cable matters for years and years and years. One of the OTP Committee members is reputed to have said to a cable man who immediately fainted and turned into shock, "If I told you that this cabinet level committee would give you all you wanted in five years, would you be willing to wait that long?"

If we were in fairly decent shape now, I think the obvious answer, maybe not for five years but for two or three would be, "hell, yes." Because long-range we might come out better with this cabinet task force than we have under the FCC but you've got real problems now and the name of the game is compromise.

It's an unfortunate situation but I don't see any way out of it.

Bruce E. Lovett -- I have the same question of Jack Cole. Jack, you know what the Commission is considering now as exposed to the Senate Committee by Chairman Burch recently, the three-signal/two-signal concept, and that certainly has got to be ultimately compromised, particularly in markets 51 through 100.

Do you think two distant signals are enough? Do you think you can go out there and build all of those markets with two signals? Have we had enough experience to indicate that this is sufficient for a real breakout of cable?

Do you think it's a good compromise? That's my question.

John P. Cole -- The watchword in Washington is compromise and you go from Washington to the legislative process and legislation should be changed to compromise because we have been placed in a situation where compromise, as Jack Matthews just observed, is -- it is a Hobson's choice but it's a way out of an impossible situation and this industry has literally been frozen for a period of five years. Five years is a long time to maintain your manufacturing expertise, your personnel even and we've been put into a situation where we are clamoring to grow and we need to grow and we will accept compromise almost if it's unreasonable compromise.

I think your point is exceedingly well taken about footnote 69 where non-duplication is there, there is no logical reason for it. It's purely and simply a compromise solution. I think that -- and one thing we all know deep down is that when this industry gets off the ground, when you pack the political punch that your opponents punch, when you have as many subscribers or nearly as many subscribers as the broadcast industry has viewers and access to viewers, this is going to be a new ballgame and we fight a battle at a time. The war is not over but, if we're going to win this battle, we've got to start making some progress and maybe we can make some progress through reasonable compromise.

I'm still worried whether we have enough strength to pull off reasonable compromise and I do think that at this stage of the game Dean Burch's proposal is reasonable. I think that I'm not nearly so worried about markets 50 to 100 with two distant signals as I am worried right now about markets 100 to infinity with one distant signal, because that's where the problem comes in and it's so incredible to me that we have been with a Commission for eight years that has said, do anything you want to in the small markets because all of the muscle, all of the talk about preservation of free TV has come from the big boys, and then a sensible Chairman comes in here and takes a look at the matter and says, My God, there's no problem in the big markets. They can stand competition. But let's change the course and let's just favor or discriminate to people that happen to reside in the smaller towns in this United States. And that policy makes no sense to me at this time.

I want to conclude and get off this mike by saying one thing. Once this industry gets off the ground and once it begins moving again, there're going to be a lot of changes and those changes may be two and three and five years away but they're going to be changes that we're all going to welcome.

Bruce E. Lovett -- Mr. Chairman, can I ask one more question of Mr. Phillips?

Gary L. Christensen -- Okay, one more, then I noticed there are some people out in the audience.

Bruce E. Lovett -- Just to be irascible, I'd like to ask Gerry how much money is he talking about? I'm not saying you're going to get it. But how much do you want, maybe related to size of business? How much money as a percentage of gross are you all looking for, let's say, from a 5,000-subscriber system, 10,000 or 15,000-subscriber system?

A Voice -- Can we put that in writing?

Gerald Phillips -- It's an easy question because we don't know the answer right now. We met yesterday among ourselves to put some people to work on trying to get a resolution of that question. For the first time we now talk about exclusivity in certain markets and not others. We talk about a number of signals into a certain number of markets and with that we will hope to get the figures together. I think it will be within two or three weeks from now that we'll have some ideas of some figures.

Let me throw out a possibility. Does it make any sense, Bruce, I'll kick the question back to you, if someone determined for us and said, look, this is the figure we feel we're going to be damaged. You determine how your industry should pay it and assume for a moment that you think the figure is reasonable.

Bruce E. Lovett -- My answer is no. I don't think that's reasonable at all. I don't think that the discussion of fees requires us to underwrite any loss that you may speculate will occur. I don't think that's what we're talking about.

I think we're talking about arbitrarily establishing a basis where the CATV industry can move forward by getting copyright behind us and that's it and we don't want to pay any more money than we have to and I don't think we should pay any more money than we absolutely have to in order to reach a resolution of the problem.

In this regard I want to point out one thing, that the CATV industry so far has agreed to pay a percentage of gross for reception of both distant and local signals.

I see Fred Ford in the audience and I know Fred's position on two tickets to one performance. His theory is you should certainly not have to pay any copyright for local signals because they've already been paid for by the broadcaster and all you're doing is improving his reception.

Now that conception was made out of a spirit of compromise again, total, absolute compromise and made arbitrarily.

All I'm really trying to get at, Gerry, is that I think the answer will be in a head-on negotiation. You try to get what you can and we'll try to keep from paying it and whatever that breaks out at will be the figure and I think it will be just that arbitrary. But I don't think it will have any relation, exact relationship to the amount that you either lose or think you will lose through distant signal importation.

Now that may sound harsh but that's my judgment of how it will work out.

<u>John D. Matthews</u> -- Gerry, I'd like to ask Bruce and John both a question about the exclusivity provisions of the agreement, particularly the two-year rule.

Gerry, a client of mine in Upper State New York gave me at lunch today some yellow sheets of a one-day study they did of the VHF New York independents and what blackout would be entailed by virtue of compliance with the exclusivity provisions of the copyright arrangement.

I notice that one station is on the air 17 hours a day, you're blacked out 7-1/2 hours. Another one on the air 17 hours, you're blacked out 7-1/2 and the third on the air 17, you're blacked out 4-1/2.

That seems like a hell of a lot of blacking out to me when the Commission's non-duplication rules don't encompass that type of blackout activity and what was the reason for this other than, as Bruce has put it, a spirit of general compromise between the two competing groups?

<u>Gerald Phillips</u> -- For our salvation, survival, we need to grant a local station exclusivity and perhaps you should answer the question I put to you before. If you originate and pay money for it, won't you ask for exclusivity over the other stations? The name of the ballgame in regard to all copyrighted works is basically exclusivity and that's what the Constitution did when they said there should be a copyright law.

What you're really suggesting is that, although we have a copyright, we have no exclusivity over it.

Bruce E. Lovett -- Don't you have any concern about the Commission's pending rulemaking on exclusivity and the Justice Department's interest on it based on the comments filed?

Gerald Phillips -- Of course I'm interested in what they have to say but I do think we can justify perhaps in a city like Philadelphia, if we have licensed programs to Philadelphia, that a CATV in that city should not bring in the same program the day before it's going to be shown in Philadelphia. Because if that will happen, will the television station in Philadelphia pay the same license fee?

Gary L. Christensen -- I think that's the basis of our argument and the reason for a compromise in that connection and the insistence of the CATV industry that we didn't think that fractionization meant that much and the insistence of the copyright proprietors that exclusivity should not be violated. That's the question which we arbitrarily negotiated and settled upon.

I think with that we ought to turn the floor over to the audience. Would you kindly step to the microphone, if you have a question, and identify yourself and then ask your question directed to any panelist you please.

Mr. Allen -- I live on the border in Arizona. I've been a member of this Association since 1953.

I hear all this conversation about compromise. I live in a community 65 miles from the metropolitan center of Tucson. I receive only those stations whose B contour encompasses us theoretically. I pay no copyright fees because it's the presumption that the copyright fee has been paid for that audience by the broadcaster. Now we're compromising because we want to go forward in the big cities. We're compromising and we're now asking a community such as mine, my customers, to pay a second entrance fee to that same performance.

I'm asking: Is this part of the compromise that we are asked to support?

Gary L. Christensen -- To whom do you wish to address this?

Mr. Allen -- To anyone, the entire panel as a matter of fact, because we hear so much from the Association, as a matter of fact, this may turn into a little bit of a tirade against the Association. I've come back to Washington wearing a white hat on several occasions to come in to get the "party line," rushed down to my Senators and they say, "Oh, son, you didn't get here in time, because they've switched signals on you. There's another group that has a different opinion."

But I simply am unable to determine what these compromises are we're suggesting and, if I understand them properly, it would mean that I now would have to pay a copyright fee in order to carry signals within the Grade B contour of those stations for whom the copyright -- who has already paid the copyright fee.

I'm not sure that that's what we're talking about in this "compromise." Compromise to me means two contending parties, one gives a little and one gets a little. I don't know quite what we're going to get. I know what we're giving, if we're required to pay a copyright fee.

Gary L. Christensen -- Bruce, would you like to try your hand at it?

Bruce E. Lovett -- Yes. I'm not sure how successful I will be.

May I ask you a question. Do you use microwave at all?

Mr. Allen -- I do not use microwave.

Bruce E. Lovett -- Okay. I ask you to put yourself in the position of someone who does, just for purposes of discussion, in an existing system because the necessity for compromise goes further than just trying to resolve the political problem.

You do have a problem with the CBS-TelePrompTer Case. If the case goes against us, it would mean that anybody who is using microwave to carry signals, distant or local, but probably distant signals, would then be subjected to total copyright liability and by total copyright liability, I'm not talking about paying for it, I'm talking about not getting it. I mean just being absolutely cut off the next day from every signal you're carrying because they would withhold the right to carry those programs.

Okay. I just want to particularly point out that this is a serious problem which does require that we settle the copyright dispute.

Going one step further. There is no question but that you pay no copyright today and, if you're not originating programming, you would not be affected by the CBS case and, as a result of the compromise for the good of the industry, you would be required to put up some money. Now presumably, if it's a small system, it would not be that much. But there's no question that you would be one to sacrifice as a result of the compromise.

Mr. Allen -- Mr. Lovett, my approach to this panel was on a principle. I joined an Association which professed at that time and held off onerous legislation and regulation on the basis that we were a master antenna and then later we got to the microwave to serve larger interests and now we want to go into the -- the argument seems to be between 50 and 100 top markets and, do you know, I couldn't care a hoot whether anybody ever puts a cable system in there.

I know what this sounds like to people working for the Association but I must say that there may be two different types of cable systems and there may be a need for two different kinds of conventions.

For example, I'm afraid that I no longer see the value of this Association to my particular position, and I know there's a cry for unity and all that and I won't be apt to disrupt the whole situation I'm sure.

Kenneth Cass (Federal Government of Canada, Department of Communications) -- I'm not involved, I haven't been involved in this issue of compromise but we are working on this copyright issue in CATV in Canada and I'd like to just address a few legal questions in this, sticking to the legal issues as such.

I don't understand why, if somebody is using a microwave carrier, this is going to affect the copyright liability of the person involved in it or, if he's originating programs.

I'd like to stick to two technical things. If a person or a CATV company is actually interfering with a signal by either switching it to another channel so that there's no ghosting or delaying it, would this be a factor in copyright down here? Because we think it may be back home.

John P. Cole -- We don't suggest to you that it is a factor. It is a factor to be considered by the Supreme Court. In the decision, the famous Fortnightly decision which resolved this, the court was very careful to say at the beginning of the opinion and at the end of the opinion that it was deciding the issue solely on the basis of the facts of the case before it and it emphasized that the signals were received directly off the air and it emphasized that the cable system presented no programming other than received -- than television signals which were received and distributed -- and it bought, on that basis, the master antenna concept saying that this is a cable system, this is a means of cable reception and then it specifically ended the opinion by saying this doesn't mean that on a different set of facts we might not come to a different conclusion.

Now I think that Bruce and Jack and Harry and I would all be willing to argue that the existence of a microwave-fed system is not a material distinction insofar as the conclusion on copyright liability was concerned. But because of the court's care in the Fortnightly opinion, it certainly leaves room for Mr. Phillips to argue that this is a different case and warrants a different conclusion.

This is a matter that has not been resolved even by a district court at this stage and I suspect that, if it ever is, we're looking at a district court and a court of appeals and a supreme court.

Kenneth Cass -- I would agree with you but I'd like to then ask in terms of whether or not the factor of fooling around with the signal, of changing it to another channel or taping it and then playing it at a later time, whether this would be a material factor?

John P. Cole -- No question but that would be a material factor, because --

A Voice -- The second, not the first.

John P. Cole -- Possibly the first, if the signal was materially changed. Just placing it on a different channel for reception purposes is debatable, I guess, but I think most of us would conclude that the result of the Fortnightly case would apply.

Now, if you're going to take the signal and delay it for one minute, 60 seconds, you lose the theory of the master antenna concept. You then are -- you have taped the signal and you're distributing that signal and, even under Fortnightly, I think it's reasonable to conclude that copyright is applicable.

Kenneth Cass -- Thank you very much.

Gerald Phillips -- Gary, may I make one point clear to the gentlemen. That there was a case on this dealing with Alaska. A CATV operator, in a sense, took the programs in Seattle off the air and then distributed those tapes into Alaska.

Our District Court in Seattle, Washington, said that was a copyright infringement. I don't think there's any question, under our law, that, if you tape a program, that would be a copyright infringement.

Peter Spreadbury (Boston) -- I'd like to point out or ask a comment of Jack Matthews on the footnote 69 question.

Where we have a proposal from the FCC now to, one, provide adequate -- have an adequate service provision and, two, a bonus two signals into most -- into every market in the top 100, would this not substantially alleviate the footnote 69 question and therefore would it not be better, rather than to seek a compromise on footnote 69 as to viewing habits on the overlap, to just drop it completely, take the proposals from the FCC on the adequate service and two bonus signals and then go back to footnote 69 and get the whole thing?

John D. Matthews -- I wasn't attempting to lump them in together. They are separate. But keep in mind that when the Commission says local signals, plus distant, plus a bonus, in any event, they're saying local signals affected by overlapping major markets, plus distant signals, plus your bonus.

Now, let me give you an example. In San Diego the system is grandfathered in about half the community with the Los Angeles independents. If they were allowed to expand in the rest of the community with a bonus of two, they would still be carrying there three less than what they were carrying in the other half of town because footnote 69 knocks out those Grade B signals from the Los Angeles independents.

You've got to get rid of footnote 69 before you can make any meaningful sense in the major markets, and I'm pretty familiar with the corridor you are describing between Manchester-Boston and Providence, because we have some of those clients.

Peter Spreadbury -- I was thinking of San Diego, actually.

John D. Matthews -- Right. It's a bad rule and the Burch distant signal proposal helps it a little bit, if it stays in, but you don't get nearly the advantages of the Burch bonus proposal or the distant signal proposal, if you leave footnote 69 in in its present form, particularly in the overlapping markets.

Harry M. Plotkin -- I'd like to go back on that because I'd like to refer to the philosophic question which Bruce raised and that's the morality of compromise on 69. I think it's immoral to compromise on footnote 69. There are some places where you don't compromise because, if we ever agree that a Grade B signal that's available off the air does not become available, if you belong to a CATV system, that's an immoral compromise that's absolutely inconsistent with the Commission's whole allocation philosophy.

To say that if you put up your own antenna you can get a signal but, if you have the nerve to subscribe to a CATV system, the government by fiat will cut off the signal, that's immorality. Now, we may not win. There are tough political forces, there are tough economic forces against this but on the moral/immoral issue of that type I don't think we ought to compromise. I think it's wrong to compromise and I think we ought to go all the way on footnote 69 and we'll win some day. Truth will come out. I don't think we ought to give on this.

"STATE REGULATION"

Speakers

Morton L. Berfield, Esq.
Cohen & Berfield
Washington, D. C.

Jay E. Ricks, Esq.
Hogan & Hartson
Washington, D. C.

E. Stratford Smith, Esq.
Smith & Pepper
Washington, D. C.

Moderator

Charles S. Walsh
Assistant General Counsel
NCTA, Washington, D. C.

Charles S. Walsh -- Over the past year public utility bills have been introduced in the State legislatures in 19 States. Those include major States like California, New York, Illinois, Pennsylvania, Florida and Massachusetts.

We are fortunate that in all of these States the bills were beaten, many of them just barely.

It is obvious, as Bob Folkes here from Florida can tell you, the States are obviously serious about regulating us as a public utility.

Today we have with us three very prominent members of the Washington communications bar, all of them having very specific dealings not only with CATV but with the problem of public utility regulation and public utility bills.

From my left to right, Mr. Jay Ricks, who is a partner in the law firm of Hogan & Hartson. Jay will cover a subject today that I don't believe has been covered at any national convention on any program, and that is the impetus behind many PUC bills being introduced into the legislatures and the consequent need for franchising ethics in the CATV industry.

Secondly, Morton Berfield, a partner in the law firm of Cohen & Berfield. Mort will discuss his own experiences in representing the New York CATV Association and their battles this past year in the New York legislature with the New York PUC bill.

Mort will also discuss some of the strategy that the New York Association took in opposing the bill this past year.

Finally we have Mr. E. Stratford Smith, partner in the law firm of Smith & Pepper. Strat will discuss with us one of the alternatives to State regulation, the best alternative, many believe, and that is Federal pre-emption -- pre-emption of all regulation by the Federal Government.

Mr. Walter Kaitz, as you see by your program, was to have been here today. Walter is the renowned legal counsel for the California Association. Unfortunately, circumstances made it impossible for Walter to be here.

Jay E. Ricks -- Thank you, Chuck.

As Chuck mentioned, I am going to discuss the question of the ethics of CATV franchising, particularly as it has had an influence on State legislatures considering CATV as a utility.

In the area of franchising I think it is fair to say that CATV is its own worst enemy. And I am not directing this criticism to a small vocal minority of the industry but to the industry at large.

CATV is a growth industry and acquiring new franchises is a less expensive way to grow than buying existing systems. Thus, the fantastic competition which we see today for CATV franchises.

Typically we find the applicants for a CATV franchise in a kind of classic poker game. The first gambler says, "I'll see your $4.95 subscriber rate and I'll raise you down to $1.80 rate per month." The second gambler says, "I'll see your $1.80 rate and I'll raise the percentage payment to the city from 3 to 14 per cent of my gross receipts." The third gambler says, "I'll see the $1.80 rate, the 14 per cent payment to the city and I'll raise both of you an option to the city to acquire the system at net book value of assets, excluding franchise, within ten years." The fourth gambler closes the bidding by seeing all previous raises and promising to construct underground facilities able to serve every one of the 100,000 homes in the three-station market within 12 months of the grant of the franchise, irrespective of FCC permission to carry distant signals.

The city happily collects the bets, grants the franchise and adds the kicker of a $400,000 performance bond.

This may sound like a fantasy or, perhaps more accurately, a nightmare. But each of the promises that I have recited has been made to a city by a CATV applicant, although I have used the advocate's license in combining them to make my point that some CATV operators are in danger of promising themselves into bankruptcy, or, alternatively, they face the prospect of having to persuade local officials to change the terms of the franchise with all of the attendant dangers which that entails.

Have I overstated the magnitude of the problem? A review of the history of the telephone industry which, as you will recall, in its early days also required local franchises, indicates that I have not.

In his book entitled Monopoly, Joseph C. Goulden states with respect to the development of independent telephone companies as follows:

> The independent movement had ingrown problems. An overeagerness for new business was foremost among them. In the Middle West particularly the independents wooed franchises from city councils by pledging low rates, only to find that they had so underpriced themselves that they could not stay in business. Companies which could not wheedle increases went broke.

And I think all of you know who picked up the pieces. That some CATV operators must face the same bleak prospect because of overpromising to win a franchise is indisputable.

At current construction prices CATV in my judgment is no longer a $5 a month industry and certainly cannot even recover costs at subscriber fees much below $5 a month.

No prudent businessman can justify the investment in CATV plant if that plant can be acquired by the city at depreciated value after only ten years of operation.

The fact that franchise holders in over 23 markets have not begun CATV construction during the past three years is strong evidence that a promise to build without distant signals in such a market is risky at best.

Only a company with a guaranteed rate of return on investment can justify a promise to extend its service without additional cost to every home within the boundaries of the franchising authority.

The promise to pay an excessive percentage of gross receipts to the city may not bankrupt the system, but it must inevitably cause a reduction in the quality and diversity of service offered by CATV. Thus such a promise will lead to another circumstance described by Mr. Goulden in his book Monopoly.

> In order to improve telephone service through competition, the New York Legislature in 1901 passed a law directing cities to grant franchises to all applicants. Regrettably for some of the existing telephone systems, the Legislature did not require that all such franchises be identical in their terms.
>
> The consequence was that applicants seeking to overbuild the existing telephone company through political influence received franchises more favorable in their terms than those held by the existing telephone company. Through this process many independent companies succumbed to Bell competition.

I do not stand in the pulpit and point the accusing finger at the cable television operators. We in the legal profession stand in pari delicto with our clients because we typically are the advocates who conjure up the promise that we will win the franchise contest.

The dilemma of the CATV applicant is best described by the phrase, if I don't make the extravagant promise or if I don't accept the outrageous demands of the city, my competition will.

What is the solution?

Can all of the applicants for a franchise agree in advance on the amounts to be offered for rates and franchise payments? Not unless they would enjoy several years of making little rocks out of big rocks.

An industry association is similarly precluded by the anti-trust laws from adopting price guidelines for its members.

The United States Supreme Court held in U. S. v. National Association of Real Estate Boards, a case dealing with the real estate industry in Washington, D. C. which had advised its members to charge a standard percentage broker's fee, on real estate transactions, as follows:

> An agreement shown either by adherence to a price schedule or by proof of consentual action fixing the uniform or minimum price is itself illegal under the Sherman Act, no matter what end it was designed to serve.
>
> And the fact that no penalties are imposed for deviations from the price schedule is not material.

Thus the mere adoption of a code of ethics by an association that contains price guidelines and voluntary adherence to such a code by members of the association would probably violate the law.

Does this mean that self-regulation in the area of franchising is impossible and that the problem must be solved by the enactment of State or Federal laws regarding franchising guidelines? I think not.

The solution which I recommend involves the education of the franchising authorities by the cable television industry acting through its Association.

NCTA could adopt a comprehensive set of principles to guide municipalities in the function and purpose of CATV franchising and regulation.

Such principles would emphasize that unrealistically low subscriber rates or unrealistically high payments to the city will inevitably lead to reduced service to the public or, more likely, to an unbuilt system and subsequently to trafficking in its franchise.

The Association in the interest of protecting the industry's reputation should frankly point out the dangers of overzealous bidding for franchises, such as uneconomical overbuilding of systems, post-franchise proceedings to revise the ordinance, lawsuits to nullify the more onerous franchise provision, and -- bite the bullet and admit -- the possible corruption of local officials.

Having observed the development of a franchise ordinance and the comparative criteria for its award by my home community in nearby Arlington County, I am convinced that communities can be persuaded to base the award of the franchise primarily on the applicant's ability to perform in the public interest as it is defined by the community.

For example, after determining such matters as the number of channels that should be dedicated for access by the public, technical standards, schedules of construction, channel capacity, service to educational facilities and other broad band services, a community should judge each applicant on the basis of its financial, technical and operational qualifications to perform under the franchise.

Subscriber rates, if they are to be included at all in the franchise, should be expressed in terms of maximum allowable and by no means should they be the subject of bidding.

Payments to the city in the form of gross receipts tax should not be contained in the CATV franchise but should be added to the community's business license tax ordinance. The level of the CATV license tax then legally could not be significantly above the license tax for similar businesses.

In any event, the CATV tax should be no higher than an amount reasonably related to the cost to the city of assuring compliance with this ordinance. By no means should it be the basis of bidding.

The franchise process under the guidelines that I have suggested would be just as competitive as the current practice of bidding. However, the competition would involve an evaluation of each applicant's qualifications to perform under the same franchise provisions rather than a bidding contest among the applicants to determine what provisions the franchise ought to contain.

The elected representatives of the community and not the CATV applicant should determine what interests of the public should be served.

I believe that most elected officials would welcome guidance from NCTA in this regard.

I am well aware of the fact that previous efforts have been made within NCTA to develop a consensus model CATV franchise and that such efforts have been less than successful.

I suggest, however, that the alternatives to self-regulation in the franchising process are extremely undesirable.

Morton L. Berfield -- A not so funny thing happened up in Albany, New York, this year. The New York Assembly and Senate passed and Governor Rockefeller signed into law a bill freezing and prohibiting for one year the granting of any new cable television franchises throughout the State of New York.

That bill, at least in my opinion, is based on factual assumptions which are wholly unproven if not outright erroneous. The bill I think is of dubious legality, and with its across-the-board freeze the bill is restrictive and regressive.

In sum, the only favorable aspect of the New York moratorium bill is that it could have been much worse. For there were two main bills introduced earlier in the legislative year in New York which proposed far reaching and highly adverse cable regulations.

Neither of these other two substantive bills got out of committee, and the result was the stopgap interim moratorium measure.

To place these legislative events in New York in perspective a bit of background is helpful.

In New York, as in most states, CATV has developed through municipal authorizations generally referred to as franchises.

The first efforts at State intervention occurred in 1965 with the introduction of a bill to place cable television under the Public Service Commission of New York. Public hearings were held but apart from an antenna trade group whose special interest was obvious, there was no support whatsoever for the legislation and the bill died in committee.

For the next four years after that bills were introduced each session that received no support and died without hearings or committee clearance.

Then, however, in the summer of 1969 new efforts commenced. The principal forum was the Committee on Corporations, Commissions and Authorities of the Assembly, The Honorable Robert Kelly, Chairman.

Chairman Kelly's committee conducted in the summer and fall of 1969 a series of public hearings on cable. At this time the antenna trade group remained silent but other special interest groups, particularly the motion picture theater owners and one of the national networks, spoke out for restrictive State regulation. But no cable subscribers complained, no consumer groups complained, and no one even attempted to demonstrate any public abuse by cable.

Conversely, during those hearings there was extensive support for cable and opposition, strong opposition, to State intervention by local officials, mayors, county and township supervisors, who wished to continue to exercise local supervision of cable and believed themselves capable of doing so without control from Albany.

Ultimately, in the 1970 legislative session, cable bills were introduced, but there was no public or legislative support and the bills again perished in committee.

Then, following the summer and fall of 1970, Assemblyman Kelly held further hearings, and with the same result: widespread support for cable and no discernible public support for State regulation.

At this time, however, the New York Public Service Commission began preparing a report on cable television under the direction of Public Service Commissioner William Jones.

So we had these two lines of inquiry, one by Assemblyman Kelly and the other by the PSC, and these resulted in the two basic bills which were introduced in the 1971 legislative session.

The Kelly bill, as it came to be known, had these basic features: A completely new State agency would be created, the New York State Commission on Cable Television. The State Commission would consist of five members, appointed by the Governor, ratification by the Senate.

The State Commission would set franchise standards and all new franchises would require an application to the State Commission for a final certificate of approval.

Existing franchises would be grandfathered, but extensions, amendments and transfers of existing franchises would require a State certificate. Existing and new franchises not substantially built within one year of the date of the bill would be automatically invalidated.

The State Commission would levy the following fees:

Up to 5 per cent of your gross receipts for a fund for educational television. This 5 per cent program tax would be over and above local franchise fees, which could go up to an additional 5 per cent.

Over and above that there would be a set yearly operating fee ranging to $5,000 per system paid to the Commission.

There would also be fees for the certificates of approval and other applications would have to be filed with the State Commission.

The State Commission could require the filing of all company information, including balance sheets and other financial data. The Commission would have full subpoena and investigatory power.

No merger of consolidation of cable firms could occur until the State Commission had investigated and approved such consolidation, and the following companies would be banned from receiving any new franchises or from acquiring any existing franchises. Those banned and barred from cable TV would be newspapers, broadcasters, equipment manufacturers, no matter how little or how much equipment you manufactured, program producers of all kinds or any distributors of movies, entertainment, sports, business information or data services.

In addition to these specific requirements and prohibitions, the State Commission would have been empowered to promulgate whatever other regulations it deemed appropriate to its task, including rate surveillance.

These, then, are the main provisions of the Kelly bill for establishment of a State Cable Commission.

The second major bill introduced and proposed was that cable be regulated by the Public Service Commission.

The principal features of that bill are these:

The PSC would establish franchise standards for municipalities to enforce but would require a confirming PSC certificate of public convenience and necessity.

The PSC could pre-empt local franchises entirely where the PSC decided that a CATV system should cover two or more separate communities.

Existing franchises would be grandfathered, but any extension, amendment or renewal would require a PSC certificate.

No franchise, existing or new, could be transferred without prior PSC approval.

The PSC could require extension of CATV service into any adjacent area.

Any new franchise must be built in accordance with PSC construction standards.

All systems, existing as well as new, must operate under PSC standards, subject to revocation or suspension of your PSC certificate.

The PSC can order a franchisee to build if it finds construction has been unreasonably delayed.

The PSC could fix rates if the CATV owner and municipality could not agree, or upon any complaint or upon the Commission's own motion, and the Commission could reduce rates upon a finding that the system did not meet PSC service standards.

The PSC could require uniform books of account, specify depreciation schedules, how your expenses and receipts are to be entered, charged or credited, with the burden of proof on the company.

The PSC would require reports, examine all books and records and inspect any and all facilities.

The PSC may enact whatever multiple ownership rules it desires, require access to channels for public purposes, as well as channels for educational purposes.

Large systems at a certain point under the PSC would be ordered or could be ordered to convert to a full common carrier status.

So, gauged against these two substantial proposals, the one-year moratorium bill which did pass doesn't seem so onerous.

Of course, on the basis of past experience, moratoriums or interim freezes tend to acquire a life of their own. And this is troublesome and leads to this basic question: What happens next year?

There are several alternatives.

Of course, the most far reaching and comforting would be adoption by the FCC of rules and policies pre-empting the field, as proposed by the NCTA.

If, however, full pre-emption does not occur, then the New York Association stands ready to muster its forces against repressive State regulation.

Fortunately in New York cable has these things going for it:

First, the pressure for State regulation does not come from the public but has been internally engendered by certain legislators and the PSC.

Secondly, while there have been allegations of abuse, no proof has been forthcoming that the cable industry in New York has in any way misused the subscribing public.

Three, there is a strong tradition of local home rule in New York, with municipal, township and county officials concerned about the flow of power to Albany.

In this connection there is in New York now a special commission headed by former New York City Mayor Robert Wagner which is studying home rule, and that would appear to be an appropriate forum for examination of home rule of CATV.

State regulation would inevitably cause a substantial expenditure of State funds.

There was in New York in this legislative session in effect a taxpayers' revolt, and proposals for higher State expenses are not received with great enthusiasm among the public.

Again, and perhaps one of the most important items, the New York State Association has and will continue to have strong leadership through its officers and directors. These men have devoted countless hours to the legislative task and developed experience and expertise in sifting and appraising all the complicated factors in a legislative confrontation.

Finally, in my opinion, there are serious questions as to the legality of many of the provisions of these proposed bills.

Some of the provisions are clearly contrary to the FCC's authority under the Communications Act and may well be invalidated on constitutional grounds as an undue burden on interstate commerce or as a violation of the constitutional guarantees of due process and equal process of law.

These are the main lines of argument and effort employed by the New York State Association last year, and the game plan for next year is to renew and concentrate our efforts.

In the final analysis, however, the main bulwark is that there has been no showing of any public necessity to warrant the restrictive regulations proposed. After all, if the communities need information and assistance in deciding franchise applications, this could be handled in many ways other than by State regulation, as by the proposal just made by Jay Ricks for national guidelines set by NCTA and made freely available to all communities.

The desirability of distributing franchise information and developing franchise standards in my opinion in no way justifies the costly, burdensome State schemes proposed in New York.

And one of the most disturbing aspects of these proposals is the implicit assumption that the Government knows best and that some State agency should be empowered to decree rules covering all facets of cable television from bookkeeping to construction standards to rates to areas served. Perhaps it is the political and social climate in which we live which leads to this unspoken assumption.

Yet I strongly submit that our experience tells us otherwise, particularly when the subject is a fledgling industry struggling to develop and expand.

The job ahead in New York, indeed all over the country, is to persuade, as politely and persistently as possible, the legislators and the public of the dangers of restrictive State regulation. And I am confident that this task, as difficult as it is, can and will be accomplished.

<u>E. Stratford Smith</u> -- I approach my brief remarks today unfortunately with a sense of frustration and futility. The matter of the appropriate relationship between State or local and Federal regulatory authorities in the field of CATV is in my opinion the most critical legal problem before the industry. Its appropriate resolution is in my opinion as important to the growth and development of CATV as is the availability of distant signals, if not more so.

Many months, even years, have passed since many of us in the legal field, as well as our clients in substantial numbers, began to recognize this fact. And every month that goes by, it becomes more and more doubtful that the issue will ever be satisfactorily resolved.

My frustration and feeling of futility stem from the fact that I can find nothing new to say or nothing new I can do to impress upon the FCC the importance of coming to immediate grips with this issue.

I heard a good natured jibe yesterday from a lawyer friend of mine who sat in on the Tuesday legal panel, when he said of a lawyer panelist, who is also a friend of mine, "Well, he is giving his 1963 speech again today."

Ladies and gentlemen, so am I giving my 1963 speech today.

We have all been grappling with these same problems for years. Several of you have heard me speak on this subject before. Although there is little that is new, I am going to repeat some of what I said, with the pious hope that the word will get to somebody who can do something about it. But I shall be brief.

Clay Whitehead, the Director of the President's Office of Telecommunications Policy, told us last night that the "objective of the Administration's new Cabinet-level CATV Committee is not to delay the FCC in its proceedings, but rather to provide a different perspective of cable regulation." "A perspective," he said, "we feel, is badly needed."

Of course his purpose may not be to delay, and we can pray it won't delay access to distant signals. But it can certainly do nothing but delay resolution of the Federal-State issue unless we can impress upon him the urgency of it.

Listen to these words from his address last evening in speaking of the purpose for which the Office of Telecommunications Policy was formed:

> Our role is quite simply to formulate Executive Branch policy on communications matters. We are not a regulatory agency. Our interest is in policy, not the details of rules and regulations. Thus we would hope to formulate the policy framework within which the FCC, the States or the courts might regulate or not regulate cable. A sound cable policy framework must specify such matters as industry structure, common carrier or limited carrier status, the degree and level and type of regulation, copyright in the broadest sense, access, ownership, public service uses, the effect upon broadcasters and on special classes of viewers.

Ladies and gentlemen, on June 24th, 1970, the FCC institute rule making in all of these areas, including one, to formulate the policy framework within which the FCC, the States or courts might regulate or not regulate cable.

Now, somebody is kidding. What reason on earth is there for the FCC to spin its wheels on this important question if Mr. Whitehead and the Cabinet-level Committee are going to formulate the policy?

He surely does not intend to formulate policy and then not implement it by regulation.

Thus, if this policy, when formulated, does not fit within the framework of the Communications Act, how long will we have to wait for Congressional legislation and then a new FCC study to implement the new policy?

Yes, I am thoroughly frustrated.

At considerable expense to our clients, my colleagues of the Washington Bar and I have filed exhaustive comments with the Commission in December of last year urging the Commission to fully pre-empt the field of cable regulation in the interest of making possible the development of a uniform national policy in that field. We pointed out the urgency of immediate action.

At that time 23 State legislatures were actively considering public utility regulation for the CATV industry, and, as you know, several States have already implemented such regulation.

The arguments against public utility regulation of CATV with concurrent comprehensive regulation by the FCC of the CATV industry are many.

We are all aware that the Commission has in fact asserted full regulatory jurisdiction over cable. Almost no facet of CATV has been left untouched, operational, technical or economic. Permissible reception has been prescribed; technical standards are proposed; local program jurisdiction has been asserted, and broadcast regulation standards will apply; cross-ownership rules have been adopted multiple ownership rules are proposed; free channel services to local Government, citizen groups and educational agencies are proposed and will undoubtedly be required; leased channel services to the public are required; the provision of channels and services by telephone carriers to CATV has been brought under Commission control; and the scope of the Commission's jurisdiction over the poles, both power and telephone, is under consideration.

The industry is vigorously regulated to protect local broadcast service.

To repeat, the regulatory acts and aims of the Commission reach virtually every area of CATV operations.

On the other hand, public utility regulation by a State contemplates full control of the economic structure of the utility. Its rate base, operating expenses, rate of return, the provision of new facilities, the extension of service, quality of service and technical standards are all controlled under public utility regulation.

It is unrealistic to assume that this type of regulation will affect only local aspects of CATV and not obstruct achievement of the FCC's goals for CATV and the Congressional purposes reflected in the Communications Act.

Public utility regulation contemplates a comprehensive regulatory scheme encompassing the entire economic corpus of the regulated industry. It demonstrably requires that the regulators have a firm regulatory grasp over all substantive aspects of the regulated business.

However, it is the duty of the FCC, not the States, under the Communications Act and the Southwestern Cable case to maintain a firm regulatory grip on CATV as a very important aspect of radio communications.

It is difficult to comprehend how the FCC can achieve its objectives with respect to cablecasting and free channel service if the States and municipalities are permitted to control rates and earnings of CATV. Programs cannot be produced locally and production equipment and channels cannot be provided for free governmental use and public access without a high level of income.

These objectives are essentially requirements of the FCC and they will be of secondary concern to State agencies.

Thus it is the duty of the FCC which imposes these requirements to maintain that degree of control necessary to assure that CATV has a reasonable opportunity to realize the Commission's goals.

Local control over the economic structure of CATV is unacceptable in the light of this obligation.

Utility type regulation of CATV at either the local or Federal level is unnecessary, as well as undesirable.

It is to be noted that the broadcast industry is not subject to rate regulation, nor is it thought necessary, even though many broadcast stations are highly profitable, to say the least.

It may also be noted that public access to broadcast facilities is extremely difficult for many and impossible for others because of extremely high time costs, which are a direct product of the cost of programming and the private profit motive.

However, broadcasters are expected to devote a substantial portion of their revenue to local public service programming, and many of them do.

Also, however, the FCC hopes to require the same of larger CATV systems. Meaningful program origination by CATV, a non-utility function, also requires substantial capital, as will the provision of free channel services to local agencies.

Thus the prospects for unreasonable profits from CATV operation are indeed dim, particularly in the light of the cost of program origination, free channel service and the payment of regulatory and copyright fees.

I say again the Commission in imposing these costly requirements upon cable must afford the industry a reasonable economic opportunity to carry out the Commission's requirements. It cannot permit CATV to be hampered by State and municipal regulatory activity.

Moreover, it is wasteful and improper for the Commission to permit the States to move ahead in the regulatory field relying on the doctrine of the TV Pix case to the effect that the Commission can recapture the jurisdiction whenever it seems desirable.

The States should not be encouraged or be permitted to pass legislation and gear up to regulate CATV only to have the FCC subsequently state that the States cannot be permitted to regulate.

The major point in this connection, however, is that if a significant number of States do equip their public service commissions to regulate CATV as a public utility, as a political matter it would become impossible for the Commission to recapture or pre-empt the field.

States' rights are not given up that easily. The time for full preemption was at least two years ago, and the times are now perilous.

Mr. Whitehead in stating his objectives for the CATV policy review said:

> It seems plain that cable is an important example of a new technology which simply does not fit any of our existing institutions. We want to avoid the danger of trying to force cable into unnatural molds, molds developed for different purposes in different times. We need a comprehensive new policy to deal with the special problems and unique capabilities of cable, and we certainly do not want to repeat the mistakes which are all too apparent in our broadcast regulation.

Mr. Whitehead, cable is being forced into unnatural molds, molds developed for a different purpose at a different time.

Cable is not a public utility industry and the pressures in this direction should be countered immediately before it is too late.

I would hope that Mr. Whitehead might be made to see the seriousness of further delays in this regard and that he might be persuaded to recommend to the FCC at least an interim full pre-emption of all areas of CATV regulation so as to preclude further encroachment by the states pending the completion of the new study and its implementation.

As one of our local sportscasters says at the end of his broadcast, "My time is up, I thank you for yours."

DISCUSSION

Charles S. Walsh -- Mort, in your presentation you mentioned that the pressure for State regulation in New York had not come from the public but had been internally engendered by certain legislators and the PSC. And you went on to say that while there had been allegations of abuse, no proof had been forthcoming.

For the benefit of the audience, where were the alleged problems? What allegations were made that caused the legislators to put the bill in and that caused the PSC to make the study it did?

Morton L. Berfield -- The principal allegation, the only allegation recited in the bill which passed, the moratorium bill, was the allegation that there had been trafficking or speculation in franchises. That is, that parties, companies or entities had received CATV franchises and had sold them at large profit without ever having built.

That was the principal allegation that was recited in the preamble clauses of the moratorium bill.

Again, to our knowledge, there was never any documentation of proof of this.

Jay E. Ricks -- I noted at the end of your remarks, Strat, that you seemed to be suggesting that the FCC impose a moratorium on State regulation.

Would that be the gist of it? Or are you suggesting that it merely pre-empt without adopting comprehensive regulation?

E. Stratford Smith -- My thought is simply this, that if the Office of Telecommunications Policy has really got to study this industry again, and particularly this State problem -- and Whitehead pointed out that this was one he was going to study -- that the FCC ought to pre-empt the entire field of regulation now so as to prevent further encroachment by the States.

And by that I meant to imply that the FCC should prohibit any further public utility type regulation until it and the Office of Telecommunications Policy make up their mind what kind of relationship we are going to have between the Federal and State Governments.

And I did try to emphasize the fact that there is really no need at all for utility type regulation of the industry now, so there will be no harm in having at least an interim pre-emption while these long-range policies are studied again.

Charles S. Walsh -- Jay, you talk about NCTA establishing some guidelines for the municipalities and local communities to use in granting franchises.

Two thoughts: One, it does seem like a good idea, although we have had difficulty formulating a model franchise.

But I wonder how effective would guidelines coming down from the cable television industry's own trade association be with a municipality?

And secondly: How did Arlington County come up with what seems to be an enlightened franchise without apparent help from outside?

Jay E. Ricks -- Arlington County did get help from outside. It was its convenient access to a tremendous amount of information in Washington that allowed Arlington to, I think, do the job that it did.

And I believe it obtained information from NCTA, and from the FCC. It obtained information from the various study commissions that have been engaged to analyze the potential of CATV, and it created a legislative committee that boiled all this information down and came up with a set of objectives that Arlington wished to see in cable television.

It wished to see in effect the adoption of many of the proposed rules of the FCC, such as channel capacity, access by the public, and provision for facilities for education.

And I think that the Association ought to recognize the reality of Chairman Burch's speech. CATV is going to have to produce the goodies in order to get what Polly Dunn described as the bread, bread being distant signals.

So it may as well alert city councils to the potential of cable, tell them realistically what the technology can provide today, have a technical committee of NCTA develop tight but nevertheless realistic technical standards and, sure, the city can engage and retain a consultant to determine whether these objectives really are what the industry can produce today.

And then I think you put the city in a better framework to develop a public interest ordinance, one that you can have true bidding on, not bidding on the provisions, but bidding on ability to perform under the provisions.

E. Stratford Smith -- The New York legislation that you described, Mort, is so oppressive that I was wondering if you thought there were any ulterior motives or objectives of the persons in the legislature who were pressing for the bill.

I have in mind a situation that some CATV operators encountered last summer and I won't identify the State, simply to keep from causing any further trouble over it, but a State legislature was proposing a very comprehensive CATV bill and about half way through the lobbying efforts on it, the industry representatives were given to understand that if certain insurance policies were transferred to certain insurance companies, and certain other little things taken care of, that possibly the administration in that State would lose interest in the bill.

And this was a pretty frightening bill that was proposed there.

I am wondering, in your work did you detect anything of that type?

Morton L. Berfield -- No, we did not. In New York when we said these things were internally engendered, we firmly believe that, because there has been no real public outcry.

What we think we are the victim of is that certain members of the legislature have suddenly discovered cable television. And the principal members of the committee which are pushing for this oppressive regulation live in areas where they don't even have cable television yet. But they have read all this literature, and everyone reads the NARUC bill, and the age of consumerism, and we think some of the legislators feel that they have an issue which they think is attractive to the public. And that seems to be the motivation.

I think somewhat the same motivation is true with respect to the Public Service Commission. The Public Service Commission effort as far as we can tell, was almost entirely engendered internally by certain members of the Public Service Commission who think that they have a role.

And, interestingly enough, if you talk with them informally and you say, "Well, we're not really a public utility," they will say, "We agree with you." They say, "We concede that you're not a public utility, but we're going to regulate you anyway."

As a Public Service Commission they want to stand as the consumer protection agency of the State of New York.

And I think it is frightening when you think of the ramifications of where that could lead.

"FINANCING, TAXATION, AND SPECIAL PROBLEMS"

Speakers

Lewis A. Rivlin, Esq.
Peabody, Rivlin, Cladouhos & Lambert
Washington, D. C.

Richard Hildreth, Esq.
Fletcher, Heald, Rowell, Kenehan & Hildreth
Washington, D. C.

Harold Jenkins
Arthur Andersen & Company
Cleveland, Ohio

Moderator

Stuart F. Feldstein
Assistant General Counsel
NCTA, Washington, D. C.

Stuart F. Feldstein --Paul Kagan, who was supposed to be the fourth member of our panel, is unable to make it this morning. He sends his regrets. He is ill and is unable to be here. He may make it down to the Convention later in the week but he has been ill since the weekend.

One of the panelists expressed the feeling that he hoped that none of the people here would feel that this was a bait and switch tactic, but I don't think so.

The way we're going to run this panel is to have our three speakers get up seriatim, present their topics and then we'll take questions addressed to any one of the three panelists.

The first panelist is Mr. Lewis Rivlin, who is a partner in the Washington law firm of Peabody, Rivlin, Gore, Cladouhos & Lambert. He is going to speak to us on certain aspects of going public under a corporate structure and I believe he is also going to say something about subchapter S corporations, a subject which is not complex but a subject about which many of us know all too little since it can be of considerable value in the CATV field.

Lewis A. Rivlin --For those of you in non-public corporations, which are contemplating going public, I will, if successful, have imparted an ability to ask the right questions of your own counsel.

Let me start off with why you shouldn't go public. There are a lot of other ways of raising money. You can borrow. There are insurance companies; there are banks; there are other lending institutions; there are ways of creating convertible loan equity deals. You can merge with another company. There are many other ways of accomplishing the objectives, in other words, that you may seek to achieve by going public.

Going public is a bother. There are all kinds of reports, as some of you well know, annual reports, semiannual reports, quarterly reports, non-periodic reports on special events such as mergers and so on. You're in the report-writing business once you're a public corporation and once you go public you're always public. It stays with you.

It's also an expensive process. I'll talk a little bit more about that later.

You also open yourself up to other interesting possibilities. If you're a public corporation with more than 50 per cent of your stock in public hands, although the chances are 99.9 per cent probable that you'll be able to control the destiny of your corporation, you have opened yourself up to corporate raiders and you could conceivably lose control of your corporation.

There are a number of other problems, but those are a few of the high points. In other words, don't rush headlong into going public. Think about it a good bit before you take that fateful step.

Why should you go public? It's a relatively cheap way of raising a lot of money. It's not a cheap way of raising a little money. It will inevitably almost raise the price of the shares in the sense that the public in trading stock, even over the counter, will take much more account of the future of an industry and of an individual company than would be the case in a private financing. You will get into price earnings multiples that are well above those that would be true in a private offering, or a special private financing.

It should be added, though, that if you are the present substantial stockholder in a relatively small CATV operating company, it may take you a little while before you can realize the paper profits that you'll see in the increased value of your stock as it gets traded. So it is a benefit to existing shareholders and eventually with a little patience, they can in fact sell their own stock to the public. It's not impossible to have a secondary offering of some of your stock in connection with a first public offering but that makes the public very wary as to why the original owners are giving up some of their stock, if it's such a hotshot company.

It makes it a lot cheaper to acquire other companies. If you have a publicly traded stock which takes into account your future earnings, you have a relatively cheap commodity with which to buy other companies and, if it is a publicly traded stock, you may be in a position to realize the value of that stock in relatively short order.

That's a lot cheaper dollar, in other words, to use in buying another company or CATV franchise which is unbuilt than after-tax-dollars that come out of your earnings.

Also, you avoid high interest rates, especially in an industry such as ours in which we're going to need a lot of capital, hopefully soon, Mr. Burch, Mr. Pastore, and others who may be listening. I think this industry is on the verge of the need of a great deal of capital to build the larger cities and the cities within 35 miles of the larger cities. And in an industry which will need a lot of capital and where the real earnings potential is still just a little way off into the future, going public may be by far the cheapest way to finance instead of paying high interest rates for borrowed money.

Two last points about why you should consider going public.

Stock options are possible in a publicly held corporation to a greater extent than in a privately held corporation. This can be very useful in the recruitment of excellent managerial talent and in their retention.

Then, finally, you can rather materially increase your borrowing power. If you've been a company that's been capitalized or had a book value of, let's say, a million dollars and then you sell two million dollars worth of stock to the public, banks and other lending institutions will look much more favorably on this infusion of capital through a public offering in considering substantially greater loans for construction.

Let me give you the going public alternatives as I see them.

You can have small private offerings, semi-public offerings -- I'll talk about those in a minute -- that will permit subchapter S utilization.

You can have intrastate offerings.

You can have so-called regulation A offerings for smaller offerings under a half million dollars. Then I'll talk mainly about full registration public offerings.

The small private offerings are under an exemption to the securities laws which permit offerings, which can be interstate, to fewer than 25 people. Now let me explain quickly that the offering to 25 persons or less is very much a rule of thumb. The nature of the transaction and the nature of the offering and the nature of the persons to whom stock is offered all come into the question of whether this is indeed public, requiring the protection of potential investors, or whether it's in fact a private offering to knowledgeable investors.

If you're going to be offering it to widows and orphans and the gullible, it can be a public offering with four or five offers to the public.

If it's extremely sophisticated investors in very large amounts of money, you can have a private offering in fact with more than 25, although be prepared to argue vigorously when the SEC challenges your judgment on that. The key though is that, if it's a private offering, the intervention of the SEC is not necessary to make sure that the disclosures are full and fair.

Now the reason why you might want to consider a small private offering in large amounts of dollars per share raising large quantities of money through a small group is the possibility of using subchapter S. Let me tell you quickly the benefits of subchapter S are that if you have ten or fewer stockholders and they are all individuals and not corporations, which may require the creation of a special corporation to handle a particular city, and provided, as I said, no stockholder is a corporation, no stockholder is a trust, no stockholder is a non-resident alien -- in other words, if these are basically individuals living in the United States, you can then, during the loss period, which is the early period of development of the CATV operating company in an individual city, take the losses that have been generated under proper accounting means in that city and take them into your personal tax picture, all ten of you or fewer who are the stockholders in this subchapter S corporation can take those losses as your personal deductions from your own income tax return.

In other words, the stockholders in a subchapter S corporation, a corporation which has elected to be taxed under subchapter S, have the option of taking losses for, let's say, the three or four years until you turn into a profitable corporation into your own personal income tax, which can be quite a benefit.

Then after you see that this is going to be a profitable operation, let's say you're expecting a turnaround in year four, just to be arbitrary, you then change your election for year five and elect to be taxed as a regular corporation thereafter. Then you can have corporations owning the stock and so on. It's just something to consider.

The intrastate offering comes under another exemption in the 1933 Act, Section 3-A. If you're going to try to stay outside of SEC regulation through an intrastate offering, the following things have to be known to you.

Who are you selling to? There can't be a single person offered stock in your corporation who lives outside of your state.

You must be incorporated in that state and you must be doing business exclusively in that state.

If you can meet those requirements, it's a lot cheaper to go into an intrastate offering. It can be quite bothersome. You have to closely police the transactions in your stock. You'll need investment letters from those who buy your stock. But, as I say, it can be substantially cheaper in that rare situation in which it's feasible for you.

The Regulation A offering which was changed January 7 of this year to permit new public offerings up to a half million dollars -- it used to be limited to 300 thousand -- is again a much cheaper way than a full registration statement. You can go for a half million dollars a year. One year must have passed before your last Regulation A. But if you're on a Regulation A, there are a number of benefits that cut the costs.

One is it's a lot simpler. It's dealt with by the field offices of the SEC instead of having to come to Washington and you don't have to submit certified financial statements so the accountants can do it much more expeditiously and cheaply.

What does a company need to consider before going public? I think you've obviously got to have a lot more than just simply applications for franchises. You've got to have franchises of measurable value at least. Profitable operations are better. Ideally, you should have a 5-year track record before any responsible underwriter will talk to you.

Then again it depends on what kinds of franchises you have. You've got to look at the quality of them, the regulatory situation peculiarly in your own jurisdiction, and the duration. Look at the degree of exclusivity that's in your franchise and the political realities of the situation. These are all sorts of things that will enter into it. Are these really things of value and a knowledgeable underwriter, when you go to see him, is going to be asking pretty penetrating questions. Conceivably a one-year renewable franchise would support it under certain circumstances but obviously the investing public is going to be very concerned about investing in a company whose franchises are all for very short terms.

Ask yourself how much money do you need? How much of your stock are you willing to give up? Normally, when companies go public, they give up in the range of 20 to 40 per cent of the stock in the company. I'm speaking now of the generality of companies, not particularly CATVs. You could go to 75 per cent reasonably under certain circumstances.

In my opinion, it's silly to think of going to a full registration statement unless you're trying to raise at least $1 1/2 million. Otherwise, the costs are going to eat you up and that's why there's an unrealistic distinction between Reg As and full registration statements. There's a gap.

But let's assume you've decided to go forward. You have got to do three things. You've got to select counsel, you've got to select an accountant, and you've got to select an underwriter.

And my 2.6 minutes are about up in addition to my original 8 but let me say quickly that your counsel should be knowledgeable and experienced. There are many around the country in the larger cities who have helped to take companies public. You can possibly go through your regular counsel to counsel in New York or Washington. Your counsel will be useful and helpful even if he's inexperienced in SEC law.

Select first class accountants. If he's of the highest quality, use your own, because he'll be familiar with the company. He's got to be familiar with SEC Regulation S-X. In other words, this is no time to flounder around.

Your underwriters will ask about your counsel and your auditors because they want assurances that their questions are going to be answered right, that the documents will be right. They'll need to be perfect. So they're going to be looking for the highest ethical standards.

In selecting your underwriter, you want the highest quality. You've got to get guidance from someone. Don't shop around to a number of them, getting your offering shopworn, as it's called in the trade. What you want is the highest quality for the kind of offering that you're going to be making.

Sometimes there are good local houses in the larger cities around the country. There are advantages and disadvantages. They probably don't know CATV but they do know how to sell stock to the public locally. But consider a nearby city, a regional city like Chicago or Minneapolis or Houston or Dallas, or go to New York. You'll need preliminary information before the meeting with an underwriter, and this is very important, work up a presentation before you ever make your first contact that will put your company and its history in an understandable light.

Then, racing through to the end of my notes that I had wanted to cover, what you want is a firm underwriting in preference to a best efforts arrangement with an underwriter. A firm underwriting means that the underwriter will buy your shares for an agreed-upon price and then he will sell them at his risk to the public.

Best efforts means that he's simply your agent and he'll try to sell some of your shares. But find one who'll make a market in your stock after it's been brought public and this means asking a lot of questions of knowledgeable people about the underwriters that you're contemplating using. You don't want somebody who's going to bring you public, take his profit and walk away.

In terms of the profit, an underwriter will probably want eight to ten per cent discount on the shares so that he'll make that markup when he in turn, in a firm underwriting, sells to the public. And the rest of it is a question of bargaining. He may want some other cheap stock or, more likely, warrants.

Let me just say basically that registration with the SEC and a full registration statement is a disclosure document in which you're going to tell the public contemplating investing in your company what are the good and bad things about your company with emphasis on the bad. If you have said everything bad, then a stockholder has no right to complain that he was misled into buying your stock and, therefore, you'll describe the risk factors, and the regulatory situation.

I have a couple of public offering prospectuses of CATV companies with me that I had nothing to do with, just public ones, that you can look at afterward if you'd like to. But they're pretty negative, which they should be in stating the situation, because if you do mislead the public you're subject to all kinds of liabilities, recision of the sales transactions, private suits, even jail and fines.

Stuart F. Feldstein -- Our second speaker is Richard Hildreth who is a partner in the Washington law firm of Fletcher, Heald, Rowell, Kenehan & Hildreth. Mr. Hildreth is also a cable operator and he is going to speak to us on the tax aspects of involuntary divestitures of systems and the tax impact of trading systems. He's also going to speak a little bit on the possibilities of government assistance.

Richard Hildreth -- I've gone into an area that I think is of interest and my approach to this is the fact that CATV systems and operators of systems are interested in expansion. They're interested in moving on to other systems and one very intriguing aspect, of course, is how this is going to be paid for.

I'm not going to go too heavily into the tax aspects because this is going to be something that depends primarily on the facts of each individual case. You're going to have recapture problems under some of the subchapter S situations, in privately-owned or partnership-owned CATV systems and so forth. These matters all have to be dealt with individually and tax counsel should be sought out and their advice taken.

The one thing I do want to refer to, however, is the Commission's action in Docket 18397, which doesn't mean much by number, but that is the docket in which the FCC directed that television stations after August 10, 1973, may no longer own CATV systems within their grade B contours. As I'm sure you're familiar, many, many television stations have become active in the ownership and operation of CATV systems.

Many of the systems are within their grade B contours and, as things stand right now, those systems will have to be divested by these television licensees.

The Commission is also now looking at the problems of possible newspaper cross-ownership of CATV systems and also radio station cross-ownership. So there may be, and it appears there will be, a fertile field for the individual system operator, the non-television station-owned system, to trade up to acquire CATV systems and CATV franchises on a basis that is attractive to him and also attractive to the television station involved.

In taking its action, the Commission pointed out that CATV systems that are owned by television stations and that will have to be divested would be covered by Section 1033 of the Revenue Code. That section deals with involuntary divestiture, or conversion as it's called.

It does a very simple thing. What it does is postpone any gain on the sale of a property by the person selling it, if the person reinvests in like or similar property. In other words, a television station owning a CATV system that it must get rid of can sell or trade that CATV system, acquire one or more additional systems, and in divesting itself of its own system, no gain is recognized on the sale or trade of that system.

This means that it's an attractive proposition for the television station operator. He can take his franchise, or his operating system and you can go to him and trade or buy or sell the system and the television station operator will not have any taxable gain as a result of that transaction, at least not at that time.

This opens up many, many areas for system owners who want to trade up, acquire larger systems or get together with a group of other systems and get into a larger system. Indeed, as Lew was pointing out, this is a possible area in which you could go public and build up and trade up into a much better franchise area than you might have at the present.

The Commission and the Internal Revenue Service have had long experience in this. This is basically patterned after Section 10-71 of the Internal Revenue Code which deals specifically with broadcast stations. So it is nothing new. The practice has gone on for many, many years.

So if you are interested in trading up and looking at additional CATV properties, I suggest that you look first at those properties that are owned by television broadcast stations within their Grade B contours. It's an attractive proposition and I think it's something that will benefit all parties involved and it will also, of course, carry out the Commission policies.

One of the areas I want to get into right now and one that really hasn't been explored to date is the question of access to CATV channels. At an NCTA seminar on the 30th here in Washington, Bud Hostetter was the moderator and, as Lew pointed out earlier, one of the topics of discussion was the millions, indeed billions of dollars that are going to be required to create the wired nation concept. I think it was $10 billion that Bud had reference to over the next ten years.

The panelists at that seminar were representatives of banks, mortgage companies, underwriters and so forth, and they made it pretty clear that in financing, the normal routes of financing, they are interested in only larger systems, systems that have track records, systems that have proven management and systems that have, as one gentleman pointed out, approximately 75,000 subscribers.

In other words, they were talking primarily about the multiple-system operator. Not many of us have a track record of that type, the systems of the type or the management depth that the multiple-system operator will have. Obviously then this financing is going to have to be found elsewhere.

Now you recall that Chairman Burch of the FCC recently appeared before Senator Pastore and in his presentation he said that, and I quote, "of all that emerged from the proceedings -- that is the FCC proceedings -- perhaps the most significant new development was the sense of a substantial demand for access channels; that is, for cable channels available to the public for community-oriented program origination."

This, I think, is going to be the wave of the future. Whether you like it or not, you're going to be forced to maintain and to provide access channels. In the Chairman's presentation, he was speaking about new systems that would have to have at least 50 per cent of their channels available for access.

In this convention there are a number of panels that are going into local origination and access. The question is: How is this going to be taken care of: I think a significant development has been the President's Committee on CATV which has been recently appointed and which will be chaired by Clay Whitehead.

That committee will include Elliot Richardson, Secretary of Health, Education and Welfare, George Romney, Secretary of Housing and Urban Development, Maurice Stans, Secretary of Commerce, and others.

The areas they are going to be looking into are the social and economic implications of cable, the kinds of service it should provide: health, education and so forth. In short, we have Congress, we have the FCC, and now the Executive Branch all pushing cable and all pushing for access channels on CATV systems.

In the June issue of Television Communications there was an interesting article by Jeffrey Nathanson of Optical Systems pointing out the various concepts of channel accessibility and leasing. Of course, the question arises: How are these going to be financed? The channels are available but to be put to work, money is going to be needed. Indeed, in many cases, to be put to work, systems will have to be expanded.

I think one of the great untapped sources of money is the U. S. Government. Probably unknown to most of us, the government has hundreds and hundreds of plans, primarily looking towards the utilization or access to minority groups, to underprivileged areas, to redevelopment areas and the like.

The loans that are available are long-term, low-interest loans. There are also grants available. Let me give you an example. The Economic Development Administration, which is a section of the Department of Commerce, has a program for what they call public works. This provides for grants and loans. The grants can be up to 50 per cent of the total cost. The loans can be 40-year loans at 3 per cent interest. In other words, you'll have 100 per cent financing of which 50 per cent is pure grant.

Now to obtain these, of course, you are going to have to develop the concept with the minority groups and those that can use these channels to finance their studios, if you will, finance the leasing, the payment to you, the commercial operator of that channel. This can be easily done. The corporation simply has to be a non-profit corporation.

The Economic Development Administration also has low-interest, long-term loans of 25 years up to 65 per cent for developing a business. In other words, forgetting for the moment a minority or an access type situation, in those areas in which channel leasing might be possible, the government will provide financial guarantees of loans, direct loans, of up to 65 per cent of the fixed assets. In addition, they will guarantee working capital loans up to 90 per cent of the working capital needed.

This matter of government money has an intriguing aspect to it. As I mentioned earlier, they primarily look in some of these areas for non-profit corporations. That does not mean that a non-profit corporation, for example, could not in fact build an entire CATV system and lease channels or occupy channels and at the same time has a side corporation, a commercial corporation to which it will lease channels for the commercial side of the operation.

This is something that can be accomplished. It normally will have to be accomplished in the designated areas of development, minority needs and so forth. But it is an area in which money is available, lots of it. In this one area there is no limit on the amount of loans that can be made.

As a matter of fact, to help in this very area there is an Office of Minority Business Enterprise which will assist any organization in coordinating the entire government program and help push it along.

The potential of this, I think is rather staggering. We are talking about the difficulty of financing a system. If you are familiar with financing commercial buildings, you know that one of the best ways to obtain financing is to have leases in your pocket. When you have leases in your pocket, normally a lending institution will be very ready and willing to talk to you. Without the leases, you are simply dealing with potential.

If you have a 20-channel system and you can arrange and organize minority groups and what-have-you that need and desire this access and you can lease out 10 channels to these groups who can be funded through the government, your financing picture is going to be made somewhat easier because then, at that time, you can go to the lending institutions and have long-term leases on 10 channels. That should make your cash flow picture look rather attractive.

The organization of the non-profit companies is primarily going to have to come from the CATV systems. However, there's nothing wrong with doing it. It's certainly economically sound to do it and I think all the assistance that you can give them is going to end up as money in your pocket. The leasing approach can be very attractive, it can be very profitable and, as I mentioned earlier, there is no reason why the whole concept cannot be turned around so that the non-profit group can in fact finance and build the entire system through financing, and then lease the commercial side of the operation to a CATV operator.

If you haven't had the chance to explore the government availabilities, I suggest that you take a long, hard look at it. As I expressed at the outset, one of the things that's happening is that CATV Systems, whether we like it or not, are going to be forced into providing access channels.

I think a lot of systems reacted adversely to this because it's a bother and it didn't seem financially rewarding. But I think, if you look at it from the leasing standpoint and the fact that these organizations of minority groups and the like can obtain money and can have long-term leases on your systems, you will find that there's a ready and consistent source of money available.

I might also point out that one of the additional areas for money lending is in the development of the visual arts of the media and grants of up to $110,000 are available for the programming preparation of these leased channels.

I suggest, therefore, that you might take a long hard look at the government financing availability. It's there for the taking. I think it needs shaping and pushing but it will provide a very rewarding operation, both to the minority group who wants the access and, of course, financially to the CATV system.

Stuart F. Feldstein -- Our final speaker this morning is Harold Jenkins who is a tax partner in the Arthur Andersen & Company accounting firm. He is from Cleveland, Ohio. He has firmwide responsibility for CATV. His speciality is in regulated industries and in the depreciation of assets, specifically CATV equipment.

Harold Jenkins -- The Internal Revenue Service is kind of in the curious position of being a silent partner in every business in this country and in terms of capital additions they do provide a source of financing but they only provide it over a period of operation. They do not provide the front-end money.

They also have a kind of unique partnership ability in that they rewrite the partnership agreement when they want to.

There's a hundred-page supplement to your partnership agreement here which I'll cover at about 10 pages a minute. I do want to say that this is one of the most complex things that I've ever worked with in taxes. I'm really only going to try to give you some very broad highlights today. There are exceptions and exceptions to the exceptions.

The development of this has taken place probably over a year. I've worked somewhat with Treasury in the evolution of this. The announcement by President Nixon was made in January. It's gone through quite a gestation period with hearings and proposed rules and these final rules were released about a week and a half ago.

There is a great deal of publicity concerning the various public interest groups which have indicated they are opposed to this and intend to have a court test as to the validity of these regulations. There are also a number of newspaper reports indicating Congress may perhaps take a look at this particular new system as to whether or not it should go into effect. As far as Treasury is concerned, it is in effect now. As to whether or not it will meet some stumbling blocks along the way, I don't know.

This system is technically called the asset depreciation range system and it has picked up the ADR as its designation. That's what I'll use today. It provides liberalized tax depreciation rules for certain properties. It is entirely an elective system, so that any taxpayer can choose just to ignore these new rules and go on as has been done in the past. But if a taxpayer does elect to use it, the taxpayer is bound by that. Once you roll the dice with this system, you can't look back and change your mind.

It provides generally what are intended to be 20 per cent shorter depreciation periods for tax purposes. It includes some rules which allow you more depreciation in the first year that you put property in service and it eases somewhat the tax rules about the deductions that may apply for repairs.

Let's talk about what property is eligible for this.

First of all, the ADR system only applies to property which is acquired or constructed after January 1, 1970. It will not apply to property you held prior to that date.

It also only applies to property which is designated and included in about a 30-page list of property which is eligible.

I would like to tell you there is a line in there that says CATV. There is not. There is a caption Radio and Television Broadcasting with no description, only those words. Our experience under depreciation guidelines was that the Treasury considered CATV to be included in that caption. We assume, and I say assume, that you're in that category for the ADR system.

I don't have anything to point to in writing. I think at some point that's going to have to be cleared up as to the fact that you are in there but for purposes of this discussion I'm going to assume that's Treasury's intent.

The system will not apply to buildings, but that's general-purpose buildings. So I believe that most of the assets you're dealing with in your industry will qualify for this as eligible property.

It applies to used property. If you acquire an existing system after 1/1/70 it potentially can be eligible for depreciation under this system.

The depreciable lives that are established for radio and TV broadcasting, and, as I said, I'm assuming CATV is here, are a range of five to seven years. You can pick a life between five and seven years for property placed in service. If you pick a life within that range and elect to use this system, that life will be fixed for tax purposes. No revenue agent can claim that the property is actually going to last longer or shorter, nor can you subsequently argue that it is not proper. It's not a question of how long your specific system is going to last. If you select from this range, that is the tax depreciation recovery period.

I mentioned that used assets can qualify but there's no special break for used property. Used property also has to fall in that five to seven year period.

This does not restrict your choice of depreciation method for tax purposes. You can use any of the accelerated depreciation methods or straight line that you would otherwise be eligible for. There is no requirement that this same life be used on your books and financial statements. It's strictly a tax determination.

As I said, once you file the return and elect that life for the property that went in service that year, you cannot change it.

Under the depreciation that is allowable in the first year under the old rules, generally most people take six months in the year the property goes into service. In the case of a very large addition such as a system the Service sometimes insists on the number of days you owned it during the year. So you would end up with some fraction of a year.

The ADR system allows you a choice each year to choose between some arbitrary fractions. One is three-quarters of a year depreciation on everything you placed in service. That means, if you put a system on line December 29, you get nine months depreciation. That's one option you can choose. You can also choose a half year on everything.

There's another more complicated option where you can take a full year's depreciation on part of your additions and half a year on the remainder. You can choose which one of these options you want to use each year when you file your return.

That may not sound important in the abstract but, when you put a pencil to it, a new system going on line, particularly late in the year, can create very generous extra depreciation deductions.

The repair allowance. Under the old rules it was probably one of the most typical controversies between the government and taxpayers as to whether a particular item constituted a deductible repair which would generate an immediate tax benefit or an improvement which would be depreciated and recovered over a period of time.

For the radio and TV category, they have established a free zone of 10 per cent of the cost of your property. If your repairs do not exceed that, it can be deducted without any argument with the government. To the extent they exceed that, they are required to be capitalized, again without regard to the nature of it. This includes all property, including pre-1970 property. You can elect to use this repair allowance to shield your deductions and, again, it doesn't matter what you do on the books; even though you may treat it as a capital item on the books, if it fits this repair allowance, you're entitled to a deduction with no argument. This is an election you can make each year.

If you do not elect to use this allowance, you use the old rules that you've lived with for some time.

What does this mean when you put these rules together? We've done a little tracking on this. The guideline life was six years and the five year life under the ADR system may not sound too much but generally under the guideline life of six years and a half a year depreciation the first year and using the accelerated method you'd end up with about 17 per cent of your property written off in the first year. Under the ADR system you can end up with 30 to 40 per cent written off in the first year. You can end up with 75 per cent written off at the end of the third year. This is an extremely short capital recovery period.

In terms of the problems it creates, I think it places a tremendous premium on planning because you are not going to be able to go back and change your mind. If you are planning on net operating losses as mentioned in subchapter S where you use those as individual deductions, sometimes your loss can be too big and you can't use it. Sometimes as a regular corporation you generate losses which cannot be carried back or carried forward.

But because this has no flexibility and no way to look back and change your mind on your depreciation recovery period, you'd better project pretty well about what kind of tax deductions you want. Maybe the government is going to give you more than you actually can use.

I think in terms of acquiring systems and for used systems it injects a significant new factor in determining whether or not a deal should be taxable or tax-free. It also injects a different factor as to how fast you're going to get your money back on the acquisition of a used system.

Those are just the highlights and in case that sounds complicated, let me say that the government has in preparation now a whole amendment to the partnership agreement as to how to depreciate your old property acquired prior to 1971. That is in the draft stage. We've just had some tentative hints as to what may be in it but I won't get into that at all because it would require another eight minutes.

"LABOR UNIONS, CRAFTS, GUILDS"

Speakers

Erwin G. Krasnow, Esq.
Kirkland, Ellis, Hodson, Chaffetz,
Masters & Rowe
Washington, D. C.

Harold Farrow, Esq.
Farrow & Sequra
Oakland, California

William A. Krupman, Esq.
Jackson, Lewis, Schnitzler & Krupman
New York, New York

Harry P. Warner, Esq.
Los Angeles, California

Moderator

Charles S. Walsh
Assistant General Counsel
NCTA, Washington, D. C.

Charles S. Walsh Picture a scene, if you will. A cable television operator sitting in his office at his system worrying about how he's going to increase his system saturation, perhaps how he is going to cut his costs and how he's going to get a rate increase out of his city council. His secretary buzzes him and advises him that a Mr. Shaeffer is there to see him. He stops and wonders who Mr. Shaeffer is. Mr. Shaeffer comes in and announces to the CATV operator that he's an area union representative for the International Brotherhood of Electrical Workers and that the IBEW has been authorized by a majority of the system's employees to bargain for them and to represent them.

The CATV operator stops. He's shocked to think that his employees have done this to him. He asks himself how this happened and what he could have done to prevent it. He asks himself what should he do now.

This situation is what we hope to discuss this morning. We will also touch on what an operator should do that is already unionized and had a union certified for his particular system.

This morning we have four very talented people to discuss the various aspects of labor union organization of cable television systems.

From right to left: Mr. Erwin Krasnow, a member of the law firm of Kirkland, Ellis, Hodson, Chaffetz, Masters and Rowe, who will speak this morning on the background of union organization in the communications industry and its importance with respect to union organizing of cable television systems.

Mr. Harold Farrow, a partner in the law firm of Farrow and Sequara in California, who will speak on the very important subject which is often overlooked as to how a CATV operator can avoid unionization prior to knowing a union is on the scene trying to organize his employees.

Mr. William Krupman, a partner in the firm of Jackson, Lewis, Schnitzler and Krupman. Bill will discuss the problem of action once a union is on the scene, once the CATV operator knows that a union is trying to organize him.

And, finally, Mr. Harry Warner, an attorney from California, who has, for our benefit, both communications and labor law experience. Mr. Warner will discuss the possible action once you have an election and particularly once you've lost a union election. In other words, is the ball game over?

With that, let's open the session with Erwin Krasnow.

Erwin G. Krasnow: Based on conversations that I've had at the convention, there are a number of commonly held misconceptions held about labor unions in the cable industry. It seems that many people think, one, that there's little or no union activity in the cable industry. Two, that recent activity of unions has been limited to the large systems and in connection with their local originations. Three, that unionization is generally limited to the large cities, especially the big cities in the Northeast. And, last, that union agreements with CATV systems usually result from the organizing efforts of the unions themselves, rather than grass roots efforts on the part of employees.

However, none of these statements is accurate. There is already a significant amount of union activity going on in the United States. Almost all of the union agreements that have been entered into in the communications industry involved what is known in the trade as below-the-line labor, technical employees of the system, such as your linemen, installers, splicers and technicians. There have also been many agreements with members of the talent guilds.

In CATV I found it difficult to find statistics on the exact extent of unionization in the country. Many CATV system owners are reluctant to talk about union problems. They're reluctant to tell you that they've had the experience of a union and having it certified.

If they've had labor union problems that have involved rifle shots and shooting and destruction, which has happened in the past few years, their public relations arms of the systems say, "Don't talk about it. Don't mention your problems."

Union officials, too, are reluctant to give you exact figures on the extent of their union contracts and there is no one who has tried to put it together. Based on fragmentary information that I received from union officials, from multiple system owners and labor attorneys, the picture appears to be as follows:

The International Brotherhood of Electrical Workers (IBW) and the Communication Workers of America (CWA) are the two most active unions in cable. IBW has nearly 100 agreements with CATV systems. That's by far the largest, in about 95 communities across the country.

CWA has agreements with about 30 systems.

The Teamsters are perhaps into every industry in the country, have agreements with about a dozen systems.

In addition, there's a hodge-podge of unions. I don't know exactly how they got there but unions such as the Seafarers Union, the Construction Workers, the Chemical Workers, District 50 of the United Mine Workers have one or more agreements with systems around the country.

Rather than having unionization in the big cities in the Northeast, a look at where the systems are located that have agreements demonstrates they're in all areas of the country and they are systems of all sizes, from almost a mom and pop operation in Butte, Montana, to the larger systems.

If you had to make a generalization as to where the unions are, you would say that they are mainly in medium-sized communities in the South and the West.

If we look to the future, union organizers say that they're going to the West Coast and that is going to be the hotbed of union activity in the next few months.

Up until the past year or so there has been no concerted effort by the unions to organize CATV system employees. Instead what's happened in CATV is the same pattern that happened in radio during the 1930's and 1940's. The employees themselves have sought out the unions.

Typically what happens is that you have an employee in your system who had worked for the telephone company and at the telephone company he belonged to IBW or CWA and being a former union man he decides it might be a good idea to have the union in the local CATV system. Then he goes about his own organizing effort as opposed to IBW, CWA or the Teamsters coming down into an organizing effort into the various communities.

However, this picture is changing. Both IBW and CWA are now being geared for organizational efforts in CATV. You may ask, why are they looking to CATV? You would think that CATV is an infant industry. You have very small systems around the country that are not known for having a large amount of employees.

Union people say that the reason they're interested in CATV is their regard of CATV as the last opportunity for technicians to get jobs in the communications industry, technicians who previously had worked in radio and television.

I'm sure you all know that the current picture for technicians in radio and television is quite bleak. Unlike the early days of radio, radio stations are now run by one or two technicians. They have remote control equipment. They're highly automated.

In fact, automation is so prevalent in radio and television that ABC went through a 52-day strike with NATA and after the strike they discovered they could operate with about two-thirds of their pre-strike staff because of automation.

Technicians who had jobs in radio were laid off and then went into television. However, now opportunities for technicians in television have dwindled and there will be even fewer jobs in television now that the FCC has authorized remote control operation for VHF and UHF stations.

In contrast, the entire CATV industry is looking for more qualified technical people, resulting in large part from your switchover from broadband to solid state equipment. Systems will need even more technical people once the FCC adopts technical standards for systems.

As the cable industry attracts technical employees you don't have to have a crystal ball to predict that unions won't be far behind. The technical unions, with cutbacks in the aerospace and defense industries are really hurting now. They are losing membership. They are looking for ways of increasing membership.

It used to be that you needed a minimum of about 25 technical employees before NABET or the stagehands would even consider entering into a contract with a radio station. Now they'll settle for four or five employees.

It used to be that IBW would limit its bargaining unit to technical employees, people really that had true technical skills. IBW is no longer so selective and will take in their bargaining unit for a system from the janitor on up.

Then add to this picture the fact that technical unions are already starting to take a much more aggressive role in cable. For example, IBW has recently been developing training programs for cable technicians.

I've talked mainly about technical employees. What about above-the-line labor, the talent and creative people who are involved in the production of local origination? There hasn't been much, if any, CATV unionization in this field. Perhaps because there has been a very small amount of origination by CATV systems nationwide involving employees who are associated with the talent industry.

But surely as your CATV originations grow, the talent unions will grow. I'm sure you're aware that the talent unions involved are the same ones involved in television. They are the American Federation of Television and Radio Artists (AFTRA), the Screen Actors Guild(SAG), the Writers Guild, the Directors Guild of America and the American Federation of Musicians. These are the talent guilds that are involved in television.

Incidentally, about 70 per cent of television stations in the country are unionized so if CATV originations are successful and you use talent people, you'll get them from people who have had experience in television and the virus of having belonged to a talent union in broadcasting will surely spread to cable.

What does all this add up to? What, in sum, is the big picture, as far as labor unions in the cable industry? As I see it, the CATV industry is the new technology which is going to need more and more quasi-technical people. In contrast, the technology of radio and TV has just about plateaued. There is very little construction going on in radio and television, very little new stations going on the air, few improvements are being made.

Then, in addition, if program originations are successful, the cable industry is going to attract talent and creative personnel from television. However, even though we're talking about a new technology, the cable industry still has the same basic problems as broadcasting. It is going to need employees with identical skills. Since the employees in radio and television have a tradition of union affiliation, a similar pattern of union growth will take place with the growth of the cable industry.

This being so, it leads us to the other panelists who will tell you about the tactical aspects of dealing with what is going to be a more and more important phenomenon, the labor union in the cable industry.

Harold Farrow -- I would say one thing. I'm not too surprised about the size of the crowd here because I ran into Harry Warner the other night in the exhibit area and he told me that he had just recently successfully concluded I think eight separate sets of negotiations with labor for cable. I told him, "Hell, Harry, you just wiped out our audience. There's nobody left with a problem." But apparently there are a few of you out there who still have a problem or else you think you do. So we'd better have a look at it.

I might give you one bit of word of encouragement. If you will stay with us this morning and listen to some of the other panelists, you may be able to find that there is somebody here who is an expert in labor law. However, my subject encompasses what to do while waiting for the union. It does happen that I have, in spite of my lack of expertise, I have a few suggestions for you.

The first thing you might think about is just to say a prayer and for some that may work well. If that's not quite enough and you kind of go with that theory that The Lord helps those who help themselves, I've got some points here that I'd like to present to you.

The earliest action you can take to prevent unionism is a program of preventive maintenance which might better be called participative management with one's employees.

Things like letting your employees know their areas of responsibility, reviewing with them their potential for advancement, wage and salary and benefit programs and involving them in both the company and the industry are just a few of the things that should be done.

Review your own programs to be fully competitive with comparable occupations. Encourage an exchange of information between job classifications. Don't allow walls to be built between job categories in your system.

Labor attorneys retained to assist in campaigns prior to election have attempted to find out what went wrong with the employees and why some employees signed the authorization cards. The answer was seldom those things that you might expect such as wages, working conditions, fringe benefits. The answers were poor communications, distrust of management by employees, feelings that were being overlooked and neglected and feelings that they as employees didn't know what was going on.

Unionism in almost every instance was instigated initially not from the outside by the union itself but rather from the disenchanted individual or group of frustrated employees. Before a union ever comes near your system, management must be vitally concerned with employee attitudes and should attempt to provide the opportunity for employee communication and employee advancement and participation within the company. Not only will this promote efficiency dollarwise but it is a critical step towards minimizing a much more consuming and less rewarding activity in collective bargaining with the union.

And don't think for a minute that because you only have a few employees that this will deter the union. Not in the slightest. Any union organizer would consider it a good year's work to organize ten systems each with five or six employees.

I'll add to it one thought, that in my own particular experience, which is limited, I have in the past represented unions themselves. The one fellow you might watch out for while you are waiting for the union is the articulate incompetent. This fellow invariably is the one who becomes that disenchanted employee who looks upon his position as a shop steward or what-have-you as job insurance and he'll give you more trouble than anybody else in or out of the union.

So that if you really want to be thinking about that, you might really look over your shop carefully and, if he's incompetent and you want to keep him, hope that he's not a good speaker.

William A. Krupman -- I want to tell you in all honesty that I don't know the first thing about programming fees and I can't tell you a thing about it.

Seriously, how do you know when a union is knocking? That's the first question. The subject was what to do when the union knocks but how do you know first that it's happening?

You're going to know first in a number of ways. One is that your loyal employees will come to you and tell you that the union is soliciting them.

The second possibility is that you're just going to hear about it from some third party at the local bar in town.

Another possibility is that you're going to hear about the union organizing by receipt of a letter from the union or a visit by a union representative.

So that in all these ways you're going to learn at some point that there is organizing. I suggest to you from the outset, to keep your ears to the ground all the time. When your people are buzzing, that's the time to be listening. If your people aren't buzzing, that's an even more important time to be listening.

Now what happens when you do hear and you do know that the union is soliciting your employees to sign authorization cards? First, let me say this, what is a union authorization card? Some of you may not have seen them even. I've just got a very simple example right here.

The union authorization card states nothing more than: I designate IBW, CWA, or whatever union to represent me for the purposes of collective bargaining. That basically is it. Name, address, phone number, signature, and that's it. That's a contract that the union has signed to have this union represent them, and, believe me, the Labor Board says it is a contract.

What should you do when you hear that the union is around soliciting? We hear from many employers and many advisors saying, don't do anything, don't say anything, all you can do is commit unfair labor practices.

I say to you that that's the wrong advice. When you hear that there is organizing by the union, that there is union solicitation of authorization cards, that's the time to act, to act forcefully, to act unequivocally and to act positively.

Yesterday I was in Canada -- the laws there are a little bit different but we worked up a letter for the employees and I'd like to just very quickly read it to you. They had a union organizing campaign going on there and here's what we wrote to the employees. Some people say to me, "Okay, fine, we should talk to the employees, but what should we say?"

> Dear Employee: We understand that the union is continuing to visit your homes and call you in its efforts to obtain signed authorization cards. As we have said, we do not believe it is to anyone's advantage to have this union in our plant. We are confident upon reflection you'll agree.

We know, however, from past experience in this community and elsewhere, that the union will say anything and do anything to get your signature on the dotted line. We want to advise you to be most careful that you do not become unduly influenced by their wild promises or by their badgering.

We suggest you give careful consideration to the consequences of what the union is asking you to do. The card the union is asking you to sign is a contract. I'm sure you'd think twice before signing a contract of any sort, whether it's a subscription to a magazine or whether you're taking out a life insurance policy. I know that you'd read the fine print of the contract and learn more about the reputation of the company that is presumably standing behind the insurance policy, the magazine subscription or whatever it may be.

Have you read the fine print on the union authorization care? Do you know very much about what the union is or who it is that stands behind that card? Do you know what costs you are committing yourself to? Do you know how much dues initiation fees are? Do you know that if you sign the card you may be subjecting yourself to fines and assessments? Do you know anything about the many rules and regulations set forth in the union's constitution which you're swearing to obey if you sign the card?

These are important questions which can affect your entire working life at our company. I trust that you will give them serious consideration.

There is one other important question concerning the union's efforts to get you to sign a card which I want to discuss with you. What can the union do with the signed cards? A union has a number of options. First, it can file for an election, if it has 30 per cent of the employees signed up. Secondly, if it wants, if it has a majority of the people signed up, it can come to you and ask you, the company to bargain, to sit down and negotiate a collective bargaining agreement. If you refuse, the union can then go to the Labor Board and ask for an election but it can also call a strike.

Thirdly, the union can, if it wants, take the cards to the Labor Board and file unfair labor practice charges against you, the company.

We urge you not to give up your democratic right to vote in a secret ballot election because the fact is that if the union does go to the Labor Board and file charges, the Labor Board can direct you, the company, to bargain with the union notwithstanding the fact that there's never been a secret ballot election.

> We ask you to consider carefully the very serious consequences that signing a card may mean. If you have any questions, please do not hesitate to speak to me or anyone in management.

This is what we believe should be stated to employees at the time a union comes around to solicit authorization cards.

Now if the people have all signed cards and you may learn fairly soon that the people have all signed up, you should still speak to your people. About what? About your position. Why? Because the employees generally don't realize that management may be strongly against unionization of their facility.

It's critical for you to stand up before the employees and say to them, "We don't want a union here. We don't think it's in your best interest. We don't think it's in the best interest of the company. We think that if you as employees want to preserve your freedom, your freedom to deal with us directly, your freedom from dues and fines and assessments, you too will feel that signing an authorization card is a mistake and has very serious consequences."

After the card speech has been made and after you've told the people your position what can you do to stop further organizing?

You have a right, an absolute right to stop people from talking about the union while they're working. Just keep in mind that work time is not break time, coffee time, lunch time or any other time that they are off duty, so to speak. But work time is for work.

I've had situations where people have been installing systems and they're out in the field and the union comes down the pike and wants to talk to them. If they're working installing a system, you're paying for that time. The union has no right to talk to them and I suggest to you that your supervisors enforce the rule that work time is for work. The union has plenty of time in the evening hours to talk to the people.

As I said, the union can file a petition for an election and this is normally what it does do. There has been some talk, about, well, the union can't come after me, I'm too small. Erwin touched on that subject and the Labor Board prints every month a report of its election statistics of a thousand cases or so every month. There are about 12,000 elections a year. Every election is reported and I assure you, every month there's something about a cable TV system involved in an election.

This past month there were two of them, Dothan Cable Television in Dothan, Alabama, lost two to nothing to the CWA. TelePrompTer Corp. in Lompoc, California, lost to the IBW nine to nothing. Pretty sad. But it is happening every month, believe me.

If the union does obtain a majority of the authorization cards, it will file a petition with the National Labor Relations Board most likely. I'm pretty confident that everybody in this room is under the jurisdiction of the National Labor Relations Board. The requirement is that you do $100,000 worth of business a year, which doesn't take too much to come under that jurisdictional standard.

If you don't meet that standard, if you don't do $100,000 a year and there is no state law and there aren't too many state labor laws, then the law of the jungle applies. The only thing you have to worry about then is a little job action, a little work stoppage, a little secondary boycott. There are no laws protecting the union, there are no laws protecting you. It's just who's strongest is going to survive.

On the other hand once the petition is filed at the National Labor Relations Board, the Board will direct an election. You can agree on who is going to vote. If you don't agree on who is going to vote, the Labor Board will tell you who's in the bargaining unit. If you don't think you can win the election, I suggest to you that you don't agree on who's going to vote and buy all the time that you can in order to get your house in order. At least in three months time you'll possibly have a better chance of winning.

Because, if you agree on which classes of employees are encompassed in the bargaining unit, the election is going to be within 30 days.

Finally, we come to the election campaign. What can you do? Again we hear people say, "Don't talk to the employees, or, if you talk to your employees, tell them how wonderful your company is." I say again to you that an election where the choice is union or no union is no different from the election of whether it's going to be Goldwater or Johnson or Nixon or Kennedy. People vote against things; they don't vote for things.

So I suggest to you that your campaign be geared to voting against the union and this means stressing to your employees the cost of unionization in terms of dues. They can be anything, they can go to anything. Initiation fees. Fines. Believe me, there are fines. Every union has the ability to fine and does fine employees. Assessments. Again, every union has it in their constitution that they can assess employees and they do.

The union constitution itself, I've mentioned it already, usually 50, 100 pages, singlespaced, typewritten, many, many rules governing employee freedom. Do the employees know about that? You've got to tell them about it. You've got to spell out for your employees what it means.

You can do all these things and say all these things individually, by speeches, by letters, in small groups, any number of different ways. I don't care how big your organization is, whether it's two people or 200.

You can use gimmicks. There are plenty of gimmicks available. For example, here's one that we've seen people use. It says on the front, "What the Teamsters Union Can Do for You." See inside?

A Voice: Nothing.

William A. Krupman: Right, nothing.

We also suggest that you make it very clear to the employees that they should vote because it's a majority of those who vote that determines whether or not there's going to be a union. So you must get everybody out to vote. The person that doesn't go out to vote is a person who would vote against the union, almost invariably. The people that come out to vote are interested in this thing and may be interested in having a union. So you've got to get out the vote.

There is the need orally or in writing for an explanation of the vote, an explanation of the ballot and an explanation of why they should vote no: No union, no initiation fees, no dues, no strikes, no fines, no assessments, no picket duties. No, no, no, all the time.

You could also run contests. A contest of what was the longest strike that this union ever conducted. You can also have a contest on what was the largest fine this union ever assessed against employees. This is all perfectly legitimate.

A day or so before the election you can take people in and show them exactly how the vote goes. Most of them, I'm sure, have never been involved in a vote and neither have you, but you can find out how a vote is run and you can explain it to them very, very simply and take the mystery out of it. They will then know that the boss is giving them the straight scoop and that when they come to vote they're going to vote the right way, and the right way is on the righthand side of the ballot which is no.

Finally, the night before the election -- and we suggest this most strongly, that you hold a dinner or a party for the employees. Now people say to us, you can't do this, it's illegal. It's not illegal, if you hold it off the premises and you make it voluntary and, believe me, everybody's going to attend this dinner. If you're in a good position at that point, you don't have to say one word about the union and you're going to win the next day.

If things look tight, you may want to blast the union but you can do it. We have found that it's tremendous. People love it. The union may say or one or two employees may say you're trying to influence votes, and that's exactly what you're doing and it's perfectly legal. Believe me, it's worth it.

Harry P. Warner   I am going to dispense with the usual preliminaries. I learned a great deal about labor negotiations from the late Y. Frank Freeman, who was the Executive Vice President of Paramount Pictures Corporation, and he was in charge of labor negotiations for the entire entertainment industry on the West Coast.

He pointed out that you can approach labor negotiations by getting in bed with the union, being very palsy-walsy. You generally know when you get in bed with the union who gets shafted. It's not the union -- management is the one that gets shafted.

I think the only way I know to negotiate a labor contract is to be hard, firm and extremely hardnosed in dealing with the union. The people on the other side of the fence have one objective in mind. They want to get the maximum dollar for their employees and they'll do everything within their power to attain that objective and I think that if you want to do an effective job for management you have to be as hardnosed, you've got to be a son-of-a-bitch as far as your dealings are concerned with the union.

For my discussion this morning we have reached the posture with the union where the National Labor Relations Board has certified the IBW or the CWA as the collective bargaining agent for the employees in the unit at your system and, as these gentlemen have pointed out, you can have two, you can have 15, or you can have 20 employees in the unit.

I can't impress upon you enough the importance of defining the scope of the bargaining unit. We've had several instances in Southern California where we excluded working foremen from the bargaining units and working foremen can do the same jobs that installers and technicians can do.

This was important in one case particularly because we had a strike, were able to keep the plant going because working foremen who were not in the unit could do the work that the installers could do. So be extremely careful in defining the scope of your bargaining unit so that you can keep your business in operation.

As far as the clauses are concerned in the union contract, let me point out that the most important thing that you can do when the union throws its very first contract at you is file counterproposals which I usually refer to as the so-called skinny contract. Regardless of what the union throws at you, as far as proposals are concerned, you submit to them what you want in your first labor contract.

This is extremely important for several reasons. First, it will negate any inference that you're not bargaining in good faith because, by submitting counterproposals, you're telling the union, look, you buy these counterproposals and we have a deal.

Item number two. Neither the Labor Board nor the Supreme Court of the United States can dictate to you the provisions or the terms of a labor contract. All that the National Labor Relations Act does is require that you negotiate in good faith. And if you learn anything here today, submit counterproposals and, if you can get the union to negotiate from your counterproposals, you're way ahead of the game.

I've negotiated CATV union contracts in Santa Barbara and in Florida and a few other places and in each instance we've been extremely fortunate in being able to negotiate from the counter-proposals that we had submitted.

As far as the clauses in the contract that you ought to be aware of, one is the union's security clause. Now under the National Labor Relations Act, if you're in a non-right-to-work state, the union can state that you have to discharge any employee who fails to join the union within 30 days after the collective bargaining agreement has been signed.

As has been pointed out by the previous speaker, we have used the union security clause very effectively in this regard. We have pointed out in our pre-election campaign that we want the employees to have freedom of choice, that they shouldn't be bound forever to a union contract and that they should be free, just as people are free to vote.

This has been a very effective tool in negotiations that we have had with unions. To permit the union this clause, we got a lot of concessions in return.

There are modifications of the union security clause such as maintenance of membership and agency shop but time doesn't permit me to go into that in any great detail.

In the clause where you recognize the bargaining unit, refer specifically to the certification order of the National Labor Relations Board which holds that the bargaining unit includes installers, technicians, laborers and excludes everybody else such as supervisory employees, confidential clerks and the like.

This is important for the future.

Watch your strike assistance clause because this will help you in the event you are faced with a strike and you've got to anticipate that this may occur sometime in the future.

With respect to the so-called standby clause, many employees insist on on receiving additional compensation, if they are available at night to be called in to keep the system functioning and this is something that you have to work out.

In several instances we have written into the clause that, if the men are called back to work, they will be paid a minimum of four hours of work but they receive no additional compensation because they're on a standby basis. Cable is such that you have to have the men available 24 hours a day and usually you can rotate the schedule so that two men may be available one evening, two another evening and so forth.

Another clause that you want to watch is the so-called dues check-off clause. This refers to collection of union dues by management and the remission of these dues by management directly to the union.

I negotiated a renewal of contract in Florida and we struck that clause out of the agreement. We told the union that it wasn't our business to collect their dues. If they wanted to collect dues, collect it from the men. The company was not engaged in the business of collecting dues.

This is an extremely important clause. Put in a strong management right clause. After all, if you're management, you're running the company and not the union, and I think that it's extremely important and helpful if you have a clause such as that written into a contract.

Another clause that's quite important is the clause which enables you to subcontract the work. The union will resist this but obviously there may be occasions in your operations and expansions where you have to subcontract the laying of pole lines and unless you include this clause you can be hung up for months.

Watch your vacation and sick leave clauses. These are important.

The very last thing that you ever negotiate in a contract are wages and fringe benefits because these cost you money. I'm talking in terms of such items as vacation, sick leave and the like and the last thing that I've always discussed in any labor negotiation has been the dollars that we pay to the employees.

In California one of the things that they developed within the last few years is prescribing the standards whereby employees move from one grade to another. In other words, if you meet certain prescribed qualifications, then you can move to a higher grade where you receive additional compensation. This has been worked out with some of the unions.

I think I've probably covered the high points in the contract but labor negotiation, particularly the first contract, is a long and painful process at times. It takes time on your part. It takes a substantial amount of preparation. It also takes patience but in the long run I think it's worth it because you have to look ahead tomorrow.

One more item. Please don't put in a clause that I saw the other day in a radio contract which, for all practical purposes, precluded a radio station from engaging in automation. Leave yourself free to advance with the technical art. This particular station in Los Angeles made it mandatory in their contract with the union that they hire at least seven employees and the manager called me up the other day and said, "I've got five guys standing around looking at the secretaries and twiddling their thumbs."

There's only one way to negotiate a contract and that's to be a hardnosed son-of-a-bitch.

Charles S. Walsh -- We'll take some questions now but as the Moderator I will take the prerogative of asking the first question.

Perhaps Bill or Harry might attack this problem. I was wondering if a CATV operat or is aware that a union is on the scene, perhaps in its preliminary stages of getting authorization cards signed by the employees, what about the possibility of employees organizing their own union within the company?

And secondly, what about the possibility of you helping them do that?

William A. Krupman -- The answer to both is no. So far as the employees organizing their own group, we think it's a mistake, because you're simply creating a monster which some day is going to be taken over by an outside union. Once you give the employees the idea that they have an organization and somewhere down the line the organization doesn't function right and they have a grievance and they need arbitration help or legal help, they're going to go to the CWA or the IBW.

We absolutely say no. I have one company where employees insisted upon doing that, but technically you cannot help them form their own organization. That's illegal. If they ask you whether they can do it, you certainly can tell them that they can do it, but legally you cannot participate in that formation.

By the way, the company that I mentioned that insisted upon doing it, the employees were thereafter taken over by the Steelworkers Union.

Charles S. Walsh --Harry, do you have a different comment?

Harry P. Warner --I agree with you 200 per cent. You're going to run into problems with the NLRB if you start assisting your employees to form a union. Stay away from it.

Charles S. Walsh --Let me throw out one more quick question.

Again, Bill or Harry. What if the union walks in and says, I've got authorization cards signed by a majority of the employees? And they ask you to recognize the union. What should you do?

Harry P. Warner -- I wouldn't recognize them. I'd just tell him I want an election. I want to define the scope of the bargaining unit. The Supreme Court handed down the Gissel case a couple of years ago and, as I read the case, and I think Bill can bear me out, as long as you have not committed an unfair labor practice -- you just say, Okay, so you've got the authorization cards, we still want an election. And I would insist on an election for a variety of reasons.

One of them is that what you say in your campaign will be of material help to you when you negotiate your labor contract such as on your union security clause and other clauses. But I certainly wouldn't accept the authorization cards and let the union take over.

I mean, I would fight it.

William A. Krupman -- Let me just add this, that I did intend to cover that point and I slipped over it.

Please be very cautious, if the union does approach you. You are not to look at cards, if you want an election. Don't look at the cards, don't count the cards, don't acknowledge them in any way. As a matter of fact, we've had cases where the union has sent cards in the mail, I don't know why the unions don't do it more often. If you get anything from the union in the mail that looks to be a card, you just put them back in an envelope, have somebody witness it and you send them right back without looking at them.

The only exception that I'll take to what Harry has said is that it sounded like there may be a possibility that you're going to lose the election and that's why you should fight it, because it's going to help your negotiations. It is true, but let me say this to you.

You have just as good a chance of winning that election as you have of losing it. Unions win 50 per cent of the time and when employers resist it, employers win 75 to 80 per cent of the time.

From the Audience -- Rather than a question, I'd like to urge something. I'm sure you gentlemen know that the Internationals clear all contracts and I was wondering whether we should not develop a file of labor union contracts with CATV systems which might be of benefit to an operator involved in contract negotiations.

Harry P. Warner -- Let me say this, that in California, and I'm active with the CCTA as Harold is, we have urged that all contracts be filed with Walter Kaitz so that everybody knows what's happening. I think that's about the best you can do under the circumstances.

I would also suggest it would be very desirable to file your contracts with the national organization. Now, for example, the NAB requests all of the radio and TV stations to file their contracts with their Labor Department, and probably -- I'm sure that the NCTA, as labor develops, will do likewise in time.

From the Audience -- That's what I'm urging.

Charles S. Walsh -- Let me make a request now for any of you in the audience that have existing labor contracts to provide NCTA with copies. If you'd like to delete any information, please do so, but understand that, in any event, the principals involved will be kept on a purely confidential basis.

Are there other questions from the audience?

From the Audience -- I've got another question. I find this awfully interesting. Is there a different manner of conduct by the CATV operator which is permissible with his employees before you know a union's on the scene and once you know that a union is there with the cards and, if so, what is that?

William A. Krupman - The laws are such that it's an unfair labor practice at any time to promise an employee that he's going to get more money if he rejects a union, that it's an unfair labor practice, if you threaten an employee that he's going to be fired or lose overtime or what-have-you, if he brings in a union. It's an unfair labor practice at any time, if you do that.

However, this is a very technical distinction, it's only after the union files a petition for an election that, if you do that kind of thing, question employees, promise employees, threaten employees, that the election can be set aside.

So what I'm saying to you is that any time before the petition is filed you can do it and not get into too much trouble. I don't suggest that you do that because it's not necessary. You can find out how people think about a union and you can get them on your side without threatening them, interrogating them or making promises.

But basically the laws are the same at all times. If that answers it.

Harry P. Warner -- You do have more freedom, let's say, before a petition is filed than after. Once a petition has been filed by a union, then you've got to be a little circumspect. You've got to be extremely circumspect in what you say because it's an unfair labor practice to threaten a union or promise any benefits. This is pretty well spelled out under the act.

From the Audience -- I'd like to direct a question to Mr. Farrow. You touched somewhat briefly on preventive maintenance, so to speak, and keeping unions out to begin with. What would be listed as good sources of information and how do you derive these sources of competitive wage scales in the area? Do you have any formulae, per se?

Harold Farrow -- Yes, there are all kinds of statistics being published. There is, I'm sure, in almost every major metropolitan area a central labor council and you can find wage scales for almost any occupation or any comparable figure.

You know, another area. If you're in a major market in this country, that means that you're also in the market with a large and growing minority population. One of the more active things you see these days are affirmative action programs and you may very well find that in order to survive on the local level politically you must solve this problem. If you do solve that problem, you quite often find your largest ally against unionization because these are the guys who have been excluded from membership in many instances and they feel no affinity with the unions.

And if you can solve their problem of training and promotion and better job opportunity, you'll maybe have the best insurance you've ever had not to have unions.

William A. Krupman -- That last question came from Mr. Conley whom I planted in the audience to ask me a question, and I resent very much his asking you one.

Seriously, I'd like to just amplify a little bit on that point. Mr. Conley's question implies that wages are a big part of the problem and it is true they are but I think, as Mr. Farrow pointed out in his speech, it's not the whole problem by any means.

The real, basic problem with having a union come in and people voting against the company is your supervisors. If you don't have the right kind of supervisors, the kind of supervisors that know their employees, talk to their employees and, more importantly, the employees feel that they can talk to the supervisor, the foreman, or, if it's you, to you, there's where you're in trouble. In most industries that are non-union, for example, in the retail industry and all these chains of retail chains, they pay minimum wages but they're non-union.

Why? Because they have this kind of a good communications, if you will. It's a hackneyed phrase, but, believe me, it's the whole answer to this question of maintaining a non-union business.

"PUBLIC OWNERSHIP OF CATV"

Speakers

Thomas G. Shack, Esq.
Smith, Pepper, Shack & L'Heureux
1776 K Street, N. W.
Washington, D. C.

Arthur Stambler, Esq.
1737 DeSales Street, N. W.
Washington, D. C.

Lee G. Lovett, Esq.
Pittman, Lovett, Ford, Hennessey & White
Washington, D. C.

Stanley B. Cohen, Esq.
Cohn & Marks
Washington, D. C.

Moderator

Stuart F. Feldstein
Assistant General Counsel
NCTA, Washington, D. C.

Stuart F. Feldstein -- All of you, I think, are familiar with the fact that the past year has seen the eruption of a trend which many private system operators and franchise seekers find somewhat disturbing, and that is the tendency of at least some municipalities to want to get into the CATV game in the ownership end. We're here this morning to explore various aspects of that situation.

Our first speaker this morning is Thomas Shack, who is a private practitioner in Washington, and he is going to speak to us on the general philosophical framework of public ownership of a business like CATV.

Thomas G. Shack -- Whether the expected second revolution of cable evolution can actually be implemented will depend in large part upon the regulatory constraints placed upon it. The scope of such constraints seems to be dictated in large part by the FCC's perception of the urgency of encouraging better or different services, even at the expense of existing investments of CATV firms.

In a sense, the direction of the CATV growth, originating from within the Federal FCC framework, will be shaped by the situation at the various State and municipal governmental levels. In general, the majority of the various State public utility commissions have already held that they have no jurisdiction under their respective enabling statutes and have earlier declined to assert any form of jurisdiction over CATV.

However, it has been common practice for local communities to require cable companies to secure franchises before establishing operations and in the process of issuing these franchises, ostensibly granted to permit the companies to use the streets or for stringing cable in alleyways, the franchise conditions placed what amounts to, in many instances, a type of utility regulation on cable.

The franchise usually includes conditions pertaining to rates, channel use, and technical standards. Rate regulation in particular has been one of the most sensitive issues in both local and State CATV regulation. The National Association has had a traditional fear of regulation and some States have been afraid to impose it in the belief that CATV lacks sufficient public utility characteristics to constitutionally support such regulation.

But times are changing and revenue-poor municipalities are now asserting that most CATVs usually have an exclusive franchise and thus fall within any classical definition of a public utility. Moreover, even if a CATV does not have an exclusive franchise, it certainly seems to meet the Supreme Court's exceedingly liberal test of a business affected with the public interest.

At the regional level the modern public utility is concerned primarily with supplying local services and commodities such as water, gas, electric energy, transportation and facilities for communication.

The regulation of public utilities has always been a source of controversy, a battleground of politics and divergent opinion.

Although the National Association has fought against the concept of cable as a proper subject for public utility regulation, the fact does remain that CATV has developed along the same lines as have the traditional public utilities just mentioned. It has developed as a reasonably natural monopoly. Even when the CATV franchise is not exclusive, the general experience in competitive systems operation has been either a merger of the two companies or the failure of one.

Of course, in those areas where cable is the only viable means of television reception or where zoning ordinances prohibit rooftop antennas, for example, it must be considered a necessary service. Is it any wonder then that the State and municipal authorities are now beginning to feel justified in reopening the subject and in attempting to subject CATV to full utility regulation on at least the State and local level?

Indeed, it has now become fashionable to assert that, if the full potential of cable television is to be reached, it can be done only in terms of a total regulatory framework set jointly at the Federal, State and local levels.

I mentioned a moment ago two facts. One, that although cable companies normally have received non-exclusive franchises, monopolies of sorts have usually resulted, and, two, that virtually all municipalities perceive themselves as revenue poor.

The inevitable conclusion has been reached. Municipalities are now increasingly convinced that a cable system under monopoly conditions is highly profitable. Thus, at the very least, they expect to exact large payments in exchange for a franchise. More and more communities attempt to procure high franchise fees either from renewal negotiations or by requiring new CATV applicants to bid against one another.

No one doubts that municipalities are impelled to do this because of their chronic, sometimes desperate shortage of revenues. In extension of the foregoing, municipalities and States are having second thoughts about public utility regulation over cable. Municipalities employ franchises to make CATV a revenue-producing source for the city. CATV is generous in producing revenue for the cities and CATV entrepreneurs have painted a reasonably prosperous picture. Well, the cities now want the whole pot of gold, so to speak, for themselves and, if they do not yet have the authority, regional government will increasingly attempt to amend government codes to allow them to own their own cable systems.

The cities often will cite four general advantages of municipal ownership and operation.

The first would be the elimination of conflicts of interest between owner and manager and subscriber. Under private monopoly conditions, the interest of the owner in maximizing its net profits would usually be in conflict with the subscriber's interest in having the service supplied at the lowest feasible rate.

Regulation is greatly simplified. Rates can be fixed simply and promptly to yield the cost of the service, prolonged investigations are not necessary to determine the present fair value of the franchise at a reasonable rate of return and orders fixing rates are usually not appealed to the courts.

Two - The rates of the municipal operation are or should be based on the actual cost of the service.

Three - The price policy adopted by municipal ownership offers, supposedly, an advantage to the city customer.

And, four - The lower costs of operation arise out of public ownership and operation. These lower costs exist with respect to operating expenses and capital charges.

There is, of course, significant rebuttal to each of the foregoing general advantages. The weaknesses of municipal ownership are many.

Individual operators working at the municipal level must fully acquaint their municipal authorities with the high cost and speculative nature of the industry and the madness, so to speak, of municipal ownership. A few of the severe disadvantages of municipal ownership:

One - The management of publicly-owned operation has been a weakness. Many municipal systems are controlled and managed by municipal officials who may not give full time and attention to the affairs of the cable operation and who are not likely to be expert in cable matters.

The lack of the incentive associated with the profit motive mitigates against the attainment of efficient management of the municipal system.

Two - political considerations sometime influence their decisions with respect to questions of policy and of administration.

Three - The personnel policy of publicly-owned operations is a serious handicap to the attainment of efficiency and progress. Lower salary scales mean difficulty in securing and retaining the services of the most competent people.

Four - The relationships between the municipality and the operation become blurred. Frequently there is no distinction between the cable operation and other departments of the municipal government. Revenues get mingled with the general funds of the municipality.

Where the system has been successful, the surplus earnings are absorbed by the city treasury and applied to general municipal purposes, and, should the undertaking not be prosperous, the public treasury has shifted the losses to the shoulders of the taxpayer.

Five - The dangers of public injury arising from public ownership. The municipality has an immunity from suit for tort negligence. It has a chilling effect on organized labor, as municipal employees cannot organize or strike.

The loss of both a property tax base and a gross receipts tax is another obvious disadvantage.

Six - Rapid technological developments often necessitate rebuilding prior to the terms of depreciation. This takes large amounts of capital which the cities will find difficult to raise.

And, finally, it simply violates the basic essence of the free enterprise system, that is, government competing in an area where the private sector can do the job.

In conclusion one should say that one wonders whether the cities which can scarcely keep the municipal lighting, sewage, traffic control, and garbage collection systems in working order, much less handle foul air, polluted waters, overcrowded schools, dirty streets, starving poor, inadequate housing, rising unemployment, ineffecient police forces, outdated fire departments and excessive taxes -- are they really able to cope with the potentially technologically complex problems of cable operation during this period of revolution and over the next decade.

I suggest that the answer would almost have to be logically no, that they really are not in a position to do that.

Stuart F. Feldstein -- Our next speaker is Arthur Stambler, also a private practitioner in Washington, D. C. Arthur has the unique perspective of being the attorney for the Frankfort, Kentucky, municipally-owned system, and in light of his experience in that capacity, he is going to outline for us some of the conditions where municipal or government ownership of a CATV system will and will not work.

Arthur Stambler -- By the time the panel finishes, I think it will be fair to say that it is a loaded panel. This is not because somebody has been spiking our orange juice but because I feel that the consensus of everyone on the panel will be that municipal ownership of CATV systems is not a particularly good idea for a variety of strong policy and practical reasons, which Tom Shack has already outlined.

But to play the devil's advocate for the moment, I would like to just refer to the situation in the City of Frankfort, which has already been mentioned by Stuart, as one in which there were considerations supporting municipal ownership of the CATV system, but I believe that a full understanding of how that situation arose and what it means and how I think in those circumstances that it was a good approach for the community, can seriously and strongly be distinguished from the present situation with CATV where I believe municipal ownership is not a good idea.

Going back to 1953-55, in a community of some 25,000 to 30,000 people, 30 to 50 miles from the nearest television stations, primarily built on the side of hills which prevented the people of that community getting decent television reception off the air and with the CATV industry just in the cradle and getting started, the community of Frankfort, through its municipal water and power board, decided that they would build a CATV system to serve that community and they did.

That was built within the essential confines of the community and it was a fairly simple affair for those days. It just picked up the signals off the air and ran them in the traditional form of CATV distribution to the homes within the essential core of the community.

The charge was $2.25 and to this day I believe it is still within 50 cents of that. And for 15 to 20 years after that they have simply gone forward to operate that CATV system. The profit or the operating gain which they show over the maintenance cost is donated by the municipal board to various local civic and charitable works, such as building a new YMCA and so forth, and I think it has worked out quite well for the people of Frankfort, who might not otherwise have had cable or television for a substantial period of time.

But I believe when you look at that in terms of the traditional 1953 to 1955 development of cable and then look at the situation today where you have cable developing in metropolitan communities which already receive a substantial amount of television off the air, you have a totally different situation in terms of municipal ownership, because it has become a high-risk, speculative and very competitive operation.

In Frankfort, with no one receiving television service off the air, almost everyone has subscribed to the cable. Therefore, the cable system can be run in much the same manner as the water and sewer and power and so forth, because it is, by its very nature, a non-competitive, so highly desired operation that there is almost no question that the people want it and will take it, with no frills, no sales and so forth.

But the situations in which municipal ownership is being pushed today are those involving fairly large communities which, as I said, have television. Therefore, the CATV activity is one that is extremely dangerous for a community to get into and I suggest the reason for it is the misconception that the cable industry is simply a gold mine, a cash register. This is the same problem broadcasters have had for years, that people in government think it's just a little simple thing. You can just throw it up and the money pours out so why shouldn't we have the money?

The answer is that cable in these highly competitive circumstances is not such an operation and a community would have no more reason to take over the motion picture theaters, just because people attend motion pictures. They are laboring under a misconception that it's a simple device. They do not know that it is now complex to build, that the costs are highly problematic and are very often subject to misconception.

They don't know that with people getting a variety of services off the air that it's difficult to go into a home and get $4.95 or $5.25 for service which perhaps is a little better technically but very often doesn't provide too much more to the person who has to pay for it.

Therefore, communities are going to find, if they get into it, that it is infinitely more complex, more expensive and it is quite possible that the community can very well bankrupt itself by being involved in a cable system with expanding costs and difficult to sell.

Now this is I believe the future of cable, a highly competitive business in which people who already have television service are going to have to be implored and sold and convinced that it's worth the money to get something a little bit better, something more technically proficient, a few more signals. But it's not going to be easy and in communities like Frankfort it just worked automatically because it was a traditional form of CATV. But those are not the areas in which you have municipal ownership threatened today.

They are usually communities in which a private entrepreneur would be taking a substantial risk with his investment.

And I might finally say that the history of broadcasting shows a similar municipal encroachment along about the same time in the development of broadcasting, namely, after it had gotten started and it had proved its worth in terms of the commercial market, communities began to be interested in broadcasting and there are a substantial number of communities around the United States that own their own radio stations. But the trend in the past several years has been for them to try to get rid of them because the bloom is off the rose and broadcasting is an infinitely simpler thing to sell to the community. If you have the only radio station or one of the two radio stations, you have an infinitely simpler sales job than you do if you're trying to sell cable against television off the air with all the other demands on people's money.

So I suggest that the Frankfort situation which was an appropriate one, a good one and worked out fine for the community, in my way of thinking, is not one that is properly applied to communities today and I would venture to say that any community that gets into this highly speculative business will find out in a fairly short time that it was a bad move and it will rue the day that it ever did this.

Stuart F. Feldstein -- Our next speaker is Lee Lovett, who is a partner in the Washington law firm of Pittman, Lovett, Ford, Hennessey and White and he's going to deal with some of the technical, economic and political aspects of municipal ownership with an accent on the political aspects.

Lee G. Lovett -- Of the year 1775 Charles Dickens soberly and perceptibly observed, "It was the best of times, it was the worst of times. It was the age of wisdom, the age of foolishness, the spring of hope, the winter of despair. We had everything before us, yet we had nothing before us. In short, the period was much like the present period."

Since Dickens penned those words 112 years have elapsed but little has transpired to alter his eloquent depiction of the polarized ambivalent dilemma of mankind. For both mankind and the CATV industry it is the best of times and the worst of times. We have everything before us, yet we have nothing before us. Today we conclude another convention with great expectations for the emergence of cable television as perhaps a major technical method of diminishing the problems to which Dickens referred and which clearly characterize the twilight of the twentieth century.

Our primary motive is the same one that has stimulated most of America's technical and economic growth, namely, profit. Our willingness to take gargantuan financial risks is grounded in the belief that American television and American communications are primitive, crystal-set-like precursors of their 1980 successors. And yet our spring of hope, our unbridled optimism, our indefatigable daring remain frustrated by Federal restraints and now by a new emerging threat: government or public ownership of CATV, the very sound of which sends tremulous chills throughout me.

Some 9 cities have already assumed cable ownership and many others contemplate it. As such, this seemingly quiet morning session may involve the most insidious, ominous and atomic issue of this entire Convention.

Public ownership could take many forms. It could be ownership by one or many non-profit organizations, similar to ETV. Or it could be de facto public ownership via compulsory dedication of many or all of your unused channels to the public. Such de facto public ownership might be characterized in FCC vernacular as common carrier status. Or it could be direct ownership by the local government, municipal, county or State.

This panel is directed to concern itself primarily with municipal ownership. The propriety and desirability of any form of public ownership must be evaluated in terms of its technical, economic, political and philosophical contributions vis-a-vis private ownership.

From a technical standpoint, it is evident that CATV is still in its infancy. Which sector, public or private, is most likely to inspire new cable technology? To gamble large sums on high risk services? And to absorb large losses that must follow CATV from its present infancy through its adolescence and early adulthood?

Will municipalities be prone to experiment with new, unproven two-way gear, facsimile services, pay TV, digital communications and the like? It would seem not. Such grave risks of tax dollars and the attendant potential public criticism would not be politically prudent. Indeed, as taxpayers, we would disapprove of municipal squandering of $10,000 to $15,000 per mile on experiments to provide luxuries that may be desired by less than half of the public.

It should be apparent to the layman that CATV technology can and will advance only as fast as CATV speculators encourage it, that is, without a daring breed of entrepreneurs to purchase and experiment with exciting, unproven gear, we may expect a sedentary freeze upon the advancement of cable technology.

To paraphrase Sinclair Lewis: Every compulsion is put upon government to become safe, obedient and sterile, a prognosis quite foreign to cable innovation of the past and present decade.

The economic aspects of public and private ownership will be covered by another speaker in just a moment. Suffice it to say that cities flirt with financial disaster when they assume that major market CATVs will generate enormous or even any profits.

Cities fail to comprehend and even ignore the incredible unknowns of the new generation of cable TV. Moreover, I query: Is it reasonable to assume that municipal employees without personal profit incentive will operate a CATV as efficiently, energetically and creatively, or, is such public ownership prone to lead to less service, greater costs and a chronic drain on tax dollars that now support other public needs?

Economically speaking, cities and non-profit groups may find the CATV pot of gold more akin to oil well speculation than to that of a static utility service. Further, when economic risks of CATV are weighed against the guaranteed percentage of gross, plus the tax revenues that can be dervied from private ownership, public ownership of CATV seems manifestly economically imprudent.

From a political standpoint, how might public and private ownership compare? This is a decisional criterion. In a democracy, is it the business of government to run businesses for profit? Does the fact that a man can gain votes or political appointment prove that he can administer a complex business?

Can a city councilman ignore his political obligations while running a CATV? Will he be prone to consider personal political repercussions of every facet of the operation? Will his constituents want more cable services or will they want lower subscriber rates and large municipal operating losses?

How would public officials react to the use of public channels by anti-government groups? Could government officials be totally unbiased? What if Mr. Agnew were mayor or city manager? How would the Pentagon papers be handled?

Is there even a chance that the city officials might be tempted to manipulate the CATV media? If so, is it worth the risk? Hitler controlled the media and the Russians control the media, and to what end? Can we forget Lord Acton's axiom: Power corrupts, absolute power corrupts absolutely?

Just how much power do our governments need? Regardless of the degree to which cable owners are or are not permitted to originate programming, editorials and the like, it is clear that cable owners will enjoy certain legal and/or practical methods of influencing the content of at least a portion of CATV's originations, even if those controls are confined to the operational scheduling of studio availability for public access channels. And, if common sense is used, cable operators will be encouraged to originate because it is they who have the greatest incentive to create and produce programming to meet needs, to attract subscribers and to serve the public.

Moreover, why should cable speculators be denied their constitutional right of free speech? Hence, since the practical and legal considerations support the concept that CATVs will have some influence upon at least a portion of cable's originations, should such influence be in municipal or private hands?

Are elected officials and bureaucrats more qualified than private entrepreneurs to operate the communications media? If municipalities are found qualified to operate major market CATVs, why should they not be found similarly qualified to operate newspapers, commercial television, telephone companies?

While daring to assume the independence of the only communications media of his age, Thomas Jefferson once observed audaciously: Were it left to me to decide whether we should have government without newspapers or newspapers without government, I should not hesitate a moment to prefer the latter.

As between CATV and the government, we might expect Jefferson to make the same choice, that is, cable. In any event, our wise founders would hardly have supported government ownership of cable television.

Hence, technologically, economically, politically and philosophically it is difficult to perceive justification for public ownership of CATV.

This morning in true Socratic style I have asked more questions than I have answered. In closing, however, I am constrained to observe that the glory that has been America's has emanated largely from the stimulus of the free enterprise system. The grandeur of our public services, however demeaned, has been the issue of taxes of privately-generated profits. Our greatest leaders have remained constant in their support of this democratic ideal and for a most conjectural and visionary fear of unwarranted CATV riches or manipulation of public opinion, what honest patriot in the full tide of the successful American experiment can abandon that system which has so far kept us free and firm?

This government, devoid of nationalized industries and media control, remains the world's best hope. It does not lack the energy to preserve itself and need not usurp the entrepreneur's function to do so. Such usurpation would constitute to me the beginning of the end, the ultimate evil, the emergence of a political power of ineffable proportions.

The very presence of such a threat should sound an alert for all media and all entrepreneurs. If indeed this threat continues to grow, George Orwell's big brother may in time be watching you.

<u>Stuart F. Feldstein</u> -- Our final speaker is Stanley Cohen who is a partner in the Washington law firm of Cohn & Marks and he is going to deal specifically with the monetary aspects of the municipal ownership situation which have been only tangentially touched upon thus far.

<u>Stanley B. Cohen</u> -- In part, the approach that I've taken results from a conversation I recently had with a friend of mine who functions as a psychiatrist with disturbed and runaway children and he said that each time he comes together with groups of parents he has two choices. He can either console them and tell them how terrible the incident has been or he can try to get them to understand the whys, wherefores, and reasons without judging one way or the other.

I think if I'm to serve any benefit at all this morning I would rather take that approach as opposed to persuading you that this is something you don't like and therefore it shouldn't happen.

It's here. It's here in part. In order to understand the finances, in order to understand any aspect of it, we have to understand why it's here and what we mean by public ownership, some of which has been touched.

Public ownership can take many, many forms. One, the obvious form, is the city itself attempting to build and own the hardware. That obviously has certain economic consequences. This is the kind of activity which has been more or less assumed in the prior discussions this morning.

There's a second possibility. The city itself, directly or through the offices of the State, can create a semi-public corporation, a COMSAT kind of operation where you have either a corporation which is limited to appointed public officials or it could be a partnership between public officials and representatives of the private sector. This has been done in the communications field and the latter concept represents a positive illustration of the mixed body.

The Port of New York Authority represents a situation where a corporation has been formed by States for the express purpose of having jurisdiction which not a single one of the States alone would be able to exercise.

There are other organizations that could serve as illustrations.

There's a third possibility and that's this. Cities have now been thinking in terms of creating CATV entities and at the same time avoiding some of the obvious financial problems, some of the obvious problems incident to seed money, construction money, startup money, etc.

One way of accomplishing this, and particularly in light of the recent court decision which places the franchise tax in legal jeopardy, is to allow, and I use the word allow advisedly, a private entrepreneur to construct the system in return for which he deeds two, three, four, or five channels to the city. The city becomes a partner in the operation of a CATV system. When I use the word deed, I use it in its full legal sense. The city owns three channels. This is another method of municipal or public ownership.

Finally, we get to the concept of leased channels which Mr. Lovett referred to a few moments ago where the city gains control by virtue of leased facilities on a common carrier basis or some sort of arrangements sanctioned by the Commission.

Each of these techniques carries with it different financial obligations and different consequences and to attempt to mingle all of them together is to ignore the realities. Why are we drifting toward at least an attempt at municipal ownership?

One obvious reason is the hope for revenues. It's true that in many, many instances cities regard CATV as a goldmine and as a source of potential revenue. I'm not at all sure that this is the motivating factor in all instances.

Administrators are not simpleminded idiots. We may think they are on occasion but most of them have some notion of the dangers inherent in operating a commercial business. There are other pressures.

The CATV franchise does represent an opportunity to satisfy different elements in the community, minority groups in the community, among others, people who are the come-latelys. They are not part of the establishment. They want a voice. They have not gotten into radio ownership, they have not gotten into FM ownership, they've not gotten into TV ownership. Their time has come and their pressure is present and the city is reacting to that pressure and the pressure is for an opportunity to be heard, an opportunity to communicate.

To ignore this aspect of the problem I think is to treat only half the problem. It's to assume a monetary motive as an exclusive motive.

That's a second factor. The prior experiences in governmental ownership lead to the generalization that the governmental entity can provide the service at a lower cost to the subscriber. This is not an insignificant factor. There's a very substantial fear prevalent among municipal administrators that CATV can be a very, very expensive future. They're visualizing not only the present situation of where service can be bought for $5, $6, or $7 a month but what will occur with the unification of CATV and pay TV, which is sort of a natural brotherhood.

Will you have a situation of where an uncontrolled private ownership can have material effects on the welfare of the community? In the absence of ownership, can effective control be maintained through rate regulation or through some other form?

These are thoughts. These are thoughts that I've heard expressed by administrators, administrators who were seriously contemplating some form of CATV activity.

Finally, we all know that there is a very significant legal question as to how the community or the governmental authority can derive revenue from CATV. Now, to assume that the governmental authority wants revenue from CATV is to really see only one phase of the problem. Cities are starving. Cities want money. CATV franchises are a potential source of revenue.

Up to now the experience has been in terms of applying a franchise tax to gross revenues. This has now been placed in jeopardy because of the decision of the Sixth Circuit. In light of this, how do you permit CATV to grow in your community and at the same time turn over the money for public purposes?

It seems to me that the latter points have actually greater historical validity than the concept that CATV municipal ownership would reduce costs to the subscriber. The only evidence, the only study that we have is the Rand report and the Rand report analyzed a substantial number of municipally-owned water and gas companies and undertook to compare costs to subscribers of municipally-owned systems with private systems. The evidence in favor of municipally-owned systems is not conclusive.

In a good number of the cases the charges to the subscribers were higher. Even in those instances where the charges were lower, it seems to me there was some reasonable question as to the quality of the service.

What does municipal ownership mean in terms of programming and why?

It is not enough simply to make time available or to have a CATV system and expect from this any substantial amount of local programming. In order to have local programming, it is necessary to have money. It takes money to produce programming and the administrators who are moving forward in this area are finally coming to a realization that funds must be secured and those funds can come in part from plans for partial or complete public ownership.

One of the plans which I heard advanced only recently, and in light of the court decision, was for the city to grant a franchise to a private operator. That franchise would cover only half the channels. In return the city would keep half the channels. Some of those channels retained by the city would be kept for purposes of municipal programming. Other channels would be kept for purposes of sale to the CATV operator.

In this way the commercial operator is subsidizing municipal programming. In this way, hopefully, from the viewpoint of the city, they are able to overcome the court decision. This is not a tax. This is a sale of city-owned property, property gained because of permitting the use by a private operator of city facilities, the streets.

The reason for highlighting this is to emphasize that the dangers of municipal ownership in whole or in part continue to exist. Municipal operators are aware of the problems of financing new systems. They know what it takes. They've read the industry figures. To tell them it's expensive isn't furnishing them with any information that they don't already have.

Specifically, they know and are going to the foundations and to public companies for seed money to make their feasibility studies. They've undertaken to get expert advice in terms of financing through bonds and/or the sale of stock, in the event of the utilization of a public corporation. They're frightened. They're aware of what the experiences have been in radio. They're aware of what the experiences have been in television. But they're moving forward in the hope and in the search for alternatives to come up with money and to produce programming and I think it's important that you recognize that these things are happening and that the motivation for these things to happen continues to exist and to the extent that those needs are not being met by the private operator they're going to be met otherwise. We, as private operators, have to take this into account in planning our own proposals to new communities and our existing services to existing CATV cities.

There are some very, very significant problems incident to municipal ownership and those problems exist whether or not the ownership occurs by way of a public corporation, a semi-public corporation or the city itself. In some ways they're accentuated when the city itself takes over.

We have a traditional freedom in the area of communications. We do not have a government-owned communications network, and this is a very, very common thing in Europe and elsewhere throughout the world. We're able, in large part, to make judgments about the consequences of public ownership. Not all of those judgments are favorable to public ownership and there are some very severe political consequences.

Now someone made the observation that there really is no need to fear the political consequences of putting the media in the hands of a political group. After all, we have existing publicly-owned stations now and the experience has been that those stations do not get themselves involved with politics.

That experience, unfortunately, is an experience which assumes the existence of a policeman and any form of municipal ownership necessarily will carry with it a need either for the FCC or for the State to assume a regulatory posture, and consequently a posture which takes again the basic responsibility from the hands of the local group and puts it in the centralized unit.

DISCUSSION

Sidney Dean (New York) -- I would like to ask the panel -- I'm an independent myself -- I'd like to ask the panel what the industry is doing or should do to offset the increasingly onerous demands of municipalities for free studios, free channels and other kinds of free services? It will take collective action to do it. The individual franchise applicant is handicapped and may I say that the American Civil Liberties Union, whose position on cable is rigorously for common carrier treatment, at the same time is rigorously opposed to any free services to municipalities without the payment of a fair rate, because they see the risks of governmental intervention in programming and content services as even more dangerous in the hands of politicians and government officials as they do in the hands of private operators.

<u>A Panelist</u> -- I'd have two quick reactions to that question.

One, I would suggest that to the extent the cable industry does more program origination it will diffuse the interest or the public demand for locally-oriented programming and, hence, to a degree, city services.

Two - I think to the extent that the cable industry shows its financial statements, perhaps not in the altogether best light, is pretty good fuel, too.

<u>A Panelist</u> -- And I would add to that that I think you should -- I think the industry has to work through its associations and in some form of its own collective bargaining. What I'm looking for here is a little package which the California Association sent around in terms of municipal ownership. Here it is. It's a package of material sent to all their members about municipal ownership and a series of talks and articles and obviously, should the task be beyond the individual system, you have to do it through a collective system.

But I think the only answer really comes in -- There is a scene in The Male Animal where they have a pep rally at night and everyone gets up to give the football team a big talk for the next day's game and all the talks consist of, from everybody from the president of the school down to the head of the student council, is get in there and fight and that's the only answer.

And you have to make the cities aware of the fact that it just shouldn't be done but it takes a lot of strength and a lot of guts to do it because you stand the risk of course of losing your franchise or the application.

<u>A Panelist</u> -- No other utility has been charged with those burdens to any appreciable extent.

But that's because they're not being given out today. I think if they were being given out today, they would be charged.

<u>From the Audience</u> -- What effort is the industry making in terms of representing the industry before municipal governments in hearings on new and proposed ordinances with these restrictive and burdensome policies being added to proposed new franchise operators in their areas?

<u>Stuart F. Feldstein</u> -- I can answer for the national association. We have not generally made appearances in localities, but insofar as State regulation is concerned, the NCTA does make presentations before State legislative bodies and PUC bodies in this regard.

In the locality the State associations are active and, of course, the various people who are interested in getting franchises in the various cities have to deal with this on a local basis with perhaps informational help from a broader representative group.

<u>From the Audience</u> -- Is the industry susceptible to any inquiry or request from localities -- I'm thinking primarily of urban cities -- to make appearances in opposition to these outlandish proposed ordinances that are forthcoming?

A Panelist -- If I could mention the California Association again, which I have the highest respect for, they found, for example, in California that cities were exacting a higher and higher franchise fee, which is something no one has mentioned but obviously is of major concern. They fought for and put through the California Legislature a State law limiting the franchise fee to 5 per cent, with certain exceptions. But there's a perfect example of how a State association can protect the individual city situation by cutting down one of the major aspects since the cities were putting the squeeze on franchise applicants and getting as high, as you all know, as 10, 20 and sometimes 30 per cent of gross.

From the Audience -- Are there State associations in every State?

Same Panelist -- I believe so and there are also regional associations and perhaps the answer is that some of them have to be made a more effective tool of the individual systems but the tools are there. I mean, the associations are there, the membership is there and certainly the will is there.

Stuart F. Feldstein -- I think there may be 41 or 42 -- I'm not sure of the exact figure -- State associations.

Michael Enzer (North Carolina) -- I'd like to ask a question primarily of Mr. Cohen. I'm thinking about some remarks that have been made by Charles Sofkin in his book The Advertising Man: Seven Glorious Days, Seven Funfilled Nights, in which after viewing American broadcasting available in New York City for seven days his final conclusion was that the best way to solve the programming problem, as he saw it, was to take a machinegun down to the network offices and start shooting everyone in sight.

After more consideration, he decided that that really wasn't the solution and in fact there was no solution.

I wonder if you can see any mechanism outside of public access, either through leasing or deeding or ownership of channels, any way in which we will get a difference from the existing broadcasting system in terms of the present programming, that is, programming which is primarily directed to a mass audience in the lowest common denominator sort of thing?

Stanley B. Cohen -- I think I can answer you in two ways. One, there's a Virginia City, right outside of Woodbridge, built by a private developer, called Dale City. Dale City was one of the groups studied in the Rand Report and I have that section of the report with me, if you're curious.

What happened in Dale City was that the CATV system was constructed when the city was constructed. It went with the underground cable. It's privately owned by the developer and to the best of my recollection it's operated by professionals. As part of the franchise, they made certain hours available to the community organizations and they're actually under the auspices of the Jaycees.

One of the things the community learned is that there's a significant limit as to how many hours of reasonably interesting programming a community group could put on. The study indicates though that they did program and that the programs produced by the communities did get a substantial audience in competition with television because it concerned itself with community matters. They have very significant financial problems, they have very significant programming problems, insofar as the community is concerned. Nevertheless, in Dale City, with this kind of community cooperation, the community is thoroughly behind CATV.

They're friends and because they're friends, there will never be a public franchise in Dale City.

There's a second possibility and that's in terms of minority programming -- minority audience programming without a mass base through the utilization of additional revenue sources. English translation: pay TV on CATV.

My own feeling is, if pay TV is permitted to occur without regulation, the end result will be a duplication of mass audience programming. That may very well be good. I'm not saying it's either good or bad. But it simply will result in the pay TV operator being able to outbid the CATV operator or the television operator for programming which is calculated to appeal to a mass audience.

The net result, I'm afraid, is that someone like the Federal Communications Commission will step in, as it always has stepped in in the past, to lay down rules and regulations as to how the programming designed for minority audiences is to be programmed, when it is to be programmed, etc. With this type of outside supervision, there is a possibility that the additional revenue sources would supply additional programming.

I'm not sure in my own mind whether or not the risks are great enough at the moment to warrant this kind of outside supervision.

Lee G. Lovett -- On this point, two or three thoughts come to mind. It seems to me that in the major markets cable television cannot survive without distant signals but I question whether it can survive with them. In my judgment, it's going to require a great deal of program origination. Necessity will be the mother of invention. I think that necessity will stimulate cable operators themselves to create, perhaps not to produce and direct everything that goes out, but to stimulate, one way or another, an abundance of programming, some of which unquestionably will be minority-oriented and highly specialized programming.

At the FCC's March oral hearings one of the speakers -- a gentleman by the name of Klein, from New York, a very articulate guy who talked about computers and library banks for programming and that sort of thing -- made the observation very aptly that we live in a visual society and it's not a question of will we watch, it's a question of What will we watch? But there is no recognition in today's television, that's why it's so primitive and crystal-set-like to me, of the highly sophisticated and specialized interests that exist in this country today.

Cable television in the major markets, through its great quantity of channels, will offer the public an opportunity through a variety of means to receive that specialized programming, and leasing and public access are quite viable ways of achieving those objectives.

I, for reasons stated earlier, am diametrically opposed to municipal control of that and I think justifiably so as an American but the leasing concept or public access is a good one. Unfortunately, the FCC, State and local public access proposals today have assumed erroneously that there is a public need and demand right now for those channels.

As one who has done work for the City of Dallas and others who have been active in radio operation, I know that it's one thing to say that we're going to make an hour a day available; which of the public would like to come in and use it? We'll provide you the crews. No one shows up. Even if the cities or the FCC or anyone else dedicates or requires the cable company to dedicate 5 or 10 or 50 channels for public access, it may well result in dormant channels 90 per cent of the time.

In my view, the public's got to be educated, guided and encouraged to use those channels and who better to do it than the cable operator himself.

There is one other problem with public access that concerns me and it was discussed a little bit again at the March oral hearings by the NAB General Counsel and it was an instance, a rare one, on which I agreed with him. He was talking about the public access problem in this regard. Who is most apt to use the public access channels? In all likelihood it's going to be the same extremists that make bad news today on television. If we're not careful, we're apt to find that our public access channels deteriorate to a proliferation of pornography and slander and all forms of undesirable programming.

And even in our liberal society today there are many people who will be offended by that programming, so I think, as does the NAB General Counsel, that there must be some supervisory control over public access channels. Again, I think the person or the group which is most apt to do a good job on that is the party with the greatest risk, the greatest investment, and that's the cable operator himself.

So I think to create a demand and utilization of public access channels we've got to encourage the cable operator to do it. We've got to give him some supervisory role at least initially and, above all, we've got to keep it away from control by any form of government.

"CATV FOR THE CITIES (PROBLEMS AND PROMISES)"

Speakers

The Honorable Ralph H. Metcalf
U. S. Congressman -- 1st District
Chicago, Illinois

Amos B. Hostetter, Jr.
Continental Cablevision, Inc.
Boston, Massachusetts

Dempsey J. Travis
Sivart Mortgage Corporation
Chicago, Illinois

Barry Zorthian
Time Life Broadcast, Inc.
New York, New York

Theodore Ledbetter
Urban Communications Group
Washington, D. C.

Moderator

Samuel S. Street, Jr.
S. S. Street & Associates, Inc.
Wheaton, Maryland

Samuel S. Street, Jr. -- We're going to explore the problems and promises of cable communications in the city. This discussion will investigate the social and political problems as well as financial and technical considerations of major CATV markets.

With us today are a group of experts with a diversity of interests. However, they have one thing in common: the growth of CATV in major markets.

Our first speaker is a member of the House of Representatives, elected from the First District of Illinois, which includes a part of Chicago.

It is with great pleasure I present The Honorable Ralph H. Metcalfe.

Ralph H. Metcalfe -- As with so many new endeavors, cable television has met with great optimism and predictions for a revolutionized future in communications. It has been compared with the very beginning of television itself. Yet television has also been a source of great disappointment.

Former FCC Chairman Newton Minow's pronouncement of television as a vast wasteland is as true in 1971 as it was in the early '60s when he first uttered that now classic condemnation. Cable television presents the same challenge and potential that over-the-air television did 25 years ago and, likewise, the disappointment could prove to be equally great.

On the positive side, cable television presents an opportunity which was never possible on conventional television. It has been proposed that a system of branch cable will provide local communities with their own communication network. This would create neighborhood televisions like neighborhood newspapers, with the added advantage of instantaneous communication and a wider audience.

It is particularly important in black communities where both network and most local programs do not meet the needs of the community. To be relevant, media must serve the needs and the interests of its specific community. This is impossible where standard television is forced to cater to a mainstream audience.

Not only would the community have its own voice through cable television system, but new jobs would be created for media people previously excluded from the mainstream media or forced to work in a capacity alien to their principles or concerns.

Another criticism of over-the-air television is that in an effort to please everyone in the wide audience, all controversy is avoided and only a very narrow spectrum of opinion is expressed. Cable television would permit the expression of all ideologies, left and right.

Governmental control is both necessary and inevitable in the cable television field. Even some industry spokesmen have granted that the industry is under-regulated. Some States and local governments have already taken this initiative. The problem of overlapping governmental jurisdictions, so common in the communications field, will probably make Federal control inevitable.

The initial Federal response to the whole question of cable television can be described as cautious. President Nixon has appointed a high-level committee to develop a comprehensive policy for cable television. Included on this panel are some of the President's closest aides and cabinet members. Some view the committee as an attempt to circumvent the FCC and Congress.

The presidential committee is less than two weeks old. Therefore, it is too early to predict its policies or functions. Congress has always shown an interest in cable television. Such diverse political figures as Senators Eastland, Dole, and Majority Leader Mike Mansfield have expressed great concern over the future of cable television.

Last February Senator Hubert Humphrey of Minnesota wrote, and I quote him:

> The ramifications of a broadening of CATV seems to be of such a serious nature that I feel Congress should look into this problem, should study the effects, good and bad, of increased CATV and then provide the FCC with positive guidance on this matter.

Senator John Pastore of Rhode Island, the Chairman of the Subcommittee on Communications, has held open hearings on cable television questions. Included in the testimony received were the general recommendations of FCC. These recommendations were described by FCC Chairman Dean Burch as conservative and a compromise.

The most interesting legislative measure is H.R. 7443, the Public Broadcasting Bill. There is an attempt to get subsidized telecasting equipment written into this bill. Such a provision would give minority and community groups access to the cable television system without depending upon civic company facilities.

Few members of the black community have the capital to invest in the cable industry. We cannot let this become an obstacle to black participation in this industry. There are three other major bills in Congress affecting CATV systems and they are as follows:

Senate Bill No. 792 to amend the Communications Act of 1934 to provide for the regulation of community antenna systems. This bill would authorize FCC to fully regulate cable television in the public interest.

Senate Bill No. 644, General Revision of Copyrights, deals with the copyright procedures.

House Bill No. 1246 would give cable television the same tax exemptions as are presently afforded radio broadcasting stations on Federal Communication Commission orders, as well as other investments.

The real means of achieving successful community oriented cable television systems does not rest with Congress, the presidential committee or the Federal Communications Commission. What is necessary is the active participation of private citizens in a community on a community level. In turn, cable television industry must show a great responsiveness to public needs and public interests.

At this, the Twentieth Annual Convention of the National Cable Television Association, every effort has been made to receive the advice and viewpoint of a wide variety of individuals. I applaud these actions. They are to me an indication that cable television does indeed have a bright, dynamic and innovative future.

Samuel S. Street, Jr. -- To develop the top 100 markets we have to look at a lot of different concepts -- concepts of ownership, access, who our markets are, who our subscribers will be.

Our next speaker is one of the young lions of CATV. He is Vice President of Continental Cablevision in Boston. He is a system operator. He is involved in some major markets. Bud Hostetter is a member of the NCTA Board of Directors and the Executive Committee.

Amos B. Hostetter, Jr. -- I remember in 1967 or thereabouts when I was on the Convention Committee, we spent more time selecting a theme than on virtually any other item. While I have long since forgotten that one, I think all of us will be well advised to keep in mind this year's theme: CATV 1971: The Second Generation.

In my mind, this theme implies a full measure of respect for the imagination, wisdom and grit of our pioneers but emphasizes the fact that our productive years are still ahead. This is where the emphasis should be. If 1971 brings an end to the freeze, and I believe it will, it represents more the beginning than the end. In the words of the rock musical "Salvation," "Today is the first day of the rest of our lives."

This is a simple but awesome thought. Especially awesome when we consider the basis on which this industry is to have its life. No one can consider the ebb and flow of regulation over the last few years without recognition that, if cable is allowed to move forward, it will be due in large part to its promise in the cities, the hope that somehow better communication can break the chain of dehumanization, depression, despair and defeat that blights urban America.

Likewise the political realist must see the considerable debt the industry owes to the community and minority interest groups whose pro bono efforts in the last few years have focused attention on the hope of the wired nation.

In taking the cities as our reason for being and the minorities as our allies, we have created and accepted a great responsibility. It is for the second generation to see that that responsibility is fulfilled.

I would like to say that it will be easy but that just ain't so. In many ways the cable industry resembles an obsessive child which the psychiatrists define as one able to find a new problem as soon as an old problem is removed. It appears that the regulatory problems which have obsessed us for almost a decade are near resolution. However, there is already a formidable substitute: the problem of funding the wired nation.

Last week a panel on the subject was held here in Washington under NCTA's sponsorship. Representatives of each of the traditional sources of corporate capital addressed the issues of funding the wired nation. Let me try to summarize my impressions of that meeting.

Let's start, as the panel did, with the assumption that the industry needs a base of about 25 million cable homes, that is, 40 per cent of the nation's TV homes, in the next decade to develop some of the more socially promising applications of cable. This will probably require passing 50 million homes and require capital commitments on the order of $10 to $15 billion or $1 - $1.5 billion a year over the next 10 years.

This annual requirement represents about 1/1000 of our GNP and about 1/100 of our annual corporate investment. So far not so bad. But since better than 70 per cent of corporate investment funds are internally generated, that is, represent profits plus depreciation, and this industry's current rate of internal generation is probably less than $100 million, the problem gets a little tougher. In fact, the total national savings-to-investment flow of new funds to corporate users is at a rate of only about $25 to $30 billion a year. Of this the utilities, including the telephone companies, take over half. No other single industry, not the airlines, not the gas transmission lines, not the railroads, attract capital at a rate in excess of $1 billion a year, which is the rate at which cable must attract in order to reach a 40 per cent saturation in 10 years. A formidable task in a decade that economists already feel will be one of unparalleled demand for capital.

For the faint at heart who would conclude from this that the private sector cannot do the job, there is not much solace in thoughts of government subsidy.

Total new State and local fundings in 1970 were about $13 billion. Much of this was not raised for capital formation but represented deficits in service budgets by overtaxed local authorities. There is, of course, a tremendous public policy issue related to applying public credit to cable hardware in substitution for badly needed community services. But quite apart from this issue, you don't have to be an economist to see that, given our present taxing and allocation structures, State and local sources are already extremely tight.

Well, then you say, what of the Federal Government? Yes, we spent $23 billion in 1968 in Vietnam and we spent $13 billion there last year. Yes, our agriculture programs cost over $10 billion per year and we probably spent $10 billion a year for highways during the 1960s. But recognize that these latter two are politically solid, middleclass applications. Let's look at Model Cities as more politically comparable to the job of wiring the cities: a total budget of $2 billion last year. And how about Public Broadcasting with perhaps a $50 million annual need, about one-thirtieth of our annual needs, still unfunded and with no good long-term prospect in sight.

It seems to me that if we are to go forward in any reasonable time frame, it will have to be with funds drawn primarily from the private sector. By bits and pieces we'll have to patch it together.

What does all this mean for the new entrants to the industry? For the local and minority groups?

Individually it may be irrelevant. We have come a long way in terms of access to traditional capital sources by minority groups. Further, there are developing significant pockets of minority capital, including the MESBICs. The blacks particularly are becoming more conscious of the value to corporate America of their consumer and investment dollars. Strong black banks and insurance companies are developing and underwriters can't be far behind.

On the other hand, I must say that collectively the new entrants will be at a distinct disadvantage. Last week's panel here in Washington was clear and direct in stating that the operators with experienced management and a proven record will be in a preferential position in the scramble for new capital.

I'd like to make a few final observations related to black efforts in cable.

It appears at this point in our evolution that black political power surpasses black economic power. I leave it to Mr. Travis to contradict me, if he chooses. In any event, in your own self-interest, apply both to cable television for maximum benefit but apply both judiciously.

I would urge you to try and keep in perspective the fact that ownership of the facilities in this industry is not the end all and be all. The hardware side of this industry is immensely capital intensive and marginally profitable. The software, i.e., programming, and I don't mean by that only entertainment, will entail a much lower capital commitment but will be highly people and talent intensive, i.e., more wages than interest paid.

At this point software is of unproven profitability but it seems axiomatic to me that if cable is going to work in the cities, if the hardware is going to have any value, the software will first have to be profitable.

Be involved in the franchising process, if you have the political power to be a factor, and by all means, if you can get the franchise outright, get it, on any reasonable terms. By reasonable terms, I mean a workable balance of rates, services and fees to be paid to the municipality.

Parenthetically, I don't think the existing industry has set any great examples for you in this area but I assure you that they will soon either sober up or fold up or both.

Either during the franchise process or after it, if you get it, recognize the real costs of capital and experience in negotiating with existing MSOs and capital sources. If one tells you you want too much, tell him to go to hell. After a half dozen have told you so, you'd better rethink your deal. Don't let your franchise go stale. Both you, your friends in city government and the community will suffer.

In my judgment, you may often be better off trying to liquidate the value of your political power quickly and reapplying it to less capital-intensive areas, perhaps programming on an access channel.

Lastly, look hard at the opportunities in these leased access channels. A cable system in your community will shortly offer ten or more new TV licenses and dozens of FM channels. You know the urban markets better than most. What are the informational needs? There should be a way to make those channels profitable to the lessee while returning capital costs to the lessor.

Believe me when I say the existing industry wants someone to make a fortune on each of those channels. When we figure out the way to do that, we will have gone a long way towards assuring the realization of the wired nation and discharging the responsibility of the second generation.

Samuel S. Street, Jr. -- Our next speaker is Mr. Dempsey Travis. He's President and Chairman of the Board of Sivart Mortgage Corporation in Chicago, which is the largest black-owned mortgage banking company in the United States. He has devoted more than 20 years to the real estate business. Recently he formed a company called Chicago Cablevision, which has applied for a CATV franchise in Chicago.

Dempsey J. Travis -- This is my second opportunity to attend a workshop dealing with cable television, the first having been two weeks ago when I attended one sponsored by the Urban Institute, Black Efforts for Soul in Television and the Urban Communication Group, which dealt with minority opportunities in cable television.

However, I can say that I have had 51 years' experience of being black so I consider myself an expert in that area and I think that's the area we're going to have to deal with.

Now I'm not going to rebut Mr. Hostetter, but I am going to say that I don't think political power has overcome black economic power. We haven't gotten around to putting those things together until very recently and I think it was certainly exemplified with the quarter of a million dollars that we raised right here in this hotel two Fridays ago and of course we intend to continue to keep that format straight across the country which will then make this a real reality.

This visual-audio business is an interesting one. However, in order to fully appreciate it I think we have to sometimes go back into history.

As I discovered and you will discover, blacks have not owned in any quantity a media of communication since they invented the African drum. I think we can safely say that the first long distance audio communication used by man on any continent was this drum.

The American Indian was, of course, the inventor of the first video communication -- the smoke signal. But because of our social and economic structure both of these groups have been denied an opportunity to project their early creativity in our current mass of video and audio mediums.

Now, interestingly, the African drum is being mass produced in Elkhart, Indiana. Needless to say, no blacks are playing any part in the action.

And, of course, the Indian smoke signals would get rather scattered reception today because of pollution.

In these times I really think it's critical that blacks play a major role in controlling the form of the media that's spreading through their communities, because blacks are certainly concerned about the type of image that is being projected on them, as opposed to the type of image that they can project upon themselves.

A good example, I was talking to my nephew who lives here in Washington last night and he told me he was getting married on the 12th of August. I wished him well and asked where he was going on his honeymoon. He said, "I'm going down to Jamaica to get some sun."

I said, "What the hell are you going to sun, the palms of your hands or the bottom of your feet?"

We've got to control this media because you're mixing us up. I look at the television and I read and hear that if I get tan I'm sexy. Hell, I mean, I'm not making it, so something is wrong.

Cable television is in its infancy in the metropolitan areas where the black population ranges from 21 per cent in New York City to 71 per cent in Washington. Just yesterday I read that 14 more cities have been added to the list of those with a black majority. That means 103 counties in America are over 50 per cent black, with Macon County, Georgia, leading with 81 per cent.

Now it would appear to me that blacks will have to be represented in this media not only as tap dancers and singers but as owners and programmers.

Now if I read the mood of the community correctly, outsiders will not be running the wires through the streets, over the poles without community participation, and this is as it should be and, of course, as it will be.

There is a solution, as I see it, to this problem. That solution is joint ventures. Outside experts will join hands with black businessmen and community leaders in a sincere effort to make cable television a viable and meaningful instrument for a black audience.

When I say participate, I'm not thinking in terms of that token black guy sitting in the window for some large national corporation. I mean real participation. I know, as a businessman, that there are a lot of black guys around with money who only need some direction. They don't have your expertise, they didn't come on the scene 20 years ago with cable or any other media but they are ready to join forces with you in a realistic business proposition. Because, as I see it, if the banks will participate and the insurance companies will participate in the same manner they are participating with some of the owners here, there is no reason why there can't be black ownership of cable TV in the center city.

Samuel S. Street, Jr. -- Our next speaker, Mr. Barry Zorthian, is President of Time-Life Broadcast. They are large CATV owners, over 100,000 subscribers.

Barry Zorthian -- These preliminary comments are running probably longer than the patience of the audience, so let me confine my comments to a few main points and then get on to Ted Ledbetter and the question and answer period.

I'm speaking and referring from our experience of constructing and operating a CATV system in the southern half of Manhattan Island only and I make a point of that simply because Manhattan is probably unique among all urban areas in the country that are available or will be available for CATV development.

It has some characteristics of its own. The name of the game is no distant signals. We're already delivering 12 area stations. The name of the game here is what additional attraction you have for the subscriber and that is primarily at this stage a reception problem. Manhattan is a vertical town. Its highrise buildings create, particularly for color television, an enormous problem in reception.

Ultimately we have to present and are now starting to present additional programs. Right now the principal attraction is sports events, our local hockey and basketball teams, movies, some original programming. But there are plans for much more.

I am not sure these same characteristics will apply to other areas. Perhaps in some of the core cities they will, but nevertheless, I underline the uniqueness of the Manhattan problem because, as I say, the experience may not be transferable.

However, there are some characteristics that I think perhaps have relevance to other areas. The great need in Manhattan -- and I would think in any major urban CATV system -- is capital. Our franchise area covers some 350,000 dwelling units. It will require, before we're through, about 10 years and $35 million to develop completely and this comes out at $100 a potential subscriber, $200 a probable subscriber, with a 50 per cent projected penetration.

Capital is an enormous requirement. I endorse Bud Hostetter's comments in that regard and I think the reality, the problem of creating capital has not been given sufficient consideration by those who are looking to urban areas as a prospect for quick development.

The actual construction itself has been an enormous problem in Manhattan and the management and staff of Sterling Manhattan Cable have broken a good deal of new ground. The vertical nature of the area creates problems in skipping floors where subscribers don't want to subscribe. There are only 75 miles of street construction required but obviously a very difficult 75 miles.

Manhattan is fortunate in one other respect -- a very important respect. In 1890 the city had the foresight to put a claim on underground ducts being built by the telephone company and under our franchise we have been authorized use of these underground ducts. Without this feature the construction costs in Manhattan would be even more enormous.

No one is rushing at the moment to pour the millions required into the other boroughs of New York City, the Bronx, Brooklyn and Queens, because the costs will be even greater.

Access to apartment buildings, agreements with landlords, controlling marketing so that customer demand doesn't run ahead of your available cables. Manhattan Cable started building in Manhattan in 1965. We don't think this system will be completely finished, at least the main cables won't be laid, until 1974. Marketing has to keep pace and has to be carefully controlled.

We have had, and I cite it not as a problem but again as a very real fact of life to live with, a very interested and committed city administration which has been very demanding in its franchise. For those who have doubts that a good municipal government can demand and get a franchise that takes into account the public interest adequately, I'd suggest they look at the New York City franchises. They're tough but they're fair, we think, and we can operate under them. But they also take into account and provide for the public interest.

Some of you may have read that as of July 1st the first public access channels in the U. S., so far as we're aware, went into operation in all Manhattan, the northern half being run by TelePrompTer, the southern half by Sterling. Two channels are now available to legitimate public groups. They may program, within obvious limits, anything they really want.

In addition, the city itself has two channels. There are four public channels from that viewpoint. The effective use of these channels will continue to grow.

There are many other problems in Manhattan: union problems, clearance problems, the availability of skilled labor and so on. But rather than go into any details at this stage, let me stop here and give Ted Ledbetter his crack at the podium and then answer any questions you might have.

Samuel S. Street, Jr. -- Our last speaker is Ted Ledbetter. Ted is President of the Urban Communications Group, a private telecommunications consulting firm here in Washington. He has worked as a radar systems engineer and program manager with Litton Industries for 8 years. He left Litton to direct the Urban Economic Development Staff of the National Urban Coalition.

He started private CATV consulting in 1968.

Theodore Ledbetter -- I have to start off by saying how happy I am to see so many brothers and sisters here in the room this morning. I think there were 6 black people at the NCTA Convention in Chicago last year and I think this is quite an improvement.

You know we usually discover a good thing long after it's gone. In cable television, however, I think despite all of its cross ownership by newspaperowners and broadcasters and despite the fact that several major black communities around the country are already franchised, I think we're still only about two years behind. But if you think about it, that's closer than we've ever been in our history.

Cable offers great potential to those of us who have been denied access to and ownership of the media. We own less than one per cent of the thousands of radio stations and absolutely none of the more than 800 TV stations in the United States.

Cable offers us the possibility of changing this imbalance and unless we realize this potential in cable, cable will be useless to minority people and, therefore, will not develop in the great cities of our nation. So, to help cable to realize its potential and to help you all avoid the mistakes of the other media, I'd like to outline the Ten Commandments of Urban Cable Television.

These are the basic rules which will never be promulgated by the FCC, will never be legislated by Senator Pastore and will never be ordered by the White House. These are rules which you should consider, however, as binding as rulemaking, legislation and executive order, all in one, if you hope to realize the $4 billion market for cable television in those cities.

Number one - Ascertain the community needs. Broadcasters have an ascertainment requirement in their license process. You don't have the license process therefore you're not required by the government to ascertain those needs but I suggest that you do. These cities are not simply markets. They are people who hurt and who love just like you. They have needs, wants and desires which they will expect you to meet.

Number two - Invite community participation in the planning process for only by learning and doing in this early stage can communities help you to maximize the profits and service of urban cable television. If you doubt my word, ask Ma Bell about the profits derived from easy-to-use and reliable communications equipment.

Number three - Buy from minority suppliers, including construction subcontractors, automobile dealers and advertising agencies. It might also be extremely expeditious to open demand account, tax accounts and certificates of deposit in minority-owned financial institutions.

Number four - Hire and promote minority employees as though each one were your brother-in-law or his wife.

Number five - Provide all service to all citizens. I know you like to wire those highrise, high-income apartments first but you'll find the density of most urban minority communities to be around 500 to 600 TV households per mile. How's that for an appetizer?

Number six - Don't discriminate with rates, deposits or service. We are already conscious of the differential pricing in the ghetto supermarkets and the mandatory discriminatory deposits required by utility companies if our address happens to be within the black lines on a city map.

Incidentally, you might be interested in one kind of myth that has been intentionally created about minority communities. That is the myth that minority people are bad credit risks. Three years ago when I worked for Carl Holman, Sarah Carey and John Gardner at the Urban Coalition, we studied the problem of consumer credit. We found that many small jewelry, appliance and clothing stores in minority communities reported a high rate of slow payment and non-payment. We also found, to the amazement of the major department stores who would not grant credit to these people, that these people in actuality had a much lower slow payment and non-payment rate than was reported. Do you now understand that these ghetto merchants were actually withholding the true facts in order to hold onto these good captive customers, customers whose credit in fact was as good as any other group of people?

Mr. Kahn, do I see you nodding? Just on cue. Beautiful. I think you ought to listen to guys like Irving Kahn in this respect.

Number seven - Provide sufficient capacity and channel access. Access to me is the most exciting word in our language but there must be sufficient capacity if access is going to be available to many people, because only sufficient channel capacity can destroy the inherently discriminating economics of scarcity.

Number eight - Supply origination facilities and equipment and money for programming. Despite the Midwest Video case, I think that most of you ought to originate. We realize that access will be limited even on free channels, if we cannot afford the equipment or other resources required to develop original programming to meet the needs of our community. Imagine the beautiful advantage you might have in applying for a franchise if you were to propose a 2-1/2 per cent gross dividend for programming in addition to the 2-1/2 per cent or 5 per cent that you plan to give to the city.

Number nine - Support minority-owned cable television systems. Your only strong allies in the Congress and elsewhere are minorities, educators and young people. You need the support of the 25 million black people in this country if you are to succeed in penetrating the cities.

But while you're at it, I want you to stop using the same old cliches. Don't tell us that we don't need to own systems, that we can lease channels to get access. Certainly that's a route to access if the question of liability and responsibility is ever resolved. But the $2 billion in subscriber fees that will be paid by minority subscribers before 1980, if the freeze is lifted, is even more important. We want our own communities to determine how that cash will be used.

The second cliche to forget is that CATV is too technical and complicated. I don't need my engineering background to tell me that CATV is probably the second easiest business to run. Its ease is only exceeded by the outfit that supplies water. All they do is lay a pipe that lasts for 20 or 30 years, pump water through it and send bills to each of us.

Your business is only slightly more complicated but only because you must at different times send bourbon, orange juice and milk down that same pipe.

The third cliche is the best one. Cable system ownership is too expensive for minorities. I might as well let you in on two major secrets.

Number one is that many major cities in this country are going to be divided into separately franchised cable districts. This process will lower the capital costs per system because each system will be smaller than an entire city, small enough so that each local community can potentially own its own cable system.

Secondly, black people constitute a $30 billion market that can afford anything we want when we get it together. Just ask Prudential, Safeway and MacDonald's and Procter and Gamble.

Number ten - Well, actually, I've listed only nine because I want to save one for the next two years. I expect cable to grow if the freeze is lifted at a 30 to 35 per cent rate during those two years and I'm going to be watching your progress and our progress. This just might be the first time that technology actually served the interest of the people or it might turn out to be 1984 all too soon.

The next step is up to you. Good luck.

(Questions were asked but participants did not go to the microphone.)

"EVERYTHING YOU'VE ALWAYS WANTED TO KNOW ABOUT RATE INCREASES, BUT WERE AFRAID TO ASK"

Speakers

Joseph R. Brennan
Associated Utility Services, Inc.
Moorestown, New Jersey

Marc Nathanson
Cypress Communications Corp.
Los Angeles, California

Alan Gerry
Liberty Video Corp.
Liberty, New York

Moderator

Abram E. Patlove
Vice Chairman
NCTA Public Relations Committee

"I AM CURIOUS (CABLECASTING)"

Speakers

The Honorable James Thomas
Mayor
Ottawa, Illinois

Jack Williams
TelePrompTer Corporation
New York, New York

Thomas C. Dowden
Cox Cable Communications
Atlanta, Georgia

Moderator

M. William Adler
Immediate Past NCTA National Chairman
Member, NCTA Public Relations Committee
Weston, West Virginia

"CABLECASTING -- STATE OF THE ART"

Kenneth D. Lawson
Chairman
NCTA Cablecasting Awards Committee

Session Chairman

William J. Bresnan
TelePrompTer Corporation
Los Angeles, California

William J. Bresnan -- Our first panel this morning is a ticklish one. Meeting here in the glass house of our national convention, we find ourselves presenting a panel on rate increases.

I want to strongly emphasize that we are not encouraging rate increases. To the contrary, we urge that rates be kept as low as humanly possible. And, hopefully, with the introduction of new services in the future, perhaps the basic CATV rates could be reduced.

We do recognize that CATV subscriber rates have generally held the line. In fact, I would estimate that over the years most systems are probably charging the same rates today they did five, even ten years ago. The cost of everything else is spiraling, especially gas, electricity, phone service, etc. We also recognize that our costs to operate our businesses are continuing to spiral. In addition to the rising cost of equipment and labor, we are facing the FCC fees, copyright fees, higher pole rental rates, program origination costs, and the continual costs of improving and expanding our services.

So we present this panel in the hope that if you must raise rates, that you will at least have had the benefit of hearing our experts today.

I am particularly pleased to introduce the moderator of the panel on rates because he has served with me on the Public Relations Committee now for the past two years. He is a member of the NCTA Board and is president of Communications Associates. He is expert in both the operational and promotional side of system management and he has been active in the CATV industry for 11 years.

The Moderator of "Everything You've Always Wanted To Know About Rate Increases, But Were Afraid To Ask," Abe Patlove.

Abram E. Patlove -- This panel and the subject of this panel and the title we have given it closely resemble a book published recently by Dr. Reuben on the subject of sex. In that book Dr. Reuben stated he intended to present a reflection of the combined experiences of patients yet preserving their anonymity. Hopefully the messages of our panel this morning will also reflect our patients' experiences without preserving anonymity and reflect experiences which perhaps can be even more emotional, more gratifying and certainly longer lasting than those reflected by Dr. Reuben.

To paraphrase, Dr. Reuben states in his closing paragraphs that he has selected people -- we in turn have selected a panel -- whose experiences hopefully will replace ignorance with knowledge and, most important, replace fear with confidence by telling you honestly, directly everything you wanted to know and do about rate increases, but were afraid to ask.

Our first panelist is perhaps the industry's number one authority on rate regulation, rate determination and rate increases.

Joe Brennan is President of Associated Utility Services, a consulting company in Moorestown, New Jersey.

Joseph R. Brennan -- As the lead-off speaker today I feel both honored and apprehensive. I am honored because of the opportunity to appear before you and with the other members of this panel, and apprehensive because, frankly, it is impossible to do real justice to the subject in the time allotted. The best we can do is touch the highlights. Accordingly, we will dispense with the usual opening humorous comment and plunge ahead with the subject at hand.

I have been involved in rate cases for about fifteen years and one facet stands out as never changing -- no two cases are exactly alike -- even cases involving similar companies. Oh, it is quite true the philosophy and techniques employed are very similar if the case is to be presented as a financial problem requiring a financial solution, whether the company in question is involved in water, sewer, electricity, gas, telephone, urban transit, water transportation, microwave, or cable television. The difference is in the people who must be persuaded. Federal, State, city, county, township, borough, or village regulators differ. They differ in ways too numerous to mention and they respond differently, therefore, to a variety of approaches.

Federal and State regulators, of course, employ procedures which have been developed over the years with respect to financial data required and courts have established broad standards to determine whether or not proposed rates for a particular service should be allowed to become effective.

Local regulators -- the ones most of you have to appear before in connection with seeking rate increases -- generally are not bound by, nor do they employ, the same formal techniques or standards used by their legislature-created regulatory brethren at the State and Federal level. In fact, most local regulators, be they city, county, town, borough, or village elected bodies, have probably not ever before faced a request for authority to increase rates charged their constituents by an investor-owned company. This is both good and possibly bad at the same time. It is good in the sense that they likely have an open mind with regard to standards to be employed, or the form of presentation, to determine if the rate request is justified, rather than blind adherence to techniques that predate today's evolutionary or changing economic environment as is practiced by some formal State and Federal regulatory agencies. It is bad in the sense that you, the regulated, must educate the local regulator to the problems of your industry in a manner he can both appreciate and understand. You must not put on his shoulders the burden of the decision. You must make a compelling case which leaves him with little choice but to grant the request because it is in the public interest. This is not an easy task for it must be kept in mind that the local regulator must answer for his action on election day. You must help him by giving him no objective reason for disagreement with your cause.

The following are some of the methods that have proven successful in securing rate increases:

1) Put into the hands of the regulator general information about the cable television industry. Nothing overly elaborate or overly long -- but a concise background fact sheet.

2) Put into the hands of the regulator the background of your company, including the scope of its endeavors and the experience and background of its principal officers.

3) Identify the involvement of your company in the local economy, including the number of its employees, the amount of money spent locally by your company in addition to the wages paid, and the amount of taxes paid locally. Your taxes may have paid for a new school or a library and the end result of creating a new local employer may well have also created or stimulated many times over the direct measurable benefits to other local business, such as gas stations (your company trucks and your employees' cars all use gas, don't they!), motels, food stores, etc.

4) Put into the hands of your local regulators comparisons of the value of service today and at the time present rates were established. Stress how the availability of cable television helps attract other job-creating and tax-paying business to your area because areas without cable television cannot offer the same spectrum of entertainment and information. Your community has the added dimension. You are a positive force in the community. Today you may provide a twelve-channel service rather than four channels five, ten or fifteen years ago. You may also originate now and did not in the past. You may also have rebuilt the system and the quality and reliability of today's service may be vastly superior to that of another era based upon the technology of days past.

These four items, to the extent possible, should be presented to your local regulators personally in booklet form by the top local man in your organization with the request for meetings with those empowered to adjust rates, at which time you will make a formal presentation including financial data. I am aware that there is a reluctance on the part of some people to reveal financial information but the cold hard fact is, without the candor of a financial presentation, often the local regulator becomes needlessly suspicious of the real need for rate adjustment. I do not mean to imply that detailed historical financial statements need be merely handed over, since historical results are, in fact, irrelevant. I do mean, however, that pro forma statements based upon actual recent results should be prepared and provided.

Incidentally, I hope you have noticed we do not refer to a rate increase when speaking of a rate case -- we refer to a rate adjustment.

The first part of the formal presentation should recite the need for rate relief. Attention should be focused upon the fact that most goods and services have increased in price for many of the same reasons you need to adjust your price. You do not live in a vacuum but are subject to the same pressures experienced by others, namely, increasing expenses and investment without a corresponding increase in income.

Unfortunately, the mere recitation of these words usually falls on deaf ears, simply because your audience has heard it all before and possibly all too often. They cannot readily appreciate your problem unless you can strike a responsive chord such as identifying your problem with something which rings a recognizable bell.

I have often found it useful to ascertain the work background of those who sit in judgment of your request and to compare the price behavior of their work-related product or service. For instance, a tabulation of the price behavior of audience identifiable items since the point in time cable television prices were last established often is meaningful. If one of the regulators has a legal background, cite the per cent change in price for legal work per hour as prescribed by the local bar association. The per cent change in price of the local newspaper, local hospital room rates, local property, wage, income or sales tax, local utility services, local school taxes, local college tuition rates, local wage rates, a local loaf of bread or a quart of milk. The source of statistics is all local and usually readily available and obviously recognizable. You would be surprised at the magnitude of the percent increase in such items as compared with cable television over any reasonable period of time.

The point of it all is that cable television is no different and not immune to the rigors of inflation and usually cable television managements have held the price line longer and better than most, not even considering the fact that in many instances the value of your services today is better than in the past because you offer more or a better quality. A loaf of bread, a quart of milk, electricity, water, etc., are all just about the same today as in the past; only the price has increased, it is higher and sometimes not by a little bit. With regard to cable television, the quality and the quantity of your service usually has increased, but not the price.

The second part of the formal presentation to the local regulator should stress several points in addition to those discussed before, and should be pre-filed prior to the formal meeting. One of the most important points to make is the fact that a <u>regulated</u> or <u>administrative price</u>, whether by local, State, or Federal regulators, <u>is</u> no more than <u>a substitute for a market-determined price</u> -- that is, a price that would be determined in the marketplace were it not for the fact of regulated or administered pricing. Accordingly, the very best place to seek a solution to the problem as to what is a fair price is the marketplace for capital with respect to that portion of the price which represents profit, for profit is in reality an expense -- the expense or payment for the use of capital, just as wages are an expense, the payment for the use of labor.

In its simplest form, the price of most goods or services can be broken down into two broad categories. One element is that portion of the price which represents recovery of all of the expense of doing business, including wages, maintenance, depreciation and amortization, and all taxes including taxes on income. The other element is payment for the use of capital, such as interest with regard to debt and earnings with respect to stock.

It should be relatively easy to demonstrate the aggregate amount of expenses that need to be recovered in the price, including, I might add, prospective increases in expenses such as a forthcoming increase in wages, taxes, postal rates, etc.

Rate making is prospective since the proposed rates are requested to be collected in the future and the goal of all concerned is to determine the adequacy of future revenues predicated upon proposed rates with respect to future expenses and adequate payment for the use of investor-provided capital employed in rendering cable television service.

In regard to the adequacy of that portion of revenue remaining after recovery of all expenses, it may surprise many of you to learn that more often than not standards employed by formal regulatory agencies, such as State and Federal utility commissions, when applied to the cable television situation, indicate that your rates produce an inadequate level of profit or payment for the use of investor-provided capital. In fact, if standards for determining profit employed by State and Federal regulatory agencies were properly applied to cable television companies, more often than not the indicated price you would have to charge your customers would be a price higher than you usually seek to make effective, simply because such a price would likely be rejected in the marketplace.

I believe it is very persuasive to be able to state to a local regulator that the price adjustment you seek will produce a level of profit which is less than the level of profit allowed or actually realized, relatively speaking, by the local Federal or State regulated gas, electric, telephone, or water utility. Obviously, your level of profit, or rate of profit, should be higher because you do not sell a utility product or service but a product or service which better compares with broadcasters and other purveyors of entertainment with respect to risk, and rate of profit and risk are inter-related. I assure you cable television companies would be delighted to earn a rate of profit equal to financially-healthy broadcasters. I believe, however, that it is more persuasive to use as a standard with respect to the rate of profitability the obviously lower risk local utility purveyor. As I said before, most of you would be surprised to learn that, if your price was based on producing a rate of earnings equal to most public utilities, in most instances the price of cable television would be more than you would want to charge because it would be a price rejected by the marketplace. In other words, the marketplace is usually more of a limitation on price than most regulatory applied pricing techniques. The local utility is identifiable and obviously has a low rate of profit in the minds of most people, and this, I believe, is very persuasive evidence to even the most skeptical.

If the local utility, whose rates are strictly regulated by a State or Federal agency, earns a rate of earnings greater than the rate of earnings your proposed cable television rates appear to produce, who can objectively argue your proposed cable television rates would produce excessive earnings. If you can arm the local regulator with the fact that the cable television rates he allowed to become effective produced a rate of earnings <u>less</u> than the earnings rate allowed the State or Federally regulated utility, he can better afford to be objective.

To appreciate this, of course, requires a knowledge of the manner in which regulatory agencies determine allowable profit, and merely stating the fact or a particular interpretation of facts is the easy part. The real test comes when questions are asked -- and such questions are always asked. In other words, view the rate case as a battle. To do battle you must be armed. Not armed with some of the facts -- but all of the facts. You must, of course, be better armed and more knowledgeable about the subject than your opposite number. He will expect, in fact, no less. And he will not be persuaded unless you can make an intelligent, well-thought-out presentation and unless your armor -- facts -- can withstand his probing.

The cold, hard fact is that no general who successfully survived battle would ever think of engaging in battle unless he was confident he had the best possible chance of victory. Why should you consider doing anything less?

In conclusion, let me end my part of this morning's discussion by reminding you that unless the price you charge produces sufficient revenue to recover your costs, provide sufficient dollars to replace the facilities used in rendering your service, and produce a profit level sufficient to attract new capital on a reasonable basis as needed and to pay for the use of existing capital employed, you will not have to worry about persuading anybody of anything. You will be out of business and the regulator, whether local, State, or Federal, should keep this point in mind -- because the verdict of the marketplace is very objective -- if the price of the product isn't up to the task of providing adequate profits commensurate with the risk, capital will go elsewhere and cable television, and all the jobs, taxes, and economic stimulation attached thereto which obviously benefit a community will likewise go elsewhere or ultimately cease to exist. Business history is littered with the remains of endeavors which once thrived but perished for the lack of proper pricing and thus failed to meet the verdict of the marketplace with respect to proper profit levels required to obtain the capital needed to finance the enterprise.

Abram E. Patlove -- Our next speaker is Marc Nathanson, Director of Corporate Development for Cypress Communications in Los Angeles.

Marc is going to give us the benefit of his experience and an overview on several rate increase campaigns in which he was personally involved, both successfully and those that did fail.

Marc Nathanson -- Thank you, Abe. About a year and a half ago the management of Cypress Communications Corporation took a look at our 43 systems and decided we really didn't know anything about rates. We were not really evaluating the situations: in certain systems we had very high rates and in others we had very low rates. There was no uniformity; there was no company policy.

So we attempted to study the situation, and we found one very important thing. After we did projections we compared areas, even though each had different political ramifications, etc.

We sent out questionnaires to our system managers, and universally all of them wrote back, "We'd better not do a rate increase right now, there is some reason we can't have a rate increase."

Just as with sex, I think the biggest problem in rate increases is fear. Fear of bad publicity, fear of losing subscribers, and, of course, the fear of being turned down by municipal authorities.

We proceeded, working with the managers very carefully, the home office, hiring outside consultants in some cases, working with local attorneys in other cases, to obtain rates in targeted areas. We targeted about 20 systems where we felt we were definitely justified in rate increases. In most of them we hadn't had rate increases for four or five years, and in some of them had never had rate increases.

We decided that we were justified in seeking rate increases and we proceeded to obtain them.

In about a year of these 20 targeted areas, we have obtained rate increases in 11 of them; five are waiting; in three the pressure was mounting and we had put them off a little bit; and in one we were very promptly turned down.

I would like to just discuss these with an overview to you and tell you some of the problems that we ran into.

The most important thing, whether it is to an MSO or to a private system operator, is the rate increases we got in four Cypress systems alone -- in Fort Walton Beach; Kingsport, Tennessee; Palm Springs, California; and in Flagstaff, California -- amounted to almost $400,000 in additional gross revenue to the company. In the other systems, which were mostly smaller, there was another $120,000 in gross revenues.

In Bakersfield, California, in which Joe Brennan was our consultant, in our managed Kern County system, we also obtained an increase that made the system suddenly profitable.

We also didn't have an installation fee there and were having problems with disconnects. We got an installation fee and our disconnect problem and non-pays have almost gone away in that market.

Probably the question you have is generally, "Will we lose subscribers when we raise rates?"

I think this is a tremendous fear. We are all very complacent in what we are doing and we really don't want to rock the boat. Yet other businesses, businesses that are much more sophisticated than our own, have periodic evaluations of their systems and of their revenue. Many times, if you look at the telephone companies, when certain price levels go high enough, they feel they also are justified in raising their rates.

Cable systems are also. They shouldn't be encouraged to do this. You shouldn't raise or seek rates on a whim, because you aren't going to get them. But I think many of the cable systems around the country are more than justified today.

As to the question, "Will I lost subscribers?" in our experience we really did not lose many subscribers. The most we ever lost in a system was about 6 per cent, which is quite high, and you have to evaluate this against your rate increase.

But of that 6 per cent, all except 2 per cent, or in other words 4 per cent of those people, eventually came back on the service. They were mad, and they dropped off the service. But they came back. They missed their cable service. We have a valuable service in this particular community, and they came back.

I think if we had done our homework a little better, we wouldn't have lost that many. We suffered a lot of bad publicity and the newspaper had a vendetta against us, and that hurt us. But we came back.

In Malibu, California, we raised our rates a dollar after long evaluation. We had rebuilt the system, there was ample justification for it. We didn't have one subscriber out of 2,500 complain.

We were doing a good job. We had purchased the system. We had rebuilt the system. Our service had improved tremendously. We raised our rates, we were justified in it, and our subscribers accepted it.

The most important thing about rate increases is not rushing into it. Look at it. Evaluate it. In other words, do your homework. Decide what you need as a local manager or as a corporation -- whether you need outside consultants, which many times you do, such as Joe Brennan. In other cases local attorneys can be very helpful if your managers are not used to speaking or making a persuasive argument before a city council.

If we were giving a good picture and were performing a valuable service to the community and were constantly on our guard as far as service calls and keeping them down, we found, of course, we had less problems.

So the first question you have to ask yourself before you think of obtaining a rate increase is, "Are you really giving adequate service?" If you aren't, what are the problems?

In one case, Kingsport, Tennessee, where we have had some service problems in a system that was built in 1951, we are rebuilding. We went before the city council and everyone on the council complained about the service. They commended our manager on the change in the service, where we have beefed up the staff, we have gotten more knowledgeable people on our technical staff in that system.

But this was a forum for complaints on the cable system. And the funny thing is, we welcome this, because we heard the complaints. Many of them we already knew about. And we told them what we were doing and what we were going to do to alleviate them.

This satisfied the council. We told them the dollars we were going to put in. We told them about our construction schedule. We are living up to that construction schedule. And they gave us a rate increase of $1 in that system.

Another question you might want to know is, what do we do as far as formal documents to prepare for a rate increase?

We do two things. We prepare a detailed document of varying lengths, emphasizing different points to the city council. This will include various costs, changes that have occurred, improvements we have made in the service, additional channels we have added, and in some cases financial information.

In Bakersfield, California, it was almost entirely based upon a financial evaluation of the system, which Joe Brennan prepared for us. In other systems we have just emphasized service.

We have also compared our rates to rates of municipal employees in the city and military rates if we are involved in an Air Force situation to show the cable system which hadn't raised its rates since 1960 -- compared to the Armed Forces, compared to municipal employees, compared to all other services which had increased drastically -- had held down our rates. Our rate increases in these cases would be far below any of the rate increases over the years that the telephone companies have had.

Again, fear is a problem. We overcame fear because we felt we were justified in this case.

I think everybody wants to know about the times we were turned down?

I think the three that we didn't go into were really like being turned down, because we decided to test our situation by getting some opinions from the city attorney and we got our ear full.

As management of a corporation we found out many things we didn't know were going on in the system. We have taken steps to remedy these situations, hoping that in the future we will go for a rate increase.

There is a classic case, at least in our history, because after a number of successes, we at Cypress were beginning to think we were quite good at rate increases. Then we went into Greenville, Tennessee, a town near Kingsport, a system with a few thousand subscribers.

We had done our homework, we prepared our reason why we should have a rate increase. This was a system we had purchased from United Utilities. We did hear the story that a United Utilities manager had two years ago gone in for a rate increase and he was physically thrown out of the city council chambers. But that didn't stop us or our new manager; we decided we would proceed.

The mayor happened to be in the hospital, and we talked to the deputy mayor and outlined our reason: we had never had a rate increase in the city; we had rebuilt the system once and made gradual changes in it; and had beefed up our service staff.

It sounded all right to me. It doesn't sound like any problem to me, but we asked the local manager if a local lawyer was needed. Did he need any consultants; did he want us to fly out from the West Coast or anything? "No," he said, "You foreigners stay away, I can handle it, no problem, I know these people, lived here all my life."

He went into the city council. The mayor was back in town -- got out of the hospital. Our manager presented his case to the city council, but about in the middle of his case, the mayor interrupted him and said: "You don't deserve a rate increase. You guys are making too much money, you always have, you always will, and I don't even think you had a right to transfer your license to these Cypress guys."

So immediately we got into a large hassle. I must explain, in Greenville, according to our interpretation of the franchise, we didn't need the permission of the city council to raise our rates. But home office in its tremendous wisdom said it's much better to go through the council and use the appropriate steps and show the courtesy.

Well, we got into a little problem there. We saw the council wouldn't budge, wouldn't even listen to any reason whatsoever. We decided we would proceed to raise our rates and notify subscribers we were raising our rates.

The city promptly threw a suit against us saying not only did we not have a right to raise our rates, that we needed their permission, but also we didn't have a valid franchise in that city because the franchise wasn't transferred properly.

It shook up a lot of people. We got a lot of bad publicity, and we got some subscribers who dropped off. Right now we are still in a very long process of talking and negotiating with the city, and I don't know what will be resolved.

We put the increased money that has been paid to us by 98 per cent of the subscribers in escrow 'till we resolve our situation. But I am sure we will go all the way up to the higher courts, and it's a problem. We have lawyers involved in it and tremendous legal fees.

That made us a little more cautious, but it certainly did not stop us.

We proceeded in several other communities to get rate increases and were successful.

The last question that you probably would like to know is, how do you notify your subscribers once you get a rate increase?

We have studied this, and I think this is one of the reasons we have such a low dropoff when we do raise rates.

There are two schools of thought basically. One is a very short approach (I call it the totalitarian approach) used by most of the telephone companies, which announces, "We have raised your rates," period. The approach we prefer to use, is a two-page letter from the manager, much briefer than a presentation to the city council, which describes the reasons we have gotten a rate -- such as we spent $200,000 in improving the system, we have added X, Y, Z channels and so forth.

Abram E. Patlove -- Our next speaker is Mr. Alan Gerry of Liberty Video in Liberty, New York. Alan owns four cable systems in that area.

Alan is going to discuss with us a case history of successful rate increases with a particular emphasis on the public relations aspect of the cases in which he was involved. Alan.

<u>Alan Gerry</u> -- If anyone were to ask me what the secret of success was in appearing before five different municipal bodies requesting rate increases that ranged from 50 cents to $1.50 and getting every one of them, I would have to say that it was simply a question of doing my homework. As Marc indicated, knowing community problems relating to our cable companies; knowing the feelings of the city or village councilmen; and, of course, more important than anything else, appearing before the council with the assurance that you have run a clean house, satisfied your subscribers over the years and instilled in your system employees the sensitivity they must have towards subscribers' problems.

I would like to relate to you an experience I had with an initially hostile village board in a small but growing system in upstate New York.

The system was started in 1967 with a rate of $4.50. We were going for $5, an increase of 50 cents.

Before going to the village board with our request, I visited with the mayor, who was also in business -- it's a part-time mayor situation, a small community. He was in the automobile repair business and he was well aware of the price increases and his own cost of materials, cost of labor and generally running his business. I explained to him our need. He was sympathetic and indicated to me that he would talk to the other members of the board so when we requested this rate, they would be somewhat familiar with our needs. And he assured me that we would get this without any problem.

Well, let me tell you what happened. It didn't work that way.

I appeared at the next board meeting. I was armed with financial statements of the last two years' operations. I discussed the matter very fully with the board and was told to come back at the next meeting. They were very, very noncommittal.

I spoke to the mayor the following day and asked him what happened. He was at a loss. He said he had talked to these people, he didn't know why they didn't go along with it, why they wouldn't bring the matter to a vote.

The next month I appeared again. The mayor was sick that time and I was told by his assistant to come back again the next time.

Well, there I went back again, and we finally had the matter brought to the point where the board agreed to hold a public hearing. In New York State you have to have a public hearing before you are granted a rate increase in a case of a cable franchise.

The date of the public hearing came. We had quite a turnout from the village residents, cable subscribers. There were no serious objections to the cable increase asked.

The board did not vote. They told us at that point that they were going to think things over, even though we had a responsive indication from the people who attended the meeting. We were told we would be notified as to the board's feeling.

The following week, unbeknownst to myself, the village board had a meeting where they were going to vote on paving a parking lot. It was a closed meeting. There was nothing said to the public about it.

At that point, after they voted on the paving of the parking lot, one of the members brought up the case of the cable increase. He asked for a vote that the cable increase be denied, and several of his colleagues voted with him, and the rate increase request was turned down.

I knew nothing of this. I read about it in the paper two days later. This was held at a closed meeting.

Well, I realized at that point something was very, very wrong if the mayor didn't understand what was going on in his own village board. I decided it was time to visit these people, the board members, on an individual basis.

I made appointments with them. I saw them at their homes, I saw them at their places of business. I talked to them on a man-to-man basis. You would be amazed at the difference of attitude when you sit down with a person on an individual basis rather than meeting with him as part of a group. He thinks for himself in this instance. He is very, very responsive. He is not trying to vote in the way that one of the other people that he may try to please on the board is voting.

Fortunately, I was able to prove to these people our real need for this raise. We had to have it. At that point we only had a little over 1,000 subscribers.

I asked for it and got the promise of support from all three of these members who brought this negative vote to be several weeks before.

To make a long story short, the next meeting they had I reappeared. I asked once more for a vote. This time I got it, and we had the rate increase passed.

Now, what is the story here? What is to be learned in this instance? A very obvious lesson.

I mentioned earlier the fact of doing your homework. In this case, gentlemen, I did not do my homework. This was a system that was operated in a remote community from our main system. The only person I knew there when I walked into that board meeting initially was the mayor. I had to go on what he said. I didn't know the councilmen, I didn't know their feelings. I didn't know there was a wide variance of opinion on many items outside of cable between the mayor and the councilmen.

In the future we feel that in any case of a remote system, no matter how remote it is from where we are operating, where our main base is, we have to maintain a very open line with the local government. If a new mayor is elected, you have to get to know him. When new councilmen are elected, invite them over to see your cable plant, show them what you are doing. Get to know them on a first-name basis.

I had not done this in this instance. When I walked into the board meeting, I walked in as a stranger. There is no substitute for knowing your local government. If you don't know them now, get to know them. If you don't need them now, you may need them next week or next year. Don't be a stranger in the community you serve.

Thank you very much.

William J. Bresnan -- While the panel on PR aspects of local origination is assembling, I would like to take just a minute to discuss with you some of the thoughts of the PR Committee in regard to next year's National Cable Television Week.

Program originations are the best public relations activity that our industry has. Obviously that is one of the reasons for this next panel. Program originations have excited many, many people about our industry, people in groups that we cannot afford to let down.

They are excited because, as some have said, cable TV has the capacity to enhance the quality of life. It is this concept of improving the lifestyle of our subscribers through the wise use of our medium that we would like to use as our theme for next year's Cable Week. We need to tell our local origination story more forcefully, both to the public and also to ourselves.

Many of you are familiar with the fact that NCTA has had contact with many associations and organizations to interest them in cable. We think there is a great community of interest here. We can use their product to assist in developing programming for minority interests and they, simply, can use the exposure.

We are interested in having a wide variety of groups and organizations using cable -- The American Cancer Society, the TV Society, United States Department of Labor and other governmental agencies, the National Foundation and March of Dimes, the Association of Retired People, conservation and ecological and minority groups.

We think it would be an impressive exhibition of our industry's goodwill and its capabilities for us to join together in a week-long effort with many of these organizations to improve the quality of life in our communities. And I am not just speaking about systems that do program originations. Many systems feel they cannot originate programs -- I said "feel they cannot" afford to originate programs. But, regardless of how you feel about this, we can all afford to do something, even if it is only on our automated channels.

For example, the moderator of our next panel operates a small system in western West Virginia. Bill Adler's system is a prime example of what a non-originating cable system can do. Bill runs a highly popular news service on his time-weather channel. He not only gives all of the local news, updated twice daily, but also gives exposure to local events and people. Hopefully Bill will be able to squeeze a minute or two in to tell you about this.

But, to make the point again, all systems of all sizes could combine in a significant demonstration of our industry's intentions to improve the quality of life.

I urge you to plan now or begin to plan now at least to participate in the 1972 Cable Week.

The moderator of "I Am Curious (Cablecasting)" is a member of the NCTA Board and of this year's Public Relations Committee. This afternoon when the election of officers and directors takes place, he will step down from the NCTA Board service for the first time in eight or ten years.

M. William Adler -- Welcome to "I Am Curious (Cablecasting)," subtitled Morrell's Complaint. We have three superbly qualified panelists to discuss the public relations aspects of cablecasting.

It is probable that at the present time in most cities and towns cablecasting's most certain benefit is in public relations, in its very nearly unique ability to provide thousands of hours annually of intracommunity communications.

Our first panelist this morning is one of the beneficiaries of cablecasting and he serves perfectly as a representative of all those various elements within a community who make use of our facilities to inform and be informed.

He is The Honorable James M. Thomas, Mayor of the City of Ottawa, Illinois. Mayor Thomas has just started his second successive four-year term as Mayor of Ottawa. He had previously served a four-year term as Commissioner of Public Health and Safety.

The Honorable James Thomas -- The City of Ottawa, Illinois, for the last ten years has enjoyed the services of cable TV, and under the capable leadership of our former manager for the past five years a programming system has worked very successfully between cable TV and the City of Ottawa, and the city government in particular.

I was asked what I would like to see as Mayor of the town. Ottawa is about 20,000 in population. It is located a little over 100 miles southwest of Chicago, which puts it just outside of the range of receiving the signals we would like to receive, and so TV cable has been an asset to our community.

In answer to the question that was posed to me, I would like to see a continuation of the programming that was established by the former manager. And I would like to cite a few examples as to how we used the TV cable, the city government and the community together, as a service.

For example, the State of Illinois had a water pollution bond issue which was just presented to the voters in this last election, and through the courtesy of TV cable, we were allowed over eight hours of air time on three different occasions. During this time local State senators and representatives were brought into the community to explain the position and we allowed individuals to come from the audience and also ask questions and express their views.

I might add the bond issue was a success and we are very grateful to the cable system.

Ottawa was like all other communities in the nation and our sewage system was also under the orders of the Environmental Control Board. A secondary treatment plant was necessary. I was offered the services of cable, and in this manner I was able to sell a $1,250,000 bond issue. And nowadays selling a bond issue to a group of taxpayers is rough. But we managed to succeed, and the project has been completed and we will be dedicating this the latter part of this month.

I also had a very effective program arranged with TV cable that was called the "Mayor's Hot Line." At the time this program started, there was a lot of criticism in regard to the idea of this program. A lot of the local politicians thought I was a complete fool for even trying such a program.

We arranged this program so I have a direct connection from city hall to the TV cable. We have the cameras and equipment of the TV cable and the microphones set up, with desks, and I would also have direct lines through the telephone company's exchange, with a time lag. Each week, at a prescribed time, we would conduct a program that was similar to what we have here today, where I would answer any and all questions that were available. If I could not answer a caller directly at that moment, I could phone and get help I wanted.

This program for a small community proved to be one of the most successful. As proof, I was just re-elected as Mayor. This is my third consecutive term on the City Council. Each term is four years. And my plurality was higher this time than it has been the last two times. So apparently this did not hurt anyone, myself or the TV cable. But the public relations that we cemented between the two was very, very well received and most appreciated.

We also had a program in which all local candidates were offered time prior to election. It was operated in somewhat the same manner, where a person could sit in his armchair and phone in questions and the candidates would answer.

It is hard to get a meeting hall large enough in a community of our size to be able to accommodate the crowds you would like to have. So we used this method of cable TV. It served the purpose and we achieved tremendous success with it.

We also had election night returns of local and county government. We realized the networks' returns on the national and State level is excellent. So we never even bothered to discuss it. But on the local level this is the one that the local people themselves are interested in. It may be a bond issue, it may be a personal friend or a relative, or just the fellow down the street. But you are interested in this particular election, and this type of service was most highly received.

I am sorry to say that during the last election this service was not available to us, and I cannot even comment on how many inquiries we received as to why this program was eliminated. But this is one of the things that happened.

Our local manager, as a community service, spearheaded a drive through the cable system, and he raised over a million dollars in subscriptions to build a new hospital. The hospital presently is under construction at this time.

He also conducted a 69-hour telecast at which he promoted the United Fund to a figure that has never been equalled before or since.

What I am pointing out, gentlemen, is the need for local programming and local TV cable and a special channel to be set aside where the people will have access to information on their home town, its people and its activities.

We receive all the national and State coverage that we need, but local coverage is something that is lacking. The type of approach I feel TV cable should use would be to offer a service of at least one channel to a local community and in this way perform a service that would be most beneficial, not only to the local government and to the TV cable itself, but the entire community. Everyone would receive a tremendous amount of benefit, and in this manner I think we would manage to operate a little better than we have.

I said I was on the Council starting my third consecutive term. I went onto a Council that was in the red; today we are well in the black. We have a very healthy bank account, everything is paid. And as far as I am concerned, it is strictly due to public relations and being able to contact the people, and I think TV cable could offer this service to communities.

M. William Adler -- Our next panelist, in fact the next two panelists, are both representatives of major CATV companies, the two largest multiple system operating companies in the country, in fact. Both have had extensive experience in cablecasting, one of those companies, the Cox Company, which of course has had great experience in broadcasting as well as in cablecasting.

The next speaker is Jack Williams. He is the National Programming Director for TelePrompTer Corporation, the largest multiple system operating CATV company in the United States. Jack is directly responsible for the programming and personnel in some 68 TelePrompTer systems now engaged in program origination.

Jack Williams -- I think I should preface my remarks with the fact that this is on public relations and there are some things we will do in our cablecasting operations that just can't be measured in dollars and cents. With that, I would like to go to the title of my topic, "Responding to Community Needs -- and the P&L Statement." I hope that you don't jump to the conclusion that I am going to tell you how to make money with public service programming. By jumping to that conclusion, we might be in the same boat as the rooster that came into the henhouse and found a brightly colored Easter egg there and immediately jumped the fence and attacked the peacock.

Most of us begin local programming with a specific purpose in mind. That purpose may be as an advertising medium to make additional money, it may be to secure additional subscribers, to fill specific needs in a community, to retain the customers we now have, or in most cases a combination of all of these. The point remains, there is a definite place in nearly every community for locally originated programs. Cable television can fill gaps that commercial television cannot.

We have been called a minority medium. Our philosophy has been narrowcasting rather than broadcasting. All of this makes sense because we can serve a specific area and cater specifically to individual needs rather than concentrate on the mass audience that must be commanded by the broadcast stations.

Let's look at a couple of aspects in our local program originations. First of all, the service we give to the community. As a result of our efforts, we can become a communications medium for each of the communities we serve. By serving specific needs, we become a very important factor in the day-to-day activities of a community. We can be a tool for community betterment by utilizing our facilities in the public interest. This is public relations in the most positive sense.

Now let's look at what we receive by public service programming. Naturally, if we do our job and become a needed service in the community, it is going to increase our subscriber count. The reason most people connect to the cable is to improve and enhance their television viewing. If we offer particular programs that are pertinent to their community and their everyday lives, then we naturally are going to attract more subscribers because we have something to offer that cannot be received anywhere else. In addition to securing new subscribers, we satisfy our older subscribers with these same programs.

Every cable system, without exception, has customers who must make comments, usually derogatory, at the first of each month when it is time to pay the bill. A good example of what programming can do is related by a system in Montana where, after one month of programming, a continual complainer came in and, rather than complain about poor service and the price being too high, complained that the locally produced garden show was not in color and therefore could not be fully appreciated. True, she still complained, but then, even cable programming cannot produce miracles the first month!

Much publicity and free advertising can be obtained through our participation in various events in a community. For example, the annual Chamber of Commerce banquet, which would be attended by practically every businessman in the community, is a great place to display your cameras and videotape machines. By recording the program and playing it back, you not only give each one of those attending the opportunity to look for themselves in the replay, but you give each of them the opportunity to see your equipment in use and make them more aware of your purpose in the community.

Where do we find the programs? How do we know what the people want? How can we best serve our community? These are questions that only you can answer. You, as the cable manager, and in many cases the program director, must decide what your community wants and needs through your day-to-day involvement in community affairs. There are many obvious places that we can look for program material such as the City Hall, Board of Education, Chamber of Commerce, civic clubs, schools, charitable organizations and religious groups. But we must not stop with the obvious, we must seek out and present programs for everyone in the community. I cannot emphasize too strongly that, unless all of the relevant community groups are represented, we are defeating our purpose. One of the best ways to get to know people who speak for the community is to schedule informal meetings at least once a week with not only the obvious leaders and prominent citizens but those less well known in your area. Through them you will learn of others. Meet with teachers, civic leaders, civil rights leaders, students, leaders of every ethnic group, children, politicians, doctors, labor leaders, and anyone who might be overlooked in your first glance.

Although the community will seem to divide into obvious segments and even though one segment might seem to be clearly the majority view, be certain to air the minority view as well. How many times have you seen a bond issue get voted down when there was apparently no organized opposition. Being businessmen in a community, we sometimes gear our thoughts to those of other businessmen and forget what some of our customers have on their minds.

How do we handle all the groups who want time and have something to offer our community? In many cases, we begin by offering free time to anyone who has anything to say. This works great for a while, but then it seems that the "New" wears off and programming becomes work, as well as costly and time consuming.

I would suggest that the key to sensible programming is to set a schedule, plan your time, and don't overdo a good thing. By fitting specific groups into a specific program, you can cover the things that need to be covered in a community on a regular basis at a scheduled time when people know to be watching. Your cost can be cut to a minimum by proper scheduling.

It is also important that you use the people of the community in these programs rather than try to do everything yourself. They are the people who should be most interested in the program you are doin Therefore, it would be vitally important for them to take an active role in planning and producing that program. This has many advantages. Not only can you save money by using these individuals, but it will give more meaning to what you are trying to do.

For example, a telethon can be a success only if you have the 100 per cent cooperation from all those involved. I would submit to you that if you try to do all of the work yourself your telethon will not be a success. On the other hand, if you involve many different groups from the community, such as the Lions Club, to help set up the auditorium and perhaps make sets and get ready for the show, the Kiwanas Club to run a concession stand with proceeds to go to a charitable event, the Boy Scouts to act as ushers and get people in and out of the auditorium properly, the Jaycees to serve as a collection agency and actually go from home to home collecting the money, a ladies club to handle the pre-telethon publicity and mail and help in scheduling the events, and many others in the community who wish to take part. If this is done, the telethon becomes not just a cable sponsored event but an entire community effort toward a cause that is important enough to these people to spend not only their money but their time. I can guarantee you a successful event.

This would work in many other areas. A good example is pre-election coverage. The League of Women Voters or other such groups are always trying to work and encourage active participation during political campaigns. In many cases they have prepared a list of question for all candidates for public office. Ask these questions to the candidates and record their answers for cable playback. By doing this, these people not only feel a sense of accomplishment in their community but they also have given you valuable program material.

Right here, before I close is a good time for a word of caution. Your programming is never going to please everyone. And the more you try to give expression to the diverse voices and the controversial issues in your community, the more some people are going to get riled up. About the only thing that you can do is to be forthright, explain your obligation to look at all sides of an issue on your cable channel and, above all, don't lose your cool.

Here's where the old adage about "an ounce of prevention being worth a pound of cure" comes in. Hopefully, if you've done as I suggested earlier -- had meetings and gotten to know all of the people who represent various viewpoints in the community, you'll have earned respect and established lines of communication that will permit calm and rational discussion.

This won't always work. But one thing we must recognize. If we are serious about developing a new medium of communications, then we have to expect to be in the forefront of occasional controversies. You'll recall that former President Truman had some good advice when he said, "If you can't stand the heat, get out of the kitchen."

The key to good public relations in your community is to know what your community needs are through your personal involvement by working with other community leaders to fulfill those needs. Be honest with yourself, your employees, and your community. If you try to be something that you are not, if you make a promise and fail to deliver on that promise, if you do not approach this in a good businesslike manner, then you are worse off than if you had not tried to do it in the first place. Know your community, serve your community, and your community will serve you.

M. William Adler -- Our final panelist this morning is Thomas C. Dowden, Vice President and Director of Development for Cox Cable Communications in Atlanta, Georgia. Cox Cable is the second largest operator of CATV systems, with 32 such systems in 15 states serving 230,000 subscribers.

Thomas C. Dowden -- I must admit I don't feel too comfortable about my topic, "Cablecasting: A New Breed of Cat." In fact, the points I would like to make here today probably will be interpreted as meaning that cablecasting is indeed subject to the same guidlines, subject to the same set of economic factors, subject to the same methods as commercial television broadcasting.

I think back to early last year when we first began to focus on local origination in our company -- the meetings we had, the plans we made, some of the assumptions we made. I will have to admit that I'm not so sure, if I had had this past year-and-a-half's experience, that I wouldn't have come to the conclusion then that local origination is indeed the same breed of cat -- only with some very big barriers to overcome, primarily its lack of size and lack of numbers.

Now, please remember that what I am talking about here this morning is local origination of programming; programs, either bought or produced by the system. I am not speaking of "programming" a cable system. In our company that is something different. In that sense we are talking about the uses of the cable, the access channels, the leased channels, the merchandising channels, and on and on. To us that is programming a cable system. We are talking about here, of course, this morning local origination of programming.

By way of background let me say that in the past year Cox Cable has been heavily involved in several different approaches to local origination. A great deal of time, money and creative effort have gone into our local origination planning, and we think we have brought some expertise and knowledge to our efforts.

As some of you may have seen in a recent issue of TV Communications, we described the four basic approaches we took in our company to try to learn more about this new animal, local origination.

Just briefly, what we did was start with our systems in Lewistown, Pennsylvania; Warner Robins, Georgia; Lockhaven, Pennsylvania, and San Diego. And we looked at the four systems as being representative of all of our company systems.

The approaches we used covered the lot. We went from the far end of the spectrum, San Diego, where we did, we think, a good job of putting in a good package of equipment, trained production personnel, technical personnel. We put about $30,000 or more into remodeling the studios, and about $60,000 into equipment.

On the other end of the spectrum was Lewistown, Pennsylvania, where we put in a minimum package of equipment. Here we decided to do a minimum schedule of programming, using essentially system people, to see what we could learn under those circumstances.

In Warner Robins, Georgia, another system of about 7,000 subscribers, we tried yet another approach. We made arrangements with Young & Rubicam in New York, the world's second largest advertising agency, where they would create and produce the programming, and we would be responsible for the sales effort and furnish the facility. That test ended after six months.

In Lockhaven yet a fourth approach was used. Here we let an outside production company come in and lease the channel from us. That has since gone by the board.

From these widely varying approaches to local origination we hoped to find the key to successful programming on an ongoing, sustaining basis, successful programming. I mean by that economically successful and also successful in the sense that what we did made a contribution to and was accepted by the communities in which we operate.

Our conclusion at this point from analyzing our experiences of the past year and a half is that we cannot justify an origination effort that turns out beautifully produced local programs that lose money month after month, year after year.

We have concluded an effort of this type does no one any good, not the cable operator nor the community he serves. If local programming is not a viable competitive factor, the community receives nothing, the same as it is in the broadcast industry.

If a station is operating in the red, the programming it produces and puts on the air is going to reflect that fact. On the other hand, a strictly commercial operation that relegates community interest to the lowest priority while cranking out 20-year-old syndicated films isn't our bag either. We don't feel "My Little Margie" or "Cisco Kid" are going to be the saviors of local origination. It doesn't take the local advertiser very long to figure this out either.

Once the novelty of sponsoring a few segments of "Charlie Chan Meets the Three Stooges", wears off and he finds that exactly 2.6 people saw his commercial last night, he is an ex-sponsor who suddenly goes back to newspapers or radio.

We believe the key consideration on this subject to be: can strictly local programming be both economically sound and serve the community? Can it stand on its own as a self-supporting entity, separate and apart from subscriber revenues?

In the present makeup of our industry it is our general conclusion that local origination cannot stand on its own in this regard in systems of 3,500 subscribers or less.

We have sound evidence, we think, in our experiments in two 7,000-subscriber systems that it can't there either. We doubt that it can in systems of 10,000 subscribers. The verdict is not yet in on San Diego with its 50,000 subscribers. I must say we do have some encouraging signs in San Diego, of ongoing, sustaining advertiser support.

If this sounds harsh, it is meant to be. If it sounds unrealistic, please remember it is based on some cold, hard operating experience for the past year and a half in our company, and prior to that, Lakewood and some other experiences our company has had.

Let me say this, that it is based on sound budgeting with no frills insofar as operating and capital costs are concerned in operating these systems.

Also remember that no definitive research, so far as I know, has ever been done that states that cablecasting, local origination or programming will be successful with X number of subscribers. We just don't know yet.

Also bear in mind that the majority of the helpful-hint articles we have been reading have been written by-and-large by people outside our industry. There haven't been enough articles like the one Don Anderson wrote in TV Communications a few months ago. In other words, most of these people are selling. While there is nothing wrong with that, sometimes the vested interest aspects get mixed up with really what the true picture is.

Many cable operators have been conditioned to think by merely buying the equipment and a package of programs and working their way down Main Street with a blank sales contract is going to put them into glamorous, profitable show biz. Not too many articles have been written about the bottom line. Much has been written about local expression; but not much about local apathy when it comes to viewers and advertisers.

The theory that local residents will flock to support of a local origination channel because it is their very own has yet to be proven as far as we are concerned.

The theory that Little League baseball, town council meetings and Saturday nights at the sewing circle can compete for viewer attention and advertising dollars is also questionable.

We have yet to receive the first call from an advertiser saying I'll take all the city council meetings you can cover.

In short, community response to programming depends on more than just involving the community. The product has to be of sufficient quality and merit to warrant watching it as opposed to the 10 or 11 other channels the viewer has at his fingertips. And in this sense, as all of you, I am sure, have already thought through, cable in this sense is its own worst competitor in putting local origination on one channel, because it brings in so many other channels.

So far I have sounded negative, and meant to, about local origination. I know it is in vogue today to be bullish about local origination. I don't mean to be a prophet of gloom, and I am not advocating that you cap up your cameras and seal up your studios and roll over and watch Bonanza. We are not doing that in our company, and we are providing local public interest type programming in the bulk of our systems we were required to under the ruling. I am merely trying to be realistic about the thing and suggest that perhaps we are going about this thing in the wrong way for the wrong reasons.

For those companies who have approached local origination with the idea of making it a self-supporting entity, a reassessment might be in order. Perhaps they should accept that local programming is not going to be a new profit center in our industry, and it is not going to go away either.

It is, however, becoming a growing and progressively more influential factor in this industry's growth. Those of you who have tried getting a franchise lately know that cities are placing about as much value on local programming as they are on other things like percentage of the gross or some of the other requirements.

Perhaps a reassessment is also in order for those companies who are maintaining a programming effort geared to public service rather than profit and who are willing to write off the losses. At this point in time our company is among these.

But I question our collective ability to present on a long-term, ongoing basis significant, meaningful programming if it is on a loss basis. When the novelty wears off and when the individual political needs quiet down, the tendency might well be to ease out of an expensive situation. No one and no company likes to lose money. It's as simple as that.

What, then, is the answer to this so-called new breed of cat? I'm not sure I have the answer. I know that 300 or 400 cable systems, each going its own diverse way, cablecasting to thousands and reaching hundreds, is not the answer. Like it or not, numbers is the name of the game.

No advertiser or agency that can spell "media" is going to pay $5 to a cable system to reach 1,000 people when he can go down the street and pay $3 for a newspaper or radio ad.

At this point in time what system can offer anything in the way of numbers to an advertiser? What kind of numbers? Take a minimum -- one million. Tremendous by cable standards, a drop in the bucket when it is stacked up against broadcast or newspaper coverage areas. Unfortunately there aren't too many CATV operators around who can offer such an audience.

But how about four or five cable operators, 10 or 15 maybe? And what about a group of cable companies who, rather than going off on their own diverse tangents, begin talking to each other about creating areas of mutual benefit? A network eventually, yes; a pooling of interest, definitely.

If there is one thing that we can learn from our friends in the broadcasting industry, it is that an unaffiliated station standing on its own struggles to survive. Can we really expect cable systems will somehow be magically different?

Television stations with varied corporate ownership and sometimes opposing points of view align themselves with a network for their mutual benefit. Cable at this stage of its development would do well to neither copy nor discard out of hand all broadcast practices.

But, let's face it, they are doing some things right, and we are in a unique position to profit from both their successes and failures. I am not suggesting a cable network structured upon or rival to the big three. That would be economically and technically foolhardy and probably impossible.

I am bringing to your attention the fact that in the past 18 months most attempts at program syndication and networking, while all well motivated, have been done by people outside the cable industry -- people with a peripheral knowledge of CATV operations trying to benefit from the recognized but yet unrealized value of vacant cable channels. And, again, there is nothing wrong with that.

On the otherhand, the cable operators who know the business best have been bent on doing all programming individually and meeting with limited success.

So one of my point is: Why not a marriage of these two concepts? Extensive syndication and networking, but done by the people with a vested interested in its success -- the cable operators themselves?

Limited by geography and money at the beginning, gradually evolving from four or five systems to a regional structure, a cable network is possible. Perhaps not nationwide, perhaps not totally interconnected, but it would still bring nearer the promise of local origination that the FCC, the cities and the communities and most of us in this industry want to happen.

For those of you who would say that such an idea defies the concept of local programming, I disagree. Quite to the contrary, it makes possible meaningful, quality local programming by offering a substantial economic base to fund on an ongoing basis the type of programming this industry is committed to.

For those of you who say such an idea is technically impossible, I would say let's talk.

For those of you who say that such an idea is grandiose and out of reach, I say let's talk.

For those of you who say that I've talked enough, I agree.

M. William Adler -- At the present time, a most interesting contest is under way between the House of Representatives, and particularly the House Commerce Committee, and the President of CBS, Frank Staton. The interesting question that arises here is, can the government, which licenses television stations, have very much to say about the content of the programming which they put out?

We are in somewhat a similar situation; we are franchised by the local communities and some of us are engaged in cablecasting and carrying news and editorializing and possibly we might be critical at times of our local city government.

I just wondered, Mayor Thomas, if you had any comments to offer on that subject.

DISCUSSION

James Thomas -- We have had -- and I emphasize "had" because it has been eliminated from the system for some reason or other -- a local news program. This was a daily program which was well received. They did not editorialize.

But, speaking of my relationship with many men who have been elected to offices of all types, I would say the reaction would be something similar to what you get to a newspaper editorial. It is more or less the individual himself, how thick his skin is and how fast you can get to him.

From the Audience -- A question for Mr. Dowden. Do you have any experience or a viewpoint about the appropriateness or the applicability of cablecasting to increase the penetration of cable TV?

Thomas C. Dowden -- The position we have taken on that is that we say -- and it's true -- we see no evidence that would show that local origination programming will add subscribers.

In our Lakewood experience three years ago, I guess 90 per cent of the appeal of the Lakewood system was 55 hours a week of programming. Yet our subscriber level stayed almost constant, almost flat.

That told us local origination didn't add that much.

We haven't seen much evidence in other systems. It's very hard to pin down. It's hard to detect what causes a person to subscribe.

We do feel it helps retain subscribers. We feel that if a person had a choice of going off the system, giving it up for one reason or another, local origination programming is another plus to help keep him on.

M. William Adler -- Jack Williams, has cablecasting in your experience at TelePrompTer made any difference in seasonal disconnects?

Jack Williams -- I would say that it definitely does, and furthermore in many cases we have seen direct results as a result of our programming in increased subscriber gains.

I think a good example is the programming that we are doing in New York City. As you can well imagine, there are plenty of available television signals. Granted, we do improve the quality of these. But I think we probably have done more studies in that particular system to see the direct results coming in, and by programming specific programs to specific groups, we have been able to see the increase coming in.

Needless to say, when we started running the Madison Square Garden events, the New York Knicks, the New York Rangers Hockey Team -- if you think that won't help you, just try it.

As far as summer programming goes, if you have a program that is of interest to the people and it's good and it is something that they can't get from their ordinary television, it has to be an incentive to stay on the cable during the summer months.

M. William Adler -- When Bill made his introduction, he mentioned a service we are providing in our town, and because I think we are answering some questions and solving some problems that Tom has alluded to, let me mention it.

We are doing local news in our system via a character generator crawl across the bottom of the time and weather channel. I think we are the first system in the country to do this in this way.

The true significance of it is this. It is on 24 hours a day. It repeats over and over and over and over again. So that the subscriber tunes in at his convenience, not at ours, to see what is happening.

I think many of the problems that we are running into in local originations in our industry today relate to the fact that if you do a program and it is on for one-half hour or for 15 minutes or an hour and it is on once a day only, obviously that is not the way to maximize the audience and give the advertiser the most for his money.

With the success we have had in this one instance, we are now looking for machines -- video tape for example -- that would permit us to televise a city council meeting or put on an entertainment type program but be able to repeat that program on a 24-hour basis to give the subscriber the opportunity to tune in at his convenience. That way we do maximize the audience, we give the advertiser his best buy.

That kind of equipment, to my knowledge, is not really available to us yet. I hope it will be. I think when it becomes available, more of us are going to be able to do economic local originations.

William J. Bresnan -- Next, I would like to introduce to you Ken Lawson. Ken has been in the cable business for several years, being, I guess entirely throughout his career interested in program originations.

He was Sales Manager for Telemation for, I think four years, and now most recently has formed a company of his own, MSI Television, of which he is President.

Ken is the chairman of this year's NCTA Cablecasting Awards Committee.

Kenneth D. Lawson -- I represent the panel of judges which was charged with the task of designating awards for the best cablecasting programs during the past year. We were presented with 120 entries, each of which had merit and showed the result of constructive personal energies in bringing a growing new type of local television programming to American communities -- cablecasting.

We made ten first prize awards for the ten basic program categories. Fifteen special awards were made in addition, for programs which displayed unusual qualities of program content or ingenuity. You will see video tape excerpts from the ten first prize awards, but there is not time to show the special awards. I'm sorry that we cannot see the special awards, since they are often the ones which are a little more on the wild side and demonstrate the unique personality of cablecasting.

As for the state-of-the-art of cablecasting, the video taped examples tell the story better than can I. But some things should be said for the record, which will serve as a benchmark between the past and the future.

CABLECASTING.......THE PARTICIPANT SPORT

In these tapes you will see everything from the polished techniques of the professionals, such as the systems in Manhattan, to the modest uncomplicated style of Rawlins, Wyoming. There is one striking characteristic, which runs like a thread through these programs, however...a characteristic which establishes the greatest differentiation between cablecasting and broadcast television...and that is the accent of participation by local residents.

It seems that as much effort is made by cablecasters to get local people in front of the camera, as broadcasters make in getting these same people in front of the TV set.

CABLECASTING EQUIPMENT.......REQUIRES INGENUITY

Cablecasting equipment is, in general, still classified as closed-circuit in variety, which means very much a little brother to sophisticated broadcast systems. This has demanded ingenuity from cablecasters to make up for these deficiencies -- and this ingenuity has been forthcoming.

For example, Twin County Trans-Video of Allentown, Pennsylvania, braved the cold and the dark of an October night to cablecast, in color, the town's biggest event of the year -- the Halloween Parade. Twin County captured, with low cost color cameras, action which the most daring broadcast mobile unit would shrink at. They caught thirty-three marching divisions of Allentown's young and old clanging and banging past the cameras, strategically located with skillfully placed lights. This is technically almost impossible. The program was carried live to the many who could not move out into the cold of night, and was repeated several times on subsequent days for the review of the thousands who marched or cheered.

Then there was the little cablecasting crew at Lakeland, Florida, who could only dig up a single camera for the Annual Speedboat Regatta. This sure-disaster situation for the ordinary television production crew turned into an award for TelePrompTer. With a local boat enthusiast pouring out all of his love for the race on his $30 microphone, the cameraman panned and zoomed as if his mind was anticipating the announcer's every word. The result was that the panel of cablecasting judges set spellbound with the action and had to rerun the segment to convince themselves that it was a single camera and microphone.

Additional ingenuity was demonstrated by Comtronics of Grand Junction, with their thirty-minute commercial. That's right, I said thirty-minute commercial. They recognized the unique ability of cable television with its numerous channels to try something new and began the first electronic shopper's channel. You would have to see it to believe it, but the first half of the program describes several products with unique audio and visual treatments, and the last half of the program assists the viewer in making choices and ordering from the appropriate source.

CABLECASTING.......A PUBLIC SERVICE MEDIA

Cablecasting has continued to be heavily oriented towards public service programs. Cablecasters are stepping into community affairs, and they are being credited with changing local life constructively.

For example, one of the winners you will see today is the program, "Save Our Schools," by TM Communications in Long Beach, California. The cable system decided to take sides on the issue of a tax override election. Proponents of raising the tax level were up against formidable problems: eight per cent unemployment in the community; nearly a quarter of the community classified as retired persons; and the two previous school tax elections had failed. The cablecasting crew went out into the community and highlighted those school functions which would suffer the most, such as music instruction and participation in sports. The voters turned out in much higher numbers and passed the issue handily. Credit was given publicly to the efforts of TM Communications.

Our panel awarded a special award to Gallup Cable TV of Gallup, New Mexico, for what they did in behalf of the Navajo Indian Tribe. In a tourism series of three one-half hour programs titled, "Visit Navajo Land," the cablecasting crew went deep into the reservation and filmed the Navajo Tribal Museum and Zoo, the works of the arts and crafts guild, and the amazingly advanced tribal forest industries. Stickers were placed on hotel and motel television sets to alert tourists about the program, which was continuously played over a special cable channel. The results were that attendance to the Indian areas substantially increased, and credit was given to the cablecasting program.

Again, TM Communications walked right into a long-standing community problem with their production of "Easter Beach." Traditionally, the residents of Daytona Beach, Florida, considered the invasion of youth during Easter Vacation a nuisance. Generally, the public had only seen the side of this activity which is reported under the headings of arrests and other mischief. By video taping a comprehensive picture of the major activities of the visitors, the program helped to reshape the attitude of the local residents. Better relationships between visitors and residents ensued, and the glories and fortunes of Florida were enhanced.

WE HAVE OUR CRITICS

We do have our critics of cablecasting. I found most of these at seminars, where participants were drawn from the ranks of professional theater and TV program production specialists and agencies devoted to administration or reform of social programs.

Criticisms of the professional program producers were generally that cable operators fall far short of allocating the kind of financial resources they need to produce pre-packaged audience-drawing programs on extra channels. Social critics argued that cable operators are not opening up enough channels as a forum for those who are disenfranchised from finding a place on off-air commercial television.

Cable television operators, like anyone else, should listen to their critics for those occasional gems of wisdom which bring true progress. In all honesty, however, I feel that our principal critics do not yet have a sufficient understanding of the economic and political environment of our industry. We need to work for a better mutual understanding of how professional program producers and government and civic agencies can help us take full advantage of the potential of local cablecasting.

As a starter towards gaining this understanding of our cablecasting efforts, let me say that the quantity and quality of locally originated cable programs -- while insignificant by broadcast television standards -- is no small achievement. Cable operators entered into this activity knowing full well that the return on capital invested in studio facilities would look nothing like that of a broadcast station. In fact, cablecasting usually cuts heavily into existing subscriber revenues.

For example, a scheduled cablecasting operation of today may consist of twenty to twenty-five hours per week of local programming. This can easily cost $3,500 per month for operating costs, exclusive of depreciation of equipment and studio. Add depreciation and interest of a $45,000 studio complex (small by broadcast standards) and monthly costs rise to $4,500. For a 5,000 subscriber system, this would be ninety cents per subscriber or fifteen to twenty per cent of gross subscriber revenues.

This does not include the costs of any "canned software" from professional studios or motion pictures. The cost of a worthwhile package would be at least fifty cents per subscriber, in addition to locally produced programs.

Since only ten per cent of cable systems have more than 5,000 subscribers, one can see that the financial burden of cablecasting approaches real sacrifice for the majority of cable systems. Finding money to increase the quantity or quality of cablecasting is difficult because it is not the habit of the TV viewer to pay large sums of money for public service type programming. Neither are advertisers greatly interested in supporting productions aimed primarily at one small segment of a community at a time, as is typical of cable public service programs. There is, I am sure, room for improvement in programs which will draw more subscriber revenue and advertisers, but this is probably where the state-of-the-art of cablecasting is more primitive at this time. We welcome all those who can help us with this problem.

ROOM FOR IMPROVEMENT

In viewing the cablecasting award entries, I think we might indulge in some constructive criticism aimed at ourselves.

We are falling into some typical ruts of the low budget panel show. Oftentimes, these shows, like the bikini bathing suit, begin nowhere and end all of a sudden. These programs need to be well-established with a rousing and definitive beginning, and end more in relation to the achievement of program objectives, rather than merely the position of the hand on the clock.

These shows generally need more props and exhibits. Also, panel shows often would benefit by the presence of a somewhat spectacular local personality to conduct the conversation.

Our shows generally need more humor and drama. The highway patrol show, entered by the TelePrompTer system at Rawlins, Wyoming, is a good example of this. The technical production was not network in quality, but an occasional vivid motion picture clip of an accident scene riveted your attention and drilled home their highway safety facts dramatically. It was worth an award.

Audio is not a forgotten art in cablecasting -- it just hasn't been discovered. More study is needed on simple microphone and audio mixing techniques.

In the last year, there has been a marked improvement in production skill. Inexperienced people originally assigned to the cablecasting task have learned a great deal, and many new experienced people have entered the industry. We must continue this trend to become a fully accredited member of the television communication industry.

Equipment maintenance continues to be a problem for many operators because of the lack of trained video technicians, spare parts, and back-up equipment. Cable operators still have a tendency to want equipment at wholesale prices without weighing the future need of having a qualified closed-circuit television supplier around tomorrow to help when it is needed. This is the biggest complaint of equipment suppliers, that the CATVer wants bargain prices and maximum personal service at the same time. This has caused some unfortunate customer-supplier relationships for cablecasters.

In conclusion, the cablecasting awards panel finished its job with an overwhelming feeling of professional appreciation for the job that is being done daily by cablecasting personnel operating under budget and staff restrictions unknown to most television stations. These cablecasters are all heart; and I hope that the people of our industry, the Federal Communications Commission, and the Congress of the United States fully recognize the contributions that these people are making.

"BRINGING THE BLUE SKY DOWN TO EARTH"

Speakers

David H. Polinger
Holmes Protection, Inc.
New York, New York

Hubert J. Schlafly
TelePrompTer Corporation
New York, New York

Gordon R. Herring
Telecable Corporation
Norfolk, Virginia

James E. Turney
Technicolor Information Systems
Hollywood, California

Frank Drindel
Continental Transmission
St. Louis, Missouri

Geoffrey Nathanson
Optical Systems Corp.
Los Angeles, California

Moderator

Wally Briscoe
Managing Director
NCTA, Washington, D. C.

Wally Briscoe -- We have separated the two panels this morning on the management side of the program by considerable distance, for which we apologize. The accommodations are designed to give you lots of exercise. The reason we've done so is to provide an opportunity for those particularly anxious to continue discussion of the satellite issue to do so, while at the same time protecting the time allocated for this panel, which we regard as tremendously significant not only to our industry but also to those who are beginning to include in their future plans some utilization of cable technology.

You know, a year ago this panel would not have been possible at this convention but a very interesting series of things has happened during the past year. To give you just a little insight into the reason we feel so strongly about the presence of these people and the subjects they'll treat, not long ago one of our directors was in my office talking about a conversation he had had with his banker in the process of discussing loans for construction of cable systems.

He said the banker pulled out of his desk a clipping from a newspaper from which he had clipped the dateline and the source and he said, "I'd like to read this document and tell me of these things that they mention in the article, things like meter reading, burglar and fire alarms, et cetera, et cetera, many of the things that we've talked about in CATV for a long time as potentials. Tell me how many of these things you are now doing in the industry."

He read the article and he turned back to his banker and said, "Well, I have to admit that I can't give you chapter and verse on any present utilization of the things that we have seen mentioned in this article."

His banker said to him, "Now I want you to tell me when you think this article was written." He said, "I have no idea." The banker said, "I pulled that out of a magazine in 1958. Now this is 13 years later and you tell me that the things that were talked about in 1958 as possible new technological developments for this industry are still not in operation?"

I think the gentleman who was subjected to that little fusillade was not privy to some of the information that these gentlemen have and will convey to you.

But the question before us this morning relates precisely to that inquiry. Where or maybe what is cable today? For years we've talked about potential uses and for years we've had very little to show and tell but that is now behind us, as we enter the second generation of CATV, as you will soon learn from this group of distinguished industry panelists who are here to demonstrate that some of the promise that we have as an industry is no longer blue sky.

Now we are dealing with ideas you can see and touch and, most important, put to work in your systems at a very early date. We hope that we will have an opportunity at the conclusion of the presentations this morning to allow you to ask questions of our panelists, and to discuss the issues. Perhaps the panelists may have some things to say to each other. I wouldn't be at all surprised.

At any rate, to open our presentations this morning, it is my pleasure to present to you David H. Polinger, Vice President in Charge of Marketing of Holmes Protection, Incorporated, in New York City.

David H. Polinger -- Before I address myself to the prepared portion that I have here before, I am most intrigued by the title for this panel which is called "Bringing the Blue Sky Down to Earth."

Approximately 12 years ago it was my privilege to build the first 24-hour FM-stereo station in the world, WTFM, New York City. At that time I was also elected to the Board of the National Association of FM Broadcasters, of which there were like 20 of us.

The organization grew over the years and I remember every year having to discuss when we were going to become a successful broadcast medium and when was the blue sky going to come down to earth. I'm very pleased to say that this station, which is an investment on my part, today grosses well over a million and a half dollars a year. It may have taken about 12 or 13 years for the blue sky to finally come down to earth but it does happen and I would say that we must have experienced in the FM industry, as I'm sure most of you are aware, perhaps seven or eight years of sitting at our conventions with the NAB and at the NAFMB asking ourselves, My gosh, it is around the corner? Is it really going to happen? Is it ever going to happen?

I guess paralleling what Wally has observed, I think the time has come here in this industry to where it has happened. We at Holmes Protection in New York, which is the company with which I'm associated now, are very pleased that we have some contribution in the security field to tell you about today.

We call it the Holmcom which is a new profit opportunity for CATV operators and before I even get into a description of what, how and when, since we indicate that it is a new profit opportunity for CATV operators, we'll tell you how we're going to market it first and then I'd like to tell you a little bit about how it works.

We would like to propose that all CATV system operators consider an association with Holmes Protection in one of three different ways.

One -- We would like to sell you the security equipment that we have, the devices for the home as well as the headend monitoring console or computer for monitoring the alarm conditions. However, we do recognize that most system operators still have incomplete systems and do wish to finance and finish the construction of the existing system. Hence, we have come up with two alternatives.

In certain markets, we will joint venture a security thrust with a CATV system operator whereby perhaps we will supply the equipment and you all will supply the sales effort, the installation effort and the maintenance and monitoring effort.

In other markets, we ourselves would like very much to come in and say to you, especially if your system is large enough, that we would like to lease your cable and we'll pay you a royalty each month. We will build the headend monitoring complex for the security system. We will make the installation in your subscribers' locations and we will do all of the maintenance and service.

So there is a very positive direction here whereby with some systems specifically we can actually go out and start paying something right away.

But somebody is sure to ask, do you have one installed or is there one going to be installed? The answer is we do not have one installed. There is going to be one installed in October. It will be a system in Pennsylvania and until the contracts are finished I'd just as soon not talk about it today.

But let me tell you a little bit about how we work for those of you who are not familiar with what we do.

The sharply increased demand for alarm systems that protect against burglarly, robbery and fire have spurred us at Holmes Protection, which is one of the most reliable and largest names in the security industry in this country, to offer a rather unique protection system using the CATV cable.

The warning signal is relayed from the subscriber's location over the cable to a central station. The technological breakthrough of being able to use existing CATV cable installations as a carrier of security alarm signals provides you with an immediate new source of revenue and, in addition, the great awareness by consumers of the need for this protection gives you an important sales tool for adding more subscribers, as well as providing an important service to the community at large.

Speaking of community service, we are very pleased that Mr. White, the Capitol Architect, has shown an interest in this system and is perhaps suggesting a modification for the improved security of the Capitol complex as a result of the recent bombings here in Washington.

Our engineers at Holmes Protection have developed dependable circuitry that provides a two-way communication path via the coaxial cable. Each subscriber's location is tested approximately every five seconds through a multiplex supervisory signal. Intrusion, wire-cutting, fire or interruption of the signal creates an alarm condition.

Within seconds the Holmcom system decodes the signal and interprets and communicates these findings to a central security monitoring facility. The monitoring individual, the monitoring personnel, the monitoring supervisor immediately notifies either the local police or the local fire department or a response force that can be dispatched immediately where appropriate action can be taken.

Holmes Protection also offers a full range of compatible security equipment that is designed to signal entry through windows or any other vulnerable point. Among the many signaling features of the Holmcom security package is a panic button built into the master control unit generally located near the door on the subscriber's premises. In addition, an optional portable hand-held device can transmit an alarm signal from any room in the subscriber's residence. This is particularly valuable should medical emergencies occur. We have featured this for cardiac patients or other individuals who must alert some central monitoring personnel that there is an emergency condition existing at that particular moment.

The Holmcom system can be expanded to incorporate financial, mercantile and industrial monitoring, as well as any other detection options for which devices are currently in use. The optional equipment can be used to protect safes, vaults, night depositories, monitor water-flow pressure in sprinkler systems, detect flooding and many other subscriber requirements.

A single console conveniently located handles up to 500 different connections. Above this number we have a mini-computer capable of handling up to 10,000 connections. Of special importance to the CATV operator is the fact that the Holmes Holmcom operates on a carrier in the subchannel frequency range normally unused and unprofitable. The carefully engineered Holmes system isolates the selected frequency from the picture-carrying signal in the cable.

Holmes can arrange for the service and maintenance of all equipment. In addition, Holmes will provide sales and merchandising aids to help you promote this new service to your current and prospective customers.

Just a word about Holmes Protection. It's been a pioneer in the development of home, industrial and mercantile security systems for over 100 years. Holmes's position today as the leader in the security field is evidenced by a broad range of services, research and development facilities, manufacturing capabilities, system installation techniques and maintenance forces.

Currently Holmes Protection, Inc. operates offices in New York. We have 31 offices in New York City, Philadelphia, Pittsburgh, Florida, Connecticut, New Jersey, and Mexico City. We are also represented internationally for research and manufacturing agreements with companies in the United Kingdom, Japan and Spain.

You can be confident when you put Holmes equipment into your subscribers' locations that you're giving them the most advanced security and communications equipment available.

We think the incorporation of security systems into a CATV system is one of the first steps toward achieving the blue sky which has long been heralded by cable television operators. Perhaps today the housewife still cannot shop from her home but at least, perhaps, with a Holmes Holmcom she can leave her home safely.

Wally Briscoe -- Dave, I think there might be some comment from some of our other panelists about that housewife's ability and what she can do from home. I hope there is.

Our next speaker is a gentleman that you've seen on many occasions at our conventions on both sides of the program, technical and management. He's the President of TelePrompTer Corporation, Hub Schlafly.

Hubert J. Schlafly -- I'm very happy to be on this panel. It has an extremely interesting name and it's a name that has been used to sort of needle the industry, as Wally mentioned. It's like, So what's new? and, What have you done for us recently?

Bringing the Blue Sky Down to Earth. You television people out there know that it only takes a slight turn of the knob to change that blue sky to green and we believe that the greening of the sky in a down-to-earth manner is beginning to happen in a way that even those who have been following it for 10 to 13 years find it hard to believe.

Wally, I suggest that that banker that you were referring to 13 years ago is partly responsible for the delays that may have happened because I don't believe that that banker would have invested a few million dollars of his bank's money in funding some enlargement of a cable system at that time to include some of the devices that were referred to in that article. I think it was the 1960 Convention down in Miami Beach that we made a presentation on key TV which was an extremely primitive form of what you see in almost every booth downstairs in the exhibit hall this year.

I think that same banker might be standing in line to get out some of his money to the industry now so that some of these evolutionary and revolutionary things that we have talking about can indeed be operated.

I think it's a lot of nonsense about blue sky. I think the enlargement of our scope of broadband cable activities has been growing at a fantastic pace. It isn't a matter of delay. You have an awful lot of people to convince, to educate. But remember now, we are in a generation that is different than the generation that I grew up in. The classes in school I took are totally obsolete now. I'm even afraid from month to month that I'm going to be obsoleted because so many new things are happening that I know so little about. But you keep trying to run fast so that you can keep up or at least stand still.

The time scale has greatly accelerated. The older generation, myself included, are familiar with projects that took years and years to bring to fruition. In fact, this is one of the problems that I've had. I've been preaching the gospel here in Washington among some of the government agencies, among some of the foundations, the trade associations and others and I find that many of the people who are on the committees that are making the studies of investigating CATV and seeing how it can serve in the public interest are mostly of my generation and they have the experience of building battleships and major projects of one sort or another that take years and much investment of public funds before productive results can be achieved.

So their time frame has been trained to be in the magnitude of years, perhaps decades, before productive results from their efforts were realized.

CATV, however, I hasten to remind you -- it's not necessary to remind this group -- has grown from scratch without tax dollars and without public funding, without agencies approving and writing the specifications for it. We've been fortunate in that small investments of capital allowed small operators who had probably more guts than fears to put up small cable systems that were productive enough in bringing in dollars to allow them to extend those systems and thereby grow practically by their own bootstraps.

Studies are good but, if not in the right time frame, they can be misleading. I think that I was personally instrumental in causing the National Academy of Engineering that has just come out with a tremendous report, published and available at the National Academy for -- it's going to cost you money -- $3.00. I recommend it to those of you who want to be updated on current thinking on telecommunications for assistance in solving the problems of our communities.

When I was first asked to address that committee group, their thinking on many of these things was in the late 1970s at least -- or perhaps 1980. I was successful in moving up that time frame for them by actual facts presented to them, by actual demonstrations of what was going on in the industry, not only by ourselves but by many others, so that now they believe that instead of eight or ten years, we're talking about one or two for some of the even more far-out opportunities that broadband cable will permit.

I would like to read a short paragraph from a report that I prepared about a year ago to the Sloan Foundation. It's particularly appropriate for the title of this session because it starts off: The writer is aware of the temptations of blue sky reporting and I say that in this report, if it's indulged, I'll certainly identify it as such.

However, the technology has progressed farther and faster than members of this Commission and staff might know, even faster than many of the seasoned cable system operators might know or choose to believe.

The factor responsible for this growth pattern is timing. Cable communications have appeared on the scene of history at a time of explosive expansion of related technologies. Data theory, computer design, solid state circuitry, orbital vehicle control, communication theory and a vast cadre of highly-skilled engineering companies and personnel ready to apply this know-how were not created by the cable industry but have converged at a point in time ready for efficient and immediate use by the cable industry.

Therefore, earlier time cycle standards, even those of our own generation, for an industry building on new technologic developments do not now apply to cable communications. The five to ten-year growth pattern under examination by this Commission is not technology-limited. The controlling factors will be, one, the desire of the public and true public need for and the productive use of broadband information service and entertainment access for the home.

Two -- the incentive, foresight and wisdom of industry and other leaders who must marshal the risk capital, realistically appraise the political and competitive fight and supply the energy to make this happen.

Three -- the effectiveness and magnitude of opposition by established services whose immense plant investments or carefully developed profit patterns caution them to let new services happen but all in good time.

And Four -- the vision, energy and competence of regulatory bodies.

Let me move to a different subject.

It does take planning, it does take money, it does take energy, it does take vision to cause these things to happen. One of the arguments that our company gave to the Federal Communications Commission in seeking their approval for the merger of TelePrompTer with H & B American was that greatly expanded base of subscribers would allow more opportunity and more incentive to develop community service programming and develop the broadband services that we have been talking about.

That promise to the Commission has certainly been true. It has allowed us to build our programming, local origination programming, which we probably would have done, even if the Commission hadn't insisted on it as a condition, later set aside by the courts, but I think that's immaterial. So that we now have some 64 systems that are capable of originating programs, many in color, and on July 1 we announced, with dancing in the streets and balloons and steel bands and plenty of people who were able to get before the microphone and the cameras, the opening of the two public access channels in New York City, and this is going on a continuing basis.

We have also been able to fund research and development programs in the last year, and this may -- it's sort of frightening to me and it may be surprising to you. We funded about $1.4 million in our R and D program. There are 23 separate research and development programs that are currently being carried by the company. Some of them are approaching fruition such as the local distribution microwave services that you see displayed here in final production form, something that will be tremendously important to the industry.

But just to walk through the exhibit area downstairs to see the hardware for two-way communication and for data transmission is a very heartening experience.

Now where do we stand on some of these? Is it down to earth? The very fact that that hardware exists, hardware that is -- I'm not going into all of the things that data communication to the home can do for you. I think that's been spelled out for a large number of years. It is fantastic.

Let me predict to you that we're going into a new era of social communication for the home, for the benefit of people, really public interest. It will provide services and conveniences and information as well as entertainment to the home, the basic element of our society. The necessary things to do this are the transportation system and the CATV industry has been responsible for causing that to grow because almost without the knowledge of the public in general, new broadband communications networks have been growing. I don't know whether it was the seeds you passed out that helped, but these networks have been growing across the nation.

We have for the first time the ability to communicate to the home without going through the telephone company.

The data communication industry has grown along with this and by urging and pushing and I think TelePrompTer has played a major role in that heckling and doing which are both effective ways of making progress. We come to the point where unbelievable things to the layman and even to those who are familiar with it can happen.

The subscriber response system that was described in one of the technical papers and the other papers that were given, EIE and Vicom and others here at this Convention, indicate rapid real time response to large masses of people in a community to bring services to them. And when I say rapid response, I'm talking about one megabit data rates. Now what does that mean?

That means that 10,000 homes could be interrogated and send responses back to a central processing location for action or for services to be rendered within a period of one second. That's almost real time. That means -- in fact, one of the papers indicated -- that no person on a system would have to wait more than 2 seconds to get a response to an inquiry or a request that he made.

The ability to do this is not blue sky. It exists. Hardware is available. It has been done. It is being done. The question now is: How fast do you want to insert dollar bills into that situation in order to make it happen on a mass scale rather than on a test scale? And I can assure you that that is going forward just as fast as our company can push it and probably just as fast as several others may want to push it.

We believe that we have taken the lead in this. The Los Gatos experiment which has largely been completed now has been a two-way, one megabit, upstream system on a single cable. We learned a lot from it. We didn't believe that you didn't have to do it to find out what mistakes you would make before you actually begin to install it on a large scale. And we made a lot of mistakes in Los Gatos and we found a lot of answers and we have incorporated those answers into revised thinking that I am happy to say has now been implemented.

I had the pleasure not too long ago of instructing our CATV division that all future construction and all major rebuilds of existing construction would be two-cable trunk and a partially two-cable feeder. So that all homes could bring back information to the headend as well as receive information from the headend and that we could use other broadband two-way services in a very convenient manner.

So that order has gone out and particularly we are pushing now on building a system in the Los Angeles area for precisely trying furth to test the two-way data terminal. I am happy to announce that we are building -- right now. It's under way -- in El Segundo, in the Los Angeles basin, a two-way system. We will have the electronics in partially in October, working. We have arrived at an agreement with the Jerrold people to cooperate with them. We've been giving them directions and specifications on exactly what we want to do resulting from our Los Gatos experiments.

This equipment will go in quickly this fall. Hopefully by December we will have the entire city wired for two-way transmission for testing of the one megabit data equipment that you have heard described at other sessions here at this Convention, specifically the equipment that's under display at the Theta-Com booth.

I think I would like to wind up this discussion by a definition. One of the touchy points, it seems to me, as we discuss these points, is a distinction between what cable can give and what telephone systems already give. In other words, why can't I use my phone and dial up my Congressman and tell him what my opinion is? Or why can't I respond to a television commercial as they say in the credit lines at the end of the commercial, Dial Bigelow 6-8000 and tell the man that you want to buy this ballpoint pen?

Sure, I can do that. Why is it broadband that we're talking about on cable rather than narrow band? It's broadband because we're taking into consideration, for the first time, and this is something that the telephone company did not have to do and did not include in their planning, almost real time response to large numbers of people.

Now when you add those two ingredients, speed and mass audience, then you begin to get amounts of information that fall into the broadband category, to the wideband category, the category that is particularly suitable for broadband cable television services as we know them and have been practicing them.

Telephone service is a comparatively narrow band, dedicated line to a particular home or terminal back to a switching center, over trunk lines that then have to be selected by that switching center to determine if there's one available, to another switching center and possibly another and another and finally back to a dedicated line that goes to a home.

So anybody can talk to anybody perhaps anywhere in the world and this is a vital, necessary service that has contributed greatly to our national and international and industrial growth and, Lord love them. You know, I hope they're very successful and I hope they improve their service tremendously. They've got a big problem. They have grown even beyond their own fondest dreams in the requirements of the public for transmission services of this nature. Personal message service from anyone to any other one.

Also, I might say it is a non-disciplined communication service. It is at human speeds, that is, voice or picture, and I can get on a telephone line and as long as I can pay for it I can tie up that facility and I can talk about the most important thing in the world or about nothing but I can tie up the facility for either one of those purposes.

In broadband cable concept we are talking about a kingsize party line with time shared, dedicated and disciplined. Disciplined is the word I wish to use, disciplined services. So that specific amounts of time for machine language, rather than human language, are allowed to go back to a central control point where you can immediately act on those services and service requests.

It is quite a different ball game than the telephone service and I think the distinction can be very clear to all concerned, particularly to the government regulatory bodies.

I believe that those about complete my thoughts on bringing the blue sky down to earth. Simply be assured that it is moving at an extremely fast rate and by the time we stand here again next year I think that you will have much more information, experience, market analysis and equipment testing than we have actually today.

Wally Briscoe -- Our next speaker is Director of Research for Telecable Corporation in Norfolk, Virginia. They've recently been involved in the beginning of one of the exciting new concepts and capabilities that the industry has looked toward for a long, long time.

Gordon R. Herring -- For the past several years in the cable industry, there's been a great deal of talk about the potential of a bidirectional broadband network. Everyone and his brother has an opinion of what will and what will not come to pass with regard to two-way applications. Until a few months ago there had been very little action to back up the enormous amount of discussion.

Instead of talk, the industry has needed a few people to get their feet wet and show exactly what potential exists. Telecable Corporation, an MSO based in Norfolk, Virginia, hopes to become a catalyst to precipitate the tremendous two-way revolution which our industry can offer the nation.

We have an elaborate bidirectional experiment we are currently conducting. We do not propose that the experiements in our system in Overland Park, Kansas, will be the final answer. Far from it. We do propose, however, that until a forward-thinking cable operator pushes the industry's state of the art to the hilt the cable industry will never realize the benefits of the two-way potential.

Telecable's plant in Overland Park is a new dual cable plant constructed with EIE bidirectional amplification equipment. The plant itself can provide two-way capability from every home within the system. The peripheral equipment used in Telecable's experiment is designed and manufactured by Vicom Manufacturing Company of Dexter, Michigan. It is a computer-based system which repeatedly interrogates each terminal to see if there is a message stored, very similar to the ones that Hub was just describing.

You will be able to see a little bit more in detail how this works in a moment with some films that we have taken out there.

Telecable's approach is to provide a basic two-way system with various fundamental applications. The format of our program is general but versatile since it can be adapted to many uses. The experiments we are conducting represent only a few of many potential applications this system is capable of performing today.

Our purpose with this system is to stimulate the imagination of our participants in this experiment and also of potential users. By doing so, the system can be further refined and the effectiveness greatly improved.

Will you start the film now.

The first portion of our experiment allows an audio-video interactive network controlled by the computer. The application that we are demonstrating with this program is the schooling of homebound children. Through the system, the student is allowed to raise his hand from his home and the teacher can recognize the request to talk. If the student has a camera in his home and wishes to show a visual display of something that he is working on, he can request a cablecast and the teacher can authorize this request allowing the student to be seen by anyone else in the network.

This is Jeff Hubert, the student that is working with us on this system.

The system is so designed that a large number of terminals can have access to the network. The limitations will be placed upon the teacher's ability to control and converse with a given number of students. One can readily see the savings which a school system could gain from a network such as this. Instead of having to send a homebound teacher to each of 200 homes in Overland Park, Kansas communities which have homebound children, the school system would be able to allow three or four teachers to handle classrooms of homebound children from a studio or from any remote location.

There are many other educational uses that can be accommodated with this system, including adult education, education of unwed mothers, education of pre-school children. The potential is only limited by the educator's imagination.

The interactive network is not limited solely to instructional applications. The cable operator could lease the network to a group within the community such as a women's club or a doctors' organization. With this service, the organization would be able to conduct a meeting from various remote locations without having to get together at one location.

Time does not permit further discussion of the audio-video network because the applications are limitless.

The next portion of the experiment, which you see on the screen now, is -- Telecable is conducting a shop-at-home demonstration. The system is technically capable of performing this function now. However, it will be a while before the merchants are ready to accept the new medium.

Shopping by cable will not replace the stores but will supplement them. The products to be offered over the cable will likely be impulse items. In Overland Park Telecable is working with the local Sears store to show how shopping via the cable can be done.

Sears is presenting a live fashion show with novelty items and to demonstrate how products can be displayed on the cable for on-the-spot purchase in the home. Revenue to the cable operator could come from either a leased channel price or could come from a percentage of the gross revenue to the merchant.

The third portion of our demonstration in Overland Park shows the potential for participative programming. The program as it currently exists will allow a mayor or an M.C. of a program to ask a question of the viewers. The viewers would be able to respond immediately and a tabulation of the responses would appear at the bottom of the screen

With this application, a mayor would be able to get an immediate response from his constituents on an issue of public concern or an M.C. would be able to take a vote on a particular topic.

The call-in talk shows are very popular today and with this added feature the audience would be allowed to participate more directly.

If you let your imagination run, you can come up with extended applications of this capability such as participative programming in which an audience selects various alternatives at a decision point in the program script and thus decides the outcome of the plot.

My objective this morning has been to give you a brief overview of the several experiments we are conducting in Overland Park. Again, we do not propose that we have the final answer. We do propose however that we have a good beginning, a beginning which this industry has needed for a number of years. We feel that Telecable is making a significant contribution to bringing the blue sky down to earth.

We have selected an approach which is very flexible and which can be modified to meet the unique needs of our future customers. It is our hope that this experiment can serve to stimulate the imagination of future customers and to help the cable industry realize its potential in two-way.

Wally Briscoe -- The next gentleman is James E. Turney, who is General Manager of the Information Systems Division of Technicolor Information Systems of Hollywood, California.

James E. Turney -- About two months ago I was in Philadelphia at Wharton School and with about ten minutes' notice was asked to discuss in front of a seminar the topic I'm going to describe to you today and without any more warning than that I had an hour and a half to present what I'm going to try to do here in five minutes.

We've been involved in CATV viewer research for about a year and a half now. This was an outgrowth of market research activity, program testing and commercial testing which was done in an organization I was associated with previously and this research had been conducted in the theater and at one point someone got the bright idea that a closed circuit situation would be better.

We experimented on a master antenna system, found out that people are willing to put up with it and we did in fact get some good research results.

Since then I've left that firm. For a while I had my own and am now associated with Technicolor. We continued these experiments, and for a period of about a year this research was conducted jointly with one of the major television networks.

I think we made about every mistake we could make, which is one of the hazards, I guess, of pioneering in this and other fields. We have been waiting for a long time for this two-way data system contact with subscribers because our mechanism was simply by mail and telephone. We were able, though, through some pretty outstanding cooperation with cable television systems, the management, the technical people and the viewers, to verify that this is a valid method of deciding who wants to see what on television.

The way we performed this research was, first of all, to find a system that would permit us to use an open channel, whether it was a duplicated channel in some cases or a time-weather channel or a completely open channel. We would then do some sort of a technical checkout of the system because in many cases there wasn't any origination other than the time and weather. Sometimes this was rather difficult.

I can recall times going up the mountain to the head end in a j ep with an Ampex tape player clutched in my arms and we were sort of praying when we got up there that things would work out all right.

So after the technical checkout, we generally informed the viewers on the system what we were about to do. This generally was in a PR type letter from the manager of the system saying that we are honestly interested in improving programming for you but we require some cooperation from your end.

Following that introduction, we had to call some number of people, not necessarily everybody, but enough to have a good sample for testing and the information that we requested was fairly demographic data and, of course, when we started doing this there would be some concern on the part of the system management, as there was on our part, as to how people would react to the kind of probing information we required.

I think our dropout rate, that is, people who were home and answered the phone when we called them and said, "No, I don't want to have any part of this," was on the order of four per cent. Sometimes we'd get people that were violently opposed. So much so that they would request their service be discontinued. But I think maybe we lost one or two in any single cable system and this generally was after we'd made something like 6,000 to 8,000 demographic data interviews. I think that's a pretty high level of confidence.

Following the collection of the demographic data, and here we were, as I say, we were pioneering in the sense that we were maintaining parallel data base, parallel -- by that I mean there was an accounting system data base and then there was a research data base. We are looking forward to the time when these two can be combined.

So selecting from our data base, we would create a sample for program test, send out an announcement to make sure that they knew that there was going to be something on a particular channel, say Thursday night at seven thirty, and inviting them to watch and pointing out that this programming was available only to them.

We would produce the program, cable the program, as I say, generally on one-inch video tape, which caused us some problems sometimes in compatability plus delays. I can recall getting the source material, the one-inch video tape, from an airplane about a half hour before we were supposed to go on the air. That happened more than once and at least once when we got it ready to go on the air it was not of good quality so we stopped the experiment.

After the program was aired on the cable, we'd call everybody in our sample base and you can imagine this. We were making a thousand telephone calls in 90 minutes to find out who was home, of those who were home who was watching television; if they weren't watching television, were they aware our program was being tested and, if they were watching television, what were they watching? If they were watching something else, why didn't they watch what we had? If they were watching what we had, who watched?

The following day then we would call back some number of people who we knew were watching that night and ask them what they thought of it.

As I say, we've learned quite a bit from this type of experimenting. We've discovered that there are, as we had hoped, some advantages to the cable system in participating. One of them obviously is that it gets some special programming that wasn't otherwise available. As a matter of fact, we had one cable system come to us and ask if we couldn't possibly use them in the testing program because their neighboring system was doing much better than they in adding subscribers, simply because they were getting one or two extra programs a week.

In the town it was good public relations for the same reasons that any other local origination is good, that people on the cable get it and people who aren't don't. We like to think, although it will take, I'm sure, a few seasons to work this out, that we might get some better network programming as a result of the research and possibly some expansion of network programming to take advantage of special situations, demographic situations in different sections of the country.

We've gone beyond this type of research to program research, although we're continuing with it, into commercial testing, both pre-testing and campaign testing. There are a number of firms involved in this, one of which is associated with TelePrompTer and I think they also know of some of the pitfalls of pioneering.

Another some of you may have heard is AdTel which is doing a good cable experiment and having some problems primarily again because of the hazards of pioneering.

We are currently working with a second television network in program testing and are in the beginning stages of some commercial research with five major ad agencies with approximately 20 other ad agencies aware of this and watching very closely.

We think that CATV systems -- we're not alone in this. We think that CATV systems offer a unique setting for test marketing. If we have enough systems available with the right characteristics we can offer to advertisers different campaign programs in perhaps adjacent systems with the idea that over some period of time they would be exposed to different products, different advertising content and intensity and to study these differences and the effect of these differences by a combination or exclusive or panel diaries and store audits.

As we are building our data base, we are collecting a substantial amount of demographic information. As the two-way data system becomes more common and reaches more people, we'll be able to provide, we hope, a fairly substantial and quick turnaround set of information that could be useful both in product testing and in program testing to the extent that eventually we'll be able to assist cable systems in offering the equivalent of other types of rating services, an improvement over any other type of rating service to the advertiser so they can decide how to allocate their budget.

Presumably if we can, as I say, have a large enough data base to present to them, which may represent the combination of a number of individual systems and possibly groups of MSOs that it will provide the necessary information for the agencies and their clients to spend some of that advertising budget with us.

We are continually developing new methods to perform this research. We are quite involved with computers and with computer software, since we sort of grew up in that industry, and I would say that there are some parallels there of the dangers of pioneering and the problems of technology exceeding the capacity of the software. We're hopeful that we can learn from some of these previous experiences and pass on some of the benefits to this industry.

Wally Briscoe -- The next gentleman has with him on this trip a device that incorporates some of the things that you have heard alluded to and shown in the film. Some of the technology is quite interesting. I think it's probably one of the most fascinating live presentations of the utilization of this sort of thing that we've seen here at the convention.

I would like to introduce to you Lyle Keyes who is President of TeleMation, Incorporated, the man with the dollar bills on his lapels.

Lyle O. Keyes -- There's probably never been an industry that issued so many open invitations to fast buck promoters as this one. In our frenzy to justify our existence to the outside world, we have touted cable as the panacea for every conceivable communications requirement.

These pie in the sky plans have been offered from within the industry without even having been thought through, let alone tested as to their viability. They have been exploited for their PR value and outside promoters have been quick to climb aboard this same PR merry-go-round.

Slide please.

One of the most popular gimmicks is meter reading. People talk of it as a fait accompli, yet there are at least a dozen valid reasons why meter reading will never be a significant source of income to our industry.

Burglar and fire alarms are also frequently touted and we see equipment being demonstrated on the convention floor for this purpose. I suspect they will find applications but not without serious problems. The cost of installing suitable sensors in a residence will probably be high and frequent false alarms will likely result in police and fire departments' refusal to respond.

Dave may want to have an opportunity for rebuttal there.

Our own experience in our plant has been that the sheriff's department no longer responds to our alarms.

Slide please.

Interactive computer terminals is a phrase with a nice ring. I'm told that it's good for at least half a point on the price of your stock. I'm happy to see that Telecable is doing and not talking about this service.

Slide please.

Films are popular but when you have to compete with the networks for viewers and with the broadcasters for product and where your production costs are necessarily comparable to those of television stations, you find yourself behind an 8-ball labelled CPM, cost per thousand.

Would you turn the projector off please.

I'm not here to bad-mouth local origination. It has great significance to cable television systems of all sizes. But not, I believe, to duplicate the services that are best provided by broadcast stations. The sale of advertising is undoubtedly the most lucrative source of additional revenue for cable operators. All we need is a viable advertising medium.

This medium, to be successful, must meet three criteria:

One -- To attract viewers in sufficient numbers to make it worthwhile as a medium for advertising.

Two -- That its cost of operation be low to permit rates competitive with local radio stations when measured on a cost-per-thousand basis.

And Three -- A means of presenting the advertising in a manner that is acceptable both to the advertiser and to the viewer and at a frequency that will garner the thousands of daily impressions necessary to meet the CPM criteria.

TeleMation is displaying a new concept at this show that we believe fits these criteria. We call it the money machine and our expectations are that it will prove to be just that when its advertising potential is properly exploited.

The cost-of-operation problem is met by making the machine automatic in its operations with computer control of all sequencing and control functions, plus random memory access. It can, therefore, operate unattended with periodic update of advertising or program content accomplished by office girls operating the character generator keyboard.

Of the three viability criteria, audience penetration is by far the most difficult to achieve using automatic devices. Our experience in using automatic weather and news presentations as an advertising medium convinces me that news ticker or weather information by themselves or in combination will not attract sufficient viewers and that only a multiplicity of viewer services is attractive enough to do the job.

The money machine provides these services by means of its random access disc memory having a storage capacity of 2,000 character lines, with alpha-numeric characters produced by a broadcast quality character generator.

The control of format, timing and sequence is accomplished by means of a standard mini-computer having a memory capacity of 4,096 words, each of 16 bits duration. With this combination, we are able to store and present sufficient information to attract viewers with many worthwhile features.

Typical features are classified advertising, swap shop, job listings, lost and found, weather forecasts, local news, public service announcements, storm warnings and dozens of others.

Another feature which is expected to be popular with the viewers and of promotional value to the cable system is the program listing capability. Once each hour, the computer will call out the upcoming program schedule of each cable channel, identifying the station call letters and the city of origin, the network affiliation and the cable channel. Schedules of local TV stations will also be presented identifying them with the actual channel they occupy on the cable system.

The slides again please.

This next slide is a block diagram showing the major components that make up the money machine. The computer is the central device in the money machine. It controls the sequencing. It determines the character generator output and its sequence of operation.

The computer also accomplishes all of the computations necessary to interpret the weather phenomena and to make certain computations that are more accurately achieved by computing rather than by sensing. The weather instruments are all specifically designed for digital applications.

A clock calendar is provided to give the computer its input time codes. The clock calendar also resets the rain gauge daily, monthly and yearly. It even has a February 29th recognition capability.

Perhaps the most significant part of this device that makes it a viable advertising medium, so we believe, is the disc memory. 2,000 character lines and the disc memory is accessed during operation by the computer but for programming it is accessed by the keyboard. This is the broadcast keyboard. The operator can address any one line of the 2,000 line capacity disc memory and she can enter any number of lines in sequence instantaneously because both the address and the number of lines are programmed.

There is a capability for a horizontal crawl news wire. In the booth, we're showing the AP news wire which also has 150 stock listings but is capable of using the AP or any of the other news wires or the weather bureau wire service.

The output display is matted, colorized and edged in order to make it more presentable both to the viewer and the advertiser.

The slide scanner is a basic unit built by Sylvania. We replaced the optics in order to improve the colorimetry and noise and obtain a quality of color that we believe is acceptable for this purpose.

Audio is optional. Generally speaking, audio is not, I believe, the proper method of presenting commercial announcements, because it requires a professional announcer, if it's going to be done properly and competitively. Bill Adler, who operates what he calls an electronic newpaper up in Western West Virginia, has taken a similar philosophical approach. He has the character generator supered over his weather channel and his philosophy is that the background music is more important to the obtaining of adequate viewers during the day, or adequate listeners perhaps I should say, and that interruption of the audio would constitute an unnecessary degradation of the system. He, therefore, uses the character generator display of commercials with the data being entered from the keyboard, as we propose here.

The next slide please, or the previous slide.

This is the display format. The calendar generates the input and the computer then the appropriate words. You see it's Friday, July 18, 5:53 a.m., the present weather, temperature now, high and low.

We have in addition to temperature the barometric pressure, the wind direction, wind velocity, both gusts and peak, we compute wind-chill factor by knowing temperature and wind velocity. We compute relative humidity by measuring dewpoint and temperature.

We also have the news wire, shown here, which is a horizontal crawl across the screen, and you'll see here a color slide saying First Security Bank and the copy here, Savings accounts earn 4.5 per cent quarterly, and, Friendly banking at First Security Bank.

The computer coordinates all of the alpha-numeric information which is entered from the keyboard and accessed by the computer from the character generator and the presentation of the slides. So that there is correlation between the slide and the copy.

One of the problems that we have seen in advertising on cable television is that the typical systems do not have the capability or access to laboratories to prepare color slides on a regular basis.

In this concept, the pictures would be taken by the advertising sales person or the sponsor himself and will be of an institutional nature. The copy then can be updated, since it is electronically generated. The copy would be updated on a daily basis by the girl in the office.

This shows the broadcast keyboard. All of the control functions up at the top, the cursor control here and the data entry.

These two windows are LED readouts showing the address on the disc and the number of lines to be entered or accessed. The switch is provided to determine whether it's in the first thousand or second thousand lines and these are controls for just the color matting and video level and the rate of presentation when it's operating in its self-controlled mode.

That's the end of the slides please.

Getting back to the cost per thousand, assuming two per cent rating during the day and one per cent in the evening, the projected revenue potential from sale of commercial ads is over $10,000 yearly on a system of 1,000 drops. The sale of classified ads can add another $3,000 to this figure. The yearly equipment amortization and maintenance will run $4,000 leaving a potential gross income of $9,000 per year to cover sales and production expenses.

It is, therefore, my belief that this development can be a self-sustaining supplementary service on systems as small as 1,000 drops and can be a highly profitable investment for larger systems.

Wally Briscoe -- Our next speaker has had the happy experience during this past week of unveiling something that he and some of his associates have been working on for a long time.

It's a real pleasure to introduce the President of Reston Transmission Corporation, the CATV system in Reston, Virginia, and Vice President of Continental Transmission in St. Louis, Missouri, Frank Drindel.

Frank Drindel -- You know, it's a real pleasure to sit up here and hear everybody talk about blue sky and say that we are or we aren't going to do it and what we can or we can't do. This week at Reston we unveiled a computer-controlled time-shared interactive home terminal. It's in operation in our system. We can put 32,000 channels of digital information on one 6 megaHertz band width.

We have it in operation in our system and you're all invited to go out and see it.

We're working with the Mitre Corporation of McLean, Virginia. Mitre is a non-profit organization dedicated to the advancement of education and social good. We firmly believe that the future of CATV involves giving the educators and the local government channel accessibility so that they may provide all the necessary controls for providing future education.

Let me expand on this for a moment.

Recently, Bill Harley of the National Association of Educational Broadcasters stated that the NAEB should become the public telecommunications centers, that they should control for education and services the future of our industry and our destiny. I don't completely agree with that. I do agree that we must give more channels to the educators and more channel accessibility to all groups who want to make use of our systems.

In order to do this, we must have a system that has this capacity. We are currently operating about 25 software programs in the computer. We have a home-desk calculator which you can interact with. It does square roots, it does all the calculations you could want. We have five CAI, computer assisted educational programs in the computer. We can teach basic mathematics to the children which are now using the computer terminal over the CATV system in the dayschool centers at Reston.

We firmly believe that Continental's involvement with Mitre is a major breakthrough in total communications. We're not talking about tomorrow; we're talking about today.

The cost effectiveness of this system is important for all of us. The terminal, the interactive terminal on a mass produced basis of 100 thousand units will cost $17.00. The computer, the mini-computer that does all the management information, interactive switching and controls the address system which can address each individual subscriber on an interactive basis will run $100,000.

It's backed to a system of a 360 model 50 computer which stores all the memory banks. One 360 model 50 could maintain and access several hundred mini-computers with the capacity to educate on an interactive basis over 250,000 students.

We are managers, gentlemen. There is money in education. Terminal hour usage at the home level will run 10 cents an hour. We can now develop a system to provide for the future of educational TV and entertainment at the same time.

Our 40-channel system at Reston is providing 14 channels of entertainment services now. Considering that we take six of the channels and put them into interactive modes, you're talking sixth power to the 32,000 channels. It's unlimited.

The maximum response time, if everybody accessed the computer at once, is ten seconds, before the computer can access, digest and address the last person that came on line.

I was interested to hear that somebody doesn't believe in meter readings. Well, fortunately, I don't either. We looked at this a long time ago and it costs the power companies $2.25 a year to read a meter. But I am impressed with the decision that we are taking, along with Mitre, to go into power consumption control.

Power companies at peak load periods require 50 per cent extra generating capacity. It's a multi-multi-million dollar investment for them. Through the interactive terminal of the CATV system we can remotely control on a sequential basis water heaters, air conditioners, shutting them off for only a momentary second but we can control the usage of power.

NSP and other power companies have told us that they're willing to pay as much as $100 a year per connection in revenues to produce this type of control so that they may maintain a standard generating capacity. They do not have to build the extra peak load capacity which more than likely 90 per cent of the year is never used. Only in peak wintertime and peak summer loads do they have to go into their extra generating capacity.

From their investment standpoint, the millions of dollars, the loading and the interest on it, they can afford to pay the CATV System this type of revenue.

We do have a few pieces of literature, it's available and I'm hoping that all of you will be able to come to Reston some time. We intend to expand the interactive terminals to over 1800 homes. We will do a marketing study. I'm not God. I don't know what people will pay for this service but we will do a study. We will determine from a market and mathematical model what people are willing to pay.

We are working with educators. How much of the expenditure per student a year can we transfer as revenue for our system? I'm sorry that we can't have a terminal here and I'd like to have one that was in operation but I think the impact is a great deal larger if you see it in a system, if you see it in a person's home and you can actually sit there and interact with it.

If there are any questions, I have a few slides over here, after the meeting I'd like to show you where we are and where we think we're going with it. We have some displays and I'd be glad to answer any questions.

Wally Briscoe -- For those of you who are in the Washington area and might have occasion to want to visit Reston, Ken Chamberlain, why don't you stand up so they'll know who you are, Ken Chamberlain is the manager of the system over in Reston and has been very cooperative in being a tour guide. There's a very exciting capability there.

To conclude our presentations this morning, I'd like to present to you a gentleman who has a little bit different approach to the blue sky in his belief that it's not a matter of some of the technology that has been discussed this morning even, that there's an intermediate blue sky somewhere ahead of us and I think you'll enjoy his presentation and his concept and its practicality.

Geoff Nathanson, President of Optical Systems Corporation of Los Angeles.

Geoffrey Nathanson -- The subject of this panel is most appropriate, coming as it does in the last day of the Convention when all of us should take a sober and very realistic look at the future of our industry.

However, I question just how many of you out there really want to bring the blue sky down to earth. You may be very disappointed. Let's face it, what is technologically possible today may not be economically feasible.

Video telephones were demonstrated many years ago, yet they are still not in use, even for commercial businesses. I mean, after all, like Lyle says, "It's the wired nation, the broadband, the two-way, the meter reading, the burglar proofing, the facsimile and the like that make headlines and keep our stocks selling at big multiples."

I know one thing very simply, these superservices are a factor of the economic size. They could be three, five, ten years away and though experiments are being conducted, I don't know of a single CATV community in the United States that can afford to build a complete two-way headend-to-home communications system and make it pay off.

Most of you out there in the audience are practical CATV businessmen. You have systems to operate, projections to meet, bank loans to retire and certain obligations in the terms and conditions of your respective franchises. What does broadband or two-way communications mean to you?

I can answer that question. I means absolutely nothing unless the expenditure required to rebuild your system is accompanied by a guaranteed return on that investment. What each of you out there is looking for is a method of generating additional income with what you have today, with an absolute minimum expenditure.

Most of you who have tried to support any kind of meaningful program origination through the sale of advertising have had very disappointing experiences. The Buck Rogers stuff will come, I'm sure. However, every concept must walk before it can run, and this industry is already in the position technologically to move beyond the recirculation of conventional television signals.

You have at this moment the capability to offer your subscribers a multitude of additional one-way services via your present unused television channels. That's right, I said one-way services and unused channels. I'm talking about utilizing unused channels in such a manner that they will generate additional income by providing services that are presently unavailable on conventional television.

Some of you may not think you have any empty channels. Well, I'll bet you do. With few exceptions, every 12-channel system has some unused channel capacity. They could be channels that have been going unused because of off-the-air pickup problems or because of a result of non-duplication blackouts. Many operators simply duplicate network programming on more than one channel.

Most new systems are being built with 20 or more channels. Some are even utilizing two cables and talk in terms of 26 to 52 channels. There are individuals, companies, institutions with a need for those unused channels as a means for reaching your CATV customers and they're willing to pay you the cable operator for the privilege of doing it.

I'm advocating a leased channel concept for cable television. I feel strongly and our company is investing millions of dollars on the assumption that every cable operator has unused channel capacity and that there's a tremendous market for the lease of this capacity and for the specialized entertainment and the services that can be transmitted in a single direction.

These channels can and will become a profitable new source of income for cable operators without necessitating the rebuilding of your existing system. I place the leased channel customer in two categories: the man who is interested in open channels; and the man who is interested in private or closed circuit channels.

The open channel customer could be a department store, a supermarket chain, a church group or fraternal organization, a neighborhood or ethnic group that wants to own its own channel.

Some local entrepreneur might want to lease a channel to run classified advertising. Another channel might be used by a radio station that wants to simulcast.

The big potential as I see it, however, is the leasing of private or closed circuit channels. Let me explain what I mean.

Private channels are created by encoding programming at the source of origination and then decoding at the subscriber's television set. This technology has been developed. In order for the subscriber to view this encoded channel, he must have a device which can, through the use of a special decoder, restore both the picture and the sound to their original mode.

Our company has developed an attractive home terminal device which is usually placed on top of the television set. This device can expand the VHF tuner of your television set to accommodate 52 additional channels and each and every one of those channels, through the use of a unique constant memory programming system, can selectively decode any, all or any combination of those 52 channels in accordance with the individual subscriber's preference.

Let me name a few potential private channel customers.

The police and fire departments, for example, in your community can use the private channels for surveillance, emergency alert, precinct video interconnection.

The schools in your town for multiple classroom interconnections.

The banks for interconnection with their branches, for check or credit card verification.

Instead of you, the cable operator, giving away your stock market channel, why not lease it to a brokerage house which might offer it to their customers and only their customers as a bonus for doing business with them?

Private channels can be used by many businesses for interconnection on a closed circuit basis but certainly the most important use of private channels is for educational and instructional purposes.

I go along with Frank as to the importance that our medium must play in this area. Elementary, high school, college, accredited courses can be made available to cable subscribers. In addition, these channels will be used for commercial schools which teach such home study courses as foreign languages, cooking, music, arts and the like.

Home study, whether anybody here is aware of it or not, is one of the country's fastest growing industries. Today over 2 million adults are enrolled in correspondence courses. In the last six years the number of correspondence schools has doubled. Over 95 per cent of these students have television in their homes and with television proving itself to be one of our most effective teaching tools, the people in the home study industry are looking at CATV and the wired nation as the key to the fulfillment of their wildest dreams.

They're excited about CATV's ability to bring a lecture or demonstration to the pupil in his home. Private channel television will not only enhance the teaching effectiveness of their course material; it will provide them with a valuable new marketing tool.

Obviously we can't talk about private CATV channels without going into its potential for bringing entertainment into your subscriber's home that is presently not available on conventional television. If you heard Milt Shapp talk last night, you know that one of these days someone's going to walk into your office and he's going to want to lease one of your private channels to offer first-run motion pictures to your subscribers. He might be the local motion picture theater in your town who has simply discovered that he can open another movie house without putting up a building or buying a piece of real estate.

Some very interesting changes have occurred in the motion picture business during the last five or ten years. I can remember when movies were a family experience and if a picture wasn't seen by 60 or 75 per cent of the people in the community it wasn't considered a success. Today, if a picture attracts 15 or 20 per cent of the potential theater-going audience, it's a blockbuster.

Most pictures that are made today are beamed to a specific audience, young people between 15 and 30. For these people, motion picture attendance is a social experience. Most of these pictures, to appeal to this group are not produced for family consumption.

The producer knows that it's tough to get the working man and his wife over 40 years of age out of the house, to go mingle with the so-called swinging youth set.

Another important reason is that the cost of movies is very high, as much as $2.00 or $3.00 to go to a picture these days. For a father to take his family to the neighborhood motion picture theater it's going to cost him a $10 bill before he gets through, not to mention the buttered popcorn at 50 cents a box and the Pepsis at 25 cents a cup, small size.

On the other hand, the adults are exposed to the publicity, the reviews and the blow-by-blow endorsements of the pictures that they get from their teenagers and they're frustrated about not being willing or able to go to the picture and see it during its initial release. The prospect of waiting three years to see "Love Story" or "Butch Cassidy and the Sundance Kid" on network television is not very consoling.

If they could subscribe to a channel for $5 a month that would bring five different pictures or more a month into their homes, without any commercials and no interruptions, new pictures, in their present release, I don't think they'd pass up the opportunity.

Of course another important use of private channels would be for telecasting closed circuit or blacked out sporting events. CATV today could double the size of that box office. A million people paid $10 to $25 a ticket to see the last heavyweight championship fight in the theaters and auditoriums across this country. An additional 20 million people could have seen it on private channel CATV for a lot less, probably as little as 50 cents a head.

The public is ready and willing to pay directly for programming of a better quality than that available on regular television.

A woman in Flagstaff, Arizona, has as much right as a woman in New York City to see the New York City Ballet without traveling 3,000 miles and the man in Harlem has as much right to see the championship fight as the man on Park Avenue at a price that he can afford.

Let's put blue sky in its proper perspective. Each of you cable television operators is already in a position technologically to move beyond the recirculation of conventional television signals. You have at this moment the capability to offer your subscribers a multitude of additional one-way services via your presently unused channels.

In conclusion, let me say that most operators I've talked to are interested in CATV's ability to generate additional income today, right now. Somehow, while shooting for the moon, the prognosticators in this business overlooked an area of service that can be not only an important source of revenue but one that has a vast social significance.

CATV's open access concept of community involvement and public service needs a base, a foundation. Your unused channels can provide that foundation. I say, leave the blue sky where it is. Continue the experiments. We all need something to reach for. We all need that half a point, Lyle. In the meantime, I urge you to harvest the fruits of present day technology.

If you'll pardon my use of a contemporary expression, leased channels -- the leased channel concept is where it's at.

Wally Briscoe -- I think what you've heard this morning is a very good demonstration of conflicting philosophies all going forward in their own way and it's going to be very interesting to watch the final developments and evolution of the concepts that have been discussed here this morning.

I may also say that if portions of this presentation this morning had a strong commercial sound about them, so be it, because until new ideas generate there's not going to be anybody around to sell them and I think that's part of our point. There are some new ideas, some new concepts ready for the market and I think this panel has very aptly demonstrated that this morning.

DISCUSSION

From the Audience -- I live in Reston and I'm on the cable and I'm curious as to when I can have one of those interactive terminals.

Frank Drindel -- We are planning on having them ready, if we can get production set up, we should be able to get them out to subscribers. Right now we don't plan on charging you anything for it for a market study. Probably by November.

Wally Briscoe -- You have how many in operation now?

Frank Drindel -- Six initially for demonstration.

From the Audience -- What's the charge?

Frank Drindel -- We aren't going to charge at this time. We're going to do a market study. The computer has the ability to retain which programs people are using and at what rate. From that we can do a mathematical model and decide what people will really pay for these services.

"THE EDUCATOR AND CATV: POSSIBILITIES FOR PARTNERSHIP"

Speakers

Emil Proctor
Educational Improvement Center
Pitman, New Jersey

Monroe Price
Sloan Commission on Cable Communications
New York, New York

Mrs. Red Burns
The Alternative Media Center
New York, New York

Robert Mariano
New York University
New York, New York

William Lamb
Sterling Manhattan Cable Co.
New York, New York

Moderator
Mrs. Ethel Greenfield Booth
Beverly Hills, California

Ethel Greenfield Booth -- In the interest of setting the tone of this meeting at the outset, I would like to go on record as applauding NCTA for having invited educators in to talk about education. It takes a certain amount of courage to admit that you may not have all the answers to all the questions. You run the risk, in looking for the answers, that you may find out that you don't even know the questions

Even as the cable industry is undergoing rapid change, so is education and often, as with cable, reluctantly. This afternoon we would like to expose you to that part of it very much involved in bringing about change. We believe you in cable are or should be vitally concerned. We know you've heard from what you may consider to be the educational establishment and you are probably familiar with specific school systems or situations that have frustrated you. Let me assure you your frustration is shared by the school people.

Today we believe that we are going to deal in positive approaches. We want to give you examples of success, philosophical attitudes, ways of assuring some success to all of you, whatever you try to do.

Now, we believe you in cable are or should be vitally interested. We wanted to create a total educational environment and so, in line with some of the newest thinking about how to involve everybody in the process, we not only have panelists on the platform but in two instances we have one member of a team on the platform and the other in the audience. Not only that but in this audience there is, in addition to cable people, a liberal sprinkling of educators and there is no political pun intended.

Along with them, there are also distinguished representatives of Federal agencies concerned with education who are, I believe, great potential contributors on every level to the future of the cable industry, and the double meaning is intended there. So you're surrounded. Nevertheless this is no plot. Everybody is here to talk collaboration, not negotiation or bargaining.

Each one has a special point of view not ordinarily accessible from the same platform to this kind of mixed audience. The mix was deliberate and because I knew that we were trying something that is not often what you expect when you're listening to educators, as you have seen, I've also done something that I never did before. I wrote down what I was saying so that I was absolutely sure to get across the points that I have, I hope, successfully made.

We know that there are people in the audience who, after the brief formal presentations, will be able to talk and will be able to bring about a level of debate that will indeed bring out some of your specific concerns. We hope that from all this will come some greater understanding.

In order not to interrupt the flow of ideas later, I want to identify all our people right now so you can be making mental notes as things go along of whether or not you think there's something here for you. I think there is.

Next to me is Emil Proctor who is the supervisor of educational communications for the Educational Improvement Center, a regional center assisting southern New Jersey public, private and parochial schools to improve education. This agency is funded by the Federal government.

His duties include consultation services in all aspects of television, and developing new and innovative programs for utilization of television in the schools and the community. The approach here is to encourage the use of media as one of many instructional tools, to use it only where it does the job best. That is only one phase of a total educational program.

His teammate is Walter Frees. Walter was television project director of the Willingboro Public Schools, actively involved in developing instructional and public relations programming over CATV. In the folder that NCTA gave you, you will see a reprint of an article which, when it first came to my attention, was what led me directly to these two gentlemen. Walter is the program consultant for cable television in Burlington County.

Our second speaker is Monroe Price. Monroe has been something of a traveler and perhaps this has led to the breadth of vision which he brings to the subject of cable. Born in Austria, professor of law at UCLA, educated at Yale, he has been professional assistant to Secretary of Labor Willard Wirtz, law clerk to Associate Justice Potter Stewart of the United States Supreme Court and on the editorial staff of the American Heritage publishing company.

Now Deputy Director of the Sloan Commission on Cable Communications, he has worked with Indian Affairs, with OEO, law enforcement commissions, organizations dealing with mental health, art and technology. He has written a great deal.

Our next speaker has come to us literally from a bed of pain and I'm going to introduce her but she has requested me to tell you that in the event she cannot carry on we also have an able partner and assistant for her. So let me tell you about Red Burns.

She came to media through the National Film Board of Canada, which has been known to educators for its innovative approach to the use of film initially, and now to television and to cable. Their special contribution has been to encourage communication between groups through the use of media.

Red worked later in commercial television and came to the faculty of the NYU School of the Arts, working with Professor George Stoney, and to the School of Continuing Education. She is community media coordinator for the School of the Arts and executive producer for the Alternate Media Center at NYU, of which you will hear more later.

I didn't realize how appropriate what I wrote down next was going to be. What I wrote was: Red Burns has a mission in life and you will soon find out how you figure in it. You know that she has missionary zeal or she wouldn't be here.

Her partner in this activity is Bobby Mariano, the boy with the video tape camera over there. He is both student and teacher and a vital part of the very unorthodox missionary team. At the moment, in his student and teaching work, he acts as program manager of the NYU Video Tech All-University Experiment in the potential uses of television in higher education, and when Bobby says higher education he uses that term to encompass a lot more than formal college classes.

He's a student at the NYU School of the Arts and a member of the faculty of the School of Continuing Education. Dual identity is no new thing for Bobby. Although he's worked both sides of the fence in school, he's also done it by checking hats and coats at one point at the Loeb Student Center. But he has contributed more significantly to the theater as a performer on Broadway in the original productions of Music Man, Gypsy and Bye Bye Birdie. I hope you're impressed; I am and we will hear from Bobby later and you will see what he's doing, as we go along.

Then we come to Bill Lamb who again is someone known on both sides. I hate to use the word fence because it sounds as if we're involved in fence straddling which I think nobody here will really discover when we start talking.

Bill Lamb is now the president of the Sterling Manhattan Cable Television Company and has been that since May and you may wonder how he got on this panel until I tell you that he was the senior vice president of Channel 13 NET for 9 years, from 1962 to '71, and previously had been with NBC.

He has worked consistently on various professional committees to improve the state of the art for a long time.

I think you can see then that we have a rather different mix this afternoon and I urge you after the actual formal presentations, which will be brief, to get yourselves involved, because that's what we're here for.

Our first presentation will be by Emil Proctor.

<u>Emil Proctor</u> -- Ethel alluded earlier to questions and answers and I suppose at conferences and conventions of this sort, you come to get answers to questions. Of course, that's our game in education. We're always looking for questions and answers to questions and I had an interesting experience I'd like to share with you.

We had a fellow come to me one day and say his company had invented a machine that could give an immediate answer to any question. You know, this is remarkable. We're in the information service business and this would be a complete breakthrough. We wouldn't need teachers, we wouldn't need books, we wouldn't need anything, any of the media. It was a gigantic computer with bulbs and things like that.

I won't mention the name of the company, it's initials were IBM, and being a Czechoslovakian first generation American, we middle Europeans, we're a little skeptical about things like this and so I asked for a demonstration and I thought I would snow this guy a little bit.

My father had passed away about 10 years ago and so I thought I would throw that question at him and I said, Knock out, Where is my father?, on your machine and see what the answer is. So he sat down and he typed away and the answer came out: Your father is fishing in the Delaware River.

Of course I laughed at this. It was absolutely ridiculous. I said, See, you guys, you come in with this big sales pitch. You're wrong. It's an incorrect answer. And he said, That's impossible. This thing has been designed and engineered, it's perfect. It answers every question imaginable. Something must be wrong. Restate your question.

So I thought I would humor him a little bit and I said, Okay and I thought about it for a second and I said: Where is my mother's husband? And he typed out and the machine started all the light bulbs and of course out came the printout and it said: Your mother's husband is dead but your father is still fishing in the Delaware River.

But enough of computer business. Let's look at CATV and education. I wanted to call this thing, "CATV, We love you: Signed, An Educator." Because I think we need CATV very, very badly and honestly I think you need us too. Let's look at why schools need CATV.

First of all, educators, many educators, not all, but many are vitally interested in the school-to-home concept. You know, the living room becomes the classroom. As a matter of fact, by the year 2000 some educators are predicting that the majority of the instruction will take place in the home. So you're a natural there.

Public relations is another reason we need you. It's been researched by PR people that a better informed community supports education and in New Jersey, where we have to vote our bond issues and our budgets every year, we need an enlightened public to support us.

CATV provides a very unique feedback system to educators and we're vitally concerned. We don't have our Nielsen, you know. We have other ways of getting evaluation and feedback.

Last but not least, we need CATV to provide some unusual student experiences and I'll talk about that a little bit later.

But in terms of school-to-home television, the classroom becoming the living room, when I was at Willingboro we went to our CATV people and asked if we could have access to their local channel to try some crazy ideas that we had in mind. We were very interested in pre-school education, getting the kids before they even went to kindergarten. That's a rather hot trend, incidentally, in education. We designed a series of programs called Stepping Stones, which was a pre-school reading readiness program and we knocked out about 16 video tapes, lessons that went into the living rooms. We also gave kits of materials to parents, nothing expensive. Paper and pencil type of things, buttons, utensils that are found the home that could be used for followup experiences.

We had a very interesting experience there too. The second or third lesson the TV teacher said -- we filmed it on location in the community library -- Now, Monday I'm coming to the library in Willingboro and I hope some of you will be there because I'll show you the kiddy section of the library.

Going to work that Monday, I thought I would stop in and see what was going on and, My God, cars were backed up all over the place, cops were out there leading traffic.

I fought my way into the library and it was wall-to-wall kids. The place was jam packed. The librarian and, excuse me, but he was sort of the -- you know, the stereotyped fuddy-duddy type of librarian -- was pulling out his hair and he was going crazy and in the middle was the TV teacher like Santa Claus, surrounded by hundreds of kids and parents. I thought, My God, that's a success. You could easily measure it. There they were live and in living color, these kids.

Willingboro also came up with another idea called Mission Discovery. That's described in that folio. This also went to the homes. We did this a little differently. We established what we called home centers and four or five kids went to that home and that parent became sort of paraprofessional teacher and followed up the lessons with the kids in her home.

They also came up with something that sounds unbelievable. It's called Toy Shop and it was a program designed for pre-school hard-of-hearing kids. Now without audio, how do you put across the television program? It's a rather interesting approach and right now they're planning to experiment with some school-to-home television dealing with drug education.

So in Willingboro they have embraced the school-to-home concept of instruction and are really going ahead, moving with it.

In public relations we did things like Coaches Corner. We rolled our equipment into the shopping center. We asked parents questions -- or they asked us questions -- about schools. Sort of a bitch session. Then the second half of the program we videotaped educators responding to those questions. We called it Shopping for Answers.

We also did programs on the new curriculum programsin the various schools. I won't bore you as to what they are. But again just informing the public as to some of the new things that were going on. Modern Math, for example, was a pretty good series of programs.

We also did a sex education show. Not the one in California that you might be thinking of. This was a little different. We had some kids, teenagers talking about sex ed. and it was a pretty good show.

Then we collaborated with some of the civic organizations, the fire house, the local JCs, etc., which is a little bit of spinoff, I think, we find very valuable in education. We are now involving other community agencies. That's a nice triumvirate: CATV, the schools and the civic groups.

I mentioned earlier the importance of feedback. Sesame Street gets a lot of rave notices and the evaluations showed it was great and it is a great series and when you transmit over the air tens and tens of miles, it's pretty tough to really localize it. With CATV you can follow up by a knock on the living room door and say, How did it go? What's bad about it? What's good about it?

The drug education series that I mentioned, for example. In Willingboro, they have a drug center in town and after programs it's about a five-minute drive to the drug center to get the materials that they need. You just don't get this kind of localized feedback with an over-the-air transmission system.

Last but not least, I mentioned schools need you because of getting kids involved. We're in that business and I don't mean just opportunity for kids to operate equipment or go in front of the camera and be the announcer or talent or something like that. I'm talking about some unique experiences like vocational ed. There are a lot of opportunities in the broadcast industry and in education and we seem to have overlooked the broadcast business in preparing kids.

A couple of schools have taken mentally retarded children and put them on the air with their own ideas as programs and also socially maladjusted and emotionally disturbed kids have produced programs. Can you imagine these kids doing something which is up in the tube in hundreds of living rooms in the community. If that doesn't do something for their psyche I don't know what does.

But we're all enamored with something I haven't been able to identify. I'll just call it the mystique of television. It has some kind of sex appeal. I don't know what it is but the kids really get turned on and when you start getting those kinds that are turned off involved it does wonders for them.

Another reason we need you is a technical reason. Many schools are experimenting with ideas of broadcasting their programs to other schools in their district and they're talking about 2500 MGh or what-have-you. That's a heck of a lot of money. CATV can link all the schools up for them. You guys give them a local channel and they can play a program at any time into all the schools at one time. You're saving them a lot of bucks and we're interested in bucks as much as you are.

Why do you need us? I think it's rather obvious and I won't insult your intelligence. You're out to make sales. You're out to get clients. By having local production, it adds a little pizzazz to your local channel and I'm sure it will attract more customers.

So we need each other. What do we do about it? I'm the assistant superintendent in charge of research and development, who is also intrigued by television. We went to the CATV people. They loved the idea and we worked all those different projects that I mentioned and the ones that they have in the planning stage.

But out in a district where they don't have fellows like this, what can you do to encourage them? You can contact the local educator, set up a meeting, and discuss some possibilities of their using the local channel and in this I suggest you become more knowledgeable about the way education can be used over CATV. Cite some of the examples I mentioned or do a little bit more research in depth.

Invite some classes to your facilities. Zero in on that one or two teachers that you find really turned on and bug you a little bit. You know, how can I get something started like this in my school?

One way to really get people turned on, the Board of Education or the administrator who's a little reluctant, is to volunteer to video tape something rather easy; the Christmas show or a panel show or something in which their faces will appear and then when it's played over CATV you will see their attitudes change drastically.

You can give them some technical support. Let them use your facilities in the beginning, perhaps give them some staff on a volunteer basis. I said, particularly in the beginning, because what they want, their long-range goal is to get their own facilites. They want the local channel.

What else can you do? Educators are always looking for freebies. Once the programs are under way, why not put a nice juicy ad in the paper. You have an example of one in your portfolio there. Why not print the schedule of the various shows?

We had about 3 hours every day at various times and they were good enough to print the schedule in the local newspaper.

Last but not least -- and this may break your heart but think about it for a while -- why not drop a direct line to the school system, to their origination point, so that they don't have to get into their car and run it to your studio every time they want to show something.

I did it for a while. It's a real pain in the neck. Sometimes the door was locked. We couldn't rely on the staff there because they had other commitments. Sometimes they didn't really care about the very serious commitment we have in education and they would come late and we would get the phone calls, not them. So why not? For a few thousand dollars let them have their own origination point. They've got kids that will stay up to all hours to run programs through your system. They've got people. They'll have the equipment there. I had to throw the VTR into my little sports car and I ripped my leather seat. Maybe I'm being prejudiced but no, no. I really mean it.

It would be a hell of a benefit to them if you would drop that transmission line to them so that they could broadcast from the school and not bother you, as far as playback is concerned.

That's my presentation, You've got an ally, you've got a friend and on second thought I think I will call it "CATV, We love you: Signed, An Educator."

Monroe Price -- I just want to talk about some of my reactions to Mr. Proctor's excellent comments and some of their implications for NCTA, and I'd like to start with some of the comments that were made at lunch in a certain sense by Senator McClellan and this prospect of settlement of a copyright agreement and seeing it as a compromise between the broadcast industry and the cable industry.

What I'd like to suggest is that there are other institutions and societies that have a very vital stake in the way that the cable industry grows. And it seems to me shortsighted both on behalf of the cable industry and the broadcast industry to think that this is a pie that they ought to divide and that somehow it is a suitable compromise if the cable industry and the broadcast industry agree on a particular course of action, and that's something that should be shot through the Senate and the House and then legitimated.

What brought this to mind was the comment by an excellent attorney here in Washington, Harry Plotkin, at the last panel on copyright, when he said, We've got to fight the FCC on this origination requirement, we have to fight them on the public access requirement, because if you get their fist into the ballgame they're going to regulate everything that you do.

This would seem to me to be a perspective, if I may, that comes from the first generation of cable and not the second generation of cable. If you want a successful second generation of cable, one that is more in tune with tendencies in the country at this time, you should think in advance of the other institutions which are part of the great compromise which you should reach in terms of fashioning your industry.

In terms of education, I think that there is a very important institution that should be considered. Not only the public schools at the high school and elementary school level but the universities as well.

What NCTA ought to think about is how can cable be structured in such a way that it becomes really an integral part of the educational system in this country? And let me say that I think that is of great importance to the association for the following reasons:

If we're going to have a wired nation and if we're going to have a cable country, it will be because people perceive cable and television as being something which is not a luxury and cable television in particular, which is not a luxury but which is a necessity and education as an institution is one area where it's very easy to see that, if cable becomes a vital part of education and if education becomes a vital part of cable, then everybody really has to have it. It has to be something which, as a matter of Federal policy, must spread throughout the country.

Sesame Street, for example, is now something which is almost a national necessity and it seems to me that a lot of our public attitude toward television will change as we see the need for television and proper television programming in each home.

So I would hope that NCTA, in a sense, instead of making education a minor part of its agenda, instead of kind of exploring it gingerly, tries to see how we can make education and cable or cable and other institutions of society really serious and generous partners.

I think that this will require the kind of experimentation which Mr. Proctor talked about at the local level and a great deal of that needs to be encouraged but it also requires much more creative thinking at the national level, both in the association and in the Federal government.

NHK in Japan, for example, has a very considerable system of supplying vocational training and high school education on a national level over television. On one of its channels several hours a day are devoted to this formal instruction for people who cannot for some reason go to school or who want to work or something else. It's integrated more flexibly into their life.

That kind of attitude is only beginning, I think, with Sesame Street, in the United States. As many of you know, the Children's Television Workshop has now developed a second national television show which will be directed at children who are 4 to 6 years old. It seems to me that we will begin to think of education on a national level at other stages of the educational career.

In my own university, the University of California, we are beginning to think of how extension can be more cleverly delivered to the people of California using television and particularly using cable television.

I notice that the National Cablecasting Services, one of the exhibitors, is cooperating with universities in Michigan in distributing programming and charging subscribers who seek credit. This is something I think should be a matter of high priority for the association.

Secondly, and I'm sure this is something that Red Burns will refer to, is what we think of as the second, as the other or neglected revolution. Cablecasting is really a means of transmission. But what we see happening is a new form of literacy, a kind of video literacy as young people more and more begin to use the kind of camera that this gentleman is using, a very inexpensive, half-inch equipment.

There now is in almost every university in the country and in many high schools inexpensive video equipment being distributed. It seems to me that we will begin to get a kind of video literacy by young people and the question is: How can cable and the transmission capabilities of cable be used in a sense to transmit the information and improve this tendency?

I would say that instead of rejecting the effort in some communities to reserve channels for education, it might be well for the association to urge educators and urge the FCC to reserve channels for education.

I also think that this whole problem of adjusting cable to education and adjusting education to the new technology will be much more difficult than we think. It has been very common in the last several years to try to list fantastic uses of cable television in the schools and in newspapers and things like that.

It turns out there are really significant barriers to institutional change, to modification of old institutions to new technology. We have it even in the adjustment of cable to broadcasting. So if you look at the problems of a school, for example, the vested interests in preserving a particular form of delivering education, the habits that are long ingrained, it's not something that is going to happen over night and it's going to require a great deal of care and a great deal of thought and the kind of work that Mr. Proctor has done in Willingboro, it seems to me, is very important for demonstrating in a careful way what can be done in a particular community.

But it is illusory to think that schools are going to be able quickly to adjust to the new technology. The 1960s is really a decade of vast investment in technology in schools which are underused and nobody knows what to do with it. There are fantastic investments that have been made in taxpayers' money and we really don't know what it all means and it's important that that does not occur in the context of cable.

So it seems to me that, to summarize, you should be both adventurous and cautious. You should seek a vital connection with our educational institutions but you should also do it in a way which illustrates that you realize the institutional barriers that exist.

Mrs. Red Burns -- I was promised by the doctor that he would stabilize what I had. He hasn't stabilized it, so I don't know how long I'm going to last but for how long it is, here I am.

What I wanted to talk about was, as Monroe said, half-inch tape, because I think that that's a whole large area of software that people really haven't been thinking too seriously about. There's been a lot of flak from engineers about the stability, about the problems of half-inch and all kinds of things and at the risk of embarrassing DeLand, who cooperated with us about a month ago, and with half-inch managed to get on the cable for an entire week -- I think it was about 40 hours -- solely using half-inch, a community process which took place in the west Village which was in the Sterling Manhattan Cable area.

We had no roll-over, we had no flop-over. The engineers at the station were very cooperative, as indeed was the station and a community that had really been very reluctant to allow us to cablecast and had said, We don't want the cable, it's a rip-off, and what do we want to do that for?, now suddenly became involved in this process of the cablecast. Because what we did was to take three large monitors and put them on top of a truck. The truck was outside and we cablecast on a two-hour delay. I won't go into the hairy details of the two-hour delay, which was hairy, because every time we started to shoot it was a half-hour till we got to the end of the first tape. It was then another 20 minutes to get it up to the station. Anyway, it all went without any problems at the end.

What I do want to stress is the fact that people came around and looked at the cable. They saw themselves two hours after, in some instances it was only an hour after they had participated in something, and they suddenly got the message of cable in all kinds of ways and I think that perhaps what really happened was we ended up selling cable. People have accused me of being a Stoney salesman and I think now we're becoming a cable salesman as well.

The exciting thing about all this is that this was really what happened. I should give you some of the background. The community had been given $3.6 million to develop a new school facility in Greenwich Village. They evolved an accelerated community, planning process, and what happened was that we went into the community and we gave a port-a-pack, which is that machine over there, to one of the members of the community and taught her how to use it. She in turn taught several other people how to use it and they then began to explore in the community what was going on in relation to people's thought as to the charette itself, the school, the planning.

High school kids used it, parents used it, all kinds of people used it and we suddenly found ourselves with a lot of material which we promptly brought up to Sterling and said, Will you put it on your seven o'clock news? and they said, Certainly and we now had three-minute inserts. It was the first time again that we had managed to put the half-inch directly onto the system. They had two-inch at

Sterling. Here we were with our little port-a-pack. We took the port-a-pack and modified an adapter and hooked it into the two-inch and it went on the cable.

We did this for a week prior to the charette so that what really happened was you had a kind of in-built notion of what was going on and then suddenly the charette itself, which started I guess Friday night about seven-thirty and went on until Sunday night. The cable company cablecast until two-thirty in the morning in each instance and it was a follow through of what had happened in the news and there was really a community cable involvement.

Here was a time when the cable was really serving the community. The community was involved with the cable. Undoubtedly many people will now be buying cable because they begin to understand how the cable really can serve them. The cable has fulfilled its responsibility, if you will, and you have what is really education because you have information that is kind of going out all over.

We are also working with TelePrompTer in the Inwood-Washington Heights Section of Manhattan and there we are going to try to draw a portrait of that community. What is that community? Who are the people that live there? What do they think? How do they feel?

We started in a park and within a very short period of time have really found some marvelous information. We've discovered that there are old people and young people in the park that don't talk to each other; one stays in one place and the other stays in another place and with the use of the video cameras what has been happening is that people have been starting to talk to each other and they're becoming much more involved in each other. This information will go out on the cable. Cable subscribers in Inwood and Washington will be able to see themselves and their neighbors. They too will be very interested and fascinated and again you have the same situation where people are expressing themselves without the interference of professional interpreters and that's really been the hue and cry of everybody; it always has been that everybody has interpreted them to other people.

The professional media have come in for five minutes or ten minutes or whatever and they have purported to understand what the situation is but they really don't and we're talking about with cable, with the use of half-inch -- and half-inch needs a lot of improvement undoubtedly -- but what we're talking about is the fact that it is possible now for people who are not professionals to be able to create programs, to be able to get on the cable, to be able to show themselves to each other and hopefully out of that is that everybody talks about where's the software going to come from.

But we're thinking of software in the old sense, about what software really is. Software is shows. Well, we can talk about novels or letter-writing. Lots of people have lots to say. The thing about the multiplicity of channels is that there is now the possibility of saying it.

Ethel Greenfield Booth -- I am going to call on Bobby Mariano in a moment to amplify some of the things that still remain to be said but for the benefit of so many of you who came in midway and who did not hear the introductory statement, which to me at any rate as the person responsible for putting together this panel -- I want to make the statement over again as to the deliberate intention of this kind of panel.

We took the broadest possible view of what constitutes the educator and I think Red indicated very clearly that to people who think that way, there are no longer walls to a classroom, that the community is the place really where most learning goes on, and that what we're trying to do is bring to everybody, both school people, cable operators, interested adults, children, anybody, the whole idea and the possibility of having experiences through being able to use media.

You may be thinking that what we're talking about again is public access channels. Not entirely. Monroe Price tells us institutions are difficult to move and therefore instead of setting one's sights on the impossible dream which we hope will some day be possible, we have to move in parallel lines as we go along.

Bear this in mind before we get through, and when you ask the questions make them specific because these are people who do start with the philosophical point of view that may be a broader based one than what you normally might hear from a similarly advertised panel.

Bobby, we'd love for you to say something now. Do you want to drop that and come on and tell us how you as a student, rather than as a teacher, evolved into somebody dealing with video tape.

Bobby Mariano -- Over the last 6 months there has been an experiment going on in the potentials of half-inch in education, higher education in particular, at NYU, as an institution and as a community. Some of the problems that we've run into are applicable to communities at large as well as to a large diverse institution like NYU with campuses in uptown New York City, downtown New York City, mid-town Manhattan. First of all, the experiment was completely underwritten by the entire community. It was underwritten by the faculty, the students, and the administration. With that we had in a sense a kind of university equipment with which we started teaching people who were not professional film makers, who were not working with video tapes -- essentially this was students, the staff or administrators, faculty. They would come in, show their ID cards and with that we would show them in a couple of hours how to use the equipment and then they would be able to use it as a new tool. It could be a sociologist or a major in anthropology. The students began to use it during the last semester for making tapes instead of term papers.

People used it to tape senate meetings in the university, the highest governing body in the university and we used it to do projects outside with community students who were doing things for social science classes and so forth.

Out of the broad range of activities, because there was, first of all, no editing board, everything was video-ed from your notes. Any person who shot tape would have the right to be able to edit the tape and then we'd show it in the community center during the day.

We began to discover a number of things right off.

One thing was that as for education and appreciation there were different perspectives. You know, that's my perspective right now: While I'm sitting over here in this chair, this is my perspective of the situation. That's what education is and that's what learning is. It's each person learning, discovering at a particular peculiar moment in time (rather than . . . much of what discussion is going on in higher education and education in general is).

How do you get away from the massified classrooms where the teacher stands up in front, pontificates. If you now make tapes about people standing up front pontificating or giving you the answer all at once and everybody in this room is going to learn that one, this single idea all at one time. This is not the way it happens. This is not the way you learn things in life. You learn at different points at different times.

So this equipment, this technology allows you to learn at your own pace, just as a paperback or a library would. You've got this particular kind of information, let's find out more about this particular field or that. We now can choose.

One of the things that happened right off in the beginning at the NYU experiment was this increased appreciation and diversity of people's perspective. The different ways people would see some things. You would have a group, an SDS group that would see either a segment of society or the administration or the university or education a particular way. The Young Republicans Club would see it another way. Women's Liberation groups would see it another particular way and now they're functioning as a student newspaper or a student radio station.

<u>William Lamb</u> -- One of the things that I found very stimulating, I've only been in cable television for two months, but I was in broadcasting for 15 years before that, and as anyone that comes from a broadcasting background knows, you are put in the position of playing big brother. You always have to make a choice from a wide variety of subjects and producers and material and then you select a very small group of programs to put on the air. In doing that you bring certain judgments to bear and by and large I found that

it is an extremely difficult position to be in. You're never quite sure you have the wisdom. I think that cable television in the two months I've been in it has freed me up in a way that I did not anticipate when I joined.

I knew most of the obvious advantages of cable television, which were to be able to cablecast many programs over a lot of channels, but I didn't realize that I'd have the opportunity to hear a good idea from someone like Red Burns, for example, and then to say, Okay, go and do it. Because basically the channel time is available and they know the community and they have the equipment and we were able to cooperate. I think this is what Bobby Mariano was speaking about.

Now from our standpoint in New York City, we have on our cable system three educational channels, two city channels, which will be educational informational service channels and two public channels, which probably should have some elements of education in the community then.

I'm very excited about the prospects of it and hope that we'll be deeply involved in it. We see, for example, community service education, programs that are intended for neighborhoods that have different needs.

In Manhattan the upper east side is quite different from the lower east side and programs that are attractive to one group at any given time may not be attractive to another. Also special information is needed at different times by different people.

For example, you may have a Puerto Rican enclave in the lower east side. If we could produce programs ourselves for that group, we would be serving them very well in their educational needs, but there's no reason why they couldn't produce the programming themselves and play it back over either our channel or one of the public or city channels.

I see that this is not education necessarily in the formal sense. It doesn't have to be organized by a school or school system or university but, if they will be involved in it too, that's all the better, in the community kind of sense.

I think that we are exploring now very significantly with the city and with universities this type of programming and I hope that some of it will flow from the public itself.

There are programs that can't possibly be shown on commercial television because of their need for mass audiences to support their system. For example, special educational programs for the deaf. No reason why a channel or a part of the day on a channel shouldn't be devoted to the education and informational needs of the deaf and I can just think of that one but I'm sure there are a half a dozen others.

In New York City ethnic programming. There are dozens of different ethnic groups that never see themselves represented on normal broadcast television. Cable television will offer them that opportunity and it would be an educational experience.

I believe there will be great opportunities for testing educational programs. For example, you could test on the west side of your town a program designed to teach children or adults certain subjects with the material organized in one way and on the other side of town teach it with a different set of programs or with different support materials, and see which is the best and then redesign the programs for the future to improve them.

Later on, of course, there'll be two-way communication.

Finally, I think one of the most attractive parts of it, at least for the educational, the formal educational system, is that we can present the efforts and work of students doing films of video tape on our channel or on the public channels in a way that their work could never be shown to their community just in a little school system.

I think this motivates education in a way that has not been done before. We have a community film workshop in which the students go out and produce films. Now they never have a chance to have those films shown on commercial television and this would be a very discouraging result. But by showing it on cable television, they see it on the air, they get reactions from the public and they are motivated to improve their work and later on to develop it in other ways.

In general, I'm very, very excited by the combination of cable television and education in its broadest context.

Ethel Greenfield Booth -- This concludes the formal part but I would be remiss if I didn't once again try to add parenthetically that, of course, there are people who are much more interested in how schools specifically will be involved with cable and I want to point out to you a publication called Schools and Cable Television, which comes out under the auspices of the NEA and AECT. I think one of the distinguished authors, Dr. Harold Wigren, is in the audience and I hope that in the course of the questioning we may get a chance to discuss some of the things that you may still find troubling you or unanswered even after the exciting presentations that our panel made.

I do think they were exciting, don't you agree?

"THE OUTLOOK FOR BROADBAND TELECOMMUNICATIONS 1970-1980"

Speaker

John P. Thompson
Arthur D. Little, Inc.
Cambridge, Massachusetts

Moderator

John Lady
Director of Informational Services
NCTA

John Lady -- John Thompson is a senior member of the staff of Arthur D. Little and has been active in the electronics industry for many years, first with General Electric, then with Hewlett Packard.

At Arthur D. Little he has been particularly active in consumer electronics and telecommunications. He is a past chairman of the Communications and Industries Division of EIA and chaired the committee of EIA that responded to the FCC docket in 18397, Part V, on the future of broadband communications in October 1969.

He also is case leader of the Broadband Communications Network project at ADL. He is not going to talk about that particular project, though, today. He is going to tell us about the optimum cable telecommunications network.

John P. Thompson -- I think I might start by saying that, as Senator McClellan said at lunch, there is a time for study, a time for debate, and a time for action. It looks like, from what Senator McClellan says, we are going to get some action hopefully on regulatory methods and procedures on copyrights.

But what I would like to talk a little about today, I am sorry to say, may lead to a little more planning; at least in my judgment it might be helpful. And I would like to talk about, instead of broadband systems, as this talk was billed for, the optimum cable telecommunication system, as hopefully it may become some day.

And you note the phrase is "telecommunication system," not entertainment system. And I hope you will grasp the difference.

In 18397, Part V, that we filed in October 1969, we recommended that the FCC regarding broadband cable communications should really opt for two systems. One system would be the picturephone system, and it would be for business. And we didn't think that business needed any more than a megahertz band width on picturephone. We didn't think it needed color, because we didn't feel that businessmen needed to watch motion on a picturephone. And we didn't think that any further resolution was needed, because facsimile would be a part of that picturephone network, as well as data.

But then there would be another network that would have a band width of about 300 megahertz.

That network would be a cable network, a two-way cable network, that would bring services, other services to primarily the home, such as we have heard about for many years, like the electronic newspaper and the home shopping services, education, library services and so forth.

And we said that by its very nature, this latter system would be unbalanced, it would be maybe 20 channels of video in one way, but a maximum of three channels or four channels of video back, and primarily the signal coming back would be a response to some kind of a stimulus or the viewer dialing up some type of data bank.

Since that time I have been talking to many people about cable systems, in Europe and Japan and the United States, and I have come to the opinion that maybe there is a chance that we could with cable systems build a two-way switched color video four-megahertz system. Not fully switched, though, but switched on a limited basis. I don't quite see that we will ever get to the point that we would ever want one housewife dialing up another housewife or one home dialing up another home maybe on a four-megahertz video network.

But it seems to me within this decade business, industry, government, public institutions are going to need services like this.

And certainly the telephone communication systems, in the United States anyway, are probably not going to provide anything more than, say a one-megahertz network, and you have seen some of the latest general press articles on Picturephone. Picturephone is not being very well accepted at this point, which is probably not much of a surprise to many people who have been looking at the activities of Bell in the Picturephone area, at least from a marketing standpoint.

One reason that in this filing we were discussing we did not think it would be at all feasible to talk about a fully switched two-way network or even a limited switched two-way network was that the Bell System and associated telephone companies -- I mean independent companies -- are now spending about $9 billion annually on equipment, bricks and mortar and similar capital expenses.

I think it is over ten per cent of all capital spending by business in the United States, and that is just for a voice network. And the voice network is having its problems. Therefore it seems almost utterly ridiculous to talk about a fully switched video network. Yet that is what I am going to talk about.

As a matter of fact, the President's Task Force on Communications said it would cost a trillion dollars to install a fully switched network in the United States. And well it might if the telephone company did it or if we tried to switch every household or every other household.

But to get into the subject further, what I would like to do is describe two cable systems, the one that is typically in use now, of course an FDM system, a frequency division multiplex system or a coax system, branching system, and then later get into an

SDM system, which is a space division multiplex system, and try to show you why I think we might have some opportunities here that we could capitalize on in this decade.

First let's look at the branching type system, and I might briefly describe this.

(Slide) This is a system of this type with a head-in and sort of tree-type configurations. Now there are new systems with 20 channels out and three channels back. The systems typically installed now have about 12 channels out but no return channel.

The system consists of one coax cable and, as I said, the system is frequency division multiplex, which is achieved by putting in various line amplifiers along the cable.

I would like to show you some costs now, estimated costs for systems of this type.

(Slide) Here are some comparisons of cable systems in dollars of investment per subscriber.

Now for a typical 12 channel one-way system now installed, we estimate it will cost about $125 per subscriber of investment; a new 24-channel one-way, about $135; and a new 24-channel two-way, about $140.

I am talking about a 20,000-subscriber system,although I don't think it would vary remarkably, for maybe down to 10, 10 to 20,000 let's say.

From the Audience -- Is that at 100 per cent saturation?

John P. Thompson -- No. 50 per cent saturation, in a suburban area.

These charges would probably be about 30 to 50 per cent higher, I would say, in some place like Manhattan.

From the Audience -- Does that include the subscriber drop and terminal device?

John P. Thompson -- Yes, it includes the drop, but it does not include the head end equipment.

(Slide) To retrofit these systems for full viewer feedback -- and by full viewer feedback I mean a system that the subscriber can respond to a stimuli from the front end of the system with maybe ten characters of information, and also the head end of this system can monitor the subscriber to see what he is watching when, with the permission of the viewer or the terminal owner.

And to retrofit a 12-channel system, we estimate this would cost about $160; a new 24-channel one-way system, $145; and a two-way system -- that's a mistake. It's not $145. Excuse me. My artist must have had a problem with the chart here.

From the Audience -- These are add-ons to your original cost?

John P. Thompson -- Just to retrofit the two-way system, it is only $115, since the other, since the two-way system is already installed.

So the total cost of the system that is in now, for full viewer feedback on a system that is in would finally add up to about $285 per -- of investment per subscriber.

A new system 24-channel one-way retrofitted, would be $280. And then to retrofit the two-way would be $255.

From the Audience -- Based on the way you have explained the costs are you saying that the actual cost for 100 per cent in a system with 12 channels would be $142.50? Are you saying if it's 50 per cent saturation, you double that?

John P. Thompson -- No, I'm not. I just worked this out. We tried to work this out on a 50 per cent saturation. And I don't have numbers on a 100 per cent saturation system, but it could vary up or down.

It might double; it might not double.

From the Audience -- Well, how can you get the 50 figure? That's what I don't understand. You have your first number at $285 total.

John P. Thompson -- Right.

From the Audience -- And you say that that's 50 per cent of saturation. Therefore, if that system were 100 per cent saturated, could I assume that that figure should be $142.50?

John P. Thompson -- No, it doesn't follow.

From the Audience -- What does follow?

John P. Thompson -- If you would like to talk to me about this a little later, I think we have got more things of more importance to talk about than how these figures were arrived at.

From the Audience -- It seems to me it's rather significant, the fundamental numbers, but maybe I'm wrong.

I'll take the time later to discuss it.

John P. Thompson -- Figures are available at various types of saturations for dollars of investment cost per subscriber. These were taken from some studies done by some of the foundations and other people, and I don't have all the data here with me.

But the point is I am going to try to make a comparison between these systems and an STM system and show you what some of the costs look like and then go on to show you how we may be able to justify the difference in cost here and come out with a building block system.

And we could go into the detail on the cost later, if someone is that interested.

Not only at this point in the history of the CATV industry are we thinking really seriously about two-way fully switched systems, but there are really no systems installed with any numbers of terminals that have full viewer feedback, to my knowledge. Maybe one of the larger systems might be 50 to 100 terminals. But we have no systems installed with full viewer feedback that might have 10,000 or 20,000 subscribers.

But I think that with the various studies that are being done, the National Academy of Engineering study which is coming out now, the Sloan Foundation study which will be available in September, the study that Mitre and Jansky & Bailey are doing in Washington, and other studies, and we are going to be convinced that full viewer feedback will pay, that we can provide hardware and software that the public would want and will pay for and that we are going to see these systems develop and be under way in late 1973 or 1974.

But we certainly are going to need a pilot system or two, in my view, to prove that some of these full viewer feedback services will pay.

Now I would like, with your permission, to talk a little about a space division multiplex system.

This is a hubbing type system and this is shown on the -- a quick schematic of it is shown on the next slide.

(Slide) This is a hubbing type system. And for a 20,000-subscriber system you might have 40 of these hubs with 500 people on each hub.

The hubs are connected via video cables. And I didn't say coax purposely, because I am told that we may find something better than coax to use.

But for a 20-channel system, for example, initial installment, there would be 20 cables between each hub, video cables; for 36, there would be 36 between each hub.

And there are switches in each hub to connect the terminal to a particular channel.

And at installation, the line from the hub to the terminal carries is capable of carrying two-way video. But, of course, initially it will be carrying one-way video.

(Slide) Now, this type of a system, with the numbers developed in the same basis as the other type, 50 per cent saturation with 20,000 terminals, comparing these charges to a typical 12-channel one-way system, you will note that the SDM system initially costs almost three times as much as an FDM system, and the total cost -- well, in this case it is a comparison of $370 to $285. So there is quite a bit more money involved. But it is a less amount of additional money if we are beginning to think about and do really begin to install full viewer feedback systems.

<u>From the Audience</u> -- On what do you base those costs? The foundation work that you described earlier?

<u>John P. Thompson</u> -- Some foundation work, some work by the various parties involved in systems of this type, and of course, some of our own work too.

We, of course, also looked at systems of this type as well.

With this type of a system (slide), installing 36 channels, let's say initially, would provide a number of two-way video channels for public, institutions and industry which could be either fully switched two-way video, they could be unbalanced switched, they could be one-way video, they could be data and voice.

And with this extra capacity, it seems that it is possible to me to develop enough additional revenue to justify the additional capital cost of the system.

Now, the interesting thing about this type of a system to me is that once we get it in and once one could get the system loaded with the feedback services, with two-way video and other services, data, then we can go back and frequency-multiplex each channel -- or maybe we will find a better way to multiplex than frequency multiplex -- we could multiplex each one of those channels and so we could add -- If we had initially a 20-channel system, we could ultimately have a 400-channel system. And the system could be installed on an as-needed basis.

And this system also can be adapted to various neighborhood needs or rural area needs.

The NAE study or the Connecticut study is pushing for de-urbanization with telecommunication systems. If a state was trying to de-urbanize an area, it could put in a number of telecommunication services like this in a rural area and hopefully it would get business and other public institutions in those areas.

So this could be a building-block system in which, in my view, we might be able to justify some of these initial major cost differences.

How might we justify these differences?

I think that there is a possibility, based on some of the work that I have seen done, some of the work that we have done, particularly the National Academy of Engineering study, that we might look to business and to public institutions. Undoubtedly, with some of the industry's history so far with schools, we may look some place else but education.

But here are the institutions from the NAE study: city halls, hospitals, nursing homes, schools, vehicular traffic control, colleges, libraries, police stations, fire stations, bus stations, railroad and airports.

I know you're undoubtedly very skeptical about ever getting any money out of public institutions but broadband systems are being installed. The Los Angeles County Sheriff's Office is installing one and some of it is installed already, if not the whole thing, but it will ultimately have 77 microwave stations and the total capital cost is between $5 and $6 million, I understand.

The new Metropolitan Regional Council or Communications Council in New York will have 16 to 17 stations using channels for two-way video conference calls, voice and data, and it's going to have a budget of about a million dollars.

And before you dismiss the fact that you can ever develop revenue from the public institutions in the states, read the NAE report because we've got some most sophisticated citizens from industry, from the academic community and from government who participated with the NAE in its study and you will find that a number of states are extremely interested, according to the report, in really pushing telecommunications for many different reasons.

Some of the cities that they worked with and they obtained enthusiastic support from were Washington, D. C., another one, New York, Nashville, Chicago, Atlanta and Sunnyvale, California. All of these cities and many other ones participated quite actively with the group and were eager to participate.

Now the NAE report recommends quite a number of projects that should be carried out. It doesn't say who should carry out these projects but most all of them could be carried out, I think, by an SDM type system and here are some of the pilot projects that they recommended. Now, wait a minute. Let's go back.

Community telecommunications systems, and this would include a municipal resources management center and community information centers.

Then in education, they recommend two-way educational delivery systems with interactive home terminals and also computer-assisted instruction.

In telecommunications in medical resources they were recommending a telemedicine systems capability study, a rural medical care system and a nursing home medical care project.

In transportation, the specific areas they were talking about were the transit information center, transportation transfer facility and automatic vehicle monitoring, as well as a travel substitution study. In other words, again using telecommunications, moving the idea rather than moving the body.

In crime prevention, they were talking about automatic location and identification, urban security systems with low-light-level TV cameras and pollution sensor development and about three additional projects.

One key factor that this committee didn't look at, however, was what kind of revenue would be generated by these new services, as well as who would put them in and pay for the capital cost.

So I think it would be very worth while if we could generate two studies, one which would look at how much revenue we might be able to generate with this type of an SDM system, and a technical study which would nail down the facts on costs on an SDM system that would determine just how much trunking capacity might be needed that would see if there are some new ways that we could make an FDM system as flexible as an SDM possibly that would see if the cost could not be maybe decreased from the numbers that we have at this point.

One of the other reasons that technical people in the communications area have not even considered a two-way fully switch system is because of the vast trunking band widths that we think would be needed. But in 1973 I understand that new millimeter circular wave guide systems will be available which will carry 120 one-way video channels or 60 two-way video channels and with new developments in fiberoptics it's becoming feasible, it's feasible, technically, right now. Our people tell me that we can develop fiberoptic cables that will allow us to carry laser energy over fiberoptic cables that will have three times the capacity of the circular wave guide systems which would mean 360 one-way video channels or 180 two-way.

So it looks like we might have the technical trunking capacity at the time it would be needed.

So to summarize, today I've tried to illustrate the economic and technical problems a cable operator has in deciding the type of cable system to install. You can see with the numbers I have anyway that it would be difficult to justify a full viewer feed-back system with the tenuous type revenue generation opportunity that seems to develop now but I've said and I think there are going to be enough studies around and experiments going on to prove that this can be justified.

So, to conclude, I propose that we have an opportunity now of starting the telecommunications system of the Twenty-first century maybe in the mid-seventies and I encourage each of you to see and think about what you might be able to do to help generate this type of a system.

"ORIGINATION CONCEPTS -- PROFIT OR PERIL"

Speakers

Conrad Bastow
TV Transmission, Inc.
Lincoln, Nebraska

Leo Hoarty
Buckeye Cablevision
Toledo, Ohio

Robert Bleyer
TelePrompTer-Manhattan CATV
New York, New York

Moderator

Robert Weisberg
TeleMation Program Services
New York, New York

Robert Weisberg -- We have represented here a diversity of markets. We have a major market, New York City. And we have Toledo, Ohio, and we have Lincoln, Nebraska, represented. New York City has forty-some-odd-thousand subscribers; Toledo has 17,000 and growing; Lincoln, Nebraska, has 8,000 to 9,000 subscribers and growing.

Conrad Bastow -- In the three years or so that we have been originating, we have averaged between 90 and 100 hours a week of local originations, which I suppose is a fairly ambitious undertaking, and, in accord with the title to today's Eye Opener, I think we have been through all the perilous parts of program origination and cablecasting, and now we are trying to find some of the profitable parts of it.

We have a unique market circumstance which yields the reason that we got into cablecasting in the first place.

Lincoln, Nebraska, is the 89th largest market in the nation. It has five VHF signals that you can pick up with a wet noodle for an antenna. And of course we got in too late to have any distant signals at that time. So we needed something to offer tantamount to an independent station.

The alternative, to gain subscribers at the outset, to hold them today and to add subscribers in the future, was to originate.

We began, as I say, with a fairly ambitious program, probably too ambitious, some three years ago and have continued with only minor cutbacks in the operation.

We started at about 75 hours; we upped it to a high of around 100 hours a week; and we are now down to about 85 hours a week.

Lest I mislead you, 90 per cent of our program origination is film; about 10 per cent of it is local live or local video tape. We do a tremendous amount of remote cablecasting and we have had what we consider to be profound subscriber success with the cablecast in general.

We have had a lot of subscriber comment. Business is good and we are constantly adding subscribers. Our rate of growth is not profound but it's good. And we can only attribute it to the succes of this miniature low-budget UHF-type independent station that we operate.

We log tightly, much as a broadcaster would, down to second increments. We do sell commercial time. This is a relatively new undertaking for us. We have only been at that about a year. Our original effort was to gain subscribers by offering a diversity of programming, and now we are trying to pick up some money by sustaining that programming with commercial announcements.

I don't know what I can say that would be equal to my two compatriots up here in the way of origination other than that we do a tremendous amount of remote work. Had we had it all to do over again -- we have a sizable investment in studio black and white equipment, as well as color film chain equipment -- I think I would have put that into a remote rig first. Subsequently we did build an elaborate van, remote type, using four plumbicon cameras and two VTR machines and we use it for everything you might think of.

For instance, we do baseball. We do not have a minor league team in Lincoln but we do Legion baseball and high school baseball. We do football, both small college and high school. We do basketball. We had an extremely successful State basketball tournament of which we covered eight games and sold very successfully. We do horse racing. We do tennis. We have done golf. We have done just about every conceivable sport that you can imagine. Sports, we find, merchandise very well. They are probably the best thing that we do.

We do also a number of the items that I guess just about everybody has either considered or already tried: the city council meetings, which don't merchandise worth a plugged nickel; a Sunday church service, which has some subscriber appeal but certainly doesn't gain you, in my opinion, thousands of subscribers, nothing like a State basketball tournament would; a lawn and garden show; a kiddies' show, etc. Nothing particularly imaginative or creative.

I would say that our best success has been the fact that we counter-program, which I understand many of you who either contemplate cable-casting or currently cablecast also do. If these other V's that are coming in there happen to have soaps on all afternoon, that's the time to put on an afternoon movie; if there are no cartoons available for the kids, that's the time to throw in a cartoon; if there is a minimum or no selection of a late night show, that the time for the late night flick. It has been very, very successful.

One thing that we do do that we are very proud of now is that once we have established a reasonably sound schedule, much like a broad-caster would, we come out different from the broadcaster's year; we don't come out in the fall or September with a new program format; we start on a calendar year. And we come out with a basic schedule which we adhere to during the entire year.

Then we take that format and we merchandise the life out of it to attempt to get commercial sponsorship.

We have done so by developing a file folder with our name on it. It is the approximate size of a legal file, which our advertising time salesmen get in the hands of our prospective advertisers. And every time we come out with a show, we put out a flyer on it. It has some of the pics that are available from the film producers; when the slot runs in our routine schedule; why people watch it; and a rating, if it is possible, and they are extremely difficult to get.

We also put them out on our own local live, such as (exhibited flyer) the State basketball tournament that I mentioned. One of a golf match that was sponsored.

We do horse racing on a video tape playback configuration, and it has been extremely successful. Any of you pony players know that it takes a long time to sit through an afternoon of racing. There is, I think, an average of 20-25 minutes pari-mutuel time between each race and so forth. We edit them all out, play the tote before the the pay after. And the actual running of the race in a 9-race card cuts to about a 45-minutes show.

The pony players love it, and a lot of the people who don't play the ponies enjoy the show. It has been easy to sponsor. We have gotten some good national advertisers; Falstaff and Schlitz, potato chip manufacturers, and so forth, have gone for it year in and year out. So it has been a successful item.

Some things have been perilous in sustaining by commercial announcement. There is no way you are going to get somebody to sponsor a church service. I mean that is PSA any way you look at it. There is no way, I feel, that you are going to get good sponsorship of a city council meeting. Now, maybe you have got a fire-and-brimstone city council that is going to draw viewers like a State basketball tournament, but we don't. So it is really PSA too. And we have a difficult time in good conscience getting any kind of a sponsor. We have a difficult time getting any kind of a sponsor even in bad conscience. They just plain are not interested in something that does not draw a lot of viewers.

The more expensive originations are not necessarily the ones that get a great deal of viewers. Our most expensive undertaking so far to date in cablecasting has been the final three holes of golf tournaments, basically local golf tournaments where there is a great deal of local interest.

That is tough. It takes a crew of about 22 to do an adequate job of golf coverage. That makes it an extremely expensive origination.

If you attempt to offset that by sponsorship -- and golf is a panacea for sponsors, as you know -- every time anybody putts, you can throw in a commercial. It takes a tremendous amount of merchandising effort. You have basically a narrow audience. I don't know whether your wives and avid golfers or even have much interest in golf. It is mostly men interested only in golfing. So we found it very difficult to sell, very expensive to produce.

I don't think that there are many sports that we have not attempted to cover in some manner. Some we feel we have done quite professionally; some, unfortunately, are fairly amateurish.

Our marketing effort has been surprisingly successful and we feel that it is very, very possible that -- and I am going to go way out on a limb -- in the next 18 months, we may possibly be able to sustain our entire cablecasting operation off commercial sponsorship.

And keep in mind the first thing I said: The reason we are in the business is because we don't have an independent. We are merely retransmitting pretty much what they receive off the air. So this is the diversity of programming that you all merchandise. The cablecasting channel produces subscribers, creates revenue, and if by any way it can sustain itself through commercial sponsorship, there is no doubt in my mind that it can be a definite plus in your cable operation.

Robert Weisberg -- Thank you very much, Connie.

I remember the first time I went into Connie's market about three and a half years ago to visit with him about programming. I drove from the airport by taxi and I asked the taxi driver about the cable system. And he said, we don't need a cable system here. As Connie said, you do throw up a wet noodle for an antenna and you get reception from Omaha.

I was quite concerned at that time about that system. He began after the first year with a 22 per cent or 20 per cent saturation and it was simply due to the type of origination they were doing in that market.

Connie's system is also famous, I think, as the first cable system to use instantaneous playback at football games. We were used to using a two-man crew in our system many years ago. And I think Connie had about 10 or 12 men at the football games with instantaneous playback three years ago in cable, which is quite something.

Now we are moving into a larger market, Toledo, Ohio, which is a famous system in the sense that they opened up on March 15th, 1966. This was the day of the closing of the grandfathering privilege for systems after the Second Report and Order.

Toledo is the 38th market in the country. If they had opened up a day later, they would not have been able to bring in distant signals. They managed to beat the gun.

The system now has 17,000 subscribers. They have 407 miles of plant and are still growing.

I heard a story about Leo Hoarty's system last night that was interesting. I understand that when they send out mailings from time to time, instead of the regular offset or mimeographed mailings, Leo brings in a crew of 50 people, to handwrite letters: "Dear Neighbor, I have a brother-in-law who happens to have a few evergreens available and if you will join our cable system, he'll be happy to deliver an evergreen and plant it in your garden. Sincerely, Your Neighbor, Leo."

I don't know if this is apocryphal or not true, but this is evidence of the kind of public relations that Leo has been doing in that system over the years.

Leo Hoarty -- The thing that Bob was referring to was a campaign in which we wanted to take down the antennas, an anti-pollution movement. We wanted to plant some trees. So we did give away a little miniature tree. And that campaign has been going on for some time, rather successfully.

We are in a market like Connie's where you have eight off-the-air signals. So it is very competitive and we have to offer something different and it has to be good.

We have been cablecasting about four years, mostly experimentally and with an attempt to create something that would not look silly when compared to the very good television reception that we offer on ten channels.

Consequently, our commercial success in selling this was very, very slow in coming, and we are not in the black yet as far as cablecasting.

But we did do a few interesting things and discovered a few new things that might be of interest to you.

I would say that we follow Connie in many respects. I don't think we have done as much sports as Connie's system. And until he mentioned 22 people, I was embarrassed that it took 20 people to do our first baseball game. I have since been able to cut that down to 14 people. But we are cablecasting live the Toledo Mudhens from the local recreation center ballpark where they play, and this has been a very successful thing for us.

You would be surprised to find out that we've got Pillsbury as a sponsor to co-op a local supermarket to sponsor the Toledo Mudhens when they play the other teams of the International League.

It was costly to do. It took a lot of preparation. We actually had to do a little reconstruction of the ballpark. We had to cut out pieces of fencing and put in some special unbreakable plastic for cameras to be shielded behind.

But by working it out carefully and utilizing a lot of college students from the University of Toledo, we were able to put together a very good looking baseball team live.

In other words, the criteria we use is that you can't tell the difference between our cablecast channel and any of the other stations. It's in black and white, this is the only difference. I can't do it in color.

But I am finding a lot of residual benefits from this. For example, after we got going, about four baseball games later, we worked out a deal with the ball club to allow us to give all of our subscribers two free tickets. Now, a lot of people don't go to baseball games, a lot of people have never been to a baseball game, and a lot of the students we use to cablecast the game we had to train in baseball. A lot of young men have never been to a baseball game, I find.

So we sent out a pair of tickets to the game with the mailing to our subscribers, courtesy of the Mudhens and Buckeye. It was very, very well received. A good percentage of the people used the tickets. It was a nice promotion. I was pleased to give them something. And I did. In one mailing I gave away $40,000 worth of tickets, which didn't really cost us but it helped the ball team and made us look good. It gives us something to be proud of and I think it has really helped us in our subscriber growth. A lot of people have written us letters and talked about it and called us.

But it is not easy to do. We probably won't make a profit. I wasn't even sure we could sell it. But if you tackle it, I have found you can do it.

We are using four cameras to do it. In the beginning, we had so many problems, I had to have a backup man for the four cameramen, and we had a lot of things that we had to take care of.

I am not paying anything for the rights because actually I am doing something that the local television stations don't want to do or can't do. The ball team is very happy to have us. The League President came down and appeared on our channel the first game.

I think baseball in that league, at that level is kind of neglected by broadcasting, and that is why we moved into it.

Now, for the same reason we are running all-night movies. I found that after Johnny Carson and his competitors went off, things went dead on the 10 channels that we have.

So five nights a week we are carrying all-night movies from one a.m. until the stations sign on again, which is around six to six-thirty.

We don't do it on the weekends because that is when television runs all night and we are not in business to reproduce or compete; we are just trying to fill gaps.

The all-night movies we started about eight months ago. I would be afraid to stop it now. In a way I am trapped. But I also can sell it, I found out.

First of all, we are in black and white, as you know, and I can't buy new movies. But we are trying to get quality films of the era that we can touch. In other words, if the film is 20 years old, I would like to have the best film of that year. And it is surprising how many good films are available.

The other night we had "Hamlet" with Laurence Olivier. I'm not saying "Hamlet" is popular, but it appeals to a lot of people.

We are in a factory town, so second-shift workers get home at 11 to 12 at night. They have something to eat and there is nothing to do. And by the time they finish eating and cleaning up, Johnny Carson goes off. So I have that group of second-shift workers that we are appealing to.

And then I discovered a lot of lonely people, a lot of old people, a lot of people who are ill, a lot of people who have nothing to do and they are up and down, they really don't go to bed, a lot of night-time people, people with sick children, some student staying up late studying. And the thing that really surprised me was the number of people who worked during the daytime who would tell me that they couldn't sleep last night and were watching the all-night movie.

It is very popular. In short, I would recommend it if you are in a market where you need promotion, you are in a buyer's market instead of a seller's market as far as cablevision is concerned and where the local stations or the stations you carry are not on all night.

In getting to the cablecasting aspect, like Connie, we do a lot of remotes. It is the most difficult thing to do but it is the most important thing for us to do.

The most surprising sale we made recently. For some reason or other they have an annual weight lifting marathon and it lasts six hours. But it was very well carried out and we went there and did it.

We didn't have a sponsor for it. So we videotaped it and I was quite surprised that last week a local appliance store bought a rerun of that six-hour show, which was condensed to four and a half hours, and paid us $300 for that rerun.

I felt rather grateful for the sale, because we are finding that it is not easy to sell. I mean we are the least desirable channel as far as an advertiser because there are just too many of them. And after you run through three or four TV stations and 20-some radio stations, our advertising salesman has a very tough job selling it.

There are two kinds of markets in this too, a buyer-seller's from a cablevision standpoint and a buyer-seller's market from a cable-casting standpoint. And I will be glad to answer some questions on that later.

We do work very tightly. We are trying to get it down to seconds and we are trying to make it look professional. Frankly, I can't afford to put on anything that doesn't look good. If it doesn't look as good as the local U, I had better not do it.

And I would say, like Connie, we are 80 to 90 per cent film.

Robert Bleyer -- In some areas the problems of my two friends over here are mine too.

What are we doing in New York? What kind of programs do we need? And what makes for subscribers? And what kind of subscribers do we have?

We are split many ways. Our area in Manhattan runs from 79th on the West Side up to 218 and on the East Side, from 86th up to 218. That puts us between the East River and the Hudson River. We have many ethnic groups that we handle. So how do we program?

We do the following. We have black programming, Spanish programming, community news, sports, etc.

This year we started programming a show called "Third World News." This covers both the Spanish and the black market. This is a new show that is run for and by the blacks and the Puerto Ricans. It has been fairly successful for us.

We also have a show called "Lo Mejor de Puerto Rico." I few down to Puerto Rico and found a variety show which I liked very much. We brought it up here and we are playing that.

We do a great deal of community news and community events. This we find very important and find that we get many subscribers from it.

We cover a whole multitude of sports. We do occasionally Irish hurling and soccer on Sundays. We are now doing the New York Cosmos. This is the soccer league which comes from Yankee Stadium. We tape this and play it back the following night. This has been fairly successful for us.

We also cover in sports Columbia University basketball and football. Basketball we go live with; football, there is a delay because of rulings.

We find that we do get an audience on the nights that we play it and we take a whole strip of time, maybe two or three hours. We get many calls on this. The viewers are quite interested in this kind of programming.

We also have bought packages of movies. That is how I met Bob Weisberg. We have bought some what we call very good movies, the Janus package and also the Official package, which is a package of 60 films.

These are played every night. One goes on at eight o'clock and one goes on at ten. This takes us to about midnight. Then we put on our Spanish programming, which goes from 11:30 or 12 o'clock to 1:30.

We have found that this Spanish programming works better in other areas. We find that if we play it from eight to nine-thirty at night on another channel that the viewers -- and this is purely in Spanish -- accept it much more readily because they claim they go to bed at ten or 11 o'clock.

We also brought in another show which we produce ourselves called "Inglés con Rita Madero." This is a show in which we are teaching English to the Spanish-speaking people. This is a half-hour show and this works.

Since our area covers the Irish, the blacks, the Puerto Ricans, the Jews, we try to program for what they want.

I think the name of the game is subscribers and how do you keep them. We try to do it with programming.

We also feel very strongly about community involvement in the kind of news we do and the kinds of things we cover.

Last year we did a thing called the "Harlem Sports Foundation Jamboree" where kids from all over the area came together and had a swimming meet, pole vaulting, jumping, and running. We covered this for four days. It worked. We got subscribers with it.

We also have been doing a lot of work in our studio. We have a studio on 178th Street, which is about 20 x 20 feet. We have three color cameras in it. We have a small site, we have front projection, we have a crawl.

We also have a remote truck which we threw together. This has three black and white television cameras. We go out and do all our remotes. We have found that most of the things we do are not live. We have to tape them because of problems with some of the sports and also in some of our scheduling. We also have problems, even though we shouldn't say this, in getting our signal from an area because of buildings, even with our microwave. So if we have a direct line to site, we can go live; otherwise we tape everything.

We used to program from 11 to 11. We now have changed our program schedule and we start at five in the evening and go to one-thirty. And this is seven days across the board. On Thursday nights we have decided that we are going to make that a cultural night. So what did we do?

We went to the Y's in the area, we went to all the small groups, and we do cable concerts. We do a mini opera in our studio where we bring in a piano and a piano player and opera singers, and in a 20 x 20 studio we do Pagliacci, Tosca, La Boheme, Madame Butterfly.

But it is done on a very small basis, and we just do the arias. And it is amazing the amount of phone calls we get saying more culture, more culture.

The problem is how do you keep a subscriber and what do you do to hold him and what do you really need in a system like New York?

I don't have the money to compete with the other stations, 2, 4, 5, 7, 9, 11, 13; so I have to do it in my own way. And what I try to do is give them things that they would not completely get anywhere else.

We do children's shows, which we have been fairly successful with. We have a show called "Leslie the Schreve." We bring kids from the neighborhood in to the studio or we go out in the park, and she teaches the kids how to do things, a little painting, you know. But I am sure these are things that every other cable system is doing now.

We also have a great thing in the Garden package. We have the Knicks and Rangers. This and some other events that come out of the Garden, I think, have brought us a great deal of subscribers.

Now we'll talk about profit. I don't know what that means really. We are just beginning to sell now our whole package of shows.

I feel that with salesmen we can sell. But how do we price? This, again, is another thing: How do you make a profit? Everything at this point is going out and nothing is coming in.

So what we are trying to do now is sell. We have a thing we call the "TV Guide." That is on another one of our channels. It pinpoints every show that we do and every show that is on any of the other stations. We can put advertising in that.

We also have on the Stock Exchange. That's an alphameric and digital thing where we can put advertising.

But what we are really trying to do is sell chunks of advertising. And I hope that very soon we will be doing that.

Robert Weisberg -- Thank you very much, Bob.

Let's see if I can semi-summarize. Origination of programming is profitable if it has two dimensions: One is the public interest programming. Let me add one thing that Bob didn't mention. They began public access programming in New York City last week. Thursday was, I think, the first official opening of a channel which is open to the community. In New York City anyone can come into the studios and put on a television show.

There is a facilities charge at Sterling which costs $25 just for the taping. I think TelePrompTer does it free uptown. But anyone in the community of New York City now has access to a channel for their programming.

Liability is a problem, of course, but they are working within that problem by prescreening some of the material. And on the very first day there was a narcotics program at Sterling in which there was the use of what formerly were called vulgarities, but in the atmosphere of narcotics these words are common ordinary words and language. And it was surprising but not shocking when this program came on the air that this program was allowed to go on in its entirety, four-letter, five-letter and ten-letter words included, with no telephone calls of objection; on the contrary, I think there was an opening, an opportunity for the community to see some reality that is happening down on the street corner in no matter what area you live in New York City and perhaps in your own community, which I think is a very striking thing that has happened last week in New York City.

Robert Bleyer -- We did six hours of programming. Charlotte Schipp, who is sitting back there, ran that program. We did it in the street in front of the studio. We cordoned off the entire street, brought everybody in, and anybody who had anything to say got up. We taped it. Again, here, we are open to liability, number one. And, number two, God knows what they are going to say. Somebody did come in with a tape that was so bad that I was horrified. There were things in it that were unbelievable, I mean they were completely pornographic.

But we opened the street, we had guests in, we had politicians, we had local groups. Charlotte put the thing together with Mel Bailey and she ran it. How many guests did we have, Charlotte?

Charlotte Schipp -- About 100.

Robert Bleyer -- It turned out to be very interesting. I can see in the future that any group can come up, any group can say what they think. But I think it is going to have to be on tape, otherwise it's going to be a problem.

Robert Weisberg -- You do have the liability problem. There are some insurance policies that may be available. And in New York they are trying to get the city as the franchisee to become partially responsible for what does go on the air.

But what has happened is that the programming has opened up, I think, a new dimension, and free over-the-air television is not doing this.

But certainly we see the first examples here on cable TV, and New York City has suddenly become a very small community town, it is becoming a community-oriented city.

The system must promote and promote and then promote some more to tell the subscribers what they have got on the air and on their channels.

A couple of quick examples. This is from Charleston, West Virginia, with an ad which appears weekly about the feature programs or whatever it is that they have got on the air. Another brochure which goes out to subscribers. This happens to come from Sterling-Manhattan Cable, "Every Night at the Movies," with this box showing the stars that will appear during that week.

All personnel must know what is going on in the origination channel. I have called systems to talk about programming with them and I sometime get the operator and ask what they have on the air and the operator doesn't know what is on the air on the local origination channel.

So all personnel, whether it is the operator, the repairmen, the maintenance men, really have to know what you are doing and they have got to be excited about it.

If the system is going to carry advertising, forget it if you don't bring in a professionally trained man who has sold advertising, whether he has sold advertising for radio or if he has sold advertising for any other medium. I don't think that a Fuller Brush salesman or vacuum cleaner salesman can sell advertising. He might sell subscribers, but he is not going to sell sophisticated advertisers.

All phases of the origination should be professional, not just the cameramen and the shooting. But your graphics, your IDs have to be professional, your promotion and advertising.

You have seen some good examples from Connie. Let me, without mentioning the name of the system, show you just something which I have seen many, many times at systems of poor graphics.

Here is the new "Channel 4 Weekly Program Schedule" starting July 26th only on Cablevision. It doesn't look very professional, it doesn't look exciting.

Research into your market is critical. Program analysis work has to be done. This (exhibited document) is an example of a market survey. The blocked-out areas -- it is a market in Massena that we did -- indicate the children's programs in that market so that we know where to play children's programs in opposition to the stations that don't have them on at that time period.

A more sophisticated kind of research uses ARBs which determine the type of audience, the audience availabilities, their programming preferences. And this is in the larger type market areas that we are moving into.

Profitable systems besides Lincoln and Toledo and New York City: Charleston, West Virginia, where the system says that programming has helped them particularly in the area of retaining subscribers. He doesn't think it has gotten him any new subscribers but he thinks it has retained subscribers for him. That is the area that he is interested in.

In Pensacola, Florida, they have an enormous schedule, opening up at seven in the morning and ending at two the next morning. It's too long, I think. But they seem to be moving along.

They say that cable can compete with prime time, we have been doing it. This is a quote from Bruce Baker at the system. "Last week all subscribers received cards asking them to comment on programming. 400 cards were returned -- that's 10 per cent, which is pretty good -- and the cards cited the actual programming and some of the films or local programs which they saw." Special events. Here is something interesting we haven't talked about yet. They use boxing from Toronto, Chicago, LA. They have played the bullfights which originated live from Spain. They are picking up the Clay-Ellis fight through Top Rank, Incorporated. I understand that there are vendors of that fight. I also understand that there is non-exclusivity on the vendors from that standpoint. I think Top Rank, as being the owner, should be contacted if any of you are interested in doing that.

They are selling local clients on these special programs, at $25 per spot, and they sold 40 commercial spots at $25 each to local clients in the bullfight from Spain last month.

The microwave cost, of course, is high in Pensacola. It's $4,000 a month. But they are just about breaking even. They say, "You've got to get a professional salesman to go out and sell if you're going to do this."

The profitability is going to expand if we think about ourselves as cable and not television. Television programs horizontally. They put on a program at five o'clock every day, Monday to Friday, for children or for adults, if you want to call them adults, at two o'clock in the afternoon with the soaps. And the soaps go on in the morning and so forth. But it's horizontal.

We have an opportunity, and this is just beginning to happen now more significantly, of vertical programming, that is, one channel for children, one channel for perhaps movies, call it a grind house, if you will. But the opportunity to watch movies is important for some people from an entertainment standpoint. A sports channel, a public access channel.

If I want to see something exciting in New York, tune in to Channel 13, "Open Channel," open mike, Monday, Wednesday, Friday, and then see some exciting programming. This public access channel will be a new dimension.

Therefore I would like to suggest the thinking of vertical-channel programming, so that when anybody wants to tune in to a type of program, they know what to tune in to. They don't have to be there at exactly three-thirty to tune in to that type of program.

DISCUSSION

From the Audience -- I want to know if Mr. Hoarty from Toledo could maybe make a comment in regard to his talk in December in Chicago on programming.

Leo Hoarty -- You are referring to our FM, I think.

We used to be all-band and I hated it and the subscribers didn't appreciate it. All-band is really not much better than having an FM radio.

So when the new modulated things made it possible to put each channel on its own piece of equipment, we bought it, and we put on 27 channels. Five of them we made short wave. The Toledo Police Radio is a local thing, hobby. People listen to it. I don't know why. We converted that to an FM frequency and put it on. And it is very popular.

Then we put on BBC, London and Radio Moscow, Armed Forces Radio, and Radio Prague. We have an ethnic group in Toledo, a lot of Polish, German, Lithuanian, Czechoslovakian people. So we started picking out short wave stations that would mean something to them and put them on. It has been very popular.

We have sold several thousand FM connections to people who really don't care about television. It might surprise you, but a lot of people don't have TV still.

So we had something else to sell and it has been very helpful.

From the Audience -- What is your rate on that FM?

Leo Hoarty -- We charge the same things as television. If it is a second set, we charge $5 to install and $1 a month. Since the cable doesn't know what it's hooked to, it costs us the same amount, and we charge the same amount.

We have a lot of FM customers who pay $15 to install and $5 a month.

One short thing on the side benefits of this kind of programming. We announced on June 10th we were going to charter a jet to Las Vegas for three days and four nights, going through a travel agency. When I left a couple of days ago, 110 people had signed up. We are going to make a small profit on that. That is, we are marking up the tour, but we are offering a very good, low-priced tour. And naturally we will send along a cameraman or somebody to bring back a record of that tour and promote it.

As soon as we have booked 143 -- we've got 33 more to go -- we are going to announce a new tour. This tour is announced for November. I'm going to announce one for January, maybe to Israel or somewhere.

But I see a market of tremendous potential for cablevision aside from subscribers. I mean there are other things you can sell.

That is not this subject, but it's something I'm keen on. I am dickering with a large national insurance agency for group insurance at a discount for subscribers. That will give you an idea. I'm dealing with a catalog company that is interested in doing something like that.

One thing I find fault with in my talk is that I realize that some of these things I couldn't do when we had 5,000 subscribers. So it won't apply.

But, on the other hand, I think a small system that doesn't have a lot of television stations in the market that can become the TV station has a greater commercial opportunity than we have, because we can't sell all of what we can do in our market.

From the Audience -- I'd be curious to know what the monthly expense budgets are for origination, if you would care to reveal what they are.

Robert Weisberg -- Connie, can you discuss your expense budget, monthly?

Conrad Bastow -- I would say that it's approximately $8,000 to $10,000.

From the Audience -- How many people are employed?

Conrad Bastow -- There are a total of about 22 but a great many are college students who work on a part-time basis. 16, to be exact, are college students who work on a part-time basis for us.

Robert Weisberg -- Bob, is there any way you can break it down?

Robert Bleyer -- In my origination I have about 30 people. I have two directors, a news man, two reporters, one producer, and 13 or 14 engineers.

In Kankakee, Illinois, the annual budget for programming and manpower runs about $40,000.

In some other markets out west the programming runs annually about between $40,000 to $60,000 per year, including manpower in a small system under 5,000 subscribers.

Some of the systems don't break it down carefully on a cost accounting basis. This is another problem.

Robert Weisberg -- Let me give you a market that hasn't gone on the air yet, Findlay, Ohio, which has about 8,000 subscribers. They're going on the air September 13th. We were discussing the programming yesterday and it seems that a good portion of their advertising is already sold and they project 50 per cent of their costs to be handled by advertising revenue in the first year. That's their projection right now.

They're already sold out for the first 13 weeks and their programming will consist of a good portion of film programming and a good portion of local live programming. The mix is vital. If you don't have the local live, there's no point in just carrying on a pure entertainment channel and vice versa, pure entertainment without local live.

From the Audience -- How are you getting your national advertising? You mentioned Pillsbury.

Conrad Bastow -- Yes. Pillsbury was the Toledo customer but we mentioned beer dealers.

We start with the local affiliate and they generally contact their national. We have not affiliated with a rep of any sort yet, nor have we made any particular ovations to national ad agencies yet. Basically it's the low end up. However, the spots come out of the national place.

Our, let's see, Schlitz spots for the horseracing, which begins on our system tomorrow, came out of Dallas I'd say 48 hours after we signed the deal.

From the Audience -- Connie, in selling your advertising, do you have any breakdown of what per cent of the market you have for each one of the programs that you sold . . .

Conrad Bastow -- We have an analogy to the commercial station's cost per thousand and it troubles me greatly to say it isn't all that much less. I don't think there are many cable operators who are going to be able to sell much on a cost per thousand basis compared to a commercial medium of any sort, even radio or particularly commercial television.

The second part of your question is no, I do not have a good measurement of percentage of audience that I can guarantee this advertiser I'm going to deliver him. If I could say, I'll deliver you 10 per cent of the television sets in the City of Lincoln, Nebraska, from ten-thirty till midnight on Monday evening, it would be a great asset. I do not have that kind of information available.

From the Audience -- Don't you find out that most of the people who are considering buying your time want something concrete to put their finger on . . .

Conrad Bastow -- We're cheap enough so that they are not that concerned and by that I mean, let's say, our local prime time commercial the 4-A time, goes at about $162 a minute, which is high for that size market. The 89th market. We get $10 a minute, plus production. So basically, he's willing to settle for the fact that he knows we're not going to get to the same market in numbers but for $10 he'll gamble.

Robert Weisberg -- I don't know of any system that uses cost per thousand. I think, if we did, we'd end up with a $10 to $15 to $20 cost per thousand. It would be much too high. We've got to find new ways to sell the time.

From the Audience -- Connie, are your salesmen able to gather any information back on the advertising on how successful you have been?

Conrad Bastow -- A good question.

Yes, some. When we first began with this, we attempted several sponsorship arrangements whereby the sponsor would agree to, let's say, give something away or make a store special or something like that and merchandise it only on our channel to give some sort of a measurement.

Here I think you've got to keep in mind our comparative sizes of systems and audience and everything. I'm the little guy, you know of these three operators here. We merchandised on a two-day ROS 40 spot schedule an open house at a boat dealer and he agreed to give away at I believe his cost or slightly below, which was like a dollar or $1.25, a ski rope, one ski rope to everybody who said, "Hey, I saw you ad on cable TV. I want a ski rope." And he agreed to do that for I think 150 ropes or something like that. They were gone by the beginning of the second day of the open house.

So we know that we delivered him at least 150 bodies through this front door and that was worth something to him. I think he felt he got his money's worth.

"MARKETING -- STATE OF THE ART"

Speakers

Burt Kittay
Markit Communications, Inc.
Los Angeles, California

Irwin Polinsky
Sterling Manhatten Cable Television
New York, New York

Ben Kittay
National TeleMarketing, Inc.
Los Angeles, California

Richard Vance
Television Communications Corp.
New York, New York

Mark Van Loucks
CATV Marketing, Inc.
Walnut Creek, California

Moderator

Jack Gault
American Television & Communications Corp.
Denver, Colorado

Jack Gault -- There are many panels, as you have noticed, on the program that deal with various aspects of marketing, sales, additional services, ways of making money through the ownership and operation of a CATV system.

But this panel is primarily concerned with marketing as you know it as a system owner, manager, operator, home office assistant, aide or whatever. We have tried to gather here some of the leading experts in the field of marketing as we know it today to discuss programming, direct sales, dealer tie-ins, and other marketing concepts that I hope you will find interesting.

I would like to get right into our presentations by introducing Burt Kittay, who is President of Markit Communications, a Los Angeles-based marketing firm which serves CATV. He has been in the industry for over four years now. Before forming Markit with Jeff Marcus he was Manager of Television Presentations, a subsidiary of Sterling Communication.

Burt Kittay -- There are many ways people get to be consultants in an industry. Most of the people on this panel became marketing consultants by way of traveling to a lot of systems and learning about a lot of systems and learning a general pattern that can make a system work.

There are many different answers. Some panels at this convention are going to speak about the importance of the engineering area in tying a system together.

Our feeling, I think is that marketing ties it together. We feel that marketing is the essence of the cable experience, and I am going to speak on one phase of it. And that phase is the after-sale followup.

People in this room, many men, are wearing ties. I would imagine that whenever you bought that tie or the suit that the next day you didn't receive a telephone call from the salesman who sold you that tie or sold you that suit. Every now and then somebody cares enough about the product that they sold you to ask you about it.

Many cable television operators are finding that this is a way to solidify a long-term subscriber. We have found in our experience that following up with a subscriber assures the fact that he is going to stay with you, because the name of the game is long-term subscribers.

The importance of the after-sale followup call relates to the fact that marketing and CATV are sort of intangible areas. Until somebody has cable in their home, they don't really know what it is.

And, as many of you know, if you have antenna television on Tuesday and cable television on Wednesday, by Thursday, you can't really tell the difference. For the homeowner, it's already vague in his mind.

Therefore, I would like to just simply stress that, no matter what kind of marketing you go through, follow up with a subscriber after installation to let him know what he has, what the difference is and how it is going to serve him and, most important, your interest in continuing to serve him. Because if you show him this interest, he certainly is going to stay with you for a long time.

<u>Jack Gault</u> -- We have with us today Irwin Polinsky, who is taking the place of Chuck Dolan. Irwin is an attorney who has been with Sterling Manhattan for over three years as Real Estate Director and Director of Marketing and now is General Counsel and Vice President with operational duties for Sterling in Manhattan.

<u>Irwin Polinsky</u> -- We had to develop many new techniques in wiring New York City. I won't dwell on those techniques, but we had to in effect introduce a new product which was unheard of in a large city, build a plant and sell it, all simultaneously.

We developed techniques that involved direct telephone solicitation, direct mailing, some attempt to do door-to-door solicitation, which is fairly standard in suburban systems but to some extent not exactly feasible necessarily in large systems in the cities.

But I would like to dwell a little on programming as programming will affect CATV systems.

We started a system in the city where reception was very poor, notoriously poor, and with the construction of two very large Towers, was expected to get very bad. The city had seven VHFs and five UHFs, so that there was an adequate number of channels, something that very often is lacked, let's say in a suburban system, but there was very poor reception.

But here and there we noticed that we were hitting buildings where there was excellent reception on master antennas and other means of reception. And we were not getting very great sales penetration.

We made arrangements for movies uninterrupted by commercials. We obtained films which were classics, "Rashomon" and other old but classical films.

We noticed almost immediately after that, within a few days, an upsurge in the amount of sales that we were making. We were the first ones to sign the Madison Square Garden package, which consisted of 125 sporting events from Madison Square Garden, which were the Knick and Ranger home games and playoff games, horse shows, dog shows, etc. That was enormously successful, to the extent that we sign up buildings now 100 per cent, where we send one bill to a building that has 300 tenants. We don't bill all the tenants, just the manager of the building. But he is back billing all the tenants.

And that is because, we think, of the programming, not only the question of reception, because there are people who get good reception, but they have all gone along for the ride.

We think that the role of programming in the future will be very key to obtaining customers, to obtaining funds, revenue.

We think that ultimately in one way or another this is going to have to be paid for by the subscriber. We are going to have to do a certain amount of public service broadcasting.

We just opened up four new channels in New York. Two belong to the city for municipal purposes, and two belong to the public. The time on the channels is free if they are public service oriented. The time on the channels is paid for at nominal amounts if they are of some public interest, but not necessarily public oriented.

So that the other types of programming, the commercial programming, is going to have to pay for this type of programming.

But just to sum up very briefly, we have found very dramatic experiences with new forms of programming and we expect to see much more dramatic experiences in the future with that.

Jack Gault -- We now have Ben Kittay, who is President of National TeleMarketing, Incorporated, located in Los Angeles, California. Ben was previsousy in real estate with Tishman Realty and he was also with a market organization where he became Director of Operations.

He formed National TeleMarketing in April of 1971, which is presently marketing in 37 communities throughout the country.

Ben Kittay -- A few years ago in this town a gentleman named Martin Luther King had a statement to make that he had a dream, and I believe that is why we are all here. We have a dream of seeing a wired country from one end to the other.

I think the key to this is basically marketing and programming, but a combination of everything that we can do.

Presently most of us are in the door-to-door sales organizations, along with mailers or one or two other factors. But I think to facilitate getting cable across the country is going to take more than what we are doing right now. It is going to take a combination of your efforts and our efforts and going into other things such as newspaper advertising, promotional, billboard, direct mailers, door-to-door and combining all in one program rather than individual programs as most of us seem to have a tendency to do thus far.

The basic idea is to bring a momentum to a town or a total saturation where every day there is something that everyone will see which will bring cable to their eyes, to basically go out and saturate a town as quickly as possible and as expeditiously as possible, to place concentration on the followup campaign after the sale, to bring the sales in with the soft sell because we have a lot to offer in our industry to bring local origination into play where it is needed, to bring extra channels, if the FCC does allow us to, from other communities and things of interest.

I think our greatest failing so far has been that each of us in our own way has gone after one segment of the market in one specific way and then gone into the next market after we felt we had reached the cream of that particular saturation through that particular way of marketing.

I think that the future, if we want to facilitate going after a total package throughout the country, is going to have to be a combination of all these things, rather than one at a time; rather than just sending out a mail campaign and newspaper campaign in the beginning, to go with the door-to-door campaign in the beginning, to go with the promotional giveaways, to go with the direct mailers and everything else that ties in.

Jack Gault -- Dick Vance has had long experience in franchising for several consumer products and in 1966 he entered cable television as Sales Manager for the Imperial Broadcasting Company in Ohio. In September of 1969 he joined TVC, which is Television Communications Corporation, as the Sales Manager for Akron Cablevision. In July of 1970 he was promoted to TVC's Sales Coordinatorship and just recently he has been appointed to a staff position with Television Communications Corporation as TVC's National Sales Director.

Richard Vance -- I think one of the most frequent questions that is asked me when anyone visits our system is,"What makes a successful sales organization?"

Each of you gentlemen probably has some type of direct sales organization in your individual system. And the primary thing that I think makes a successful sales organization is control.

We can find all types of salesmen to work for us who have been in every field you can possibly imagine. But the downfall of most men is the fact that they cannot control their time. They make a little dollar here or there, and they are done for the week.

Make sure that you know at all times what your representatives out there in the field are doing, controlling how many homes they are able to contact, controlling how many homes you give them. If they do not contact each and every home, they don't get any more work; if they don't get any more work, they don't make any more money, controlling to the point where they must contact each and every home.

We make sure that we hire experienced men who primarily have been in consumer products, people who have had to beat the doors before, people who are honest.

I think we have an industry we don't have to lie about, we can tell 100 per cent truth.

So if you go into marketing in your organization in the direct sales field, make sure that you know what those men are doing, that they make a good dollar. If they make a good dollar, you can force them to do what you want them to do and explain it the way you want it explained.

I have been very fortunate in the past seven years in that I have never had a man quit me, which is phenomenal really in a great sales organization. But I make sure that they do make a good buck, more than they can make anywhere else, and for this reason they have given me a lot of loyalty and they would give you a lot of loyalty.

Jack Gault -- We now have Mark Van Loucks, who is President of CATV Marketing, Incorporated, which he says was the industry's first direct sales company. CATV Marketing began over four years ago and has since served over 200 systems in 39 states. I might say that our company has used Mark's services.

Mark Van Loucks -- We have been on approximately 400,000 door-steps and made about 200,000 sales in every market you can imagine and a few we both can't imagine. And we are still learning the business.

People will fool you from market to market from time to time. The basic concept behind the advertising program that precedes the knock on the door is a direct stimulus that will introduce the salesman, introduce the product and the service.

Let me tell you the biggest secret of our business in my opinion, that it is not difficult to make a sale, for the most part. But what is difficult is to enter into a dialogue with the potential customer, to get him to sit down and listen to you for five minutes, ten minutes, fifteen, whatever it is. That is the difficult part.

And that is the purpose of the direct mail program, to encourage the potential customer to give you an opportunity to discuss cable with him.

Within that concept, then, the greatest marketing tools that you can have for an advertising campaign are some very direct things: honest, originality and humor.

It is a matter of marketing sophistication and, by the way, common courtesy, whereby you prepare a potential customer for the knock on the door.

And further, what is most appropriate here is the fine relationship that you can establish through an advertising campaign even with those people who might reject the service to begin with, because they will come back later if you have made a good impression.

A direct sales campaign without a concurrent public relations campaign of some sort is really a short-lived shot in the arm and it will soon dwindle.

Let me show you one of our programs. This particular campaign was developed for the Cox Cable Communications System in San Diego, California. Notice as we go through it that there is a general outline to the campaign.

It's a series of three letters, and the first is designed to tease the customer about service. It says nothing except that there is something exciting coming in the mail and to watch for it.

The second letter give a little bit more information but is still a teaser.

The third letter, as you will see, gives all the information.

In this particular market everyone knew about cable television, so ours was not the job of educating them necessarily, but, if you will, to get them involved, to tease them to get them interested in discussing service with the cable salesman.

Jack Gault -- Before we start, the format will be that Mark's presentation will go on now, and then I am going to make some remarks, and then we are going to discuss some things between ourselves, with questions directed from one toward another, and then we would like to throw this open totally to the audience who may direct questions to the panel as a whole or to individuals on the panel.

Mark Van Loucks -- (Slide) The first letter that a potential subscriber would receive in this particular market. Notice that there is no identification of cable TV here at all. This is a teaser. We don't want to discuss cable TV until the knock on the door. So it says Mission Cable Headquarters.

The name of this particular system is Mission Cable TV. So we designed a program around the Mission Impossible television campaign, which was very popular at this time in this particular market. And this set of mailers involving secret missions, spies, and so on.

This is the envelope. Inside this envelope is another envelope, and inside that envelope is another one.

I don't know if you can read it in the back. It says: Soon you will receive an important message from Mission C Headquarters. Watch your mailbox closely. Bronze Finger.

Now, obviously, again this says nothing about any product at all. We want to get them involved with the service very casually and very subtly. We want to build that involvement and build that interest until the knock on the door.

Timing is the most crucial thing, I think, in selling anything, and certainly a direct sale.

(Slide) The second letter is a self-mailer. It is a diecut and it is a secret spy-agent standing holding his coat closed and the seal across his coat is a little seal that is broken to open it.

The back is where the addressing label goes, and he has his supply of hot air and miracle liquid and telephone and so on.

The customer opens the front of the coat and reads this message: There is not much time. You must act quickly. Go to your television set and turn it on, flip through all 12 channels and carefully note what is missing. This information is of vital importance in your next assignment. Await further instructions to follow in the mail. Bronze Finger.

Now, again we know what is missing. The potential customer doesn't.

(Slide) The third mailer is a rather large mailer and surprisingly inexpensive, although it is not going to appear so.

It is a large envelope. Down at the bottom it says Top Secret Record and Confidential Materials Enclosed. And in the envelope there are two items, a record and a set of secret material.

(Slide) This is the inside front cover. I'm sorry that the photographer didn't take this the way he should have. But this is the inside front cover of the record. You can see the hole right here. And up here the spy is reading his instructions, which include how to play the record. It's a regular phonograph record, 33-1/3 RPM. And it says: Adjust sound level to insure that only authorized persons may hear. Listen carefully, and so on.

(Slide) The inside back cover of the piece is the record. These are surprisingly inexpensive. As with anything, in advertising promotion you can get horribly expensive or you can use your head and do some careful planning and keep your costs way down.

These sound sheets are about eight or nine cents apiece in mass production.

You can't see it, but right here is a note and it says: Note: This record will not self-destruct in five seconds, it's too darned expensive.

And then the person just plays the record, as I am about to here.

Also with the record is another envelope -- (Slide) This is the front of it -- with secret materials and the inscription: Do not open until instructed to do so by the record, please, or you will blow our whole advertising campaign.

There is an important concept there too. I'm sure we are all experienced with salesmen who for the half hour that they are with us totally sell us, they never get out of the selling mood, they never let up for a moment.

In direct consumer sales it is very important that you shift gears, that you are big enough, if you will, or able enough to stand back with the consumer and sort of take a quick laugh and then get back into selling. It's very important.

Now, hopefully the guy won't open the envelope, as we won't open the envelope, because I've got the switch, until the record says to.

Now, as we play the record, listen carefully. I am going to tell you some things that I think are surprising when it is completed.

(Playing of record.)

Sure, we are trying to sell you something. I guess everyone in the world is, but we're trying to do it a little bit differently.

This is a rather sophisticated market. There is a lot of humor in the record that is only specific to that market. Ronald Reagan, for example, is quoted in there, and that is a very contemporary issue these days, for you folks who are not from California.

Let me give you an example of how cost can be spared with some adequate planning.

We had to reproduce, if you will, the spy theme, the Mission Impossible them, which, of course, was written and is owned by Henry Mancini, and lest we get sued, we needed to get somebody's permission.

They did not give us permission to use their theme, so we had to change one or two bars of the musical score. We went to a professional orchestration group in San Francisco and they wanted $10,000 to rewrite those two bars, believe it or not, and another $5,000 to have a professional orchestra record it.

Somebody in the group, I forget who it was, got the idea to go to a high school orchestra, which we did. And for a total cost of $100 for the musical conductor, we got the score rewritten just a slight bit, and for a total contribution of $200 to the school's trumpet fund, we got the high school to record that, and the orchestra you hear on that is sophomores and juniors in high school.

So there are many things in the record that are that way in terms of production.

And, again, if you take the time to plan and shop around, you would be surprised at what you can save.

Now, with this particular campaign the proof is in the pudding, and, as with all these mailing campaigns, we follow up with a knock on the door.

The San Diego system was about 35 per cent saturated and it had about 31 subscribers in June of last year when we first entered this system. We were there eight months, and we added net -- not gross -- we added 12,000 sales to the system in the period of eight months.

What is more dramatic than the sales that were added, than the money involved, is the public relations. The cable system received a lot of letters from subscribers saying that maybe I signed up for the service, maybe I didn't, but I was interested enough to bother.

I have one other program to show you which is a much shorter one than this.

You have probably read in recent Look Magazine articles about Kissimmee, Florida. Kissimmee, Florida, is an old sleepy town that is about to be inundated by a huge industrial complex, namely Disney World. Disney World is being constructed near this city in Florida, bringing in 30,000, 40,000, 50,000 employees and so on into this rather isolated community.

Kissimmee is an ATC system. It sits about 30 to 40 miles south of Orlando and it has one thing in common with everyone that is in Kissimmee, and that is that they are there to be left alone. They have either retired from their New York or Chicago business life, they have a lot of money and they want to spend the rest of their days boating in Kissimmee, or they are older people who have grown up there and lived all their lives.

The point is that they are very, very much afraid of the new Disney complex that is coming in and what it will bring in terms of this community, and they are also a very, very old community.

So the concept we developed here -- and, of course, again realize this is just specific to one community only. The concept we developed here is a "Remember the good old days" concept.

(Slide) Now, here, since this is a brand new system, and since most people don't know about cable television, this is less of a teaser campaign and more of a three-part educational campaign.

There are three different presentations in these letters. The first stresses the value of cable TV. The second one stresses the origination concept, and the third one stresses the offer itself.

(Slide) This is the envelope of the first letter. And inside the envelope is this piece here. Now, this is the front cover of the piece:

"Remember when a nickel was really a nickel and two of them could get you into the movie house? Gone are the days of Bogart, Fairbanks, Garbo and Chaplin and the ten cent movie house where you could spend an afternoon watching them. It's pretty darn hard nowadays to find an entertainment bargain as good as that. But it's not gone. We have brought it back with cablevision.

"Yes, cable TV is under construction right now in Kissimmee, Florida," and the copy goes on to describe cable TV in general terms. And it ends with: "And cable TV is priced like those old time movies. When it comes to the entertainment value of folks with nickels and dimes, we are 30 years behind the times."

This is the general format of the piece that I am reading to you. (Slide)

The second piece, again the same kind of envelope. That is a baseball dugout, an old time picture of a baseball dugout.

(Slide) This is the cover of the piece inside.

(Slide) And this is a group of fellows sitting around an old potbelly stove talking about things.

The copy is: Remember when folks had the time to reallly talk to one another?

(Slide) And here is the copy: There was a day when you could give the first name of just about everyone in town. Yeah, and folks knew about almost everything that was going on. Somewhere we have lost that old way, the way of people-to-people talking and listening where ideas and experiences were shared with every-body. What we need is a community television station just for the folks in Kissimmee and cable TV has brought it to us.

Construction is under way right now for Kissimmee's own TV studio. And then the copy goes on to explain what kinds of things cable TV can bring: your neighbor's son playing the guitar, the church choir singing, just neighborhood goings-on. Come on down to our studio and help us develop Kissimmee's own TV station. We will welcome your suggestions.

And the leadout sentence is: When it comes to communicating with out neighbors, we're 30 years behind the times.

(Slide) The last piece. A scene in an old time barber shop on the envelope.

Again notice there is no return address on any of these pieces. We don't want them to get directly involved in the cable dialogue until the knock on the door.

(Slide) The envelope and inside front cover of this piece has this picture on it.

By the way, there is a very, very strong VFW and other military organizations in Kissimmee, Florida. They are very proud of that heritage and there is a little subtle selling on here. As you can see, those are military outfits, and in the back there, I wonder if anybody recognizes that old time movie actor.

<u>A Voice</u> -- Gary Cooper.

<u>Mark Van Loucks</u> -- Right.

This particular piece, since it immediately precedes the knock on the door, is going to emphasize the offer itself.

"Remember when a deal was made with a handshake and that was good enough? We remember that kind of sincerity and trust too. Maybe that is why we place a high value on the kind of dealing where people can talk face to face. They can talk face to face so that when a deal is made, they can both feel confident they have come out ahead.

"In the next few days one of the people who works for us will stop by to chat with you about Kissimmee's new cable television service. He will tell you the whole cable TV story and answer any questions you may have. It is a fascinating thing this cable television. Give him a few minutes of your time. You'll be surprised."

Now, the copy up here reads: "He will also tell you about our deal, one you can really feel confident about." And in this brown square is the installation charge, the monthly charge and so on, the offer itself.

The copy over here is: "Well, there you are. There are no catches, no gimmicks, no contracts to sign, nothing fancy, just a sincere deal to try a fine service. When it comes to dealing with our neighbors, we are 30 years behind the times and proud of it."

Now, again, timing is the most crucial concept, we think, in selling. So immediately after these third pieces, whatever the campaign is, there is a knock on the door.

And of course these mailings are structured very carefully so that we can follow them up within a day or two at the most.

The last comment I would have to make, and I think it would be shared by everyone on the panel who is in marketing in this industry is that, as I opened by saying, it's a fascinating business, the industry as such, marketing cable television as such.

And I think we should always keep in mind that we are an industry of new ideas and we should always welcome new ideas and try anything that is new and different, especially in marketing.

I am reminded of a slogan we have in our company about this particular matter: A man who always has his feet firmly planted on the ground has trouble getting his pants on.

Jack Gault -- I would like to sum up the remarks that these gentlemen have made today by talking to each one of you who are all faced with different problems: the small CATV operator; the multiple system operator; the operator who is involved in a major city around the country that already has five or six signals of television; and the operator who is going into a community that may only have three UHF stations that don't provide adequate service into the market.

We presently serve less than 12 per cent of the entire country. From what these gentlemen have been talking about, preludes, the explosion -- and that word was used four times in the FCC's Second Report and Order -- the explosion of cable television upon the American scene. But not one of you, except in very, very rare instances is going to be able to sit back and go into a market and watch the people knock down your doors, unless you do something about it.

And to do something about it, you have to begin with the basics, including those of you who are sitting here today with 80 per cent saturated systems stuck some place in the hills of East Wherever.

You must identify your markets. You must understand yourself what it is that you are going to sell. You can call Burt and you can call Ben and you can call Mark to come in and sell, and each one of them, I am sure, will do a fine job. But they are going to leave some day and you are going to be there, and it is up to you to keep the customers that they have gotten for you.

In some instances you want to go out and get the customers yourselves. So I am going to repeat some things that seem so basic they shouldn't need repeating. But I will anyway.

You are selling pictures. You are selling service. Cable television is a service business. You are selling programming, which Irwin directed himself to.

This is a relatively new concept, to sell programming to get people on.

And you are not only going to be selling programming that didn't exist five or six years ago, you are going to be creating programs.

You are going to be creating local origination for profit. It has been very difficult to do that up to this point in time, but we are now going to go into the markets where it is possible to create local programming and sell advertising, where it is going to be possible in New York City to create programming by getting hold of the New York Rangers' and the Knickerbockers' games and a hundred events from Madison Square Garden and to get programs from Philadelphia and Cincinnati and Chicago and put them onto a CATV network that will interconnect most of the communities in the East and the West and the North and the South.

And every one of you must begin to realize just what all of this is going to mean to you and your system.

Burt talked about the after-sales followup. Irwin talked about programming and putting on different kinds of programming to get customers. Ben talked about an over-all sales approach which we must all recognize and perform in our sales efforts.

We talked about what made a successful sales organization. Dick Vance addressed himself to that. He talked about control and your controlling the sales organization. You must control your own sales organization and you have a major responsibility in helping to control the input to the national sales organizations who may come in and help you sell.

Mark talked about the tomorrow in programming and marketing which is today.

This is a fascinating business. Your people who work for you, the girl behind the desk who answers the telephone, the TV dealer around the corner whom you have set up a campaign to work with to sell cable television in addition to his selling a set -- just a regular television set. Every new television set that is sold in town from this point on should be sold with cable television. I won't say there is no excuse if it doesn't happen, because you are not going to have every TV dealer dying to put cable television in the homes, especially if they are in the antenna business. But I think you can get that message across.

I'm not up here to hit you with ten minutes of harangue on the power of positive thinking. But it is important.

Everybody is going to have cable television. Everybody in the country is going to be connected in some way to a wire television service. The people in this room and the people in this hotel are going to be responsible to see that happen.

DISCUSSION

From the Audience -- What sort of cost per hookup per subscriber would you figure in terms of sales campaign?

Jack Gault -- The installation charge, you mean?

From the Audience -- No. The sales -- the cost you budget for your sales people.

How much did the San Diego campaign cost per hookup per subscriber?

Mark Van Loucks -- Let me break it down for you.

The advertising portion, the set of three materials with all of our costs, production costs and so on, averaged out to about 65 cents per home.

That includes postage, First Class.

These campaigns for us usually average around 40 to 45 cents per home. It is expensive. But in terms of the philosophy, if you get four or five per cent more of the community to listen to you, the sales will be huge. That is the advertising portion.

From the Audience -- But it doesn't answer my question.

Mark Van Loucks -- Well, sales commissions, is that what you mean?

From the Audience -- For the whole thing, how much does it cost to hook up one subscriber?

Jack Gault -- What kind of systems budgeting?

Mark Van Loucks -- The system budgeted probably around $38 including installation.

From the Audience -- Mr. Vance has his own organization. Maybe he can tell us how much he has to pay his people. He pays them well, he says.

Richard Vance -- Our sales program runs around -- now I have to include my salary in on this naturally -- $13. That is per sale. Now, this is not including your install and so forth, but your over-all campaign.

I would like to interject something here.

I appreciate Mark's elaborate sales campaign that he goes through prior to sending the salesman on the street.

I would like to kind of put it on the record that I do not agree with that concept, for some of you men who are thinking about putting in your own sales campaign.

I have spent approximately 17 years in direct sales, and anytime I let somebody know too much about something before I ever get there to explain it to him, they form their own opinions.

I have tried direct mailing prior to selling, and a very high percentage of these people, immediately when that salesman went to the door, said, "Well, I know what it is, how it works, I don't want it."

And I have found out that if I keep them ignorant and when the salesman goes to the door, if he has that proper door opener himself, without something before him, he can get in that door. And you want to hire salesmen who can get in that door.

He will sit down with these people who don't know anything about it, have no qualms against having the salesmen come into their house, and within three minutes he can give them a sales presentatio

I signed up over 30,000 subscribers in Akron last year. And half the time I had to send the men throughout the rest of TVC in order to take up some of their time, because we were selling anywhere up to 1500 subscribers per week with 12 people, without any direct mailing before we went into this.

Jack Gault -- I think Burt would like a minute of rebuttal on that.

Burt Kittay -- We don't find in our experience that it is difficult to get into the door. We find that if you have a salesman who can relate to his community, that he is treated as somebody from the community when he walks up to the door.

The important thing that we find is in control, as you mentioned, and training of the salesmen. We give salesmen written exams, oral exams. We have group sales meetings regularly to keep the spirit up in the sales force.

We find that when a salesman goes to the door, if he can relate to the community, there is no reason why he has got to start out by fighting somebody's preconceived notion.

That is why in a new system we feel that door-to-door sales is the best way to go into a market, because you haven't solidified a negative response from somebody for many reasons.

One reason in a new system why a media ad hurts is because in some areas of town you are not going to be there for about a year.

So we use a mail piece just so that there is a click in the back of somebody's head that a salesman will call. But we don't use it as a complete informative campaign.

You can go the next step and not have any mail pieces, but I think an outside organization has to take that extra, extra care, because we are working for you, and there is always going to be a kook in town. We have had salesmen shot at in Mississippi who just walked up to doors, before they said anything, and things like that. And I guess it is not a too atypical situation. We have had some very strange experiences.

But we have to take the extra care in going in to someone else's system to make sure that these things are minimized.

Irwin Polinsky -- I would like to make one comment, which is sort of the middle ground.

We have a large system with a large sales force. In fact we have a very diverse market. We have hotels, hospitals, bars, office buildings, schools, both parochial and public school systems, and residential customers. We have three distinct, separate sales forces entirely within our control.

However, we are having very serious discussions right now with Burt Kittay with regard to using his organization in suburbia where we are in the course of developing other systems.

However, making reference to Dick Vance's previous comments, I would suggest you condition your market but be very careful on how you condition your market out in advance.

At the beginning we were gung ho and we could hardly service anybody because we had very little plant built. We circulated the word about cable TV and we were inundated with requests for service that we were unable to fulfill. And we wasted an awful lot of time talking to these people, answering correspondence and then answering complaints to the appropriate authorities, the Attorney General, the Consumer Affairs Division, etc., as to why you advertise and yet were not able to fulfill your obligation.

To condition a market, we advertise but don't expect a response; we don't give a phone number or an address, we just talk about cable in general, so that ultimately when the system gets there, the people are conditioned to some extent.

In the city we don't put our lines on poles. We are underground and then down the blocks and then into buildings we wire vertical rises and horizontal rises. We generally don't even tell the people what we are doing in the building until the system is just about completed and ready to go, at which time we distribute literature and follow up with telephone solicitation, so that when the solicitor calls or contacts the customer, he can give him an immediate date for installation.

If you stimulate your market too far out in advance and you are not able to satisfy that market, you are in trouble. It is worse than if you had never contacted that person.

Jack Gault -- We are going to go down the line. Ben, would you like to make a brief comment?

Ben Kittay -- I think if we are looking for a 30 or 40 per cent saturation, then direct sales is definitely the way to do it.

I think if we are looking for greater saturation in our system, we have got to totally combine this and create a Follow-the-Joneses attitude towards marketing. And this is not going to be done with just direct sales. It has to be combined with the newspaper, it has got to be combined with your mailers and everything else to bring cable into mind every day with every potential subscriber.

That is the only way we are going to reach a total marketing saturation.

Mark Van Loucks -- A couple of quick points.

I think the vote is about two to two, with one in the middle.

We could all talk, I am sure, for hours on marketing philosophies and advertising philosophies. I think that shows you the fascinating part of being in this sort of business, both yours and ours.

Real quickly, though, the beauty of this kind of campaign is that it is direct, it is not a media, so that you don't overexpose the market. If there is an area that you are not going to be into for two months, you simply don't send the letters there. So you can control absolutely and completely the exposure, unlike the media.

And also, without getting into it, there are many more things to consider than just how many sales you make with what purpose.

The other things to consider are the amount of retention, how many of those sales get actually installed, and of the ones that get installed, how many of them stay installed.

So there are many more things to consider in a sales program than just the quick knock on the door and the quick installation.

Richard Vance -- I think you gentlemen, if you are building a new system, are investing anywhere from $4,000 to $8,000 -- depending upon whether you are putting a single system in or a dual system -- per mile out there in the street.

The people in the community are interested in knowing what is happening in that community. If they are digging up your street, you go out and you find out, "Are you putting in a new water line, what are you doing out here?"

If your sales campaign is directed during the time that you are wiring a certain community, those people want to know what is happening out there on those poles, what is going on. So that $4,000 or whatever you happen to be investing per mile of cable that you are putting up is doing you a tremendous amount of good as far as advertising is concerned. It is also going to get that salesman in the door, just simply because people are inquisitive as to what is going on.

Jack Gault -- As Mark said, the vote possibly is two to two, with one in the middle.

I would like to make this one comment.

Direct sales, including direct mail, media tie-ins, radio advertising, are all tools. And I would not suggest to any one of you that you take one of the tools, one of the potential effective tools in your sales arsenal and put it aside.

The use of direct mail is one tool that we have used with great success, and I am not saying it is the answer or a universal panacea for getting subscribers in the house. I recommend it under certain conditions. As a matter of fact, I recommend it under most conditions.

There are moments and there are times when you will not use direct mail. But there are many times when you will, as well as all of the other promotional tools and aids that you may want to use to get customers into the house.

"POLICING THE DISTRIBUTION SYSTEM"

Speaker

Robert Tarlton
Panther Valley Television Co., Inc.
Lansford, Pennsylvania

Moderator

Greg Liptak
LVO Cable, Inc.
Tulsa, Oklahoma

Greg Liptak -- Also on the panel this morning is a gentleman who is recognized as the founder of our industry, Bob Tarlton, from Panther Valley in Pennsylvania. Bob is going to talk to you specifically about some legislation which was achieved in the State of Pennsylvania which permits prosecution of or an attempt to prosecute those who are found to be illegals.

It's amounting problem in our business and also one which will become probably even worse as cable gets the opportunity to get into the major markets.

Our industry today and I emphasize today could be losing $13 million annually. That may be a startling statement but it just might be true and, if the number is not quite that high, I think I can prove to you that it's a very substantial figure.

The reason for this loss of revenue stems simply from the fact that there are apparently thousands of households which receive our service and pay nothing for it. Now certainly the proper policing of our distribution systems is a key management responsibility and yet I think it is an activity which is often pushed to the bottom of the list of priorities.

Proper system surveillance is a difficult, time-consuming job and yet I'll wager that 95 per cent of all cable systems in the United States have a situation in which a number equal to 5 per cent of the subscriber count could be classified as illegal connects.

Five per cent is a substantial figure. You take 5 per cent of the nation's 4-1/2 million cable subscribers and multiply this number by an average of $60 annually and you come up with more than $13 million that I predicted earlier.

Our company has made a determined effort to spot illegals over the past three years. We've experimented with several different approaches of how to get this job done. We have one particular idea to present to you this morning which we think has great merit as a way of substantially reducing illegal connects.

First of all, let's define a term or two. An illegal is a residence, single or multiple-family or commercial business, which receives our service and pays nothing for it. Further, the resident or business may not be aware that they are receiving our services. Our drop may be hot at the tap but unconnected to any television receiver. The resident or business may have had no part whatsoever in getting this free service. The address may simply have never been disconnected at one time or another.

I think we all like to believe that we have loyal, trusted employees and I think we generally do. However, we may have a man in a system who just does not want to go up to the tap to make the disconnect. The weather may be too hot or too cold or snowing and so on. You all know what I'm talking about. So he signs off the disconnect order as completed. Now, if this man continues to do this over a period of time, irreparable damage can be done to the system and this problem can go unnoticed for months and, as a matter of fact, it can go unnoticed for years before the cable system manager realizes what's happened to him.

Of course, the other category of illegals refers to the people who deliberately get into our distribution systems using nails, hairpins and other creative devices, as well as the proper equipment.

I think generally speaking a small cable plant is easy to police. However, when you get up to more than 5,000 subscribers and when you have in excess of 100 miles of distribution system, you then must have a well-organized and continuing program to keep that plant clean.

Let me give you a couple of examples:

One of our systems is being carefully checked this summer and our audit is three-fourths complete. The system has 9,000 subscribers. We have found 433 that we can definitely say are illegals. So far we've converted 111 of these 433 to paying customers. We've disconnected the rest.

Interestingly enough, we found one 18-unit apartment building getting unauthorized free service.

In another small system, 2,300 subscribers, we found 190 illegals. We've converted nearly 50 per cent of these to paying subscribers.

In a third cable system, this one with over 12,000 subscribers, in a community which is particularly transient -- I might make a comment about that. This town, we believe, has an annual turnover rate of near 30 per cent. The national average is something in excess of 20 per cent and I think this is what we're going to be faced with when we get into the big towns. I see Bob Felder from Akron there and Bob might have a comment on that. I'll bet you Akron is approaching that 30 per cent level.

At any rate, in this sytem of 12,000 subscribers we found over 1,300 illegals when we conducted an audit two years ago. Now we also recognize that because of this high move-in-move-out rate in this metropolitan area it will be necessary to have a continuing audit program.

A physical audit will require an actual visual inspection by walking down the alleys in a given community. The inspector must work from basic written records, a street address of hot customers, drops that have been carefully marked on an aerial map or, using a method that we've been developing, a subscriber maintenance card which reflects every drop in a given cable system whether or not that drop is hot or cold.

First of all, there is no simple way, no easy way to conduct this physical walk-out. As you all know, it takes time, money and great care and effort.

The new procedure that I want to talk to you about this morning we've been working on for about the last year and it involves the use of what we call a customer identification tag. I brought a package of them and I'll just pass this out and you can take one so you can get a feel for what these look like.

This customer identification tag is a small plastic tag with a wire hasp. This small plastic tag, and I'd like you all to grab one while I'm talking about it, has a wire hasp and they're inexpensive when purchased in quantities. They may be obtained from a particular supplier whose address I'm going to give to you. As a matter of fact, I have a little brochure from this fellow. I'm not here as a spokesman for him but it just so happens that this is the only supplier that we know of who understands the cable business because we've been working with this guy for over a year.

The supplier is a company called Budco, Box 4593, Tulsa, Oklahoma 74104.

As to the cost of these tags, in quantities of 5,000 the tags are 2-1/2 cents apiece. Once this tag is installed, the only way that it can be removed is by cutting it off. Now let me tell you how we use this drop identification tag.

When we receive an order for service and our girls prepare our work order, they also prepare a tag which will correspond to this work order. The tags are numbered. They come to you numbered and the number is placed on the work order itself. The installer then attaches this tag by mounting it over the cable and directly behind the connector at the tap.

By installing the tag at this point, it cannot be removed unless cut with a pair of dikes or you have to remove the connector in order to strip the tag off the cable.

When the installation is complete, the work order is turned back in to the office. Then, following the system we're working on, this tag number is transcribed to our subscriber maintenance card which is, as I mentioned, the record of every drop in the system, hot or cold.

Once a tag has been installed, it permits a much quicker physical audit, and I'll show you some pictures of this in a few moments. As you drive through a community, these colored tags fluttering in the breeze are a very attractive sight. Parenthetically, we use two different color tags, and by the way it comes in 14 colors. The orange color we use for a drop which serves an individual account. The second color, which we have chosen as red, is used when more than one customer is fed from an individual drop.

As an example, a single drop may be feeding a duplex or an apartment complex where two or more individual accounts are served. When an installer or technician is working in an area and observes one of these red tags, he knows immediately that this particular drop is not to be disconnected at the tap because more than one customer is served.

He then traces the drop down to the duplex or apartment unit and there he will find separate orange tags for individual accounts. This helps in eliminating the consistent problem of disconnecting the wrong drop.

Now another side benefit is that the use of these tags seems to make it more difficult for deliberate illegals to hook up to the service. This tag is almost a proprietary item and our supplier indicates to us it will be very difficult for people to get their hands on these kinds of tags because they're not available through the normal sources.

The big payoff in this procedure, however, is in processing disconnects. We make it absolutely mandatory that when processing a disconnect order our installers return the tag along with the completed disconnect order. One of our office girls then checks the number on the tag which has been returned against the number shown on our records, our subscriber maintenance card for that particular drop.

Granted, this is not a foolproof procedure, but we have found it to be very effective and we believe it makes it much more difficult for anyone who wants to sign off a disconnect order without actually completing the disconnect.

The tags, as I mentioned, are available in 14 colors and can also be used with underground drops. I have here a little brochure which I will leave on the table that, if you're interested, you may pick up on the way out.

We think that this new ideas has great merit in hopefully reducing the number of illegal subscribers connected to our distribution systems and we think it is a problem of importance to properly and continually audit our cable plants and we also believe that there are direct dollar benefits to be gained by seeing to it that our distribution systems are as clean as they possibly can be.

Now I think what we'll do is we'll hear from Bob and then we'll have some slides. Then, after you see these slides, I think you'll understand the concept we're working on and you might have some questions about it.

DISCUSSION

From the Audience -- In large quantities, they will also stamp your name on them and if you have a color that he doesn't handle, if you order in large quantity, he'll make it for you in that color.

From the Audience -- How long have you had these tags in use?

Greg Liptak -- I guess the oldest one we've had in is slightly over a year. Now you're going to ask how long do they wear. That is a tag that is supposed to be designed for long, long wear, possibly 10 to 15 years.

From the Audience -- They have been used in the electrical field for years.

Greg Liptak -- Yes.

From the Audience -- The only thing I wanted to note was we've used a tag system now for 10 or 12 years. I don't know whether it's a nylon or just what it is -- but nylon like a handle or strap, for instance -- of any light color disintegrates in a year or less. We've had orange tags that have been broken and cut to take down that just disintegrated. We had to go to black and we've finally gone to stainless steel but we changed completely with the stainless steel tag, with the exception of the account number on the tags.

Greg Liptak -- We don't have enough experience to know how long they'll last. All we know is the supplier tells us that they're at least a 10 year minimum and possibly more than that.

From the Audience -- Sunlight is absolutely murder on light colors. In terms of dark colors it doesn't seem to bother them nearly as much.

Greg Liptak -- I'd like now to introduce to you the gentleman who is founder of the cable television industry. It is my pleasure to introduce Bob Tarlton from Panther Valley in Pennsylvania.

Robert Tarlton -- The illegal tap is as Greg has said a growing problem and it's been a problem ever since the inception of the business. I can date back to about 21 years ago when the first connection was made. I experienced illegal taps. But we won't delve into history.

The illegal tap not only is the original or the one single basic subscriber but also second and third connections and I think that you'll find that there is also a growing problem whereby your subscribers themselves are making connections in the home and creating problems for themselves, technical problems.

I speak from experience in at least one of the systems in which I'm involved where we had some radiation problems from nothing more than subscribers running twin lead, mismatches in the home and causing some problems in our basic system.

But I'm quite surprised that there hasn't been any widespread legislation, State legislation to give some assistance. In doing some research on this we find very few States whereby you have the State penal code to give you that protection.

Back in 1953, in Pennsylvania, we had introduced and passed in the legislature, the general legislature of the State Assembly in Pennsylvania, an amendment to the penal code and that's one item I would like to call to your attention this morning and I'm going to take a few minutes to read the section that was introduced and written into law in Pennsylvania and I would remind you that it does date back to June 3, 1953. So the industry wasn't very old at the time that we had this introduced.

Of course, forgive me for mentioning it, but in Pennsylvania one of the things that we are known for is the fact that in Pennsylvania there is possibly the largest number of systems in the country. In 1953 we did have possibly over 100-and-some-odd systems at that time, after less than three years in the industry.

But there were problems and it's quite ironic. The reason this was first introduced, what motivated this at the time was radiation and a good many of us forget the problems -- as a matter of fact a good many of you may not have been in the industry at that time -- but there were problems of radiation, single-shielded cable, tremendous mismatches, technically, in the system and all and the system was possibly radiating as much signal as it was feeding to a home.

So a number of illegal connections weren't even illegal to that extent, because the system was itself radiating. Potential subscribers would put up very simple dipoles or pieces of twin lead very close to your cable and get free service.

So some of our ambitious operators who had some political punch in Harrisburg went to some of the legislators and had this bill introduced. The intent of it originally was to stop these people from putting up antennas. At that time I was a bit active and continue to be active in the State Assembly and I shuddered to think that the true intent might be discovered and the bill be killed.

However, the language in this particular bill is such that it could have, and it did at that time, cover all bases and there were some prosecutions. I know of at least 3 throughout the State soon after this bill was passed into law whereby there were prosecutions on nothing more than radiation. But since then, the provisions of the bill have been used to, if nothing more, scare people but also there have been cases where they have prosecuted to the fullest extent of the law.

It might be well for you in other States to give very serious consideration to such a bill. This is very simple -- I've just taken the meat of it out. I am not going to read the malicious injury to property provisions of the bill, the penal code, but I have just condensed it and inserted the proper wording here so that you'll get the gist of what is in this particular bill on which Pennsylvanians are able to prosecute.

It's in Section 49-16 of the Penal Code titled Malicious Injury to Property. "Whoever willfully or maliciously breaks, injures or otherwise destroys or damages any of the posts, wires, towers or other materials or fixtures employed in the construction and use in any line of a television" -- and here is one that I was sorry that at least I or someone didn't catch, it's just coax, instead of being more specific, but at that time coax was kind of popular with a number of lay people -- "in any line of a television coax cable or willfully and maliciously interferes with such structure so erected or in any way attempts to lead from its uses or make use of the electrical signal or any portion thereof properly belong to or in use or in readiness to be made use of for the purpose of using said electrical signal from any television coax cable company or owner of such property is guilty of a misdemeanor and upon conviction thereof shall be sentenced to pay a fine not exceeding $500 or undergo imprisonment not exceeding 12 months, or both."

That bill, that provision in the law is nearly 20 years old and, as I said, it is surprising that a number of States, most States don't have any provisions in their law and I would suggest and, as a matter of fact, we would make this available to any legislators or any contacts you have with legislators that you would want to get some provisions placed into the law.

One thing I'm most concerned about is the tampering with the cable after it gets into the subscriber's home and one of the systems in which I'm involved, the basic system, the Panther Valley System, about 3-1/2 years ago acquired the system in an adjoining community. It's about 3-1/2 miles away and we tied it into the basic system.

At that time, first of all, the system was very poorly run. We rebuilt it, but didn't get into the subscriber's premises to check all the service drops. We were terribly busy and just now are getting into every single service drop. We made a spot check of some and found that they were horrible. So we decided to make a physical inspection. For the last year or so in the crews' spare time they were given work orders on every single home and are making a systematic inspection of every single service drop.

I guess I should have known it but I was still horrified to find that after about six months the percentage of second and third connections in that portion of the system was far exceeding the second and third connections in our basic system, which is 21 years old. A little investigation discovered that after some inspections in our basic system, sure enough, there were 2, 3, 4, and 5 sets hooked up by the subscriber or their enterprising serviceman in these homes and creating problems.

So we've adopted a policy of a complete physical inspection of every single service drop and, as Greg said, no matter what you do takes time, it's time-consuming and it costs money. But we find that our service personnel do have time on their hands once in a while. If we give them enough work to do, it does keep them busy and this is one of the planned programs.

I have been concentrating for more than a year on making a physical inspection of every single service home and coming up with amazing results in getting these second connections. Once the people get "caught," there's no problem. We hook them up right and they get a bill for them and they're invariably so embarrassed that there's no question whatsoever.

So it's been paying for itself in that respect. That's another facet of the illegal connections and it does merit serious consideration to a system that is installed for any period of time. Of course, again I'm talking about a system that's 20, 21 years old.

But I would strongly urge your investigating in any of your States that don't have any provisions. The industry is a legal industry and we need additional legal protection. These provisions in the penal code in Pennsylvania are well worthwhile and well worth your consideration in other States.

<u>Greg Liptak</u> -- Thank you, Bob.

We've got a slide projector and we're ready to line it up and show you 3 or 4 slides on how this tag thing works.

This shows a picture of the pastic tag. And, as has been mentioned, they can be numbered in whatever way you wish to number them. We attempted to get them numbered according to our subscribers' account numbers, the numbers we maintain on the ledger cards for individual accounts, but when you do that it becomes a special numbering process and your cost goes up by about 40 cents a tag to get a special numbering system.

This will give you an idea of the size of the thing. As I say, they're available in 14 colors and in quantities of 10,000 or more they are 2 cents apiece.

Of course, this program, just like any program requires constant followup and it's a real problem when you're trying to install this program in an existing system of any size while they're in use, which happens to be where we're mainly using these tags.

These are the orange tags which indicate that that particular drop is serving a new account. As I mentioned to you, we use a red tag to indicate that several accounts are served from a single drop and the installer then is supposed to know that he's not to disconnect that particular drop at the tap because it serves more than one account.

We've heard also of some people using this as a drop identification method in underground plants where, because these tags are available in 14 different colors, they are color coded at the pedestal and then color coded at the drop so that you can follow them through.

Obviously these things depend on people. They are supposed to be checking to make absolutely certain that the number of this tag is the same as the number on this work order because, when this work order number is returned to the office, that becomes a part of the permanent records that will be later checked.

As you can see -- it's location. In existing systems where possibly construction isn't quite as neat as this, we have one that we know of where the drops are wrapped around and it's very hard to tell, but if the construction job and the installation job is proper, almost from the ground level you can see what's happening to you as far as drops are concerned, generally speaking, or with a pair of field glasses or something like that. But it immensely aids in this physical audit of your plant.

As I say, we're not getting any commission from Budco in this but we happen to think it's a very good idea. I don't know that there is enough for everyone, so let me give you that address again.

It is Budco, Post Office Box 4593, Tulsa 74101. If you wish to call this fellow, it's area code 918 - 936-2323.

Bob, I think we have a couple of minutes left and we would appreciate hearing any comments that anyone has on this idea and other system audit ideas.

DISCUSSION

From the Audience -- When we get into conversation with these people, we recite to them the penalties of the Federal law and I realize we may be stretching things a little bit but we tell them that radiation or unauthorized broadcasting makes them subject to a $10,000 and/or 2 year Federal fine and that our personal attitude as a company is that we don't want to get involved in this and, if necessary, we will actually remove the facilities from their house but that's what they are playing around with.

Also in two of our vehicles, my own station wagon and one of the other vehicles, we use a battery-operated TV set that is tuned to our time and weather channel and whenever we hear or see that come to life we know we've got some work to do and it's relatively simple to run down your radiation because, as you mentioned, so many people go to a permanent method of using twin leads, but they make a sloppy connection and there's going to be radiation and this works.

The word is around town that, "Hey, you've got that car with that detection unit, haven't you?" You bet I have, fellow.

Greg Liptak -- It's a battery-operated TV set, and you can pick it up?

From the Audience -- You can run it with a battery or plug it into your car pack which is what I do but it works pretty effectively. We just tap off our whip antenna or let the whip stick up. There are many ways you can do that. We're all engineers.

Robert Tarlton -- I might say that from practical experience I unfortunately had the FCC come in on a radiation problem with an antenna. A subscriber had an antenna and we had radiation and we didn't know about it and the fellow wrote to the FCC and we had the FCC come in and we had in one block about 3 or 4 subscribers who had buggered up the system and, yes, we do use the same thing. We use a little dipole and check for radiation that way.

But from practical experience -- and here again it's a real old system -- from practical experience we did have an actual case where we were nearly cited by the FCC.

From the Audience -- I have two questions I want to direct to Bob.

Number one - I think we must have copied your law because it reads exactly the same.

Robert Tarlton -- You possibly did. I think we've sent it to a couple of systems.

From the Audience -- Do you know of any case of anybody ever having been prosecuted under this law?

Robert Tarlton -- Yes, we have actually had prosecutions.

From the Audience -- What was it? This was somebody that just continued to give you difficulty?

Robert Tarlton -- To put it in proper perspective, I didn't pursue it but it was another system and the system owner was so angry that he just carried it to the fullest extent.

Prosection depends upon what you're defining as prosecution. He carried it to the extent where the interfereracquiesced and they compromised.

From the Audience -- In other words, he did turn it over to the local authorities?

Robert Tarlton -- Oh, yes, it went through a justice of the peace. The judicial system, the elementary judicial system in Pennsylvania, it went through a justice of the peace.

From the Audience -- The other question, and I think this deal is probably the most difficult one which is the one where the subscriber in the home who is the paying subscriber attaches additional sets.

He knew it was wrong but he didn't really think of it as dishonest and obviously with the position this fellow had in the community and this is the case, I think, a lot of times. It's just like the same thing with the telephone company. People have an extra telephone that the telephone company doesn't know about and they feel like they're getting away with something and not being dishonest.

Has anybody that you know of ever conducted any type of PR educational type program as to the fact that this is a dishonest act?

Robert Tarlton -- Not that I know of, excepting in a way. I've seen a number of systems do promotional work on second connections and such. But that's a good suggestion, a PR program. It would have to be something -- I'm PR conscious -- something that was continuing, a continuing program.

Someone made a comment when I walked to the back of the room that they have a continuing program of surveillance but that whenever someone makes an illegal connection or tampers with their system in the home that you'll never get in that home, and that's so true.

This person had the same experience as I did and he mentioned what he did and we've done the same thing. You just judiciously disconnect that service so he has to call you for a service call and then you can get in the home. Of course you have to use your ingenuity on a lot of these.

From the Audience -- We sent a mailer out to all of our subscribers and spelled right out in that what illegal attachments were and that it was illegal and we did that specifically because our lawyers thought that would best protect us if we did pursue a case. Because we've taken several to the local police officials and they were more than happy to cooperate and they'd give the guy the word and it really shook them up.

Greg Liptak -- You're in?

From the Audience -- New York State.

From the Audience -- My questions deal with cost of using your tags. For example, you cite the cost per tag. Have you done a cost analysis on the kinds of things that have to be done extra, putting the number down, the record-keeping and stuff like that.

Greg Liptak -- No, we haven't, because, as I mentioned to you, it's simplest when you're on a new system and you're putting in the drops. You know, it's another step in the process.

We are going back now selectively on a couple of our existing plants and trying to do this. In one situation we're having a major cable replacement project and so it's easy to do that. But the cost will be probably very high and yet it sure seems to us at least that this is one of the better ways that we have found of trying to control this situation and we wouldn't be involved in it had we not done these earlier audits and recognized that we may have between 5 and 7 per cent of our subscriber count illegals and you know, you take that number and you project that over a period of time, a few years, and it becomes a very economical thing to do.

There's something about, as was mentioned earlier, the other people in the community. If everybody knows you're watching the situation, word spreads very quickly and one important fact too. We've found that once you spot these illegals, you absolutely must identify those people and you must check them at 30, 60, 90 and 120 day levels. Otherwise they're going to be right back on doing the same thing they were doing. You've just got to keep after them.

From the Audience -- We found from prosecuting that we got most of our benefits without trying to be overly hard in publicizing the case in the local newspaper. It was an eye-opener to many people and we had one area in particular where we found 28 illegal drops.

We found that when we prosecuted one, the area went completely quiet. Due to the fact that we were in the process of prosecuting I would get many phone calls with queries about it from anonymous people.

Greg Liptak -- Yes, sir.

You have used these tags in your --

From the Audience -- No, I haven't used the tags but I'm kind of like you, I've been the purveyor of them. I've had a student of mine come up with, "Gee, if my company starts putting those in, it's going to cut out some of our moonlight money." I don't know whether this is popular or not but this is something else.

Greg Liptak -- We had an organized gang -- gang, I guess is the word -- operating in one of our towns that was hooking people up with the absolute, proper equipment for 25 bucks flat.

From the Audience -- Greg, to comment on that, I have personal knowledge of one case like that and, if you pursue them, this is what counts in a case like that. Because if I paid somebody for $25 to hook me up and I'd get it disconnected and cut away from the house a week later, I don't say anything to the television cable company. I get after that guy and that is exactly what happened.

Greg Liptak -- I want, Richard, if you would, I'd like you to very briefly outline your new method for record-keeping on drops.

This is Richard Schneider who is the chief engineer for LVO Cable and he's come up with a new idea that we're going to use in one spot. Would you briefly outline that?

Richard Schneider -- First, the mapping system that we use is one that's hinged to 200 aerial photographs and we've spent a considerable amount of money having the entire continent photographed two or three years ago.

That's the basic part of it and then being able to take these mylar photos and make sepias from them or anything else we want to make from them, and print them -- we can even change the scale. For that matter you can come up with amazingly good visual aid as far as seeing where you are in your system and what you've got there. Some of you may have used these.

You can go along and write the address on each house, each building in the whole system and then you can take a grease pencil -- you can make these up in a book -- and you can put your drops on there in, say, black and red with slash marks indicating the condition of it or possibly slash marks to indicate the ones you're going to follow up on.

What we were searching for, basically, is something that you can give to inexperienced, untrained people, or to a handicapped person or part-time help like college students or high school students even and they can go out and check the system for you without getting all involved. Using this visual aid it's very easy and it's quite easy to keep up also because you can just erase what you're putting on there with your finger. The addresses are put on there with India ink, all the addresses.

We think this has a great deal of promise, particularly in the smaller systems. We're not so sure about the big ones yet.

Greg Liptak -- It's amazing how good these maps are because you can go down an alley and there's that map and, by gosh, what's up there looks like the map and that's one of the real problems, if you've ever done a physical audit, just to have the basic records from which you observe, to see what's happening. This, we think, is a real fine idea.

Does anyone else have any experience, particularly medium to large market experience?

Bob, have you done any of this in Akron yet?

From the Audience -- We are just starting. This is our second year of operation and in certain parts of our system we are just beginning to really tap. But ask me in another two months and I'll tell you how bad it was.

Greg Liptak -- Are you finding some?

From the Audience -- I don't know, we just started. But we're doing something very similar to your tagging, except that we don't have a tag. What we did or are in the process of doing, we took our construction maps and we numbered each leg, each amplifier, each power supply with a unique number and each line extender with a unique number and each tap from a line extender with a unique number and we assigned from the office the trunk, leg, power supply, mainline station and line extender, and the installer goes out and finds the tap working out of the line extender.

So it's a unique number just like your tag that goes into our computer and then we have a record of, every job that's been installed has a unique number now. If we get more than four tap numbers on a printout, you know, with the same line extender, amplifier and leg designation, obviously someone's made an error and we can check it.

But then we have the unique number that follows that customer account through eternity and when the customer goes into an inactive status we get a printout that shows us that tap address as a drop being installed but not active anymore.

Now we're in the process of doing this this year. Next year or the next time we do a tap check we'll get a complete computer printout showing us by tap number, you know, the unique numbering of every active account and every inactive account and this will be a computer printout in sequence order. So that anybody can walk down the street or drive down the street and by knowing where he is in the system, through a series of maps, check the system to see if there are any taps that have been made other than what we show on our records or if there is an active tap working that should not be working.

So it's basically the same idea as the tagging is but we don't have to go through the job of putting the tag up in the air.

From the Audience -- We have a system close to 9,000 subscribers and in ours we have a similar setup. We don't use a computer. But to the address file, when we get a disconnect or we have a bad debt disconnect, we take a little plastic tag and we put it right on the card and leave it in there. This is either red or green. Red for bad debt disconnect and green for moving or some other reason for disconnect.

We put this on and this will give us and has given us over a period of time active and inactive drops instantly visible when you go to the card file and in sequential order so that it's very easy to drive the system now and check it.

And it's also inexpensive.

From the Audience -- With our number, we also get a failure rate history on any piece of equipment in the system because it has the unique number and any time it fails the technician on his work order, if a mainline station fails, he writes that number down and we get an instant printout. We keep a day-to-day record on that piece of equipment.

From the Audience -- So we can get an idea of any abnormal failure rate in any part of town or any abnormal trouble condition that pops up. We'll let you know how that works out in the future.

Greg Liptak -- Okay. Yes, sir.

From the Audience -- I think you'll find in big cities that the policing problem is far more serious than in the small ones.

$25 seems to be the going rate for bootleggers.

Robert Tarlton -- Sruki, do you have that up in Canada? I didn't think you had that.

From the Audience -- Oh, yes. Toronto is now full of that. There must be half a dozen contracting firms in Toronto that work as installation contractors for 12 companies there and there are probably -- with the kind of labor turnover they have -- several hundred fully-trained installers who may be doing something else now, working for electricians or whatever, that have probably still got all the tools, all of the hardware left over and $25 is the going rate for going around and putting in a bootleg installation and our experience so far is that the larger the system, the more severe the policing problem you get. In this city, it's like Toronto with 2 million, you get into downright criminal problems.

In small centers the only serious problems we've had is where we've had a dishonest office staff and that turned out to be a combination of financial audit and drop audit problems.

But I think you'll find the bigger the system and as it gets slightly older you'll run into very sever problems.

Greg Liptak -- Are you using any method other than some of the methods that have been expressed here?

From the Audience -- The computer. The computer has turned out a street book and we use college students in the summer then to go down and check that against the computer printout of what should be there and then cross-check back again.

Greg Liptak -- Tell us, this is in Toronto you're doing this?

From the Audience -- Yes.

We audit all our systems but Toronto is the biggest one and, as I say, we are now turning our attention more and more to the bigger systems and less to the smaller ones because the smaller ones turn out to be peanuts really compared to the problems in bigger systems.

Ross Dryden (Belleville, Ontario) -- I'm a neighbor of Sruki.

On the tag system, we have worked hard and long to find a tag. I am interested in your plastic one. We've been using tags for about two years. But we have a rather unique problem that hasn't been mentioned now that I've heard and that is where you have a semi-rural area and you are providing service to customers along the way. We keep a street address book, not computerized, we're not that large, on identifying these people. They live at RR number so and so and so we are numbering the taps with the tags and designating tap number 21-3, if it's the third ticket on the tap and this sytem works out quite well and that is entered in our street reference so we can go back to Mr. Jones for this tap 23 out in the country somewhere.

From the Audience -- We pay our installer a $10 award on uncovering an illegal additional outlet and a $25 award for uncovering an original tap. This has been pretty effective. There are not a lot of them turned in, I think, but they are conscious of it. And it overcomes the guy that says to the technician, look here, if you'll hook me up, I'll give you $25 flat.

"CATV -- THE NEXT DECADE"

"Loca Origination -- The First Step of CATV's Second Generation"

Robert Peters
Stanford Research Institute
Palo Alto, California

"CATV Systems as Common Carriers"

Edward Shafer
Foster Associates
Washington, D. C.

Moderator

John K. Lady
NCTA Director of Informational Services
NCTA, Washington, D. C.

John K. Lady -- Bob Peters has been with SRI since 1967 and is involved in the techno-economic analysis and projection of the market for numerous products and services, including closed circuit television equipment, integrated circuits testers, check microfilming systems and various types of instrumentation systems.

Prior to joining Standard Research, he was with the Hewlett-Packard Company in Palo Alto and the U.S. Army Satellite Communications Agency at Fort Monmouth.

Bob has a bachelors degree in electrical engineering from the University of Santa Clara and an MBA from the Harvard Business School.

Robert Peters -- Over the years CATV has been profitable in those areas of the country needing improved signal quality and wanting a greater diversity of television programming. The industry pioneers of the 1950s and 1960s were selling access to improved television viewing and, in many respects, they could not have cared less about the actual viewing habits of their subscribers. Realizing that local and imported signals did not saturate the available channel capacity, some of the more innovative system operators gerry-rigged a rotating camera in front of a series of weather dials and a clock, which gave birth to the concept of locally-originated automated services. Live program origination was hatched when a select few system operators rotated the weather camera 180° to cable cast the local high school English teacher presenting his view of happenings in the community and announcing coming local events. With this, the CATV game was at least partially modified from only providing access to better and more diverse television programming to attract a viewing audience from among the system subscribers.

As of early 1971, according to this year's TV Factbook, 524 systems or approximately 20 per cent of all CATV systems were originating local programs, and 1,477 systems or 57 per cent of all systems were providing automated services -- primarily time and weather. This is almost a 90 per cent increase in the number of systems providing live programming over the last two years, in spite of the confusion about equipment, the problems of regulations, and the resulting reluctance of the industry to initiate local programming.

It is interesting to note that about half of the 524 originating systems had fewer than 3,500 subscribers while the other half had more than 3,500 subscribers and were supposed to become a "significant means of local expression" by April 1, 1971. Of course, this mandatory requirement has been thrown into limbo by the Midwest Video decision stating that the FCC does not have the authority to require systems to originate. No matter what interpretations of this decision higher courts may give, it is likely that the FCC will become more flexible in requiring systems to originate, considering such factors as the need for video expression in the area covered by the system and the state of development and financial resources of the individual system.

Even so, the CATV industry must realize that local origination is its "ace in the hole" for improving the regulatory environment, And the first fruit in the public cornucopia of services that has been described so often. These services include leased channels, premium entertainment and instructional programming at an additional fee -- a form of pay TV, if you prefer -- and two-way broadband home communication services.

Perspective on the expected evolution of CATV to full programming services can best be achieved by placing cable in the context of other media, from the printed word through motion pictures, radio, television, and ultimately, cartridge television (or CTV). The principal ways that one medium differs from the others include:

The ability of the viewer to select a title (program).

The convenience of acquisition and use of the title.

The degree of realism -- resemblance to natural forms -- of the presentation.

The cost of acquiring and presenting programming tends to increase with the increased selectivity of titles, convenience of acquisition and use, and the degree of realism. For instance, the consumer was willing to pay the added price for broadcast television (i.e., investment in receiver and higher product prices) because the degree of realism was significantly greater than that of newspapers, magazines, and radio, and the convenience and selectivity of titles were greater than those available at local movie theaters. However, the new generation of young consumers and TV viewers has perhaps tired of the current fare on broadcast TV and is asking for increased selectivity, which can be provided by CATV with full-service programming but at an added cost.

Conventional local origination is the first step toward increased selectivity, and premium TV via the cable could eventually provide selectivity of feature films equivalent to that of the local theater and do it more conveniently and at a lower cost. CTV can provide even greater selectivity than that available via CATV, but the cost is greater and the convenience is less (assuming physical distribution of programming to the viewers). Cartridge television has yet to demonstrate that today's consumer -- or even the 1975 consumer -- is willing and able to pay the added cost for this selectivity. However, just as broadcast television founded the market for CATV, the development of CATV could well be an intermediate step to wide program selectivity, which will finally evolve into significant sales of CTV units and programming in the 1980s.

Thus, the full development of local origination in CATV appears to be the next economically feasible step in the ever-expanding entertainment and information services provided by the media to an increasingly astute and affluent consumer.

One of the most significant attributes of CATV is its participative capability: the viewer can interact with the machine, whether in playing bingo, watching neighbors at the town council meeting, or viewing the children playing in the little league baseball game. The interaction can be repeated at several convenient times, and even some day with the magic of instant replay, economics permitting. In these initial years of local origination, this element of participation must be used to get the subscriber accustomed to tuning in the local origination channels and to considering these channels as a source of new types of programming.

Once audiences can be delivered to the local origination channels, the ever-accelerating spiral of increased revenues, broader programming, and more subscribers and viewers will have begun. From this, the demand for leased channels will emerge.

Special-interest groups will use leased channels as the soapbox in an "electronic Hyde Park"; enterprising program suppliers will lease channels for selected audiences; advertisers and merchandisers will lease channels to present newly developed special-interest programs on such topics as fishing or camping, complete with promotional material; the government will lease channels to present important information to the disadvantaged and other groups; and the nonprofit foundations will lease channels to experiment with new forms of educational and instructional programming.

Financially, one of the more significant developments for the system operator will be the leasing of channels for the presentation of premium entertainment and instructional programming for which the subscriber will pay additional fees. As we are all well aware, Gridtronics announced its special four-channel approach two years ago at the San Francisco NCTA Convention, but they have had difficulty securing feature films to serve as the anchor source of funds.

The funds required to develop premium programming on leased channels can come from many sources, depending on the nature of the programming and the sponsoring organization. Programming developed by civic, religious, social, or political groups could be funded by donations and membership fees, which could often be solicited during the program. Merchandisers could fund this programming out of advertising budgets. Entrepreneurs, developing a special package of programs, could solicit advertisers having products that would appeal to specific segments of viewers. Programming directed at professional groups could be funded from two sources, provided the current FCC rule restricting advertising on pay channels is relaxed. The first source of funds is the organizations that want to sell the products described (e.g., the drug manufacturer broadcasting to doctors). The second source is subscription fees from the preselected and restricted viewers seeking the information. Finally, mass-audience premium programming, such as movies and sporting events, could be subscriber-supported or advertiser-supported, depending on the drawing power of the event. Even if advertising continues to be restricted on channels for which the viewer pays an additional per-channel or per-program fee, a more "subtle" form of advertising is likely to emerge as an integral part of the programming.

As with most of the significant developments that we have witnessed in this 20th century, it will take time to implement the scenario of development for CATV programming to deliver audiences who in turn will generate revenues and thence more varied programming. This scenario will be slowed even further, because the development of local origination must rely on the growth of CATV systems and increased CATV penetration in metropolitan areas, which has been encumbered by the uncertainty in government regulation. Although the use of significant amounts of money might have some influence on hastening the day when cablecasting reaches the take-off point on an economic growth curve, there is no guarantee. Perhaps one of the greatest impediments to the viability of cablecasting in the near term is that the subscribers are not accustomed to thinking of locally originated programming as good -- and, in many instances, unique -- source of entertainment, information, and instruction.

Local origination costs money and, being reasonable businessmen, CATV operators would like to increase their revenue to pay for it. As already indicated, the prospective sources of revenue include more subscribers, advertising, channel lease fees, and special subscriber fees.

On balance a CATV system can expect to increase its subscribers by 10 per cent, if it offers a reasonable series of automated local/ live, and prerecorded programs. This increase in number represents an increase in potential monthly revenue of $500 per 1,000 subscribers in the system. Advertising revenues could be about $175 per 1,000 subscribers per month, assuming 20 hours of programs per week, eight minutes of advertising available per hour of programming, an advertising rate of $1.00 per 1,000 subscribers, and only 25 per cent of the available minutes sold. The estimated advertising rate of $1.00 per commercial minute per 1,000 subscribers is a reasonable average in light of (1) the experience reported by systems currently accepting advertising, and (2) the cost of other media. Granted, some would argue -- and we would agree -- that the cost per 1,000 is not an appropriate way to sell CATV advertising; nonetheless, it provides a necessary basis for making estimates. Some programming on CATV -- particularly unedited public-service programming -- is not likely to deliver a large audience and will thus not attract significant advertising. On the other hand, some programs, such as local athletic events, will command a higher-than-average advertising rate.

Looking five years into the future, it is not improbable that monthly revenues from advertising could increase tenfold to $1,750 per 1,000 subscribers. This is based on the assumptions of 50 hours of programming per week, the same eight available minutes per program hour, an advertising rate of $2.00 per hour, and 50 per cent of the available minutes sold. Thus, the substantial increase foreseen in advertising revenues results from the multiplicative effect of increased program hours, increased advertising rates, and a higher percentage of available minutes sold.

Looking at the expense side of the picture: monthly origination expenses currently vary from about $2,500 (plus a sales commission) for a modest $15,000 monochrome facility to over $9,000 (plus commission) for an $80,000 color studio (both include depreciation of equipment).

If the current revenue is estimated at $675 per 1,000 subscribers -- $500 for increased subscribers and $175 from advertising -- it would take a 3,700-subscriber system to break even if a mundane origination facility were used, and over 13,000 subscribers to break even if a color facility were used.

However, let's once again look five years out and assume the revenues from origination are $2,250 per 1,000 subscribers -- $1,750 from advertising and $500 from additional subscribers. Systems having just over 1,100 subscribers could afford a modest monochrome facility, and a 4,000-subscriber system could afford a color studio.

These estimates raise several points, the most obvious of which is that the CATV operator contemplating local origination should first assess the expected increase in subscribers and advertising revenue that can be derived through local origination. Then, the operating expenses should be geared to the expected monthly revenue. The facilities could well be modest at first and upgraded as the subscribers, hours viewed, and resulting revenues increase.

Let's extrapolate system revenues into total industry revenues from increased subscribers and advertising, as well as the prospective revenues from channel leasing and additional subscriber fees from premium entertainment and instructional programming. Projections by SRI indicate that the revenues resulting from local origination activities could increase from less than $10 million in 1970 to over $90 million in 1973, over $350 million in 1976, and almost $2 billion in 1981. Explosive growth? You bet! However, it's not unlike the growth that occurred in television revenues after the freeze was lifted in the early 1950s. And television revenues grew strictly from advertising. In CATV, multiple sources of revenue are available. In fact, by 1981, a little less than 50 per cent of the revenues would come from advertising, about 20 per cent each from subscribers who would not otherwise subscribe to CATV and from added fees for access to special programs or special channels, and over 10 per cent from channel leasing.

Let me briefly justify these projections. The expected advertising expenditure is predicted on an extrapolation of the previously identified advertising revenue per 1,000 subscribers to the approximately 26 million subscribers that are expected to be on the cable in 1981. An advertising expenditure of slightly under $1 billion in CATV by 1981 appears reasonable on several counts. First of all, it represents less than three per cent of the $37 billion expected to be spent annually on advertising in the early 1980s. If the CATV industry cannot do at least that well in local, cooperative, regional, and national advertising, something is wrong.

Second, this advertising expenditure can be viewed on a per household basis. At present, total advertising expenditures are equivalent to about $350 per household; newspapers account for $100; television for over $60, and radio and magazines each for about $25 per household. By 1981 total advertising expenditure is expected to be over $500 per household, with newspapers accounting for $150, television for over $100, and radio and magazines each for over $50 per household. The SRI projection of CATV advertising revenue would represent only $13 per CATV household based on 76 million U.S. households, or $36 per CATV household. This is reasonable in light of the fact that television advertising expenditures increased over tenfold between 1949 and 1955, from $1.50 to $20 per U.S. household.

The revenue derived from the incremental increase in subscribers is based on the assumption that only two per cent of the households currently subscribing to CATV do so because of local origination, but by the early 1980s this number will increase to 20 per cent.

The estimate of revenues from additional per-channel or per-program subscriber fees is based on the assumption that by 1981, 30 per cent of the CATV households will subscribe to these additional services and that they will pay an additional monthly fee of $5.00.

The assumptions behind the projection of leased channel revenues are more complex. First, it is assumed that the daily number of leased hours will increase from six in 1973 to 12 in 1976 and to 24 in 1981. Note that we are considering <u>access</u> once again, not the need to deliver audience on these leased channels. These hours could run simultaneously on numerous channels or sequentially on fewer channels. The hourly charge for a leased channel is estimated at 0.1 cent per subscriber, or $1.00 per 1,000.

The estimate of 0.1 cent per subscriber-hour could well be conservative, considering the following:

> If an advertiser were charged an equivalent of 0.8 cent per subscriber-hour, the charge of 0.1 cent just to reach the subscriber leaves an adequate sum for programming.
>
> It has been estimated that the cost to place external programming on the air is about $15 per hour. Assuming a 5,000-subscriber system, that's about 0.3 cent per subscriber hour.
>
> The cost to rent a local meeting hall is at least 3 cents per user-hour.

> Finally, there is the question of providing access at a reasonable cost to anyone who wants to lease a channel. At 0.1 cent per subscriber-hour, the lessee could have access to 15,000 subscribers for a cost of only $15 per hour and, even if only half of one per cent of the subscribers (75 people) watched a specific channel, it would be cheaper and more convenient than requiring people to leave their homes and travel to a central meeting location.

There is another area of potential revenue which I have not discussed, and that is program production services. Although the program production function is likely to become totally separated from the program distribution or traditional CATV business, the advent of leased channels will require that the special-interest groups using CATV or any other non-broadcast video medium be given assistance in program production. The industry is in a good position to provide these services.

In summary, local program origination must be considered as the next step in the development of the medium. Although the growth of local origination as a significant means of informing and entertaining people can be accelerated through creative, relevant, and participative programming, the spiral of increased revenues, broader programming, and more subscribers and viewers will still take time to reach substantial proportions -- especially in light of continued government restrictions. As proprietary CATV channel programming, leased channels, and premium entertainment and instructional programming increase, the variety of revenue sources to support such programming will also increase. Although these various forms of revenue will surely increase over the next five to ten years, initially the local origination activity in any system should be geared to the expected near-term income and then expanded as additional revenues develop.

<u>John K. Lady</u> -- Our next paper is "CATV Systems As Common Carriers" and will be given by Ed Shafer of Foster Associates.

Ed is a vice president and senior consultant with the economic consulting firm of Foster Associates in Washington, D. C. He has held this position since 1967. Mr. Shafer is responsible for the firm's activities with respect to market studies and forecasting, economic feasibility and evaluation studies, acquisition and merger analysis and economic impact of regulatory developments in the field of cable television broadcasting and communications common carrier services.

He has been qualified as an expert witness before the Federal Communications Commission, various public utility commissions and the courts. Mr. Shafer also appears before numerous municipal bodies as an expert of CATV matters.

Prior to joining Foster Associates, Mr. Shafer provided consulting services through his own firm from 1964 through 1966. From 1957 through 1964 he held several executive, administrative and marketing positions in the electronics and communications industry.

Mr. Shafer has authored more than a dozen papers dealing with regulatory, economic, and financial matters in the cable television industry. Academically, he holds a BA degree in economics from Brooklyn College and an MBA from the City University of New York.

Edward Shafer -- This morning I'd like to consider some of the questions relating to the possible role of CATV as a "common carrier."

The Communications Act of 1934, as amended, created the Federal Communications Commission for the purpose of regulating interstate and foreign commerce and communications by wire and radio so as to make available, so far as possible, to all of the people of the United States a rapid, efficient nationwide and worldwide wire and radio communications service with adequate facilities at reasonable charges.

The Act specifically contains separate provisions for the regulation of common carriers and separate provisions for the regulation of radio or what would now include television, of course. However, in contrast to the prevasive regulation of these two branches of communication, that is, common carriers, radio and TV, the FCC has chosen not to regulate CATV until the middle of the last decade.

Since that time, CATV has been regulated on the basis of its relationship to broadcasting. CATV systems have been dependent upon broadcast television for their product and have functioned largely as an auxiliary to broadcasting. Regulation has tended to reflect this relationship between CATV and television.

The rules and regulations which have been applied to CATV have had as their stated purpose the assurance of maximum television service to the public.

During the history of the CATV industry there have been occasional proposals that CATV systems should be regulated as common carriers. In 1958, in the Frontier Broadcasting case, the FCC held that CATV systems were not subject to regulation as common carriers as the term is defined under the Communications Act of 1934 and between 1958 and 1968 the subject received very little attention.

During the past three years, however, the possibility of CATV systems serving as common carriers has received more serious attention. The FCC raised the issue in its broad rulemaking proceeding in Docket 18397 and in 1968 the Commission stated: We believe that the public interest would be served by encouraging CATV to operate as a common carrier on any remaining channels not utilized for the carriage of broadcast signals and CATV origination.

The Commission also proposed to review the possibility of a multi-purpose, local CATV communications system and such related questions as the appropriate relationship between CATV, communications common carriers and other entities.

Since 1968, the FCC has evolved a number of rules from the original Docket 18397. However, until recently the common carrier question has evoked comparatively little interest. In its First Report and Order in Docket 18397, the Commission continued to suggest that CATV systems lease channels for use by others.

More recently the Commission, through Chairman Burch, proposed that one-half of the signals carried on cable systems be non-broadcast signals. While the proposal does not specify that all of the non-broadcast channels should be leased, it implies that a considerable number would be available for this purpose.

Thus far we've seen that CATV regulation has been based on its relationship with broadcasting. As long as CATV served in an auxiliary capacity, it was appropriate for regulation of the industry to come within the context of CATV's relationship to television broadcasting. However, the evolution of the broadband communications system concept necessitates a reevaluation of CATV's role.

If the CATV system is to be the fore-runner of the broadband communications system, it cannot be regulated as a supplementary service to television or to any other communications service.

The FCC should determine how CATV service can provide maximum long-term benefits to the public and the Commission should then select that regulatory form which is most likely to fulfill its public interest objectives. This paper will consider one of the regulatory alternatives which the Commission may look to, namely, CATV as a common carrier.

This is the subject that I'd like to consider today, not with the expectation of reaching some definitive conclusions but with the intent of exploring the significance of a policy decision which would apply common carrier status to CATV systems.

First, what is the current definition or how does the Commission now look at common carriers in CATV? Once again, we could go to the definitions that the Commission has. Under the Communications Act of 1934, for example, a common carrier is defined as, "Any person engaged as a common carrier for hire in interstate or foreign radio transmission of energy but a person engaged in radio broadcasting shall not, insofar as such person is so engaged, be deemed a common carrier." 1

Under the FCC's rules and regulations, a community antenna system, "means any facility which in whole or in part receives directly or indirectly over the air and amplifies or otherwise modifies the signals transmitting programs broadcast by one or more television stations and distributes such signals by wire or cable to subscribing members of the public who pay for such service."

Under the FCC's rules and regulations, a community antenna system, "means any facility which in whole or in part receives directly or indirectly over the air and amplifies or otherwise modifies the signals transmitting programs broadcast by one or more television stations and distributes such signals by wire or cable to subscribing members of the public who pay for such service."

A comparison of these two definitions makes it apparent that the current definition of CATV does not anticipate that CATV systems would serve as common carriers. Appropriately, common carrier is defined in broad terms, without limitation as to the nature of the communication being carried. Furthermore, the definition appears to anticipate that the carrier will make his facilities available to all who request service.

Under the current definition of CATV, CATV is viewed in a different and much more limited sense. The definition is based primarily upon CATV systems receiving, amplifying and modifying programs broadcast by television stations. The CATV systems service is considered only in terms of its distribution of television signals to subscribers.

In other words, CATV's current role is viewed as one which is limited and ancillary to that of television broadcasting.

How are common carriers and CATV systems similar and how do they differ? Communications common carriers operate under licenses and/or certificates which define the nature of the services to be provided, the areas or market to be served, and the terms and conditions under which they may provide service.

Such carriers generally provide a number of different services and serve a variety of customers. Telephone carriers have the greatest diversity of service to customers. Other types of carriers usually provide fewer types of services to smaller numbers of customers. However, in vitually all cases, common carriers provide more than one type of service to a variety of customers.

CATV systems also operate under a license or a franchise. However, CATV systems have traditionally provided a single service to a single class of customers. Until recently, distribution of broadcast television signals has represented the full extent of CATV service. Furthermore, with few exceptions, identical service is delivered to all subscribers in a given service area.

Communications common carriers and CATV systems are similar in terms of their large capital requirements. Both businesses are considered to be capital-intensive. By this we mean they require large investments in fixed plant per dollar of revenues that they produce. Because of the relatively high percentage of their cost represented by depreciation charges and other fixed costs, both CATV systems and common carriers benefit from so-called economies of scale. By this we mean that the average cost per unit of service decreases as the volume of service increases. As the volume of business increases, those fixed costs can be amortized over a large number of units so that the unit cost is reduced.

For both common carriers and CATV systems, profits per unit of service generally increase as the volume of service increases. While common carriers and CATV systems are similar in several respects, there is a very important characteristic which distinguishes CATV systems from common carriers. As stated above, both CATV systems and common carriers benefit from so-called economies of scale. The prospect of higher profit per unit of service provides an incentive for both CATV and common carriers to increase sales.

The carriers can increase sales volume in three ways. Sales can be increased by adding new customers and by selling several services to each customer. Volume can also be increased by selling each customer more of each service. However, unlike common carriers, CATV systems can increase sales only by attracting new customers. The type of service and the quantity of service which is provided to each customer does not vary.

Furthermore, as they now exist, CATV systems appear to have little, if any, opportunity to increase the quantity of service in such a way as to increase sales volume.

The opportunity to sell a greater volume and a greater variety of communications services to the large number of customers could be of great benefit to the CATV industry and to the public. Such increases in the services offered would permit more intensive use of the cable system. Because CATV systems operate under the economies of scale, both the public and the CATV system owner would benefit from the lower cost of service. Such benefits would accrue to those who subscribed to existing services as well as to those who would subscribe to new services.

Furthermore, some services which might not be economically feasible, if they were offered separately, could be offered over a broadband communications system which also is carrying other services.

Thus far, we have considered the regulatory framework and several selected economic characteristics which are relevant to a discussion of common carrier status for CATV. The balance of this presentation will be concerned with the ability of CATV systems to serve as common carriers within the near term.

In the short run we must assume that the FCC will continue to regulate CATV primarily on the basis of CATV's relationship to television broadcasting. In the long run perhaps we can assume that CATV will serve as a broadband communications carrier under regulation which is appropriate to such a role. However, we will not attempt to speculate at this time on the nature of CATV's long-range role or the policy changes which might lead to such a role.

What are the possible services which CATV systems could provide as common carriers in the near term? Some might suggest that CATV systems already serve as common carriers in that they deliver a standard product at uniform prices to all of their customers within specified service areas.

However, if CATV systems are now serving as common carriers, their role is a very, very limited one. By contrast, those businesses which are in fact common carriers are required to meet the public's full demands for the services provided by the carriers. The public can obtain any amount of communications service through those carriers which are designated to provide the service.

For example, virtually unlimited telephone service may be obtained from telephone carriers, telegraph service -- after the strike is over -- from telegraph carriers and so on.

CATV's basic offering consists of broadcast television service. If CATV systems were to operate as common carriers, they would be permitted to meet any and all demands -- any and all demands -- for local or distant television service through their own facilities or through interconnection with other carriers. Expansion of this service, that is, broadcast television service, would be most compatible with the existing technology of CATV systems. Those systems which have unused channel capacity would be encouraged to expand service, if the importation costs did not exceed the anticipated incremental revenue. Those systems which are already utilizing all available channels will have an incentive to add capacity.

It is likely that the increased program diversity would attract new subscribers. Increased saturation would prove beneficial to the CATV system owner because of the aforementioned economies of scale. Lower units of cost of service could also benefit the public through rate reduction. Lower rates could attract additional subscribers thereby increasing saturation and so on.

Furthermore, expansion of channel capacity and increased subscriber saturation would make it feasible for the CATV system to offer additional services. Some of these services might not be financially feasible on systems which have limited channel capacity or relatively low saturation.

The addition of these services could attract new subscribers thereby further benefiting both the system owner and the public. However, any expansion in the types of services which are offered must depend upon the CATV system's ability to expand its economic base. In the short run, broadcast television service is the only feasible service which is likely to provide the economic base which would permit CATV to expand significantly.

However, as stated earlier, the FCC CATV regulations continue to be based primarily upon CATV's relationship to broadcasting. In this context CATV systems are precluded from fully serving as common carriers of that service which they are best able to provide. Therefore, without a change in FCC policy which would permit CATV systems to expand their television offerings, the industry would appear to have nothing to gain from accepting common carrier status.

Chairman Burch's recent proposal to permit CATV systems in the top 100 markets to import distant signals may, may represent an important step in the relaxation of the restrictions on broadcast signal carriage. It remains to be seen whether the currently proposed increase in signals will provide the revenues which are needed to expand the services offered by CATV systems.

Either with or without expanded broadcast television service, CATV systems could attempt to capitalize on their unused channel capacity by leasing channels. The leasing of channels could prove doubly beneficial to the CATV system owner. He would, of course, receive revenues from those who lease the channels.

Also, if the programming which is offered by those who lease the channels is of interest to the public, the system could benefit from the addition of subscribers which it might otherwise not have gained. While CATV systems would benefit from leasing channels, a number of questions must be raised.

Many systems are already operating at or near full capacity. For these systems the decision which would require them to lease channels could necessitate a complete reconstruction of their facilities. In most cases, this would entail very substantial capital outlay. As prudent businessmen, system owners would reject such outlays, unless they could expect a reasonable return on their new investment.

If the system reconstruction would provide no other new revenue sources or opportunities for cost savings, it would be necessary to set the prices for leased channels so as to fully reflect the system reconstruction costs. The resultant prices might be so high as to discourage those who might wish access to the system's subscribers.

Channel leasing raises a number of additional questions. Perhaps one of the most important is the simultaneous demand for the same time periods by several would-be leasors. For example, let us assume that a CATV system has three channels available for lease and that there are five prospective customers who wish to use these channels only between the hours of six and nine p.m.

Let us assume further that there is relatively little demand for these channels at any other time. One possible solution to the problem would be to price the most desirable time periods on the basis of value of service as well as on the basis of cost. If the price is raised high enough, some of those who would use the channels during prime time will withdraw or shift to another time period because they are unwilling or unable to pay the high price.

However, the greatest source of demand for CATV channel space appears to be from community groups, some of whom may be least able to pay for the service. If higher prices were to result in the exclusion of those who might use the channels in the public interest, the public will have lost the primary benefit which channel leasing is supposed to provide.

Alternatively, some other means other than price must be devised for the distribution of time on the leased channels. Some have recommended that time should be made available free but there's no such thing as free time. To the extent that the CATV operator could sell that time which he would be required to give away, he has lost revenues. Furthermore, there are some direct costs associated with the leasing of channels. In the very least the system must be compensation for such direct costs.

However, if the system is permitted to recover only direct costs, there will be no incentive to lease channels. The system must have an inducement to provide leased channels. Such incentive may be of the ability to lease channels at prices which fully reflect the cost of service, plus a reasonable return on such investment as is related to the leased channel operations.

However, as stated above, prices which would fully compensate the system owner may preclude the use of the leased channels by some of those groups who might wish to do so. If the full price of leased channels would be so prohibitively high as to exclude some potential users, the price could be set at or just about the incremental cost of these channels.

As an incentive to CATV systems to make leased channels available at such reduced rates, the Commission could permit CATV systems to import a greater number of distant signals. Such importations would attract additional subscribers and increase revenues and net income. The higher net income would in part compensate the system for those revenues which would be lost because of the reduced rates for channel leasing.

I'd like to add a few words on the system or method for pricing of new distant signals. To the extent that CATV systems benefit from importing signals because of the increased programming diversity which they can offer to potential subscribers. If this programming is sufficiently attractive, non-subscribers will be induced to subscribe. In theory, CATV systems recoup the incremental cost of the distant signal importation through higher revenues and higher profit margins made possible by higher subscriber saturation.

Historically it's been argued that CATV systems benefit from importing signals because of the increased programming diversity which they can offer to potential subscribers. If this programming is sufficiently attractive, non-subscribers will be induced to subscribe. In theory, CATV systems recoup the incremental cost of the distant signal importation through higher revenues and higher profit margins made possible by higher subscriber saturation.

As systems now operate, the rates for service with the additional imported signals would remain unchanged despite the increase in both the cost and the value of the service provided. However, there appears to be little justification for holding prices constant when cost increases are associated with the new services and when these new services have some incremental value.

CATV systems should price their service on an incremental basis. By this we mean that rates for service which include new distant signals should be higher than rates which were charged prior to the introduction of these new services.

If CATV systems are to operate as common carriers, they should be permitted to establish rate schedules which reflect market conditions and the need for their service in each community. In effect, some minimum service -- and this minimum service might be along the lines suggested by Chairman Burch in his testimony before the Senate Communications Subcommittee -- in effect, minimum service should be priced at one basic charge. Higher charges would be made for each service in excess of those considered to be minimum.

If in some markets minimum service is represented by three network signals and three independent signals, such service would be provided at a single monthly rate. However, to the extent that additional signals may be looked upon as supplementary services with identifiable costs and incremental value, they should be priced accordingly higher.

Those subscribers who wish only the minimum service would pay only the basic monthly charge. Other subscribers wishing greater programming diversity would pay the incremental charges. The price for both the minimum and the supplementary services would depend upon market conditions and the cost of providing service.

Pricing CATV services on the basis outlined above would offer several advantages.

First, it would permit subscribers to purchase only those services they may wish to purchase. Those who do not wish additional services would not be required to bear additional costs.

Second, the ability to charge a higher price for additional services would serve as an incentive to the CATV system to obtain as many attractive services as the system operator believes can be sold in his market. By offering the greatest programming diversity to the maximum number of subscribers, the system operator would be using his facilities most efficiently. As a result, all subscribers could benefit in terms of service diversity and possibly in terms of the reduced cost of service.

Perhaps most importantly, the ability to offer a wide variety of broadcast signals could produce sufficient net income to permit channel leasing at the lowest possible price.

What about the future role of CATV? So far I've covered only a few of the considerations relating to CATV systems serving as common carriers. These remarks have considered only the near term. For the long run other factors must be examined and alternatives to common carrier status must be explored.

Any attempt to delineate the future role of CATV is made difficult by the need to consider a number of complex and generally immeasurable factors. However, some effort must be made in this direction. The FCC should determine the degree to which the public interest would be served by the introduction of channel leasing and other services which CATV systems appear capable of providing.

A determination that such expansion of CATV service would be in the public interest should be followed by the adoption of rules and regulations which would encourage the introduction of these new services. The recent proposal by Chairman Burch before the Senate Communications Subcommittee reflects a serious effort in this direction. However, it should be viewed as only a first step in an attempt to redefine the role of CATV from that of an auxiliary service to one in which the public could derive the full benefits of the new technology.

"CHANGING APPROACHES TO CATV FINANCING"

Speakers

James F. Ackerman
Communications Advisors, Inc.
Indianapolis, Indiana

Frank P. Krasovec
Pittsburgh National Bank
Pittsburgh, Pennsylvania

James F. Straley
Home Life Insurance Company
New York, New York

Grant M. Wilson
John Hancock Mutual
Life Insurance Co.
Boston, Massachusetts

Moderator

Bob Hughes
Communications Properties
Austin, Texas

Bob Hughes -- Last night at one of these cocktail parties I was discussing with somebody the general quality of the panel discussions that we have here at the NCTA, and somebody made the comment that one of the problems was that the people who were on these panels were not the people who actually did things, the people who were on the panels were the ones who liked to get on panels and they weren't really the doers.

I think we have here this morning some real doers. So I hope we will have a good panel discussion.

We have a banker here who has done a good bit of CATV lending, and we have got a couple of life insurance company people who have also been very active, as well as Jim Ackerman, whom many of you people know from many years in CATV financing.

As many of you have noticed, the theme of this convention is "CATV - The Second Generation." I am sure when they gave the convention this title, they had in mind the second generation of equipment, second generation of cablecasting, programming, etc. But I am here to tell you, and I hope before we leave here today that you will also see, that we are in the second generation of CATV financing. There are really some changes that have taken place in the financing picture, particularly in the last 12 to 18 months. And I hope that some of our discussion here this morning will convey some of those changes to you in both the banking and the insurance community.

I think back here -- by way of introducing this first speaker -- to eight years ago and the first chance I had to work on a cable TV financing deal. In 1963 I recall we put together a $3.5 million term loan financing package with one of the large New York City banks. And I particularly recall that the package was a five-year term loan, a very secured loan, absolutely no leeway to speak of for the borrower; he was very tied up with restrictive covenants, no particular room to expand beyond the original $3.5 million debt.

I think our first speaker here this morning, Frank Krasovec, can explain to you some changes that have taken place in the banking community which is now giving us CATV people some more latitude; I feel that it is the real answer to the type of financing that we have got to have to expand these cable TV systems.

Frank is a lending officer with the Pittsburgh National Bank. The Pittsburgh National has been quite active in financing CATV and particularly in the last 12 to 18 months they have evolved and done several of what we call the revolving credit type of financing.

So, with that introduction, I would like to turn it over to Frank, who will explain this to you a little more specifically.

Frank P. Krasovec -- Thank you, Bob.

I would like to talk about what we call renewable revolving credits that we are doing at our bank and I am aware of some other revolving credits that other banks are doing.

To build a framework for this discussion, I would like to briefly touch on some of the financial comparisons between CATV and utilities and also to touch on a description of the typical bank financing for utilities; I think this is important in seeing what we are doing and how we have shaped our particular type of credit.

In terms of the financial comparisons between CATV and utilities, in terms of similarities here, both industries have continuing needs for funds. This requires long-term money. We see utilities, as rule of thumb, doubling their plant capacity every ten years. And over the next ten years, who knows how much is going to be spent in the cable industry? You have all seen figures. We know it's in the billions. A lot depends on regulation, etc. So we can see tremendous needs for funds, and this relates itself to long-term needs.

Secondly, both industries have a very stable revenue base, which again attracts long-term lenders.

And lastly, both industries have a very sizable cash flow as a percentage of gross revenues, which we hope relates itself to profit or we consider it profit on that basis. And we think that this does attract lenders, long-term lenders in particular.

With that little background in terms of how we have looked at the similarities, I would like to talk about the historical bank financing for utilities, again because this has helped us build the foundation for some of our renewable revolving credits.

The banking industry has traditionally loaned money to utilities on an unsecured line of credit basis. A line of credit is an informal arrangement, generally renewed annually after the year-end report comes out for a company. This is extended to the most credit-worthy customers at prime rate or a small factor above prime. It carries no covenants, no security.

One of the similarities here between utilities and cable is that the proceeds are used for construction and expansion.

When we lend to utilities, we see that the borrowings fluctuate rather widely because the utilities are constantly funding us out with some long-term debt and equity over a period of time. And we sit down with the corporate treasurer as other bankers do and go over the various funding plans because we want to know when our money is going to be repaid. But we know we are not in there for real working capital, we are in there for construction. It is long-term uses and we are the short-term provider until the money is funded out.

I think the important point to repeat here is that with utilities we are not paid out through cash flow but we are paid out through funding. This is a very important point to make.

Utilities have been able to qualify for this favorable type of bank financing because of some obvious reasons. One is that they have a very established track record and their debt instruments and equity issues have gained wide acceptance over the years.

We feel that CATV companies are just beginning to gain this wider acceptance from both long-term lenders and from the investment community, and that utility type bank financing will become available to them as the industry matures and as the companies mature. But during this period somebody is going to have to satisfy this insatiable appetite for funds and if we can't do it with utility type bank financing, it is going to have to be done another way.

So we have set up a hybrid form of financing which we will call renewable revolving credits. Principally this is for the MSO operator.

A revolving credit, as differentiated from a line of credit, is a contractual relationship between the bank and the borrower. The borrower is paying a commitment fee for this and the bank is legally obligated to honor this commitment as long as the terms and conditions of an agreement are met by the borrower, as opposed, again, to a line of credit which is an informal arrangement without any commitment fee being paid.

With the cable companies we have set up revolving credits for 12 to 24-month periods, depending on specific situations, with options for renewal for subsequent 12-month periods. Let me give you an example of how this works.

Let's say we set up a 24-month initial revolving credit period. During the 24th month of this credit, or let's call it an anniversary date, we at the bank would have an option to terminate the credit, but the credit would not have a maturity in the sense that we would have a forced review of the situation. Presumably if things were going well, this thing would automatically convert to a 12-month renewal and continue like this as long as we did not take any action on our part to terminate the credit. The company would have the right to terminate the credit at any particular time. We are not holding any chains on a particular corporation.

But what we are really trying to do here is say there is a continuing need for funds in the industry, and we are just kidding ourselves if we are going to set up a shorter term credit with some fixed maturity. So we want this thing to convert and begin converting automatically and eventually blend into a line of credit, as we have for the utilities.

We recognize also that in the cable business if for some reason we would decide to not allow for renewal and actually terminate under the revolving credit, we have to provide an exit provision for the cable company. It is unlikely that they would be able to replace us overnight, and while they could probably get some alternative financing, it might be costly and market conditions might be such that it just wouldn't be right to go out and seek longer-term funds.

So we will set up generally a four to five-year term payout, which is, again, what we like to consider an exit provision as opposed to a real term loan, because it is just a way for the cable operator to pay us out over a four or five-year period if we decide to part ways for whatever reason.

I want to make two points here on the use of the proceeds.

First, the company under revolving credit has the right to borrow and repay at its discretion and reborrow at its discretion as long as the terms and conditions of a loan agreement are met.

The proceeds -- and this has to be specifically aligned to our bank, because I am not that aware of what other banks are doing -- under a revolving credit should be available for acquisition and expansion of both cable and microwave, depending on each situation, and we might expand that.

In other words, we are not really limiting their expansion in either area, as long as they meet the terms and conditions of the loan agreement. We are not asking for right of first refusal to look at situations; we are really putting the judgment in the hands of the management. We are betting, so to speak, as much on the jockey here as the horse. It's a case where we feel these people have continuing requirements; we want to try to provide them with a flexibility, provide them with a pool of funds to go out and take advantage of opportunities in the business, because there are only two ways, as you know, you can expand in this industry. One is to go out and buy a system, and the other is to go out and secure a franchise and build.

And the acquisition connotation here or the stigma that exists in some other fields does not exist in the cable business. It is the only way you can grow, in many respects.

So we are not particularly concerned with acquisitions as such, again as long as they fit within the basic terms and conditions of the loan agreement.

We don't provide these revolving credits to everybody who walks into our shop, and I'm sure the banks are the same way. We do have some criteria. I think these are very important and I would like to outline what we review.

The first thing we look at is management. Maybe this seems obvious to a number of you, but we do look at management depth, we look at the over-all experience and we look at a team here that we feel can take this company forward and where there could be replacements of personnel without too much difficulty. It's a professional type organization.

In the cable industry, as you know, this type of management team or approach has really evolved in the last four or five years. Most of the systems were owner-operated.

The second criterion is a balanced debt structure with 10 to 15-year money on the books. In other words, we are looking for companies that have already secured long-term money because we see cable as having a continuing requirement. If they have secured long-term money, it's a lot easier to go back and get some more, either from the long-term lender they have been working with or with other long-term lenders.

We also feel that long-term money is particularly important today because the larger systems that are being developed near the major markets and the ones to be developed have cash flow characteristics that are a little different from the old traditional systems, where all you had to do was put the cable down the street and they ran to your door to subscribe. I think we are seeing a slower cash flow development and as a result, really an accentuation in the need for long-term funds.

The third criterion is a proven willingness to give either equity or some other form of compensation to really balance your debt structure out to secure the long-term money.

Competition at this point for long-term money is such that cable people have to give something other than rate. And I am not here to serve as PR for long-term representatives, but I think we simply recognize that you can't own 100 per cent of everything and the best way to balance your debt structure out is to get some long-term debt.

And we feel that, number two, the balanced debt structure and the willingness to give equity go hand in hand.

If these criteria are met, it is likely that we are going to move forward with some form of revolving credit.

In terms of how we arrive at the amount, I don't really want to go into that now because that could take a little time.

But what I would like to point out is that as long as these criteria continue to be met and we come up to these anniversary dates under the revolver, it is very likely we are going to be moving forward without any termination under the revolver, it is going to be an automatic type of renewal.

And I think the point here is that during this period under the revolver we are looking for periodic funding and not payment through cash flow, just periodic funding.

So we feel that the emphasis has been shifted from the traditional financing, which was five or six years and repayment or seven years and repayment from cash flow.

So if you look at what I have just described on the revolving credits and then recall what I said about utility type financing, we are really talking about a restrictive utility financing package for cable which simply recognizes the lack of financial maturity in the industry, yet a need for funds. And we are really just bridging the gap in financing cable on a more restrictive basis until the industry matures. And obviously we have a lot of confidence that it will.

I would like to point out three key covenants that we generally set up in our agreements.

One is a prohibition against additional short-term debt, bank debt in particular, which means any debt coming due within 12 months.

Our idea is that we as a bank in the credit or a bank in a group should be the interim source of funds and that there should not be an ability to really raise a lot of other short-term debt, because this is where companies generally run into some difficulties if they have too much in the form of short maturities.

The second covenant, which is the most important one we look at and the most important one we build in, is a limit on annual debt maturities of long-term debt. In other words, we are much less concerned with the total debt of a company than we are with the time in which these debt maturities are coming due. We just feel that if you can have $50 million of debt stretched out over 30 years, that is much better than $10 stretched over two years.

We are not really scared of the amount of debt, because this industry is obviously capital-intensive and it just needs funds to expand. But we are more concerned with the structuring of it. We don't want to see everything coming due in five years. We want to be considered the interim lender, and to really feel confident that we can see some periodic funding, we like to see a structured debt maturity schedule.

The last covenant is basically a prohibition against the encumbrance of assets or a negative pledge. All we want to do is make sure that existing properties are not pledged without some review with us.

However, we are not at all concerned with any acquisitions where purchase money mortgages are given to the sellers and the assets are secured by that particular acquisition. We have no concern with this. We feel this is a part of normal activity in making acquisitions.

So, just to summarize briefly, I think the role of banks is changing. I think we are seeing more revolving credits. I think these credits are setting a pattern. And once the major markets really open up, these revolvers will grow in size and I think grow in terms of number of banks participating in the industry.

I think this does provide the industry with some flexibility. It allows management to make the decisions on various situations and to take advantage of opportunities.

And if I can repeat one thing, size of the company is not paramount in determining whether or not they can qualify for this type of credit; it is the criteria, the management, the balanced debt structure and a demonstrated willingness to give what is necessary to balance the debt structure, whether that be equity or some other form of compensation.

And, again, we are not looking for repayment through cash flow but through periodic funding.

Bob Hughes -- I would like to come back to a couple of things Frank said a little bit later in the question-and-answer session. But to move this along, let's go ahead now.

I would like to try to tie a link between what Frank talked about and our next two speakers.

As Frank pointed out, in the type of lending they are doing, they are looking for their repayment via a refunding with some long-term lender. This means that you have got to have standing in the background somewhere, the life insurance companies, pension funds, somebody like that.

These sources of financing, as most of you know, are developing within our industry, but there are certain little intricacies of this type of financing too. The main one, with which we are all concerned I think, involves what type of equity kicker, etc., we have got to give to these long-term lenders, as well as what kind of criteria and restrictions they are going to impose upon us.

And we have today two different life insurance company lenders and we have asked them to appear because, quite frankly, they have two different approaches as to how they expect to get their compensation out of a loan.

So I would like to turn it over to them and have them describe their two different approaches. First I would like to turn it over to Jim Straley, with Home Life Insurance Company. Jim has been lending money to CATV systems now for some six years, and has had a good deal of experience in this area. Jim's method basically involves long-term loans with an emphasis on the capital gain or the equity participation.

James F. Straley -- Let me tell you what I see as the real problem in this industry.

A company such as mine which has lent to, I guess, 15 or so different CATV companies in amounts somewhere around $25 million is no longer interested in starting up a new system, and this is where you really need the money, obviously.

We are only interested in the kind of system that can qualify for the kind of financing that Frank is talking about. And I think this is rather typical.

We have started up three systems, the first one of which, we said, let's get into this thing and get our feet wet and find out what the industry is all about, and before we knew it, we were up to our ears. The other two we probably are going to make a great deal of money out of.

After this initial experience in starting up a single system with the traditional CATV operator, the mom and pop shop, we have changed our viewpoint to where we want the multiple system operator with the depth in management that Frank talked about, a fairly wide exposure around the country, and with really big bank financing behind him. We have done perhaps 12 or 15 of these kind of things and are relatively happy with them.

I am not going to talk for all long-term lenders, although I think that our view is not atypical.

We are talking now of somewhere around 12 to 15-year financing with a moratorium on sinking fund payments for somewhere between two to five years. What we would like to see is, going in, the kind of cash flow at that point which can repay our debt.

Now, we would expect that after we put our money in, there will be some kind of coverage of mandatory debt repayment, varying somewhere between one and a half to two times. And we would typically write such a covenant in our loan agreement.

As far as we are concerned, we would lend somewhere between $150 to $200 per customer, assuming a relatively saturated group of systems. And that is about it.

As Bob indicated, the thing that my company is going for is an overall rate of return made up of the interest on the bonds plus some kind of equity call that is going to average out, as near as I can compute on the kind of things that we are doing and the kind of things I see other companies doing, to around 15 per cent per annum.

Now, this is a ridiculous number, obviously. And I would be glad to answer any questions on it, but that is about where it appears to be.

Some of the more prominent companies this year have tied up a couple of deals that look like 8-1/2 to 9 per cent money cost, but they have given away enough stock, and it's a long-term call on this stock, 10 to 15 years, that looks as if there is about a 15 per cent cost of money in there when you compute that price of the stock.

In our case we would not ask for stock below current market, but we would ask for a call on a number of shares that, given the kind of cash flow that we can project -- and this is fairly easy to project in this industry as against a number of others -- you know, with whatever you will have, a 7 to 10 per cent annual growth a year, say seven years from now, that kind of cash flow, given our call on it through shares, is in effect going to double your money. And that is about what 15 per cent a year is.

The way we do these things is either through warrants, a call on X number of shares, or through convertible notes, convertible into X number of shares, and once or twice through not buying shares but being given shares in conjunction with a debt deal.

The latter is not common among New York life insurance companies because we have some legal problems with it.

Bob Hughes -- Jim, the one thing I might point out because I think it maybe will point up a difference between the way you approach and the way Grant approaches it -- correct me if I'm wrong -- is that I believe in your type of approach, in effect, you are interested in a company where that company is either already public, it has the ability to go public, or you have got to have some way to convert your equity into something down the road. I think that is something you didn't mention.

James F. Straley -- Right.

Bob Hughes -- And I think it is something that is important, leading into this next approach.

Grant Wilson is with John Hancock Life Insurance Company in Boston, and John Hancock has evolved a different approach to how they obtain their compensation for doing one of these long-term loans. It does not involve an equity participation, and it is very possible that, using the approach which Grant will describe, the company would not have to have this ability to go public or to provide some way for him to convert his interest into an equity participation.

So, Grant, why don't you explain to the group your method.

Grant M. Wilson -- The John Hancock looks at the CATV business in not dissimilar fashion to Home. We prefer to do business with the larger, established MSO's.

The over-all rate of return we are looking for on the sort of situation that is currently under consideration is sometimes as low as 12 per cent, but more usually towards the 15 per cent that Jim is talking about.

We do consider and we have in the past made loans to build particular systems.

The type of the technique that I am going to describe to you is in many ways more applicable to financing for a large city system than for general corporate purposes, although we certainly have considered using variations of this scheme for general corporate purposes.

The basic concept of our technique is to provide the difference between the coupon which, let's say, is 9.5 per cent, and the 12 to 15 per cent that we feel we have to have to compete with other deals that are presented to us.

We try to get this spread from the cash flow, from the revenue of the system or of the company, after the system or the over-all number of systems has demonstrated their ability to generate cash.

The way this works is that first, of course, we have to satisfy ourselves on the basic criteria of the borrower, careful scrutiny of the management. We are more concerned with the balance sheet than Frank is. We generally like to convince ourselves that after funds have been provided, the company will not have appreciably more than, let's say, a dollar and a half of debt to a dollar of equity, to convince ourselves that there will be ability to pay. We also look to have perhaps not more than $150 per subscriber, though, of course, when you are talking about building a new system, you have to factor some future into the way that you set the standards.

Generally we put this in terms of the covenant that permits the company to borrow additional debt. We might gear that to, say $150 per subscriber. And also we would look for, as Jim said, about two times coverage; that is, the income available for debt services about twice the required debt service.

How do we structure the rest of our package? We will sit down with the company and the company will say, well, you're interested in one system or perhaps four or five or six systems. We can show you that we expect a certain growth. You all expect growth. So, the revenue projection for the systems is as follows. And the company will also say that we feel we have to get to perhaps 40 per cent, 45 per cent saturation before we could really afford to give you a piece of the revenue. And we will try to lay this out over a 15-year period and go to our computer people and ask them what piece of the revenue above what the company feels it can afford to live with, say a 40 per cent saturation, what piece of the revenue above that on a fixed percentage we would have to get to give us, on a present value basis, the rate of return combined with the coupon that we are looking for.

And that is really essentially how the system works.

And, as Bob said, it is not essential that the company have a public equity market, because clearly we are looking at the revenue stream rather than the capital market.

I should say that in the particular case of John Hancock, so far as our particular lending policy is concerned, we do have concern with size. I doubt that we would be able to do business with an MSO that had fewer than say 50,000 subscribers.

Bob Hughes -- Grant, I am sure some of the group will have some questions for you, because this is a different approach and it is one that has evolved really just within the last year and I think it is an interesting approach that some of you may want to ask some questions about.

I would like, though, rather than get into the questions now, to go ahead and have our last panelist speak to you.

As most of you probably realize, the discussion up to this point in time has been basically a discussion on how the MSO is going to obtain financing. And I know there are a lot of you here who are not MSO's. So we wanted to have one panelist here who could deliver some words of wisdom as to how some of you other people might go about obtaining some financing.

So I would like to switch the ball over at this point to Jim Ackerman. Jim, as many of you know, has been financing CATV systems for over ten years. He was formerly with Economy Finance Corporation, Senior Vice President and a Director with that company. He is now heading up a company called Communications Advisors, Inc., which is acting as a consultant to the financing of CATV systems.

Jim, I'll turn it over to you.

James F. Ackerman -- Our esteemed panel has all the answers except one. That is, when a guy has got a little franchise, what the hell does he do with it?

And that, of course, we all know, takes money.

Years and years ago when we first came into the industry to look at financing -- and a lot of you here in the room will remember this and a lot of you won't -- at that time connection charges were $150, and systems were being financed out of connection charges. At the time we started making loans to the industry, there were approximately 500 systems in the United States. Today there are 2,500 or 2,600. So things have changed.

As we go now into this second generation they are talking about in equipment, we are also talking about the change, the second generation in financing. You have heard these new ways of doing the financing.

However, it still doesn't beat the old methods that have been evolved in the past or first generation. And that is financing either through a local bank or through a regional bank in the area or through a finance company or through the manufacturer.

All these methods are being used currently and will be continued to be used. Even the MSO's will use these items where they can to supplement what they are doing with their lead banks and their insurance companies.

Basically, when you get down to it, if we ignore for the minute the large MSO -- and Grant mentioned you're interested in those who have 50,000 connections or more -- we have two types of financing: either the new franchise that you just got or an old franchise which is being refinanced or is being acquired or being rebuilt.

These are different in this respect. If it is a new franchise -- and I have been out pounding the bushes for many years -- it is hard to find someone who will just step right up and say we'll take it on. In these particular cases you are going to be looking at higher rates and you are going to have to find other collateral, often other than the new franchise itself. If you can put up an old franchise that is well paid for as security, that's fine. But the local or regional bank normally -- now, there are exceptions -- will not look at a brand new franchise with a nominal amount of investment as enough collateral to collateralize the loan over a repayment period of say five to seven or eight years. Now we are talking about brand new franchises in a smaller town.

As you move into the larger cities, we have a problem even more different in that none of these systems will pay off in five to seven to eight years. It is going to take ten-fifteen years for the larger cities to pay off.

And when you do that, then you are outside the bounds of normal bank financing in that it requires cash flow which will not generate itself for at least three or four years.

So how is a system going to pay for itself? That is why, usually, the additional collateral is needed, in the form of guarantees and in the form of something else to be put up with the collateral of the system itself.

The new franchises today probably will be difficult to finance unless there are at least 2,000 homes or more.

Years ago people were willing to finance the real small towns. Today it is basically not economically feasible to do so, because you can't get the personnel to run the system. It takes just as good a man to run 1,000 connections as it does 10,000 connections. And both financing and financial institutions look at what you are going to have in the way of management, as Frank mentioned earlier this morning.

The easiest way to finance a local system is to have your local bank step up and say we'll take part of the loan and let's go to the correspondent bank and get the balance.

When that can be done, financing is much, much easier. The local people know you and you will get the best rate and the best terms possible.

It has been our experience over the years, however, that nine out of ten times it can't be done. And what you have to do, then, of course, is get a regional bank or a finance company.

For years as a member of a finance company, I was always accused of being a high rater. But after you hear our panel this morning, our rates that I was always quoting of 12 to 14 per cent were considerably below those of our panel.

So finance company rates are not necessarily high when you consider you don't give up any equity. This is the big difference.

So there is room for all types of financing, both finance companies and banks, and also the other party, the manufacturer.

Many of the manufacturers, as you know, carry their own paper for a while and then they lay it off, as they call it, or they warehouse it for a year or two and then discount it with somebody else or you as an owner of a franchise can then go in and refinance it.

In today's money market, to give you some idea of what we are talking about ratewise, we are seeing rates in the banks -- if you ignore for a minute the point that some banks say oh, we have to have a compensating balance, so we want prime plus one plus a 20 per cent compensating balance, or prime plus a half, or prime plus two, or what have you, figuring what that compensation balance is worth -- we are talking about bank rates of somewhere between 8 and 10 per cent. Eight may be a little low after yesterday, as I see a few more banks went to a prime of 6. But when you can say that the effective rate from banks is somewhere between 2 and 3 per cent over prime, we are probably fairly close on what the bank rates are.

Finance company rates today are in the neighborhood of 6 per cent over prime.

Now, term. Banks usually do not want more than five year maturities. They will schedule out a loan over seven or eight years but do it with a balloon whereby you have so many payments plus a balloon payment at the end, at which point you refinance the loan.

Finance companies will go five, six, seven years, sometimes they will go a little further than that. But they also, if they have to go further than that, will have to use a balloon. One of the reasons is they have restrictions with their insurance companies who loan money to the finance companies.

Manufacturers. We understand there are some new plans out where you don't have to pay anything back for three years and then you pay back over a period of five years. But that really doesn't amount to much, because you can get something similar by just paying the interest only for the first three years, and the interest doesn't amount to that much with all the other cash flow items that you have, the other things that have to be paid for. So there isn't a whole lot of difference whether you don't pay any interest for three years or you do pay interest for three years. That should not be a factor in whether your franchise or your system is a good or bad deal.

So, in summary, we say that all types of financing can be used by a knowledgeable operator who is small and hasn't reached the stages yet that qualify for the revolving line of credit or the insurance company lines of credit and so forth.

As we go down the road in the next generation and see the larger and larger cities built, it is going to take more ingenuity on the part of all lenders to help the CATV industry grow and prosper.

"CABLECASTING -- WHERE ARE THE ADVERTISING DOLLARS?"

Speakers

Miss Bobbie Weinberg
Good Communications
Philadelphia, Pennsylvania

Barry D. Stigers
Columbia Cable Systems, Inc.
Westport, Connecticut

Jack Williams
TelePrompTer Corp.
New York, New York

Moderator

Byron D. Jarvis
C-COR Electronics
State College, Pennsylvania

Byron D. Jarvis -- I was asked to put together a panel on low-budget origination, only to discover that the title for the panel was something about advertising dollars and we've made a very quick addition to our panel in the form of Bobbie Weinberg who is going to help us cover the title of the thing. So we're tickled that she's with us.

She has a couple of very exciting and interesting things, I think, to say, just based on what she just told me, and not to downgrade the other guys I'm going to let them go first because their talks are a little more prosaic. They are what I lined up originally.

Barry's going to talk today about how you go about newscasting, particularly as it relates to a low-budget operation. If any of you are in radio stations, you know that the news is the most expensive thing you do and it can very well turn out to be that way in cable television.

When you're talking about newscasting, low budget is a relative term because it's certainly more expensive than other forms but there are still techniques for making it low budget and that's what Barry will talk to us this morning about.

Barry D. Stigers -- First of all, I must admit when Doug asked me if I would talk about low-budget cablecasting, I was in the middle of preparing a budget and immediately said I thought I should be disqualified because I'm not really sure that there is such a thing as low-budget cablescasting compared to what most of the industry people think low budget should be.

It really is a foreign object to most cable operators and when they get into cablecasting and they start running it as they do a cable business it immediately gets to be a big expense and a big problem because most of us have to work at cablecasting while everybody else is home playing.

The ballgames are done on Saturdays and Sunday and Friday nights and parades are held on holidays. So basically your cablecasting people work very unusual hours while your regular office is kind of a 9 to 5 situation. So it's little bit different and this does drive the cost up in some areas.

One of the first things that we have tried in New Jersey for the first time is the use of small rover cameras, these small Sony portable packs.

In New Jersey, we are so close to New York City that the off-air pickup is tremendous. Basically, with rabbit ears most of the people in that area get very good, sometimes excellent television. This creates a problem for the cablecasting guy because you can't turn on your cablecasting system and do a bad job or even a half-bad job because pretty soon they compare you immediately to the Gabe

Pressmans in New York City who are out really banging local hard news, and they do it for sometimes an hour and two hours a day and like it or not we really do get compared to these people.

They look at our guys and if our guys don't have makeup on, we get calls. If we do bad reporting, we get calls. People just don't watch it or they complain. Frankly, I'm happy when they complain because I feel at least they're watching the thing and, if we correct what they're complaining about and they find something new to complain about, at least I feel we have a viewership there.

But our local news programming there is in two phases. It starts, first of all, with the daily newscast that runs 15 minutes and begins our broadcast day. We take the Rovercorder and we go out. We have a full-time newsman, by the way, whose salary runs in the area of about $8,000 to $9,000 a year. His full-time job is to write news and sports and he goes out and does all the things that a local news director of a radio or local TV station would do. He has established his sources. He works with the local police departments. He hits the local mayors' offices every day. We have 7 communities so he has a pretty big job. He does an awful lot of phone work.

We listen to the other media in the area and basically from this we try to create then a 15-minute newscast every night that scans the 7 towns that we serve.

We have a format which opens with two reports outside the office. In other words, using this Rovercorder twice every day, it comes out to 10 times a week. We thought this was very ambitious when we began it and we find that now we are up to about three times and sometimes we even do a sports Rover report every day. So we're now up into the area of 14 or 15 of these things every week within this 15-minute news block.

It's working well. We don't have many of the problems that most of the guys that have these things have and one of the reasons we don't is that we have added some technical help to this Rovercorder.

One, we bought a processing amplifier which takes the video information from this recorder and rebuilds it and brings it up to a level which is compatible with the rest of our system.

We also use another technique which I don't know of anybody else using, the Sony 3650 machine, a small half-inch playback which references itself to your EIA sync.

We also have the Craig machine, a one-inch tape machine which also does the same thing. It senses the incoming sync of your system and it locks to it. It times itself to this sync pulse.

So by having both the playback and the record machine doing this, we literally accept this rebuilt synchronization and lay another sync track on the machine, put the video from the Rovercorder on that sync track and now we have a brand new thing to work with. We have a brand new piece of video information that comes out on the system looking just like a camera.

It has taken away the jittering, and it has taken away the non-edit feature of using these small recorders. We can edit with them and we've done it very successfully now for a period of two months. We're very happy with it.

We're using this Rovercorder by going out and shooting entire 15 and 20 minute programs, coming back and cross-editing them, assemble editing and insert editing with these things and coming up with a very slick presentation that I can compare to any of the UHFs we're carrying on our system. We're certainly not NBC but we don't try to be. But I am comparing it constantly against the independents and our programming right now looks as good as theirs.

We are using professional, talented people. They look good on camera. They're pros and therefore the customers out there respond very nicely to it and so are my sponsors. Our news show is 40 per cent sponsored now with one client we hope to close this week -- and if things go well -- which will fully sponsor our news out completely and it will pay for itself.

It's costing me right now about $18 to $22 a day to create this 15 minute newscast. That includes one full-time director and one full-time newsman and whatever else we spend to create the news. That's really it. We're not loading all costs in there.

For instance, we don't load typewriter costs. We have typewriters. We're not loading our phone costs in there because we have also telephones. It's a raw cost.

Our over-all programming, to create some 35 hours a month, now is running us in the area of about $1,900 a month. A lot of it is because I do have two full-time people and as we increase our schedule, of course, we can bring that cost down.

We're doing no canned programming. We're buying no software. Everything we do is locally produced and we are using this Rovercorder. We're using a lot of outside action, a lot of local sports and the rest is news programming and that's basically it.

We are finding this Rovercorder is the key. It's a key for us to do the things in our local communities that we feel are necessary to be an active news reporting medium in this market. We have been able to turn public relations problems right around to our own benefit by taking mayors who really didn't like us because of many problems which were not ours when we got into this system and going into their towns and by highlighting them on these news programs and by exploring some of the problems they have in these small towns on these newscasts. They're really excited with it and their entire image of us as a cable operator in these communities has turned 180 degrees, which has been very rewarding for us.

When the gypsy moth comes through one of these towns and eats half the leaves off the trees and the people get very up-tight and the city council really tried to save the trees, we can go in there and get the people involved in these issues by standing them in front of a tree and doing a report there. Believe it or not -- it sounds a little crazy -- but that happens to be something we did and the case of why something was done was immediately exposed to the entire community and it did the trick.

The city council was happy because they felt for the first time they really were quoted honestly because the guy at home could see the person involved making the statement.

Secondly, it sort of added credence to the news. All of a sudden he's really saying it's not an interpretation of the local newspaper.

I will say one thing. A local radio station does not do a good job and therefore what we do is rather refreshing. That does give us a great edge and I think is a key to part of the success of it too.

I guess if we did have a radio station that was doing a tremendous amount of audio local reporting and getting a lot of beeper phone reporting, we would have to work a lot harder than we are.

But I do think it's a definite key to local origination in news programming and we're really excited with it. So far it's working just fine. The acceptance has been fine. The use of the Rover recorder to give us the on-spot location reports is just doing it to the point of where I think we're now in the professional news business, particularly in our system.

Byron D. Jarvis -- Does the $18 to $22 include depreciation on origination equipment?

Barry D. Stigers -- No, I'm working on an over-all figure. Depreciation of the equipment is not included in that, Doug. No. For two reasons.

One, we have the Knicks and Ranger package out there. We have negotiated with the Madison Square Garden people and we carry 100 live and in color events in Madison Square Garden out to our subscribers in Wayne. This runs from October through April. And because of this we have a lot of equipment out there that we ordinarily wouldn't have. For instance, we have a lot of color processing equipment and we have a lot of color video tape recorders and things like this.

We have a big equipment package and it would be a little unfair, because of the news program which makes up such a small part of our over-all programming over the year, Doug, to blow that cost in there. No, it's not in there.

Byron D. Jarvis -- What is a Rover recorder and how does it work and what do you get out of it?

Barry D. Stigers -- The Rover recorder is a battery pack which is charged and can't be more than about two feet square. It's a small, portable, battery operated camera and tape recorder.

It works on a one-half inch format. It's built by Sony, which is not the only company; there are a couple others out now. And in addition to that piece of equipment, we do have a playback unit which never leaves the studio. It's in the studio and accepts the tape. After we record it, we bring it in and throw it into the playback unit and run it through the processing that we talked about.

At that point, we then have a completed product when we get it onto the air or we run it into our editing features and do something else with the program and re-record it onto a one-inch format.

From the Audience -- You said that you don't have a good local station but I guess that doesn't bother you that much. I was wondering if you were in a community that had a very good local radio station -- I'm thinking of an instance that has a very good news comment -- what is your thinking about basically buying the service of news, either personnel or facilities, from a local radio station on a full or part-time basis?

Barry D. Stigers -- We've done it. I've done it over the past few years. Sometimes it's been very successful and other times, after three or four months of what appears to be a rather successful situation something usually blows up on it and then you lose it and you have to do it yourself anyway.

It's certainly desirable, if you don't have to get into the cost of creating and reporting your own newscast every night; if you can get somebody else to do it who's in the business, this is desirable.

My experience over the years with newspapers and with local radio stations is that the minute you start selling advertising they get very touchy and you can't really blame them because, if you're any good at what you're doing, you're going to be a competitor. In fact, you have to be a competitor. Not that you're going to get the same dollars they have but they certainly think you're going to and, if you're good, you will eventually be out banging on the same clients' doors they are.

So after a period of time, it usually dies. I find that for a number of reasons. Even in the case where we weren't actively selling that much advertising some years ago, pretty soon the guys got a little touchy. So that, if there's something special the radio station wants done, you lose, no matter what agreement you have and it can't be any other way.

If I ran a radio station, it would be the same way. But it's a tough thing to operate over any period of time, at least that's been my experience and I just don't even bother with it any more. We did try it in Wayne for a while with a local newspaper there and it just didn't work out. It just finally became a major problem and we finally had to terminate what small agreement we had.

From the Audience -- What do you do with your local origination channels?

Barry D. Stigers -- We have a crawl which we throw in, public service announcements and basic information, our own schedules. We do an awful lot of public service stuff and I have a flying spot scanner. I throw in color slides. We don't use that too much during the day but we do have a continuous crawl on which we get a lot of public service stuff that normally might go in the news; but our area is big enough so there's enough hard news every day to fill 15 minutes. So we don't have to revert to the Red Cross is going to meet tonight or a collection of funds type of situation. But we do use this crawl to satisfy that obligation which certainly it is.

From the Audience -- The $1,900 figure that you mentioned, I believe it was, is that just your cost for doing the news or is that your total cost?

Barry D. Stigers -- That's total cost which is made up of two full-time people, three part-time people and just basic operating costs. I have some electricity in there and I do have some office form stuff in there. You know, basic little office stuff. It averages out around $2,000. It's run $1,800 the last 3 months and I'm not sure why. I think I'm forgetting to put something in there.

From the Audience -- Is that all for news?

Barry D. Stigers -- No, it includes news and sports. We start each program day with 15 minutes of news on the format I discussed.

Following that then, which brings us up to seven o'clock, we have a different feature each night. Monday nights we do a full-scale sports feature, high school sports, mostly, because there's a lot of high school competition within the individual communities. We have fierce competition, particularly in football and we find local football is very exciting. A lot of people like it and it's good football out there because you are in suburban communities and there's a lot of very bright kids in these communities. There's a lot of good football out there.

Paterson College there has some great sports. In the middle of the summer we are doing some things with the Pal baseball and there's a metropolitan league that's very good and we've got soft pitch and hard pitch softball.

So we basically have two sports features a week. We run them Mondays and Fridays. When we don't, we repeat the Monday thing again on Friday. Last week, for instance, we had an all-girls softball team that came in and had a pitcher who pitched through her legs; she was a real doll and we had a tremendous last minute spurt at the gate which really excited us. We don't know how much we affected that gate but after she was on, the next game they played, they had a tremendous increase at their gate. We, of course, are taking credit for that. I'm not sure it's really fair credit but we know we had something to do with it.

We got out and look each week for something to do in the sports area and we're hoping to find something exciting. Bobbie will tell you about something exciting we did find one year which is rather unique.

We do parades. For some reason people really like parades on these local television stations. I suppose it's because most of the town is in the parade and they go home and watch themselves.

Primary election coverages and things like this we do well with. That was only one week, of course, but we have about four elections a year up there and with 7 towns there are a lot of little elections which we cover.

The William Paterson College has its own studio and they present an hour a week. They create it, send it to us and we play it back. We're getting a lot of good public relations with them on and it also gives their students an opportunity to have what work they're doing be seen by a viewer.

And we have a hot line show which is a weekly issue show where we bring in guests of issue. It's in the communities. We open up our phone lines and let the people call in and question them but we also give them hard questions. In other words, we actually do the program and we let people call in the last part of the program and participate.

That's our basic programming. It averages about 10 hours a week of local programming. It does not include the Knicks and Rangers which doubles that immediately during those months.

Byron D. Jarvis -- One of the features of trying to program and not spend an awful lot of money comes on the side of the visuals. Any of you who have tried it or any of you who have at least been to one of these seminars know that you very quickly run into a problem of trying to compete with broadcast television for the visual side of your presentations.

So I've asked Jack Williams from TelePrompTer to talk to us about sets and visuals, anything in that area that can help you to make your things look more professional without spending an awful lot of money on them.

Jack Williams -- I don't think it's so much about what I know about putting a good visual set together, because I found out that on a lot of these things the best way to find good sets, good visuals, is to go some place and borrow them, and when I found out I was going to be talking about this at this particular session I figured the best thing to do was to go to someone and borrow their knowledge about it, which I did.

I think that all of us go through something, if you're married and even if you're not, that you've seen from time to time. Every few years a process that costs at least several hundred dollars is a ritual known as "Let's fix up the house and we'll find a way to pay for it later." Once that idea has been implanted in your mind, you go through several, almost like a ritual. You repaint the kitchen and the dining area, you redecorate the living room, you put new draperies all over the house and new carpeting is laid.

When the ritual is finished and your family has gone into hock, the most important part of the fresh new look comes when you have a party and invite all the neighbors over where they can see what's been done. And, of course, the neighbors are envious and they in turn want to redo their house so they can have a party and invite you.

I think that this pretty much becomes universal. There's a good reason for it because you and your family have become accustomed to the surroundings that you live in on a day-to-day basis. After you've decorated your home and you've had your party and all your neighbors come in and do the same thing, you begin to wonder why and I think that we can compare the same thing with television viewing.

We more or less get in the habit of watching a 21-inch house, so to speak, on a day-to-day basis and if all the rooms that appear in that house, such as the interview rooms, the laugh rooms, the news rooms, the singing rooms, are dull and have a sameness about them, we tend to want to make a change and look for something new. It's known as losing an audience.

When this happens, it's very difficult to get that audience back. It becomes our job in programming to stimulate an audience, to make them want to watch. I think probably one of the basic problems that most of us have is we make an initial investment in equipment. We either try to do the job ourself or we hire someone. We either hang a blue curtain behind us or perhaps we put up some wooden paneling or maybe we just put up sheetrock and paint it a color that doesn't look too bad on camera and that becomes our set.

For our news, we sometimes will push a desk in front of a blue wall. For an interview show, we'll set a couple of chairs in front of the blue wall and for sports, we sometimes will set a trophy on a desk and that's our set in front of the blue wall.

There are many ways you can pick up things that will help your studio, your set design and will make it really look professional on a very inexpensive basis. Some of the places to look, of course, are your civic organizations. During the year they may have things that will involve a photo perhaps of the new city hall that is blown up into a 4 by 8 foot thing that you can have on display.

You do with these what's known as confiscating. You back up, you pick up, load it up and take it back to your studio and store it. You may not need it immediately but sometime or the other it probably will come in handy.

Another thing is the poster craze that's going on. Any of you that have kids are bound to have posters of all sorts and shapes and sizes. These posters make very good set designs.

You can go to your dress shops and find some of the used designs and things that they will have.

Travel places are great. You can go to a travel agency and get all sorts of things that you can use as set design.

One of the things that we have to do, of course, is keep this on a low budget. I think if any of us could stand up here and really tell you how you can go back and start making a lot of money in your particular system by selling advertising, we might be considered a genius and I really don't think that anyone can be considered that at this stage of the game.

But one of the ways, of course, if you're going to keep this thing on a break-even point or to make some money, as we are today, is to keep the cost down and there are several things that we've found that you can use that will make a very good set and at the same time keep your cost down.

If I might show you a few examples. You go to the grocery store and you find a big cardboard box and you cut that cardboard box into a design. You take a little paint, spray it on and you put this with lights on a background. You can cut it out and make news lettering out of it. You can put your station logo on there. You can make names. You can do almost anything with a simple cardboard box, and a little bit of spray paint.

Sometime ago in New York CBS spent about $18,000 to have one wall decorated. They wanted kind of a bubbly effect with lights coming across this wall to create shadows and give it kind of a weird effect. What it amounted to was a series of flat surfaces with little bubbles coming out that looked something like this.

Of course, I think, as you can tell, those are egg cartons. Again, with lights and with paint you can make some pretty good things.

Another thing that is very easy to use is aluminum foil. You crinkle it up and staple it around on a particular setting. You can use something in front of it, a different color, and you can really get good effects if you're televising in color. Get your lights and use your different colored lights coming off of that.

I don't know how many of you have been to, for example, the Johnny Carson show in New York. His set -- I'm sure that most of you have seen it on television -- is a very colorful set. It's a plain, drab, white set with a bunch of tubes coming out and a series of lights and the entire thing is lit in different colors. There's absolutely no color painted or anything else. It's all done by lighting which you can do.

Another cheap and very inexpensive thing is crepe paper. You can use crepe paper for streamers and various things like that and can get some very cheap and very fine looking designs.

Another thing that you can use is a thing called no-seam paper which is something like $8 a roll. It's about 8 feet high and you can get it in a roll just about as far as you want it. You can roll this thing around and use it in the back. Bring in a local kindergarten class, give them paint brushes and a lot of paint -- and plenty of aprons or old shirts or something so you don't get sued by their mothers -- and let them paint to their heart's content. That could be the setting for your children's show.

You could have an artist or someone design a set and maybe have a class, perhaps an art class, do the painting on it. There're hundreds of ways that you can use your imagination to create new designs.

One of the things that we've used in several areas is a very simple roll panel you can roll in and roll out. On one side you can have your mahogany panel, if you want. On the other side you can have wallpaper that looks like brick and the thing can be no wider than half of that desk. You can roll it in, turn it around one way, turn it around the other way. It will probably cost you $10 to make and then you can use it to very good advantage.

In addition to that, you can put some of these in various forms on the back of it.

Just like your neighbors that came to look at your home after you redecorated, they must be impressed with what they see because we're really competing with professional people in this television business.

We realize that we can get away with a lot in a local system, if we have something that is very, very pertinent to that community on but even then we have to make it look as professional as possible.

I think that if the advertising dollars are going to come in and if we're going to look professional, we've got to learn to do this in a way so that whenever they turn us on they're seeing something other than just the same old drab thing that they see day in and day out. We have to keep this in mind. I think it's going to become a very important part of our day-to-day operations.

Byron D. Jarvis -- Bobbie Weinberg has two very, very intriguing things to talk about which go back to the title of the panel rather than to the substance of it and I'm tickled to have her.

The first is what an advertiser needs to have to get on cable. A very interesting question.

The other one is an interesting theory which I won't divulge on the nature of cable television advertising, what it's like and, rather than go any farther, I will just give you Bobbie Weinberg.

Bobbie Weinberg -- Good Communications is a marketing service organization to the entire cable industry. That means systems, advertisers and agencies and suppliers.

If I may take just a moment to establish a little bit of background and explain why we'd like to have a moment to talk with you. We have all, in Good Communications, come out of some other kind of marketing, out of broadcasting and out of advertising. We all made nice livings in that. And in fact we made a choice. We made the choice because we believe that cable advertising, cable television, CATV -- some day we're going to name the industry what it ought to be and I don't know what it is yet but it's none of those things -- is the most powerful marketing tool this country has ever known. Please consider that.

In a Quaker Meeting, people who participate are invited to speak to their condition. If, as a result of the 5 minutes or so that we chat today, we can speak to the condition of cable as a marketing opportunity, then everything can be turned around.

That's a pretty powerful statement and since we are people who are supposed to put some advertising dollars on your system, I think it's pretty fair of you to say, "Well, you know, how do you get there from here?" or, "What are you talking about?"

Cable uses television as a means of communication. I don't think anybody questions the fact that television is the most powerful consumer advertising vehicle the country has known. But, the most effective advertising medium that anyone has ever known is direct mail. Thank about it, if you will, just for a moment.

You have the only advertising medium in existence that can and does and should and must know its audience by name and address. You have viewers and they are human beings. That is the whole key point. If you must compare your marketing tool to another medium, as we had to -- I'm now playing devil's advocate. I'm now playing a buyer, if I may. If we must compare cable to any other medium, it is more like direct mail than it is like television. What it has is the power of television to carry the message.

There's an interesting advantage. Is there any question or debate about that before we go further? Because, if I can't communicate that to you, then I not only don't have good communications, I have no communication. That, I suspect, is the secret, if there is a secret, because there is no mystery of how we get there from here. The topic today is: Where do the advertising dollars come from?

If you look at the ceiling, you'll notice they aren't falling down from there and, if you ask the broadcasters, they indicate that they're coming from Santa Claus, and you can't get there from here.

How many of you have had the opportunity this year to go out to solicit advertising? I hope that each of you have had some success during the year. I want to make a prediction that the hardest thing you had to face is, how many people do you have? How many viewers do you have? That's the first thing I want to know.

And you don't know, do you? Okay. I submit to you that you will get around that problem and you won't have to deal with it at all if we speak to our condition. I am saying that once you establish that you are more like direct mail, that is, that you offer a specialized, segmented audience, you will never again be in the cost-per-thousand bind.

Cost-per-thousand is a broadcasting term essentially. I know it's used in other media too. Cost-per-thousand is a way in which efficiency is measured. And you'll all come up against it. There's no question. We do and did all the time.

However, one place it isn't used is in direct mail because the value of direct mail is the pinpointed audience. Cable offers its greatest service as an advertising medium to advertisers who need segmented audiences. It doesn't mean small advertisers necessarily but we believe that that is the entire key.

If you in fact can establish that you're speaking and representing a specialized medium, nobody will put the cost-per-thousand ruler on you because nobody would ask you to measure the height of this rostrum and the width of it with the same static ruler and that's what they're asking you when they compare you to broadcasting. That's the position you're putting yourself in when you compare yourself to broadcasters.

Then, the second part of the question becomes: What does an advertiser need from you in order to buy cable? The answer is information. They need to know how many subscribers you have. That's important and perhaps it's in T.V. Fact Book. Much more critical, they need to know who your subscribers are.

If you can help them find out that they are of this economic bracket, if they are of these many children, in this kind of an employ, that's when you become an unbeatable, unbeatable marketing tool.

Barry, I think was the first cable system man I ever talked to on the subject of advertising. Okay, and I'm a genius because for 9 years I've been buying $14 million worth of advertising and I know every-thing. I mean, you know, just ask me. There's nothing I don't know.

Except he told me about a program and I didn't know anything, but anything. He was originating then in Levittown, Pennsylvania. Levittown is near Trenton. I was going to say Levittown is near Trenton and Trenton has bars but I suspect that Levittown has some bars anyway. And Barry had a Dart Program on. Okay. And the Dart Program was in 73 bars. Barry, if your news cost $18 to $22, what did the Dart Program cost to produce, $6? Okay. A Dart Pro-gram, a Dart Program.

Who watched a Dart Program? The people that came into the bar and couldn't get to their own dart board. That's what was on in the bar. Think about that. I mean, I'm off the subject of programming. I think that wasn't sponsored in those days. I think you weren't allowed to carry advertising in those days.

Barry D. Stigers -- We were allowed. It's just that we weren't successful.

Bobbie Weinberg -- Today you want to be. Okay.

If you would please consider an automobile dealer, to say nothing of a beer distributor. Beer distributors can't, you know, can't advertise in a bar. He can on cable television, can't he? Per-haps you will supply that beer distributor in 73 bars maybe, maybe 1,000 people. Boy, does he want them. Because it's not a question then of how many it's a question of who, and the who in that case are people who at that moment can put down whatever it costs in that bar to buy whatever beer it is. That's cable television.

After the Pennsylvania Association Meeting Mimi Barash offered to distribute a questionnaire to all the systems to show you how to develop demographic information. Is that a familiar term? Demo-graphic information is in fact the makeup of your viewers, who they are, not how many they are but who they are potentially.

That's critical. You have a subscriber list. You at least know their name and address. Please, please go forward and find out more about them. If you don't know how, Barry knows how. Barry did it in Daytona, Florida. We know how. Lots of people know how. It may not be your bag and it wasn't supposed to be your bag. Three years ago you weren't allowed to do this. Today you can do it.

How many of you hope to carry advertising before the end of the year? You're going to make it because at this stage of the game -- I don't know who wrote the copy line but I wish I did -- we've got an idea whose time is absolutely today.

DISCUSSION

From the Audience -- I think I need perhaps a point of clarification. On your execution of this direct mail concept. I'm selling basketball and I'm selling football and I'm not only dealing with Joe Povitch, the local plumber, but I'm dealing with ad agencies.

Bobbie Weinberg -- Okay. Where?

From the Audience -- In Ohio. And I'm supposed to go in and sell them direct mail concepts on basketball games? I'm not sure that's going to make it.

Bobbie Weinberg -- The answer I can offer you is our own experience. We are on retainer by four advertising agencies headquartered in Philadelphia. We called on a few more and we floundered badly. The first time that we got to first base was when we got rid of the television problem and when we walked in and said, "There are ground rules to this meeting. You have to accept something. We are not talking about television. We're talking about a marketing tool."

Cable is the only advertising medium that can identify its audience by name and address, etc., etc., etc. The president of the advertising agency just said, "Hey, you're talking about electronic direct mail."

That's what we're talking about, electronic direct mail.

I will be delighted to chat with you and to develop that concept with you even further. Yes, sir, not only will the advertising agency buy that, it might be the only thing that they will buy because they can't really justify the numbers otherwise.

They're not all going to buy. But I submit to you that you've made your lives much, much easier by attacking the problem through that channel.

From the Audience -- Miss Weinberg, have any of the systems done an analysis of their subscribers that you know of?

Bobbie Weinberg -- I have not received any at all. I know that on systems where we are beginning to place advertising where we used their lists we are helping them now collect it. Daytona did, didn't it, Barry?

Barry D. Stigers -- Not completely. It went into the project. It was done by a college down there to take a look at it and their approach was rather simple. They just contacted the subscribers with a questionnaire, which is not unusual in this technique, and the returns were quite good. It gave us a pretty good sample but I'd say it was probably less than 30 per cent return on the sample.

Bobbie Weinberg -- But, consider that Neilsen is one tenth of one per cent of the country. A 30 per cent return is pretty valid.

Barry D. Stigers -- I think it's fair to say though that we did ask them what kind of programs they liked and they did fill that out and I think that was the key to getting a lot of returns in.

Bobbie Weinberg -- All you need is a simple questionnaire that perhaps goes out with your monthly bill or however you communicate with your subscribers. I'm not talking about an elaborate research project. I'm talking about something that maybe could cost you a nickel to 10 cents, at tops, apiece, just as long as you have the information.

From the Audience -- I agree with you 100 per cent. We started programming 5 channels, 5, not one but 5 different channels at once in one studio in the middle of April and I didn't believe that some of the stuff that was being broadcast would draw. Now the very first program we put on, which was a half hour, 3 times in one day, we sold to a Hammond organ distributor and we hadn't even opened up the channel by that time. But he put some advance mail out and the very first program we got 21 calls on the program. It was $1,100 item.

Then the second program he got about 13 and on the third program he wouldn't tell me how many but he knew he had plenty, so he was happy. I don't know how many Hammond organs he sold and he didn't tell me either but he was happy with it.

Bobbie Weinberg -- Your job was just to pull the leads.

From the Audience -- Exactly.

We also had this stupid Tele-Mation wheel, and we didn't know what to do with the stupid thing. So we had some advertising on it: just $6 a week per card. That's all. And they were happy because they were sending in the money every month. So we decided to activate it and in activating it we put a show on the air, a show, I tell you, and I didn't believe it was possible. It was called Eye-dentify. We put names and places, people and places on there and the viewer had to identify them, and if they did they got a prize.

The first day we had 22 calls. The third day we had 150 calls and that's going on every single day, 150 calls a day. They're playing this game. The whole audience on the cable in the daytime, and that was in the summer months.

Bobbie Weinberg -- Let me expound on 150. That's important. You know, that's great. If you say that to somebody who's putting you against broadcasting, it's preposterous. You know, you talk in terms of 15,000. 150 calls means 150 leads. Let me tell you something. I would rather talk to this group right now, because you're prospects for Good Communications. No question in my mind about that. I'd rather talk to the 150 people in here than stand up at the General Meeting of the NAB where I can get 20,000 people. That's the difference.

From the Audience -- I don't know who best can answer this question. We talked about selling the advertising and the programming behind it. Then you've got to have something to put on the air. Namely, a commercial. How much of an over-all problem is the actual production of the commercial?

Barry D. Stigers -- It's a big one, it's a big problem. It really is. There's no easy, fast, slick way to getting a good, swift commercial on the air that I've found. I've tried a lot of them but I keep coming back to the same problem. They keep wanting to look like NBC. You know, they keep thinking that they should have a good looking girl riding on this lawnmower and a good professional voice underneath saying what a fantastic lawnmower it is and, if you don't give him this, it's tough to get him to renew.

There are slicker ways to do these things. There are things here at the show I'm sure you've seen that would kind of tickle your imagination. They allow 35 millimeter slides in color. We're using that process with some success.

From the Audience -- Were the costs for the commercial paid by the advertiser or do you absorb them?

Barry D. Stigers -- That's up to the option of the salesman and how hard he wants to get the buy and how big it is. I can answer that both yes and no.

We have a format within our rate card that we will put in two produced commercials for every client to get him on the air. If he wants real fancy stuff and we have to move cameras and people out, then I have costs for that and he pays it. Frankly, if the guy is in the area of $2,000 or $3,000 within a 13-week period -- and we'd all love to have 10 or 12 of those -- certainly I'm going to run out and do just about anything he wants. You know, it's sort of like what does he want and what can he have and he can have anything he wants, if he wants to sign a buy that makes it reasonable from a business point of view.

I think each guy has to develop this himself. I really do.

Jack Williams -- I think that's one of the biggest problems we have. And one of the toughest things is to keep the people from trying to overdo it, like Barry said, and trying to really produce an NBC type spot.

We had a particular instance in Eugene, Oregon. They have a triple-A baseball team, a farm club of the Phillies, and they were televising, I believe, 11 games from Portland and microwaving it back. It was a pretty big undertaking for one system to do that on their own.

We knew it would be a big subscriber-builder and retainer for the summer, which was part of it, but we also figured this would really be the big test to see what we could really do with the advertising. So we went out, we sold it and came out in good shape.

And all of a sudden I started getting complaints that the commercials weren't of the quality that they needed to be and that the video tape quality wasn't the quality of the live. And I really couldn't figure out why, because we realized one-inch machines left something to be desired but they should have at least been on the same par. I found out a little later what happened was that they had made a series of several commercials and they changed these commercials each game. What was happening was that in order to do it and really make it look sharp they were dubbing anywhere from 3 to 4 times and by the time the commercial came around to being played on the air we'd lost so much quality that we were losing advertisers.

What we did was go back to a simple slide presentation and 16 millimeter and it's working fine.

Barry D. Stigers -- We're using this Rovercorder too. It is still in the experimental stage and the initial test of it seemed to work pretty well but it takes time and it takes somebody who knows how to do it.

With one client, it took us about an hour -- two people, a cameraman and myself -- to shoot enough material with this Rovercorder to then go back to the studio and produce what I thought were 3 pretty nice commercials. The client was very happy with them and I'm in a tough market so I figure, if I could keep him happy, fine.

That was strictly video. Then we did audio under it after we got the video together. They were very simple, very formatted. The same thing you've seen if you've watched commercials on television. You'd be amazed at how simple they do them. Ed McMahon can take a can of paint and make it sound like a hamburger. You know, the guy's fantastic. But there's a key there. It's Ed McMahon. He's the salesman. So it's an open camera and a very simple set and a guy who really knows how to sell product.

How many of us have guys like Ed McMahon in our markets? Very few. We might have one guy and he can't sell all your clients. We all have program directors that are pros but you can't let him sell competing clients and things like that.

That's a big problem. There's no question about it.

<u>From the Audience</u> -- Bobbie, take your concept which I certainly agree with and translate it into dollars and cents to the cable operator.

What has been your experience and what is your thinking in regard to rates, setting rates, etc.?

<u>Bobbie Weinberg</u> -- There are two answers I can give you. One is the scientific approach. And the other one works.

Seriously, I would suggest that you start out to find what you need. Develop a budget and work backwards in terms of this is what it's going to cost, this is how many hours we're going to do, divide it and this is what I need per hour.

Then you structure a rate card and you structure some goals and objectives as well in terms of how many, are you going to sell programs or are you going to sell spots and in what ratio?

May I ask if you started to sell, have you done a successful rate card as yet?

<u>From the Audience</u> -- No.

<u>Bobbie Weinberg</u> -- Okay. Now, we'll see how this works. The first rate card I would propose is what you think the traffic can bear at the high end. I don't know what that's going to be but you'll know as soon as you do your budget and you find out what you need.

Philosophically, as a matter of fact, if you go for high failure instead of low success, you're going to have a very different subject. We heard for over a year cablecasting is terrific; you can lose more money every month if you do it right. But you can take it the other way.

You start out with your first rate card and let me say that the spot rate is $8 because that's what figure comes out if you're going to get 6 spots an hour. I'm making these numbers up. Please believe that. And you go to sell it. And you can sell it. Terrific. Two months later your rate is now $10. You started at an $8 rate and that's your published rate card and you can't sell it. I suggest that one month later you have an August special playing from this first established rate card. And if you buy for the month of August we can do this, this and this for $7 or whatever it is.

Once you've established a rate card, don't break it. Package it, merchandise it, but don't break the rate card because once you say the published rate is $8 but I'll give it to you for $5, it's no longer a question of who you are, it's only a question of how much.

<u>Barry D. Stigers</u> -- I think you can also look at your other media in the market and take your radio station rates, take your television station rates and throw yourself in there.

Jack Williams -- I'd like to quickly say that I absolutely agree with you, Bobbie, on this breaking your rate card. You break your rate card and you're dead. Radio stations have had big, big problems with this. They get into rate wars and it's a major, major problem. It's amazing how a client's respect factor for you as a salesman will go up 100 per cent when you refuse to break your rate and turn around and walk out and say, "Listen, I just won't break my rate. That's it. You pay it, everybody else is going to pay it." He might not buy but I'll bet you, if you keep working on him, he will.

From the Audience -- You said something during your speech that I don't think I've heard of. I think you said a Rover recorder?

Barry D. Stigers -- Rovercorder. Yes. It's a little Sony battery pack.

From the Audience -- Did you use your rover on those parades that you were talking about?

Barry D. Stigers -- No. For anything with action requiring more than one camera, I have to have more equipment than that. So with anything like sports I go out with a full scale mobile unit, which is 2 cameras and 4 audio and a switcher and special effects and three monitors.

From the Audience -- Barry, your portable units are they black and white, I suppose?

Barry D. Stigers -- Right. I've already started hawking them for color because I think that definitely we're all going to be forced into color and, if we're not looking to that in the next couple of years, I think we're kind of foolish. I think we have to go color.

From the Audience -- Is some of your other programming in color?

Barry D. Stigers -- No, I don't have color in my studio yet but I'm planning. Our budget is coming up, and the board of directors is going to have a big shock. They're going to have to see the color coming. We are in color on all the things we bring in from Madison Square Garden because it's originated in color and we are capable of accepting color. Wherever I can get 16 millimeter commercials dubbed over onto tape, I use them in color and I do have a 35 millimeter spot scanner that's in color.

I don't have the camera chain but that's in the budget for next year. We hope to have one.

From the Audience -- How are you using color for 16 millimeter?

Barry D. Stigers -- I send it over to a company that puts it on video tape for me in color and I play it videotaped. But there's a definite loss in quality.

Bobbie Weinberg -- Would it be the same price -- do you do that often?

Barry D. Stigers -- No. I haven't had much because really all my business has been local so far. But I'm getting into one now. I just signed a nice contract with a guy who has a garden center and he has about 4 good cooperative advertisers. If you don't understand that, cooperative advertisers like Toro have tractors and lawnmowers and that kind of stuff and they will participate at some stage with the advertiser on anything he does. It's a percentage and based on the time of the year. It might go 20 per cent, 30 per cent, 40 per cent.

These fellow will offer this garden center 16 millimeter stuff that's really professional slick stuff which helps his commercials a lot; and we dub it and work with that. We're just getting into that and it's pretty obvious we need a color film chain if we're going to do much of this. And with his signing the contract, I think my board's going to listen a little closer.

From the Audience -- Barry, have you found many companies, national companies that do offer co-ops hedging on it?

Barry D. Stigers -- Frankly, the garden center is the only one I've had any experience with. I had a lot of it in radio so I'm very familiar with the co-op and they are tough. You have to do a lot of work to get cooperative money for your advertiser. It's a tremendous amount of work but it's worth it in the long run. We had the guy there, had him on the spot and, as Bobbie's already said, he certainly compares you, he really wants to know that cost per thousand and we do have a cost-per-thousand factor that we have worked on. But we have a unique feature. We have a tremendous draw. We have color programming out of Madison Square Garden so it makes a bigger difference for us than for most of you.

From the Audience -- Bobbie, to supplement your idea of direct mail, do you find any of the systems, in addition to the direct mail type of audience for a program, also using their billing as a supplement, as a merchandiser?

Bobbie Weinberg -- Without an exception, every advertiser that we've put on a system has used that list in one way or another. You know, I wonder if I oversold. I have a habit of doing that. Let us not forget that it's the direct mail concept with that power of television. We can't lose that. We've used it both to communicate directly in a merchandising effort and also to test -- and that's very valuable -- and to sample.

Barry D. Stigers -- Yes, I think so. I think it depends a lot on your market and what you're trying to do with your local origination. In every system I've worked with I've found that you can create a tremendous amount of excitement in black and white for at least the first year, I would think. I do see color coming.

I would have the equipment that I put into any studio totally adaptable to handle color so that down the road you buy two cameras and you're in the color business. This way your people, the guys that are running your stuff, learn to use lights and techniques and when you add color, all you have to do is teach them to handle color. Because if you just throw color in there without an expert, you're going to go bananas with it.

There are so many things about color that don't affect you in black and white. Just simple techniques like getting two color cameras to look at the same subject and get the same phase of red. There aren't too many cameras you can do that with, even some of the brand names.

So you give a guy a year experience working with the equipment and then add color and then give him real hard training on just handling the color phase of it. The production techniques and all the things he has to do on timing and production and programming is all a year of experience now.

That's the way I would do it and in every case we have.

From the Audience -- Barry, what about voluntary help? Do you use voluntary help for home programming?

Barry D. Stigers -- We're really just starting that in Wayne. The voluntary help thing is a problem. You've got to use it. You need voluntary help to get your programming in operation. You must be careful how you do it. You still have to exercise a tremendous amount of control and expertise to get these people to do the job for you or they'll run all over you and they'll smash up your equipment. They'll burn your vidicons. It can be a disaster, if you don't us it correctly.

And in front of the camera, as far as this, yes. But take the Jaycee organization, they know from nothing about television. So you still have to do most of the heavy think-work, the direction work, the organization work and then use them as footwork.

It works, but it's tougher because if they don't want to do it, or if their wife wants them to mow the grass, there's a good chance you're going to lose them.

From the Audience -- Will agencies put advertising on systems that aren't originating in color?

Bobbie Weinberg -- That's never been a problem, whether they're color or black and white.

From the Audience -- Have you had any experience with putting any kind of advertising on a weather channel?

Barry D. Stigers -- No, but I think Doug has played with this a lot.

Byron D. Jarvis -- I not only was involved in the selling of this but I live on a system where it's done. It's not hard to sell and their perceptions are correct, it's probably preferable because more people watch the weather channel than are going to watch most of these locally originated shows.

You know, I moved from a big town to a small town and I'm hooked on the darn thing. But the one thing you've got to watch, and this is just a personal observation, is that the resolution coming out of the carousels basically is not real good and if you get sloppy copy coming out of that thing people won't watch it.

Barry D. Stigers -- That's a 35 millimeter slide you're talking about?

Byron D. Jarvis -- Yes.

I know one of the jewelers in town used some cuts that were done for newspaper advertising which were very upbeat. This is Mimi Barash's work and she's very, very good at this kind of thing. But when you throw it through the carousel there was enough blurring and enough loss of resolution so that it just was a black and white blob and you didn't know it was Al Crabtree's jewelry, to tell you the truth.

So you've got to be a little careful on what you put on that slide. They have now corrected it and it looks great but that's the only caveat really. It's a great way to sell.

From the Audience -- Do they just rotate?

Byron D. Jarvis -- Yes.

We charged -- it was a declining rate card -- a buck a day, which, oddly enough, came out to be about $1 a thousand.

Barry D. Stigers -- Too low, Doug, you're going to hurt us all.

Bobbie Weinberg -- There is a piece of equipment manufactured by Polaroid which as far as I know hasn't yet been marketed to CATV but it is a tabletop camera and it copies anything, which is ideal for this weather situation. The number is MP3 and if anybody cares about it at all, I'll put you in touch with the people who sell it.

We use one.

Byron D. Jarvis -- It's a transparency too, right?

Bobbie Weinberg -- Yes. It is instant slides and/or opaque. We use it for our clients to do this job because, first of all, lettering becomes very expensive; when you do it from an agency, your talent is costly. But you can take an already-well-produced piece of material, as long as you have permission to reproduct it, shoot it in exactly 7 seconds and you've got an absolutely perfect piece of material for this.

"EDUCATIONAL PROGRAMS FOR CATV PERSONNEL"

Speakers

Dr. J. Robert Burull
President, Viking Media, Inc.
Stoughton, Wisconsin

Robert Titsch
National Cable Television Institute
Oklahoma City, Oklahoma

Thomas A. Straw
Texas A&M, Cable Television School
College Station, Texas

Robert Turkisher
Colorado Electronic Technical College
Manitou Springs, Colorado

Moderator

William Karnes
National Trans-Video
Dallas, Texas

William Karnes -- We are here to discuss with you some of the educational opportunities that are available in CATV.

It has been gratifying through the last two or three years to see the industry come from a point of having practically no educational facilities to one where we are beginning to have competition in education.

The gentleman on my immediate **left** is Bob Burull, President of Viking Media, Incorporated. Viking Media is an owner and operator of cable systems in Southern Wisconsin and Bob is here this morning to tell you about some of the work he has been doing in trying to establish technical training facilities in cooperation with the Wisconsin Department of Labor through their Vo Tech program.

The next gentleman is George Gretser with National Cable Television Institute. And Bob Titsch who is the Director of Marketing for NCTI.

The next gentleman is Tom Straw from Texas A&M.

And, finally, Bob Turkisher with Colorado Electronic Technical College in Manitou Springs, Colorado.

Dr. J. Robert Burull -- Wisconsin, as you know, is very progressive in education and it has switched now from its very active role on that big, big campus up there in the city to vocational training because it is a bit safer these days.

I was approached about four months ago by a fellow named Brian Tetsloff from the State Department of Labor in Wisconsin, who is also associated with the vocational-technical training programs in the State of Wisconsin.

And he said, "You know, we are just beginning now to hear a little bit about cable; is there any possible way that we might start some programs in this area?"

He, of course, I think, just as many other people in our institutions today, was quite unaware of the many different job descriptions in cable television and in cablecasting, and was looking very hard for some help.

These people are looking very, very hard for new training areas, because they have apparently have a lot of people coming in looking for jobs. The CATV industry has a close relationship to some of the Wisconsin vocational training programs which have already been in existence for some time.

So we sat down very quickly and worked out an apprentice program. And I am not very happy with it yet because it is still pretty rough and it parallels, as far as I am concerned, apprentice programs related to two and four-year programs you find in the plumbing area.

However, at this stage now in Wisconsin, one training program has already been initiated through the state Vocational-Technical School.

Now, cable operators who need a person to work for them and who aren't afraid to spend a little time in training them will be going through the State of Wisconsin Vocational-Technical training school. They will send Byron Tetsloff an outline.

The vocational-technical school area will then sit down and look at this outline and if it looks like a good apprentice program, they will give it institutional validity, if you will; and in addition to that, they will come up with some financial help for the trainer.

This is a harder area to train a person in, because in local origination we are looking not only at the very simple skills of camera operation, directing and producing, but also at a journalistic press concept which requires more training than the usual vocational tech school can give.

But here a very close coordinating effort with the Communication Department on the Wisconsin campus brings another possibility. Students training in vocational training schools in Wisconsin will go on the Wisconsin campus and take X number of hours in liberal arts and in areas that would be compatible here, I think, for someone who is training to be some sort of local cableman.

Wisconsin's program in training and in education for cable television is just beginning. But I think through the auspices of the state department of education, state department of labor, and state vocational-technical training schools, we have really a very, very fine instrument, if you will, which has had many years of training and experience behind it, and can give validity and institutional recognition to a cable TV industry which is just beginning to grow.

It probably can provide very quickly the training facilities, in many cases well experienced instructors to close in on a training void which cable doesn't have yet today.

One thing I think we are missing very badly is a large institutional image, that is, the image of training facilities operating well that turn out that great bulk of people we will need in the next ten years in cable television.

Through your state departments of vocational training and your state departments of labor I think you will find a tremendous amount of opportunities and lots of help from civil servants there who are very anxious, of course, to expand their own training programs.

William Karnes -- To add just a little bit to that, the State of Pennsylvania also has quite an extensive vo tech program and the Pennsylvania Association is currently interested in attempting to get some of the vo tech schools around their state to begin teaching cable television, probably along the general lines of installment first and then technicians and so forth.

Robert Titsch -- I think it is important as an industry that we continue to emphasize formalization of training. Regardless of in which direction we go, whether it be on site or correspondence, everybody must get together and increase the technical efficiency of our people so that we can grow as an industry in an orderly fashion and be able to cope with the problems that the systems of the future will create and the many that we can't answer now.

NCTI offers four basic courses and two short courses, the basic course, of course, being that of the CATV installer which is designed to teach the basic fundamentals of CATV, along with the detailed treatment of the methods and techniques of customer cable installation.

NCTI has used experienced industry representatives as advisers and writers in a continuing effort to research, develop and produce the best available text material to supplement the orientation and subsequent on-the-job training process of new installers.

We have spent a great deal of time and money in developing our courses. The "installer course," for example, is 14 lessons plus a study guide, naturally. The average completion of this course is an estimated six to eight months. The cost of this course is $130.

Then we have a deferred payment and a cash discount plan.

The next course that we offer is a "CATV Tech I," which is the beginning of a more or less comprehensive study of electricity as applied to the CATV industry. It begins with the theory of electricity and proceeds through an analysis of basic circuits and includes lessons on dbs and passive devises and coaxial cable and troubleshooting.

This course is estimated to take 12 to 14 months, is 22 lessons long and costs $260.

The next course we have is "CATV Tech II." The course begins with a study of electronic circuits, including tube and transistor theory, and proceeds through the study of antennas and transmission lines.

Application is made to CATV amplifiers, basic system measurements, test equipment and concepts of the distribution system.

This course consists of 20 lessons and approximately 10 to 12 months is what we think a student should complete it in. The cost is $260.

We have the cash discount or the deferred payment plan for all of these courses.

Our most advanced course is the "advanced technician course", and it is a concise study of CATV head end systems antenna design and installation, electronic layout and construction and the basics of studio equipment. It has 21 lessons. We estimate it to take 14 months. The price is $350.

We also have a "program origination course," which is a shorter course designed for those people who may be fulfilling the function in their company of an advanced technician but may not have experience in program origination or are looking for some information.

It is the last part of the "advanced tech course," and we have broken it out to offer for people who are interested in program origination but not interested in the rest of the materials that we offer in the advanced course.

We also have the "CATV basics course" and the "technician mathematics course."

The course in mathematics is designed to be used as a supplement to the Tech I and II courses and the advanced tech course. Its purpose is to provide a grasp of the principles of mathematics as applied to electronics to those who do not have a strong background in mathematics or need a refresher course in this area.

In college I took accounting and algebra and a lot of math courses and I don't really remember much about it. Every once in a while I have to go to the accounting department to ask them how to figure a percentage out because I forgot how to do it.

The refresher course is designed just for that kind of situation. It is a supplement and a help.

We have 709 full-time people actively enrolled in our courses. We have had 102 graduates. Now, most of those graduates are people who took our courses before they were redesigned and shortened. Tech I and Tech II were combined in one course and it took a couple of years to complete.

We have broken them down and sell them less expensively and now people can finish them faster. This requires less of an investment on management's part because a man can really hone in on exactly what he wants to take instead of signing up for the whole four-year program.

Since January 1 of this year, we have added 149 students.

And there are 96 multiple system operators that have training policies with NCTI.

These policies pay from 50 per cent to the full amount of the course. Many CATV operators reimburse their employees and many pay in advance since there is a cash discount. And if a course is not completed, it can be transferred so employers do not lose their investment on a particular individual.

Including independents and systems owned by the multiple system operators, there are approximately 1800 CATV systems that will reimburse their men or pay for NCTI courses.

Over the past two years NCTI has experienced a 24 per cent rate of student cancellations. We lose about one out of every four.

This compares with the national average of correspondence schools, losing three out of four.

We feel this is very significant. Obviously it is. And it is largely due to the fact that every one of our courses and lessons are written by CATV people who have been in the industry. We have approximately 30 authors currently writing and monitoring our courses and answering questions from students who write in and want to know why they made a mistake on a problem or something like that.

We have had union approval for two training programs. TeleView had a labor problem and a training problem, so we designed a program at their request to meet the standards and specifications of the union to take them through the journeyman training program. And when employees graduate from this course, every six months when they pass through a certain increment, they get a pay raise. If they don't pass through the increment, they don't get a pay raise.

We have another recent agreement that was reached with Cypress. We also have some independents on the West Coast also that we have qualified with their local union to help their employees at the request, I might add, of the systems.

I don't want anybody ambushing me outside because I indicated that maybe we have something to do with the unions. We don't.

Cable Tech magazine serves the purpose of the school in that we try to promote learning and communications in the industry through our school publication and try to promote communications within our school among our students and graduates. We have columns and technical tips by our various authors, and to date it has been a tremendous promotional tool for the school. It is a means of expressing needs in the industry we try to serve. And to keep interest up every month we try to have a different girl on the cover.

Thomas A. Straw -- I have a slide presentation here that will show what the school is like. We have a fantastic setup down there on the site of an old air force base where we have all the room in the world on which to build any kind of system and any kind of setup that we need for the school.

(Film presentation and narration as follows:)

"CATV Training and Engineering Extension Service, Texas A&M University."

This laboratory-type school was developed to field the trainees for the CATV industry for short-course education. The philosophy of the Engineering Extension Service, Texas A&M University, is to educate the man that does the work. This is to help the man on the job to better himself and, in turn, help the industry as a whole to be improved.

The Engineer Extension Service has been working with the telephone and power utility companies along these same lines for several years.

The school is sponsored by the Texas CATV Association and an advisory committee was set up by them to develop the school. In this way we stay in close contact with the needs of the CATV industry.

Under the guidelines of the advisory committee an instructor was selected and the course was set up. The material used was developed under the close scrutiny of the committee.

The first course offered by the CATV school is for the installer. This is a two-week course developed to give maximum instruction to the installer of what he needs on the job. He studies the CATV system as a whole, basic AC, DC theory, basic math, CATV section of the National Electrical Code, frequency spectrum, reading system drawings, coaxial cable, how to install connectors, how to choose the proper tap and install it, making a house stop, trouble-shooting and hookup, basic television receiver, test equipment, public relations, first aid, climbing procedures and safety. Equipment is readied for installation and checked out.

Our simulated homes are four foot sections compete with studding and firebricks for wall drop problems. Each man installs a minimum of two directional taps in an operating line. He also installs a pressure tap at one point in the course.

Each man makes a complete installation -- DT, house drop, ground block, proper grounding and routing of wires and wallplate.

We lash up and tear down at least two times.

After he has made his simulated installation, it is bugged. Then we switch location and each man troubleshoots someone else's installation. In this way he must check everything out and this gives each man a truer experience since he will usually troubleshoot someone else's installation in a system.

After simulated work is complete, we go out to our system and each man is required to sketch how he would make a drop and give reasons for doing it that way. Then all ideas are reviewed and are critiqued in the group. In this way we learn more about the actual problems he will face on the job.

Slide presentations are used to familiarize the students with equipment and to associate symbols on drawings to the actual unit on the line.

Our classes are set up for a maximum of ten men, with each man having a full set of tools and equipment for the job to be performed. In this way close personal attention can be given to each student.

The school is situated on the old Bryan Air Field and we have a complete operating system for the student to work on.

House drop installations are made inside of a large airplane hangar, so weather does not affect the school operations.

The facilities include a local origination studio the door at the right end of this building; head end, located in main classroom; 2.5 miles of plant and airplane hangar for indoor work.

The student is instructed in proper climbing procedures and safety on poles set up for this purpose.

The classroom building contains three spacious rooms and a head end, plus a study and break area. Also the construction of the plant allows us to have the distribution run back to this building for drop purposes. By having this long run between the head end and the tapoff, two miles, we can show in the same building what happens to a signal if it is not properly handled.

Three new courses have been readied for the CATV industry. They are:

One -- Basic theory, covering AC, DC, tube and transistor.

Two -- The line technician.

And three -- The head end technician.

We are concentrating on the technician angle rather than the engineering level. The line technician and head end technician will be taught basic workings of the CATV system and proper maintenance of the equipment. There will be hands-on learning using both old and new equipment.

The line technician and head end technician courses will require completion of the basic theory class or passing it with an entrance examination.

Some of the items to be covered by the line technician are system drawings, amplifier function, AGC systems, cross modulation, return loss, noise figure, etc.

The head end technician will cover such things as modulators, demods, heterodynes, Hi-Q traps, band pass filters, UHF to VHF converters, etc.

The theory class and line technician class are scheduled for September. The head end technician class is scheduled for January.

Public relations is stressed heavily due to the fact to the customer the installer and technician are the CATV company. Our future plans call for keeping close contact with the CATV industry and to develop courses that will meet the total training needs of the industry.

Much of the equipment being used has been donated by systems and manufacturers. By this fact, the price of the course has been held down to a very reasonable price of $80 per week tuition.

There is bus and airplane transportation available to Bryan, connecting through Dallas and Houston.

<u>Robert Turkisher</u> -- We have been in the business of turning out CATV technicians now for a little over three years. This month we will put out our 374th technician; six weeks ago we took a survey and found we have 263 of the men actually working in the industry. We call them competent. They are not the best in the world and they're not the worst in the world. They are competent people that can do the job and save you money.

We are a college and we are a proprietary college, that is, we are profit makers. And because we make a profit, our tuitions are less.

Of the 374 people that will have graduated as of the 26th of this month, seven have paid tuition on their own. We have purchased every piece of equipment in our school; no system has sent us a student for which they paid or he paid the tuition. Uncle Sam paid for the tuition of all but six of these people. And those six came under the GI Bill.

We go all the way from the installer course, which is a two-week course, to a bachelor's degree program for an engineering technologist. We also have an associate degree for the engineering technician and a 425 hour CATV technician course which actually take 12 weeks.

You can send people to school and it will not cost you or the individual a dime. The Government will pay his tuition, pay for his books, give him a living allowance and pay his transportation to and from school. You can't ask for anything better than this.

All you have to do is call your local employment service and tell them you need a CATV technician. They are going to ask you, "What is a CATV technician?" because according to the Dictionary of Occupational Titles of the Department of Labor, there is no such animal.

Then somebody will write us a letter and say, "Hey, how do you do this?" Then we will come up with a code. It is a shredout, which I will have for anybody that happens to want it. They will send this individual, at no cost to you, to school. They will pay his tuition, for his books, and whatever the living allowance is for your particular state. That's what he will get, plus $5 per diem.

He can get a meal ticket for $120 a month, that's three meals a day seven days a week. He can get a room in Manitou Springs from September 1 through May 30 for $30 a month. From June 1 through September 1 it's $30 a day. We're in a tourist area. We have beautiful Pike's Peak right in the background, hunting for those who like to hunt, and fishing for those who like to fish. Now, if they like to hunt and fish and they don't want to go to school, they're not going to pass. But we have had only two failures in the past three years.

The employment service will send out men for you to interview.

If the man you select successfully passes the course in cable, or, let's say local origination, what we call the studio technician, the United States Government will pay every single dime.

Now, the only hooker is that the course must be at least 300 hours in length. And the same thing applies, incidentally, for the GI Bill. It must be 300 hours.

We have a complete system in the school. And our 18-month graduate, associate people, engineer, design and install a complete CATV system from the camera through the head end to the receiver. And then when they finish doing it, we take it apart and the next class comes in and engineers it.

It is peculiar that in the last two years, essentially at the same location, we've had about 19 or 20 different designs for the same system. But it's their design and we just give them a little bit of encouragement and a little bit of technical help to go along with it. We hope that they can do the job.

But every state in the Union has an employment service, and they will pay the bill.

We have got a growing industry and if it's going to grow, you have to train the men. Not next year, this year, because it takes nine months to turn out a studio technician. It takes us 12 months to get a man with an FCC First Class License. And if you want specialization in any particular area such as microwave, it's going to take a little more time.

So if you need a man a year from now, start training him now, not a year from now when you need him.

DISCUSSION

From the Audience -- I have one for Mr. Straw.

I got your point on the line technician and the head end technician, the dates they run.

Now, the beginning course runs more or less constantly, or what?

Thomas A. Straw -- It's set up in six weeks, and the first course is theory which does run about once every month.

It is set up so that the man can come in and take that course. If you can't let him out of your system for four weeks running, he can go back to the system and come in and pick up the next two weeks or the next four weeks, whenever he wants to.

Or, if he can pass an entrance exam, he can go into the next section.

And the line technician course is set up about once every month also.

The head end technician course right now is set up about once every six months.

From the Audience -- Mr. Straw, does Texas A&M foot the bill for actually setting the school up?

Thomas A. Straw -- The College has footed the bill for the facilities as far as the buildings are concerned and refurbishing the classroom building and giving space in the hangar, use of the hangar, and such as that.

The Texas CATV Association has, through their many channels, brought in money and people and material to build the system that we have there and the supplies that we have.

William Karnes -- I might expand a little bit on that.

The actual arrangement: A&M has for years conducted training courses for telephone people, for fire fighters, for policemen, for I don't know how many different career fields, different occupational fields.

The Texas Association, I think, originated the idea of this particular course.

It was fortunate that at that particular time A&M had just recently acquired the old Bryan Air Force Base from Uncle Sam for a dollar, or something like that. And A&M was ready and willing, and the Texas Association was willing to agree to underwrite whatever operating losses might occur.

So far the Texas Association has not had to underwrite any losses. It has been touch and go a couple of weeks, but we haven't laid any money out.

What they have done is to get enough money in the form of donations and tuition to keep the school going.

And then recently, when the technician course was about ready to be instituted, they found they did have a requirement for some additional funds to buy equipment, because one of the requirements of the school is that each man in the class have his own set of equipment. They don't believe in the business of one guy running the scope and everybody else looking over his shoulder.

So it was necessary to purchase quite a bit of test equipment. Some of it was donated and some of it was bought.

So the members of the Texas Association were asked to voluntarily give funds for this purpose, and NCTA through our Education and Training Committee agreed to match whatever funds were donated by the members of the Texas CATV Association.

I just about three weeks ago sent them a check for $7500 in matching funds, which gave them a total obviously of $15,000 to buy equipment with. Knowing the sharp traders they've got, I think they'll be able to do it for that.

I bring this point up only as prelude to telling you that in the next fiscal year NCTA has set aside $20,000 through our committee to attempt to establish similar programs in other states.

Pennsylvania is interested right now through their vo tech program. Bob Burull says that is a fantastic idea for Wisconsin.

So if any of your other state associations or regional associations have some sort of facility, let us know and we may be able to help you. Now, I'm not saying that we've got free money. You don't get it until after you have done the work of getting the thing going and all that. But we do have some funds to help in that manner.

KEYNOTE ADDRESS

Donald V. Taverner
President
NCTA, Washington, D. C.

Donald V. Taverner -- Thank you, Chairman Whitney, Chairman Demgen, Mr. Street, Officers, members of NCTA, and friends of cable television. I'm not going to make a great deal of this. I stand before you as a lame duck president and in an effort to find one proper word to perhaps describe the situation I had to search back into my educational experience and came up with the word, "alas." And I looked that up in the dictionary. It said that's early Victorian for, "oh, hell."

So we'll take off on that rather positive note. I will take you, as I have customarily, back to Maine with me for one quickie which might also describe the situation a bit. There was a fellow who opened a sporting goods store in Port Clyde, Maine. He had all kinds of fishing equipment and one thing and another. He had been there for a few days and one of his friends came in and said, "How's business?"

He said, "Well, on Monday a fellow came over from Cundys Harbor and bought a lot of tuna tackle. Tuesday nobody came in. Wednesday the fellow from Cundys Harbor came back and brought back all that tuna tackle. So probably you could say my best day was Tuesday."

Seriously 1970-71, the year since our Convention in Chicago, has truly been the year that was for cable television. It's been a year which has been accompanied by a great deal of activity and perhaps too much confusion. But nonetheless it has come foursquare that the cable television industry does offer indeed the greatest dimension for a new approach to communications that this country has ever seen. That is not only recognized now by a few educators, a few people in "think tanks" and those within the cable television industry but also by those who are able to do something about it and certainly by the American public.

Most of you in this room have experienced 20 years of a mishmash of regulations, regulations designed to overprotect one industry against another, restrictive, harassing kinds of government restrictions. If I may review with you rather quickly the year that was, we saw a turn take place in the year that was in 1970 and 1971. A new look arrived for cable television starting with the inauguration of Dean Burch as Chairman of the Federal Communications Commission in late 1969 followed by a series of events which have now come to a moment of truth.

Every NCTA President has to use terms like "crossroads," "on the verge," "we are about there." Let me say to you in complete candor and sincerity, we are now there. The door is about to be opened and make no mistake about that. That door will be opened.

Now we face a whole new approach, a whole new generation for cable television. The Congress, the Federal Communications Commission, the Administration and the American people have come to realize that this is no longer just a pedestrian, pragmatic kind of technology which can be toyed with, harassed and handicapped. It must have its run and it must meet its destiny.

We came to this decision, frankly, on June 15 when it became obvious that Senator Pastore and his Senate Subcommittee on Communications came to the conclusion that further delay in the opening of the cable television industry would not serve the public good nor the good of anything else. We fully anticipate before the Congress adjourns and the Commission adjourns for their August recess that rules will be announced opening to some degree this industry. Giving the industry the viability, if you will, the economic viability through subscriber growth to provide the capitalization that will allow us to do what we have talked about for nigh onto 20 years.

In all of this, I have to be honest with you. There is no point in palaver and Pollyanna as we face these things. This industry has been faced over a period of years with manipulation from within and from without. Once those distant signals arrive, and again I repeat they will arrive, if we continue to allow ourselves to be manipulated, if we continue for reasons of parochial concern, selfish advantage, group pressures, special interests to manipulate within our own industry, this will have all been for very little indeed in terms of gains for the industry and, more important, in terms of gains for the American people.

I think I have to identify that some of the delay, some of the lack of credible acceptance of this industry, some of the failure to inspire confidence in government circles and elsewhere and some of the success of broadcast opposition has been caused within our own industry but not with intent. If you read Pogo and his friends down in the Okeefenokee country, Pogo once said: "We has met the enemy and they is us." I'm afraid, frankly, without rancor, that this is too true and has been too true within our own industry.

I am not here just to criticize, to pass judgment and to point fingers. I'm here to make a plea with you. We're going to be unable to accomplish the destiny that is now set forth before us if we are unable to rise above parochial concerns, interorganization power ploys, mom-and-pop versus MSO, leadership kind of concerns, trade association politics which sometimes rise above the very opportunity of the industry itself.

We must rise above these things if we are to give the opportunity to ourselves and to the American people, an opportunity that is greater than anything which has arrived since the industrial revolution changed the way of life for people across the globe. We must realize it is as important as that to us and those around us.

Now let me say I don't want to turn this into self-validation either for myself, for the Board of Directors of NCTA, for the staff, the Catholic Church, the Masons or anybody else.

I just want to be very candid in getting you hopefully to realize that we must really get with it and get out of the sandlot ballgame and into the big league where we belong.

My administration has been marked to some degree by confusion, by misunderstandings, reported staff dissent, many kinds of criticisms. I'll not attempt to enumerate or evaluate them. They're all matters of the past. Many of them are matters of manufacture, frankly. But the main thing that does concern me is that we not confuse the real issue.

Somewhere in one of the trade journals it was reported that this administration had not accomplished results in Washington. That brought great smiles, frankly, from the FCC, in the committees of the Congress and it didn't bring a great big smile over at NAB. But let me just tell you what has happened over the year of this administration.

In spite of these problems which I have mentioned, hundreds, and I mean hundreds of cable men across this country, went to work on their local scene. They came to Washington by the score. They were briefed, trained and worked with our staff and then did a job of education within the Federal Communications Commission and with Congress that brought about what we now know to be a victory.

It's a short-term victory. It's not a long-range victory but it is a victory. I take a great deal of personal satisfaction in that along with the hundreds of cable men who could not find time to criticize but could find time to work energetically and intelligently to bring about what you will know more about by the end of the summer.

We are winning but if we're going to turn a short-term victory, the distant signal problem, into a long-range victory, we're going to have to clean our house. We're going to have to unify our efforts. We're going to have to make much more credible our intentions to the people within the Commission, on the Hill and across the country in the homes that will receive cable television.

I am not to be your NCTA president for a great deal longer. I'm not going to have the privilege, and it would be a privilege indeed, of helping you determine and implement the long-range success of this industry. Maybe I can do more from the outside. You have my commitment and promise that I shall certainly try. I am dedicated to the potential of this industry.

Let's turn now to a few more positive kinds of concerns. What is it that has happened that has brought about the short-range victory to which I refer and where do we go from there?

As I look back over the year that was, and if you'll give me small license to step back into 1969 for a bit to pick up the first play of the ballgame, these are the things that have happened within the cable industry as the result in good part of NCTA leadership and activity and actions that have taken place.

From late 1969 to date here's what we have found:

Positive, if questioned, action by the FCC toward the use of cable television for locally-oriented program origination. A few years before that that very opportunity was denied. Then all of a sudden we found ourselves required.

Some important steps forward for microwave communications as it related and relates to CATV.

The first meeting of state and regional association presidents in an effort to bring some unified action nationally on common concerns and goals.

Encouragement of advertising on and interconnection by cable television systems.

The emergence of the cable television industry as a participant in the domestic communications satellite proceedings.

A series of important program origination seminars and conferences to give aid, comfort and direction to those who found themselves suddenly in a new ballgame.

Some significant actions by the FCC vis-a-vis the telephone company's involvement in the CATV field.

The establishment of a full status CATV Bureau at the Federal Communications Commission.

Two substantial memoranda by the U. S. Department of Justice's Antitrust Division opposing FCC restrictions on cable and challenging an overly-protective policy toward broadcasting.

An objective approach by the Administration's Office of Telecommunications Policy toward the development of cable television.

More attention to CATV by the FCC during 1970 and 1971 than to any other concern facing the FCC. I think that's terribly important because they have not exactly had a quiet pinochle game over there recently in terms of broadcast problems. But the FCC gave more attention to cable television than to any other concern during the year 1970 and 1971, months of activity which resulted from the Commission's proposed public dividend plan for cable television, which was accompanied by tons and tons of paper in comment and reply-comment which then culminated in 20 days of the most enlightened hearings ever held by a regulatory agency.

The announced recognition by the Senate Subcommittee on Communications, following the June 15 meeting with the FCC that no further delay in decision on opening the cable television industry is in order.

I think that list has brought us to the point where we can say we need not apologize to ourselves, we need not apologize to anyone. That kind of progress, if we can keep it moving and keep it moving in an orderly, intelligent, rational manner, will bring to the American people and to this industry the fulfillment of the dream of pioneers of 20 years ago and the demands of the people.

The year that was has indeed unveiled a second generation for cable television. What are we to do as an association or as an industry, if we are to truly capitalize on the opportunities that have now been given us?

It's an old story but it's just as true as it was two years ago, five years ago or ten years ago. We simply must find a way to unite and unify our efforts. We are not going to cut it if we are unable to do that. I hope that whoever succeeds me in this position and whoever succeeds the directors on the Board will put that as a very, very high priority.

Second, we must put our own house in order. By our house I refer to the organizations, the thrust, the objectives, the modus operandi of our national trade association.

Third, and extremely important, we must recognize something that comes hard to some people: that is we are living in an era of the concern of rising consumerism. The public has become very concerned for what it gets for the dollar it pays in any given field. It has become very concerned about such things as truth-in-advertising and truth-in-lending and this kind of social-financial development will continue and grow. The time is not far away where the very pressure of public consumerism will require every cable system in this country to provide nothing but the highest quality service, both in technical aspects and in program content. If we're not willing to recognize that, I suggest we might consider selling and opening launderette, because it's going to work and it's going to come just as sure as I stand before you today.

As I said to the Board in June when I offered my resignation, I want to say to you the same thing and with all the sincerity I can muster: I'm disappointed that I shall not be your president after December 31. However, this disappointment does not contain an iota of bitterness. The cause, the need, the opportunity is too great for that. This is a very young and growing industry. It contains all of the problems and the weaknesses of adolescence. It may not be, but it could be, the greatest advance in communications since sound and picture were played together to the advantage of the people.

Will it? That is more up to you than it is up to the FCC or the Congress or the Justice Department or anyone else. It is pretty much in your hands.

Can we join our adolescent hostilities and immediate self-service to change ourselves into mutual concerns with mutual accomplishments from friends? I do certainly hope so devoutly. I sincerely wish you nothing but the very best.

CHAIRMAN'S ANNUAL REPORT

Ralph N. Demgen -- President Don, ladies and gentlemen of the cable television industry: On a program where the president of your association and the chairman of your board of directors are both scheduled to make reports to the industry, you're going to find they're not going to be too dissimilar. You may find therefore that what I have to say today might be somewhat repetitious of what you have already heard from Mr. Taverner. However, the similarity will end there because I don't happen to be from Maine. I'm not a story-teller and I'm certainly not the orator that our president is.

From me, you're going to have to be satisfied with the story of the Norwegian who went out and bought water skis and came home disgusted because he couldn't find a lake with a hill in it.

Speeches by outgoing national chairmen traditionally contain a summing up of the past year's activities, if you will, a sort of a state of the industry presentation. This year will be no exception.

Perhaps I should begin with the not-too-startling observation that we as an industry are still alive. We have survived another year and, indeed, having reached our majority last year, we are now 22. If the attendance at this convention and the enthusiasm that has already been displayed here is any indication, I'm pretty sure we'll reach our 23rd birthday.

However, for the past 5-1/2 years we have been under the wing, some would say the thumb, of the Federal Communications Commission. In 1966 this convention was recovering from the shock of the Second Report and Order and was trying to discover just what had happened to us.

By 1967 it was clear to everyone except perhaps the Commission that our industry had been placed in the deep freeze in a virtually unprecedented attempt to protect an established industry from the unwarranted fear that we were a destructive newcomer on the scene.

At the 1968 convention we were awaiting the outcome of two momentous Supreme Court decisions, namely, the _Fortnightly_ case on copyright and the _Southwestern_ case on jurisdiction. The outcome of these two cases furnished the chief topic of the 1969 convention which was the Commission's brand new scheme to regulate cable called "retransmission consent."

This was a Commission program designed to end run our victory in the _Fortnightly_ decision which held that we were not liable for copyright payments.

Last year speculation was rife the Commission had finally decided that retransmission consent was unworkable. A new proposal was in the works which would contain something for everyone. It was to be called "Public Dividend Plan."

Well, here we are in '71, a year later. The dividend plan has had a short life. Instead, we are again breathlessly awaiting a new proposal from the FCC. The door is still locked. But we are assured now by the locksmith that the next key is going to fit just right.

This industry has been told it's at the crossroads so many times that I am beginning to think that a road map is of far greater importance to us than a line amplifier. Nevertheless, it has never been more true than it is today. We are truly at the crossroads.

We have made progress. We have made significant progress in the past year. I truly believe Chairman Burch's appearance before the United States Senate on June 15th demonstrated an historic turnabout in the Commission's attitude toward our industry.

Cable TV has now become a topic of interest and importance and is being recognized as a medium with a great potential for public service in election campaigns and in a great, great, great many other ways.

As you know from the press, the trade press especially, cable has been discovered by public interest groups, the educators and Ralph Nader. The Justice Department has vigorously pleaded our case at the FCC and finally cable has officially achieved the status of a topic of great national importance through the creation of a special Presidential commission to study it.

We truly are at a stage where every cable operator in the country has an opportunity to influence his own future. That opportunity exists because he has a chance to educate and influence his senators and congressmen. But even more importantly, it exists because this association has demonstrated that it can effectively lobby for the industry, if it has the support of a united membership.

I truly believe NCTA has conducted an effective public education program telling the story of CATV to the Congress, to the Commission, to the various State legislatures and public utility commissions throughout the country. But much more needs to be done.

It is absolutely critical at this stage that NCTA be united and strong. The membership, and by that I mean all of our members, must commit themselves to the association. In turn, the association must, and I believe it has done just that, listen to and speak for all of its members.

There are those who sincerely criticize this association as being too entirely obsessed with the top 100 markets and the problems of the big operator. I think these critics are wrong but I welcome their criticism.

This past year NCTA has focused on the problems that beset the small-market operator. It has filed extensive comments at the FCC against the burdensome and potentially ruinous aspects of the Commission's proposed new technical standards.

Our president, our staff and our various committees have logged thousands of miles appearing before various State PUC's and legislative committees pleading our case in an effort to stave off State regulation, which in my judgment is potentially far more dangerous than regulation by the FCC.

We have virtually concluded negotiations with the telephone companies with regard to pole attachment charges and conditions. These are the bread and butter issues which directly affect every cable operator. They illustrate the necessity of a strong and united national organization. To this end we must go forth from this convention dedicated to that purpose.

I regret very much I find it necessary to complete my report to you today on a somewhat unpleasant note. It seems so long ago. But the period has been very brief since the board of directors of NCTA, by unanimous vote, approve the unanimous recommendation of a presidential selection committee that Don Taverner be our new president.

This selection committee had been appointed by Chairman Bob Beisswenger prior to his handing over the reigns to Chairman Bill Adler. This committee had been told to get the best man available for the job: a strong man; particularly did they feel one of the chief qualities of our new president should be that he be a good administrator.

The day Don Taverner came to Coronado, California, to accept the appointment as president, I was privileged to be seated next to him at lunch. I had been assured by all of the members of the selection committee that after all their hard work, all the interviews, all the traveling about the country, all the recommendations they had received, that Don was the man we wanted.

Even though our lunch visit was brief, I did not find any difficulty in accepting the recommendation of that presidential selection committee.

Not too long after that, as you all know, I was selected by the nominating committee to be your nominee for the chairman of the board of directors. I then made it a point of trying to get to know our new president better. To find out his strengths, his weakness. How, if it was to be my privilege to serve as your chairman, could I best serve NCTA and contribute to the making of that strong president we all wanted.

When I took office in Chicago last year in June, I was convinced we had the man we needed. Nothing has happened since that time to make me change my mind.

Perhaps I was naive to think he could get the kind of cooperation he deserved and needed to accomplish the goals we had set for our industry. Instead, sinister forces working from vantage points on our staff and outside of our board of directors were, for reasons I can at this time only describe as selfish, able to convince our board that Mr. Taverner's resignation should be accepted.

At no time in our history have we been as strong or so close to realizing our objectives. Don Taverner has played no small role in reaching this position.

I cannot at this time predict what may be the feeling of the majority of our membership. In that respect each of us must reach our own conclusions honestly and fairly. If the majority of our members are willing to stand by and allow this thing to happen without objective, then, as your outgoing chairman, I will have to accept it. However, I feel you should be warned. NCTA has been hurt and hurt badly at a time when we can ill afford to be hurt. Unless we make up our minds here and now our ship is to be run by the captain and not by a few dissidents of the crew then perhaps the ship is better abandoned.

If your board of directors and your executive committee are to be continually subjected to the pressures of a very small minority who want things to be their way or no way at all, then we might as well dissolve the board and the executive committee and turn everything over to the dissidents and let them run it. The way you spell run is r-u-i-n.

Mr. Taverner, I hope sincerely I have not caused you embarrassment. I was aware of the disloyalty that existed on your staff. I'd hoped your tremendous capacity for patience would eventually overcome this obstacle and things would work out -- that your trust in these people would have proved to be accurate.

During the past 13 months I have learned to love and respect you, not only for your ability but for your courage, your understanding and your straightforward approach to our many complex problems.

I am sorry indeed that for the past few months, for reasons of my health, I have not been able to participate to the extent I would and should have. I salute you for the man you are. Now, I want to make just a few brief comments to the members of our industry.

As you all know, I have appointed a committee to go about the job of selecting a new president. This committee has been published and I don't think there's anybody in this room that can find fault with a single member of that committee. You should also know, too, tough, that I have already been informed by one of the dissidents that he is going to fight me on the appointment of this committee.

Let me tell you here and now I am ready for a fight and, if that persons wants to resort to the same type of tactics used before, I am prepared to fight fire with fire. I am fully aware that because of conditions over which I have no control time may be running out for me. So long as there is one breath left in my body I shall fight.

I am firmly resolved the Carlton Pub Club is not going to run NCTA; the policies of this organization and their implementation are not going to be planned by a dissident few in some Washington grog shop; NCTA is going to be governed by its members through its duly elected officials for the benefit of all of our industry. It is the only way we can achieve the unity we need to be successful.

If a small group intends to force their will on the majority in exchange for a unified effort, then I say the price of that unity is too high. I would like to say to that group, if you can't be a member of the team, take your marbles and go home.

I haven't changed in the past four years I have been privileged to serve on the board of directors and as your chairman. I'm still working for NCTA and the cable television industry. Unless it is a unified effort by all of us working together then we have nothing.

SENATOR JOHN L. McCLELLAN

I do not propose today to review the protracted and complex history of the cable television controversy, for many of you have been active participants in the making of that history.

I do not propose to speak of the public's desire for cable, for that is evidenced by the significant growth in the number of cable subscribers.

I do not propose to enumerate the varied services that can be provided by cable, for that has been ably done by the spokesmen for your industry.

I do propose, however, to speak of action -- action by the Federal Communications Commission, by the Congress, and by the cable industry.

There is a proper season for study. There is a time for debate. There is likewise a time for action.

The purpose of study and debate is to prepare for and to produce construction action. The imperative on this problem now is for action -- action to permit the orderly growth of cable television.

The appropriate committees of both Houses of the Congress have had ample opportunity to determine whether legislation to regulate cable television is currently necessary or desirable. They have not reported any legislation. The Federal Communications Commission, after years of confusion and vacillation, has recently completed an exhaustive analysis of cable television. The Commission appears to be acting now with an informed awareness of the public interest and of its statutory responsibilities. In no small measure, this is the result, I think, of the effective leadership and perceptive judgment of Chairman Dean Burch.

The interim report that Chairman Burch has presented to the Congress reflects substantial progress toward achieving a just and feasible solution. The tentative conclusions of the Commission closely parallel the approach proposed in 1969 by the Senate Copyright Subcommittee. Some decisions need to be refined. Many details have to be clarified. As the principal author of the section 111 formula, which undertook to resolve both the communication and copyright issues, I am not unmindful of the enormity of the task which has confronted the Commission.

The remaining work of the Commission can -- and should be -- completed within a few weeks. It should then proceed, without further delay, to adopt the necessary rules to become effective at the earliest feasible date.

The President on June 23 announced the appointment of a special Cabinet-level committee to formulate a "comprehensive policy" for cable television. The timing of the President's action, the vague mandate of the committee, and the composition of its membership have aroused considerable speculation concerning the President's purpose.

I do not believe that the President is allied with those who are seeking to obstruct a decision by the FCC. While the President's committee may possibly make a useful contribution in a study of the long-range implications of cable television, it is inconceivable that Members of the Cabinet, can make an informed judgment on the specific issues before the Commission in its pending rule-making proceedings. Consequently, the appointment of this committee does not justify any postponement in the adoption of the Commission's new cable rules. This committee should not be instituted or permitted to serve as an obstruction to progress.

There will be those, no doubt, who will attempt to seize upon the appointment of this committee as yet another reason for delay. I doubt that such efforts would command any substantial support in the Congress. To the contrary, some Members of the Congress believe that the Commission has procrastinated in making the benefits of cable technology more fully available to the public. It is quite significant and of particular interest to note that in the recent Senate cable hearings several members of the Commerce Committee made statements urging prompt action by the Commission.

If events should develop to cause the Commission to be unable or unwilling to take the action which is clearly warranted on the basis of its hearing record, then it will become necessary to explore other options. There are several alternatives. The Congress could continue to defer further action on the general copyright revision bill. Or, the Senate Judiciary Committee could report the copyright bill, including the cable provisions of section 111. The Senate would then have the opportunity to work its will. It is much preferable, however, for the Commission to act.

It has long been my view that a just solution of the CATV question requires a coordinated disposition of both the copyright and communication issues. A consensus seems to be developing concerning the resolution of the copyright question. This is reflected in the growing support for the approach taken by the Subcommittee in section 111, and the agreement reached between this Association and the motion picture copyright proprietors.

The settlement of the copyright question, in my opinion must include several essential elements:

1. It is not feasible for a cable operator to negotiate to acquire rights on a program-by-program basis. The copyright law should grant cable systems a compulsory license, subject to certain restrictions, to carry the copyrighted programs transmitted on such signals as the cable operator is authorized by the FCC to carry.

2. There should be special provisions, contained either in the Commission rules or in the copyright bill, to protect the exclusivity in the major markets of those who buy and sell rights to a particular program.

3. The copyright royalties to be paid by cable operators must initially be determined by the Congress in the copyright bill.

4. The copyright bill should establish an impartial Copyright Royalty Tribunal to make a periodic review and adjustment of the cable royalties.

5. Public policy and equity require special provisions to deal with the unique problems of professional and collegiate sports events.

If there is a satisfactory disposition of the cable issue by the FCC it will then be possible for the Congress to resume immediately active consideration of the long-delayed copyright revision bill. The archaic Copyright Act of 1909 is clearly inadequate to the needs of the country today. Authors, composers, recording artists and other creators should be fairly rewarded for their contributions to the well-being and happiness of our society.

During the past year, no cable issue has received more attention with the public and in the media than the intense battles relating to the granting of franchises by local governing bodies. There have been indictments for extortion and bribery. Speculation as to illegal activity is becoming rampant. Several States are actively considering legislation to impose a freeze on the granting of franchises because of the cloud which has settled over such proceedings.

The broad subject of Federal, State and local jurisdiction over cable television was included in the recent FCC proceedings. It appears that the Commission is not agreeable at the present time to asserting full regulatory jurisdiction over cable and broadly preempting State, and local authority. Although the Commission believes it has the legal authority, it seems to have rejected an active role for itself in the licensing of cable systems.

Because of the intense controversy over such matters as the importation of distant signals, the question of Federal, State, and local relationships has not received the attention that it clearly warrants. I urge the Commission, immediately after completing the current proceedings, to actively explore the formulation of a more effective intergovernmental regulatory structure. It will not be easy to devise a fully satisfactory partnership, but the current abuses require a positive and concerted effort by the Commission.

The Commission has determined that cable systems with more than a specified number of subscribers shall be required to originate their own programs. The United States Court of Appeals for the Eighth Circuit, in my opinion, has properly held that such a rule exceeded the jurisdiction of the Commission. I believe that whatever may be the ultimate disposition of the current litigation the Commission should reconsider its rule for the mandatory origination of programs. Such a mandate at the present time is premature and could well contribute to monopoly and to the elimination of smaller cable systems whose survival should be encouraged by the Commission.

Ever since the cable industry began to emerge as a major communication force it has been faced with the adamant opposition of a segment of the broadcasting industry. This group, whose influence in the industry possibly far exceeds its numbers, has sabotaged every effort to arrive at a workable accommodation between cable and off-the-air broadcasting. Hostility to cable service is a luxury which the broadcasting industry can no longer indulge. The industry is besieged on all sides. It is foolhardy for the broadcasting industry to persist in attempting to block cable service when both industries should be working together on problems of mutual concern.

The technological explosion in communications will require adjustments in broadcasting and other media. Some are apprehensive and see only the potential dangers of the advances in communication technology. Others are exhilarated and view the future with undiluted optimism. A balanced attitude should prevail.

In this period of change, there is no justification for subjecting the business operations of the broadcasting industry to deliberate harassment. It is in this context that I favor action by the Congress to lengthen the maximum period of a broadcast license and to provide that in renewal proceedings appropriate consideration be given to the investment and performance of the existing licensee. While Congressional action to reform campaign spending is long overdue, I shall continue to oppose those provisions of such legislation which discriminate against the broadcasting media.

The Members of Congress have recently received from the cable subscribers in their States hundreds of small packages of forget-me-not seeds as a reminder of the government's responsibility to nourish the growth of cable. You may recall the story of the French Marshal who asked his gardner to plant a tree. The gardner objected saying that the tree was too slow growing, that it would take 100 years to reach maturity. The Marshal was insistent; he said, "In that case there is no time to lose -- plant it this afternoon."

And so there is no time for the cable industry to lose as it enters its Second Generation. It must be receptive to change, eager to expand its services, and dedicated to the public interest and the well-being of the nation. If the cable industry promotes these objectives and pursues its business in that spirit, then it need not fear that it will be forgotten by the American people.

LUNCHEON

Address:

John M. Culkin
Director
Center for Understanding Media

John M. Culkin -- My own way of introducing myself was given to me when I was in Boston, traveling on that form of transportation known as the MTA. One afternoon about a dozen people got off, one of whom was a blind man. In our play-it-cose-to-the-vest, don't-get-involved, urban society nobody was really volunteering to help him out. So I helped him down the stairs.

We walked down together, talking the while. We got to the bottom and he said, "Do you mind if I ask you a question?" I said, "No." He said, "Just how tall are you?" He had been getting the communication at a 45-degree pitch. I said, "6 foot-5." He said, "Well, how about that? I've met a real live monster."

That is really nicer than going into all those schools and doing all those things.

As many of you know, schools are increasingly interested in the communications revolution, not just in terms of using the technology in an audiovisual or instructional sense to teach the traditional subjects, but the media themselves are becoming objects of study. Kids are studying film the way they study literature. They are studying to be film critics, TV critics, film makers, and TV makers.

Recently I visited a school system to give a couple of talks. It was a school like the school your kid goes to -- where the auditorium is not big enough for the whole student body to be there. So the principal sent out a purple message in the morning telling each teacher to pick out ten media-minded students to attend my presentation at 11 o'clock in the auditorium.

I went into one of the classes to meet with the kids at nine o'clock, and the message came around. I asked how many in this class of 25 or 30 considered themselves to be media-minded? About 15 hands went up. I said to one kid, "What do you mean by media-minded?" He said, "Well, I'm not too smart, but I'm not too stupid. I'm just kind of media-minded."

The Wall Street Journal was given out by somebody named Malarkey -- there really is nobody by that name, is there? -- for free in the hotel. It had a great headliner yesterday. President Nixon was giving a talk in Kansas City about drugs, defeatism, negativism and alientation -- I think he's against them, but it's not clear from the article.

The title that the Wall Street Journal put on it is as follows: "Decadence Threatens the U. S. But It Has the Vitality to Survive."

If there is one sure stock on the street, it's decadence. You never go wrong putting your money in decadence.

They tell the story of the airline pilot who gets on the intercom with two pieces of news, one bad and one good. He said, "First the good news. We're 33 minutes ahead of schedule. Now the bad news: We don't know where we're going."

And it turns out not to be a bad metaphor for planet earth, because nobody really knows where we are heading. But, man, are we moving! We are just tearing along.

I think it is this speed of change for which nobody is programmed. There has never been an era that had to react to technological and psychic change the way we have. All the game plans and the handbooks for action are kind of scrambled. There are very few institutions that are doing very, very well in the shakedown cruise that is moving at these high speeds.

I think it is important that as we are in a second generation in your field -- a new technology that has not yet taken its shape; still in its formative ways; whose growth is still to be determine by decisions made by people within this room as well as other people -- we give ourselves a slight bit of perspective on what the communication revolution, or explosion, or whatever has done to us already, and some ways in which we can use the new technology intelligently ahead of time. We can avoid being caught up and trapped in old familiar ways because we now have some kind of experience on what happened the first time around.

I would like to do this kind of review and look ahead by focusing on young people, not just because the greatest growth industry in the country is analyzing the habits of youth, but because they happen to be the natural citizens of this communications revolution. Today's 18 and 20-year-old is a member of the avant garde of that generation which had a television set in the living room when it got home from the hospital. The first time out. There has never been a generation like that. There are plenty of people who were six years old when they finally got a TV set. The 18-20-year olds are the ones who were born in '52, '53, who had television sets and have always had a television set. To me that marks a great difference in them.

If we compare how the kids today grow up and what is in their experience, I think we get some perspective just by going back to the turn of the century. In cosmic time, it's nothing. It's ten seconds on the cosmic clock if we look back and see a million years where man made one small step just by carving his weapons a little bit differently and how change has speeded up all along. We still have the nervous system from that old world; we don't have ways of reacting that quickly to these kinds of things.

At the turn of the century a kid, just before he started the first grade, wouldn't have had a heck of a lot of information in his world which didn't come from his immediate environment. The number of communications media in his world were very small. The number of outside sources of information in his life were very small. To a large degree he lived in a rural part of the country. Buckminster Fuller tells us that he probably would not travel more than 1,000 or 1,200 miles in his entire life. Pretty much the family, the school, the community and the church were the sources and mediators of the information, attitudes, values and culture in his world.

Now, if we compare that relatively static world of only 70 years ago with the Sesame Street generation -- the kids who, before they have even started elementary school, have clocked 3,000 or 4,000 hours of television, who have been to the moon, who have seen the faces of every human being on the face of the earth, who vicariously have visited all the countries of the world, who have an enormous stock of good, bad and indifferent information, and for whom, even before they are six years old, there is almost no topic of human experience that is not available to them by flipping the TV dial -- we see, for better or worse, we are talking about people from different planets.

We have really no accumulated wisdom yet because this has all happened so fast to help us deal intelligently. These are value-free descriptions of just what is there. I'm not saying it's good or bad.

We see the first television generation. We are on the brink of a new technology here as we talk about these things today.

What happened the first time around? Well, you can make up your own Chinese list and choose from column A and column B on good things and bad things.

The good thing, I think, is the fact that they have a different way of defining themselves in terms of the world. They are the first citizens of the global village. Because they have been to Africa, to Europe and to Latin America by television, they no longer perceive themselves merely as captive of a particular neighborhood, whether you define it in terms of street, city, State or country. They no longer see themselves as necessarily being trapped by geography. They perceive themselves, because they have been programmed this way, to see themselves as part of a much larger community. Therefore frequently, I mean just as a way of analyzing things, even the notion of patriotism takes on a new definition for people psychically who are related to the globe rather than just physically related to the particular geography in which they happen to be.

Their ideas of time are different. I just want to give you a quick example. Some of this is a little abstract, but I just want to use it as a background for some very practical things.

A kid who is two or three years old has no way of knowing which things that come to him through the television tube are actually happening at that particular time and aren't. He doesn't have the discriminating power yet to make these judgments. He can therefore on Channel 2 be looking at an old Italian movie on a Sunday afternoon, badly dubbed and everything, that is 500 B.C.; he can flip to another channel and it's "Star Trek," a rerun, and it's out a couple of hundred years in the future; and he can see a live event. All of these things, past, present and future, are all jumbled up. He puts on whichever of these time periods he wills by switching the dial. But past, present and future; we can make those judgment, he can't.

On a given day, if you took an event like the Bobby Kennedy funeral, several networks in varying ways are covering to give some variety to the presentation. On one channel you see the funeral of a dead man. On the next channel you see a video tape replay of him giving a talk to workers in West Virginia. For the kid, the dead man and the living man are indistinguishable because the tube itself doesn't say one is now, one is then, one is future.

So the whole question of time and the age of discontinuity, of interruption, of things coming in small bursts and not being reflected on, on the thing that occupied everybody's attention yesterday being wiped out today because we've got to fill the headlines with some new stuff, this whole sense of quick cut, slam bang from all directions is all new.

The same kids who are the children of the tube are also the children of the bomb, the first ones to have lived to the age of 21 under the shadow of the mushroom; knowing we can blow it all up all fast with a button or we can do it slow as we are with the environment. The idea of long-range planning and patience and deferred gratification psychologically is not part of their makeup. They don't really see the future in end-of-the-rainbow terms.

I think a lot of this is automatic. Nobody gets up one morning and says, "I will now perceive of the world as a fragile, contingent thing and I will mix up past, present and future." It's blowing in the wind; it's just out there.

This has scary effects. Very few people are doing very well these days in responding to what is happening. It's easy to get mad at things that happen, it's easy to cop out and just approve across the board or damn across the board, but to understand occasionally is difficult.

It has created among those of our age -- and we are all the same age in this room, whatever that is -- the phenomenon known as the tweenager. A tweenager is a parent who says to himself, "Let's see, when I was a kid my old man told me what to do. Now I'm a parent, my kid tells me what to do. When is it my turn?"

The tweenager is in a particular bind because many of the things of which he may approve in the conduct of the young are things which in his own youth he had in his gut and in his nervous system to say and think and do. There was just no outlet for it then; it was a different ballgame.

But again, what happens now, whatever the good or bad effects that happened sort of automatically in the past?

On the brink of a new technology, what do we look forward to? Is it more of what Paul Klein calls, when talking about the network offerings for the fall, "future schlock?"

Is all we have to look forward to down the line in the new technology future schlock, the computer GIGO -- garbage in and garbage out? Or do we have new opportunities here?

Well, let me give you one simple opportunity. What happens with cable? All of a sudden there is a TV set in living rooms and it has 101 channels available. You know, next week or the week after the technicians will solve all the problems, the lawyers will get richer and richer. But what I am thinking of -- did you ever think that God may be a lawyer -- because he has invented a planet on which everybody is in danger of not surviving, but lawyers are just doing fantastic?

I think of cable when it is down the line. 101 channels can now come into the house. I believe all that two-way stuff. I know there is going to be a bird up in the sky that can make instant networks. I know that people are going to have VTR capacity in their home to take programs and play them back. All those things are easy.

But what can we do? What are the characteristics of cable? Nobody really knows yet. At this particular time we know one thing. It can outflank a lot of existing institutions. It can outflank the school system. If we are unhappy with a lot of things that are happening in the schools and know the schools are very slow to react to change, cable can outflank them.

We should think in terms of an abundance of resources, numbers of channels, rather than scarcity, which has focused all our thinking in the past.

We know that it can outflank commercial broadcasting.

Here we are, and a lot of people hear these speeches about the great thing that cable is. The cable operator is saying, "Why me? Why am I in charge of this fantastic technology? All I was trying to do was support the wife and kids by getting 'Bonanza' over a mountain in Nowheresville, Montana." All of a sudden, guys with doctorates are standing up telling me that the future of the world is in my hands.

That's kind of a crazy situation. Shakespeare said some men are born great, some men achieve greatness and some men have greatness thrust upon them. You can pick out the category for yourself.

I am happy to see that you are trying to do something about the vast wasteland. It would be nice some day if at this convention you said we have taken on the vast wasteland of television and we have done some improving. It's not where we want to get, but at least today we can get up here and say it's only a half vast wasteland.

I want to put cable and kids together very briefly and give you a very tangible pragmatic, I think workable suggestion, which is something I have never done on a public platform before. I'm more in the waltzing business than in the closing business. I would normally just say my things and sit down. But I've got something very practical and tangible that I have done a great deal of thinking about, and I would like to offer it to you.

I want to do it with this background because the people from my kind of world get written off very frequently as being impractical and visionary.

Five years ago there was no such thing as Sesame Street. There was a lady named Joan Cooney running around with 28 pages of paper looking for a buyer, looking for somebody who would say, "Look, there's another way to play the game with kids besides pumping garbage into living rooms on Saturday morning and exploiting them." There was a price tag at the bottom of her pieces of paper of $8 million.

Now, $8 million to some people sounds like a lot of money. Supposing that five years ago or four years ago a commercial sponsor -- any of the guys who are making their dough off the kids on Saturday morning -- had said, "We'll pop for the 8, and at the end of every program all we will have is a one-liner at the bottom: 'The nice guy at General Foods says here you are, kids.'" That would be the smallest $8 million that company ever spent in their life. They would never have to do anything again except run around the globe accepting awards and plaudits. Their wives would like them, their kids would like them, everybody would like them, they would be clean. And they were going to spend the $8 million anyway.

So the nutty way of thinking about the world can be the most pragmatic.

Just getting boxed in by your own concerns about what the Commission is going to do and what are the manufacturers going to go and where do we go from here? is a very short-run way to achieve what you are after.

I have a Sesame Street kind of thing to suggest to you. It comes at a point in history where the people know what commercial broadcasters care about with little kids. We know what they have done for 20 years of Saturday mornings. The appointment of three vice presidents in the 16th inning of the ballgame cannot erase that record.

What are you going to do for kids? I suggest that you have to pick a group to do something for. Everybody has got kids. You've got your own kids.

What does the commercial broadcaster who makes a ton of money to send his kids to the best school do when he comes home and finds his own kids eating up the garbage on Saturday morning? It's a weird kind of tradeoff, where you're doing it all for your family and yet some of the things you're trying to do are not all that helpful to your family.

For instance. Here is what I am suggesting: In each franchise, to be decided individually or collectively through NCTA, you designate one or two channels as the kids' cable channels, the KCC. The FCC says, "What have you done for us lately?" And you say, "FCC, KCC. We've got a Kids' Cable Channel. It's for kids and makes available to them the best existing programming, produces new programming from here, from around the world."

It is by kids. Kids are up to 19 years old. They can get their Sony videotapes and go out into the community as we did with TelePrompTer in Newburgh and put their own visions of what they see happening in the world out on a public facility. They have the same responsibility for defending what they do, that they don't hang around talking to each other the way the adults should not hang around talking to each other.

It is about kids. There might be a continuing series of programs that are to help parents with their kids of all ages.

So the Kids' Cable Channel or channels is a service for, by and about kids.

It seems to me at this particular stage when a new technology is fighting for its own identity that the easiest thing in the world is just to get out the rhetorical spraygun and talk about all the things you are going to do.

What I am looking for here is an ambassadorial, a statesmanlike role where somebody will say: we as a group are not going to exploit kids.

Not exploiting kids means this Kid's cable service will be not for profit. If we have on our own kids' channels commercials, they will have to pass standards. Maybe we won't have commercials.

If we do have commercials, the revenues from those commercials will be plowed back into making better programs for the kids. You've got to do it that clean. You just can't say you're going to be good to kids. You have to build up a mechanism whereby, once you decide to be good for kids, your resolve to do that is carried out because you assigned yourself to this kind of thing.

Now, who can this be bad for? It's good for kids, and it's not a bad thing to do nice things for kids.

It seems to me it's good for cable. It separates you out immediately. It breaks you with the tradition in this country which has not paid that much attention to kids. Until Sesame Street came along and just showed that it could be done, we know what we have had from them.

So it marks you off immediately and institutionally as a group who will not exploit kids, whose best efforts will go in on the particular channels that they assign to doing the best possible thing on behalf of kids.

It's good for you. I mean you're all going to get rich. That's all taken care of, you know. It's down the line. You need a little capital to get started and all that sort of thing. But you've got it made.

What are you going to do with it? I mean why do the silly thing that people do? They get all rich in their own medium and then they want an honorary degree from some university and they give a hundred grand to the university and sit up there on the platform. It's more important that there be good cable than universities.

Carl Sandburg said long ago that Hollywood is much more important than Harvard, much more influential.

Put the dough back in, don't give it to the old traditional kind of things. Reinvest your dough in the cable, because you've got that technology in your hands. Making it good is much more important than making local playground projects good, because it deals with intellect and ideas and emotions and attitudes.

So I would think that that something that is not bad for kids and not bad for cable and not bad for you might be a good idea.

What are the tactics? We used to have war chests. Now we will have a peace chest. The magazines tell me there are 5.3 million subscribers. The easy thing is to say a buck apiece.

Now, what does $5.3 million buy you? It gets you seriously into the ballgame. This money is put into the hands of kids' cable channel on which you have representation. There are all kinds of other people from the educational and child development world who are on the board too.

That $5.3 million fairly quickly, I suggest, can become $10.6 million because there is a very strong attraction for foundation and government agencies and private donors for matching grants.

So we decide to do a program in parent education which will talk about nutrition and child care for zero to 9-month-old children in cities. We want to develop a series of programs and scripts and things like that. The kids' cable channel has the $5.3 million, they will put up $175,000, and when they write their proposal to HEW or some place like that, they ask matching funds of $175,000. Everybody is getting two for one. A lot of foundations would be just thrilled at the idea. But it has to be something that is not commercial; it has to be something out there with the right kind of people.

You should appoint some kind of a commission, God help me for saying it. But put together a dozen people -- 12 was the number preferred by an early communicator -- and set it up as the one to come to your board with all this stuff that I am just sketching here worked out, with the feedback from the people who have talked about it and thought about it. Let the commission look something like the ultimate board of the kids' cable channel, with representation from the cable industry and not just from the big boys in the big cities, but all the geography and size represented and people from the outside world who are interested in kids and have demonstrated that fact.

Then you go and do big visible good. You do a global village conference on what can cable do for kids. You just get the biggest, most important guys who care about kids in the world and you bring them to Washington, and you say, "We are really serious, we want the best."

It's very hard for people to ignore that kind of attention. And for a technology in its earliest stages to come out with that kind of statesmanlike thing, then you get into pilot projects. Let's do a program which we'll syndicate all over the place. Let's do a training workshop where any franchise in the country that wants to send somebody in who will be their local expert in kids and education can come in for four weeks in the summer and really get to be smarter than anybody else back in their neighborhood.

Then you start developing a program syndication service. You start looking, as we have, at hundreds of films for kids that will never be seen on commercial television because they are six minutes long or eight minutes long and they come from Czechoslovakia and they come from Germany. They are beautiful, and nobody sees them.

Then you're on the way. You've got a viable continuing service whose quality is guaranteed by the legal and technical way you have surrounded it and has a permanent source of funding.

Now, that may all seem blue sky. But I suggest something along these lines. This is just sketchy stuff. An insight, a determination to do something about it and then pinning yourself down by putting up the bucks to do it and creating the mechanism which takes it away from just being a tool of some people who wanted a quick story in TV Guide.

To conclude, there is a lot of crazy stuff in the kind of society that we live in, and you come to a city like Washington and New York -- I think New York was invented by God just so people could visit it and say, "Well, things really aren't that bad back where I come from."

The concern we start to feel about these things frequently because there are no outlets for people with concern to say who they are, to say what their feelings about things are. We are told that violence is a search for self-identity. It's people who feel wiped out and unimportant and don't care about themselves and feel that other people don't care about them. The only way we find that we should care about ourselves is through these other people, that violence is what comes out because anything is better than being a cipher.

We are told also that drugs are a way out or a way in, the search for emotions and identity and feelings that are denied in the official society, are a way out of the pain and frustration that are part of it.

There are a lot of people who don't like themselves very much. We have been told on fairly good authority that we should love our neighbor as ourself. We can all climb up in the tower and look around the world and say that's a bit of advice that didn't work very well; look, everybody's beating on each other.

I think there is a piece of wisdom in there and I offer it to you because of my own concern for kids and the opportunities I see for you. We are encouraged to love our neighbor as ourselves. So a guy beating up on somebody else is because he doesn't like himself. How simple. We just look in our own life and see how that one works out.

So one of the terribly important tasks we have as parents, as educators, as communicators is to help kids like themselves, to find out that they are really likeable. You know, it's not birthday cake stuff, it's for real.

I don't particularly find commercial television helps kids to like themselves. I find a lot of schools are more interested in failure than in success. We should have schools without failure, we should have schools that teach kids how to love themselves. What a silly statement that sounds like. You'd almost get in trouble in a lot of places for coming out and saying something like that.

This is all terribly important. It's more important, I suggest, with younger children. There is a crazy thing. I mean there are very few things in the world that the absolute experts and the ladies in the laundromat agree completely on. One of those things is that what happens to little kids in their formative stages is the most important thing that will happen to them in their whole development, whether it be intellectually, effectively, cognitively. Yet we have got a school system that is based exactly upside down.

Tuition costs $2,500 a year for a 20-year-old, and the ads on the buses say tuition only covers one-third of the expenses of educating the kid.

We spend all that money on a 20-year-old and we spend an average of $600 a year on a 6-year-old.

How did that ever happen? I mean do we really believe all those people like Montessori and Piaget and Bruner when they say that what happens to 2, 3, 4, 5, 6 and 8-year-olds is really what counts? Suppose we just dumped it all upside down. Suppose you were the guys who did it. So you said you're going to take on little kids, and you're not going to let the president of the company give any money to universities. Instead, he will give it to P.S. 113. He is going to endow a high chair -- at the local elementary school.

You turn the game around. I mean it's wide open to do. No corporations are doing things like this. You can be the first guys in town -- if you want to be. Otherwise, you can just go back and give to the Community Chest and wear your buttons and do all the stuff that is so easy and doesn't demand any commitment or any thought.

I just have three short anecdotes. I offer them because you may find them useful.

By definition as you start out in something like this, inevitably you are going to be up for criticism. Sam Goldwyn, a great philosopher, was asked about the critics once and Sam said, "Don't pay any attention to the critics, don't even ignore them."

Which is not bad.

The next is the closing you may find helpful in management relations. I speak of a Ring Lardner story where the last line says, "Shut up, the boss explained."

And the last, which I think is a line that underlines almost all human conversations, which if we understood, we'd be better off, is from a New York City cab driver who commented on Mr. Lindsay and things like that and concluded with his whole philosophy of life. He took a short breath and said, "That is my opinion and it is very true."

Thank you.

CLAY T. WHITEHEAD

First of all, I want to tell you how pleased I am to be here. I've been looking at a very large pile of forget-me-not seed packages for several weeks, and now I am getting the chance to meet those responsible for this "greening" of OTP.

I have visited a number of the convention exhibits and I was both intrigued and impressed. I found that they demonstrate once again, and in a very tangible way, the vitality and potential of the cable industry.

Like all electronic communications industries, cable TV's future depends only in part on vitality and potential. It also depends on how the government chooses to let it grow. Tonight, I would like to talk a little about the development of cable television, and about the government's role in that development.

I think it is safe to say that we all view the development of cable as the most important single policy issue on the communication front -- perhaps one of the most significant domestic issues of this decade. Naturally, this Administration wants to take its own careful and constructive look at the problem before any definitive policy is formulated.

We are hoping that the Administration will be able to develop a policy on cable within the next few months. Our purpose in doing so is not to cause the FCC to delay its proceedings, but rather to provide a different perspective on cable regulation -- a perspective we feel is badly needed.

The policy issues which OTP will be studying are different from the issues with which the FCC is presently concerned. The President wants an imaginative, forward-looking policy -- one which is sufficiently comprehensive to be a valid framework for the next decade. We are not going to achieve that kind of policy framework by worrying about whether there should be three distant signals or four or none, or by trying to resolve the Byzantine enigma of "footnote 69." The FCC -- and you -- are rightly concerned with these immediate issues, because they are bread and butter issues. But those issues are not the real policy issues government must ultimately address -- we must also take the longer and broader view.

Indeed, it was precisely for that purpose that the Office of Telecommunications Policy was established. Our role is quite simply to formulate executive branch policy on communication matters. We are not a regulatory agency. Our interest is in policy, not the details of rules and regulations. Thus, we would hope to formulate the policy framework within which the FCC, the States, or the courts might regulate -- or not regulate -- cable. A sound cable policy framework must specify such matters as industry structure, common carrier or limited carrier status, the degree and level and type of regulation, copyright in the broadest sense, access, ownership, public service uses, the effect on broadcasters and on special classes of viewers.

I wish that I could predict for you now the results of our policy-making efforts. Of course, I cannot. There are, however, a few things that seem to us to be obvious and fundamental. Let me briefly outline these things.

First, it seems plain that cable is an important example of a new technology which simply does not fit any of our existing institutions. We want to avoid the danger of trying to force cable into unnatural molds -- molds developed for different purposes in different times. We need a comprehensive new policy to deal with the special problems and unique capabilities of cable. And we certainly do not want to repeat the mistakes which are all too apparent in our present broadcast regulation.

Second, the basic criterion by which the Administration will assess the policy options is by their effect on the viewing public. Our principal concern is for people, and the effect of our policies on people. The cable industry has rightfully emphasized the benefits of cable to consumers, and you must expect this to be the criterion by which you will be judged. I think there is a tendency for the regulatory process to get caught up in the short-run dynamics of competing industry viewpoints, without sufficient attention to the longer run impact on the public interest. This results in a series of short-run ad hoc decisions -- compromises, really -- which never add up to a meaningful policy. The potential impact and importance of cable make it exceedingly hazardous to make policy by accumulating a series of short-run compromises. Of course, I would be less than candid if I did not admit that political pressures present serious problems. Whatever policy we come up with will have to be not only a good policy, but a timely and politically realistic policy.

Third, and in the same context, it is perfectly clear that television service as we now know it is valued very highly by the public. People spend a lot of time and money on television. No policy will be good, or acceptable to the American people, if it threatens this basic level of television service. On the otherhand, consumers also value additional options very highly -- that is why people subscribe to cable service. The promise of cable lies in its potential for expanding consumer choice, and in reducing the cost of access to transmission facilities. But cable will not reduce the cost of program creation. If we want new and better programming and new services of other kinds, more money must be brought into programming than advertiser-supported TV now seems able to produce. Cable must make its way by offering the public new options that consumers or advertisers are willing to pay for. It is very hard to find a rationale for keeping people from paying for something they would like to buy, particularly if the existing level of advertiser-supported television service is not reduced.

We hope that we can develop a policy which will allow cable to offer people a wide variety of new services including, but not limited to, entertainment, while at the same time preserving or even augmenting the quality and value of existing television service. Only in this way can the full benefits of cable, in terms of educational, public access, and other special uses, be realized. While these special community services offer the potential of great benefit to the public sector, they can be achieved only if cable is a viable business proposition in the private sector.

Combining these three principles in a comprehensive national policy is not going to be easy. Nevertheless, the time for decision has arrived. I think that what we would like to do is to formulate a policy which creates an industry structure conducive to our policy goals. This offers a clearer, more manageable regulatory approach than does the highly detailed, meddlesome, and unpredictable Federal regulation of the traditional sort. After all, your flowers may just not fit in any of the government's old pots.

It is for this reason that we have a cabinet-level committee to look into the broader aspects of cable policy. The purpose of this committee is to provide a forum within the Administration to discuss the important ideas, explore the alternatives, and provide for the President the views of the concerned Cabinet departments and Administration officials. The purpose of establishing the committee is not, as some have suggested, to delay the growth of cable, but to accelerate the development of policy.

The second generation of cable can be very exciting but we must be very certain that we create an environment in which the far more important third generation will serve well our interests as a society and as individuals.

You are laying the groundwork for exciting future developments that will profoundly affect this country's future. I have been talking tonight mainly about the government's role in that development, but we must realize that the energy and thrust must come from the private sector.

I have an economist on my staff who tells me I should make policies which make everyone better off -- or at least no one worse off. Unfortunately, policy-making is seldom so easy. But the potential of cable is so great, and its implications for our way of life so far-reaching, that we really may be able to achieve this kind of "blue sky" goal. I hope we can all work together to that end.

JOHN GWIN

I am not going to stand here this evening and give you broad exortations about rolling up your sleeves and getting to work. It is also not my intention to try to convince you that your new board or your new officers are going to be doing the same. You already know it. It is our sincere hope that you made your selections because of confidence you had in the capability, incentive, and judgment of these men who will be leading you in the coming year, and that you are ready and willing to participate.

Let's take a look at our troubles for a moment -- any one of you could spend hours making a list. But did you ever stop to think that NCTA probably owes its very existance to adversity? The specific niche that we and our spirited predecessors have established for CATV in the total communications picture today has been inspired, in large part, by the constant necessity for better self-defense. If our opponents had been content to let us remain a simple signal service we might still be one. But fortunately we were not allowed that luxury; it is doubtful that the industry would have the vitality it has today if it were not for the crises it faced repeatedly in its early years.

The kids would say, "You've come a long way, baby." So let's keep our heads up and be a little proud of ourselves. We deserve it!

We do, in fact, have great unity of purpose and goal, and that's wha we're here for. The other evening I heard an executive describing one of his difficult board members (not this board). He said that the man was "extremely tempermental; 90% temper and 10% mental." Well, that's not true of our people, but the percentages may tell us something. When we are blessed with such an abundance of common goals and such unity of thought and purpose that have made us one of our nation's most effective young trade association, let's not attach too much emphasis to the ten per cent, or five per cent, or two per cent of our troubles and let them get us all bent out of shape so that we don't see the forest for the trees, or as the mice all say, "the trap for the cheese."

At this point, a CATV leader often yields to the temptation to lapse into the well worn unity pattern and discuss the large systems and the small systems, the MSOs and the independents, and the like. I've done it myself at many State and regional meetings. But, passing all that for the moment, I will just submit to you that in reality we do have a predominantly unified industry and a predominantly unified association and I thank God that we do.

I am certainly not playing down the importance of leadership, of internal politics, nor the importance of a well-trained and cohesive staff organization, but I am convinced that we are not beginning this year with as many problems of an internal nature as are implied by many of the apprehensive analyses that are available around here at the drop of a hat.

In other words, gentlemen, to paraphrase an old saying, "some of this nonsense has to cease!"

During the past year, NCTA has made tremendous strides in Washington. We now hold a better position at the Commission and on Capitol Hill than we have ever had in our history. We are strong in the nation's business and financial communities. The eyes of the public are focused upon us to a degree never before attained by the cable television industry. I am often asked what is our most pressing problem. Three months ago I would have said that PUC legislation was the biggest hurdle we faced. However, as is usual, the focus changes. We now have renewed copyright negotiations. We have a Presidential commission; its purpose not yet fully known.

Also, at present, the regulatory status again is not fully known. The truth is, our problems can and will change quite frequently. The association must have the ability to adjust quickly to changes in our legislative and regulatory situations and to meet each effectively as they appear. Our state of preparedness is important, but the problems themselves (and their solutions) will always be in a constant state of flux and the association, directors, and staff must all be prepared to (and given the mandate to) effectively combat them.

But, to be honest, NCTA, no matter how effective, does have a communications problem. For one example in this regard, the board, in the near future will submit to you, the members, a comprehensive new plan to divide the nation into geographical areas so that you can select a great portion of the board members right there at home. Then, according to plan, the nominating committee will be eliminated and the officers will be elected by the board you send to Washington; this should make your association even more responsive. Other items of this nature are under consideration, and the next few months will see some other changes beneficial to the membership.

But even with a responsively selected board what can you expect from your leadership? In my best judgment, you have asked for strong leadership -- and you will receive it. Admittedly the present situation cannot be called an easy one for your new board to start out with. It cannot be solved with a wave of the hand; but you have given this group a mandate to get the job done. With a president who is not expected to serve beyond the end of the year and with the anticipation of another breaking-in period beginning in January, this board will be asked to take more of an active part in the affairs of the association.

I can assure you that continuity of leadership will remain intact!

About the president, I have only this to say this evening. During the series of discussions that have taken place in the past few weeks, the point was often made that the over-all leadership of the association appeared to demand perfection and that the only perfect individual walked this earth over 2,000 years ago. But whether Don's successor eventually comes to us walking across the water, or perhaps astride the Great Horse Silver, it will be up to you to have faith in his judgment and in the judgment of your elected leaders, to effectively but judiciously make your feelings and opinions known to them, and in a dignified and proper manner work together with your fellow operators and your leaders to assure a continuation of the advancements of the past generation of cable television.

The theme of this convention is "CATV: The Second Generation." The second generation is bound to be as burdened with problems and as unstable in the eyes of the first generation as is the parallel that can be drawn with the human race. As in the case with a good parent, if God gives us the patience, understanding, and good judgment to take advantage of the opportunities that will be offered to us, CATV will indeed achieve that which we all believe, is the inevitable.

DEAN BURCH

I imagine you've been poring over the fine print in the Commission's June 15th statement to the Senate Commerce Committee as you would the entrails of so many sacred hens. And you probably know as much about 3-3, 3-2, and 3-1 formulas as we do -- not excluding their impact on over-the-air broadcasting in every market from Podunk to East Overshoe. So, let's put that level of discourse aside for today and concentrate, instead, on your own convention theme -- cable's "second generation."

Curious as it may sound to you -- particularly in view of the Commission's workload of the last several months -- I simply do not believe that the key to cable's future is going to turn up in some FCC document, and not even in actions of the Congress. There are critical battles still to be fought in both arenas, of course. But, in the end, the key remains right here. Cable's future is in your hands. Itdepends on the quality of perspective that collectively you bring to bear -- on your own conception of the metes and bounds of your own industry.

You'll recall that in the course of the Senate hearing I laid dow some fundamental propositions for the Committee to consider. I said then that cable is a permanent feature of the landscape, that it's not about to go away. And I also said, considering the public's legitimate interests and expectations, that it's well that cable should be permitted to come of age -- with all deliberate speed -- as an integral part of the nation's over-all communications system. I reiterate all those propositions today. And as I read the signs, they represent the very least of the consensus that's emerging from the Commission's proceedings and maybe from the Hill as well.

We all recognize that for immediate purposes distant signals are the name of the game. Without some signal importation, cable never will get moving in most of the larger markets. And this is another way of saying that, with rare exceptions, cable never will get moving at all -- as anything more than a minor, strictly tangential appendage to over-the-air broadcasting. Thus we're searching for that elusive "start up" point -- a just-enough / not-too-much formula that will in fact open the way for cable's orderly evolution, without doing irreparable injury to our existing broadcast system. I think the Commission is getting close and that Congress is at least receptive. And I'd better add, by way of parenthesis, that now is precisely not the time for greed to overtake realism. Nor is this the time to waste momentum in some latter-day War of the Roses within the cable family.

But to say that distant signal carriage is the "name of the game" really begs the question. It only pushes us back a step, to ask "what is the game?" And if the answer, the whole answer, is simply moving over-the-air broadcast signals around -- if cable is to be nothing much more than status quo television plus an overlay of improved technology -- then you'd better just count many of us out. I tell you candidly that cable so defined would not be worth the time and energy we're currently expending on it. And the public would be the loser.

This is not to denigrate the substantial contributions that first-generation cable systems have made and are making -- in remote and poor reception areas, and as a supplement in some markets to what would otherwise be a starvation diet of broadcast signals. These are all pluses. And the health of this minimal kind of a cable industry is well worth preserving.

But from that point forward, the game gets really interesting. And the risks and the potential injuries escalate. There are risks to the spread of cable into the larger markets, and it serves no one's interests to pretend otherwise. The strategy we outlined to the Senate Commerce Committee takes off from this fact, and seeks importation formulas that will keep these risks tolerable. And what ultimately tips the scale in favor of cable's orderly growth, what makes the price worth paying, are the benefits that cable can bring over and beyond the mere distribution of commercial broadcast signals. These supplemental, nonbroadcast benefits are the game. They're what sets cable apart as unique. And that is where the key to cable's future resides.

Not sometime in the next century, or even in the next decade, but starting now. At this stage of the game, it's not promises that will get cable moving. It is performance -- or, at the very least, building into every new system the capability for performing a great variety of nonbroadcast services, if not tomorrow then the day after.

Some of these services are possible today. And some in fact exist. Consider, for example, the capabilities of leased channels -- to bring to cable subscribers a new diversity of programming, in everything from sports to live theatre to community action, and a wealth of professional and commercial services.

The things that we're seeing these days suggest that "remote control" living is more than just a pipe dream:

*in certain places, cable service is being offered to such professional groups as doctors, to bring them up to the mark on some of the latest developments in medicine;

*there are ongoing experiments that permit medical diagnosis via cable -- to read X-rays and EKG's, for example;

*the vistas in education are literally without limit: Oregon State University, for example, is using cable to link campus with community and offers lectures, musical events, and other kinds of instructional materials not otherwise available to local viewers; in other areas adult education courses -- remedial reading, foreign languages, vocational skills -- are delivered by cable;

By the same token, we are contemplating a requirement that the capacity for two-way nonvoice communication be built into every new system in the large markets. This is now feasible and, as I said before, its availability is the key to many of cable's potential public services.

But these are not just matters of what we may or may not require. I stress again that what principally is involved is your definition of your own industry -- and your response, minimal or generous, tunnel-visioned or imaginative, to an opportunity. If that response, typically, is one of moving broadcast signals around the country in order to make a buck, so be it. We'll draw our own conclusions. But if cable takes off from its necessary base of broadcast signals and turns itself into a vehicle of maximum service -- if, in other words, it turns that opportunity into substantial performance -- then I think you can count on a response the equal of your own effort.

The Commission has not immersed itself in the matter of cable on a one-shot basis. We're ready to act, and we intend to act. But certainly we are not going to wrap it all up this summer, and map out the ultimate in cable for all time. This will be a first, small step to get cable moving and, more important, to provide us with experience as to what it's capable of becoming.

And that, ladies and gentlemen, is where we came in. In the interest of all of us, I genuinely wish for you only the best.

*there are towns in which the cable system does its own gathering oflocal news and features -- classified ads, lost-and-found, and the like -- and in effect serves as the only local daily newspaper;

*programs are now under way to automate entire libraries and even newspaper morgues, to permit rapid information retrieval from remote points via cable;

*and this gets us into two-way capability -- which may be cable's ultimate magic: for daily shopping, for links between the home and computer centers, for instant polling, and even instant voting. And the experiment in Overland Park is demonstrating that all this is technologically feasible.

And these are just samples of what is possible -- on leased channels, or on public access channels that might be reserved for local governments, school and community college systems, even for "rap" sessions open to all comers. Starting the first of this month, as you know, TelePrompTer set aside two of its channels in Upper Manhattan for "open access" public announcements and the discussion of community affairs.

But then, in marked contrast, consider some of the comments filed by cable groups in the course of the Commission's proceedings. One said it would be "premature" to specify any minimum channel capacity greater than twelve. According to another, any requirement for two-way capability "would be extraordinarily premature." And another quote: the concept of cable "serving an essentially common carrier function represents mere speculative planning, far removed from the demands of reality and experience."

There's a long list of similar reactions I could draw on, but the point is clear enough -- and the point is that some cable operators are all "get" and precious little "give." They're arguing that they must have distant signals now. But so far as cable's unique non-broadcast services are concerned -- well, sometime later will be soon enough.

We just can't buy that. And, more important, neither should you -- in your <u>own</u> best interest. Taking the minimal approach is to sell cable <u>short</u>, and the industry's future along with it.

That is why the Commission will require channel capacity adequate to insure the availability of dedicated access channels -- on a free or leased basis -- to serve the range of purposes I've been describing. Specifically, we are considering that in the large markets, for each broadcast signal carried, the cable system must provide a nonbroadcast channel, one-for-one. This seems to us a reasonable way to obtain the necessary minimum and yet gear it to particular community needs.