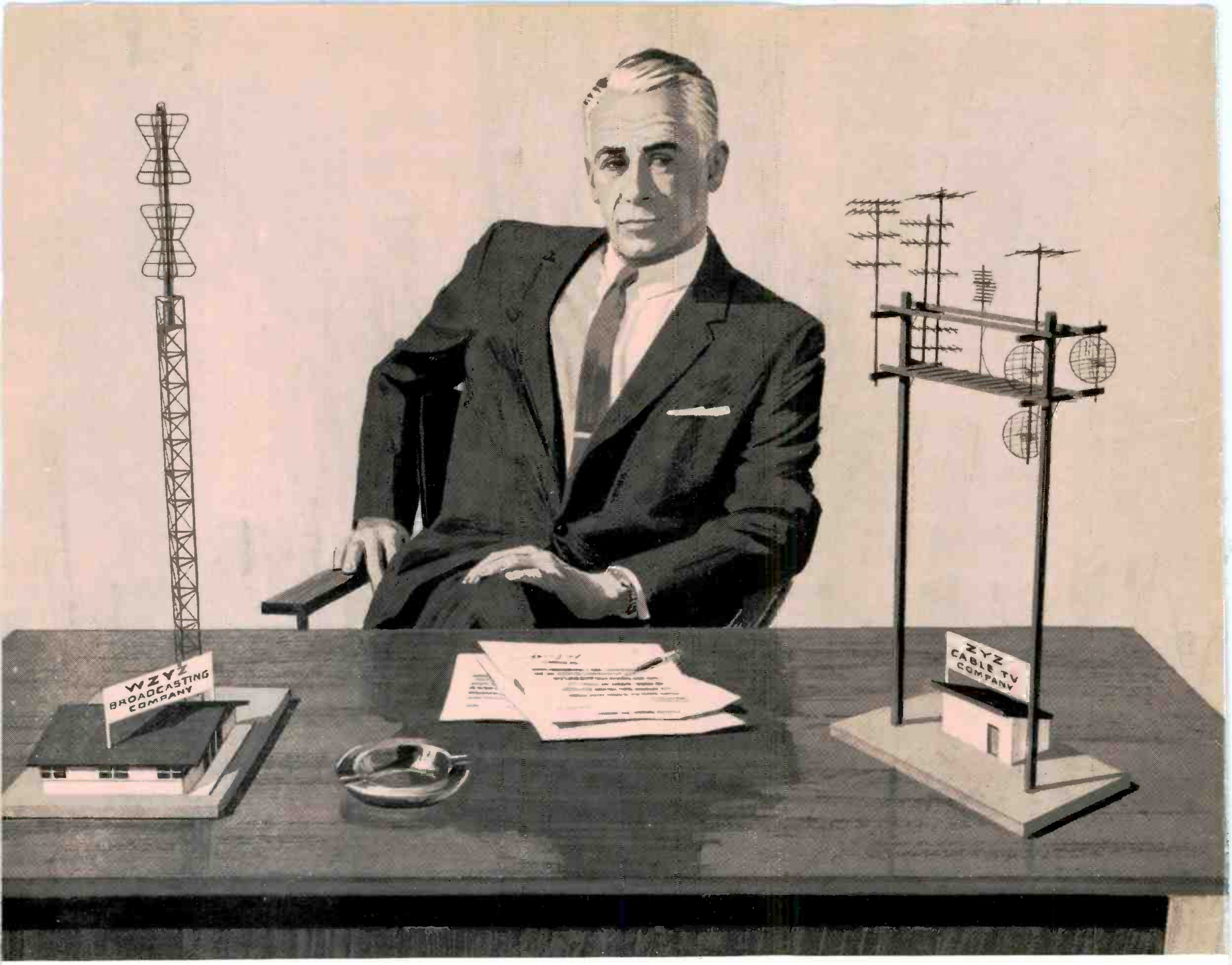
A MACTIER PUBLICATION / JANUARY 1965

BM/E

[MAGA]ZINE OF BROADCAST MANAGEMENT/ENGINEERING

Focus on Antennas



MR. BROADCASTER:
You belong at both ends of the signal

More and more broadcasters are finding that the operation of community-antenna systems is a natural business for them.

Like broadcasting, CATV is a public service, demanding a management familiar with and sensitive to the needs and desires of the public for high-quality television pictures regardless of the distance from the transmitter.

And so, to assure studio-quality reception and a rich variety of programs to homes in your broadcast area, you should investigate the advantages of entering community-antenna television (CATV).

Consult the leader • To make your entrance into CATV uncomplicated and economical, Jerrold—pioneer and leader in this field—offers you a range and depth of technical and management services unmatched anywhere. Jerrold's tremendous experience and nationwide organization can help in any or every stage of setting up a new community system—in conducting signal surveys; engineering the system; supplying all electronic equipment, including microwave; constructing the entire plant, from antenna site to housedrop; training your personnel; arranging financing to meet your needs; and, finally, turning over the key to an operating system to your system manager.

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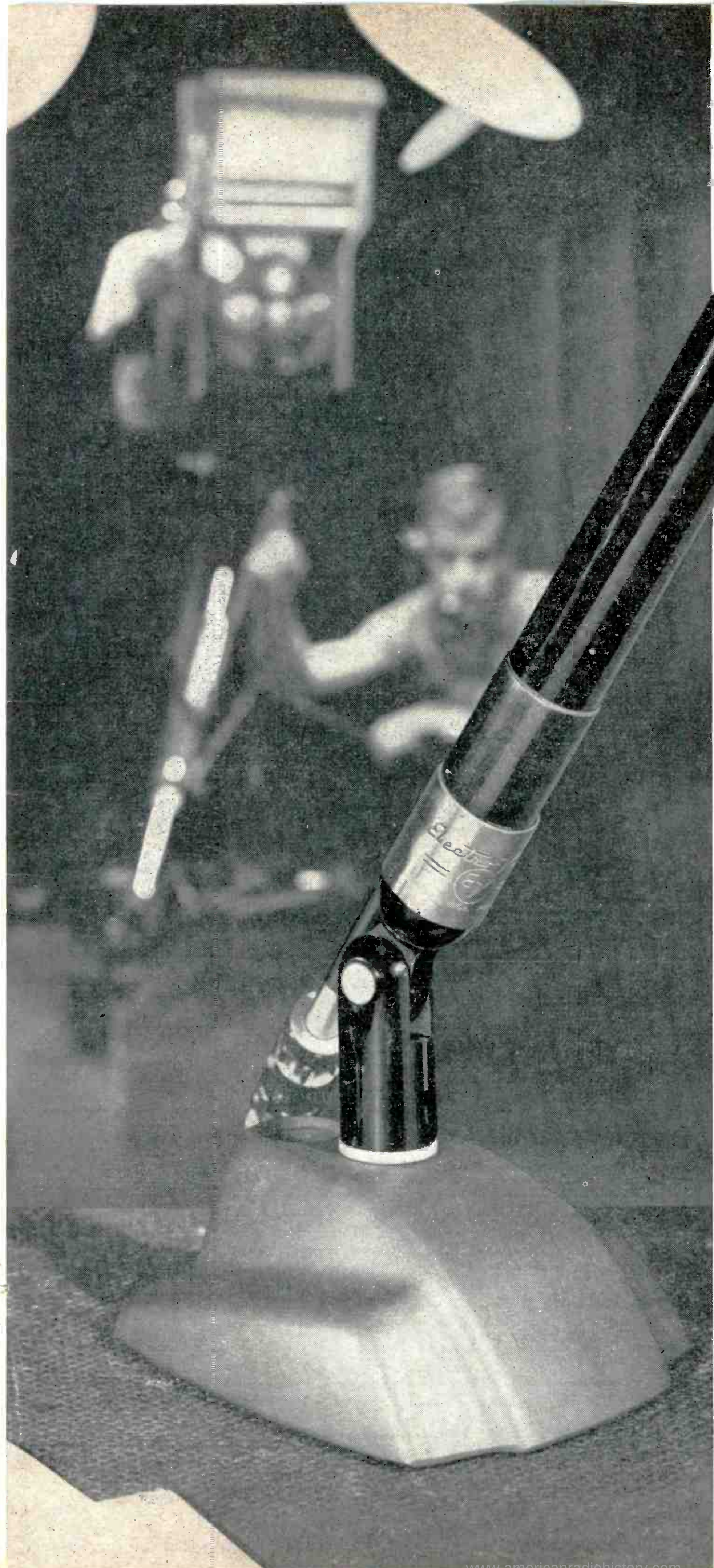

15 Years Old and Still Ahead of the Times!

It may not look revolutionary today, but fifteen years ago the E-V 655 shown here was unique. Then it was the only truly omnidirectional dynamic microphone on the market. And it offered ruler-flat response from 40 to 20,000 cps, plus plenty of output for critical broadcast applications.

Even today, those specs are first rate. Many of the early 655's are still proving that in dependable daily service. But during the years, E-V has continued to refine and improve so that today's Model 655C can set even better records for performance and service.

Having proved the point, the 655 inspired a complete series of Electro-Voice omnidirectional microphones that serves every need over a wide price range. The full benefit of our fifteen years of design leadership is lavished on even the most modest model in the line.

For instance, every slim E-V dynamic microphone uses the famed Acoustalloy® diaphragm. This E-V exclusive insures more uniform response while withstanding the effects of high humidity, temperature, corrosion and shock. It makes E-V omnidirectional microphones almost indestructible.

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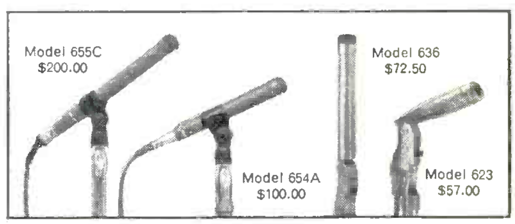

Normal trade discounts apply to list prices shown.

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Electro-Voice®
SETTING NEW STANDARDS IN SOUND

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JANUARY 1965 / VOLUME 1 / NUMBER 1

BM/E

THE MAGAZINE OF
BROADCAST
MANAGEMENT/
ENGINEERING

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Mactier Publishing Corp.
820 Second Ave., New York, N. Y. 10017, 212 MO 1-0450
Bryce Gray, Jr., President
BM/E Editorial Offices: 108 Park Lane, Thurmont, Md. 301 271-2092
Publishers also of:
EEE—the magazine of Circuit Design Engineering
Electronic Procurement
Volt/Age—the magazine of Electrical Apparatus Maintenance

BM/E, the magazine of Broadcast Management/Engineering, is published monthly by Mactier Publishing Corp. All notices pertaining to undeliverable mail or subscriptions should be addressed to 820 Second Ave., New York, N. Y. 10017.

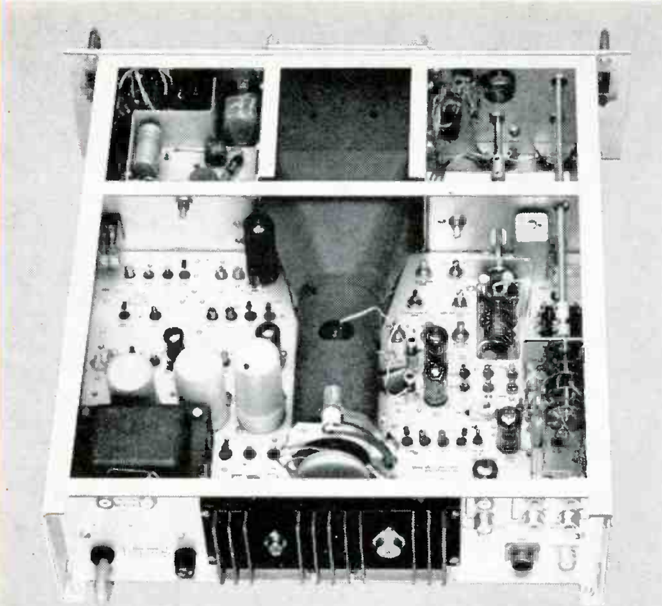
BM/E is circulated without charge to those responsible for station operation and for specifying and authorizing the purchase of equipment used in broadcast facilities. These facilities include AM, FM, and TV broadcast stations; CATV systems; ETV stations, networks and studios; audio and video recording studios; consultants, etc. Others please write for subscription prices.

 Application to mail at controlled circulation rate is pending at Baltimore, Md.

The cover pattern highlights this month's "Focus on Antennas." As a polar pattern, it represents the extent of the field of an antenna's coverage. The symmetrical lobes that Art Director Gus Sauter obtained with a folded ink-blot technique also might be taken to represent the dual aspects of BM/E's coverage of the broadcasting field—both management and engineering.

new Tektronix transistorized video-waveform monitor

with capability for analyzing VIT signals



You're looking at the back and top of a new video-waveform monitor, Type RM529. There are 45 transistors, 7 tubes, and 2 high-voltage rectifiers. All but 2 tubes and 2 transistors are socketed for easy servicing. There's no fan—it is not needed with the low power consumption of 80 watts to assure clean, quiet, long-life operation. Extremely compact, the Type RM529 uses an extremely bright crt with a full 6-centimeter by 10-centimeter viewing area—yet the instrument occupies only 5¼ inches of standard rack height.

you can do more with the TEKTRONIX RM529 than you can with any other video-waveform monitor.

Here's why:

frequency responses—Four different frequency-response characteristics necessary to monitor all Video Test signals are provided:

1. CHROMA Response centered at 3.58 Mc bandwidth ±400 kc to measure differential gain.
2. LOW PASS -6 db at 500 kc to see axis shift on Multi-Burst.
3. FLAT To 5 Mc ±1%, to 8 Mc ±3%.
4. IRE 1958 STD 23-S-1. Color subcarrier -20 db.

line selector—Provides stable displays of the Vertical Interval Test signals. Adequate brightness is provided even at the fastest sweep speed. Can display any line desired. Brightening pulse automatically intensifies the displayed line as viewed on the associated picture monitor. No modification to the picture monitor is required.

field selection—Positive acting circuit allows selection of the odd or even field for display. Noise will not cause random field changing.

dc restorer—A feedback-type restorer acts during the backporch time. Not affected by presence of color burst. Does not distort the burst. Front-panel switch can disable the restorer—when other than video waveforms are viewed.

Type RM529 Video-Waveform Monitor $1100
For waveform photography, a Tektronix Type C-27 Camera is recommended. Bezels are available to adapt other cameras to the Type RM529.

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BROADCAST INDUSTRY NEWS

1965—Year TV Transmitters Go Remote?

This may be the year VHF telecasters will receive FCC approval to operate their transmitters by remote control. Concluding extensive operating tests conducted during the past two years, the NAB Engineering Dept. has prepared a 200-page petition containing the results of field tests carried out with the aid of four stations and four equipment manufacturers.

Cooperating in the engineering tests were WABI-TV Bangor, Me., KFMB-TV San Diego, KKTV Colorado Springs-Pueblo, Colo., and WGEM-TV Quincy, Ill. Manufacturers involved in the development of the FM-multiplex and cable systems used are Gates Radio, Quincy, Ill., Moseley Associates, Santa Barbara, Cal., RCA Broadcast & Television Equipment, Camden, N. J., and Rust Corp., Cambridge, Mass.

George Bartlett, NAB Mgr. of Engineering, reports the proposal is in the hands of legal counsel, and is scheduled for filing with the FCC shortly.

Good Year for Color TV Forecast

If telecasters are wondering how many people will be watching color during 1965, industry forecasts indicate that some 2 million color receivers will be sold this year. Last year, 1.3 million sets were sold, nearly double the 1963 figure of 747,000, and well over 3 times 1962 sales of 438,000. The marked increase for this year is attributed mainly to the variety of picture sizes and styles to be offered. Compact designs, with rectangular picture sizes of 21 in., 23 in., and 25 in. (and the promise of 19 in. and perhaps 16 in.), combined with lower prices, should make color television more appealing to the general public. According to one industry source, color receiver sales in 1965 may equal the total sold during the previous 11-year history.

Jerrold Claims CATV "Not Harmful"

"CATV systems have had no adverse economic impact on the operations of existing TV broadcast stations," said Jerrold Electronics Corp., Philadelphia, cable systems operator and manufacturer of CATV equipment. In a 16-page statement to the FCC, Jerrold urged adoption of a "case-by-case approach" in deciding whether existing stations need protection from a CATV system, citing that "almost all allegations of economic injury have been prospective in nature, and from stations still operating viably, which have lived side-by-side with CATV for years."

New TV Tape Machines Ready

Commercial shipment of two advanced type TV tape machines, the TR-3 tape player and TR-4 recorder/reproducer, have been announced by RCA Broadcast and Communications Products Div. The fully transistorized units are in production at Camden, N. J., and at least 70 machines were delivered during December, according to A. M. Miller, Mgr., Broadcast Merchandising Operations.

Pictured is Charles Shepherd, Technical Director, WSTV-TV, Steubenville, O., looking over one of the two TR-4 machines delivered to the station. Transistorization has reduced the new unit's

Radio-TV Wages Rising

Two NAB surveys indicate that average wages in broadcasting rose 6-7% during the past two years. Compensation to salesmen led the rise, with sales managers running a close second. Average increases for all wages amounted to 4% for radio, 7% for television. The surveys, involving nine key jobs in radio and 17 in television, broken down by market size and geographical area, indicated a wide disparity between large and small market wages. Going rates for all positions were lowest in radio markets under 10,000, particularly in the south. Highest pay is in large TV markets of a million or more.

	Radio			Television		
	low	high	avg.	low	high	avg.
Sales Mgr.	$136	$464	$187	$189	$454	$311
Announcer	$ 78	$245	$104	$105	$237	$153
Technician	$ 80	$192	$101	$ 95	$180	$129
Chief Engr.	$ 98	$257	$125	$158	$279	$207
Cameraman	......	......	......	$ 73	$160	$ 96
Traffic Mgr.	$ 62	$120	$ 72			
Floorman	......	......	......	$ 51	$118	$ 77

floor space requirements to less than one-third that of the previous tube-type model. Mr. Miller reports that the new machines, first introduced at last year's NAB convention, are noteworthy for their modular design, interchangeability of standardized components, and quadruplex operation for full broadcast quality.

The TR-3 is described as the first "playback-only" unit. The TR-4 is a complete record/playback machine in a 33 × 22 × 66 inch cabinet. Like the TR-3, it has inherent color capability and is compatible with automatic timing control and electronic splicing accessories.

More Federal $ for ETV

Latest Federal matching grants for ETV include $141,295 to Arizona State U. for expansion of KAET-TV Channel-8 facilities at Tempe, and $67,907 to San Bernardino Valley Joint Union District for KVCR-TV Channel 24. KAET-TV will purchase a videotape recorder, antenna, tower and transmitter, providing service to an additional 20,500 people, including 8,465 students in 24 schools. KVCR-TV will provide ETV programs to almost 255,000 people, 95% of San Bernardino County, including 132,300 students in 154 schools.

A total of 47 grants, $8.3 million, have been approved since the HEW Office of Education first made funds available in May, 1963. An additional 36 applications awaiting further action request $7.7 million in Federal matching funds.

Alabama ETV 10 Years Old

The Alabama ETV Commission recently celebrated its 10th anniversary with television tower replicas instead of candles on the birthday cake. AETV's first station, the world's ninth, began broadcasting Jan. 3, 1955 from Mt. Cheaha's 2,000' state park site.

Construction of Alabama's 6th ETV station has been assured with allocation of a Federal matching grant of $298,527. The new UHF station will be located in the northeast part of the state, covering the eastern Tennessee Valley area and serving a potential 95,000 students and 331,000

(Continued on page 8)

citizens.

Part of AETV's success is attributed to the active support of General Electric, supplier of about 95% of the equipment. Raymond D. Hurlbert, AETV General Manager, states, "Had it not been for technical counsel and professional assistance from GE, our early success might not have been possible."

TV Cameras to Buenos Aires

IGE Export Div. of General Electric is supplying TV studio cameras to one of Argentina's commercial TV stations. Built by GE's Visual Communications Products Dept., Syracuse, seven 4½" image-orth cameras will be used to equip three new studios recently completed in Buenos Aires by Channel 13 TV, owned by PROARTEL. (Goar Mestre, main stockholder and president of PROARTEL, in partnership with CBS, Time Inc., and S. A. interests, is also active in TV operations in Venezuela and Peru.)

Quoting I. Spencer Ross, IGE's manager of Telecommunications Sales, "The GE cameras will be used in Mestre's extensive production of video taped and filmed program material for distribution to other TV outlets throughout Argentina and South America." Ross further mentioned that Mestre has utilized GE television equipment in all his operations, and almost exclusively in the 5-station Venezuela network operation.

100-Kw Antennas Shipped

Three extremely high power VHF television antennas, believed to be the most powerful of their kind in the world, were recently shipped to Mexico by Jampro Antenna Co. Each of the antennas has an input power rating of 100 kilowatts. One is a 6-bay batwing design ordered by Television Regional Veracruzana for use on Channel 6. Another is a Channel 8 JATV ordered by Tele-Lajas, with a power gain of 19.2 and an omnidirectional pattern. The third model, another JATV type, will be used to provide 1.4 megawatts erp for a Television de Veracruz station on Channel 10. All three antennas will be installed at a 4,000 ft mountain site some 75 miles northwest of Vera Cruz.

"Visual Views" Tells Visual News

"Visual Views of the broadcast industry," published by Visual Electronics Corp., provides information about the company's latest activities and new products. The current edition highlights recent industry meetings at which the new ELCON camera tube, KRS Audio Automation System, and Allen VTR units were featured. Installation of a new solid-state McCurdy Custom Audio console at WNEW-TV is also described. Other columns include "Personality Profile," "New Production Information," and "News From the Editor's Desk," by A. A. Menegus.

B-T Sells Interest in Benco

Blonder-Tongue Labs has sold its controlling interest in Benco Television Associates, Ltd., Toronto, to Neighborhood Television, Ltd., Guelph, Ontario. Benco manufactures translator and CATV products, and Neighborhood TV owns and operates CATV systems in Canada. Harry A. Gilbert, Blonder-Tongue V-P and general manager, reports that Neighborhood TV is acquiring 100% interest in Benco. Key personnel Philip Freen and Harry Gray will remain in top managerial posts with the Canadian operation. B-T will continue its own independent research, engineering, manufacturing, and marketing of home television accessories and master-antenna, closed-circuit, and CATV systems.

Firm Joins Broadcasting Ranks

Melcor Electronics Corp., Farmingdale, N.Y. manufacturer of transistorized circuit modules, is developing custom broadcast consoles and amplifiers. Julius Brick, Melcor Pres., advises that prices will vary from $50 to $500, depending on the user's requirements. Al Zuckerman, formerly chief engineer with Bogen, has joined the firm as product engineer, and Philip Erhorn, formerly president of Audiofax, Stony Brook, L. I., has been named manager of broadcast equipment. Both will report to Ralph Gittleman, V-P and director of engineering.

Mr. Brick has set amplifier sales for the first year at $250,000. Some of the new equipment includes program monitor and pre-amplifier/program amplifiers, expected to be available in March.

McMartin Guys Fly Skies

Since acquiring a 7-place Aero Commander last year, McMartin personnel have flown over 35,000 miles, stopping at cities in over 21 states. Ray McMartin, president, said the decision for a company plane was "dictated by a growing need for transporting more of our key personnel, longer distances, more often. In a highly technical field such as ours, it is often to our advantage, as well as to the customer's, to have our engineers available for consultation and advice at the customer's place of business on short notice."

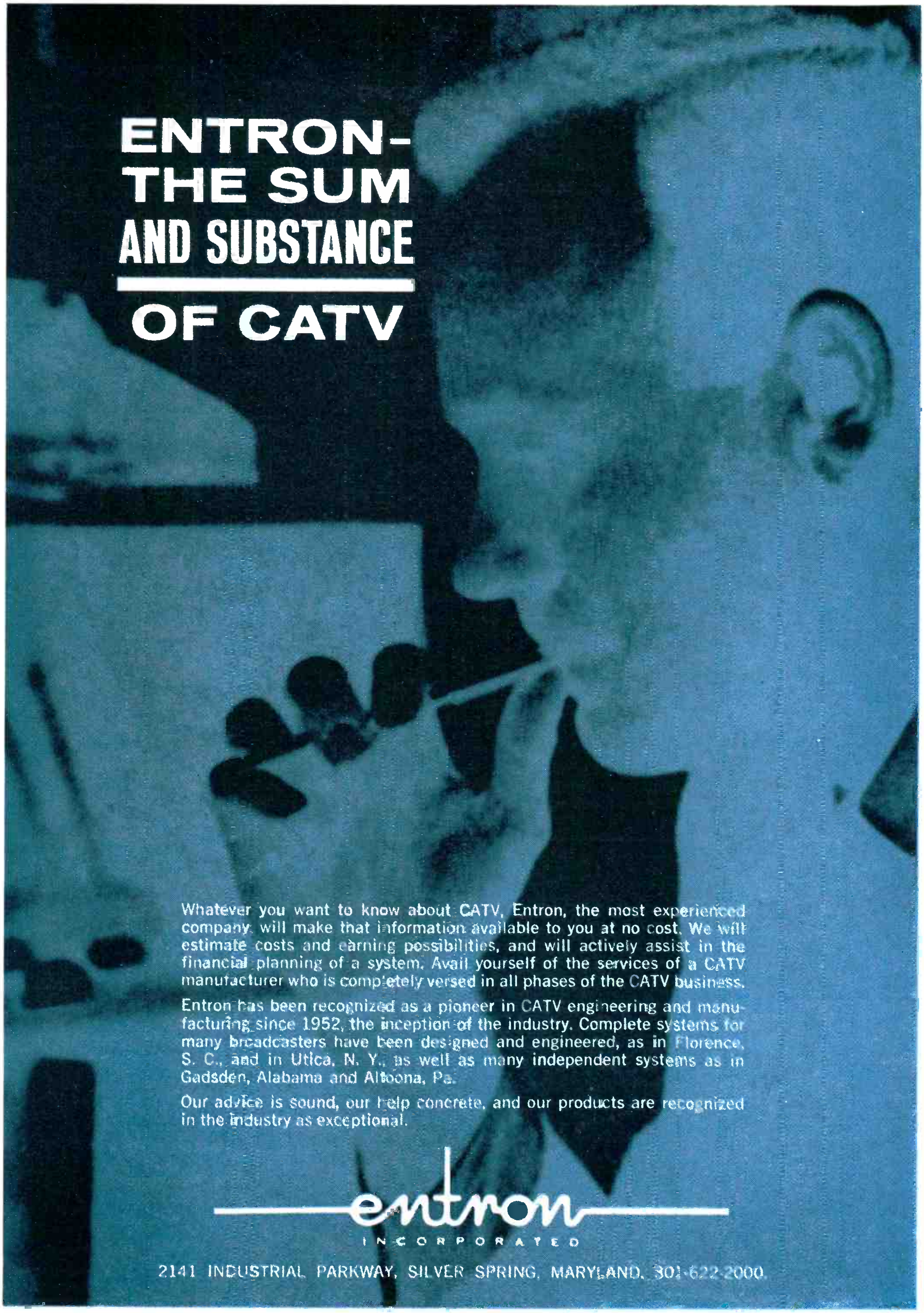
McMartin is the nation's largest producer of background music equipment, and manufactures a full line of audio products as well as FM monitoring and metering gear.

Financial

Ameco, Inc. celebrated November as its first million-dollar month. According to Bruce Merrill, president of the Phoenix cable equipment manufacturer, total sales volume for 1964 exceeded $10 million. (This does not include Merrill's own cable systems or his microwave common carrier complex, Antennavision Service Co.) Merrill sets Ameco sales for 1965 at around $20 million, based on present backlog and major turnkey jobs now scheduled.

In an exclusive interview with Robert Huston, Advertising and Public Relations Director, it was learned Ameco completed an average of one turnkey job per week during 1964. Further, nearly half their sales volume was obtained from 10 "Salesmobile" (traveling warehouse) units. The firm plans to double the number of units, providing on-the-spot sales and service to CATV systems across the country.

Collins Radio Co. declares regular cash dividend of 20¢ a share payable Jan. 15 to stockholders of record Dec. 29. The company recently was awarded a $900,000 contract from White Sands Missile Range for a microwave relay system. Collins UMG (Universal Microwave Group) equipment, utilizing modular, transistorized construction, will be employed throughout the new system.



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ASSOCIATION ROUNDUP

NAB Happenings

Radio Month Theme

The nation's radio broadcaster theme for May, National Radio Month, is "Radio—The Sound of Year-Round Pleasure." John M. Couric, NAB V-P of Public Relations, said the theme was chosen "because it reflects the character of modern American radio and presents clearly and simply one of the main reasons for radio's unprecedented appeal as a major entertainment and information medium." Sherril W. Taylor, commenting on the annual observance, pointed out that "Radio was almost counted out by its observers in the late 40's and early 50's, but only the most biased critic would attempt to deny radio's wide-ranging appeal and genuine public acceptance today."

Official industry figures place U.S. radio receiver ownership at 228 million. A recent survey showed that 65.8% of the U.S. adult population, over 80 million above the age of 18, listen to radio every day. Teen-age listening approaches 90%.

State Associations Now 100%

With the reactivation of the New Hampshire Association and the organization of the Alaska Broadcasters last month, every state of the Union and territory of Puerto Rico is now represented for the first time in history. We look forward to seeing all 51 represented at the 10th Annual State Presidents Conference, Shoreham Hotel, Washington, Feb. 4-5. Program advisory committee members appointed for the annual event are Ralph W. Beaudin, Pres. and Gen. Mgr. of WLS Chicago; Bernard E. Neary, V-P and Gen. Mgr. of WGBS Miami; John F. Crohan, V-P and Gen. Mgr. of WCOP Boston; Robert C. LaBonte, Gen. Mgr. of KERG Eugene, Ore.; and R. E. Lee Glasgow, V-P and Gen. Mgr. of WACO (Texas).

Georgia Association Seminar

Special events of the 20th Georgia Radio-TV Institute Jan. 26-28, Center for Continuing Education, Athens, Ga., will include addresses by FCC Commissioner Robert E. Lee and Judge Robert Burton, president of BMI. The four workshop sessions scheduled include: (1) Libel, Lotteries, and Legal Problems; (2) Radio Programming (3) Television Programming; and (4) Personnel & Management Problems. GAB committee meetings will be conducted Wednesday eve, with the banquet following.

GAB Elects District Member

The Georgia Association's nominee to NAB 5th District Radio Board is Charles C. Smith, WDEC Americus. Smith was also recently elected to the RAB Board.

Arkansas Broadcasters

New officers assuming their duties with the start of the new year include Pres. Bob Wheeler, KHOZ Harrison; 1st V-P Lee Bryant, KARK Little Rock; 2nd V-P DeWitt Waites, KPCA Marked Tree; and Sec. Treas. Chester Pierce, KADL Pine Bluff. Lee Bryant, with KARK since 1953, was also recently promoted to Mgr. of Broadcasting & Telecasting operations.

Another Arkansan going up a notch was Smoky Dacus, KAMO Rogers, promoted to Resident Mgr.

Missouri Broadcasters

New President for 1965 is Ken Heady, KCMO-TV Kansas City.

Florida Broadcasters

Ed Sullivan is among the noted personalities scheduled to be present at Florida gala in the Hotel Fontainbleau, Miami Beach, Feb. 27. FBA Directors will meet Jan. 22 at the Cherry Plaza Hotel in Orlando.

IEEE Convention

In conflict with the NAB Show Mar. 21-24 in Washington, IEEE's Annual International Convention is set for Mar. 22-26, at the New York Hilton and the Coliseum. Arrangements have been made to hold the IEEE broadcast symposium the 25th and 26th to minimize overlapping schedules.

NAB/NCTA Deal in "Limbo"

NCTA has refuted the voluminous computer tabulated "Fisher Report," pointing out that the prime conclusions are not borne out in actual practice. Statistical consultant Dr. Herbert Arkin, City College of New York, summed up his analysis of the NAB-sponsored CATV study, stating "The conclusions in the report about the effect of CATV subscriptions on the financial position of local television stations, are at best of dubious validity and at worst, a possible complete misstatement."

Meanwhile, NAB's Future of TV in America Committee issued the following statement:

"Because of the numerous complexities involved in the matter, the Future of TV Committee was unable to agree on proposed legislation regarding CATV for submission to the Television Board at this time."

BROADCASTERS SPEAK

I would like to compliment you on one of the major contributions to the field in the last decade. Such a magazine as yours would be snapped up at almost any price . . . and I would be one of the first in line . . . waiting for the first copy. We at WUNC especially appreciate your giving so much space to new products. The well-written articles leave no doubt as to possible application, and save one having to write to so many "dead-end" manufacturers in the hopes that they will have the exact equipment desired. Aside from the articles dealing with equipment, the two that most impressed me were "Interpreting FCC Rules and Regulations" (and don't we wish we could?), and "Broadcast Industry News."

James W. Sturges
Chief Studio Engr., WUNC
Chapel Hill, N. C.

I came across the first issue of BM/E (which had been sent to Frank Marx, Pres. of ABC Engineering) and in the brief time I spent browsing through this issue I noted many items of particular interest. I wonder if you could include my name to receive a free subscription to this publication. I know the information obtained from these issues will be of immense reference value, not only in our present day-to-day operations but for future planning and purchases.

Sammie T. Aed, Asst. Dir.
of Operations, AM/FM
American Broadcasting Co.
New York, N. Y.

I have just gone through your preview issue of BM/E and in short—congratulations. What particularly arrested my attention was the article on WJFM. Well done and most encouraging to those of us who are comparatively new in the business. Recently acquired by the Fidelity Bankers Life Insurance Corp., WFMV is going all out to promote quality listening in this rich market. I am enclosing the January copy of our program guide, which at present is being mailed free to over 10,000 families. Will you please place us on your regular mailing list.

Edw. Browning, Jr.
Sales Mgr. WFMV
Richmond, Va.

Your preview issue is tremendously interesting—and I think an unusually good magazine for the first issue. I found the microwave story by Harry Etkin especially interesting. All good wishes for your success.

G. Richard Shafto, Pres.
Broadcasting Co. of the South
Columbia, S. C.

We were pleased to receive the Preview copy of BM/E last week. It is an attractive publication and meets an important need in both educational and commercial radio and television.

James A. Fellows, Ass't to the President
National Assoc. of Educ. Broadcasters
Washington, D. C.

Congratulations on your first issue of BM/E! It may well be the instrument to close the gap between management

PEOPLE

Harold K. Dobra appointed executive coordinator for Entron, Inc., announced by Robert J. McGeehan, pres. Entron manufacturers community, master, and ETV system equipment.

Harold Dobra

James Bowen

James D. Bowen, marketing mgr., Raytheon Industrial Operation, elected chairman, Power Rectifier Equipment Sect., NEMA, and chairman, Electronic Power Supply Group. At Raytheon, Bowen is responsible for marketing the Sorensen line, as well as Raytheon power equipment.

Peter T. Barstow, Program Manager of WLKW, Providence, R. I., recently appointed to Board of Directors, R. I. Heart Association, after 10 years as their radio-TV chairman and PR consultant. Within the same week, Barstow was appointed to Board of Directors, R. I. Arts Festival, and given charge of all public relations. Barstow is also serving on R. I. Committee for the new FCC Emergency Broadcast System, working with FM stations to set up emergency facilities.

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and engineering. The article on WJFM deserves very close scrutiny by FM broadcasters, engineers, and managers alike. Too many broadcasters hang FM onto AM like an unwanted orphan instead of making FM the outstanding high quality service that it should be.

Edward Wm. Becker
Chief Engineer, WALK-AM-AM
Patchogue, L. I., N. Y.

Have just opened my BM/E First Edition and must let you know I could not put it down until I had studied it from cover to cover. Congratulations for setting a high standard with your initial effort and every good wish for the future. WRVC-FM, on the air since June, 1948, has aired classical music 14 of its 17-hour operating day since 1954, without AM support. If you'd like a story on how well our W.E. gear has held up or the listener and advertiser response which has enabled us to stay on the air, please let me know. I'll be happy to supply details.

Harrison W. Moore, Jr.
Manager, WRVC-FM
Norfolk, Vo.

INTERPRETING THE FCC RULES & REGULATIONS

The Commission vs. Programming Responsibility

Many of the questions which cause broadcast licensees the greatest concern relate to programming. What precisely is the licensee's programming responsibility? Exactly what is the extent of the Commission's control over programming. What precisely are the licensee's obligations to (1) keep up with the changing needs of its community, and (2) pass the Commission's "proposal vs. performance" test? In what programming areas is the FCC most interested?

Superficial and casual answers to these questions may well lead to a deferred renewal, hearing, severe fine, or something worse. To compound the problem, as is customarily the case with regulatory agencies, there are no easy answers to the questions. The licensee can keep out of trouble by understanding the development of the Commission's position, the current trends, and by endeavoring to offer somewhat more than is required.

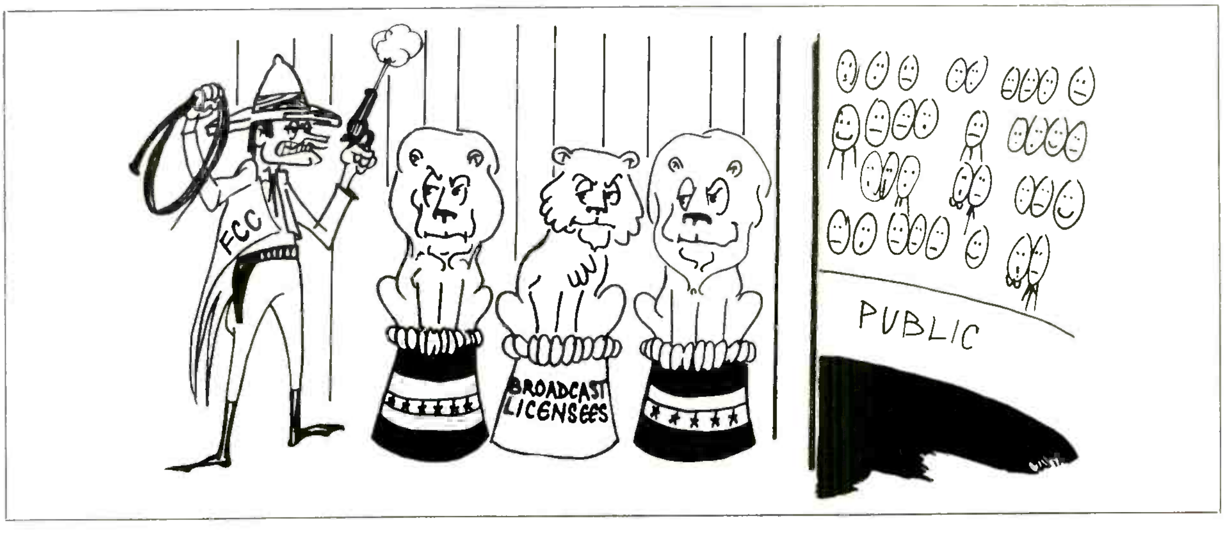
Programming Responsibility

On July 29, 1960, the Commission released its Report and Statement on Programming Policy. This document serves as the licensee's "bible" on programming and represents a codification of Commission precedents and views established during the 40's and 50's. In this report, the FCC developed, emphasized, and re-emphasized one of its favorite themes: ". . . the principal ingredient of the licensee's obligation to operate his station in the public interest is the *diligent, positive and continuing effort by the licensee to discover and fulfill the tastes, needs and desires of his community* or service area, for broadcast service" (italics ours). Many at the Commission believe that 95% of the broadcasters are no closer to achieving this goal today than they were 20 years ago! This, of course, has augmented the FCC's determination to develop methods of implementing and enforcing compliance with this fundamental requirement.

The FCC's "Big Stick"

For the past four years, the Commission has been working on a revised Section IV (program form) to be included in applications for new licenses, major changes, renewals, transfers and assignments, and the like. The forms proposed for both radio and TV stations request information that would double or triple the licensee's application burdens. More importantly, they reflect a trend to regulate programming. As a result, the proposed forms have been the subject of lengthy oral and written comments, involved meetings between the FCC, NAB, industry leaders, and a committee from the Federal Communications Bar Association. The net tangible results to date: zero. However, release of the new program forms is imminent.

During the fall of 1963 the Commission deferred numerous licenses on the grounds that the stations failed to (1) canvass and conduct surveys to determine the tastes, needs, and desires of their audiences and their community leaders, (2) program sufficient local-live shows during prime time, and (3) carry enough religious, educational, and public affairs programming. For the most part, these deferrals involved television stations. Obviously, the Commission feels that these licensees have the largest audiences and make the most money; therefore, they can best afford to canvass their respective communities, spend the most on local shows, and



afford the losses inherent in public service programming. Despite the fact that nearly all of the renewals deferred for these reasons have been granted subsequently—some over the loud protestations of Chairman Henry and Commissioner Cox—it is clear that the Commission is striving to compel compliance with the edicts of its 1960 programming statement. Statements from pro-broadcaster Congressmen combined with the Commission's intrinsically enigmatic legal position have impaired and delayed achievment of the goal—*program regulation.*

Legal Anomalies of Program Control

The First Amendment of the Constitution provides *all licensees* with the basic right to communicate ideas without abridgement. Section 326 of the Communications Act of 1934 specifically prohibits censorship. The fact that one may not engage in broadcasting without first obtaining a license does not mean that the terms for holding that license may unreasonably restrict or abridge the free speech protection of the First Amendment and the Act. While the Commission must determine if program service is reasonably responsive to the needs and interests of the public, it may not condition the grant, denial, or revocation of a broadcast license upon its own subjective determination of what is or is not a good program. Therefore, the responsibility for the selection and presentation of broadcast material ultimately falls upon the individual station licensee.

However, since broadcasters are required to program their stations in the public interest, convenience and necessity, the broadcaster's freedom is far from absolute. The Commission may not grant, modify, or renew a broadcast license without finding that the operation of the station is in the public interest. Thus, the licensee must make a diligent, positive, and continuing effort to discover and fulfill the tastes, needs, and desires of the public it serves.

The anomaly: On the one hand, the Commission is prohibited from dictating programming to licensees; on the other, it is compelled to make sure the public interest is being served. This dichotomy has resulted in a gray area that has been the source of great confusion and concern to many licensees. The Commission, of course, has a natural proclivity to augment and expand its indirect control of programming policies.

The Licensee's Burden

Due to complaints by the public, other licencees, and its staff, the Commission is becoming increasingly concerned over false and misleading matter, heavy commercialization, insufficient local expression, and unbalanced programming. Each year renewal applications are studied with more zeal, and licensees should prepare for an assault from the FCC.

Due to the incongruous legal situation, the Commission has not put any teeth in its programming ideas; it has rather judiciously avoided establishing any "rule-of-thumb" for determining the acceptability of a program structure. In fact, until 1962, the FCC raised few questions if the program structure was reason-

(Continued on next page)

INTERPRETING THE FCC RULES & REGULATIONS

(Continued from page 13)

ably well balanced, and no complaints were received. This is not the case today.

Despite the legal impediments to program control, the Commission has many well-known practical levers by which to "induce" compliance with its programming requirements. The FCC will always refuse to establish "rules-of-thumb" or guidelines for programming; a contrary course would blatantly violate the Constitution and the Communications Act. Therefore, in the absence of guidelines, the licensee has the added burden of determining what the Commission wants and requires; however, this is not nearly so difficult as it may seem. A thorough review of the FCC's July 1960 Programming Statement, and of the proposed program forms, tells the story. Furthermore, the licensee's communications lawyer is undoubtedly familiar with current cases that offer *broad* guidelines. (For example, a television station is expected to carry at least 22 local-live shows, in prime time, every year; if not, the licensee can expect a deferred renewal and had better prepare to be able to demonstrate substantial pluses to offset the deficiency.)

How to "Beat the Rap"

The day is fast arriving when *all licensees will be expected to demonstrate* that (1) their programming is in direct response to the needs of their audiences, (2) they are providing sufficient local expression and local shows, and religious, educational, public service, editorial, political, and agricultural programs—perhaps in the order mentioned—and (3) prove that they have met the "proposal vs. performance" test; that is, programmed in substantial conformance with their most recent proposal.

In short, if the licensee is operating as proposed, or has improved his programming—that is, decreased commercials, increased local-live, public service, etc.—there is little need for worry. Conversely, if the licensee has exceeded or is exceeding the proposals for commercials or entertainment, he would be well advised to apprise the Commission of the changes. This can be done by informal letter, cleared through licensee's counsel. Major changes in program types should also be reported. This affords the Commission an opportunity to object to the changes, and silence might well be assumed as tacit approval. Thus, the licensee can (and perhaps should) change the program proposal periodically. This tactic has never been tested but seems sound in view of the Commission's philosophy.

Of one thing you can be certain . . . the Commission is gradually eroding the well-established legal prohibition of program control. Its justification is predicated upon an obligation to pick and choose the licensees best able and most apt to serve the public interest; its motivation rests in a desire to raise the level of all broadcasting, and, hopefully, the tastes of the public; and FCC leverage is evidenced by its power to grant, deny, fine, and revoke.

With worthwhile available frequencies in all services practically nonexistent today, the licensee can expect others to fight for existing licenses and facilities. Thus, licensees must work diligently, along the lines suggested, to protect their positions. ●

FCC Activities

For many years the FCC has been concerned about multiple ownership. In a recent ownership analysis, the Commission determined that 37 of the 40 VHF stations in the top 10 markets are held by multiple owners with the remaining three stations licensed to publishers of daily newspapers in the same cities. Of the 156 VHF stations in the top 50 markets, 111 are licensed to group owners and 17 to newspaper publishers in same markets. Of the 40 VHF stations held by the top eight group owners, 22 are in the top 10 markets, 10 in the next 16 and 6 in the next 25. (For the purposes of defining the top 50 markets, the Commission is using the 1963 American Research Bureau ranking.)

Feeling that this degree of multiple ownership is undesirable, and that the trend toward concentration of UHF ownership in the largest markets is sufficiently serious to require the immediate adoption of an interim policy, the Commission has decided to designate for hearing any application seeking to acquire a VHF station in one of the top 50 television markets if the applicant already owns or has interests in one or more such stations. In explaining their reasons for this action, the Commission stated, "We are adopting this policy because we cannot normally make the required finding that grant of an application for a second station in the top 50 markets will serve the public interest without giving the proposal the detailed scruitiny of a hearing."

Commissioner Rosel H. Hyde dissented in this action, expressing concern "that the impact of the proposed new policy will have just the opposite effect" to the stated purpose of preventing undue concentration of control. He stated that "the new approach would tend to limit the effectiveness of the competition of other broadcast interests as against the national networks. I see no reason why the Commission should feel that larger units should not be allowed to compete in larger markets where the number of facilities is greatest and the competition strongest."

Commissioner Hyde said he feels the pronouncement constitutes a freeze against timely consideration of worthwhile applications.

FCC Personnel Charges

Daniel K. Child (Electronics Engineer in the Aviation Radio Div. since 1953) appointed Chief of the Aviation Radio Div., Safety and Special Radio Services Bureau. Child suceeds John R. Evans, appointed Deputy Chief of the Field Engineering Bureau last October.

John H. Conlin, Deputy Chief of Litigation Div. since last July, appointed Associate General Counsel in charge of Litigation Div.

Leonidas P. B. Emerson, legal assistant to Chairman Henry, appointed Chief, Office of Opinions and Review.

Improved AM Coverage—Worth the Cost?

Many station managers get the urge to improve their facilities when they see the results of the previous year's operation. For some, improvement would be a wise step, for others a big mistake. Here are some practical operating pointers to help managers make a decision.

By John H. Battison

Perhaps the hardest decision for any executive to make relates to the question, "Shall we improve our facilities, and if so, why?" In broadcasting, of course, the term "facilities" refers to the operational capabilities. In other words, the coverage obtained by the combination of operating power and frequency (not furniture or decor.)

Improving facilities engenders thoughts of greater coverage and more appeal to time buyers. Thus, the first reaction is "Let's increase power!" Fine, but what will this accomplish? Well then, let's change frequency, and/or increase power. That's good! But what will these changes involve? And even more important, will they actually bring in more revenue and increase the station's acceptance among listeners, and the man who pays the bill—the advertiser?

Increase Power

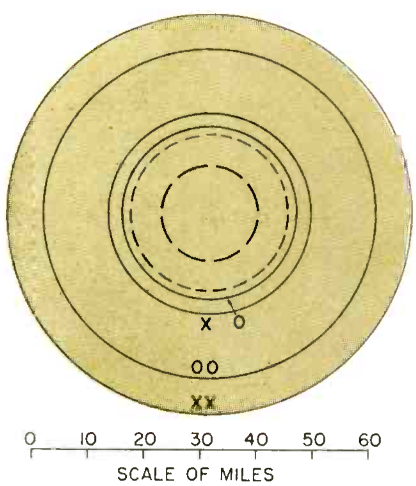
Let's start with a 250 watt station operating on a class II channel. This requires a minimum radiated power of 175 mv/m for 1 kw (same as Class III). Suppose we have a conductivity of 4 mmhos and operate on 1560 kc. The 0.5 mv/m contour will extend 14 miles, and 2 mv/m urban or city coverage will extend about 7.5 miles.

Now let us consider the coverage at 1 kw. This is 4 times the power, and will take us out to 19.5 miles and 10.5 miles, respectively. An increase to 5 kw will give us 0.5 mv/m contour of 29 miles, and 15 miles to the 2 mv/m contour, using minimum efficiency and keeping the same antenna and ground system.

AUTHOR: Mr. Battison is a consulting engineer with offices in Annapolis, Md.

This says that it takes approximately 20 times the power to double the distance to the service contours. Going from 250 watts to 5 kw may be considered somewhat extreme. A 4 times power increase to 1 kw is more likely to be the limit. However, extending the 2 mv/m contour three more miles may bring in another community that requires a 2 mv/m service, thus giving the station another market to sell.

The above assumed operation on 1560 kc. Now let us look at the other end of the frequency scale and consider 680 kc. With the same power and ground conductivity the 0.5 and 2 mv/m contour will extend to 35 miles and 18 miles respectively. Is there really much to be gained by going to 1 kw, or even 5 kw? At these lower frequencies, problems of interference produced by the 0.025 mv/m contour extend for about 126 miles for 250 watts, and for 1 kw about 170 miles. These great distances complicate the problems—and the cost—of increasing power.



Showing comparative coverage with similar powers and different frequencies.

If you are fortunate enough to have a lower frequency, consider whether you need greater coverage. Perhaps you now serve all the area you can sell. Increasing the service area may only raise capital outlay and operating costs without appreciably increasing revenue. With local stations in almost every town, an outside station may not get a large share of the audience unless they provide a unique service.

If you do decide to increase power, it will be necessary to make an engineering survey to determine the effect on co-channel and adjacent channel stations. Depending on your location, and ground conductivity and frequency, the increase in power may require a directional antenna. Determining this will involve an engineer's fee.

Consideration of a directional antenna raises an important point. Your present location may be perfect for nondirectional operation with lower power, but a directional system may call for a new location which will entail land acquisition, a new building, equipment relocation, telephone lines, etc. Another important factor is that directional operation will require the services of a first-class operator to run the transmitter, and a costly proof-of-performance fee before the FCC will allow the station to go on the air.

Change Frequency

Changing frequency to obtain improved coverage involves much the same considerations with a few additions. To change from a higher to a lower frequency may be better than increasing power, but all the problems of interference and possible directional antenna requirements still apply. There is also the problem of publicizing the new frequency and persuading listeners to tune to the new channel. The granting of your frequency change creates a new situation. The old channel becomes available for others. Your move opens the door to new competition, or perhaps a present competitor will change to your familiar frequency, where old listeners have been accustomed to dialing. Of course, if your present frequency receives interference, vacating it will not generally leave it available because the new FCC rules prohibit interference to a new application unless it is the first service to a city.

Directional antenna considerations still apply, of course; even if a directional system is not required, a drastic change of frequency may require installation of a new antenna. This is *generally* true when changing to a lower frequency, where the antenna has to be higher to achieve the same radiation efficiency. Sometimes top loading will provide the extra efficiency required, but more often a taller tower is needed. This, in turn, may involve FAA problems in connection with airspace clearance.

The transmitter may or may not be suitable, depending on the change in frequency. In some cases a change of crystal and retuning will be all that is required. Often, however, the required transmitter oscillator and tuning circuit changes are so great that a new transmitter will have to be purchased.

Change Frequency and Increase Power

Going up in frequency and increasing power to 5 kw may succeed only in providing the same or very slightly improved coverage. It will, however, give the station a better sales advantage since power is still an excellent selling point.

Ideal of course, is lower frequency plus increased power. These two combined will make an average facility into a first class operation. If you are fortunate

TABLE ONE

Improvement	Support Required	Initial Cost	FCC Application Engineering Costs (non DA)	Equipment and Technical Changes (non DA)
Increase Power	Field intensity coverage check	$200-$700	$300-$750	New Transmitter, maybe new transmission lines, new coupling components.
Frequency Change	Frequency Search	$200-$750	$250-$1000	New Ant. or changes such as top loading. New Trans. coupling components, monitors.
Change Frequency and Increase Power	One and two above	$300-$1000	$500-$1200	Any or all of one and two above.

NOTES: These figures do not include legal fees for filing the FCC forms. Directional antenna costs are not included because they can vary so much according to the degree of protection afforded and required. As a very rough example, a two-tower antenna system could probably be designed for $2,000, and a more complicated one for four towers for about $3,500. On top of the costs shown above (the initial costs are required for the engineer to determine whether it is possible to make the desired improvement) it will be necessary to make a new antenna resistance measurement when the improvement is completed, and this costs from $150 upwards. In case of a directional antenna, adjustments and proof of performance start at around $4,000 for a two-tower array.

SPECIAL ANTENNA CONSIDERATIONS

In changes involving power or frequency, the antenna system is in a sort of common category. In most cases little or no change is required for power increases (assuming change to directional operation is not involved), unless base or guy insulator problems arise. In cases of frequency change, unless very moderate, antenna tuning will be required, possibly involving a taller antenna, top loading, or perhaps a change to a folded unipole antenna. In addition, tuning components will probably have to be changed, and monitors retuned.

One frequently overlooked facility improvement is to increase antenna system efficiency. Considering that increasing the height of an antenna may improve efficiency as much as 250 mv/m, there is a temptation to extend an antenna. However, like everything else there is a snag—the FCC requires engineering applications for antenna height and efficiency increases, and the predicted coverage and interference have to be presented in exactly the same way as for a power increase.

For the small-market station, there is a way of greatly improving local coverage. This can be particularly beneficial to Class IV stations that have a low frequency competitor with a stronger local signal.

The folded unipole antenna, developed for broadcast use by John H. Mullaney, offers a solution to the need for stronger local signals. It is most effective with antennas of 0.25 wavelength or less. By virtue of its use of grounded antenna system it offers easier maintenance; and the easy realization of high antenna resistance with zero reactance operating parameters gives it high efficiency. In addition, it has a far wider band width than the average antenna. This coupled with the use of a modern audio levelling amplifier and good audio equipment generally results in a stronger apparent signal for the listener.

enough to be able to consider this kind of an operation, from the standpoint of today's FCC allocation policies, then all you need is a good deal of money. Converting to a first class facility is the most costly from all points of view. It is like building a brand new station, except for the studio and other audio equipment. These, too, are often replaced, in keeping with "new sound" of the station.

General Considerations

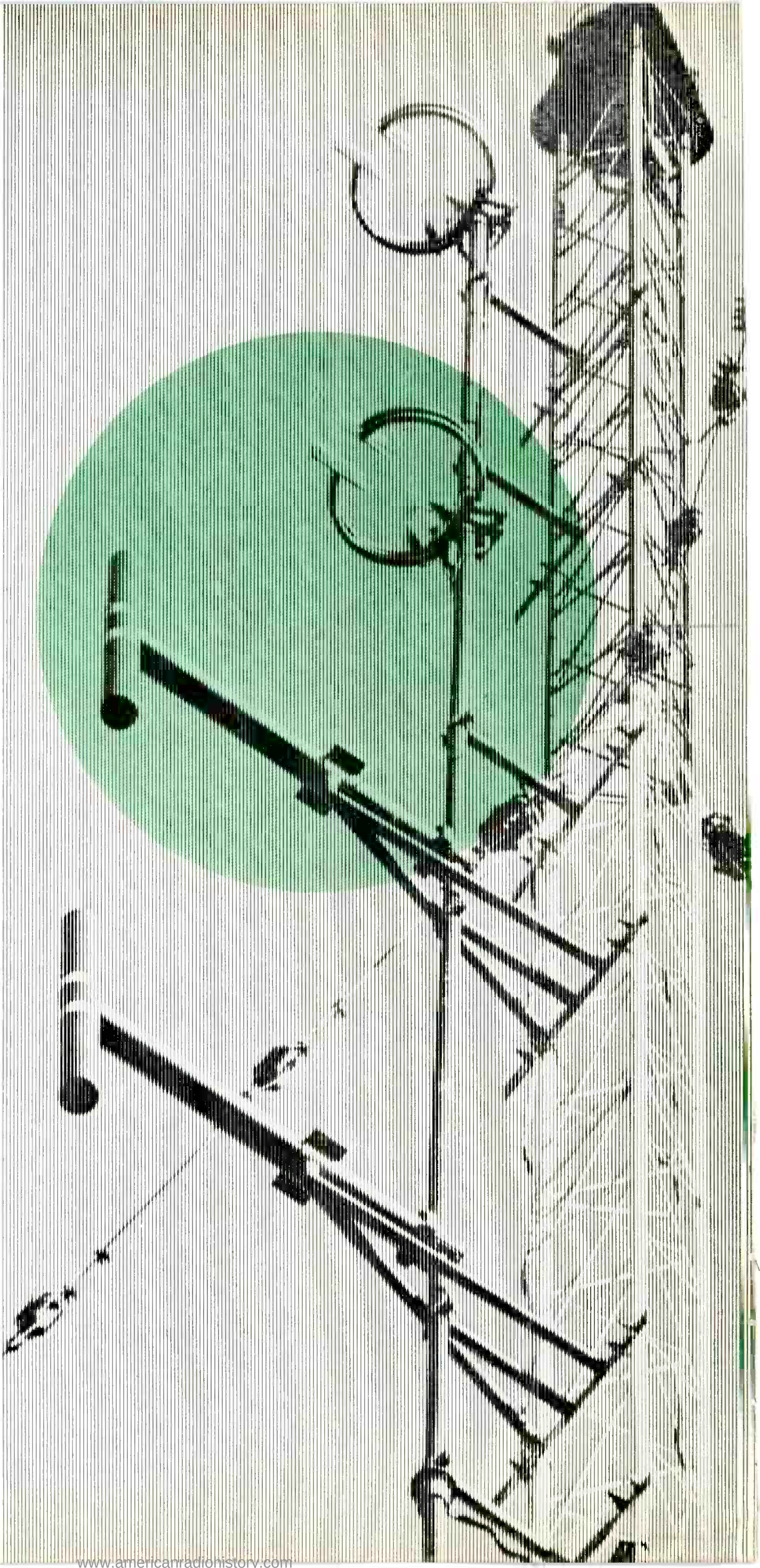
In considering power increases, decisions are mainly based on engineering costs and operating budgets. Frequency changes involve the additional factor of competition, and when contemplating combined power increase and frequency change, the frequency change facets are probably the most formidable—apart from the anticipated costs.

We have mentioned the possibility of a competitor entering your market via your abandoned frequency; now consider your selling points based on frequency. If you are now top of the dial or first (lowest) on the dial, and publicize it—you may lose this advantage. Equally or more important—consider your station frequency with respect to dial positions of your competitors—especially if you are in a multi-station-market. Many listeners "select" stations by tuning across the band and stopping when they hear a pleasing program, making a mid-band slot between the frequency spread of the other stations desirable. If your new frequency puts you way outside the accustomed tuning spread, you may suffer from lack of tune-in. Despite the facility improvement, this can be a poor business step unless recognized and proper steps are taken to overcome it.

Today, because of AM station growth and the tightened FCC rules concerning interference, it is more difficult and more expensive to find a way of improving broadcast facilities. In many cases it just isn't feasible to do anything. In the West, although the possibilities are limited, the best opportunity is presented by taking the bull by the horns and filing for one of the new duplicated Class I (Class II A) channels. In suitable locations, a low-power daytimer can switch to high power day and night under these new regulations—provided he has the money to do it! ●

Improve FM Coverage with Dual Polarization

By Harry A. Etkin



Incorporating vertical polarization in conjunction with horizontal polarization provides the maximum FM service coverage.

FM stations radiating a horizontally polarized signal experience a definite loss in transmission effectiveness because of the vertically polarized whip or line cord receiving antennas used with many modern FM sets. Transmission of a vertically polarized signal, in combination with a horizontal signal, will considerably improve coverage of the authorized service area. The advantages of a dual polarized FM antenna system are:

1. Increased signal pickup by vertical car whip antennas.
2. More signal into home FM receivers with line cord and built-in antennas. (These antennas are widely used in console FM combination radios.)
3. More signal into transistor portable FM receivers with whip antennas.
4. Increased signal level in the null areas of the horizontal antenna.

AUTHOR: Mr. Etkin is a Staff Engineer at WQAL-FM in Philadelphia, Pa.

5. Improved reception in multipath areas; more listeners in hilly terrain.
6. Improved reception of monaural, stereo, and SCA signals.

This article will provide the FM broadcaster with detailed electrical and performance characteristics for the proper installations of a dual polarized antenna system.

Technical Considerations

The addition of vertical polarization is not a cure-all in providing increased coverage. In some cases the addition of vertical antennas will not increase signal in a deadspot for the horizontal system. Vertical radiation will not cure the multipath effect, but used in conjunction with the horizontal system, improved reception in areas with multipath problems often results. The dual system also does not increase signal pickup of a horizontally polarized receiving antenna.

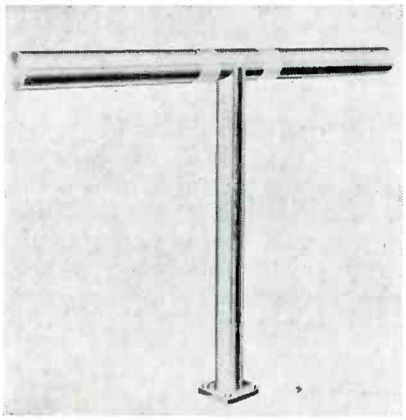


Fig. 1. Basic folded dipole.

Broadcast engineers should note that operation of both types of antenna systems does not degrade the horizontally polarized ERP when the vertically polarized antenna is installed. Existing FCC Rules authorize radiation of the same amount of power in the vertical mode. For example, a Class B station having a 10-kw transmitter and a 4-bay horizontally polarized antenna with a gain of 4 will radiate a horizontal ERP of approximately 30 kw. A vertical antenna system could therefore radiate an equal 30 kw in the vertical mode.

Horizontaly polarized vee, ring, and circular shaped radiating antenna elements have earned an excellent reputation, and their technical characteristics are well known. The vertically polarized antenna is basically a folded dipole, usually constructed of copper tubing or transmission line copper (see Fig. 1).

These dipole elements, or bays, are spaced approximately one wave-length apart. The bays in some makes of antenna are then fed in phase along a transmission line that will support from one to sixteen elements connected in parallel. The impedance of each dipole is made greater than the transmission line impedance by the number of elements. Thus, the input impedance of the antenna must be 50 ohms to match the transmission line impedance following the standard Ohms Law formula for parallel impedance ($1/Zin = 1/Z_1 + 1/Z_2 + \ldots\ldots 1/Z_n$).

The standard FM antenna is a modified half-wave horizontal dipole. Fig. 2 shows the horizontal radiation pattern, the typical figure 8. According to the position of the antenna it is possible to radiate a signal which is either vertically or horizontally polarized. When the dipole is horizontal, the signal is horizontally polarized; when the dipole is in a vertical plane the radiated signal is vertically polarized.

To produce a circular horizontal radiation pattern, the most common antennas in use today are the circular ring and vee type. These antennas will radiate a uniform

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WHY DUAL POLARIZATION?

Many of the FM receivers on the market today are "economy type" with line cord antennas. Many transistor portables and most FM auto radios utilize vertically oriented whip antennas. FM transmitting stations radiate horizontally polarized energy. Thus, in spite of adequate ERP, adequate signals are not available at a significant number of receivers.

The answer to the problem of serving the total potential audience is dual polarization. Results of authoritative tests and measurements prove that dual polarization improves the signal level in the average FM receiver by at least 15 db. (The average receiver included AC-DC units with 30-inch pigtail antennas and combination AM-FM and hi-fi stereo consoles with built-in and line cord antennas.) For signal tests using auto radios and transistor portable FM sets equipped with vertical whip antennas, dual polarization produced increased levels of 16 to 17 db.

Thus, to reach more effectively the potential audience, an FM station, particularly in lower power class, should seriously consider the advantages of dual polarization.

WHAT ABOUT COST?

Vertically polarized antennas may be installed in addition to the existing horizontal system, or in a completely revised antenna array. Costs would naturally vary with the complexity of the system; however, average cost of installing a 5-gain horizontal and vertical element antenna would be:

$ 3300 for horizontal elements with de-icers
$ 2800 for vertical elements
$1000 for shipping, installation and AC power to de-icers, for horizontal elements. (Verticals do not require de-icing.)

The average cost for a complete new 5-bay horizontal/5-bay vertical combination antenna, therefore is about $7,000. It must be remembered that one cannot get something for nothing. This holds true when adding vertically polarized radiation to an antenna system. More horizontal elements are required to provide a given ERP value, since some of the power normally going to the horizontal elements is diverted to the vertical antenna. This factor makes the antenna system larger, and increases costs. The addition of vertically polarized radiation to an existing or contemplated FM antenna system is certainly a worthwhile project. Past experience has indicated that this addition should be at least 20 percent of the horizontally polarized ERP, to be worthwhile economically.

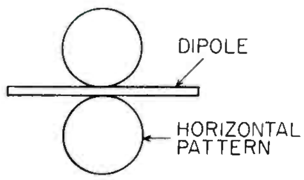


Fig. 2. Pattern for a half-wave horziontal dipole.

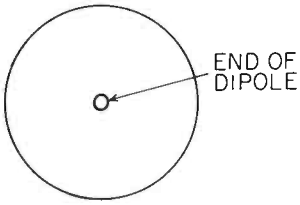


Fig. 3. End view pattern of a half-wave horizontal dipole.

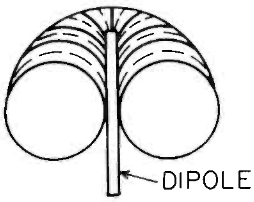


Fig. 4. Pictorial radiation pattern for a vertical dipole (doughnut pattern).

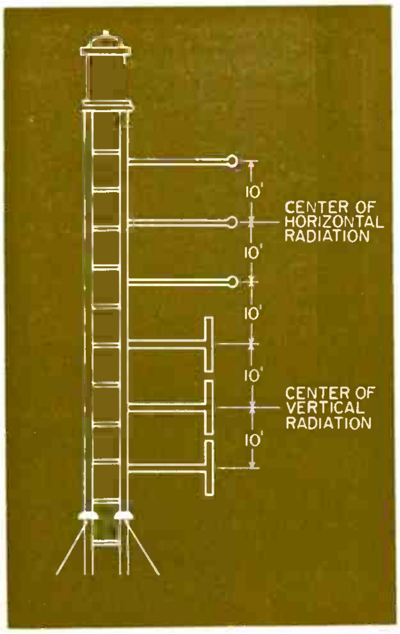


Fig. 5. Drawing of stacked dual polarized antenna system.

omnidirectional circular horizontal polarized pattern. The circular dipole is usually end-loaded to provide a more uniform current along its length. The appearance of the radiation pattern, when viewed from an end of the dipole, is shown in Fig. 3. The circular or ring antenna is simply a folded dipole bent in a circular shape, which gives a circular horizontal field pattern. The vee antenna is a folded dipole formed into a truncated vee shape. As the number of horizontal bays is increased, the vertical radiation beamwidth is decreased or "squeezed down." To step up the vertical radiation pattern, vertical antenna elements must be used in combination with the horizontal elements.

Using a half-wave dipole in the vertical mode, the horizontal becomes the vertical and the radiation pattern is circular, like the doughnut pattern in Fig. 4.

Installation Details

There are three basic configurations to be considered in the installation of dual polarized antenna systems. The first, shown in Fig. 5, is the stacked arrangement, with the horizontal elements mounted above the vertical elements. Notice that the center of vertical radiation is lower than the center of horizontal radiation. A large tower section must be used for mounting the complete antenna system.

The second method, shown in Fig. 6, is the "back to back" mounting, which distributes the weight of the dipoles equally. The vertical antenna elements are mounted on one side of the tower and the horizontal elements on the opposite side, at the same height above ground.

The third method is interposing or interlacing. This system of mounting places the vertical antenna in the same plane as the horizontal antenna with the vertical elements between the horizontal antenna sections (see Fig. 7). Notice that less tower mounting space is required than for the stacked system in Fig. 5.

Interlaced or Interposed System

Of the three described mounting methods, the interlaced or interposed system is the most effective in improving the station's coverage area. In this system the pole mounted antenna does not affect the pattern circularity.

Back-to-Back System

Some engineers prefer the "back to back" system, since this arrangement tends to balance the

FCC RULES ON DUAL POLARIZATION

The FCC Rules and Regulations, Volume III—January, 1964, Part 73—Radio Broadcast Services, designates in Paragraph 73. 310 FM technical standards that the definition for effective radiated power is as follows:

The term "Effective Radiated Power" means the product of the antenna power (transmitter output power less transmission line loss) times (1) the antenna power gain, or (2) the antenna field gain squared. When circular or elliptical polarization is employed, the term "effective radiated power" is applied separately in the horizontal and vertical components of radiation. For allocation purposes, the effective radiated power authorized is the horizontally polarized component of radiation only.

It should also be noted that Paragraph 73. 316, Antenna Systems, sub-paragraph (a) specifies that:

It shall be standard to employ horizontal polarization; however, circular or elliptical polarization may be employed if desired. Clockwise or counterclockwise rotation may be used. The supplemental vertically polarized effective radiated power required for circular or elliptical polarization shall in no event exceed the effective radiated power authorized. The rules therefore provide that the amount of power authorized for horizontally polarized radiation may also be radiated in the vertical mode. Under Paragraph 73. 257, FM broadcast stations are required to apply to the FCC for a construction permit, requesting authority to install a vertically polarized antenna as addition to the existing horizontally polarized system.

HORIZONTAL					VERTICAL				
No. Of Dipoles	Gain Power	Gain DB.	Input Power Rating KW	Input Power Rating DBK	No. Of Dipoles	Gain Power	Gain DB.	Input Power Rating KW	Input Power Rating DBK
1	0.9	0.5	3	4.8	1	.95	.002	3	4.8
2	1.0	2.8	6	7.8	2	1.97	2.942	6	7.8
3	3.0	4.8	9	9.5	3	3.12	4.942	9	9.5
4	4.0	6.0	12	10.8	4	4.2	6.230	12	10.8
5	5.1	7.1	15	11.8	5	5.31	7.251	15	11.8
6	6.3	8.0	18	12.6	6	6.39	8.057	18	12.6
7	7.3	8.6	21	13.2	7	7.5	8.751	21	13.2
8	8.4	9.2	24	13.8	8	8.57	9.330	24	13.8
10	10.5	10.2	30	14.8	10	10.96	10.398	30	14.8
12	12.5	11.0	36	15.6	12	13.19	11.204	36	15.6
14	14.5	11.62	42	16.4	14	15.3	11.844	36	15.6
16	16.5	12.18	48	17.2	16	17.48	12.426	36	15.6

pole or tower load distribution. However, because the vertical and horizontal elements are facing in opposite directions, the horizontal pattern distribution of their respective signals may be affected.

Stacked System

Many recent installations are of the stacked antenna type. These are popular because advantage is taken of the existing FM horizontal antenna. The vertical antenna bays are usually installed directly below the horizontal bays.

The difference in height of the antenna elements in the stacked configuration may affect the line of sight distance to the horizon. When tower-side or tower-leg mounted, the antenna pattern will be somewhat affected by the supporting structure. The extent of deviation from a circular pattern will vary with the type and size of the structure.

Power Distribution

Since normally one transmitter feeds both antennas, the recom-

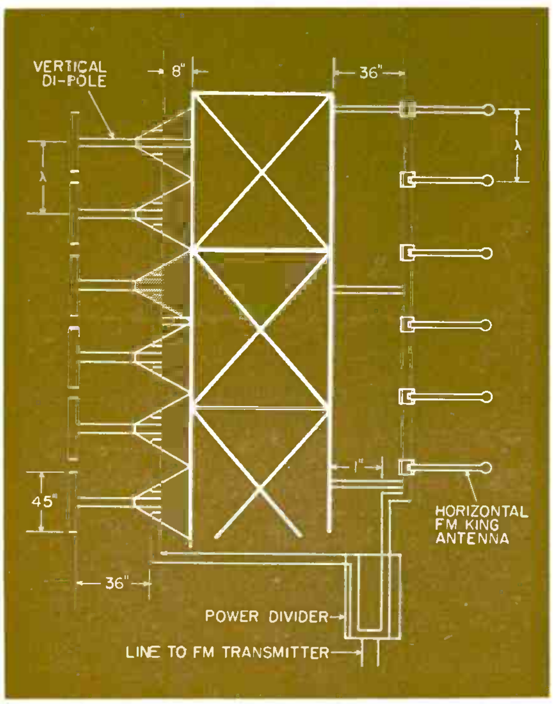


Fig. 6. "Back-to-back" dual polarized antenna system.

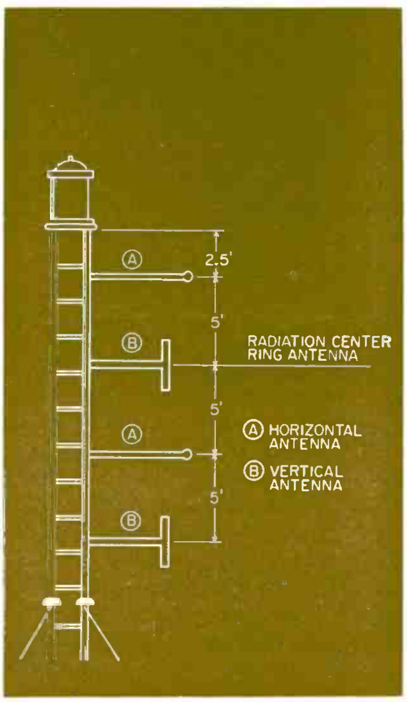


Fig. 7. Intermingled or interlaced dual polarized antenna system.

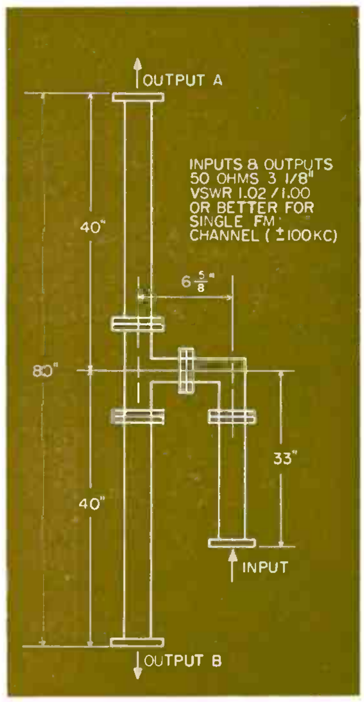


Fig. 8. A typical FM power dividing tee.

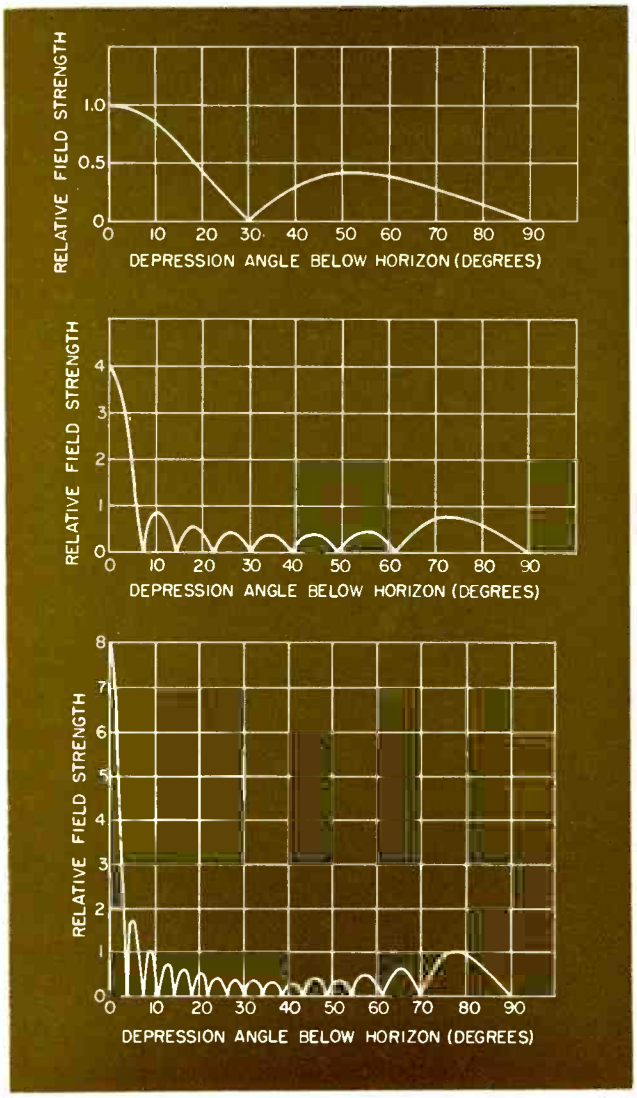


Fig. 9. (top) 2-bay vertically polarized antenna. Power gain: 1.969, db gain: 2.942. (center) 8-bay vertically polarized antenna. Power gain: 8.571, db gain: 9.330. (bottom) 16-bay vertically polarized antenna. Power gain: 17.483, db gain: 12.426.

mended type of installation is a single transmission line from the transmitter output to the antenna. Therefore, to operate with the same horizontal and vertical ERP, a power divider or splitting "tee" with a power division ratio of 50/50, 60/40, or 70/30 can be used to feed both the horizontal and vertical assemblies (see Fig. 8). An adjustable transformer may be used between the power splitter and the antenna elements to adjust for proper matching and power distribution.

As noted previously, the maximum allowable ERP of vertical polarized radiation is limited to the licensed horizontal radiated ERP power. The power available to the antenna can be determined by multiplying the transmitter power output by the transmission line loss (efficiency). For example, the total available power of a 10-kw transmitter is equal to 10 kw (transmitter output) multiplied by the transmission line efficiency of 90%, the result is 9 kw of available power. If the horizontal polarized antenna is a 3-stacked array with a gain of 3.0, and the station's licensed ERP is 24 kw, then the transmitter will be operating at less than full power output of approximately 8.0 kw.

Since the total available power is 9 kw and we want to operate with same horizontal and vertical power, using one transmission line, we must use a 50/50 power split to feed 4.5 kw to each antenna. A 6-bay horizontal polarized antenna with a power gain of 6.3 would be required to obtain the licensed ERP of 24 kw with a power input of 3.8 kw for each antenna feed line.

If a 6-bay horizontal polarized antenna is used, a 5-bay vertical polarized antenna should be interlaced between the horizontal elements. One manufacturer's vertically polarized antenna has the same gain as their horizontally polarized elements; thus, an equal number of horizontal and vertical bays may be used. The vertical polarized ERP for this combination would be 20.2 kw. (5.31 power gain × 3.8 kw power input = 20.2 kw ERP). Thus the dual polarized FM antenna combination would therefore comply with the FCC regulations. The gain of the horizontal and vertical antennas increases with the number of stacked bays used; Table I contains the figures for determining the appropriate number of horizontal and vertical antenna elements.

Vertical Pattern

The vertical pattern shows how the radiated energy is distributed and its proper choice is an important factor in good coverage. The vertical pattern is a plot of the relative field strength versus the vertical angle transmitted in a given vertical plane. Fig. 9 illustrates typical patterns for low, medium, and high gain antennas.

Choice of System

In the examples given here, only vertical and horizontal plane radiation has been discussed. Elliptically polarized radiation results from a dipole whose axis is 45 degrees to the earth. Unfortunately, this condition holds true in two general directions only. Circularly polarized radiation occurs from a combination of vertically and horizontally polarized radiators with the same center of radiation and with power 90 electrical degrees displaced. Circularly polarized FM antennas are practical in interposed arrays if the power to the vertical (or horizontal) elements are delayed 90 degrees. There appears to be no particular advantage of circular polarization over straight horizontal and vertical polarization.

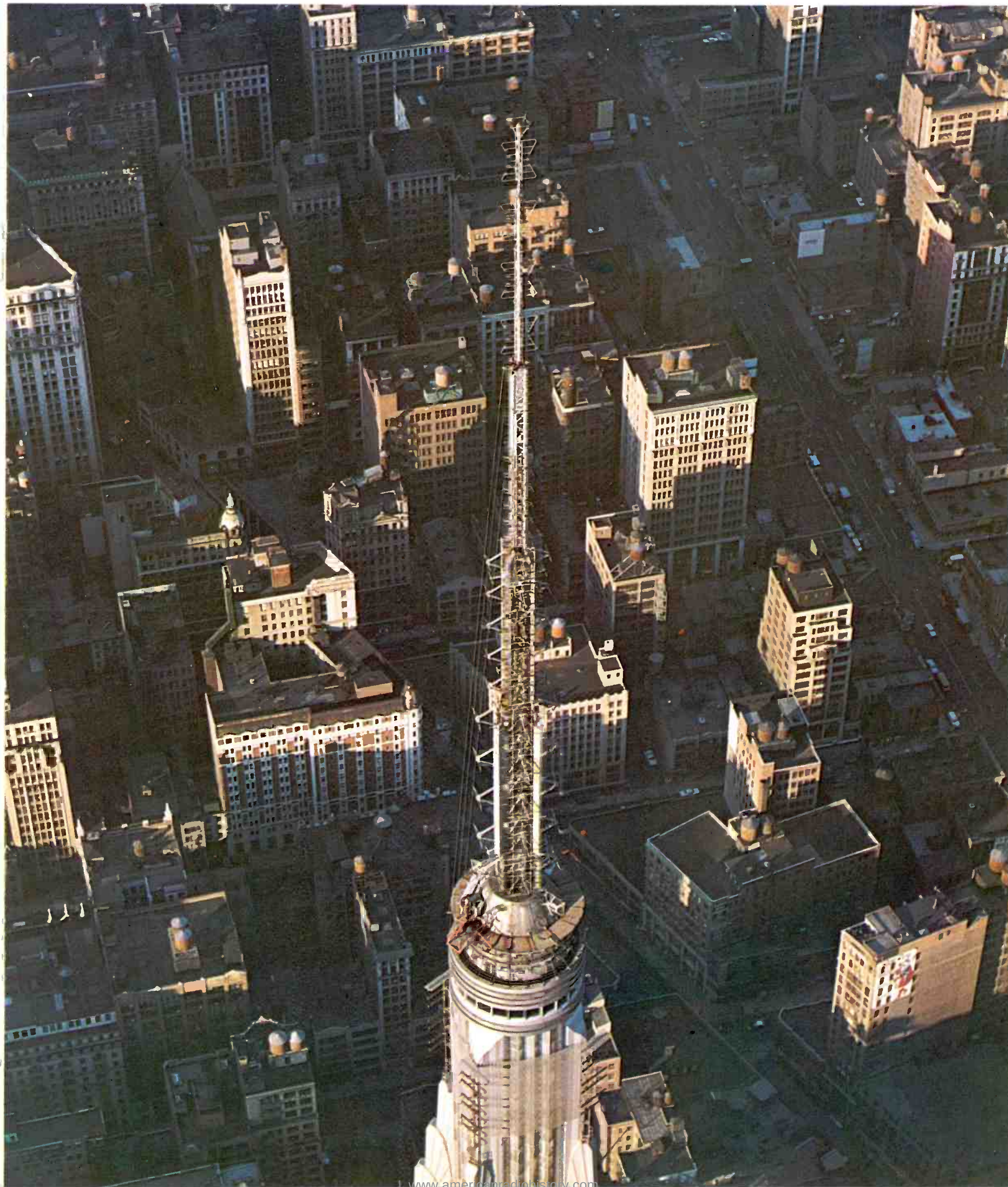
Selecting the desired dual polarized antenna system can only be made by evaluating a particular station's requirements. Consideration must be made of the inter-effects of these factors:

1. Available transmitter power.
2. Transmission line losses.
3. Existing antenna and tower structure.
4. Terrain of area coverage.
5. FCC rules.

The proper choice will result in vastly improved service to an existing FM audience. ●

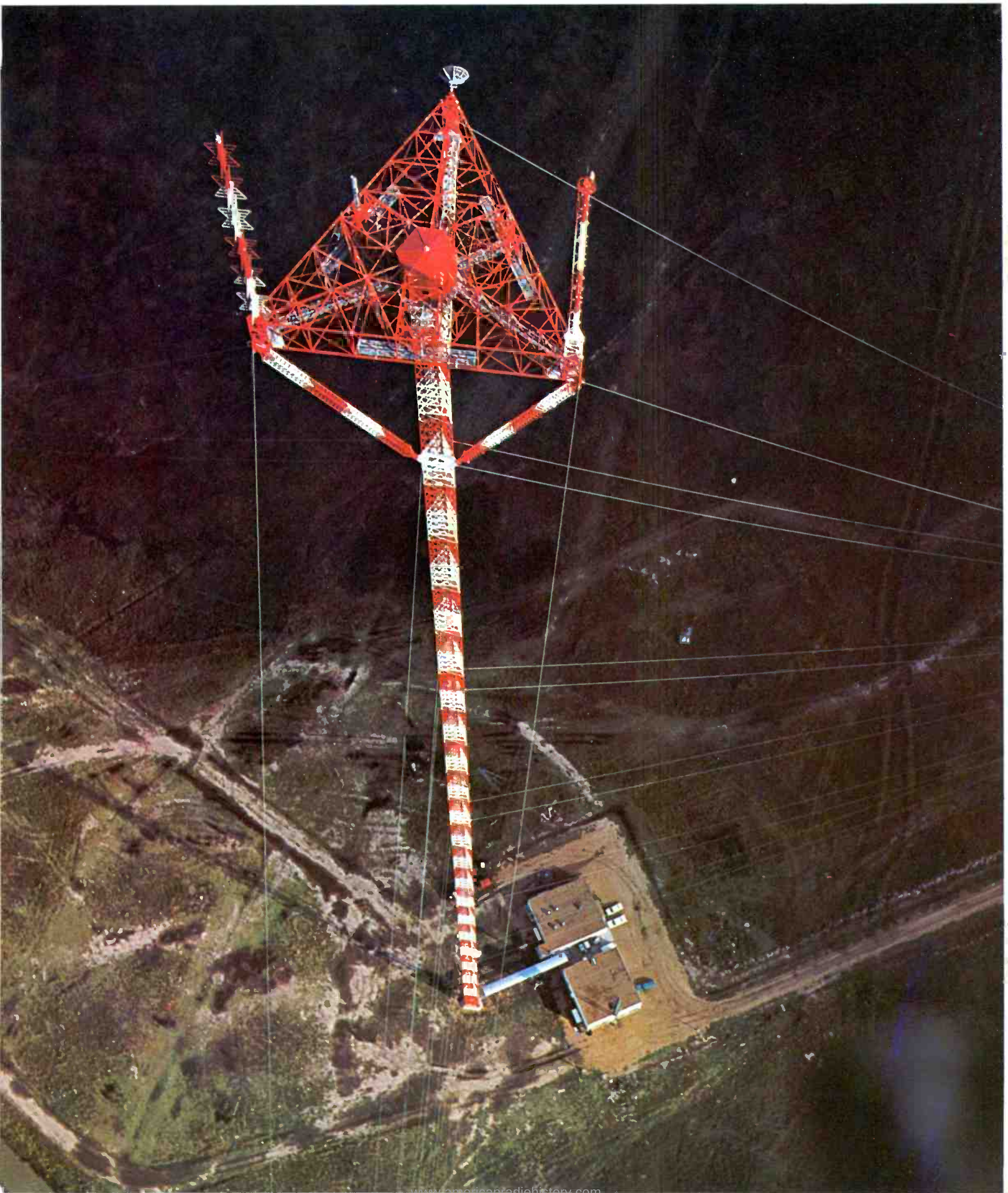
How did they fill the holes in Manhattan?

WPIX-TV: G-E VHF Zig-Zag Installation (2nd from top)



The same way they're blanketing Houston...

G-E Candelabra: KPRC-TV (new G-E batwing), KHOU-TV (new G-E helical)



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"Both viewers and technical measurements tell the same story—our new G-E VHF Zig-Zag antenna fills the 'holes in Manhattan' we had with our former dipole-type unit. The Zig-Zag circularity is outstanding—better than plus or minus 1½ db. Signal strength is up 100 per cent and more in former null areas. Correlation is excellent between the Zig-Zag's calculated pattern, test-site measurements, and field checks."

"Met Tight Specifications—Plus!"

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ENGINEERING CASEBOOK

The WCBS-WNBC Shared Antenna System

How two 50-kc AM transmitters, operating on frequencies only 220 kc apart, use the same antenna system

THE IDEA of running two transmitters into one antenna is not particularly new—it has been done quite frequently in the past. However, when the transmitters are putting out 50 kilowatts each, and on frequencies separated by only 220 kc, the idea *is* new, and difficult to fulfill. The fact that such a feat was accomplished speaks highly for the engineering staffs of CBS, NBC and RCA.

Local ground availabilities made it expedient for WCBS and WNBC to share a common antenna site on High Island in Long Island Sound. This location not only provided use of a higher antenna height, but permitted ground radials to be run into sea water (conductivity 5000). A physical antenna height of 528 feet was obtained, giving a theoretical radiation of 206 mv/m and 228 mv/ at 660 kc and 880 kc, respectively, for 1 kw. Since the FCC requires a minimum of 225 mv/m for 1 kw for 50 kc Class 1 stations, top loading and reactance-sectionalized tower construction was employed. This form of construction is not too common in the U.S., but is used quite frequently in Europe to achieve "anti-fading" properties.

A top loading of 120 feet of top guy wires was used, a value chosen to keep the sectionalizing reactance to a minimum. Because of anticipated high voltages at the ends of the top loading guys (the peak operating voltages from the two 50-kw transmitters added together) three very large insulators were used. Further, since the sectionalized top-loaded tower would have a higher than normal loop current, a thicker galvanizing cost was ordered to prevent possible excessive losses in the skin.

The ground system runs into salt water; a 40-foot copper screen is located around the base of each tower. Each of the 120 radials is about one-quarter wave length long and made of one-inch wide copper strap.

As soon as it was determined that the antenna would meet the FCC's field-strength requirements, the sectionalizing reactances were computed; these turned out to be 180 ohms inductive for 660 kc and 50 ohms capacitive for 880 kc. Current distribution was such that minimum was about 23° above ground.

Once the tower characteristics and requirements were known, the job of building the tuning hardware began. The sectionalizing reactance was highly important, requiring two-frequency operation, low-loss design, and weatherproofing. The simplest trial circuit resulted in a loss of 6 kw at 660 kc and an inductance current of 400 amperes! Also, the reactance vs. frequency slope in the 10-kc range was excessive due to the rapid base impedance change vs. frequency characteristic of the top-loaded antenna. Another circuit produced a peak voltage of over 100 kv across the capacitor. Finally the design resulted in the circuit shown in Fig. 1. The circuit L_1-C_1 is anti-resonant at 660 kc. All the 660 kc sectionalizing current flows in L_3; therefore, with only L_3 connected adjustment can be made with reference to the antenna base impedance. When the rest of the network was connected and an approximate value for L_2 used, L_1-C_1 was adjusted for the same base impedance. The frequency was then changed to 880 kc and L_2 similarly adjusted.

A standard lighting transformer was used to carry tower lighting power to avoid any loss of Q in the sectionalizing coil by running a power line through it. The

(Continued on page 43)

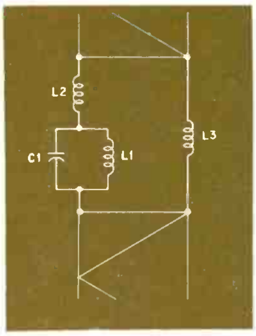


Fig. 1. The sectionalizing network finally used to separate the two tower sections.

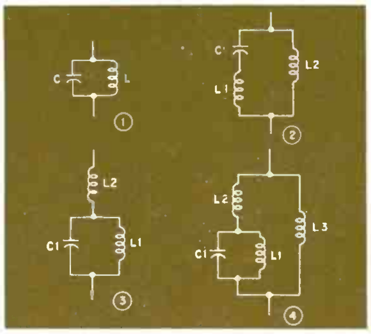


Fig. 2. Some of the earlier circuits considered for use in separating the two tower sections.

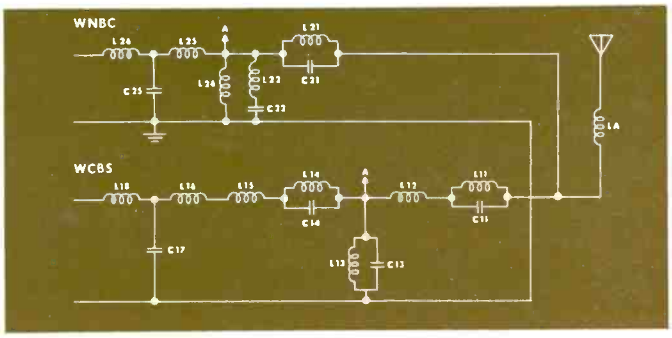
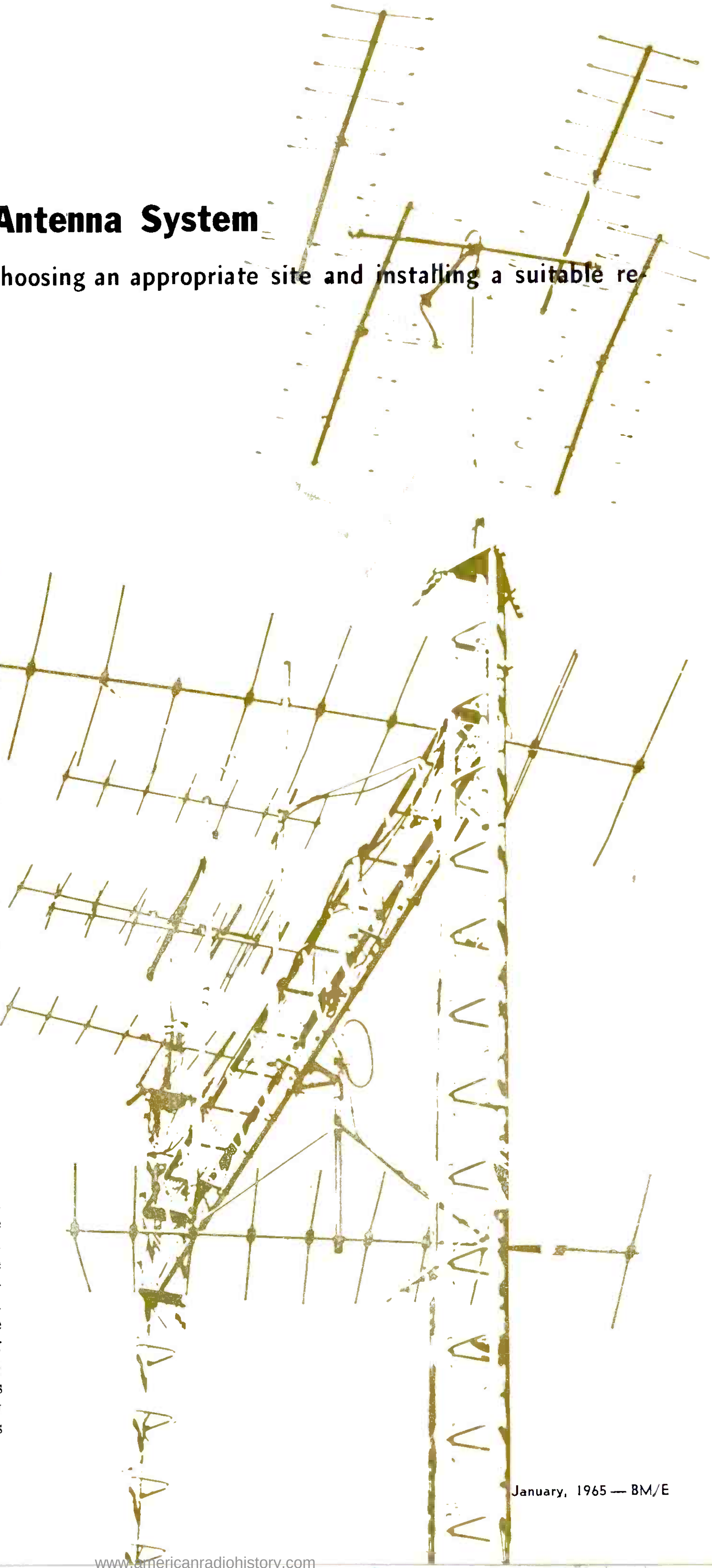


Fig. 3. The coupling and isolating networks used to connect the two 50-kw transmitters to the combination antenna.

Planning a CATV Antenna System

Here's what's involved in choosing an appropriate site and installing a suitable receiving antenna system.

By Vic Nicholson



To be successful in current markets, a CATV system must offer more than housetop antennas. And, the more channels you can offer, the better are your chances of attracting subscribers. The CATV receiving antenna set-up is therefore one of the most important segments of the system.

Choosing an Antenna Site

It is vital that the antenna site provide the largest number of channels, with the best possible signal quality. On the other hand, the site should be as close as possible to the service area, since it costs about $4,000 per mile to string the signal distribution cable to the community.

The first step in choosing a site is to make a calculated forecast of the signal expected on desired channels at various potential locations. Look for high ground near the community, yet not too far from the channels you want to receive. Then choose some potential sites, based on availability and accessibility. While some CATV system operators necessarily use Snow Cats to reach their antenna sites in winter, you should try to choose a site where access roads are usable all year.

Your site must also be free from interference. Make sure the site is at least a mile away from local AM, FM, state police, fire dept. or industrial transmitters. Also, try to find a location where received signals do not travel directly over a large city area and stay away from the airplane glide paths. In many respects, choosing

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AUTHOR: Mr. Nicholson is Chief Engineer of Community Systems Div., Jerrold Electronics Corp.

an antenna site for a CATV system is similar to choosing a site for a broadcast station antenna.

Once you have chosen several potential sites, the next step is to make a calculated forecast, or "paper" survey, of expected reception at each of these sites. The purpose of this paper calculation is to narrow the number of possible locations to a few select sites to be physically surveyed. The paper survey is prepared from available data on locations of desired stations, relative antenna heights, frequencies, and ERP.

Fig. 1 shows predicted median signals as functions of distance at 60, 200, and 500 megacycles. The curves are based on FCC charts and corrected for commonly used transmitter power ratings. (Box data shows how to calculate for *Reception Variables.*) Calculations are based on smooth earth spherical equations, the use of a conical pickup antenna at 30 feet, and on a 4/3 earth radius contour to compensate for the slight diffraction of signals. No consideration is given to hills or forest cover. (Forest cover markedly attenuates TV signals—at UHF losses can be severe.)

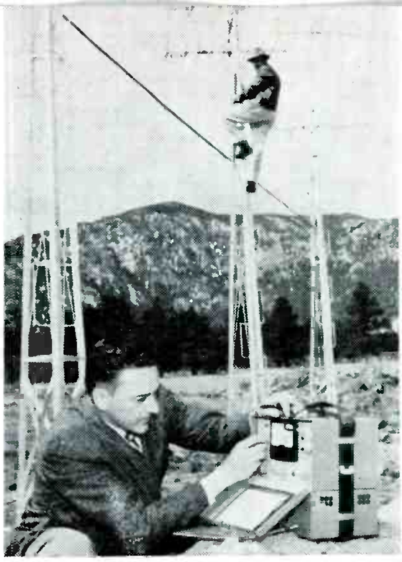
Having narrowed the site choices to the few best locations, the next step is to have a field engineer make on-site field surveys. The purpose is to determine the advantages and problems of each site, considering the following factors:

1. Channels to be used
2. Tower height needed
3. Antennas required for each channel
4. Antenna locations on tower
5. Antenna spacing to minimize co-channel interference
6. Signal quality on each channel.

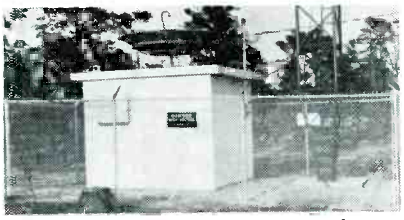
Making a Field Survey

The field survey itself consists of two phases. First, a quick check is made of all potential sites. Generally, this requires a 4-wheel drive vehicle equipped with a broad-band antenna, inverter, field strength meter and TV receiver. Reception tests of the desired channels can quickly narrow the site selection to one or two optimum spots. It is then necessary to determine the availability, accessibility and the cost of purchasing or leasing the necessary land.

Second, much more accurate data is obtained at the best sites. A 4-wheel drive truck equipped with an 80′ tower, cut-to-channel yagi antennas, calibrated UHF converters, field strength meters with recorders, TV receivers, oscilloscopes and other equipment is set up at each site for several days. Signals are viewed and readings recorded at all times of the day and night. At the same time, comparable data is obtained in the community to determine the quality of off-air reception—whether normal, better, or worse than normally is received.



CATV engineers making on-site signal measurements and reception tests.



CATV head-end equipment housing at base of tower. (Note microwave dish on top of building.)

On-site observations should include checks for co-channel, noise, and other interference problems and a report made as to signal readings and antenna recommendations. A complete pilot layout showing the direction of incoming signals and the physical layout of all antennas should be prepared (see Fig. 2). These recommendations may also include the type of tower, the head-end building, tower foundation, the amount of ground for guying the tower, and the fence enclosing the building and tower.

In areas of flat terrain it is sometimes desirable to know the signal levels at elevations up to 600 feet. For this data, a helicopter and pilot can be chartered for about $75 to $90 per hour. A high gain directive broad-band antenna similar to a TACO Paralog is rigidly mounted against the landing gear, directed forward and positioned just high enough so that it doesn't hit the ground. Using a portable TV receiver, a field strength meter, and a battery-inverter power supply, several passes are made over the chosen site, beaming the antenna at each station. Pictures are observed, and signal levels recorded, at elevations of 200′, 300′, 400′, etc., as high as desired. As a rule of thumb, an elevation providing a signal of 300 v will provide usable pictures with a fade margin of 20 db. Tests are usually made in the afternoon—the time of day distant signals are usually weakest—providing an additional fade margin.

Selecting and Installing

Cut-to-channel yagi antennas of rugged construction are recommended. Yagis are preferred because of high gain, good directivity, efficient rejection of off-channel interference, and 75 ohm impedance with low VSWR. 10-element yagi antennas or 5-element, wide-spaced low-band yagis are used because they have a gain about 7 to 8 db more than a tuned dipole. A single antenna, located at a low level on the tower, will suffice for signals originating within 30 miles. Where a signal level of 0 dbmv (1000 uv or 0 db above a millivolt) can be received off an antenna, there is no need for additional height or a preamplifier for that channel.

For weaker signals, antennas are stacked. Optimum stacking provides a 3 db signal increase for every doubling of the number of antennas. Stacking also results in increased directivity; vertical stacking sharpens the pattern in the vertical direction, and horizontal stacking narrows the main horizontal lobe. Vertical stacking reduces noise interferences. Horizontal stacking is useful in minimizing co-channel interference. (Box data shows computations for *Stacking Antennas.*)

Each yagi should intercept the wave front simultaneously; therefore, all driven elements should be parallel. Also, the same side of each driven element must be connected to the coaxial cable to ensure that signals are in phase. Antennas connected improperly will cancel, rather than add, to the total signal. It is bad practice to separate sections of an array by the steel tower because this changes the directional patterns

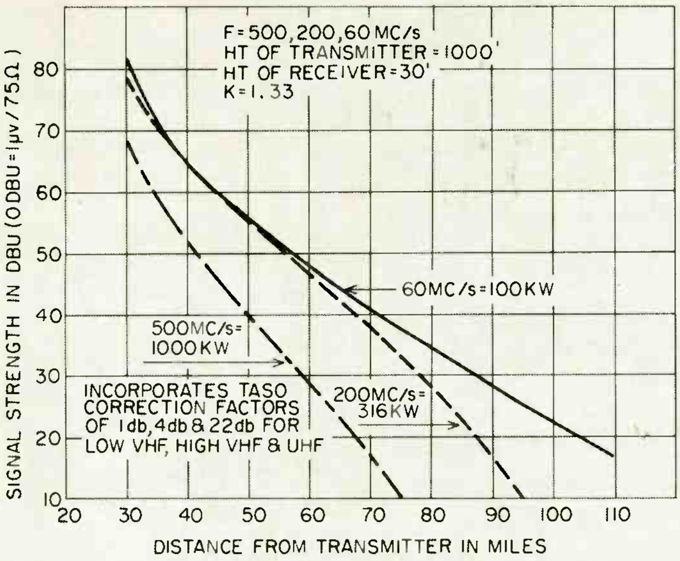
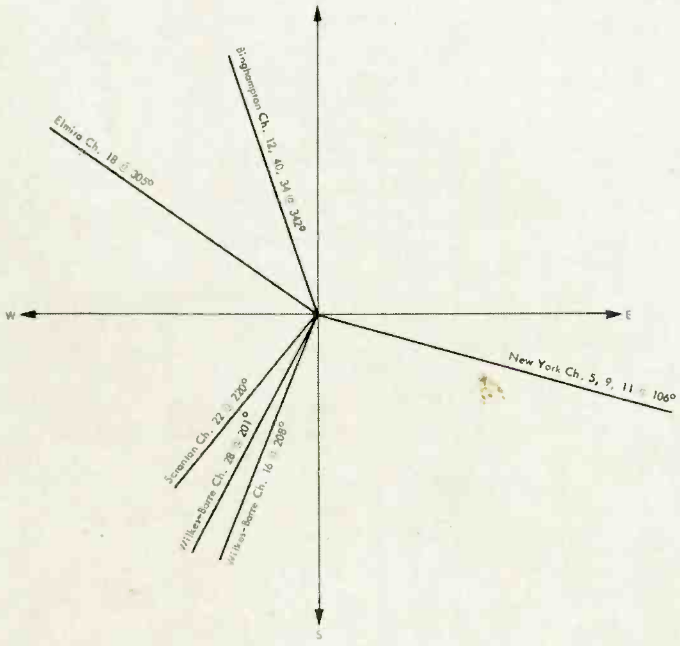


Fig. 1. Predicted median signal strength as a function of distance.

Channel	Town & State	Approx. Distance In Miles	V	H	Max. Width (In.)	Cross Arm Length	Stack	Antenna Type	Approx. Total Antenna Wt. in Lbs.
11	New York	105	58	58	30	72	Quad	(4)Y103-11	30
9	New York	105	62	62	32	78	Quad	(4)Y103-9	32
5	New York	105	100	188	79	133	Quad	(4)Y104-5	188
18	Elmira				48 Diameter		Parabolic	(1)3065A-72	25
12	Binghamton	45					Single	(1)Y103-12	75
40	Binghamton	45			48 Diameter		Parabolic	(1)3065B-72	25
34		45			48 Diameter		Parabolic	(1)3065B-72	25
28	Wilkes-Barre	15			48 Diameter		Parabolic	(1)3065B-72	25
22	Scranton	15			48 Diameter		Parabolic	(1)3065B-72	25
16	Wilkes-Barre	15			48 Diameter		Parabolic	(1)3065B-72	25
FM					70	35	Single	(1)Y51-FM	12



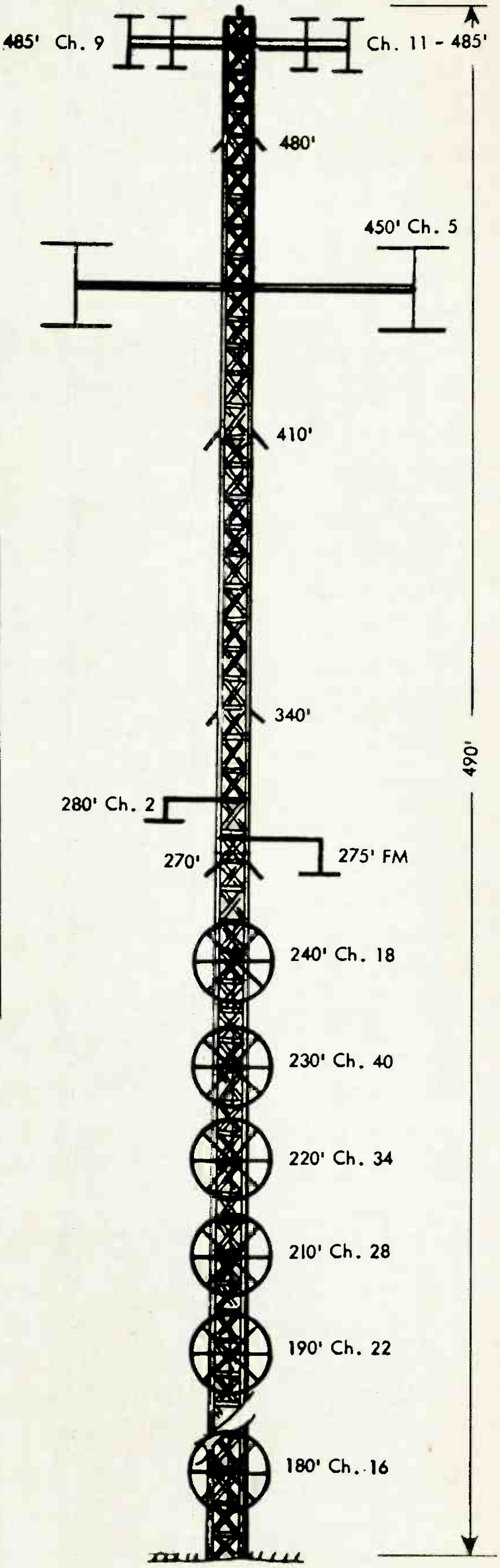


Fig. 2. Engineering layout and report on proposed antenna site.

of the antennas. Orientation is very critical and should be made using a field strength meter tuned for a maximum indication.

As indicated in Fig. 1, increased height will generally produce more signal. Often, peaks and nulls occur at increasing heights; it is not necessary to install antennas at the peaks since they change with propagation variations.

Noise Problems

Often, pictures will be more satisfactory at a much lower level on the tower. Such a situation would occur where 500 uv of signal is received near the ground and 3,000 uv at 200′. However, at 200′ the signal may be loaded with co-channel interference, a condition which is alleviated nearer the ground due to earth curvature. This is why antennas for some low frequency channels (where interference is more prevalent) are often mounted not on the summit but on the side of a mountain. Such a position permits line-of-sight reception of the desired signal and uses the top part of the hill as a shield for interference. Some system engineers have even bulldozed a cave into the top of a hill, shielding signals from all but one direction.

To reduce the problem of co-channel interference, it is possible to change the horizontal stacking of the array so that the desired signals add in phase and undesired signals from a different direction are 180° out of phase and cancel. (Box copy explains *Stacking to Eliminate Undesired Signals.*) Another effective method for reducing co-channel interference in some applications is to use a "bucking" antenna or array to cancel out the undesired signal. This approach is effective when the undesired channel is within sixty (60) miles, although the desired channel can be more distant.

The procedure is to beam an antenna to receive the undesired signal, adjusting the phase and attenuating the signal until it is of same magnitude and 180° out of phase with the co-channel interference. At this point this interference will be cancelled. The reason this method is not effective at longer distances is that beyond line-of-sight, propagation conditions will vary the phase and magnitude of the cancelling signal.

Antennas picking up signals from fringe stations are sometimes bombarded with much stronger signals from local adjacent or even non-adjacent channels. Likewise, nearby transmitters may send very high intensity signals into this antenna. These signals can cause overloading of the preamplifier and modulate the desired signal, showing up as a beat pattern in the picture. The correction for this problem is to use a selective preamplifier in addition to high Q traps or filters. The use of high Q devices keeps insertion losses at a minimum before the signal is amplified.

RECEPTION VARIABLES

To use the curves in Fig. 1 for stations of different heights and powers, or a different receiving antenna array, make the following corrections:

If a station uses an ERP other than on the chart, subtract decibels in accordance with: $db = 10 \log_{10} \frac{P1}{P2}$, or use any table of decibels versus power ratio.

If different heights are used other than the reference of 1000′ in graph for transmitting and 30′ for receiving—a correction in miles can be made using the following formula:

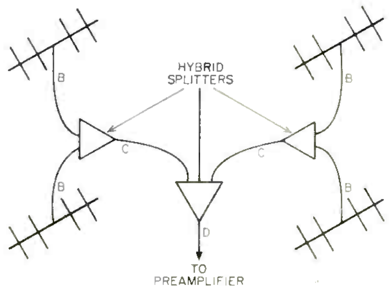
distance in miles $= 2H_2 - 2H_1$ where H_2 = final height in feet and H_1 = original height in feet.

Example: Determine signal strength of a 60-mc station of 50 kw (ERP) at a distance of 60 miles as measured with a tuned dipole at a height of 30 feet.

1. Since 50 kw = ½ of 100 kw subtract 3 db.
2. 300′ yields 2000 — 600 = 45.5 — 25 or approximately 20.5 miles.
3. 20.5 plus 60 miles = 80.5 miles.
4. From graph 60 mc at 80 miles = 35 dbu.
5. Subtracting 3 db = 32 db above 1 microvolt or 40 uv.
6. Add in db the gain of the antenna array to be used. For example, 10 db would increase this 40 uv to 125 uv, which may be a usable picture.

STACKING ANTENNAS

The use of 75-ohm hybrid mixers and coaxial cable have proven to be most practical and efficient for stacking antennas (see sketch). This method as



applied to 2, 4, and 8 yagi stacked arrays involves combining each antenna or pair through equal lengths of 75-ohm coax to the mixer. If antenna impedance is 300 ohms, a balun or matching transformer is used.

Stacking distances as computed below are very effective where the wavefront at the antenna site represents a uniform field.

$H = \frac{11,800}{f}$ = horizontal "center-to-center" air spacing of yagis in inches where f = mid-channel frequency in mc.

$V = \frac{7,900}{f}$ = vertical separation of yagis in inches.

B = lengths of vertical stacking cables are noncritical but must be equal.

D = Coax downlead to preamplifier has noncritical length.

Construction: Use an "H" frame supporting structure so the entire array can be turned at the center point and oriented for maximum signal.

This frame is constructed of 2″ conduit for horizontal members and 1½″ galvanized conduit for vertical members.

Interference sources such as auto ignition, cosmic, and industrial noises are so pronounced on the low VHF band that the only solution is to secure a stronger signal and thereby improve the signal-to-noise ratio. On the high VHF band, these sources are less of a problem and the thermal noise of the preamplifier becomes more important. A reasonable standard for a picture without noticeable noise by an average viewer is one with a signal level 40 db higher than the noise. This can be measured using a field strength meter with good selectivity.

Tower Considerations

CATV antennas are generally mounted on "H" frames on a guyed tower. To provide easier installation and maintenance, sometimes two towers are built with a catwalk between them. This catwalk is laid out at right angles to the desired channels to permit horizontal stacking of more antennas, providing sharper lobes and therefore less interference.

The area around the tower must be large enough to permit guy wires to be secured properly. A radius of at least 0.7 the height of the tower in each direction is required. Guy wires, 3/8" to 1/2" high tensile strength, are connected to turnbuckles which, in turn, are held by ground rods at a 90° angle to the guys. The 6' to 10' ground rods are connected to underground expanding anchors held by earth, rocks, or concrete. The tower foundation should be a concrete base of a size determined by tower height.

The cost of towers used for CATV systems varies a great deal. However, a rough estimate, depending on accessibility, terrain, prevailing winds, etc., would be $1500 per hundred feet up to 300'. Above this height costs increase progressively. If the tower is to be built in rocky soil, blasting will be required; if it is to be built in sandy soil, additional foundations are necessary.

Approval of the FAA is needed as to tower height, lights, painting, etc., so that there will be no aviation hazard. Lights are required for towers at 100' and above, plus two 300 to 500 watt bulbs in a beacon at the top with 200 watt intermediate lights. Wiring is usually 220 volts mounted in conduit, taking off 110 for the beacon and 110 for the intermediate lights. Photocell controls are required to turn on the lights automatically at dusk.

There are various types of towers designed in accordance with the prevailing wind to be expected. For example, a Type "A" tower is designed for inland areas with a horizontal wind loading of 30 lbs. per square foot. Towers always incorporate some type of climbing facility and should also have an outrigger with pulleys and steel rope to simplify future maintenance.

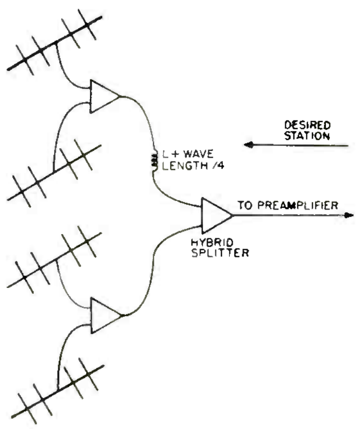
The tower and head-end building should be enclosed with a chain link fence and barbed wire to prevent damage to equipment or possible injury to children who might attempt to climb the tower.

Tower companies servicing the CATV industry will design, engineer, and completely install the towers. Normally, the CATV system technicians preassemble all the antennas on the ground. Then the tower construction crew hoists these arrays (usually with a winch) onto the tower. The antenna arrays will have their coaxial leads connected to preamplifiers mounted on the tower. The individual coaxial cable down leads from these preamplifiers are used both to bring power up and to bring the amplified RF signal down into the head-end building.

The building houses the head-end equipment. Here the signal from the preamplifier is converted to another channel if desired, amplified, filtered, balanced and finally fed into the single coaxial cable which serves as the main trunk to the community system. ●

STACKING TO ELIMINATE UNDESIRED SIGNALS

Example: The undesired signal originates from behind the array or 180° from the desired signal. In this case, mount one set of antennas 1/4 wave-length in front of the others (see sketch). Also, use 1/4 wave-length (times propagation constant of cable) more coax to the mixer from the antennas closer to the desired station. Signals from desired direction will reach the mixer in phase, while those from the undesired will be 180° out of phase.

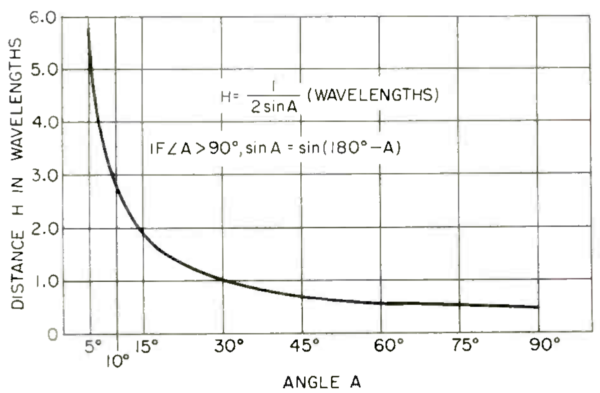


The more general case is where the signals come in from different angles. Measure or calculate the angle. Then use the graph to compute the horizontal wave length spacing between the yagis.

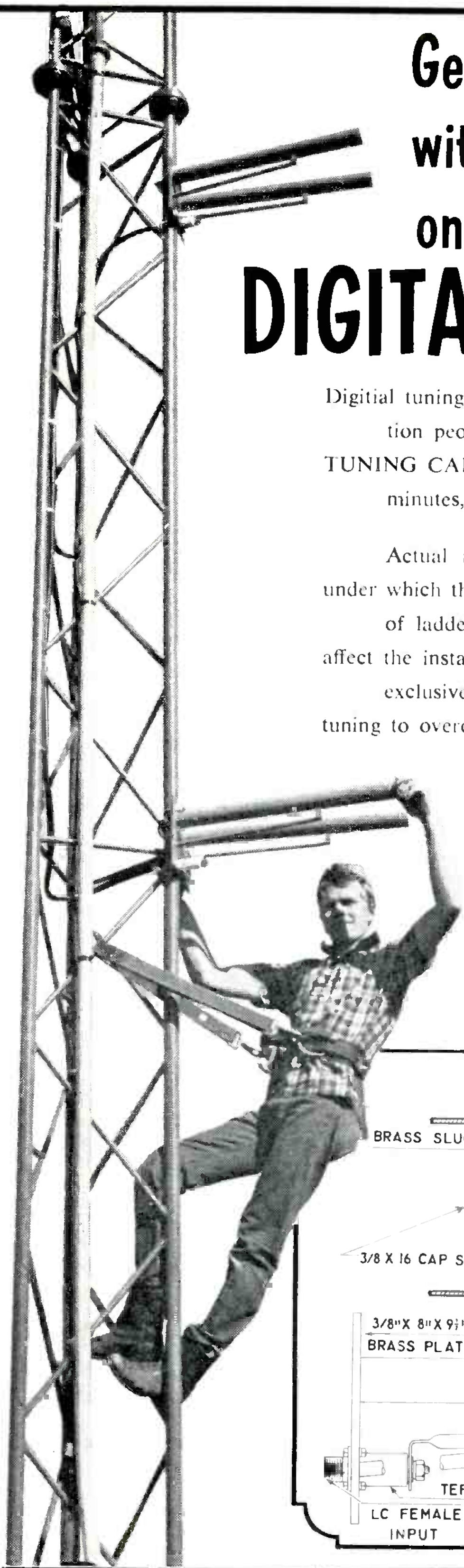
Wavelengths in air for VHF channels (inches)

2	3	4	5	6	7	8	9	10	11	12	13
213-1/2	192-1/2	175-1/2	152-1/2	141-1/2	67-1/2	65	63	61-1/2	59-1/2	57-1/2	56

Example of use: Channel 3, Angle = 70 degrees, H = 0.53 × 192-1/2 = 102"



Horizontal spacing of yagis in wavelengths (H) vs. angle (A) formed by desired and undesired signals.



Get improved antenna VSWR with a simple field adjustment on JAMPRO's new

DIGITAL FM ANTENNA

Digitial tuning permits JAMPRO antennas to be field tuned by installation people in a matter of minutes by EXCLUSIVE END TUNING CAPS*. The average 8 bay installation requires less than 30 minutes, using the transmitter reflectometer.

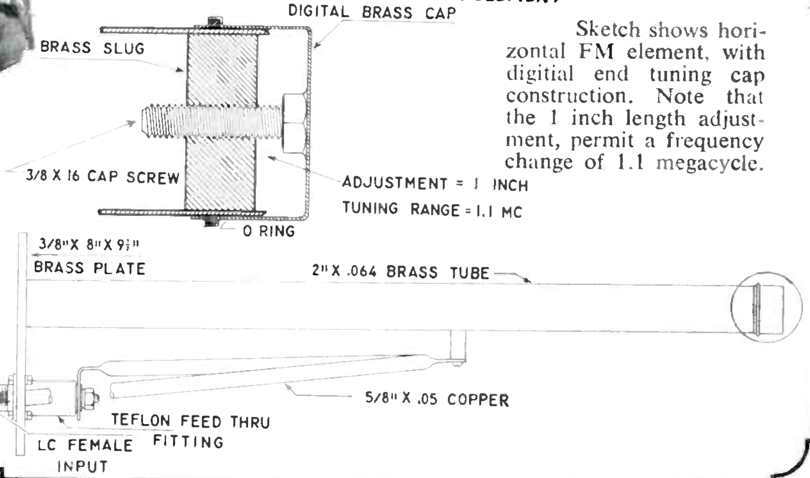
Actual mounting conditions may be different than those under which the antenna was tested. Tower lighting conduits, placement of ladders, tower construction and co-axial cable runs, all affect the installed VSWR of leg and face mounted FM antennas. The exclusive JAMPRO digitial tuning feature permits fine field tuning to overcome these problems.

This exclusive JAMPRO feature permits overall VSWR values as low as 1.02 to 1. With tower leg or face mounted horizontal and vertical FM antennas, it is always possible to achieve 1.1 to 1 or better, 200 KC above and below carrier. JAMPRO antenna VSWR is not affected by fog or rain.

*Patent Applied For.

Write for catalog on Horizontal or Dual Polarized FM Antenna.

JAMPRO HORIZONTAL FM ELEMENT



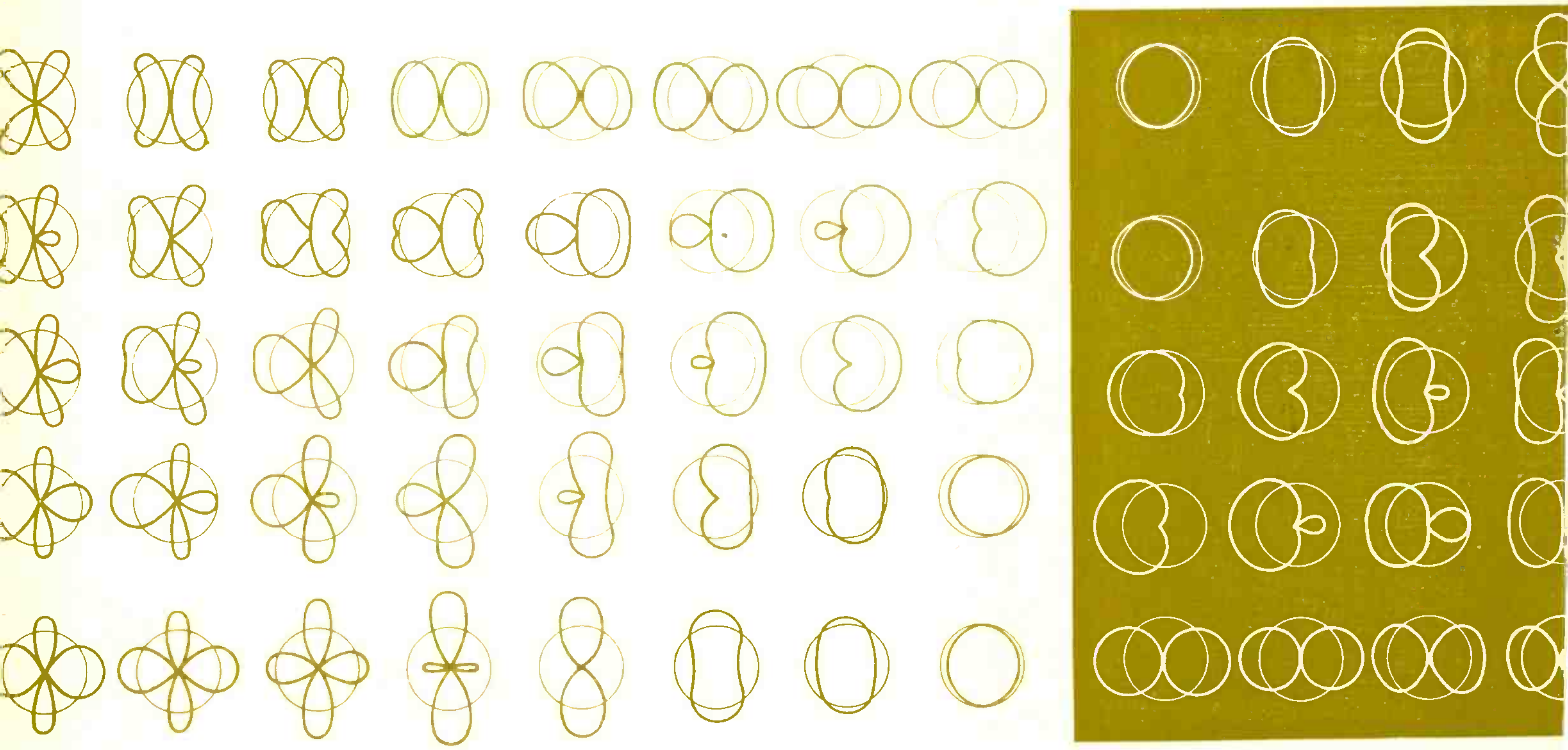
Sketch shows horizontal FM element, with digitial end tuning cap construction. Note that the 1 inch length adjustment, permit a frequency change of 1.1 megacycle.

JAMPRO

ANTENNA COMPANY

6939 POWER INN ROAD | SACRAMENTO, CALIFORNIA

Circle 8 on Reader Service Card



Guidelines for Selecting a UHF Antenna

Factors affecting UHF antenna system design

By Herman E. Gihring

As of the end of 1964, 220 UHF television stations have been authorized by the FCC. Approximately 75% of these are commercial—some 56 stations being noncommercial. UHF station grants now comprise nearly 28% of all authorized TV stations.

The all-channel bill will greatly increase public demand for UHF programming. With UHF allocations available in every community of over 10,000 population, prospects of the ultra-high frequency medium look brighter than it has ever been in the history of commercial telecasting.

UHF signal propagation requires special considerations—not generally comparable to existing and the more familiar VHF frequencies. The following will be of value to currently active, as well as future CP's. The information will enable the best choice of UHF antenna for a given set of conditions.. Station location and necessary ERP for good coverage dictate the type of antenna and the required transmitter power. The additional factors to be considered are:

1. What is the geographical area to be covered?
2. How does the field strength of the present installation compare with competitive installations?
3. What is the height of the existing antenna compared with competition?
4. In what direction are most receiving antennas oriented?
5. Is the terrain flat or hilly?
6. Should an omnidirectional or directional antenna be used?
7. Is a multiple installation with other stations feasible?
8. Can an existing tower be used to advantage?

The first five questions can be answered from available information. From this the following can be determined:

1. The vertical gain of the antenna
2. Height above the service area
3. ERP
4. Beam tilt
5. The type of vertical pattern

1. Gain. A high gain antenna results when the main beam is narrowed. The relationship between

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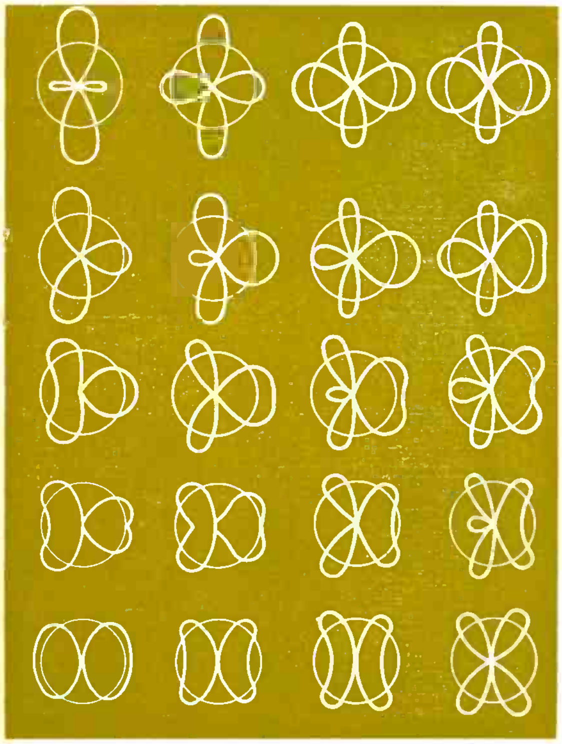


Condensed from a paper presented at the IEEE Broadcast Symposium Sept. 24, 1964. Complete text to be published in a forthcoming IEEE Broadcast Transactions.

gain and beam width at the half power point is: Beam width in degrees = 60/gain over a dipole. The higher the gain, the narrower the beam width. (This is an approximate relationship and applies primarily to a uniformly illuminated antenna.)

Fig. 1 illustrates how a high gain and a low gain antenna would cover a given area for the same input power. Assuming that the main beam is directed toward the horizon, the high gain antenna provides an increased field intensity of 3.2 db. However, it provides 4 db less field intensity in the region of 2° and 4° (a distance of 5.5 and 2.7 miles of a 1000′ elevation).

Generally, field strength should not be lowered if an existing antenna is replaced, even if field strengths are City Grade Level or better; receiving installations tend to be barely good enough to receive an established signal. The same axiom applies with respect to a competitive signal. In general, higher gain antennas should be used with higher power transmitters.

For rough terrain it is advisable to concentrate extremely high field strengths in the primary service area to obtain adequate signals behind hills. A medium or low gain antenna and higher transmitter power are preferable for a given ERP.

2. Height. In general, an increase in height may always seem desirable. This is true when the signal at the horizon is considered. However, the effect on the close-in coverage can be detrimental, as shown in Fig. 2. It will be noticed that intercept "B" is much smaller than intercept "A" for a lower height when the field at point "P" is considered. Curves 3 and 4 of Fig. 3 indicate the reduction in field strength which occurs. Hence, an increase in height may also require an increase in transmitter power to maintain existing fields if the same antenna is used. If a higher gain antenna is used simultaneously with an increase in height, a loss of as much as 10 db could occur in the first few miles. Here again, this loss can be offset by an increase in transmitter power.

Table I. Depression angle in degrees to the radio horizon for various heights.

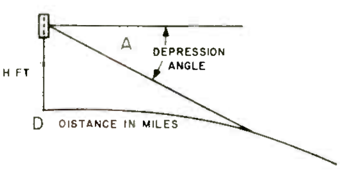
Feet	Angle to Radio Horizon
400	.304
500	.343
600	.375
700	.405
800	.435
900	.452
1000	.487
1200	.530
1400	.577
1600	.620
1800	.650
2000	.683
5000	1.08

H—Height in feet to Electrical center of antenna

D_h—Distance to horizon $= \sqrt{2H}$ (4/3 earth radius)

A_h—Depression angle to horizon $= \frac{.0216H}{D_h}$

The relationship $D = \frac{.0109\ H}{A}$ holds to right of staggered line in table below within 4%



3. Effective Radiated Power. The product of gain, transmitter power and transmission line efficiency determines ERP. This in turn directly affects field strength at various distances. Fortunately, an adequately high limit of 5 megawatts ERP is permitted for UHF operation. Antennas capable of radiating this power are already available and transmitters are being designed.

4. Beam Tilt. Table I indicates the angle to the radio horizon for various heights.

It is advisable to use a beam tilt which will aim the main lobe at the radio horizon. Figure 4 demonstrates the increase in local coverage as the beam tilt is increased. These curves are for a TFU46K high gain antenna radiating one megawatt of effective radiated power. It should also be noted that the decrease at the horizon is quite small. The horizontal gain of this antenna for the beam tilts shown are as follows:

Beam Tilt	*Horizontal Gain*
—	46.0
.25	40.4
.5	27.1
.75	12.6

The rapid decrease in this gain figure may at times be a deterring influence for using beam tilt. How-

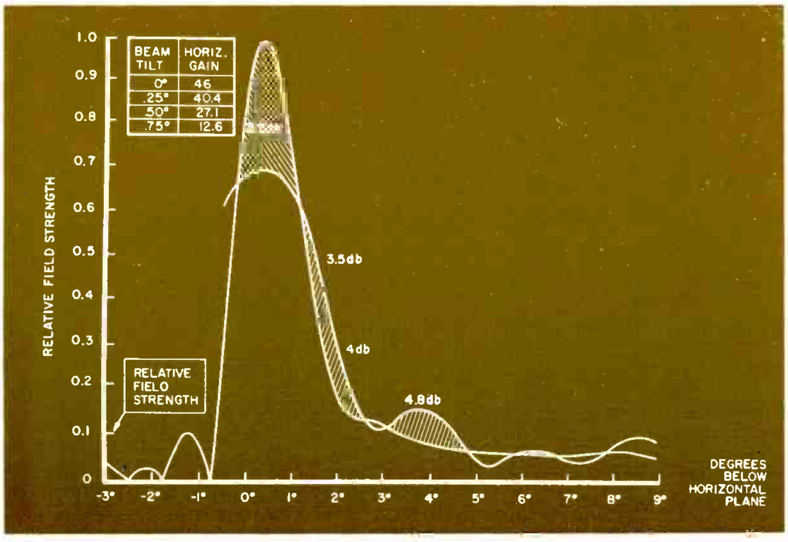


Fig. 1. Shading indicates regions in which increases and decreases in field strength will occur when a high gain antenna is substituted for a medium gain antenna. TFU-46K vertical pattern—beam tilt: 0.50°; effective gain: 46.0. FUT-24DL vertical pattern—beam tilt: 0.50°; effective gain: 22.1.

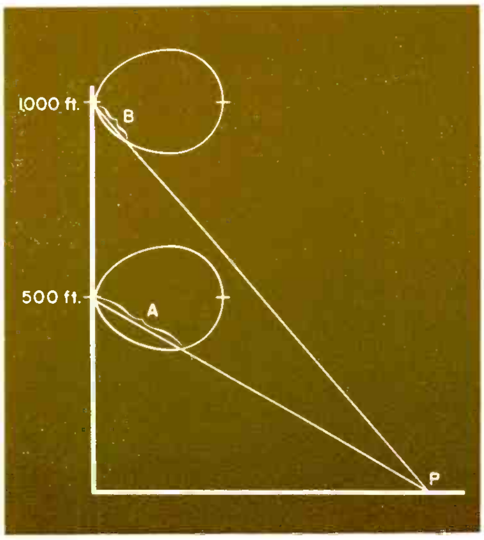


Fig. 2. Intercepts A and B indicate loss in field strength at P when the same antenna is raised from 500 to 1000 feet.

ever, the coverage is most effective when the main beam is directed toward the horizon or slightly below. Both the main beam gain and the horizontal gain can be filed in the license application.

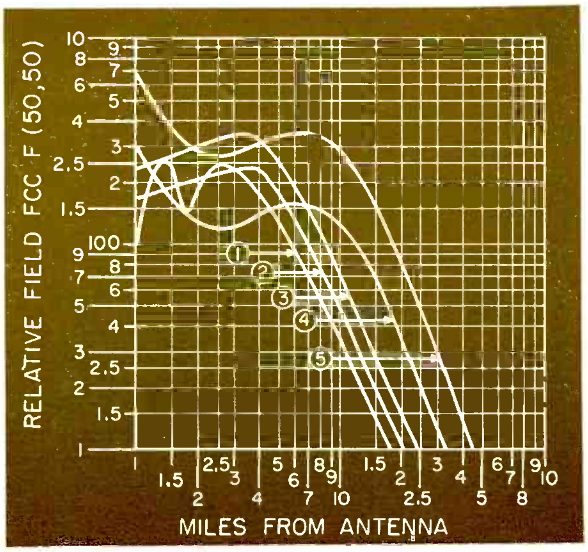
5. **Vertical Pattern.** There are, broadly speaking, three types of vertical patterns:

1. Sin x/x
2. Filled
3. Shaped

A sin x/x pattern for a gain of 38 is shown in Fig. 5. It will be noted that the first null occurs at 7.4 miles for a 1000′ elevation. After that, zero nulls occur at ½, ⅓, ¼, etc., of this distance.

A filled pattern is accomplished by varying the amplitude and the

Fig. 3. The effect of gain, elevation, and ERP on coverage*.



*The studies are based on the FCC F (50, 50) curves and are not applicable for any given situation since terrain can influence the values up to 20 db or more. (See statement concerning their application in FCC's Sixth Order and Report par. 3.683). They are used for comparative purposes only in order to bring out certain facts which will aid in choosing the best combination of parameters for certain conditions

Curve No.	Antenna[2]	Gain	Beam Tilt	Elevation	ERP KW
(1)	TFU-24DL	20.5	0.75	500	225
(2)	TFU-46K	46	0.75	500	500
(3)	TFU-46K	46	0.75	500	1,000
(4)	TFU-46K	46	0.75	1,000	1,000
(5)	TFU-46K	46	0.75	1,000	5,000

Curves (1) and (2) show the relative fields when a TFU-46K replaces a TFU-24DL with the same 12.5 KW transmitter at 500 feet.
Curve (3) shows the relative field with the TFU-46K antenna and an increase in transmitter power to 25 KW.
Curve (4) shows the relative field with the TFU-46K antenna and a transmitter power of 25 KW with an increase in height to 1,000 ft.
Curve (5) shows the relative field with the same conditions as (4) except with an ERP of 5,000 KW.

[2]The same results apply for antennas with similar gains and vertical patterns.

Based on these curves, a few general observations can be made:

1. **For local coverage, a combination such as (1) can be used.**
2. **The service radius can be increased by raising antenna gain, raising transmitter power, or raising height.**
3. **When raising antenna gain the effect on local coverage should be studied; if it is lower an increase in transmitter power is also necessary.**
4. **When raising height, especially with a high gain antenna, the transmitter power must be increased.**

phase of the current in each radiating element or in groups of elements. An amplitude step near the center of the antenna will fill in the odd nulls such as the 1st, 3rd, 5th, etc. Some phase variation is required to fill in the even nulls. Filled patterns are generally acceptable and are rendering excellent service in all parts of the country. Most of the antennas in service provide patterns of this type.

Fig. 1 is a good example of a shaped pattern. The amplitude and phase of each layer is varied along the whole length of the antenna to produce the pattern. This antenna is more complex to design and build but it does produce an optimum pattern.

Fig. 3 and its accompanying table reveal the effect of gain, height, ERP, and type of vertical pattern. By choosing these parameters properly, considerable flexibility is possible in serving a given area.

Coverage With A Directional Antenna

A directional antenna has a number of useful applications. It has been used successfully to cover the San Joaquin Valley in California and also to cover service areas adjacent to large bodies of water. There are situations, however, when their use is questionable from a viewpoint of coverage efficiency. Coverage efficiency can be defined as covering a given area with a given field intensity with a minum amount of effective radiated power. Height is also a factor as will be shown below. Some relative approximate relationships can be deduced from propagation formulas which pertain within the radio horizon over plane earth as follows:

$$r \propto \sqrt[4]{P}$$
$$A \propto \sqrt{P}$$
$$P \propto h^2$$

Where r is the distance to a given field contour

P* is the "effective radiated power" in the main beam

A is the area served within a given field contour

h is the height of the antenna above the service areas.

In Figure 6a the area enclosed by a given field intensity contour for a relative "effective radiated power" of "1" and a relative height of "1" is πr^2. The transmitting site can also be moved to the perimeter of the circle and a directional antenna employed which has a horizontal pattern in the shape of a quarter of a circle as shown in Fig. 6b. The horizontal gain of such an antenna is four, hence P=4.

From the relationship above $r \propto \sqrt[4]{P}$, r becomes the $\sqrt{2}$. The area to the same field intensity contour served is then

$$A = \frac{\pi(\sqrt{2}r)^2}{4} = \frac{\pi r^2}{2}$$

Hence, using the same transmitter power with an optimum directional antenna with a horizontal gain of 4, only one half of the area is covered as compared to 6a and hence the coverage efficiency is 50%.

It can be stated generally that because of the fourth root relationship between distance and radiated power that the center of the area to be covered is the best location for maximum coverage efficiency.

However, another factor pertains and that is height. From the relationship above it is noted that if the height is doubled, the "effective radiated power" increases four times. Hence, in Fig. 6b, doubling the height will provide "effective radiated power" "P" of 16 and "r" becomes 2. The area covered is then $A = \frac{\pi(2r)^2}{4} = \pi r^2$ which is the same as for "a".

The antenna postulated in "b", however, is not permitted under the 15 db rule. A practical antenna may have a horizontal gain of about 2. To obtain an "effective radiated power" of 16 will require a height increase of $\sqrt{8}$ or 2.8 times.

Another general rule is that where a sufficient natural height can be obtained, a directional antenna can be an advantage. To obtain any advantage, however, heights beyond a relative value of 2.8 must be obtained under the conditions postulated above.

Multiple Installations ("Antenna Farms")

Multiple installations are becoming more common for a number of reasons:

1. Airlanes around metropolitan centers leave only a few areas available for tall structures.
2. A common location of all stations is desirable because of receiving antenna orientation.
3. Installation cost economies may result, especially at UHF frequencies.

There are a number of ways in which multiple installations can be made:

1. Candelabra. A number of VHF installations using candelabras are operating successfully.

*The value here used is not only the product of transmitter power and antenna gain, but also the increase in "effective radiated power" due to an increase in height.

TYPICAL ANTENNA SYSTEMS COSTS
Delivered & Installed Prices

Tower Height	500 FT	1000 FT	1500 FT
Tower Cost, Installed (1000 and 1500 ft Towers with Elevators)	$ 50,000	$ 80,000	$200,000
Transmission Line (Single 3-1/8 in. Line For 500 ft., 6-1/8 in. for 1000 ft. And 1500 ft. Towers)	6,000	25,000	35,000
UHF TV ANTENNAS			
HELICAL	Gain=10 7,000	Gain=25 28,000	Gain=50 86,000
SLOT	Gain=6 4,000	Gain=21 21,000	Gain=46 100,000

The above data, obtained by the editors from Jampro Antenna Co., is intended to serve only as an overall representative guide. Actual costs will vary according to manufacturer, site locations, and numerous engineering factors.

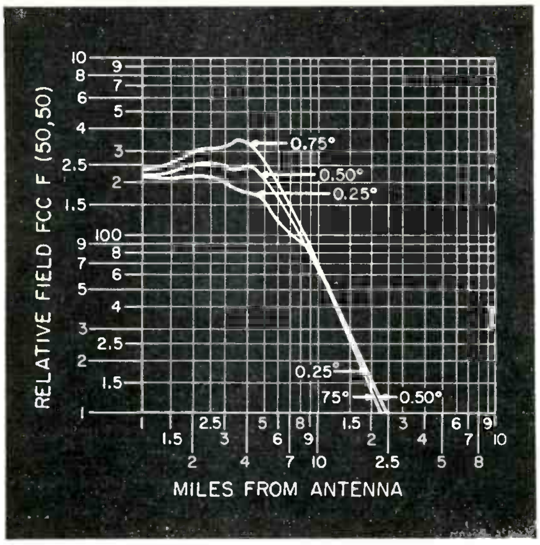


Fig. 4. These curves show how the local field strength increases and the loss in distant coverage is relatively small for a selected beam tilt.

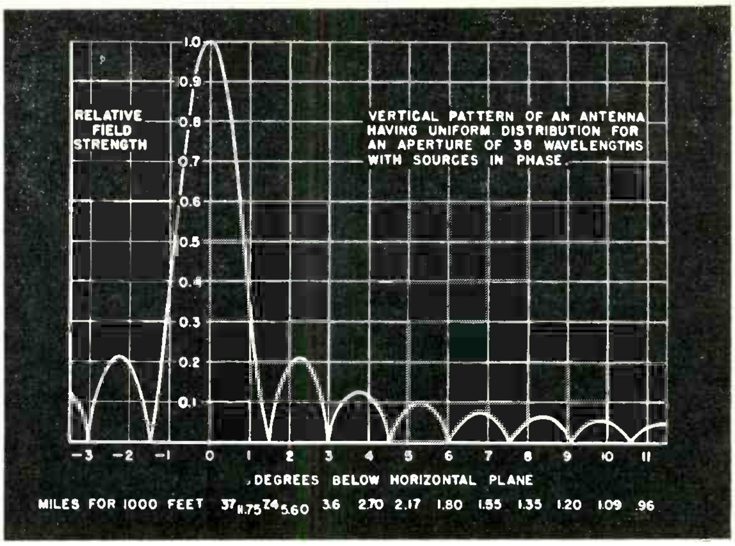


Fig. 5. Vertical pattern of an antenna with a gain of 38 having a sin x/x pattern produced by uniform illumination.

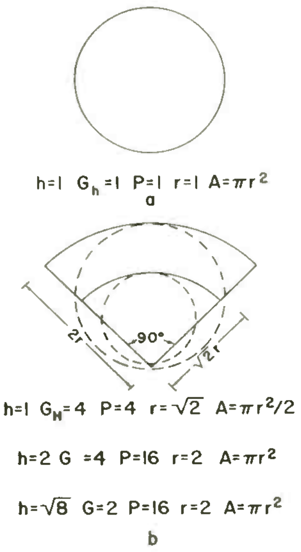


Fig. 6 The most efficient coverage is obtained when the antenna is located centrally in the service area. Only one half of the area is covered with the same input power at the same height from the perimeter using a directional antenna.

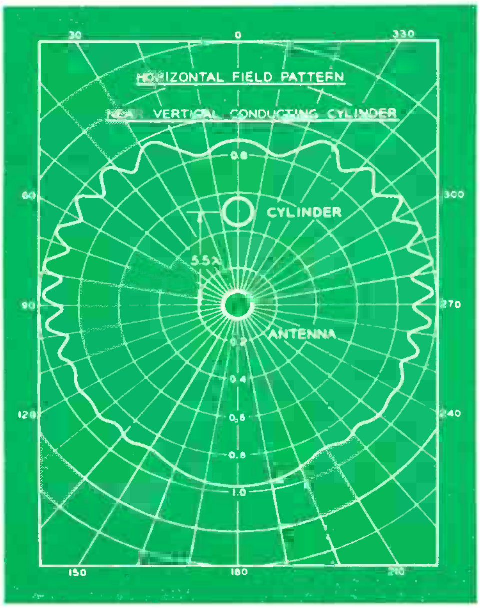


Fig. 8. Measured diffraction pattern for an antenna and a cylinder spaced 2.5 wavelengths.

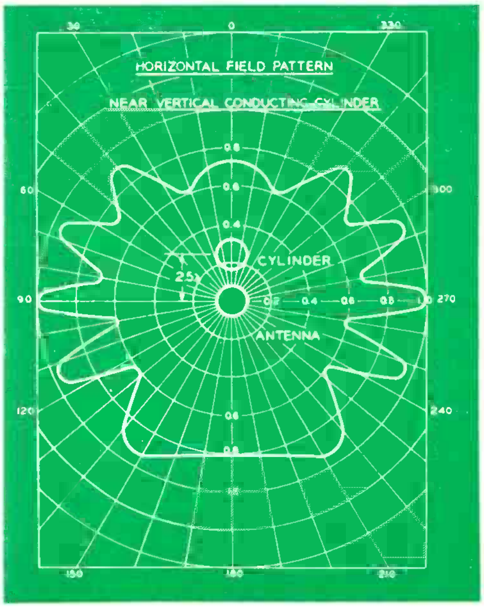
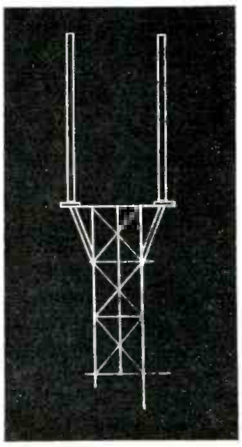


Fig. 9. Measured diffraction pattern for an antenna and a cylinder spaced 5.5 wavelengths.



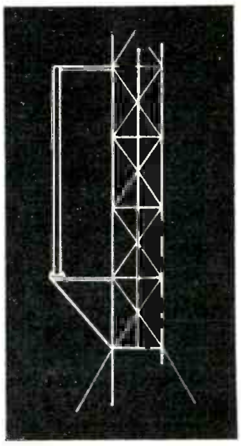


Fig. 7. Good circularities are possible with spacings of only 10 to 15 feet for two UHF antennas.

Fig. 10. Side mounted antennas should be base mounted preferably above a guy point. Best circularities are obtained with a minimum of metallic objects on the tower.

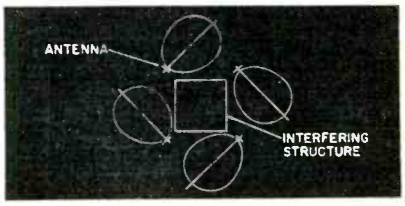


Fig. 11. Radiators can be placed at an angle to the tower faces to produce a pattern of ± 5 db.

This technique is even more applicable for UHF.
2. Stacked antennas above the tower top. This method has been fairly successful at VHF but has limitations at UHF.
3. Standard UHF antennas side-mounted on an existing tower. This method has good possibilities under certain conditions.
4. Special Panel type antennas side-mounted on existing or new towers. This method also has good possibilities under certain conditions.

Each of the above methods will be discussed in more detail.

Candelabra Arrays

While spacings between antennas are 80 to 100 feet at VHF they reduce markedly at UHF so that good circularities are obtained at spacings of only 10 to 15 feet. (Circularities of ± 2 db for a 10 foot separation to ± 1 db for a 500 foot separation can be obtained for smaller antennas; and ± 3 to ± 2 db for larger antennas. This figure includes the circularity of the antenna itself.) The isolation between antennas is more than adequate for slotted cylinder types of antennas.

Considering the fact that most standard triangular towers above 500 feet are 7¼ feet on each face, a relatively small outrigger is required for a 10′ to 15′ separation as shown in Fig. 9.

Hence, the increase in tower cost for supporting several antennas is relatively small. Furthermore, standard antennas can be used which are more economical to build. The advantages of a separate antenna for each station. which permits complete flexibility, is another important factor.

Reasonable circularities can also be obtained for three or even six antennas disposed in this arrangement. Hence, this method appears as the most logical method of providing multiple UHF installations.

Vertically Stacked Arrays

Vertically stacked arrays have been in use for many years. They are quite suitable for panel type arrays and Superturnstile antennas in which various portions of the antenna operate at various channels. However, standard UHF antennas are not constructed to support other antennas; hence, special designs are required of either a heavier cylindrical or panel type, both of which tend to be more costly.

UHF stacking is thus somewhat less desirable than the candelabra, from both an economic viewpoint and also for a lack of flexibility in changing or replacing an antenna in the stack. There are no technical limitations in using this method, however, if it seems desirable for other reasons.

Side-Mounted Antennas

When a UHF antenna is mounted in the proximity of a tower, it influences the performance of the antenna in several ways. The presence of the steel in the tower affects the impedance, and also the horizontal pattern. The vertical pattern may also be affected at steep angles, but only in a minor way in the main beam.

The effect on impedance can be practically eliminated by proper spacing. However, the effect on the horizontal pattern decays very slowly with spacing. For instance, an improvement of less than 1 db would be obtained by using a spacing of 10 feet as compared, say, to 7 feet.

Metallic objects in the tower affect the pattern. The more metal objects, the greater will be the non-circularity. The tower legs may contribute ± 2 to ± 3 db. Other items such as horizontal and diagonal tower members, transmission lines, ladders, power and telephone cables, elevator rails, etc., increase non-circularity. It is difficult to give values since much depends on the individual installation. Some calculations made on a standard triangular tower 7-½ ft. on each face indicate ± 7 db with all of the items listed above. On the other hand, a tower which is relatively transparent with only the tower members may be of the order of ± 3 db. It is also reasonable to expect in both cases that there may be several peaks or valleys which will be appreciably greater than this value where a number of these items add in amplitude and phase.

When side-mounting an antenna it is advisable to provide a base so that a standard antenna can be used. (See Fig. 10). Bracing at the top and sometimes at the center is also necessary. Guys should be avoided in the field as much as possible. It is desirable to locate the antenna immediately above a guy point and also at a point where there are a minimum of metallic objects.

When the service area is located on only one side of the tower, a directional antenna can be used to advantage with the null directed towards the tower. This will generally reduce the variations towards the service area. On the back side of the tower the nulls may be appreciably deeper than the pattern null due to the shadowing effect of the tower.

Panel Type Arrays

Panels which are side mounted may consist of either a dipole configuration or a dipole type array. Radiators are fastened to their individual reflectors, and panels can either be face mounted against the sides of the tower, or skewed as shown in Fig. 11. Face mounting has the advantage of lower interference to the pattern resulting from structural members, or other objects inside the tower. Circularities of ± 1 to 2 db can be obtained for towers with dimensions of one wavelength per side. For towers which have a dimension of five wavelengths per side, circularities of the order of ± 5 db can be achieved. This presumes a well designed panel having the proper beam width and minimum back lobes.

For larger structures, skewing can be employed with circularities of the order of ± 5 db. While smaller values are theoretically possible, the effect of back lobes and reflections from the tower tend to hold the value in this vicinity.

Summary

From the above considerations, it can be seen that the choice of the antenna, whether omnidirectional or directional; whether used in a single or multiple installation; its characteristics such as gain, beam tilt, and vertical pattern; its location and height are all important considerations which require considerable thought and study. It is hoped that this information will be helpful in guiding others in the successful choice of a UHF television antenna. ●

BROADCAST EQUIPMENT

Solid State CATV

Jerrold Electronics offers five new transistorized mainline and bridging amplifiers for CATV systems. Low power demands reduce the need for AC power. Heart of the system is the Model TML-1 all-band mainline amplifier with a gain of 24 db and 44 db output. Units are cable

powered by the solid state Model RPS-30 power supply, providing up to 12 amperes at 30 volts for a fully loaded typical section in a CATV distribution system. Voltage regulation ± 1%.

Circle 111 on the Reader Service Card.

Portable TV Relay System

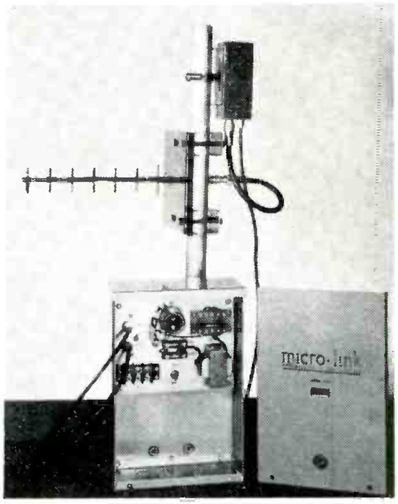
Microwave Associates' system is solid-state and operates in the 1.9 to 2.1 Gc fixed STL and mobile broadcast relay with 1 watt output on 7 dial select channels. It requires less than 50 watts power

input. Total weight is 37 lbs. An optional 20 watt power amplifier and adjacent military band operation is also available.

Circle 101 on Reader Service Card.

2500 MC Converter

Micro-Link's converter provides 5 program channels for 2500-mc Instructional Television. The transistorized converter is weatherproof, light weight (3 lbs.) and powered by a single coaxial cable. Input frequency is 2500 to 2686

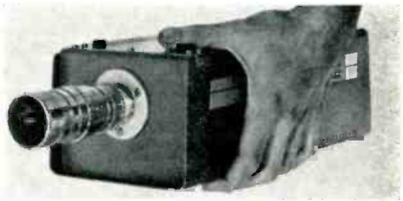


mc, and output frequency is 168 to 222 mc. Input impedance is 50 ohms—output 75 ohms. .005% stability is obtained through crystal control. Priced at $800.

Circle 102 on Reader Service Card.

Small CCTV Camera

A complete closed-circuit television system, fully transistorized, from Du Mont Laboratories, is



called the TC-175. The camera with its own regulated power supply weighs 10 pounds and is one foot long. Horizontal resolution, of 700 lines, produces pictures at light levels as low as 10 foot candles. List price is $899.

Circle 103 on Reader Service Card.

Audio Amplifier

Two microphones and one program input feature McMartin's

new MA-20 amplifier. Output is 20 watts RMS, 28 watts music and 40 watts peak. Frequency response is 30-20,000 cps. The unit includes separate bass and treble controls, master gain control, balanced 70.7V/25V speaker outputs and bridge output for amplifier. Tamper proof cover, universal microphone line input transformers, and Push-lock microphone connectors are optional.

Circle 104 on Reader Service Card.

CATV Line Amplifier

A new line amplifier by CAS Manufacturing features high gain and high output, wide bandwidth, and compactness. The cable-powered TRA-217 transistorized amplifier is housed in a weatherproof enclosure. A hinged door permits easy access. The unit requires no connectors and may be inserted or removed from the housing without disturbing the case mounting.

Circle 105 on Reader Service Card.

(Continued on page 42)

Living color with only black-and-white studio lighting

With this 3-tube set in the TV camera, the studio lighting you now use for B&W pickup is all you need to transmit superior color pictures. At the same time, you air high resolution pictures having normal tone rendition for B&W receivers. You avoid many of the lighting costs normally associated with high-quality studio color pickup...as well as the high scene-lighting temperatures and need for extra air-conditioning.

Precision construction, field mesh, and closely matched tube characteristics assure excellent registration and color uniformity over the entire scanned area.

High signal-to-noise ratio and signal output, and excellent life expectancy are additional features of the RCA-4415 and -4416.

This factory-matched set consists of two RCA-4415's and one RCA-4416 with a high blue sensitivity which increases over-all camera sensitivity by as much as a factor of two. For quick identification, each image orthicon is marked for its particular color channel.

Write or call your local distributor of RCA broadcast tubes for information on these orthicons that enable you to air living color with only B&W studio lighting.

RCA ELECTRONIC COMPONENTS AND DEVICES, HARRISON, N.J.

The Most Trusted Name in Electronics

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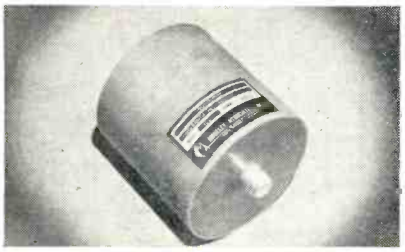
Circle 9 on Reader Service Card

BROADCAST EQUIPMENT

STL Aural Isocoupler

Moseley Associates Model ICU-1 Isocoupler is designed so that the STL antenna and transmission line can be mounted directly to an ungrounded standard broadcast (AM) tower with negligible effect on the base impedence. No

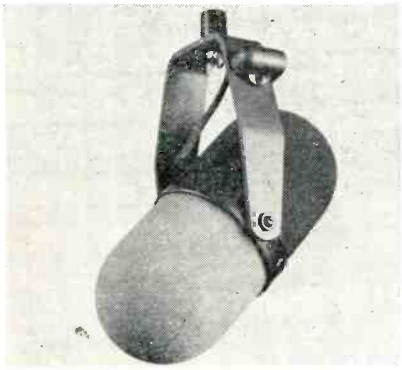


quarter-wave matching section is used. It has less than 0.3 db insertion loss in the 890 to 960 mc band and less than 10 mmf between the input and output connectors. Rated at 5,000 volts peak, it is sealed in epoxy resin. Less than 2 lbs., and 5" in length and 4" in diameter, it uses type N RF connectors. The price is $150.

Circle 106 on Reader Service Card.

Boom Microphone

The SM5 microphone from Shure Brothers has a cardioid polar pattern. An integral windscreen is very effective in minimizing noise in outdoor locations. Absence of transformers or response correct-

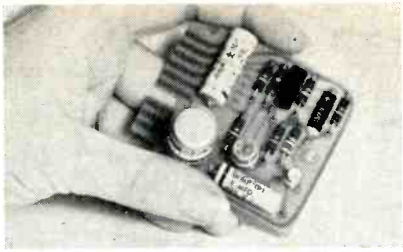


ing inductors prevent pickup of electric noise. The microphone may be used in extreme hum fields. Desk mounts are available as accessories. Price is $225.

Circle 107 on Reader Service Card.

Plug-In Audio Module

Audio plug-in units are designed for the sound specialist. Langevin builds and sells sound reinforcing gear to customers' speci-

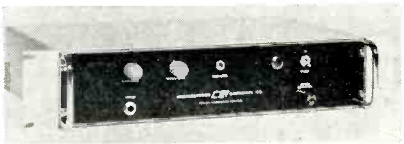


fic requirements. The 4000 series is solid state and can also be used for broadcast monitoring.

Circle 108 on Reader Service Card.

Distribution Amplifier

Nine separate outputs from a common video signal are available from Communications Electronics' new solid state DA-1. Output consists of seven video and two audio. One signal feeds an oscilloscope,



while the remaining six video are identical data outputs. Each video output is capable of driving a 91 ohm line at 1 volt RMS. Video response is essentially flat from 30 cps to 2 mc. Cost is $1,200 with 60-day delivery.

Circle 109 on Reader Service Card.

Transistorized Groundometer

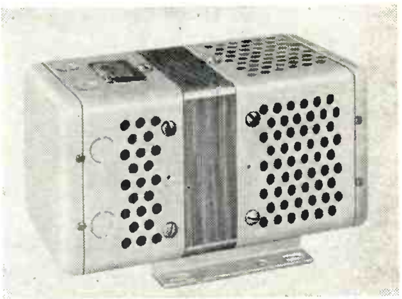
A transistor operated low frequency bridge power source, Borden Engineering's Groundometer, is designed specifically for measuring resistance paths of electric currents that flow through grounding electrodes for lightning arrestors, transformers, transmission line towers, telephone and telegraph equipment, radio and TV antennas. Completely portable, the instrument uses a synchronous meter detector to elim-

inate stray AC and DC ground currents. Full scale ranges are 1-10-100-1K and 10 K ohms.

Circle 110 on Reader Service Card.

Voltage Stabilizer

An up-dated line of constant voltage stabilizers is now being marketed by Acme Electric Corporation. The new Voltrol uses the latest in core techniques. The ferroresonant transformer uses a capacitor terminated secondary control winding which induces

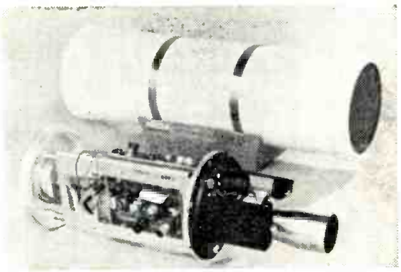


flux saturation to the secondary core portion. Highly responsive to system disturbances, a 5% line voltage variation is recovered within one cycle. Rated 30 VA through 5,000 VA; all standard input voltage ranges with stabilized output voltages of 120, 240, and 480 volts.

Circle 112 on Reader Service Card.

Iris/Focus Camera Control

Engineered for mounting on the Cohu 3000 series television camera, these units permit remote controlling of lenses with fixed focal lengths from ½" to 6". Optics and drive mechanism are protected by the environment-re-

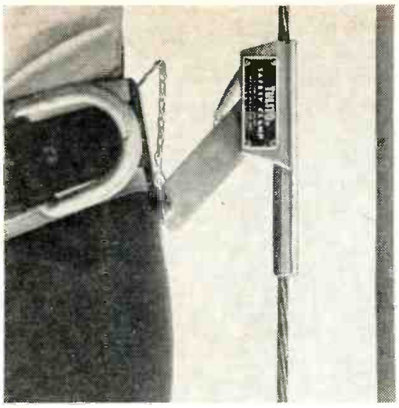


sistant camera housing. Lens adjustment rings are gear driven by small DC motors and are powered via the camera cable. Slip clutches prevent damage when power is applied beyond the adjustment limits. The price is $245 and delivery is 4 weeks.

Circle 114 on Reader Service Card.

Tower Climb Safety Clamp

For greater safety, Mayer Machine's *tulite* safety clamp is adaptable to ladder installations. The installation consists of a stainless steel clamp. Only one moving part attaches to an approved webbing or leather safety belt. Clamp fits around a ⅜"

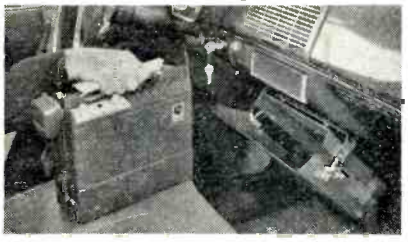


stainless steel cable anchored to the top and bottom of the ladder. The unit does not interfere with the climber. Should the climber slip, the clamp works instantaneously. There is no free-fall that can cause further injury.

Circle 115 on Reader Service Card.

FM Two-Way Radio

"Porta-Mobil", an FM two-way radio for broadcast news purposes or remotes, is now available from General Electric. It has up to 18 watts of transmit power in low



band frequencies (25-50 mc) and up to 10 watts in high band (132-174 mc). This is twice the power previously available in FM hand-carried equipment.

Circle 116 on Reader Service Card.

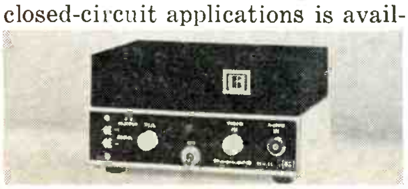
Motorized Winch for Crank-Up Towers

A heavy duty weatherproof geared motor and control unit enables control by push button operation. Fuses and a reset device protect the motor, while limit switches prevent tower damage when up or down travel limits are exceeded. The Rohn's model 200 Remote Control Unit is an optional feature.

Circle 117 on Reader Service Card.

TV Modulator

Packard Bell Electronics' MPS-5 TV Modulator, designed for closed-circuit applications is avail-



able for channels, 2, 3, 4, 5, or 6. Picture and sound are transmitted on the same channel to one or more standard TV receivers. Fully automatic and transistorized, it has an RF output of 50 db at 75 ohms and 30 db at 300 ohms. 75-ohm attenuators of 3 db, 6 db, 10 db, and 20 db are available. Video input is 75 ohms, co-axial cable output is 75 ohms and twin wire output is 300 ohms. AC power input is 115 volts at 5 watts. List Price: $125.

Circle 119 on Reader Service Card.

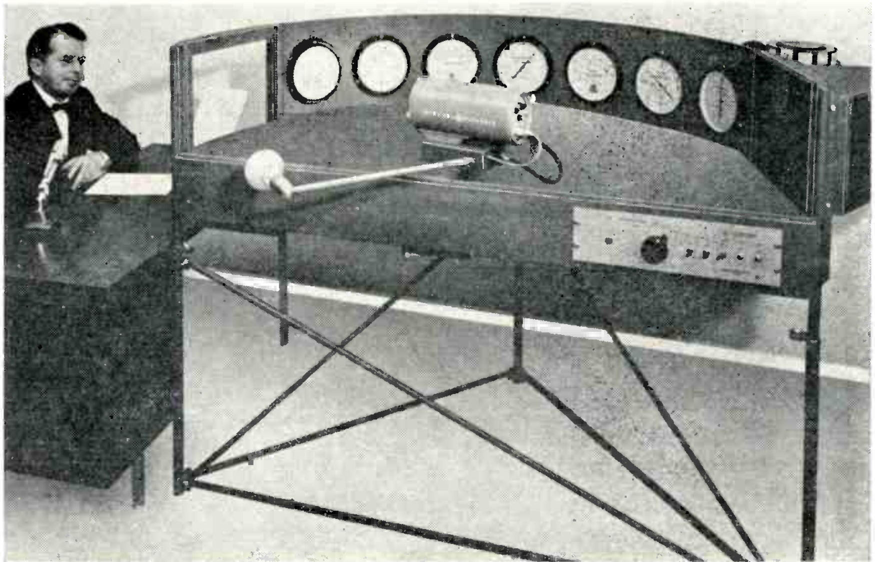
ENGINEERING CASEBOOK

(Continued from page 27)

coils used had a *Q* of about 950 before installation, but after being placed in the cabinet this figure dropped to about 600, resulting in a network loss of around 1500 watts on each frequency. A ball gap provides lightning protection, and the dc drain is via the network.

Of particular interest is the cross-modulation problem. A Class-C amplifier will generate cross modulation like a mixer (with stray RF present), with a loss of about 30 db. In a 50-kw amplifier, spurious emissions must be kept down more than 120 db to prevent interference with other service frequencies. The required conditions were met by enclosing all tuning networks in thoroughly shielded cabinets. Despite the losses incurred in separating the two operating frequencies, and the various antenna tuning problems, final 1-kw radiation values achieved were 244 mv/m at 660 kc, and 256 mv/m at 880 kc. A comfortable compromise between good anti-fading antenna properties and high losses was obtained with minimum tower current and reasonable antenna height.

The system is operating successfully, with no complaints from users of a 219-kc beacon at nearby Teterboro Airport (this is almost the difference frequency) or from listeners to 1540 kc in Philadelphia (the sum frequency). Not only is this achievement a fine example of an outstanding engineering achievement, but also of the excellent coordination between two competitive networks and the equipment suppliers. ●



LITERATURE of INTEREST

For additional data, circle No. shown on Reader Service Card.

Polarized FM antennas. New Catalog describes 20 standard dual models with varying gains. Jampro Antenna Company. 122

Antenna equipment. 96-page catalog including performance data on transmission lines and heliax flexible coaxial cables. Andrew Corp. 128

Towers. 12-page illustrated brochure on R & D of tower building. Dresser-Ideco. 175

Coaxial components. 14-page catalog of standard, miniaturized, and twinax coaxial patch panels and accessories. Trompeter Electronics, Inc. 123

VSWR—Four-page treatment on transmission lines with nomograph. Bird Electronics Corp. 124

Crank-up and tilt-over towers. New catalog, Tri-Ex Tower Corp. 125

Sweep generators, RF attenuators. Illustrated catalog in Spanish, French, or English. Telonic Industries, Inc. 127

Recorders. Condensed catalog on miniature strip chart recorders. Included are photographs and drawings. Amprobe Instrument Corp. 131

Oscilloscopes. Six-page, two color catalog lists complete line with plug-in amplifiers. Data Instruments Div. of Industrial Electronic Hardware Corp. 132

Measurements. House organ Technical Newsletter details method of improved sweep frequency testing using a comparison technique. Jerrold Electronics. 177

Transistor specifications. 4-page data sheet explains method of determining exact transistor used in switching or DC applications. Bendix Corporation. 135

Distribution amplifier. Two-page bulletin supplies information on feeding low, high VHF and full FM signals. Entron, Inc. 136

Clad metal cable shielding. 2-page technical release. Information on types of protection provided, magnetic properties, weight, sizes and forms. Metals & Controll, Div. Tex. Inst. 137

Tape reader. 19-page, illustrated brochure of digital processing and control information systems. Tally Corp. 138

Silicon amplifiers. Color pamphlet specifies plug-in modules for audio and magnetic recording equipment. Stancil-Hoffman Corp. 140

CCTV. Short form catalog lists system sub-assemblies and components. Cohu Electronics, Inc. 141

Coaxial cable. 9-page primer on choosing the proper coaxial cable for microwave applications. Phelps Dodge Electronic. 143

DC power supplies. New Catalog describes standard units and performance features. Acme Electric Corp. 144

Video tape. "Advertising with Video Tape," fourth in a series on "Concepts of Video Tape Recording." 3M Magnetic Products. 145

Microphones. Monthly house organ, "Sound Scope," by Shure Brothers. 146

Voltage stabilizers. 4-page flyer describes plug-in transistor amplifier for control and regulation. Pace-Tronics, Inc. 149

Time announcer. 8-page illustrated leaflet on "back-up" recording of all audio communications. Magnasync Corp. 150

Camera cable. 4-page with charts and diagrams. Contains specifications on physical dimensions and materials of construction on coaxial lines used for black and white and color. Boston Insulated Wire & Cable Co. 151

Scope cameras. 20-page illustrated catalogue of accessory camera equipment for oscillography. Tektronix. 152

Educational TV. Planning guide for 2500 mc Instructional Television service. Microlink Corp. 153

CCTV products. 8-page brochure lists vidicons, monitors, distribution equipment and accessories. Blonder-Tongue. 154

Programming equipment. 12-page pamphlet on programming, automatic logging, and authenticating. Continental Electronics. 155

Pulse assignment system. 11-page technical paper complete with diagrams and photographs. Visual Electronics Corp. 156

Transistorized camera. Illustrated brochure details use in live and video tape broadcasting. Sylvania Electric. 157

Cables. Application and specification catalog of RG Coaxial lines with price list. Superior Cable Corp. 158

Zoom lens. 8-page booklet illustrating equipment for servo control of zoom and focus. Television Zoomar Co. 159

Power tubes. Spec sheets and interchangeability tables on high power transmitter tubes. Penta Laboratories. 160

Coaxial cable. 4-pager with specifications and performance characteristics for community antenna and CCTV. Simplex Wire and Cable Co. 161

Electron tubes. 16-page catalog with specifications and performance data. Machlett. 162

Cartridge. Illustrated leaflet on cartridge loading for movie projectors. Fairchild Camera and Instrument Co. 163

Deflection components. 5-page article on upgrading camera performance. Cleveland Electronics. 164

Operating impedance. Application bulletin on use of impedance bridge. Delta Electronics. 165

Coaxial RF switches. 4-page excerpt from Navy report on evaluation of RF Coax Switches. Cooke Engineering Co. 166

Wide band FM detector. 1-page flyer on monitor for proof-of-performance measurements. Belar Electronics Laboratory. 167

Sound systems. 8-page catalog of speakers, baffles, horns and microphone accessories. Atlas Sound. 168

Broadcast equipment. 26-page catalog describes FM transmitters, stereo exciters, consoles, automatic control and logging equipment. Rust Corp. 170

CCTV camera. Illustrated leaflet with specifications, performance features and typical applications. Packard Bell. 171

Video recording. 28-page, 4-color booklet, describing new high-band video recording standards. Ampex. 172

Line tester. Flyer describes unit for testing line termination, splitter termination, open and shorted line. Entron, Inc. 173

Voltage regulator. 4-page brochure describing regulation equipment on 3 phase lines. Sola, Div. of Basic Prod. Corp. 176

Tape cartridge. 4-page brochure describes models used in mono and stereobroadcasting. Automatic Tape Control. 178

Audio equipment. Product brochure on complete line of tapes, cartridge systems, consoles, playback, and amplifier units. Sparta. 179

Industrial Catalog. New 572-page catalog lists 65,000 items by more than 600 manufacturers. Allied Electronics Corp. 169

Electronic cleaning. Brochure describes machine that cleans and lubricates film up to 650 feet per minute. Harwald Co. 133

BM/E

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MANAGEMENT ROUNDTABLE

(*Continued from page* 46)

mum signal to New York; maximum attenuation towards WCCO, Minneapolis.

Will this expanded AM operation require additional help?

Kunins: A larger facility, more sophisticated equipment, a 24-hour schedule—of course will demand more attention. It means we'll have to do some shifting around, but I don't think it's anything we can't handle with our present operating staff. My present concern is in the engineering planning of these preliminary phases. The many details associated with this effort must be completed to get started in the construction phase. Technical assistance in this area is limited.

DeProspo: In an active broadcasting area like New York City, there is rather a rich supply of operators and technicians. While we can't compete financially with the commercial broadcasters, we can offer other employment attractions through civil service. The fluctuating demands of the other stations make available to us this level of talent. However, I quite agree with Morris that professional engineering and supervisory personnel do not come easily.

What are the possibilities of operating remote?

Kunins: It is our intention to have a manned operation. But our designs have made provisions for complete automatic remote control of the station. We can't know for sure just what future demands will be made on our staff, but it would be unrealistic not to provide for remote operation.

Siegel: May I comment further on that? There's a general confusion that automated operation is always coincident with personnel layoffs. This, most emphatically, is not our intent. We will only use automatic operation to increase operating efficiency. Our technical responsibilities go far beyond the AM, FM and TV broadcasting operations. In fact, we assist the technical staff of every municipal department (police, fire, hospitals, sanitation, etc,). This imposes manifold responsibilities. Any technical relief we can achieve in our broadcasting operation permits us to pay better attention to these other areas. ●

MANAGEMENT

ROUNDTABLE

WNYC Execs Discuss Site Selection Problems

New York City's WNYC, the largest municipal broadcaster in the world, is going even bigger. A two million dollar capital budget is earmarked over the next two years for combined AM-FM-TV operations. Present FM activities will be moved to the top of the Empire State Building and operated jointly with their UHF-TV Channel 31, *among the strongest UHF stations in the country* (890 *kw visual*). *Although WNYC is a municipally-owned station, the operating problems are similar to those faced by commercial licensees. Thus, broadcasters will be interested in the underlying factors and management decisions involved in selecting a new antenna site for WNYC.*

Perhap's WNYC's most ambitious plan is expanding the present limited 1 kw AM operation to 50 kw. The AM will move from Greenpoint, Brooklyn, to the Todd Hill section of Staten Island and will require a 6-tower directional array. Mr. Seymour N. Siegel, Director Municipal Broadcasting Systems; John DeProspo, Executive Director Operations; and Morris K. Kunins, Chief Engineer were asked:

Seymour N. Siegel

John De Prospo

Morris K. Kunins

What considerations led to this expansion program?

DeProspo: For the past 26 years, WNYC-AM has been operating on a special temporary license from the FCC. Because of "clear channel" requirements, non interference with WCCO, Minneapolis, on our assigned frequency 830 kc, we've been limited to 1 kw transmission in daylight hours only. This kind of operation literally disenfranchises more than half that the property was already city the listeners in the metropolitan area.

Siegel: It would take more time than we have here to properly describe, but we take special pride in the unusual nature of WNYC's programming. We have an obligation to make these programs available to all residents of New York City. The new Staten Island AM operation will discharge this responsibility and probably add a total of 11 million more prospective listeners.

Why was the Staten Island site chosen?

Siegel: This is the result of an unusual set of favorable circumstances. I'll let engineering and operations describe their own considerations. For my part, after being assured the site was technically satisfactory, I was pleased owned, thus minimizing a host of administrative problems.

Kunins: An antenna site must meet a combination of technical criteria. Our first consideration was simply locating real estate big enough to accommodate six towers at our operating frequency. Fortunately, including other aspects, this location is large enough.

Why a six tower array?

Kunins: Remember, we still have WCCO, Minneapolis to worry about. At our increased power and with a 24-hour operating schedule in mind, we will have to design and rigidly maintain a proper directional pattern.

DeProspo: The prospect of these six towers, incidentally, brought some objections from unusual quarters. The local PTA raised quite a vocal protest. As a municipal organization, you can realize how sensitive we are to protests of this nature.

What was their objection?

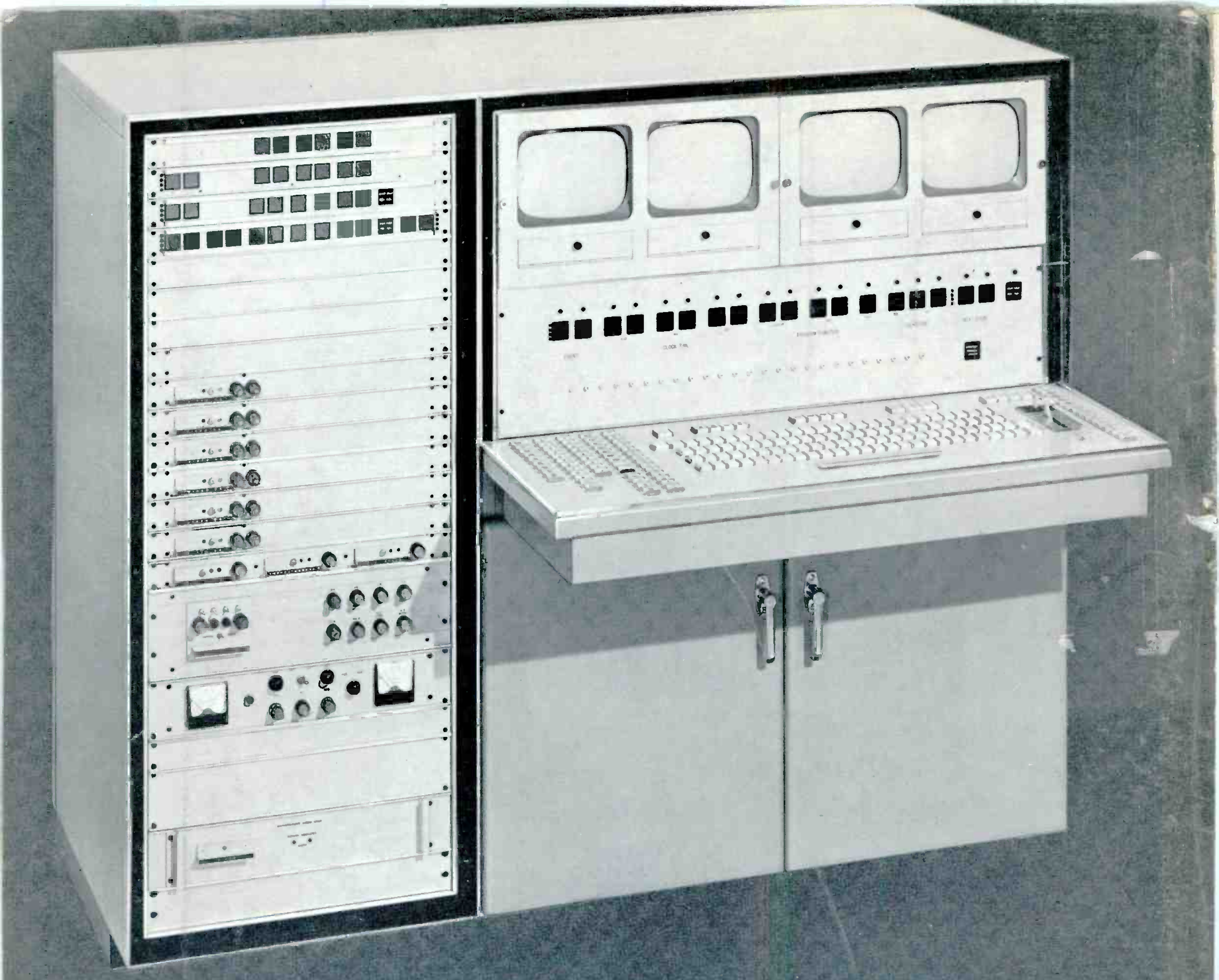
DeProspo: The new site is located just across from the proposed Susan E. Wagner High School. The PTA was concerned that the radio station complex would transform the area into an unsightly industrial compound. Fortunately, after a few meetings, explaining our objectives and showing actual plans of the installation, we were able to convince them otherwise. It will be anything but unsightly, in fact quite attractive. Also, what particularly sold them was that we would invite the students to participate in some phase of our broadcasting operations.

You mentioned that there were other favorable aspects in regard to this site?

Kunins: Yes! A station's service area increases with antenna height. The main restriction in pushing antennas as high up as you can is the cost of the supporting tower structure. We are fortunate that this site is the highest point on the Atlantic coast from Maine to Florida. At no premium installation cost, we will obtain a total height of 600 feet above sea level and thus profit from an enlarged listening audience.

Siegel: In addition, we are fortunate about the unique geographical positioning of this antenna site in relationship to New York City and Minneapolis. Assuming all the previously mentioned advantages were localized at a site northeast of the city, then both New York (our audience) and Minneapolis (our null direction) would lie along a common path. Quite a dilemma. The site's actual south-west location, relative to New York, permits us the best of both objectives. Maxi-

(Continued on page 45)



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SOLID STATE COMPUTER PROGRAMMER

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SARKES TARZIAN

BROADCAST EQUIPMENT DIVISION — BLOOMINGTON, INDIANA

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