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Cover date April 1985 on sale Thursday, 14 March

□ Publication Date
Second Thursday of the month preceding cover date
SOFTWARE FROM MSS

Just announced by Microsystem Services (MSS) is a new software suite which allows the Trace Digiscope 8612 digitiser/storage oscilloscope to function as an FFT analyser.

Known as AMS II (advanced mathematics software), it is designed for studying continuous, changing or transient events in vibration, sound or electronics. Its use adds new and enhanced waveform processing capabilities – FFT, integration, differentiation, averaging and correlation – to the Digiscope 8612, enabling the instrument to cover both the time and frequency domains.

The FFT function in AMS II allows user-definable display modes which enhance the Digiscope's exclusive capability to show recorded, stored and computed waveforms in colour. With AMS II it is possible to select real or complex amplitude spectrum, and linear or logarithmic amplitude axes.

The user can also choose between several spectra such as phase, amplitude, sine, cosine and power – whichever is most suitable for the application.

Different weighting functions have been included in the software to allow better analysis for the frequency domain display; the user may select 'Flat' for no weighting, 'Hanning Window' or self-defined window.

The combination of AMS II with the unique digitiser/storage oscilloscope provides a powerful and extensive diagnostic system in a compact mainframe – able to cover virtually any requirement for laboratory, field service and production testing.

Full details of both the AMS II package and the Trace Digiscope Colour 8612 are available from the sole UK distributors MSS.

Microsystem Services, PO Box 37, Lincoln Road, Cress Industrial Estate, High Wycombe, Bucks, HP12 3XJ. Tel: (0494) 41661.

ANALOGUE MULTIMETER

TMK Test Instruments have announced the VF3, a small pocket size analogue multimeter, featuring a full range of functions with a high sensitivity of 2000 ohms/volt on all dc and ac ranges, assuring accurate measurements without unnecessary loading of the circuit under test. Included in the 16 measurement ranges are dc and ac volts, dc current, ohms and decibels.

Rugged and reliable with a high impact resistant case, the VF3 is very easy to use. It has a single rotary switch giving analogue indication on a mirror arc scale to reduce parallax error and the meter movement is protected against accidental overload.

The VF3 comes complete with test leads and a long-lasting battery. It weighs approximately 90gms and its dimensions are 90 x 60 x 29mm. The retail price is £7.00.

TMK Test Instruments, 138 Grays Inn Road, London WC1X 8AX. Tel: (01) 837 7937.

MOBILE ANTENNA

About to be launched by ARM, the Multi-P6+ mobile antenna promises to be as versatile as a boy scout's pocket knife.

This all stainless steel British made aerial should satisfy all the needs of the discerning mobile operator. Designed primarily for 2m multi-mode working, the P6 is many aerials in one. It will operate vertical or horizontal, directional or omni-directional. It can be used as a DF loop or, by attaching the extra element, is easily converted to a directional horizontal collinear – ideal for hiltop DX working.

In addition to all this, its free space design allows these facilities to be used off the car, indoors or out. The tuning stub is continuously adjustable for higher frequencies, including 70cm. Performance in the vertical plane is equal to the popular ¾ but not having to rely on the vehicle as a ground plane means that a better all round radiation pattern is claimed by the designer.

R Withers Communications, 584 Hagley Road West, Oldbury, West Midlands. Tel: (021) 421 8201/2.

RF POWER COMPUTER

Fieldtech Heathrow Limited has announced the availability of a new RF power computer. Manufactured by Coaxial Dynamics Inc, the model 83500 RF Power Computer provides complete system flexibility by means of the quick match line section which slips on and latches to The Expediter power computer, forming a single field unit. Alternatively, the quick match cables can be slipped into the bench-mounted line

please mention RADIO & ELECTRONICS WORLD when replying to any advertisement

MARCH 1985
section for convenient out-of-the-way power computations.

The Expediter power computer may also be used for testing remote transmitters by simply connecting the matching cables into the permanently installed line section for the power computations. There is no need to keep breaking lines or installing meters at each site.

The Expediter power computer provides the following functions: two modes of operation, analogue for fast tuning and digital for accuracy; advance ¼ inch LCD display; programmable forward and reflected power ranges; compatibility with existing elements; up to three months life on a single battery charge; auto prompting and auto diagnosing for convenience; annunciators for all functions, modes, and conditions. 18 ranges from 100mW to 500kW.

Fieldtech Heathrow Ltd, Huntavia House, 420 Bath Road, Longford, Middlesex UB7 0LL.
Tel: (01) 897 6446.

LOGIC ANALYSER

Making its UK debut at the 1985 Microprocessor Development show was a new high-performance logic analyser, the K205, from Gould Design & Test Systems.

The K205 offers advanced circuit analysis capabilities and triggering power. Designed to solve at least 95 per cent of the toughest design problems, the K205 has 48 channels at 100MHz, thus making it ideal for high-speed bit-slice microprocessors, ECL devices, gate arrays, and discrete logic designs.

The logic analyser features 16 independent triggering decision levels, with four commands in each level. Four decisions can be made every 20 nanoseconds (ns), enabling designers to locate difficult logic problems by selectively triggering on a unique event. Trigger points can be chosen while running at full speed through logic sequences, without restrictions. This triggering method, known as trace control, is 150 per cent faster than any comparable scheme.

The K205's tolerance comparison feature allows fast analysis of logic circuits by comparing timing sequences against stored references. This facility eliminates sampling error difference inherent in asynchronous analysis. Reference data can be stored automatically via an input/output port, by testing a known good circuit, or by testing a known bad circuit, and manually editing a correct pattern.

Other features include an auto save facility to allow automatic storage of multiple measurements on the K205's 348K bytes without user intervention, and a glitch mode, which displays transient noise on all channels.

Gould Design & Test Systems also exhibited the 9508T, a stand-alone in-circuit emulator which supports all of the popular 8-bit microprocessors and microcomputers.

Gould Instruments Ltd, Roebuck Road, Hainault, Ilford, Essex.

POWERBREAKER

The PowerBreaker-20 electrical adaptor has been selected by the Design Council for the Design Centre, Manufactured in Britain by B & R Electrical Products Ltd, PowerBreaker-20 plugs into any standard 13A socket prior to plugging in an appliance and provides a high degree of protection against electrocution in the event of an accident. It also incorporates additional safety features.

Most electrical accidents result from cut or frayed cables, loose connections, exposure to dampness or humidity, contact with water, abuse or misuse of equipment. B & R point out that less than ¼ amp can kill, yet will not blow a fuse, and the only effective way to guard against such dangers is by using a residual current circuit breaker (RCCB).

PowerBreaker-20 provides RCCB protection in a convenient, portable form. When danger threatens, it senses a tiny amount of electricity flowing to earth - through a human body, for example - and cuts off the current in a split second.

PowerBreaker-20 is built to the relevant requirements of BS1363 and BS4293. Its additional safety features include a power-on indicator lamp, a test button and automatic current cut-off with illumination of a warning light if the adaptor should be plugged into an incorrectly wired socket (live and neutral reversed). Designed for 220/240V, 50Hz operation, PowerBreaker-20 incorporates a 13A fuse to BS1362 and is slim enough for two units to fit side by side into a double-socket outlet.

Selection for the Design Centre means that a product not only represents the best in British design, having satisfied the tough criteria set by the Design Council, but also, in the case of a product such as PowerBreaker-20, that it has been tested by an independent test house for conformity with the relevant published safety standards.

B & R Electrical Products Ltd, Temple Fields, Harlow, Essex CM20 2BG.

VOLTAGE CONVERTER

In common with other leading semiconductor manufacturers GE Intersil Semiconductor has developed surface mounting package variants of its standard product line, and the first GE Intersil CMOS linear IC to appear in the SO 8 lead package, the ICL7660CBA, is now in full commercial production.

The ICL7660CBA is a CMOS voltage converter developed for applications in data acquisition and in microprocessor based systems where a positive supply is available.

It performs a complete supply voltage conversion from positive to negative over an input range of +1.5V to +10.0V. The conversion results in complementary voltages of −1.5V to −10.0V being available at the output and conversion is achieved with a typical power efficiency of 98% and a typical open circuit efficiency of 99.9%.

Volume quantities of other Intersil linear CMOS products housed in surface mounting packages will soon be available too.

GE Intersil Semiconductor Division, Intersil Datei (UK) Ltd, Belgrave House, Basing View, Basingstoke, Hants RG21 2YS.
Tel: (0256) 57361.
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70cm CONVERTER
70cm to 144MHz low profile converter employing high level Schotky diode double balance mixer, pre-aligned helical filter and low noise transistors. The complete design gives a low noise figure and uses pre-aligned filters and pre-wound coils to give repeatable performance with minimum alignment.

SPECIFICATION: Bandwidth: 430-440MHz. RF Gain: 30dB min. Noise figure: <2.5dB. IF output: 144-146MHz. Supply voltage: 10V. Supply current: 30mA. Size: 97 x 57 x 15mm.

70cm 10W Power Amp

70cm 10W POWER AMPLIFIER
The current generation of UHF handheld synthesised transceivers have all almost all the facilities found in mobile base transceivers, the only major limitation being their output power. For handheld operation 1 watt or so is adequate, but for mobile to mobile and for use with higher power repeaters, the addition power provided by the CIRKIT amplifier increases the range considerably. This is especially noticeable, as is to be expected, at the limits of the service area.

The CIRKIT 70cm Power Amp will boost the output power of hand held transceivers up to 12W. Automatic relay switching between TX and RX, is provided via the RF sense circuitry. The finished unit is mounted in a tough pre-drilled die-cast box, which provides sufficient heatsinking while providing a rugged low profile housing.

SPECIFICATION: Power gain (CW LPE): 7.2dB. Output power (13.8V) 2W input: 10W(min).
Bandwidth: 430-440MHz. Supply current: 2 amps at 12W. Dimensions: 119 x 94 x 34mm.

70cm PRE-AMPLIFIER
This high performance pre-amp offers increased receiver sensitivity and a corresponding extension of the available communication range. The completed unit is sufficiently compact to be built into virtually any existing receiver and does not require the use of any test gear when setting up.


NOW AVAILABLE exclusively from CIRKIT, TAU high quality ATU kits and accessories.

Full H4 coverage, tunes from 1.5MHz continuously to 29.5MHz. Based on the reknowned SPC transmatch configuration, TAU innovated this composite module design with large air-spaced capacitors rated at 5kV, tested to 7kV. Roller inductor infinitely variable. Solid precision radio engineering. Heavy weight long life construction. Will tune any transmitter/aircraft combination to optimum. A lifetime investment and should never need replacing. Power handling capabilities from a few milliwatts to above 3000 watts PEP. Undoubtedly the finest ATU module available today.

STU SK ATU Kit 41-50500 130.00
CABINET - custom-made for STU SK ATU 41-50510 62.50
DIGITAL TURNS COUNTER Multi-turn, vernier scale with digital indication, for use with roller coater, with or without cabinet. Turn counter 41-50520 27.94

BALUNS
To complete the ATU, we have the following Baluns:

<table>
<thead>
<tr>
<th>Location</th>
<th>PEP</th>
<th>Ratio</th>
<th>Stock No.</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Outdoor OR111</td>
<td>1W</td>
<td>1.5</td>
<td>41-50111</td>
<td>27.55</td>
</tr>
<tr>
<td>Indoor IB211</td>
<td>20W</td>
<td>4.1</td>
<td>41-51214</td>
<td>17.25</td>
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<tr>
<td>Outdoor OR111</td>
<td>1W</td>
<td>1.5</td>
<td>41-50111</td>
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ROLLE COASTER
To complement existing equipment, covers 1-30MHz, 28Wduodec, tapered pitch for 10 and 15 meters. Roller Coaster 41-50540 46.00

CIRKIT ELECTRONICS TOOL KIT
Contains 15W soldering Iron, 2 spare bits, heat shunt, solder, pliers, cutters, and screwdriver.

41-00007 15.56

Selected Lines
PB2760 80dB Flexco Buzzer 43-27021 0.55
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FC177 LCD Freq Meter 39-17700 20.00
CM161 Min LCD Clock 40-80161 8.25
8x0.3" IC socket 28-00800 0.12
14x0.3" IC socket 28-14000 0.13
16x0.3" IC socket 28-16000 0.13
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CX520D COAX relay (Type) 46-90520 26.98
CX450D COAX Relay (BNC) 46-90540 26.98
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HC7030 0.1% Acc DMM 56-07030 43.00
Meteor 100MHz DFM 56-09010 95.00
Meteor 600MHz DFM 56-09060 121.00
Meteor 1000MHz DFM 56-09080 165.00
CS240 Antex 17W Iron 54-22300 5.20
TCP3 Weiler temp cont iron 54-20007 17.63
PUD Weiler 24V PSU for TCP3 54-20026 30.74

Books
The Radio Amateurs: Q & A Reference Manual 02-02157 5.95
Oscilloscopes: How to use them, how they work 02-21300 4.35
The World's Radio Broadcasting Stations 02-11564 7.80
The ZC Spectrum 02-00100 5.95
Electronics Pocket Book 02-21309 7.50
Practical Design of Digital Circuits 02-11831 10.45
Projects in Amateur Radio 02-21304 3.80
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Beginners Guide to Amateur Radio 02-11262 4.50
CMOS Cookbook 02-21398 11.85
Design of Active Filters 02-21539 10.15
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TTL Cookbook 02-10358 11.00
TV Antennas and Signal Distribution Systems 02-21584 10.15
PRODUCT NEWS

FARADAY PAIL UNIT
John Chubb Instrumentation has developed a Faraday pail unit for measuring charge on powders, granules and on small articles from below 10 pico-coulombs to 200 nano-coulombs. This instrument is particularly useful in studies on the charging behaviour and deposition of powders and for investigation of factors likely to cause damage in the handling of static sensitive semiconductor devices.

The pail for charge collection is 60mm in diameter and 40mm deep and may easily be removed for cleaning. The unit is an attachment for the JCI101 fieldmeter and the combination provides an auto-ranging charge measuring sensitivity from 200 pico-coulombs to 200 nano-coulombs fsd, with the reading and polarity displayed on a 3½ digit liquid crystal display.

On the most sensitive range charges of a few pico-coulombs can be measured. This sensitivity is usually quite adequate to observe charges induced on dual in-line integrated circuit packs as they slide out from carrier tubes – even “anti-static” tubes.

All the normal facilities of the JCI101 electrostatic fieldmeter are available when used in combination with the Faraday pail – battery or direct mains operation and signal and range outputs for chart recording. The Faraday pail may also be used with the JCI101C fieldmeter, which has the integral RS423 communications interface so that it may be linked to computer equipment via a serial data port for analysis of observations and for comparison and logging of results.

John Chubb Instrumentation, Unit 30, Lansdown Industrial Estate, Gloucester Road, Cheltenham GL51 8PL.
Tel: (0242) 573347.

SWITCHING MODULE
Plessey Semiconductors has announced the versatile MS2002EXP digital switching module (DSM), suitable for all sizes of electronic digital telephone exchanges from a small PBX through to main exchanges. Sample quantities are now available.

Originally developed for System X, the MS2002EXP is a complex device with the simple function of providing digital switching for 256 channels in pulsed code modulation (PCM) systems. The n-channel MOS integrated circuit therefore consists of a 256 x 8 bit random access memory (RAM) and a 256 x 9 bit RAM plus control logic and interface circuits. The device is used in single units or in groups to re-arrange the order of PCM words within the transmission frame. Consequently, it is a non-blocking digital switch capable of connecting all 256 incoming channels to all outgoing channels in any desired order, although alternatively selected input channels may broadcast to any number of output channels. Input data can be either serial or parallel at a 2.048Mb/S rate.

The position of words can be changed, and therefore if any data can be divided into 8 bit words, their significance can also be changed, so the MS2002EXP becomes a simple protocol or format converter for computer systems or local area networks.

Features of the new DSM include a single 5V supply and TTL compatibility. It interfaces directly with the European standard CCITT 32 channel 2.048Mb/S format. The MS2002EXP is currently available in a 28 lead ceramic package, but plastic package and surface mounting units are planned.

Plessey Semiconductors Ltd, Cheney Manor, Swindon SN2 2QW.
Tel: (0793) 36251.

IF AMPLIFIER
A unique IF amplifier and detector circuit capable of meeting all cellular radio specifications is now available in volume from Plessey Semiconductors.

The SL6652 offers tremendous advantages in a single chip circuit, operating up to 100MHz with an integral crystal oscillator/mixer but with an extremely low current consumption (2mA max) from any supply voltage from 2.5V to 10V.

The sensitivity and signal to noise ratio are now 100% factory tested, and the conventional FM quadrature detector ensures that the circuit is easy to use in both development and production.

A special feature of the SL6652 is the RSSI output, which offers outstanding linearity and monotonicity irrespective of IF filter tones.

The SL6652 has already entered volume production and is available from stock at most Plessey distributors worldwide. A complete applications package is now available with printed circuit board layouts and test results.

Charles Barker Lyons Ltd, 30 Farringdon Street, London EC4A 4EA.

BASE STATION
The BS250 range of radio telephone base stations incorporate state-of-the-art technology. Full duplex continuously rated operation is offered on either AM or FM single or two aerial working. RF power is adjustable from 5 to 40 watts on AM and 5 to 150 watts on FM.

The BS250 is also Band III convertible in the event of changes in legislation. This means that today’s user is safe in the knowledge that the base station can be amortised over its long working life without very costly changes to its circuitry.

The BS250 is also ‘self-diagnostics’ on the TX front panel and able to measure the following: forward/reverse power, transmitter and receiver multipeaks, modulation depth, and receiver AGC and sensitivity. There is also a DC probe facility.

6 channel operation is standard but provision is made for an FGU input for quasi-synchronous operation, or an synthesised input for multi-channel operation. Remote selection of up to 6 channels is standard for a 4 wire circuit using the linking unit.

Neve RadioTelephones Ltd, 32 Caxton Way, Holywell Estate, Watford, Hertfordshire WD1 8UA.
Tel: (0923) 31034.
PRODUCT NEWS

KEYBOARDS
Quiltertech Ltd., manufacturers of the Posi-Key range of custom-built, tactile feel keypans, are now able to incorporate customised lighting within their designs.

This lighting is provided by an additional layer that is laminated into the keyboard construction directly below the top surface. A custom-designed inverter is provided allowing the light output to be altered by varying the dc voltage input about a predetermined nominal value (usually 5 or 12V dc). The inverter may be mounted either remotely or directly onto the keyboard, avoiding exposure of high voltage conductors.

It is possible to illuminate a number of areas of the same panel in different colours while other areas remain unlit.

In addition to the electro-luminescent facility, the Posi-Key keyboards offer embossing, textured finish, 'dead front' legends, display windows etc and are suitable for a wide variety of applications including marine navigational equipment, aircraft and military equipment.

Quiltertech Ltd., 85 Stanley Road, Bournemouth BH1 4SD. Tel: (0202) 303431.

CIRCUIT MAKER
Electrolube have introduced the CM100 Circuit Maker Kit which they claim is one of the first DIY kits on the market to offer a complete and easy-to-use system for producing printed circuit boards. It is ideal for the expert hobbyist or those wishing to try their hand at electronics.

This versatile kit enables hobbyists to produce layouts from magazines and other sources using an easy four-step system which is explained in a detailed set of step-by-step instructions. These steps include producing a film positive master of the chosen PCB design, etching of the board using photo-resist, removal of the photo-resist and finally drilling and component assembly.

Advantages of the CM100 kit include the photographic development system, which allows professional quality circuit boards to be produced without a darkroom, camera equipment or ultra violet lights, and the ease of use, which makes previous photographic experience unnecessary.

Electrolube now offers items from the CM100 Circuit Maker Kit separately, which will allow hobbyists to supplement their existing equipment and supplies. Included in this list of items is a specially designed universal assembly frame, which is useful for drilling and component assembly, developers, fixer and clearing solutions for the auto-positive film, photo-resist and developer, and double-sided copper clad boards.

A useful asset for electronics hobbyists, the CM100 Circuit Maker Kit is very adaptable and can be tailored to suit the needs and demands of various situations.

Electrolube Ltd, Blakes Road, Wargrave, Berkshire RG10. Tel: (073) 522 3014.

RESISTOR NETWORKS
Balzers has expanded its complete range of chip resistors and chip resistor networks.

Standard resistor arrays (SRA) are now available ex-stock, from the company and universal resistor arrays can be provided to customer specified values and tolerances.

In the SRA, chips with one resistor and four isolated resistors are available with 5K, 10K, 50K and 100K values, and the company has announced plans to add yet further values to the programme.

The SRA chip resistors have a guaranteed maximum TCR of ±25ppm/K between −55°C and +125°C. Maximum TCR tracking within one chip is 2ppm/K.

The guaranteed film stability unprotected in air for 1000 hours is better than 0.1 per cent for 125°C, while the absolute trim tolerance is ±0.25 per cent.

High frequency resistors (HFR) are also now available ex-stock for values of 100, 200 and 300 ohms with tolerances of ±15 per cent.

The HFR chip resistors have a TCR of −70ppm/K to −130ppm/K between −50°C and +150°C. Constructed on a 0.25mm thick MRC-B substrate, their dimensions are 1.27 x 1.27mm.

URA chip resistors and chip networks of up to 12 resistors are available in a range of 400 ohms to 200K ohms per resistor.

Balzers High Vacuum Ltd., Northbridge Road, Berkhamsted, Herts HP4 1EN. Tel: (04427) 2181.

UVIPROM PROGRAMMER
Available from Ground Control, to complement their Uvipac EPROM eraser, is a low cost EPROM programmer for the BBC microcomputer which will enable the experienced user to program 2764 and 27128 EPROMs. The software available enables an EPROM to be programmed from disc, sideways RAM (STL SWR compatible) or master EPROM.

The unit, called the Uvipro, is available in two versions initially. Uvipro 1 is the basic version consisting of an uncased PCB with a normal 28 pin IC socket. Uvipro 2 is also an uncased PCB but with a 28 pin Textool Econozip zero insertion force (ZIF) socket. The Uvipro 3 based version with ZIF socket should be available soon.

Uvipro plugs into the user port on the BBC microcomputer using a 20 way ribbon cable and socket, taking its power directly from the computer. It has a switch mode power supply for Vpp (21 volts nominal) voltage generation. Two switches with LED indicators are provided, one for powering down Uvipro to insert an EPROM, and one for Vpp on/off.

The easy to use 1.0 Uvipro software is available on side-waves ROM (EPROM) only and the following commands are available:

* TEST - blank check;
* READ (asf) - read EPROM to disc;
* BLOW (asf) - blow EPROM with named file;
* VIEW - look at contents of EPROM after read;
* COMP (asf) - compare contents of EPROM to source.

When using * BLOW, * VIEW and * COMP the screen displays the data in HEX and ASCII format, in full colour. EPROM data storage starts at $2000.

Retail prices are: Uvipro 1 - £29.95; Uvipro 2 - £25.95; Uvipro 3 - £29.95; Uvipro 1.0 ROM - £8.00. All prices are for the UK and include post-age and VAT.

Ground Control, Alfreda Avenue, Hulbridge, Hockley, Essex SS5 6LT. Tel: (0702) 230324.
PRODUCT NEWS

DIRECT VIEW COLOUR TUBE

Mitsubishi Electric Corporation have recently developed a 35 inch (diagonal) colour picture tube, the world's largest for home use direct-view colour television sets, and a 35 inch colour TV set using this new picture tube.

Based on its computer simulation technology for glass bulb designing and experience in developing a colour picture tube for a 40 inch high definition TV set, Mitsubishi Electric succeeded in solving various problems involved in the development of huge screens. The 35 inch square picture tube brings the excitement of large screen pictures which has so far been available only on projection TVs.

Mitsubishi Electric optimised the distribution of glass thickness of the tube with computer simulation to reduce its weight and facilitate mass production. The adoption of a 110 degree deflection angle resulted in the compactness of the colour set despite the huge size, which is 3.1 times as large as a 20 inch screen. The TV set is 56 centimetres (approximately 23 inches) deep and 91 centimetres (approximately 36 inches) wide. It has a new natural picture control circuit to ensure crisp, clean pictures.

Other features of the colour set include a multi-channel sound circuit, three systems of audio-visual input terminals for high quality videocassette and videodisc, playback and satellite broadcasting, and an RGB (red, green and blue) terminal for teletext or a personal computer.

Mitsubishi Electric Corporation,
2-3 Marunouchi 2-chome,
Chiyoda-Ku,
Tokyo,
100 Japan.

TVRO SYSTEM

Salora (UK) Ltd is now offering an earth station package to receive satellite transmissions on the 4 and 12GHz bands.

The system comprises a dish antenna of 1.8, 2.4, 3 or 5m diameter, a low noise converter, and a satellite video receiver. Also included is 30m of RF cable to connect the converter to the receiver.

The parabolic reflector surface is finished to resist atmospheric pollutants and salts, and is designed for maximum gain at 12GHz. It can, however, also be used at 4GHz.

The low noise converter employs GaAsFETs for optimum noise performance, and is precision manufactured in order to withstand all weather conditions.

The satellite video receiver accepts downconverted signals from 950 to 1750MHz. It employs threshold extension demodulation for excellent broadcast quality performance, with a 7.5dB carrier to noise threshold. The unit also has completely automatic frequency control and LED indication to facilitate spotting.

Salora have also launched their Digi-computer range of TVs. These sets employ an 8 bit micro-computer which enables many operational modes, eg changing the vision IF, to be programmed from the front of the set by using a particular password and appropriate programming instructions.

The all-band tuner allows reception of 100 channels, including the special channels reserved for satellite via cable transmissions. For reception of direct broadcast satellite transmissions you can have a satellite tuner/decoder installed.

Salora (UK) Ltd,
Techno Trading Estate,
Swindon,
Wiltshire SN2 6EZ.
Tel: (0793) 46321.

VIDEO DATA SHEET

Acron Video has published a comprehensive data sheet on the 401P and 402P series of PAL synchronising pulse generators, which include many features normally found only in full broadcast equipment but are offered at significantly lower prices.

Both the 401P and the 402P are available with a choice of three grades of crystal reference oscillator, having stabilities to suit differing applications.

Both types deliver the full set of PAL synchronising pulses and continuous subcarrier as well as colour-black outputs with programmable white pulse on Line-7 Field-1. Model 401P series generators operate only in the free-run mode using the internal crystal reference oscillator. Model 402P is similar to model 401P but can also operate in a genlocked slave mode to a master SPP or with soft genlock to a VTR.

The type of reference oscillator fitted is denoted by a suffix letter to the model number. The 'A' version of either model is equipped with an oven-stabilised crystal oscillator, and meets the PAL I requirements over a wide range of ambient temperatures.

The 'B' version contains a lower stability ovenned crystal oscillator than the 'A' version, and meets PAL I requirements over a limited range of temperatures. The 'C' version meets PAL I requirements in all respects except for subcarrier stability, but meets PAL B, G and H requirements in full over a limited temperature range.

The illustrated leaflet gives full technical specifications of all models, together with brief general descriptive information. It is available on request.

Acron Video,
Unit 3,
Lovellace Road,
Bracknell,
Berkshire RG12 4YT.
Tel: (0344) 55625.

OXLEY LEDs

The Oxley range of T14 LED indicators has received MOD approval to DEF STAN 59-61/80/018 and 026.

These wide viewing angle LED lamps are available in red, green and yellow in tinted and diffused epoxy encapsulation.

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Oxley Developments Co Ltd, Priorsy Park, Ulverston, Cumbria LA12 9GG.
Tel: (0229) 52621.

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VHF conference

The International Telecommunication Union's regional administrative radio conference to plan the use of the VHF sound broadcasting band (87.5 - 108 MHz) has now ended.

The background to the six week conference held in Geneva was that the major World Administrative Radio Conference in 1979 raised the upper limit of the band from 100 MHz to 108 MHz. This created considerable problems for the services at present occupying the band and, from the technical point of view, for co-ordination with the aviation services (instrument landing systems etc.) which lie in the next adjacent band.

The conference involved about 100 countries in Western and Eastern Europe (including the whole of the USSR) plus Iran and Afghanistan, and the whole of Africa. It has now established a broadcasting plan for the entire area. In the course of its work, over 54000 individual broadcasting assignments were taken into account.

The final acts of the conference, which were signed at the end of last week, will come into force on 1 July 1987. Stations may be brought into use, as at present, subject to any constraints identified in the plan which form part of the agreement. There are, for example, other services still legitimately using the band on a temporary basis, so that it will not be for some years after July 1987 that all the frequencies will become available. The conference also created procedures to allow for modifications to the plan, and for the introduction by agreement of some assignments before the final acts come into force.

The United Kingdom's delegation was led by officials from the Department of Trade and Industry's Radio Regulatory Division, and included representatives from the Home Office Broadcasting Department, the BBC, the IBA and the Civil Aviation Authority.

The United Kingdom's objectives for the conference were:

a) to secure a further two national VHF networks, one to enable BBC Radio 1 and Radio 2 to have separate networks, and the other for the introduction of a new independent national radio service;

b) the provision of additional frequencies for the development of BBC and independent local radio;

c) the maintenance of the existing VHF networks and improvements to their coverage.

In the event, the plan which the United Kingdom took to the conference required only very minor modifications, with the result that the United Kingdom's aims have been fully met. In addition, the UK had to safeguard the position of land mobile services at present still operating in various parts of the band, and a Protocol of Agreement with our neighbours was negotiated.

The plan thus establishes the regulatory framework within which present and future VHF sound broadcasting in the United Kingdom can be developed.

Cellular portable telephone

The only portable cellular telephone in the UK to have passed the BABT test by early January was Motorola's 8000X, the top model in their cellular telephony family, which is both a portable and mobile unit. Motorola are awaiting written confirmation of approval.

Motorola is now the only company to have received the official thumbs-up for its complete range of cellular equipment designed specifically for the UK Ceilnet system.

One of the world's most experienced single-source cellular communications specialists, Motorola have invested over $100 million and some 1,000 man years of engineering time to develop a totally integrated hand-held radio telephone system. A complete UK turn-key cellular project, worth in the first phase over £20 million, is already well under way. This will expand to include all of the infrastructure equipment installation for the TSCR Ceilnet system.

Combining both a portable and mobile telephone in one compact package, the 8000 series represents the state-of-the-art in personal communications.

It is lightweight, takes up little room, and can be mounted as an in-car phone or simply popped into a briefcase for use anywhere covered by the cellular telephone system infrastructure and at any time.

User programmable functions provide features which can be uniquely controlled from the keypad. These include outward call restrictions which only allow specific types of call to be placed, security codes, automatic locking, silent ring and silent keypad functions.

For further information contact Motorola Ltd, Communications Group, Jays Close, Viables Industrial Estate, Basingstoke, Hampshire. Tel: (0256) 58211.

Another company to enter the cellular radiophone market is Marconi Mobile Radio, a division of Marconi Communication Systems Limited of Chelmsford, which has launched its range of 'Marconiphone' products following the recent announcement of its acceptance as an accredited Cellnet retailer.

The new 'Marconiphone' cellular products include a choice of two vehicle mounted sets and a modern cordless personal radiophone with battery charging facilities.

The new equipment meets all the demands of modern cellular radiophones including a wide range of standard telephone facilities with ease of operation. An electronic memory stores 30 most often called numbers, provides a hand-free dialling function.
to handle over 100 car
Wembley centre will be able
options to follow.

Conference and a call direct on Wednesday Market, Marconi are further expanding their national Radiophone Sales and Service Centres, particularly in London where their new Wembley centre will be able to handle over 100 car installations a week.

BBC closes transmitters

A milestone in the history of British broadcasting was reached in January when all of the remaining BBC 405-line transmitters were switched off.

When the 405-line service started in 1936, it was described as 'the world's first regular public service of high-definition television programmes'. The number of viewers had been dwindling since the introduction of the duplicate 625-line ultra-high frequency (UHF) colour service in 1969.

The closure comes as the result of an announcement by the Home Secretary in 1983 that the frequencies used by the 405-line transmitters should be released by the broadcasters for mobile radio communication. The close-down of the last transmitter, at Melvaig in West Scotland, was carried out by Syd Garroch, the local transmitter manager. In its hey-day, the 405-line network comprised one hundred and seven transmitters.

A new formal opening by the Postmaster General, Major G C Tryon, on 2nd November 1936, the service grew in popularity when the BBC screened the first major outside broadcast in May 1937, the Coronation of King George VI. Over 23,000 receivers were in use in September 1939 when the Alexandra Palace transmitter was closed for the war years. The service re-opened after the war in 1946, screening the Victory Parade on 8th June. Television spread throughout the UK with stations at Sutton Coldfield serving Birmingham and the Midlands opening in 1949, Holme Moss serving Yorkshire and Lancashire in 1951, and Kirk O'Shotts and Wenvoe serving parts of Scotland and Wales in 1952. The London transmitter moved to Crystal Palace in 1956 to provide a better signal to London and the Home Counties.

Commenting on the closures, Bill Mitchell, the BBC's Assistant Chief Engineer, Transmitters, said: The end of the first chapter of television broadcasting is a sad day for us. However, the 405-line service has been duplicated on 625-lines for many years now, so it is appropriate that these old transmitters should be switched off.

British Telecom Shop

The first new-style British Telecom shop opened in Southend High Street on 3 January.

It sells a wide range of telephones, business equipment and telephone accessories. Customers will also be able to pay their telephone bills at the shop and make general enquiries about British Telecom's services.

The new shop represents a major extension of British Telecom's retailing activities. It forms part of a trial of competitive retail outlets in high street sites.

Two more British Telecom shops will be opening in the spring - in Newcastle and Plymouth - and it is hoped that popular British Telecom will be looking for further sites around the country.

Compared to these new shops, British Telecom's chain of Post Offices have limited operations, mostly sited within department stores or telephone area offices.

The range of phones available for sale are not restricted to the British Telecom 'Inphone' range. British Telecom are also selling phones from several independent suppliers. Customers can try out equipment before they buy.

Overwhelming response

The launch of Grand Metropolitan's £1 million Innovation Development Centre at Surbiton Research Park (see News Desk, December 1984) has brought hundreds of queries from innovators all over Britain, underlining the company's belief that the creation of a technology transfer unit with a strong commercial orientation would fill a very clear gap in the existing innovation development market.

Applications already received for the sixteen units at the Innovation Development Centre, which will be ready for occupation in March 1985, cover a wide range of technologies, notably in the field of physics and electronics, fuel conservation, computer software and data retrieval systems, plastics, energy, security and even catering.

Dr George Christies, Managing Director of Grand Metropolitan Biotechnology Ltd, describes the response as 'overwhelming'.

'The most encouraging part of the response is not just the quantity of the enquiries, but the very high overall standard of the innovations which have been submitted,' he says.

New Chairman

Mr PA McDonald of Thorn EMI Electronics has been elected chairman of the Wideband Cable Systems Committee of the Electronic Engineering Association. This influential new committee has been set up to ensure that UK industry plays an active role in determining the technical specifications for the new generation of interactive cable networks.

Manager of the London office of the company's Dis-\n""
STereo Tuners PCBs. Fully tested and complete. Only needs a 12 volt supply. After a stock check we find that we have just 480 of these tuners that not only cover 88 - 108MHz in stereo but also cover MW and LW. Supplied complete with a circuit and component placement diagram, these units lend themselves to modification to Top Band or, maybe retune the FM section to 137MHz for a budget Weather Satellite monitor. Better still give the girlfriend one in the kitchen. These have got to go, we're just fed up with falling over the boxes.

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The radio frequency spectrum is a natural resource. It has been there since the beginning of time, but it is only in the last 100 years or so that man has been making use of it. Ever wondered what the short wave or amateur bands must have sounded like at the time of the battle of Hastings? Apart from the odd burst of solar noise, pretty quiet I would have thought!

Spectrum Watch takes a look at what is currently happening in different parts of the radio spectrum, from the lowest frequencies to the highest.

**VLF**

The lowest commonly used part of the radio spectrum is the VLF band, which runs upwards from around 15KHz and where there are a number of standard frequency and time signal stations. One of the most famous VLF stations is GBR at Rugby, transmitting on 16KHz with a transmitter power of 750KW and a radiated power of about 60KW. Antennae at these low frequencies are very inefficient. The wavelength corresponding to 16KHz is 18.75Km (11.7 miles).

At 60KHz and with 50KW there is the UK’s National Physical Laboratory time signal service, which gives time of day and calendar information in BCD. At 66.66KHz there is a Russian standard frequency station, RBU.

**LW and MW**

The frequencies that lie between the long wave and medium wave broadcast bands are used for many different purposes, including aircraft beacons (NDBs: non-directional beacons) and coastal navigation beacons as well as the LF marine CW band (400-512KHz).

Navigational beacons at these frequencies consist of a small transmitter which is automatically keyed to send its callsign in a regular sequence. The marine radio beacon at Cap Gris Nez, for example, sends the letters 'GN' on a frequency of 310.3KHz.

In the Channel area there are several networks of radio beacons operating in synchronism on the same frequency. Each beacon transmits for just one minute. The next beacon at a different location will automatically transmit during the following minute, and so on right through the network. The network of which the Cap Gris Nez beacon forms a part consists of six beacons. Because they all operate in synchronism on the same frequency, yachtsmen and other navigators can take several radio fixes on their position by monitoring just one frequency.

**Short waves**

The 1979 WARC, as well as opening the door to three new HF bands for radio amateurs, also set the ground for some changes in the short wave broadcast bands. A new 22 metre band is to be opened at 13800-13800KHz (just below the 20m amateur band) and most of the existing SW broadcast bands (31m, 25m, 19m, 15m and 13m) were expanded. The highest frequency SW broadcast band at 11m was slightly trimmed by 70KHz from 25600-26100KHz to 25670-26100KHz.

Although the 22m broadcast band is not due to come into service for some years, several major international broadcasters have been reported using frequencies in the new band. Radio Moscow on 13600KHz, Radio Korea on 13665KHz and Iran on 13745KHz have all been monitored already.

A future ITU conference on HF broadcasting is now in preparation. At this conference numerous short wave broadcast allocations will be reviewed and discussed by delegates from international broadcasting authorities.

**VHF and UHF**

In the UK it is the VHF and UHF ranges that are currently undergoing the greatest changes. As reported in detail in the November ’84 issue of *RAEW*, two new mobile radio services have just come into operation. Cellnet, one of the two competing consortia, switched on some
of their London area cells on January 9th. Racal-Vodafone pipped their competition at the post by switching on their first cells in the early hours of January 1st, 1985.

A stipulation of the government-issued operating licence is that they are each operational by March 1985 and that they must provide a 96% coverage of the population by the end of the decade.

Although initially operating around the capital, the two cellular radio services will spread rapidly to cover most of the populated areas of the country in the next two years. Both consortia will also be covering the main interconnecting motorways.

The frequencies used for the two new cellular services are high in the UHF band. Mobiles will be transmitting in the range 890-915MHz and base stations in the range 935-960MHz. The frequencies are considerably higher than others that have been in common use for mobile radio services in the UK.

Optimistic market predictions have been made to show that there could be up to 500,000 cellular radio users by the end of the decade. Even if only half this figure is achieved it would still represent a very significant increase in the number of land mobile radio service users in the UK. But it is not only up at the top end of the UHF band that land mobile services are looking for large market growth. Back down at VHF there are important spectral changes taking place as well.

**VHF: all change!**

The most significant spectral change in the UK for many years has been the recent closedown of the VHF Bands I and III TV transmitters. This has liberated over 70MHz of prime spectrum for civil users. The land mobile radio services will be getting the lion's share of these newly found frequencies.

TV Band I covered 41-68MHz, and Band III 174-225MHz. In broad terms, all of Band III will be used for new VHF mobile radio services. Final decisions on the use of Band I have not yet been made known, but radio amateurs are hopeful for the rebirth of the six metre band in the range 50-54MHz.

The November *R&E W* article explained how it was proposed to split Band III into three sets of paired mobile/base station bands and to use the intervening frequencies for other services. Not all the frequencies within Band III in the UK can be used for mobile radio services because of the interference that will be caused by overseas TV transmitters. Continental TV transmitters will continue to operate in Band III for many years to come.

In particular in southern England it is the transmitters of France's newly opened Canal Plus TV (as described in January's *R&E W*) that are likely to cause the most interference to mobile radio

![Suggested allocations for radio-microphones within Band III](image)
services in Band III. The proposed band-planning for the re-use of Band III has therefore avoided the vision carrier frequencies of Canal Plus. These frequencies will be allocated to services that would not be so susceptible to interference from overseas TV transmitters.

Ancillaries uncovered!

Although the BBC and IBA are probably pleased at no longer having to maintain ageing Band I and Band III transmitters in service, the closedown of these TV transmitters has presented the broadcasters with another type of frequency problem.

As well as needing frequencies for transmitting high power signals from TV transmitter stations, broadcasters also need to have frequencies available for a whole range of equally important but much less obvious uses. These are called broadcast ancillary services, and include radio-microphones in studios and on location, radio links from OB vans to control centres, radio talk-back facilities in studios and on sites, and reverse programme feeds that allow people on location or in studios to monitor the transmitted signal.

As well as all these, broadcasters also need frequencies on which they can relay programme quality sound and vision for feeding from a remote location into a control room and hence into the transmitter network.

Quiet frequencies

For many years broadcasters have been able to hide many of these ancillaries in amongst the TV transmitter frequencies themselves. By carefully selecting ‘quiet’ TV transmitter frequencies in one part of the country, broadcasters were able to have access to an adequate number of ‘discreet’ frequencies for their own uses.

Now that the VHF Band I and III transmitters have been closed down, and since these frequencies are to be re-allocated to other services, the broadcasters have lost their ‘cover’ at VHF! They will still be able to use the same techniques in amongst the UHF TV channels, but since Channel 4 has now spread to most of the UK, there are less and less ‘quiet’ frequencies to be found there too.

So the broadcasters, having just given up a very large and important piece of radio spectrum to other services, are now having to fight to obtain sufficient frequency allocations for their own ancillary service needs!

Joint study

In order to find a solution to the impending problems that UK broadcasters would have in locating their ancillary services after the closedown of the Bands I and III TV transmitters, a joint study group made up of representatives of the DTI, the BBC and the IBA was set up to look into the whole question of broadcast ancillary services in the frequency range 30-960MHz. An interim report of the study group was published late in 1984, and makes firm proposals for frequency allocations for broadcast ancillary services.

The report recommends that 4MHz in Band I and 4.2MHz in Band III be set aside for broadcaster’s radio-microphones. The report also recommends that the present radio-microphone band at 173.6-175MHz becomes a general user radio-microphone band and that the broadcasters should vacate it. The 4MHz of bandwidth in Band I is being proposed by the broadcasters is the range 60-64MHz.

The study group had been looking into the specific needs of broadcasters, but broadcasters are not the only users of radio-microphones. Radio-microphones are now used more and more frequently in theatres.

Radio-mic: QRM!

Theatres have radio-microphone problems too! This was dramatically illustrated by the well publicised fiasco on the opening night of the show ‘Starlight Express’, which relies heavily on the use of radio-microphones. Although the twenty or so radio-microphone channels could be made to work with each other, the real problem started when an OB unit drew up outside the theatre and set up its radio links. Several of the radio-microphone channels were made totally useless by ‘breakthrough’ from the OB channels.

Following this embarrassing incident the Association of British Theatre Technicians (ABTT) has put a set of proposals of its own to the DTI, suggesting that fixed location low power radio-microphone users such as theatres be given their own exclusive frequency allocations. The 8MHz of bandwidth that the ABTT proposes is made up of 7 segments within Band III. Each segment corresponds to one of the guard-bands that have been put around the vision carrier frequencies of the French TV transmitters.

Both the broadcasters and the theatres are proposing the use for radio-microphones of frequencies within Band III which would otherwise be unusable for mobile radio services. However, many other suggestions have been made to the DTI for these otherwise ‘crummy’
frequencies, and it seems unlikely that both proposals for exclusive radio-
microphone allocations would be
acception in their entirety. Alternative
accommodation may have to be found
elsewhere in the spectrum for radio-
microphone users.

VHF FM Band II

While Bands I and III are being closed
down for TV broadcasting, the FM
broadcast Band II at 87.5-104MHz is due
to be extended up to 108MHz. In the UK,
the other services that are currently
located in Band II such as the Police, and
services which are currently at the edge
of Band II such as the nationalised
industries (coal, gas and electricity), will
all have to be 'rehoused' elsewhere
within the spectrum. This will leave Band
II in the UK as an exclusive sound
broadcast allocation.

An important part of the planning of the
newly expanded Band II on an internatio-
inal level has been the ITU regional
administrative radio conference, which
was held in Geneva over six weeks at the
end of 1984.

At that conference over 54000 indivi-
dual broadcasting assignments were
taken into account. The UK's objectives
at the conference included securing a
further two national VHF FM broadcast
networks. One is to enable Radios 1 and 2
to have separate networks, and the other
is for the introduction of a new indepen-
dent radio service.

The Final Acts of the RARC will come
into force on July 1st 1987. Not all
frequencies will become immediately
available at that date, as other services
will still be in the process of transferring
to other allocations.

Satellites galore!

Up on the satellite frequencies there is
plenty of activity too! Two new television
channels have recently come on the air
through satellites.

The new 3SAT channel, which is a
German language co-operative venture
between the broadcasting authorities in
Germany, Switzerland and Austria, came
on the air in December. It is working
through the East Spot beam on the ECS-1
satellite.

Another German language TV channel
with a confusingly similar name, SAT 1,
has also started transmissions through
the West Spot beam on the same
satellite.

Since both these TV channels are
carried through communications satel-
lites (rather than through the yet to be
launched Direct Broadcast Satellites,
which will be more powerful), they can
only be received by installations with a
relatively large dish antenna.

Largest antenna ever?

The Electronics Group News of the IEE
reports a claim for what must be
electrically the largest radio antenna
ever built. It is a 15 metre diameter
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frequencies up to 750GHz (yes, GHz not
MHz!). The electrical diameter of the
antenna is 37500 wavelengths! Scaled
down to the 2m amateur band this would
be an antenna with a diameter of over
78Km (48 miles)!

This 750GHz antenna is part of a radio-
telescope that has been designed by the
Rutherford Appleton Laboratory with the
help of British and Dutch university
groups. The radio-telescope will be
located on the 14000ft Mauna Kea
mountain in Hawaii, where a number of
other radio-telescopes are already
operating.

Reference

Interim Report of the study of the
requirements for a revised broadcast
ancillary radio frequency allocation
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RUSSIAN SATELLITES

A guide to the reception and decoding of VHF signals from the USSR’s navigation satellites:

PART THREE: The computing of the received data transmissions

5. COMPUTER OPERATIONS

5.1 General
For all computer operations involved in processing satellite data, the necessary hardware consists of a minicomputer with VDU display, a dual disk drive and printer. All software for the various processing operations is written in either BASIC or machine code (when the high level language cannot provide sufficient speed).

5.2 Data logging
Two separate programs in data logging of the serial data stream from the signal conditioner are employed.

The first, 'RUNNER' (in BASIC), requests inputs from the user concerning the logging format, and also directs the data onto the floppy disk drive unit.

The second, 'SATDATA', is a machine code program called by RUNNER, and performs the serial to parallel conversion and storage in memory of the incoming data.

5.2.1 The RUNNER program
The reader is referred to Figure 4(a) for a flow chart of the RUNNER program. This program first displays a message to the user as a reminder to load the program SATDATA into memory, and also ensures that the top of the memory pointers are set to free memory space for data storage. Three pieces of information are requested of the user:

1. the length (in bytes) of files to be logged;
2. the minimum file number for disk storage;
3. the delay time required before logging commences.

The default option for length is the maximum (1791 bytes). The program proceeds to call the machine code routine which logs data until the memory is full. Program control returns to RUNNER which transfers stored data to disk and returns to collect more data unless instructed otherwise.

5.2.2 The SATDATA program
The flow chart for the SATDATA routine - see Figure 4(b) - breaks down into two main streams:

1. false sync/start sync detect
2. data logging and storage
3. the delay timer required before logging commences
4. the sync line continues to be sampled until the start of a valid sync pulse occurs. A delay of 10mS is then executed as to bring the sampling point to the exact centre of the next bit.
5. if, then, the sync pulse is still present, the data is assumed to be valid and further sampling at 20mS intervals takes place until the end of the particular word. Otherwise, the program loops until a valid sync pulse occurs.

Throughout the data logging (serial to parallel conversion), the two 8-bit registers, X and Y, of the 6502 microprocessor are used as follows:

1. X register: the number of bytes to...
RUSSIAN SATELLITES

log counter;
(2) Y register: the number of bits per byte counter.

The time of reception in hours, minutes and seconds occupies three 6-bit bytes, while the data takes up four 8-bit bytes. The data is logged and then stored on a byte-to-byte basis using the sub-routine store-in-memory.

This sub-routine stores the byte in the allocated memory space and checks for the last byte in the current second. If the check is positive a variable character is displayed on the screen to indicate ‘logging in process’.

The memory pointers are updated and an end-of-file check made, which is followed by a return to the main program if the answer is ‘yes’. Otherwise, logging continues.

After each second of data, a null byte is stored to enable the logged data to be examined in hexadecimal format within the system memory.

An example of such a display is given in Figure 4 commencing at time 01:28:00 and ending at 01:28:59. The interested reader can confirm that the satellite identification sequence is 5, 6, 7 and 8.

5.3 Processing stored data
Data stored on the floppy disk drive can be processed in binary (intermediate) or decimal format.

5.3.1 Binary listing
A BASIC program, ‘BINARY LIST’, allows the inspection of logged data files in binary format – see Figure 1(a) – before conversion. Display can be directed to screen and/or line printer and the user only has to specify certain options available to him.

5.3.2 Processed output
Two programs, ‘PROCESS’ and ‘FORMAT’, load the stored data file into computer memory and convert the binary data into decimal quantities according to the format description already given under section 2.

The result of the conversion of the binary data shown in Figure 1(a) is given in Figure 1(b).

In the case of incorrect decoding of the time, particularly the second count, the computer is instructed to print a dummy character and also to maintain its own internal timing reference.

This is extremely important since it often arises that data is spoiled by sudden bursts of interference which would otherwise cause incorrect decoding of a complete sequence of data.

5.4 System test routines
Two test routines have been developed to provide a means of testing both the hardware and software used in the complete receiving system. Their purpose is to simulate a satellite transmission, to be used in one of two ways:

(1) to create a magnetic tape of the test transmission for playback through the system;
(2) to interface the test signal with the sync/decoder input and thereby test the receive chain from the point onwards.

5.4.1 Test tape BASIC
This program initialises the versatile interface adaptor (VIA) and memory allocated to data for transmission.

Following a start time request data is added to the memory as hexadecimal AA or 55 for alternate seconds. The first and last two seconds of the frame are set to zero to conform to the real data pattern.

The flow chart for this program is shown in Figure 4(d).

5.4.2 Test tape m/c
The machine code test program is called as a sub-routine from the test tape BASIC program, and performs the actual parallel to serial tone conversion of the test data – see Figure 4(e) for the flow chart.

The scratch working areas and memory pointers are initialised each time the routine is called, and the VIA is set to produce a 7KHz tone output.
The program now transmits the time as three 6-bit bytes and two sub-routines, called 'GETBYTE' and 'TXBYTE' as described in the next sub-section.

If no break is detected, the program will begin to command the transmission of data as four 6-bit bytes. Again the two sub-routines GETBYTE and TXBYTE are called and the program loops to the next second of data.

### 5.4.3 Sub-routines in test programs

The GETBYTE sub-routine fetches bytes of data from memory and updates the memory pointers. Checks are also made for valid data, and 60 words (one minute) of data are transferred before control is passed back to test tape BASIC.

The TXBYTE sub-routine performs the actual changing of the data tone frequency. Each time the routine is called, a delay of 20ms is executed. The logic is such that the tone is only changed if the binary information changes. The sub-routine terminates after the last bit in the byte has been transmitted.

The flow chart for both the above sub-routines is given in Figure 4(e).

### 6. ORBIT PREDICTION

Future-orbit prediction is very important in enabling the observer to plan reception and measurement over longer intervals of time. The essential data needed to predict equator crossing...
times and longitudes is contained in the parameter block.

6.1 Equator crossing time
The time of equator crossing for any number of orbits after a reference orbit is simply obtained by adding the appropriate multiple of the orbital period to the time of the ascending node.

6.2 Equator crossing longitude
As with equator crossing time, a multiple of the change in longitude per orbital period is to be added to the current value of equator crossing longitude (ascending or descending node).

However, the situation is more complicated because the rate of change of longitude with time is made up of three contributions:
(i) the rotation of the earth on its axis;
(ii) the rotation of the earth around the sun;
(iii) the rotation of the plane of the satellite orbit owing to the fact that the earth is an oblate spheroid rather than a perfect sphere.

The sum of the three contributions, \( \Omega \), amounts to:
\[
\Omega = \omega \cos \epsilon + \omega \sin \epsilon \sin I + \omega \sin \epsilon \cos I
\]

where \( \omega \) is the contribution from (iii) and depends on the orbital inclination, eccentricity and semi-major axis. It is tabulated in Table 3 with the most important parameters of the Keplerian orbit of the Cosmos navigation satellites.

6.3 Accuracy of prediction
Figures obtained at intervals of two months indicate that predictions based on the above calculations remain accurate to within seconds (equator crossing time) and fractions of a degree (equator crossing longitude). It is certainly possible to use one set of figures to prepare look-alert data usable over periods of several months or longer.

7. TRANSMISSION FREQUENCIES
As one of the navigation satellites passes the observer, the maximum Doppler shift on the transmitted centre frequency reaches approximately 3.5 KHz as the satellite appears on the horizon above.

Obviously Doppler frequency changes depend on satellite elevation as seen from the observer, and are zero at the time of closest approach (TCA).

Measurements of received frequency at regular intervals (30 seconds) during a pass result in frequency plots as shown in Figure 5, which are symmetrical about a point of inflexion where the Doppler frequency is zero. The received frequency at this point is identical to the transmit frequency.

Results indicate that the satellites use transmit frequency spacings of 30 KHz around 150000 KHz as shown in Table 4.

Table 3
Orbital parameters of the USSR Cosmos navigation satellites using the VHF frequency band for data transmission

<table>
<thead>
<tr>
<th>ID</th>
<th>W long</th>
<th>incl</th>
<th>slm</th>
<th>period</th>
<th>date</th>
<th>asc.node</th>
<th>e(c)</th>
<th>( \omega )</th>
<th>Cosmo. no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>101.22</td>
<td>82.96</td>
<td>7367.11</td>
<td>104.8148</td>
<td>Aug 17</td>
<td>20:37:15.9</td>
<td>0.0018</td>
<td>-0.7364</td>
<td>1448 83-23A</td>
</tr>
<tr>
<td>02</td>
<td>106.70</td>
<td>82.97</td>
<td>7365.29</td>
<td>104.7765</td>
<td>Aug 17</td>
<td>23:15:02.3</td>
<td>0.0027</td>
<td>-0.7364</td>
<td>1368 82-69A</td>
</tr>
<tr>
<td>03</td>
<td>77.72</td>
<td>82.92</td>
<td>7363.57</td>
<td>104.7356</td>
<td>Aug 17</td>
<td>23:01:58.1</td>
<td>0.0046</td>
<td>-0.7425</td>
<td>1428 83-01A</td>
</tr>
<tr>
<td>04</td>
<td>101.31</td>
<td>82.98</td>
<td>7365.24</td>
<td>104.7721</td>
<td>Aug 17</td>
<td>02:48:34.8</td>
<td>0.0059</td>
<td>-0.7357</td>
<td>1459 83-42A</td>
</tr>
<tr>
<td>05</td>
<td>71.56</td>
<td>82.95</td>
<td>7372.15</td>
<td>104.9210</td>
<td>Aug 17</td>
<td>02:52:16.5</td>
<td>0.0042</td>
<td>-0.7362</td>
<td>1464 83-48A</td>
</tr>
<tr>
<td>06</td>
<td>73.00</td>
<td>82.98</td>
<td>7369.37</td>
<td>104.8645</td>
<td>Aug 17</td>
<td>05:03:22.6</td>
<td>0.0035</td>
<td>-0.7344</td>
<td>1417 82-102A</td>
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<tr>
<td>07+</td>
<td>145.44</td>
<td>82.95</td>
<td>7376.46</td>
<td>105.0153</td>
<td>Jul 06</td>
<td>08:39:34.0</td>
<td>0.0020</td>
<td>-0.7348</td>
<td>1333 82-03A</td>
</tr>
<tr>
<td>08+</td>
<td>289.35</td>
<td>82.95</td>
<td>7373.62</td>
<td>104.9644</td>
<td>Aug 17</td>
<td>18:03:54.3</td>
<td>0.0033</td>
<td>-0.7356</td>
<td>1181 80-39A</td>
</tr>
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<td>11</td>
<td>87.98</td>
<td>82.94</td>
<td>7392.36</td>
<td>105.2560</td>
<td>Aug 24</td>
<td>08:21:17.0</td>
<td>0.0026</td>
<td>-0.7302</td>
<td>1393 82-66A</td>
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<tr>
<td>12</td>
<td>78.39</td>
<td>82.94</td>
<td>7327.77</td>
<td>103.9750</td>
<td>Aug 24</td>
<td>09:47:13.2</td>
<td>0.0058</td>
<td>-0.7527</td>
<td>1304 81-87A</td>
</tr>
<tr>
<td>13</td>
<td>108.34</td>
<td>82.95</td>
<td>7370.23</td>
<td>104.8822</td>
<td>Aug 24</td>
<td>15:28:35.8</td>
<td>0.0027</td>
<td>-0.7369</td>
<td>1447 83-21A</td>
</tr>
<tr>
<td>14</td>
<td>2.06</td>
<td>82.91</td>
<td>7368.72</td>
<td>104.8059</td>
<td>Aug 24</td>
<td>11:14:06.8</td>
<td>0.0039</td>
<td>-0.7419</td>
<td>1339 82-12A</td>
</tr>
</tbody>
</table>

The asterisk * indicates that this satellite is not always referred to in the outputs of others in the group and also that its own data is not updated as regularly as the others. Note the figures given refer to 1983.

Table 4
 Identification number
Transmit frequency (KHz)  
149910 | 2
149940 | 3 6 7
149970 | 1 4
150000 | 11 12 13 14
150030 | 5

The satellite with identification number 8 is (March '84) inactive.

Fig 5 Doppler frequency plot for Cosmos navigation satellite

References
1 Wood C D, Perry G; The Russian satellite navigation system, Phil. Trans. R.Soc.Lond. A 294,307-315 (1980)
2 Stansell T A; The Transit navigation satellite system, Magnavoix Advanced Products Division, Torrance CA, USA.

Please mention RADIO & ELECTRONICS WORLD when replying to any advertisement

MARCH 1985
Compiled by Arthur C Gee G2UK

One is inclined to forget these days that amateur radio, with its 'black boxes' and 'chatter' on the bands, has contributed very greatly in the past—and still does, though perhaps in a lesser degree—to what one can call 'community service'. This was very well illustrated by the work done during the last war in the various specialties of radio communication, which are only now coming to light.

Quite apart from the large number of radio amateurs who were drafted into the services at the outbreak of hostilities, thus providing a ready trained core of radio technicians and operators upon which the great increasing importance of radio communications was rapidly built up, there were numbers who went into highly specialised and at the time very secret radio activities.

Secret warfare
A most interesting account of some of these activities has recently been produced in this country by the translation of 'Secret Warfare', first produced in French, which describes in detail how the French Resistance maintained contact with intelligence in England. Written by Pierre Lorain F2WI and translated into English by David Kahn, the first part of the book describes in detail the procedures taken to avoid detection of the radio systems used and the painstaking processes followed by German operators to locate a clandestine transmitter. The various codes and ciphers used, such as Delastelle and Playfair, are described and the difficulties they set for codebreakers are outlined. The second part of the book deals with how the French Resistance was supplied with equipment and personnel by Britain's Special Operations Executive and makes fascinating reading.

The book solved a mystery for your scribe which had been puzzling him for years. Just after the end of the war it was said that there had been a small steam driven electric generator, which was used for charging radio batteries in 'out of the way places'. This was even said to be available on the war-surplus market, but your scribe never saw one or heard of anyone who had ever seen one.

However, in this book mention is made of a generator. Under the heading 'Battery Chargers' appears a description of one described as a 'steam recharger'. To quote: 'This was the most amazing of all. It consisted of a boiler suspended over a brazier and attached by a flexible tube to a small 2 cylinder steam engine. The engine was coupled to a generator. The total weight did not exceed 70 pounds. With steam pressure at 70 pounds per square inch, an hourly consumption of 2 quarts of water and 10 to 20 pounds of wood, a 6 volt battery could be charged to 4 amps.'

This recharger was used frequently in the Indo-Chinese and Burmese jungles in 1945 by Force 136. In this way a group of saboteurs could remain isolated from all civilization for several months, but still maintain a permanent radio link as long as they had some dry wood'.

Coincidence
Now, would you believe it, recently a pile of old magazines came the way of your scribe. Amongst them were several copies of a magazine called 'Mechanics'. It appeared weekly in the 1940s—price 4d 'old pen cile! The copies which came into your scribe's hands were for the year 1947 and in the copy for 30 May there appeared a description of a 'Steam driven electric generator', used for clandestine radio operations during the war. There was even an advertisement for them, war-surplus from 'Marble Arch Motor Supplies'!

It appeared to be something improved model from the battery charger mentioned above, and it was described as being 'for dropping by parachute to troops stationed in forests during an AFhe war'. It consisted of a twin cylinder steam engine directly coupled to a 'standard wireless service dynamo rated at 6 to 8 volts, 4 amps.'

The advert photo showed an engine which resembles the present day 'Sirius' engine made by Stuart Turner Ltd of Henley-on-Thames, being steam driven at high speed with sump lubrication. The boiler was a simple pot type mounted in a casing which served the purpose of a furnace. Filling the boiler was accomplished by removing a flanged lid in 'out of the way places'. This was even said to be available on the war-surplus market, but your scribe never saw one or heard of anyone who had ever seen one.

However, in this book mention is made of this generator. Under the heading 'Battery Chargers' appears a description of one described as a 'steam recharger'.

To quote: 'This was the most amazing of all. It consisted of a boiler suspended over a brazier and attached by a flexible tube to a small 2 cylinder steam engine. The engine was coupled to a generator. The total weight did not exceed 70 pounds. With steam pressure at 70 pounds per square inch, an hourly consumption of 2 quarts of water and 10 to 20 pounds of wood, a 6 volt battery could be charged to 4 amps.'

This recharger was used frequently in the Indo-Chinese and Burmese jungles in 1945 by Force 136. In this way a group of saboteurs could remain isolated from all civilization for several months, but still maintain a permanent radio link as long as they had some dry wood'.
Amateur Radio World

Amateur Radio Union can now be awarded for two-way facsimile QSOs. A3C, F3C or J3C communication with all six continents will entitle the operator to claim this award and contacts of any date, past or future, are valid.

The High Speed Club

This club, which was founded in 1951, is for those who can use Morse code at a speed of twenty-five words per minute or more. Members must be able to send and read this speed perfectly. Application for membership is made by arranging several CW contacts with other club members and if you appear to qualify getting one of them to recommend you for HSC membership. Two-way CW QSOs lasting at least thirty minutes must be made for the test QSOs.

When you have obtained five such recommendations you forward them to the secretary of the club with your application, which must state that you did not use a keyboard, decoder or computer during the test QSOs. The membership fee is £5.00 or $8.00. The club station, DL0HSC, transmits an 'HSC-Bulletin' on the first Saturday of each month on 7025KHz at 1500 hours GMT. It gives information about club activities, new members and so on.

This club is not to be confused with another High Speed Club known as 'HSC E'. This society was founded and registered as a club in 1979 and persists in calling itself 'HSC'. It apparently tried to enforce its claim to this title by taking several lawsuits against members of the original 'HSC'. Judgement in these lawsuits, however, went against them in favour of the earlier club.

Further details can be obtained from the secretary, Ernst Manske DL1PM, at Anagarstr, 14 D2105, Seevetal 11, West Germany.

Radio amateurs' examination

'How to Pass the Radio Amateurs' Examination' is now available from the RSGB HQ. It is a new publication written by George Benlow G3HB, who is the author of the 'Radio Amateur's Examination Manual'. It is a must for anyone taking the RAE.

Shuttle mission 51-F

Latest news is that two radio amateurs will be on board the shuttle mission 51-F, due to be launched on 17 April 1985. Dr Tony England W0ORE will be one, the other being John-David F Bartol W4NYZ. Listen to RSGB news bulletins for the latest information on this mission.

The Northern Amateur Radio Societies Association will be holding their 23rd Annual Radio & Electronics Exhibition and Mobile Rally in the CENTRAL HALL, BELLE VUE, Redgate Lane, Longsight, Manchester, on Sunday, 10th March 1985 commencing at 11am.

Admission will be £1 to the exhibition.

Car park facilities are available as will be restaurant and bar.

Contests and a raffle will take place.

Talk in will be on S22, SU8 or any other clear frequency.

Amateur radio from RSS Discovery

The research vessel RSS Discovery will have amateur radio aboard for part of its voyage to the Antarctic, using the call GB4DIS/MM. She was due to leave Gibraltar on 7 December last and should be in Montevideo by 12 April. Three amateur radio operators will be aboard and SSB, CW and perhaps RTTY will be used in the 20 metre and 15 metre bands, daily between 1800 and 2000 hours GMT for QSOs with the UK.

FAX endorsement for WAC certificate

The popular Worked All Continents certificate issued by the International Amateur Radio Union can now be awarded for two-way facsimile QSOs. A3C, F3C or J3C communication with all six continents will entitle the operator to claim this award and contacts of any date, past or future, are valid.

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Talk in will be on S22, SU8 or any other clear frequency.
Isn't it about time
you switched
to Icom?

IC-751

The IC-751 could be called the flagship of the ICOM range as it features 32 memory channels, full HF receive capability, digital speech synthesizer, computer control and power-supply options. The 751 is fully compatible with ICOM auto units such as the AT-500 and IC-2KL. The IC-751 now has a remote push-button frequency selector pad.

Standard features include: a speech processor, switchable choice of J-FET pre-amp or 20dB pin diode attenuator and two VFO's, marker, 4 variable tuning rates, pass band tuning, notch, variable noise blanker, monitor switch, direct feed mixer in the front end, full break-in on CW and AMTOR compatibility.

The first IF is 70.045 MHz. Any XIT and RIT adjustment is shown on the display. The transmitter features high reliability 2SC2904 transistors in a low IMD (-32dB@100W) full 100% duty cycle. For more detailed information on this excellent set, please get in touch with us.

IC-290D/290E

290D is the state of the art 2 meter mobile, it has 5 memories and VFO's to store your favourite repeaters and a priority channel to check your most important frequency automatically. Programmable offsets are included for odd repeater splits, tuning is 5kHz or 1kHz.

The squelch on SSB silently scans for signals, while 2 VFO's with equalising capability mark your signal frequency with the touch of a button. Other features include: RIT, 1 kHz or 100Hz tuning/CW sidetone, AGC slow or fast in SSB and CW, Noise blanker to suppress pulse type noises on SSB/CW.

You can scan the whole band between VFO's,scan memories and VFO's. Adjustable scan rate 144 to 146 MHz, remote tuning with IC-HM10 and HM11 microphones. Digital frequency display, Hi/Low power switch. Optional Nicad battery system allows retention of memory.

Special Offers for 1985: 25 watt IC-290D reduced to £469 and the 10 watt IC-290E reduced to £399. The 70cm version IC-290E is reduced to £529. Take advantage of this money-saving offer.
ICOM can introduce you to a whole new world via the world-communications satellite OSCAR. Did you know that you can Tx to OSCAR on the 430-440 MHz IC-471 and Rx on the 2m IC-271.

By making simple modifications, you can track the VFO's of the Rx and Tx either normally or reverse. This is unique to these ICOM rigs and therefore very useful for OSCAR 10 communications. Digital A.F.C. can also be provided for UOSAT etc. This will give automatic tracking of the receiver with digital readout of the doppler shift. The easy modifications needed to give you this unique communications opportunity are published in the December '84 issue of OSCAR NEWS. Back issues of OSCAR NEWS can be obtained from AMSAT (UK), LONDON E12 5EY.

This range includes the IC-271E-25W, 271H-100W and the 70cm versions IC-471E-25W and 471H-75W r.f. output. The 271E has an optional switchable front-end pre-amp. The 271H has a mast-head pre-amp AG-25, and the 471E and 471H use the AG35 mast-head pre-amp. Other options include internal switch-mode PSU's; the 271E and 471E use the PS25 and the 271H and 471H use the PS35.

Also available are the SM6 desk microphone and a speech synthesizer that announces the displayed frequency, what more could you ask for?

**IC-02E, IC-04E**

The direct entry microprocessor controlled IC-02E is a 2 meter handheld features include: scanning, 10 memories, duplex offset storage in memory and odd offsets also stored in memory. Internal Lithium battery backup and repeater tone are included. Keyboard entry is made through the 16 button pad allowing easy access to frequencies, duplex, memories, memory scan and priority.

The IC-02E has an LCD readout indicating frequency, memory channel, signal strength, transmitter output and scanning functions. New HS-10 Headset, with earphone and boom microphone, which operates with either of the following: - HS-10-SB Switch box with pre-amplifier giving biased toggle on, off and continuous transmit. HS 10-SA Voice operated switch box, with pre-amplifier, mic gain, vox gain and delay. The IC-2E and 4E continue to be available.

You can get what you want just by picking up the telephone. Our mail-order dept. offers you: free, same-day despatch whenever possible, instant credit, interest-free H.P., telephone Barclaycard and Access facility and a 24 hour answering service.

Please note that we now have a new retail branch at 95, Mortimer Street, Heme Bay, Kent. Tel: 69464. Give it a visit, BCNU.
The desired output waveform, illustrated in Figure 3, is such that the start and end of the ramp voltage should be adjustable.

On the application of power to the circuit the voltage output of IC1 starts to increase linearly due to the negative voltage present at this time from the output of IC3. The output of IC1 is applied to the non-inverting input of IC4. The ramp voltage slightly exceeds the reference voltage the output of IC4 changes from the negative rail value to the positive supply rail value. After removing the unwanted negative output, using R4 and D1, this ‘pulse’ is applied to a logic ‘latch’ implemented using a CMOS quad NAND package (IC6).

In order for the system to operate, two of the four NAND gates are used as inverters on the input to the latching arrangement.

The output at pin 4 of the latch goes from a logic zero to logic one when the output of IC4 changes at the pre-settable top of the ramp.

The output at pin 4 is applied to a CMOS ‘relay’, which consists of a DG308 IC (four in a package), which is used to short circuit the integrator capacitor on IC1. Hence the ramp is collapsed.

At the same time IC3 samples a voltage between the maximum positive rail and ground. The inverting input of IC3 is connected to the output of IC1. Thus as the ramp collapses to zero the output of IC3 changes from the positive rail to the negative when the inverting input drops to a smaller voltage than the non-inverting input. This voltage sets the lower voltage level of the ramp, and is adjustable using RV2.

The negative pulse from IC3 is clamped with R6 and D2, and used to reset the IC6 latch. This same negative voltage is present on the inverting input of IC1 and the integrator starts charging until the cycle is repeated. The charging rate, and hence the period of the ramp, is controlled by RV1.

**Advantage**

The advantage of the circuit is that although the period of the ramp may be changed, the re-set period is independent of the ramp period. Within the response time of the circuitry re-set occurs at pre-set voltage levels.
For Z-axis blanking two transistors, Tr1 and Tr2, provide a buffered drive which may be adjusted with RV5.

The circuitry associated with IC2 and IC5 allows the amplitude of the ramp output to be adjusted remotely, via computer control for example. The dc centre voltage of the ramp may be manually adjusted using RV4. This allows the trace to be centred when using the ramp generator with a voltage controlled oscillator.

IC2 is a unity gain non-inverting amplifier and the output is potentiometrically divided as shown in the circuit diagram. In order to remotely switch in the required voltage gain, DG308 ‘electronic relays’ are used. Note that only three pre-set selectable levels are illustrated, but any number may be added to divide the amplitude in conjunction with R11. The DG308s require a positive supply rail to ‘drive’ the switch contacts.

So that the voltage ramp may be symmetrically varied in amplitude, the non-inverting input of IC2 is biased negatively so that the ramp produces equal voltage excursions about zero volts. However, in the author’s application it was desired to use the ramp to drive varactor diodes with a positive reverse bias. Thus IC5 is employed to act as a non-inverting buffer to the ramp voltage and a unity gain inverting buffer to the dc offset voltage (simultaneously applied to IC2) via RV4. In this way the original ramp voltage swing is restored and symmetrical voltage excursions are preserved.

Beneficial

In the prototype + and −15 volt rails were used. However, in this circuit a negative rail of −5 volts is adequate for correct operation. This is beneficial when using the circuit to drive varactor diodes, since the positive supply rail may then be increased and the total available capacitance swing from the varactor be used, ie so that the maximum total supply rail for the operational amplifiers is not exceeded (30 volts for the CA3140).
Although slightly more complex in design than circuits using the LS7225 keyless lock IC, the electronic lock shown below is more versatile and considerably cheaper to build. The lock is intended for use with a 'data entry' type keypad which has 12 keys and one common terminal, i.e., not a matrix type. These keypads are readily available and quite inexpensive.

Circuit description

The circuit diagram of the electronic lock is shown in Figure 1. When the first digit is pressed the pulse from IC1 pin 3 charges C2 via D1. R6 discharges C2 slowly, providing a time period in which the next 3 digits must be entered.

The high level on C2 releases bistable IC2a, IC2b and when the second digit in the sequence is pressed the bistable changes state, causing a low on IC2 pin 4. This low is inverted by IC1c, thus releasing bistable IC2c, IC2d.

The third digit of the sequence puts a low on IC2 pin 11 which similarly releases bistable IC3a, IC3b via IC1d.

Pressing the fourth digit sets bistable IC3a, IC3b in much the same way, which in turn sets the output bistable IC3c, IC3d.

If a wrong digit is entered anywhere in the sequence the whole entry is cleared by discharging C2 via Tr1. If more than one key is pressed at one time the whole entry is again cleared. This is achieved by monitoring the keyboard current. With one key pressed insufficient voltage is developed across R8 to turn on Tr2; two or more keys pressed turn Tr2 on, thus discharging C2 via Tr1. Components R11 and C3 prevent operation of the lock during the time taken to discharge C2.

When the 'lock' key is pressed, the low on IC3 pin 13 causes the output bistable to change to its reset state.

It may seem at first glance that IC1c and IC1d can be omitted by using the complementary outputs of the bistables, but this is not so. If the full truth table for the bistables (Figure 2) is examined it can be seen that a high will appear on the Q output when the corresponding input is made low, irrespective of the state of the other input.

In our case this would mean the circuit would operate when just the last digit is entered.

Construction

All components (except the keypad) can be mounted on Veroboard or a purpose made PCB. IC1, 2, 3 are CMOS and the usual handling precautions against static should be taken. If preferred, IC holders can be used.

The circuit requires a 12V supply, although other supplies can be used with the appropriate change in R8, eg for 5V operation R8=1K. The current required is about 1mA so battery operation is possible if desired.

The complementary outputs are capable of sinking or sourcing up to 10mA and so will drive LEDs directly. However for most applications some buffering may be necessary.

Selecting a code

The 4 digit code required is preset simply by connecting to the appropriate key connections on the keypad.

Note: the 4 digit code must not contain the same digit used consecutively, eg 1224, since the circuit will accept one key-press as two entries. The same number may be used twice elsewhere, eg 1242, but this is not advisable.

If more than 4 digits are required for the unlock sequence, this can be done simply by increasing the number of bistables (each with its own inverter on the 'R' input), the limiting factor being the number of keys on the keypad.

Fig 2

Bistable configuration and truth table

<table>
<thead>
<tr>
<th>S</th>
<th>R</th>
<th>Q</th>
<th>̅Q</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
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<tr>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
</tbody>
</table>

Q is set by S going low
- previous state held
- Q is reset by R going low
- unstable state

NOTE: Q output is high whenever S is taken low, irrespective of state of R input

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H I G H  Q U A L I T Y  M O D U L E S  F O R  36 S P M  1 2 0 / 6 5 6 0 - 6 5 V

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c a t h o d e  p l u s  p h o t o  t r a n s i s t o r s  e m i t t e r s

B O A R D

5 0 - w a y  x  2 1  p i t c h  E d g e  C o n n e c t o r  ( G o l d ) ,

P l e a s e  s e n d  s e l f - a d d r e s s e d  e n v e l o p e

2 1 - P A K  B A R G A I N S

£ 1 2  N o r m a l  P r i c e

O r d e r  N o .  V P 5 7

e x t e n d  v o l t a g e  &  c u r r e n t  r a n g e s .

P l e a s e  s e n d  s e l f - a d d r e s s e d  e n v e l o p e

2 1 - P A K  B A R G A I N S

£ 1 2  N o r m a l  P r i c e

O r d e r  N o .  V P 5 7

E D G E  C O N N E C T O R S

5 0 - w a y  x  2 1  p i t c h  E d g e  C o n n e c t o r  ( G o l d ) ,

M P A 3 0 .  S u p  V t g .  2 0 - 3 0 V .  P r i c e  £ 4 . 2 9

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37
In last month's edition of Data File we took a detailed look at the theory and practical applications of the LM3914-series of LED bar-graph driver ICs, and concluded by taking a brief look at 7-segment display systems.

In this edition of 'The File' we take a more detailed look at 7-segment display driving techniques and at practical 'driver' devices and circuitry.

Display latching

Last month we gave a brief introduction to 7-segment displays and to simple BCD-to-7-segment decoder/driver ICs that can be used to activate such displays. Figure 1 shows how three sets of these ICs/displays can be used in conjunction with a trio of decade counters to make a simple digital-readout 'frequency' meter.

Here, the amplified external 'frequency' signal is fed to the input of the series-connected counters via one terminal of a 2-input AND gate, which has its other ('gate') input waveform derived from a built-in 'timebase' generator. The operating sequence of the circuit is as follows.

When the timebase 'gate' input signal is low, the AND gate is closed and no input signals reach the counters. At the moment that the timebase gate signal switches high, a brief 'reset' pulse is fed to all three counters, setting them all to zero count. Simultaneously, the input gate opens and remains open for a period of precisely one second, during which time the input-frequency pulses are summed by the counters. At the end of the one second period, the gate closes as the timebase gate signal goes low again, thus ending the count and enabling the displays to give a steady reading of the total pulse count, and hence frequency. The whole process then repeats one second later, when the timebase gate signal again goes high.

The simple system described above suffers from a major defect, in that the display becomes a 'blur' during the actual counting period, becoming stable and readable only when each count is complete and the input gate is closed. This 'blur-and-read' type of display is very annoying to watch.

Figure 2 shows an improved frequency meter circuit that does not suffer from this defect. Here, a 4-bit data latch is wired between the output of each counter and the input of its decoder/driver IC. This circuit operates as follows.

At the moment that the timebase gate signal goes high a reset pulse is fed to all counters, setting them to zero. Simultaneously, the input gate is opened and the counters then start to sum the input signal pulses. This count continues for precisely one second, and during this period the 4-bit latches prevent the counter output signals from reaching the display drivers. The display thus remains stable during this period. At the end of the one second count period, however, a brief 'latch enable' pulse is fed to all latches, and the instantaneous BCD outputs of each counter are latched into 'memory' and hence fed to the display via the decoder/driver ICs. This causes the display to give a steady reading of the total pulse count, and thus the input signal frequency. A few moments later the sequence repeats again, with the counters resetting and then counting the input frequency pulses for one second, and so on.

The Figure 2 circuit thus generates a stable display that is updated once per second. In practice, the actual count period of this and the Figure 1 circuit can be made any decade multiple or submultiple of one second, provided that the output display is suitably scaled. Note that in practice a number of decoder/driver ICs are available with built-in 4-bit data latches.

Multiplexing

Note from the Figure 1 & 2 circuits that a total of at least 21 connections must be made between the IC circuitry and the 7-
segment displays of a 3-digit readout unit. A total of at least 70 connections are needed if a 10-digit display is used. In practice, the number of IC-to-display connections can be greatly reduced by using a technique known as 'multiplexing'. This technique can be understood with the aid of Figures 3 and 4.

Figure 3 shows how each digit of a 3-digit common-cathode IC display can be individually activated, using a total of only 10 external connections: the circuitry to the left of the dotted line should be regarded as 'electronic', and to the right of the line as 'display' circuitry.

In the display, all 'a' segments are connected together, as are all the other ('b' to 'g') sets of segments, so that a total of only seven external 'a' to 'g' connections are made to the display, irrespective of the number of 'digits' used. Note, however, that none of the 7-segment displays are influenced by signals on these 'segment' wires unless the display is enabled by tying its 'common' terminal to ground. In Figure 3 this is achieved by activating switching transistors Tr1 to Tr3 via suitable external signals, which require the use of one additional connecting wire per display digit.

Note in Figure 3 that three different sets of 'segment' data can be selected via switch S1a, and that any one of the three display digits can be selected via S1b and Tr1-Tr3. These switches are ganged together and provide the actual 'multiplexer' action, and should be regarded as fast-acting electronic switches that repeatedly switch through positions '1', '2' and '3'. The operating sequence of the circuit is as follows.

Assume initially that the switch is in position '1'. Under this condition S1a selects segment data 'Aa-g', and S1b activates display 1 via Tr1, so that display 1 shows the number '3'. A few moments later, the switch jumps to position '2', selecting segment data Bb-q and activating display 2 via Tr2, so that display 2 shows the number '2'. A few moments later, the switch jumps to position '3', causing display 3 to show the number '7'. After this the whole process starts to repeat again, and so on ad infinitum.

In practice dozens of such sequences occur each second, so the eye does not see the displays as being turned on and off, but sees each of them as a steady display with the trio apparently showing the steady number '327', or whatever other number is dictated by the segment data.

Figure 4 shows a more realistic implementation of the 'multiplexing' (MUX) technique, as applied to a 3-digit frequency meter. Note in this case that the multiplexer is interposed between the outputs of the three BCD 'data' latches and the input of a display-driving BCD-to-7-segment decoder/driver IC.

This technique has two major advantages. First, it calls for the use of only a single decoder/driver IC, irrespective of the number of readout digits used. Second, it calls for the use of a multiplexer incorporating only five ganged 3-way sequencing switches (one for the 'control' data, four for the BCD-segment data), rather than the eight ganged 3-way switches called for in the earlier (Figure 3) system.

In practice, all of the counting, latching, multiplexing, decoding, timing and display-driving circuitry of Figure 4 (and a great deal more) can easily be incorporated in a single LSI (large scale integration) chip which needs only 20 or so pins to make all necessary connections to the power supply, displays, inputs, etc.

Thus, a complete 4-digit counter can be implemented using a dedicated IC in a circuit such as that shown in Figure 5, or a '3½-digit' DVM (digital voltmeter) can be implemented using a circuit such as that shown in Figure 6.

Ripple blanking

If the basic 4-digit circuit of Figure 5 is used to measure a count of '27', it will actually give a reading of '0027', unless steps are taken to provide automatic
suppression of the two (unwanted) leading zeros. Similarly, if the 3½-digit circuit of Figure 8 is used to measure 0.1 volts, it will actually give a display of '0.100' volts, unless steps are taken to provide automatic suppression of the two (unwanted) trailing zeros.

**Practice**

In practice, automatic blanking of leading and/or trailing zeros can be obtained by using a 'ripple blanking' technique, as illustrated in Figures 7 and 8. In these diagrams, each decoder/driver IC has a BCD input and a 7-segment output, and is provided with 'ripple blanking' input (RBI) and output (RBO) terminals. If we assume that these terminals are 'active high' they have the following characteristics.

If the RBI terminal is held low (at logic 0), the 7-segment outputs of the IC are enabled, but the RBO terminal is disabled (held low). If the RBI terminal is biased high (logic 1), the 7-segment outputs become disabled in the presence of a BCD '0000' input (= decimal zero), and the RBO output goes high under the same condition. Thus, the RBO terminal is normally low, and goes high only if a BCD '0000' input is present at the same time as the RBI terminal is high. With these characteristics in mind, refer now to Figures 7 and 8.

Figure 7 shows the ripple blanking technique used to provide leading-zero suppression in a 4-digit display that is reading a count of '207'. Here, the RBI input of the 'thousands' or most significant digit (MSD) decoder/driver is tied high, so this display is automatically blanked in the presence of a 'zero', under which condition the RBO terminal is high. Consequently, the RBI terminal of the 'hundreds' IC is high, the digit reads '2', and the RBO terminal is low. The RBI input of the 'tens' unit is low, so this digit reads '0' and its RBO output is low. The least significant digit is that of the 'units' readout, and this does not require zero suppression; consequently, its RBI terminal is grounded and it reads '7'. The display thus gives a total reading of '207'.

Note in the Figure 7 'leading zero suppression' circuit that ripple blanking feedback is applied 'backwards', from the MSD to the LSD.

Figure 8 shows how trailing zero suppression can be obtained by reversing the direction of feedback, from the LSD to the MSD. Thus, when an input of '1.1 volts is fed to this circuit the LSD is blanked, since its BCD input is '0000' and its RBI input is high: its RBO terminal is high under this condition, so the '00ths' digit is also blanked in the presence of a '0000' BCD input.

Practical decoder/driver ICs are often (but not always) provided with ripple blanking input and output terminals. Often, these terminals are 'active low'. If a decoder/driver IC does not incorporate integral ripple blanking logic, it can usually be obtained by adding external logic circuitry similar to that shown in Figure 9, with the RBO terminal connected to the 'blanking' input pin of the decoder/driver IC.

In Figure 9 ('active high' circuit), the output of the 4-input NOR gate goes high only in the presence of a '0000' BCD input, and the RBO output goes high only if the 'decimal zero' input is present at the same time as RBI is biased high.

**Practical decoder/driver ICs**

Practical decoder/driver ICs are available in both TTL and CMOS forms. Some of these devices have integral ripple blanking facilities, others have built-in data latches, and a few even have built-in decade counter stages, etc. Let's look at a few of the most popular of these devices.

The 7447A and 7448

These 7-segment decoder/driver ICs are members of the standard TTL family. They are also available in 'LS' form under the designations 74LS47 and 74LS48 respectively. All of these ICs have integral ripple blanking facilities, but do
not incorporate data latches. Figure 10 shows the outline and pin designations that are common to these devices, each of which is housed in a 16-pin DIL package.

The 7447A/74LS47 has an active-low output designed for driving a common-anode LED display via external current-limiting resistors (Rx), as shown in Figure 11. The 7448/74LS48 has an active-high output designed for driving a common-cathode LED display in a manner similar to that of Figure 11, but with the 'common' terminal of the display taken to ground. In all cases, the Rx current-limiting resistors should be chosen to limit the segment currents below the following absolute limits: 7447A = 40mA; 74LS47 = 24mA; 7448 and 74LS48 = 6mA.

Figure 12 shows how a 7448/74LS48 can be used to drive a liquid-crystal display (LCD), using a pair of 7486 or 74LS86 quad 2-input EX-OR gate ICs and an external 50Hz squarewave to apply the necessary 'phase' signals to the display, as described last month.

Note from Figure 10 that all of these ICs have three input 'control' terminals, these being designated LAMP TEST, Bi/RBO, and RBI. The LAMP TEST terminal drives all display segments on when the terminal is driven to logic low with the RBO terminal open or at logic high. When the Bi/RBO terminal is pulled low, all outputs are blanked. The Bi/RBO terminal also functions as a ripple blanking output terminal. Figure 13 shows how to connect the ripple blanking terminals to give leading zero suppression on the first three digits of a 4-digit display.

The 4511B

This BCD-to-7-segment decoder IC has an integral 4-bit data latch, but has no built-in facility for ripple blanking. It is constructed with CMOS logic, but features NPN bipolar output transistor stages that are capable of sourcing output currents of up to 25mA.

Figure 14 shows the outline and pin notations of the device, and Figure 15 shows the functional diagram of the IC, which can be used with any power supply in the 5V to 18V range.

The 4511B has three 'control' input terminals, these being designated LAMP TEST (LT), BL (blanking), and LE (latch enable)/STROBE. The LT and BL inputs are active-low, and the LE input is active-high. In normal operation, LT and BL are made high and LE is held low.

When the LE terminal is low, BCD input signals are decoded and fed directly to the 7-segment output terminals. If LE goes high, the BCD input signals that are present at the moment of transition are latched into 'memory' and fed (in decoded form) to the 7-segment outputs while LE remains high.

If the LT input is grounded, all output segments are activated, irrespective of the BCD inputs. If the BL input is grounded (while LT is positive), all output segments are blanked.

The 4511B can be used to drive most popular types of 7-segment display.
Figure 16 shows the basic connections for driving a common-cathode LED display.

A current-limiting resistor (Rx) must be wired in series with each display segment, and must have its value chosen to limit the segment current below 25mA. Note that the 'segment' outputs of the 4511B are not internally current-limited, and the device thus has no output-overload protection.

Figures 17, 18 and 19 show how to modify the above circuit to drive LED common-anode displays, gas discharge displays, and low-brightness fluorescent displays respectively. Note in the cases of Figures 17 and 18 that an NPN buffer transistor must be interposed between each output-drive segment and the input segment of the display; in each case, Rx determines the operating segment current of the display, and Ry determines the base current of the transistor.

The 4511B can also be used to drive 7-segment liquid-crystal displays by using an external squarewave ‘phase’ signal and a set of EX-OR gates in a configuration similar to that of Figure 12. In practice, however, it is far better to use a 4543B IC for this particular application.

The 4543B

This 7-segment decoder/driver IC is a CMOS device with integral 4-bit data latch. It is specifically designed for driving liquid-crystal displays, but can also drive most other types of 7-segment display. Figure 20 shows the outline and pin designations of the device, which can be used with any power supply in the 3V to 18V range.

The 4543B has three input 'control' terminals, these being designated LD (latch disable), PHASE, and BL (blank). In normal use, the LD terminal is biased high and the BL terminal is tied low. The
state of the PHASE terminal depends on the type of display that is being driven. For driving liquid-crystal readouts, a squarewave (roughly 50Hz, swinging fully between the GND and Vcc values) must be applied to the PHASE terminal. For driving common-cathode LED displays, PHASE must be grounded. For driving common-anode displays, PHASE must be tied to logic 'high'.

The display can be blanked at any time by simply driving the BL terminal to the logic-high state. When the LD terminal is in its normal 'high' state, BCD inputs are decoded and fed directly to the 7-segment output terminals of the IC. When the LD terminal is pulsed low, the BCD input signals that are present at the moment of transition are latched into 'memory' and fed (in decoded form) to the 7-segment outputs while LD is low.

Figure 21 shows the basic method of using the 4543B to drive a liquid-crystal display, and Figures 22 to 25 show how this circuit can be modified to drive other types of 7-segment display. Note in the cases of Figures 22 and 23 that the values of Rx must be chosen to limit the output 'drive' currents to below 10mA per segment.

The 4026B

This device is a complete decade counter with integral decoder/driver circuitry that can directly drive a 7-segment common-cathode LED display. The 'segment' output currents are internally limited (to about 5mA at 10V supply, 10mA at 15V supply), so the display can be connected directly to the output of the IC, without the use of external current-limiting resistors. The device does not incorporate a data latch and has no facility for ripple blanking. Figure 26 shows its outline and pin designations. The 4026B has four input 'control'
sensitive circuits. The input terminals are designated CLK (clock), CI (clock inhibit), RESET, and D/E (display enable). The IC incorporates a Schmitt trigger on its clock input line, and clock signals do not have to be pre-shaped. The counter is reset to zero by driving the RESET terminal high.

The CI terminal must be grounded to allow normal counting operation: when CI is high, the counters are inhibited. The display is blanked when the D/E terminal is grounded; the D/E terminal must be high for normal operation. Thus, in normal operation, the RESET and CI terminals are grounded and the D/E terminal is held positive, as shown in Figure 27.

The three auxiliary output terminals of the 4026B are designated D/E OUT, CARRY OUT, and 2 OUT. The D/E OUT signal is a slightly delayed copy of the D/E input signal. The CARRY OUT signal is a symmetrical squarewave at one tenth of the clock input frequency, and is useful when cascading 4026B counters. The 2 OUT terminal goes low only on a count of '2'. Figure 27 shows the basic circuit connections to be used when cascading stages.

The 4033B

This device (see Figure 28) can be regarded as a modified version of the 4026B, with the D/E and D/E OUT terminals eliminated and replaced by ripple blanking input (RBI) and output (RBO) terminals, and with the 2 OUT terminal replaced with an LT (lamp test) terminal which activates all output segments when biased high. In normal use, the RESET, CI and LT terminals are all grounded, and the RBI terminal is made positive, as shown in Figure 29. This configuration does not provide blanking of unwanted leading and/or trailing zeros.

If cascaded 4033B ICs are required to give automatic leading-zero suppression, the basic Figure 29 circuit must be modified as shown in Figure 30, to provide ripple blanking operation. Here, the RBI terminal of the most significant digit (MSD) is grounded, and its RBO terminal is connected to the RBI terminal of the next least significant stage.

This procedure is repeated on all except the LSD, which does not require zero suppression. If trailing-zero suppression is required, the direction of ripple blanking feedback must be reversed, with the RBI terminal of the LSD grounded and its RBO terminal wired to the RBI terminal of the next least significant stage, and so on.

**Next month**

In next month's edition of Data File, we'll continue the 'opto-electronics' theme by looking at a variety of light-sensitive circuits.

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**Figure 27** Basic method of cascading 4026B ICs

**Figure 28** Pin designations of the 4033B decade counter with 7-segment outputs and ripple blanking

**Figure 29** Basic method of cascading 4033B ICs (without zero suppression)

**Figure 30** Method of modifying the Figure 29 circuit to give automatic leading-zero suppression
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In a superheterodyne receiver, the local oscillator must operate at a frequency which is displaced from that being received by an amount equal to the first intermediate frequency. Should this difference not be maintained, the received frequency will be controlled by the local oscillator but the sensitivity of the receiver will be degraded due to the signal frequency stages being de-tuned.

The action of making the oscillator and signal circuits tune with a fixed frequency difference is called 'tracking'. The accomplishment of this in wide frequency coverage receivers has always presented considerable problems to the home constructor, and as a consequence for the past half century commercially manufactured coils have almost invariably been used for this purpose.

For amateur band only receivers the problem is less acute, for over the restricted frequency ranges tracking errors are often sufficiently small to go unnoticed due to the bandwidth of the RF tuned circuits.

**Additional factors**

Returning to the original problem, however, even when commercial coils are used only part of the problem has been solved, for although the correct inductance is available the correct minimum capacitance and change of capacitance to realise the required frequency range have to be achieved. These are attained by the addition of two preset capacitors, one in parallel with the main tuning capacitor (known as the trimmer) and the other in series (known as the paddler).

Considering the effect of these capacitors on the tuned circuit, it will be realised that the trimmer will control the minimum value of the combination of capacitors and be most effective at the higher frequency end of the tuning range, whilst the paddler will control the maximum value of the combination and be most effective at the lower end of the range. As the padding and trimming capacitors are effectively in series adjustment of one effects the other, although this problem is easily overcome by correct alignment procedures.

If the radio frequency and oscillator circuits have been designed with the correct inductance and trimmer and paddler capacities, it will be found that the circuits accurately align at points near the upper and lower frequency limits and at a third point toward the centre of the waveband covered. This is known as three point tracking and the calculation of appropriate values of inductance and capacitance is the problem which this month's computer program is intended to solve. In addition, this program will solve the more general problem of designing a tuned circuit for a given frequency coverage.

As usual, this program has been written in standard Microsoft BASIC and has been tested on both Sanyo and BBC 'B' computers. Should a computer using any other 'dialect' of BASIC be used, minor changes may be necessary.

**Using the program**

For the sake of illustration, let us assume that we wish to compute the inductance and trimmer and paddler capacitances for a superhet receiver using a 1.6MHz intermediate frequency and covering the 80 metre band with a frequency range of 3.5 to 4.0MHz. The tuning capacitor has a minimum capacity of 10pF and a maximum value of 100pF.

In this case the RF tuned circuits will obviously have to tune the range 3.5 to 4.0MHz. The oscillator will be displaced from these frequencies by 1.6MHz, most conveniently on the high frequency side. The oscillator tuning frequencies will therefore be 5.1 to 5.6MHz.

For convenience we would choose a mid-point tracking frequency of 3.75MHz at a tuning capacity of 40pF. The mid frequency need not necessarily be exactly half-way between the upper and lower frequencies, for it merely fixes the frequency at one point of the tuning scale. If the main station interest is CW, then it is obviously desirable to expand the lower end of the scale. This could be achieved by selecting a rather lower mid frequency — say 3.7MHz.

Having now loaded the program, the RUN key is pressed. On the screen appears the heading 'TUNED CIRCUIT TRACKING' followed by ENTER LO, MID AND HI FREQUENCY (MHz). Two separate calculations have to be made for the RF and oscillator circuits, so taking the RF calculation first enter: '3.5, 3.75, 4.0'.

This is followed by 'ENTER MAX, MID AND MIN CAPACITY (PF)'; so we enter: '100, 40, 10'.

The necessary inductance and trimmer and paddler capacitances will then be calculated and printed on the screen, together with the accuracy of the calculation. For the example given:

- **INDUCTANCE**: 45.4419985 UH
- **PADDER**: 62.2543749 PF
- **TRIMMER**: 69.1085523 PF
- **CAP (PF)**: 3.4999997
- **FREQ (MHz)**: 100
- **10**: 3.75001451
- **10**: 3.99999966

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**MARCH 1985**

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Components cannot be manufactured to anything approaching this accuracy. Furthermore, stray capacity and inductance which cannot be predicted are always present, so it is normal practice to provide preset variable capacitors in both trimmer and paddler positions. However, if normal alignment procedures are applied, the preset elements will be adjusted sufficiently accurately to achieve the desired result.

It is now necessary to calculate the constants for the oscillator circuit. The frequencies for this will be 5.1, 5.35 and 5.6 with the capacities the same as before. In round figures these will give values of 30µH for the coil, 40pF for the paddler and 72pF for the trimmer.

It now only remains to abort this program, load the inductance program which we published a few months ago and calculate the parameters for the RF and oscillator inductances.

The program

As may be expected, this program contains some rather complex mathematics, so we hope that we will be forgiven if we tend to 'gloss over' the actual method of calculation and merely describe the purpose of each section of the program. The formulae used have been derived from the well-known equations for capacities in series and parallel and the relationship between inductance, capacity and frequency.

The program commences with the definition of two functions: FNA(C) and FNBC(C), the first of which calculates the equivalent capacity of the paralleled tuning and trimming capacitors in series with the paddler, while the second function provides an LC to frequency conversion.

Lines 50 to 80 print the title, whilst lines 90 to 150 invite the entry of the lower, midband and upper frequencies with their associated capacities. The validity of the entered data is then checked. Should this be in error, such as entering the frequencies or capacities in reverse order or a zero value, a GOTO statement moves the program to line 570 which causes an 'ERROR IN DATA' message to be printed.

It is then necessary to transpose the data into mathematical form, this being achieved in lines 160 to 200.

Line 210 checks that the capacity swing available is adequate to provide the required frequency coverage. If it is not, a warning message is printed and the program jumps to line 460, which calculates the best available solution with the capacity ratio available.

Lines 240 to 300 calculate possible mid frequencies, first with no trimmer capacity and secondly with maximum trimming capacity. Should the required mid frequency be impossible to attain, a suitable warning is printed. In such circumstances the program moves to lines 460 and the best compromise under the circumstances is calculated.

The next section of the program, up to line 440, uses a mathematical ploy known as the 'secant method' to find the value for the trimmer capacitor at which the requested mid frequency is obtained with the specified capacity.

In this method, the program commences with two guessed trimming capacitor values which are known to lie on either side of the true value. All values of capacity within these are then considered until the correct value is found. The program can normally succeed in this within 19 iterations, thus giving an excellent demonstration of how effective this method can be.

If the search is not successful, a warning 'CAUTION - CONVERGENCE FAILS' is printed. However, the authors have been unable to find a problem which the program could not solve within the 40 iterations allocated, so this warning is only a precautionary measure. This complete, the required inductance is calculated at line 460.

The results are printed by lines 480 – 500, whilst lines 520 – 540 indicate the actual frequencies which will be obtained at the specified capacities. Should a padding capacitor not be necessary, the corresponding line will not appear on the screen.

In conclusion, lines 580 to 610 invite a further calculation.

The test problems

We have provided a series of test problems for two reasons. Firstly, they will verify that the program has been typed in correctly, and secondly, they illustrate how the program handles a problem which cannot be solved.

The first problem is based on the practical example of a varicap diode which is required to tune the FM broadcast band with a linear frequency to voltage characteristic. The capacity
values correspond to a varicap bias of 1.0, 4.5, and 8.0 volts respectively.

The second test problem asks for a centre frequency which is equal to the maximum frequency. The program determines the highest possible centre frequency which does not compromise the other two.

The final problem defines a frequency swing which is too great for the variable capacitor. The program chooses an inductance which will give the low frequency exactly and the best possible compromise for the middle and upper frequencies.

Warming
Stary capacitances exist in all circuits and, particularly at the higher frequencies, these may cause considerable errors if suitable allowance is not made. Furthermore, note that the majority of tuning capacitors are not linear, the capacity at the centre of the scale normally being considerably less than the average of the minimum and maximum capacities. This is deliberate, the purpose being to prevent the tuning scale being excessively cramped at the high frequency end. Allowance for this must be made when selecting the mid-range capacitance value.

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51
In the recent article on 27-29MHz conversions (R&EW November '84) the method of frequency translation by a sophisticated system of frequency subtraction was described. Part of the discussion intimated that an alternative method of synchronisation of the two counter circuits may be desirable, and that further investigation was being made in an attempt to develop such a technique. The following note describes the method eventually evolved and shows a suitable double-sided board layout.

The problem under examination was one in which the random nature of the polarity and pulselength of the sequence initiating pulse created problems, and required additional circuitry in the form of a discriminator to clean it up. Even so, there was still an odd occasion when the pulse went wild and created a random count, thus causing irregularities in performance.

By selecting an alternative source for the initiating pulse and using a simpler approach in its sectionisation a marked improvement in performance was achieved, with a considerable degree of economy in devices.

New technique

The new technique can be established by referring to the diagram, which shows that the initiating pulse is now derived from the 10 240KHz reference oscillator. This input frequency is divided by 2048 in the HC4040 to give a 5KHz reference at approximately 100nS pulselength, so the new signal is a 100nS pulse at a repetition every 200µS. This pulse is applied to the number of tens counter in a similar manner to the original circuit, and thus eliminates half of the ALS109 and the dual discriminator.

At the output of the 2048 divider the pulselength is, as stated, 100nS, but will be broader at the point of application to the HC193E pin 11 on both devices due to the time constant of the 47pF and 2K/3K resistor network on the 5V line. The relative time intervals, however, do not affect the operation of the timing sequences.

On odd occasions it has been found necessary to re-introduce the ALS109, and in this case the 47pF cap will feed to pin 12 and follow the line of the original circuit, using the 5.6K resistor to earth as shown in the output of the dual discriminator.

The revised connections to the 74HC00 are partly a matter of convenience in order to permit a more satisfactory track layout on the printed circuit board, as discussed later.

The voltage regulator shown indicates the necessity for heavy bypassing, and cannot be over-emphasised.

Improvement

The number of tens counters were changed to HC193Es in view of the improvement in transit time. The original circuit was stated to be operating at the boundary of the devices incorporated, and advantage has been taken of the availability of more suitable devices of higher speed capability.

The diagrams illustrate the necessity for a high degree of bypassing in the dc supply.

Operating at relatively large HF values the possibilities of feedback are ever present, and the use of suitable caps with the shortest possible leads to the board is mandatory. It is essential to use tantalum electrolytics due to polarisation delays.

The board layout shown is necessary to provide adequate shielding between tracks.

The circuit analysis is as follows, assuming VCO max F = 19MHz:

(1) To stop 340 pulses it is necessary to stop the skip ten counter 34 times on receive and 17 times for the 170 pulses to

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be subtracted on transmit. Using the suggested method of attack, only IC4, IC5 and IC6 need to operate at speeds near the limit of the logic family; even so gate propagation delays are borderline.

(2) The VCO frequency input goes to IC5b, and the feedback resistor raises the gate in its linear region so that the input sinewave amplitude is increased and to some degree is squared up. The output of this device operates as the clock to synchronise the skip ten counter.

(3) In the absence of a load pulse at pin 9 of the skip ten counter, the counter will operate until a carry appears at pin 15 (high). This is inverted in IC5d and disables the count enable at pin 7 in IC6 (high count, low disable). The counter stays in this position until a new load pulse occurs.

(4) The carry, staying high, allows VCO pulses to pass through IC4b to the 7137 variable divider input (pin 19, LC7137). If the carry goes low, no pulses are allowed to pass.

(5) The number of tens counter will inhibit the application of a load pulse to pin 9 of the skip ten counter unless a carry is present. If the count by ten counter goes to zero this creates a no load position at pin 9 and consequently permits the VCO pulses to proceed. Only while the number of tens counter is decrementing will the skip ten counter continue, so by loading a pre-determined number into the number of tens, the value of the VCO frequency may be adjusted at will.
(6) Briefly, the sequence is therefore: LC7137 count period complete, load a value into the number of tens counter; the skip ten counter then operates until this value reaches zero and then opens gate IC4b to permit pulses to pass for the remaining 7137 variable divider gate opening period. The 7137 therefore receives a lower number of pulses and takes the necessary action to raise the VCO frequency to cover for the missing pulses.

Since no mixing has occurred there is no possibility of spurious frequencies being developed.

At the completion of the count period in the 7137 the sequence is re-initiated.

To permit alternative frequency shifts to be adopted, the truth table for the number of tens counter is given, as used in either receive, transmit or repeater down shift.

Obviously a variety of shifts can be incorporated to suit a particular requirement.

**Constructional points**

To facilitate track orientation, advantage is taken of the fact that certain of the devices used have inactive pins. Due to track layout the path of the circuit was arranged to run through the unused pin positions. This means that the unused positions must be isolated, so the method adopted was to clip the narrow part of the pin to avoid contact with the board. The relevant pins are HC193s—pin 12 and HC4040—pin 14.

The photograph indicates the position

<table>
<thead>
<tr>
<th>Truth table for the number of tens counter</th>
<th><strong>Function</strong></th>
<th><strong>Decimal</strong></th>
<th><strong>IC2</strong></th>
<th><strong>IC1</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Receive</td>
<td>34</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Transmit normal</td>
<td>17</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Transmit 100kHz repeater offset</td>
<td>16</td>
<td>0</td>
<td>0</td>
<td>0</td>
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FREQUENCY TRANSLATION

of the bypass caps. It will be noted that the connection between the cap and its associated positive connection is kept to a minimum length. The earth connection is made from the centre earth plane via a stiff wire to the nearest earth point on the main board. Only one earth connection is required, to avoid earth loops.

VCO core

One important point is to ensure that the modification will permit the VCO to shift to the new operating range. It is necessary to bring the VCO core out almost to its limit and secure with wax. In some cases it is advantageous to use aluminium cores (available from Cirkit) to reach the new range.

Occasionally, the padder switched across the VCO coil in the Tx condition will now be too low a value to tune it to the lower frequency required for transmit, once the coil has been adjusted for the higher frequency new Rx value.

It has been found that a further 2-3pF is required in parallel with the present padder. Some equipment has a variable padder already in position, and this may only require a slight adjustment to enable the VCO to operate at its new ranges.

The choice of a single LS device in preference to HC is taken in view of the advantage gained in propagation delay times. This is quite significant and is essential in the case of the 163 type.

In one case (the prototype) the physical size of the cases of the various ICs meant that insufficient gap spacing had been allowed. The use of Motorola devices, which are slightly shorter in length, overcomes this problem.

To probe the circuit during final frequency adjustment it is essential to load the probe end with a series 10k resistor. This prevents the probe capacity from loading the circuit and introducing erroneous readings when used for scope or DFM measurements. Even with a high cost HF probe this problem arose and caused some confusion.

Earlier the earth connection was mentioned. It had been found advisable to take the main board earth to the earth return on the 7137 to reduce delay times still further.

The technique is considered to be unique and capable of extensive development in other fields. The writers would be pleased to hear of other suggestions or results of other applications, since it is considered that the technique is only at a low level of development in its present stage.

The project outlined in this article is now available as a kit from R Withers Communications for £22.50+E1p&p (see their ad in this issue).

The November '84 issue of R&EW, containing the original article by Bill Sparks G8FBX and Colin Horrabin GI3HBI which outlined the theory behind this conversion technique, is available from the back issues department. There is a back issues order form elsewhere in this magazine.

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Short Wave News for DX Listeners

By Frank A Baldwin

All times in GMT, bold figures indicate the frequency in KHz

Now that the season for reception here in the UK of signals from the Far East and South East Asia is in full operation, I bring to the attention of interested readers that most difficult of all countries to log — Laos.

The People’s Democratic Republic of Laos is bordered by Burma, Cambodia, China, Thailand and Vietnam and was formerly part of French Indo-China. Laos is an under-developed and isolated country, the economic centre being the Mekong valley. Much of the country has thickly forested mountains from which are derived the main export of hardwoods. Most of the population exists on subsistence agriculture for rice, and food imports are necessary.

There is no railway network.

Make yourself comfortable, switch on the receiver, adjust the dial or digits to the frequencies at the times listed here and you may log some of the following.

AFRICA

Algeria

Algeria on a measured 7246 at 1655, YL with songs in a local vernacular (Berber or Kabyle) during a programme in the National Network II, scheduled on this frequency from 0500 to 2200 daily.

Burkina Faso

Radio Nationale de Burkina, Ouagadougou on 4815 at 2104, OM with a talk in French. RN de Burkina is scheduled on this channel from 0530 (Thursday from 0800, Saturday and Sunday from 0700) to 0900 (Saturday and Sunday until 0800) and 1600 to 2400 with a power of 20KW. The frequency can vary slightly at times.

Burkina Faso was formerly called Upper Volta.

Cape Verde

A Voz de Sao Vicente, Mindelo on 3930 at 2117, OM with a talk in Portuguese then YL with a local pop song. This is a change of frequency from 3931 and would appear to be permanent, having been logged several times on the new channel.

This 10KW transmitter is on the air from 1200 to 1400 and from 1800 to 2400 Monday to Friday inclusive and on Saturday from 1200 (Sunday from 0900) to 2400. Cape Verde lies off the west coast of Africa.

Central African Republic

Bangui on 5035 at 0557, OM with announcements and a talk in vernacular. Radio Centrafrique operates from 0430 to 0700 and from 1630 to 2300 with a power of 100KW. The frequency can vary from 5032 to 5035.

Chad

Radiodiffusion Nationale Tchadienne, N’Djamena on 4904 at 2034, YLS with songs in vernacular complete with local orchestra backing in typical style. The evening session of this one is from 1730 to 2100 (Saturday until 2200) and the power is 100KW.

Domestic Services, the first is based at Houa Phan and operates on 4655 and irregularly in parallel on 6140 from 2300 to 0100, from 0400 to 0530 and from 1100 to 1300 with a power of 1KW. As with all these regional stations the programme language is mostly Laotian.

Luang Prabang is scheduled on 6978 from 2200 to 0100 (Sunday until 0200), from 0400 to 0600 and from 0930 to 1400 (Sunday until 1430). The power is 1KW.

Pakse occupies the 6589 channel from 2300 to 0200, from 0400 to 0600 and from 1030 to 1415 with a power of 1KW.

Savannahet has a 3KW transmitter which operates on 7385 and according to my computer memory bank is on the air from 2300 to 0100, 0430 to 0530 and from 1100 to 1400. The Vientiane regional programme ‘National Radio of Laos’, is timed from 2130 to 0230, from 0330 to 0700 and from 0900 to 1600 on 6130 with a power of 25KW.

Xieng Khouang uses 5660 from 2300 to 0030, from 0400 to 0530 and from 1100 to 1200. The power is 1KW.

I mentioned at the outset that Laotian signals are difficult to hear for West European DXers, and in fact it is probably the most rarely reported country in South East Asia.

Although it has been logged by UK-based DXers from time to time, and I did manage it some years ago, it does most certainly represent a considerable DX feat.

Good luck with your Laotian adventures!
SHORT WAVE NEWS

THE AMERICAS

Bolivia
Radio Norte, Montero on a measured 4939 at 0225, YL with announcements and station identification at 0230, this being followed by YL with a political harangue in Spanish. Listed on 4937, Radio Norte is on the air from 1000 to 1230, from 1600 to 1730 and from 2020 to 0230 (Sunday from 1200 to 2000). The power is 1.5kW. Obviously an extended schedule for political reasons. Underground political activities are now rife in many Latin American countries and gauging from the now more frequently heard political harangues and tirades, government authorities are increasingly hard put to maintain the status quo in their respective countries.

Brazil
Radio Nacional, Port Velho on 4945 at 0403, OM with a newscast in Portuguese. Many mentions of place names including two of Tegucigalpa in Honduras, R Nacional is on the air from 0800 (varies to 0900) to 0200 but varies to as late as 0500. The power is 50kW.

Colombia
Ondas del Meta, Villavicencio en a measured 4885.5 at 0220, OM with a folk song in Spanish with local-style wind instrumental backing. The schedule is from 1000 (varies to 0900) to 0500 but this closing time can vary to 0330. Just to fool us all however it sometimes works on a 24-hour schedule. The power is 5kW — and the frequency can vary!

Costa Rica
Faro del Caribe (Lighthouse of the Caribbean), San Jose, on 5058 at 0246, OM and YL with a discussion in Spanish about religion. Faro del Caribe is on the air from 0300 to 0400 and the power is 5kW. Note however that this station has been reported closing on occasions as late as 0740.

Ecuador
Radio Nacional Espejo, Quito on 4680 at 0336, OM announces then YL with songs in Spanish. This 5kW transmitter is scheduled around-the-clock but the frequency can vary to 4683 at times. Radio Quito on 4930 at 0249, OM in a talk in Spanish with mention of Maritima Argentini. R Quito is scheduled from 1000 (varies to 1200) to 0500 (Sunday until 0300) with a power of 5kW.

Honduras
La Voz Evangelica, Tegucigalpa on 4820 at 0447, OM with hymns in Spanish. LV Evangelica is timed on the air from 1030 to 0600 in Spanish. On Monday there is an English transmission from 0300 to 0500. The power is 5kW.

Peru
Radio Difusora San Martin, Tarapoto on 4810 at 0348, YL with a political harangue in Spanish, being followed later by an OM in similar vein, being an anti-Shining Path (Maoist organisation) broadcast. RD San Martin is on the air from 0930 to 0500 (Sunday until 0300) with a power of 1kW, but sometimes operates around-the-clock.

Radio Andina, Huancayo on 4996 at 0345, OM with announcements (notices) then YL with a folk song. This 2kW transmitter operates from 0930 (Sunday from 1000) to 0500 (variable to 0600) and is part of the Emisoras Cruz del Peru network.

ASIA

Bangladesh
Radio Bangladesh, Dhaka on 17670 at 0900, pops and tone time-check, YL with the station identification and a newscast in the Bengali programme for Europe, timed from 0830 to 1000. Also logged in parallel on 21640.

China
Radio Beijing on 7480 at 2105, YL with the English presentation for North and West Africa, scheduled from 2030 to 2130.

India
AIR (All India Radio) Lucknow on 3205 at 1535, YL with a newscast in English. This is the North Regional Service which is scheduled on this channel from 0225 to 0215 and from 1215 to 1740 with a power of 10kW. English news at 0032, 1530 and at 1730.

Iran
Teheran on 7230 at 2110, OM with quotations from the Holy Quran, OM with announcements, a military chorus and band. Not in parallel with the 9022 channel until 2130.

Iraq
Baghdad on 13700 at 1900, chimes time-check then OM with the station identification and a newscast in Arabic. Schedule on this new channel unknown at the time of writing.

READER LOG

Mehta of Gloucester sent along a log of Tropical Band stations he has received on his Sony 2001, the list being composed of three Australians, eighteen Brazilians, six Colombians, eight Ecuadorians, twelve Venezuelans and four Peruvians. Amongst this wealth of DX I note R Illimani on 4945 at 0225, the Brazilians R Poti on 4965 at 0100, R Timbira on 4975 at 0130 and R Copacabana on 5015 at 0200.
Noted also are the Colombians La Voz del Cinaruco on 4865 at 0200 and R Superde Medellin on 4875 at 0400; from Ecuador there is R Iris on 3380 at 0330, R Zaracay on 3395 at 0315, R N Espejo on 4680 at 0300, R Em Gran Colombia on 4910 at 0355 and R Quito on 4920 at 0330; from Peru, R Atlantica on 4790 at 0200. A creditable performance indeed.

MEDIA NETWORK

The latest publication to hand from Media Network of Radio Nederland Wereldomroep is entitled 'InfoDutch,' this being a 20 page booklet packed with information of direct use to all computer hobbyists using their equipment in conjunction with a short wave receiver. This wealth of useful information is divided into the following chapters: General Hints, Software for Radio Use, Hardware, Bulletin Boards, Radio Related Software Information/Suppliers Addresses and Conclusions. Thoroughly recommended, this most useful booklet is available free of charge direct from InfoDutch, 'Media Network,' Radio Nederland Wereldomroep, PO Box 222, 1200 JG Hiversum, The Netherlands.

SOUTH EAST ASIA

Australia
Melbourne on 7135 at 1340, OM with the Cantonese programme for South East Asia and the Far East timed from 1230 to 1430; on 7205 at 1355, pops, YL with station identification then OM with the news in English.

CLANDESTINE

Radio Camilo Cienfuegos on 7400 at 0347, OM song in Spanish, guitar backing, OM with station identification at 0351 and at 0400, chimes then OM with a talk in which two mentions of 'Gran Britannia' were made, all in a CID programme.

Radio SUL (Sudanese People's Liberation Army), OM station identification in English on 1300 on 9610, military music, programme review and a talk. This English transmission is timed from 1300 to 1330. Transmitter thought to be based in Libya.

NOW LOG THIS

VORE (Voices of Revolution- ary Ethiopia) Addis-Ababa on 7110 at 1555, YL with a song in vernacular, YL with station identification at 1600 then into Arabic with quotations from the Holy Quran.

NOW HEAR THIS

Mogadishu, Somalia on 7200 at 2028, OM with a tribal chant then OM with a clear identification at 2032.

RRI Sibolga, Sumatra, Indonesia on 5287 at 1541 on a good day for Indonesians, YL with a song in Indonesian then local-style music with gongs etc, heard under some CW QRH.

DOTS AND DASHES

As a change of occupation, a few forays onto the CW portions of the amateur bands were made over a three day period resulting in signals from (Top Band) CT1BCM, EA6E, EA9CE, HB9G, IK2EY, K1ZM, K2EK, K8CCV, LA1GCA, LZ2CC, OE5KE, OH3JR, RT3U0, SM07W, UA1WZM, UP2B2Z, UQ2FPQ, UP2E2K, W2PLE, YU5YA and ZB2EO.

On 7MHz Morse code signals were heard from CE8PD, CE9AJ (Antarctic), CP8AK, PY2RCZ, U6SDC, VP2VCW, YV2KL and 5B4DH.
**LATEST LITERATURE**

Clubs, manufacturers, publishers and agents are invited to send details of new books, catalogues, data sheets, etc for inclusion on this page.

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**AMATEUR RADIO, SUPER HOBBY!**

By Vince Luciani K2VJ

Vince Luciani has written an absorbing introduction to amateur radio for any newcomers to the hobby, and has managed to describe amateur radio and the people who practise it in a highly readable and non-technical manner.

Being an American, the author has naturally described the amateur radio scene in his native country. However, there is much common ground that makes this a very interesting and useful book for novices in this country, despite differences in such areas as licence requirements etc.

It is not only newcomers to amateur radio who will enjoy this book. Established amateurs will be fascinated by the description of the American view of the hobby. As well as an outline of the 'nuts and bolts' of the hobby there are brief biographies of prominent members of the community who are radio hams, as well as of hams who have made significant achievements (such as a four year old who passed the novice exam).

Such items as the description of CARI (Chess and Amateur Radio International, an organisation launched by the author and his son) make this required reading for anyone who likes a book that he will not want to put down.


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**COMPUTER AND TELECOMMUNICATIONS HANDBOOK**

By Jeff Maynard

This hardback volume, published on 24 January, has been produced as a reference book for professionals in the telecommunications, electronics and computing industries, as well as hobbyists, students and computer enthusiasts.

The author has brought together a wealth of information relevant to computing and telecommunications, from international frequency allocations to international paper sizes, and listed it all under a dozen chapter headings. The areas covered include various codes in use internationally (eg ASCII, Morse, Telex, answearback etc), international standards, materials, measurements, radio (signal reporting codes, international frequency allocations, world TV systems etc) and a miscellaneous section with such items as world time and the phonetic and Greek alphabets.

The more elementary information, frequently required has not been omitted. There is coverage, for example, of component colour codes and symbols, electrical formulae and a list of useful addresses.

As the author points out in the preface, such a book can never be exhaustive. However, the coverage of this volume is such that this book will be of immense use to anyone who regularly requires technical information in the field of telecommunications.


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**RADIO BEACON HANDBOOK**

By Dr J Trochimczyk

Readers wishing to know more about the long and medium wave radio beacons mentioned by Nigel Cawthorne in this month's Spectrum Watch may well be interested in this comprehensive listing of such stations worldwide. The thousands of stations recorded here are divided into ten geographical regions, with the entries for each separate area presented alphabetically. The book lists over 2,000 beacons from Europe and the Soviet Union alone.

The information given for each beacon (where known) includes call sign, frequency, name and location of station with country, geographical co-ordinates (lat/long), power or range in nautical miles, and some indication of its purpose (civil, military, maritime, etc).

Due to limitations of space the authors have not included details of transmission times or the order in which networks of sequential NDBs operate, and there is very little information included concerning the background and purpose of such radio beacons, but in a book whose prime use is as a reference book for identifying these radio beacons when heard this is not a major drawback.

Published under its German title *Handbuch der Funknavigationshilfen* with an introduction in English, this book is available direct from the publishers.

Wilhelm Hertel Verlag, PO Box 45006, D-5000 Köln 41, West Germany. £9.00 (DM 30). ISBN 3-923 925-00-X.

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**PROFESSIONAL AND BUSINESS USES OF THE QL**

By Colin Lewis

This book is intended to allow the professional user of the new Sinclair QL to set up and use this microcomputer with the minimum of detailed instruction in the mysterious language of computing. The computer is supplied with four software packages, covering word processing, worksheets, database and graphics applications, and the author outlines the use of these for people with no knowledge of programming (and no wish to acquire such knowledge).

From the outset the emphasis is predominantly practical. Before describing the four packages, the author gives foolproof instruction in how to set up the hardware, and examines the essential features of the operating system (QDOS).

There are many useful examples included, and much sensible advice (all tested by the author on a QL/Epson FX-80 printer combination).

The appendix describes a SuperBASIC program which will allow the copying of a complete microdrive cartridge, and is simplicity itself to follow even for those entirely ignorant of programming.


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**LATEST LITERATURE**

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**Weston Developments**
The range of aerals available from Weston Developments, covering the 28-180MHz section of the spectrum, is detailed in a short catalogue available free of charge from the company.

As well as amateur radio applications, the range covers TV/FM DXing, the air and marine bands, cordless phones and satellites. The company will also provide one-off aerals to special order.

To obtain a copy of the catalogue send a foolscape size SAE to the company.

Weston Developments, 33 Chervile Street, Romsey, Hampshire SO5 8FB.

**Cambridge Electronics Laboratories**
Available from Cambridge Electronics is an application bulletin covering the use of sine, square and shaped wave ringing generators in sensitive voice and data equipment. It is intended to update designers on the latest engineering and economic factors pertaining to this particular aspect of telecom devices, and covers the company's PCB-mounting sine-wave generator.

Cambridge Electronics Laboratories, PO Box 205, Cambridge, Massachusetts 02140, USA.

**Rapid Recall**
Readers who are unfamiliar with the definition of microprocessor benchmarking, or don't know about the Sieve of Eratosthenes, can now obtain an enlightening and informative pamphlet from Rapid Recall.

Entitled A System/Architecture Approach to Microcomputer Benchmarking, and written by R. Billig and R. Cronk of the Digital Equipment Corporation, this interesting publication surveys the more common microprocessor benchmarking techniques. It also describes the various areas of system performance and proposes a performance measuring method with an example of its application.

The pamphlet is available free on application to Rapid Recall.

**Contaut Electronics**
Now available from Contaut Electronics is a new publication designed to help system engineers take advantage of the potential cost/performance benefits that accrue from the use of switch mode power supplies (SMPS).

Entitled A Guide to Switch Mode Power Supplies, this 30 page A4 booklet covers the background of SMPS and their counterparts, linear series regulators, then describes in considerable detail all aspects relating to design, specification and application of the equipment.

The booklet is clearly illustrated with both circuit and explanatory diagrams, relevant formulae and tabular data are also included. Additionally, Contaut's ML and SL series of switch mode power supplies are fully described.

Free copies of the publication can be obtained direct from Contaut.

Contaut Electronics Ltd, Kingsley Avenue, Irkton, Devon EX34 8ES.
Tel: (0271) 83781.

**Electronic Brokers**
A 20 page two colour catalogue, recently published by Electronic Brokers, details the company's vast range of test and computer equipment.

Divided for easy reference into product types, the catalogue has sections on oscilloscopes and logic analysers, multimeters, generators, counters and counter/timers, power supplies, line conditioners and EPROM programmers.

Comprehensive coverage is given of Electronic Brokers' DEC and Tektronix ranges of computer equipment.

Basic technical details are given for each product together with part numbers and prices, many of which are specially discounted.

Electronic Brokers Ltd, 140-146 Camden Street, London NW1 9PB.

**GE Intersil Semiconductor**
GE Intersil Semiconductor has published a 24 page short form catalogue detailing the key parameters of its current ranges of transistors and diodes.

The company manufactures a wide variety of semiconductor devices including micro-wave diodes, ultra high speed switching tunnel diodes, back diodes, programmable unijunctions, silicon control switches, signal and power transistors covering applications ranging from telecommunications, military equipment and computers to industrial control systems, and welding equipment. The catalogue lists more than 700 currently available devices and all the major parameters of each device, which allows design engineers to select a particular device for their application.

Copies of this catalogue are available free of charge upon request.

GE Intersil Semiconductor Division, Intersil Datel UK Ltd, Belgrave House, Basing View, Basingstoke, Hants RG21 2YS.
Tel: (0256) 57361.

**Danesbury Instruments**
Danesbury Instruments have just published the fourth and enlarged edition of their catalogue of test and measurement instruments. It now includes a wide range of scopes, DMM and other digital instruments, signal sources from 0.01Hz to 950MHz including audio, video and TV, counters and timers, plotters and chart recorders, field strength meters, LCR meters, etc.

Principals include Hitachi, Keithley, Unicam, Coline, Rickadenki Mitsui, Thandar and other leading makers. Delivery is normally ex-stock.

Danesbury Instruments, 22 Parkway, Welwyn Garden City, Hertfordshire AL8 6HG.
Tel: (07073) 38623.
Bored with a humdrum existence? Tired with a tedious life?

Fancy straying from the straight and narrow or even crossing to the wrong side of the tracks? Yes, we thought as much...
So what's the solution? Where's the sparkling new package to break the dreary mould? Why it's here!...

4x4 Magazine!

4x4 has all that's best in off-road and four-wheel-drive action. Lacking only a mushroom cloud in terms of spectacle, it's guaranteed to excite and entertain, but beware!...

This magazine contains explicit material which some readers, especially those of a frail disposition, may find disturbing. You have been warned!

Contents
Greenroading: an introduction • Long-term test: Lada Niva • All-terrain trikes • 4x4 Favourites: Hallinger • The French connection: off-road in the EEC • Axle-deep: a beginner's guide to 4x4 • Pull-out colour centrespread • News, views, hardware and a lot more besides

Place a regular order with your newsagent or take out a subscription
Send £1.25 for a sample copy
What had the airwaves to offer DX-TV enthusiasts during November? Quite a lot judging from the selection of reception reports. Tropospheric DX was very poor, so consequently much of the DX was confined to Band I channels. Sporadic-E activity occurred mainly at the beginning and at the end of the month, whereas meteor shower (MS) reception was noted on most days.

November Sporadic-E
November 2nd became extremely active during the morning and at lunchtime, according to several reports. Signals came from Central Europe and the south-east. Strength and quality were comparable to those received during the main summer season, which lasts from May until September. The MUF reached 74MHz and the QIRT FM band favoured by Eastern Bloc countries (between 64MHz and 73MHz) became crowded with stations.

The low-power Austrian channel E3 TV relay at Birkfeld appeared at lunchtime in Derby. It was accompanied by the more usual channel E2a 60KW outat Jauerling, as well as signals on E4 from Patscherkofel. The network was showing the PM5544 test pattern with ‘ORF FS1’ identification. This later switched to the monoscopic Telefunken TO5 test card.

An interesting channel to watch was R2. The ‘RS-KH’ EZO-type pattern from Ceska Budejovice in Czechoslovakia was alternating with a PM5544 carrying the inscription ‘SR1 TV’ at the top and ‘BRATISLAVA’ at the bottom. Later an FuBK test card was noted as co-channel to Czechoslovakia. The identification ‘TVR BUCURESTI’ could be made out confirming reception from TVR in Rumania.

Trops during the month
It was a very disappointing month for tropics. Vigilance towards the end of the month resulted in several Dutch and Belgian stations being seen in Bands I and II but at a very low level. During the evening of the 29th the Dutch NOS-1 outlet on E4 (Lopik) improved in strength to provide ‘entertainment quality’ signals towards the end of the transmissions.

DX log for November
This month we are featuring the DX-TV reception noted by John Bray in Cambridgeshire.

21/11/84: ORF (Austria) E2a displaying the ‘ORF FS1’ PM5544 and the monoscopic Telefunken TO5 test card; CST (Czehoslovakia) on R1 with the electronic ‘RS-KH’ EZO-type test pattern; MTV (Hungary) R1 with ‘TV-1 BUDAPEST’ PM5544. All reception via Sporadic-E.

11/11/84: RAI (Italy) on channel I8 with the ‘RAI 1’ test card.
12/11/84: RAI with programmes on channel I1.
13/11/84: CST R1 radiating the EZO-type test pattern and later the ‘CST 01’ FuBK before programme commencement.
14/11/84: SRT1 (Sweden) E2 with the ‘TV1 SVERIGE’ PM5534 test card.
15/11/84: NRK (Norway) from the Melhus transmitter on E2 showing the ‘NORGE MELHUS’ PM5534.
16/11/84: NRK on channel E2 radiating the ‘NORGE GULEN’ PM5534.
19/11/84: CST on R1 with the EZO-type test card.
20/11/84: TVE (Spain) on channels E3 and E4 with programmes via Sporadic-E.

What is DX?
Kevin Jackson of Leeds recently raised an interesting point, and would welcome any feedback on the subject. The above might seem an unusual question but most DXers are able to receive signals on a daily basis and over a greater distance than the optical horizon. Kevin, for instance, can receive the French ‘Canal Plus’ transmissions from Lille at a distance of 450km come rain or shine! Admittedly the signals are very weak, even with narrowband receiving equipment, but they can usually be produced on demand.

Similarly, Clive Athowre over in Norfolk can receive daily signals from the RTE-1 channel H transmitter at Kippure in Eire. From an easterly direction signals from the EastGerman outlet at Inseilberg will appear on channel E5 in Band III on many days if a receiver is left running. Usually reception is only of short duration. On the other hand, a weaker but closer station may only be present during an intense tropospheric lift.

Kevin would like to know just what does qualify as genuine ‘DX-TV’.

New French DX club
Pierre Godou has sent a cutting from the October 1984 issue of ‘MHz’ for which he writes. He has recently formed the ‘Association International de Reception TV à Longue Distance’ (or ‘AIRTVLD’ for short!). It should appeal to all DX enthusiasts who are well versed in French. Further details may be obtained from Pierre at: 168d Oscar Leroux, F-35100 Rennes, France.

Norway’s Band I to go?
Iain Menzies has advised that Norwegian television transmissions in Band I are due to be phased out within two years to make way for a 6 metre amateur radio band at 50MHz. Initially only a few experimental licences are to be granted in a similar manner to the UK.
There are approximately 21 NRK transmitters distributed throughout the country using Band I frequencies. Twelve of these are high-power and a total of five use channel E2. Unlike most countries where much of the main network consists of high-power, UHF outlets, Norway's is currently formed by transmitters operating in the VHF Bands I and III. These are complemented by very low-power UHF relays in areas shielded from main transmitters.

In view of this it does seem rather strange that licences will be granted. This would lead to the whole network having to be re-engineered in record time.

The cost of DXing

A letter arrived recently from a reader asking about the cost of DXing. Well, there's no definite answer to that since tropo DX can be received on a standard UK TV set during a good lift, provided the aerial is facing the right way (see notes on propagation later in this column).

An improvement in reception will be possible by utilising an aerial with higher gain instead of a standard domestic type. Wideband aerials are available which embrace the entire range of UHF frequencies. These will cost anything from about £20 to £60 depending on the size and type.

Some form of rotation is desirable for best results, and this can be arranged manually if funds do not permit the purchase of an electric rotator. Many DXers find it fascinating to receive long-range signals via Sporadic-E or meteor shower, and regard the expense of buying a rotating system well worthwhile.

Successful reception of DX-TV signals calls for equipment covering Band I frequencies, and most UK receivers will not be fitted with suitable tuners. The same applies for tropo DX at Band III.

There are two ways of dealing with Bands I and III reception. One is to purchase a receiver equipped with the necessary channels, ie E2 to E4 in Band I and E5 to E12 in Band III. These channels are found on one or two portables currently available or on imported colour sets. Unfortunately their wide bandwidths mean that selectivity can be rather poor. The reception of adjacent channels such as E2 and R1 during a Sporadic-E opening usually results in signals on these channels floating with each other.

The other method is to use a converter such as the D-10. As mentioned in the December 1984 issue of R & E W, these units are mains-operated and simply plug into the aerial socket of virtually any UHF TV receiver. This particular converter has its own in-built tuner and switching arrangements for narrowband IF which provide enhanced selectivity.

The typical price for a multi-channel portable or a converter is about £65. Aerials need not be too elaborate for Sporadic-E work at Band I frequencies. A home-brew array will suffice. Indeed, a simple dipole with each rod cut to 50 inches will be adequate for initial experimentation.

Reception reports

Harold Brodrribb has written again from his St Leonards-on-Sea location with further reports of DX. He first noticed the Sporadic-E opening of November 2nd at 0950 when Russia and Czechoslovakia were encountered on channels R1 and R2. Both networks were radiating test cards. The Russian pattern was the familiar 'Leningrad' type, while from Czechoslovakia Harold saw the 'RS-KH' electronic test card. This was later seen alternating on channel R2 with the 'SR1 TV BRATISLAVA' PM5544.

Using an RL85 monitor for the sound, he counted no less than 29 Eastern European FM stations between 66 and 73.3MHz. At 1215 there were no fewer than 39 of them. Within an hour the opening had completely disappeared.

There were aurorae galore during November, according to Iain Menzies of Aberdour. They were present on the 11th, 12th, 13th, 14th, 15th and 16th and the whole of Band I was affected at times. Reception included the characteristic 'sleigh-bell' sound which is usually associated with aurorae.

Much of Iain's reception comes from Norway (NRK), and on the 15th the band was open to that country on channels E2, E3 and E4. He was able to identify 'Jewel in the Crown' at 1940. He also saw Sweden (SR) on test card after closedown at 2200.

Simon Hamer of New Radnor in Powys logged Switzerland on E2 during a luncheon opening on the 15th. Signals were via Sporadic-E and the '++PTT SRG1' FUBK test card was being radiated. On the 25th, strong and prolonged meteor shower activity produced viewable pictures on channels E3, R2 and E4 at 1950, but identification was impossible.

Tony Privett of Basingstoke forwarded an excellent log for the month. He too saw the major Sporadic-E opening of the 2nd. Signals identified included CST (Czechoslovakia) on R1 and R2 transmitting the 'RS-KH' EZO-type electronic test card and the PM5544, plus ORF (Austria) on channel E2a with the 'ORF FS1' PM5544 and Telefunken T05 test cards.

Sporadic-E was also encountered on the 1st, 2nd, 3rd, 4th, 17th, 20th, 26th and 28th. Spanish and Italian DX formed most of Tony's log. However, on the 20th at 1650 the Icelandic channel E4 outlet of RUV was noted broadcasting the PM5544 test card which carried the identification 'RUV ISLAND'.

In St Neots, John Bray usually has his DX-TV equipment in operation for about 30 minutes before work and again during lunchtime. Fortunately most TV services transmit a test card during these periods, which helps immensely with identification. John has commented that RTBF (the French language service in Belgium) from the Wave transmitter on E8 and NOS-1 (Netherlands) from Lopik on E4 are seen around midday on an almost daily basis.

The interesting letter arrived from Fred Pilkington G3IAG (Newmarket, Suffolk). He spends a fair amount of his time in warmer climes – on the Spanish Costa del Sol. He's been experimenting with reception of the TV service in neighbouring Gibraltar (GBC) at his location some 90km away.

Transmissions from GBC are low-power and officially the maximum ERP is 250W. The Gibraltar Broadcasting Corporation have now deserted their previous channel allocation of E11 in favour of E12. The original channel suffered from interference caused by an RTM outlet in Morocco, despite the use of 45 degree polarisation to counteract problems from the horizontal RTM broadcasts.

The good news to say, while Fred is in Spain he can always receive Moroccan TV, and on one visit he even managed to tune in Senegal, which is quite a distance to the south.

Chris Howles telephoned his log through from his Lichfield location. He too enjoyed the Sporadic-E opening of the 2nd. At 1030, TSS (Russia) appeared on channel R1 with the 'Leningrad' test pattern. TSS were also noted on R2 at 1115. At 1133 the PM5544 test card was logged from TVP in Poland on channel R1. As usual it had a darker background than the standard PM5544.

Signals from TVE (Spain) were noted just before lunchtime when the colour electronic test card emerged on channel E3. The clock caption from Austria was 'An ext nevis' at 1205 on E2a. This was followed by the PM5544 and Telefunken test cards.

Possibly the highlight of the day came at 1250 when Chris received the FUBK test card from Rumania on channel R2. The identification was 'TVC BUCAREST'. On November 7th he...
received DDR:F on E4 via meteor shower. This was the first time Chris had received signals from East Germany.

Danish TV scene

Its good to know that RAEW is read in Denmark. Michael Summers Larsen has written from Taastrup near Copenhagen with details about television services in his country. In 1981 the Danish parliament gave the green light for local television services to be established. At present all the stations operate from transmitters with 200W ERP in the UHF band.

The original idea behind local TV was to provide services for minority groups. Over the past few years most stations have received huge financial backing.

In Copenhagen there are four different organisations. Three of the networks share transmitters and programme time to minimise the vast expenditure required to keep them on the air. It is expected that transmissions from these services will be scrambled in the near future and they will become local 'pay-TV' companies. Apparently the Finnish Salaro company will be providing the scrambling equipment. The extra revenue will of course be welcomed by the stations since it has already cost almost 14 million Krone (that's about £1M) to get just one network on the air.

The three main stations in Copenhagen are known as 'Kanal 2', 'Kanal Plus' (not to be confused with the new French service, 'Canal Plus') and 'KKR & T' (an abbreviation for Copenhagen Christian Radio and Television). The deposit charged to watchCanal 2 is around £50 and the annual subscription is approximately £100. The fourth network is owned by a group of newspaper proprietors. They have invested about £230,000 and, naturally enough, they broadcast mainly items of news.

At present there are two transmitters in service; the north of Copenhagen is served by an outlet on channel E53 and the inner city areas receive programmes on channel E56. The state-owned service of Denmark Radio (DR) currently radiates the PM5534 test card, but the new stations use the FuBK type. It may well be possible for some DX-TV enthusiasts in the UK to receive the new services during favourable tropospheric conditions. The FuBK test card will be radiated whenever there are no programmes, so the test card could show up anytime during the night!

There are also a number of local radio stations on the air in Denmark – in fact, about 80. They operate in the 100-104MHz spectrum and all transmitters have an ERP of only 10W. In Greater Copenhagen alone there are no less than 14 stations. It is interesting to note that commercials are not allowed on Danish radio and television stations.

Our thanks to Michael (callsign OZ1GOY) for sending the above information about Danish television. We hope to receive photographs of the Danish FuBK test card in the near future.

Notes on propagation

Probably the easiest mode of propagation for DX-TV newcomers to experiment with is 'Tropospheres'. Provided the enthusiast is not too interested in receiving sound channels a domestic UHF TV receiver can be used. If the standard aerial is facing in the right direction signals can be picked up from several European countries, including Belgium, West Germany and the Netherlands.

The troposphere extends to approximately 5,700 metres above the surface of the Earth. At irregular intervals, slow moving areas of high pressure (known as anticyclones) can affect television reception. Anticyclones usually produce clear blue skies by day and clear but cold nights.

Long-distance television signals will be enhanced via improved tropospheric conditions mainly in the UHF bands (Bands IV and V) in the early morning and late evening. Reception will normally come from the near Continent but a cold front at the boundary of the region of high pressure can extend the range. Almost ten years ago an exceptionally good tropospheric opening in the UK produced signals which originated some 900 miles away.

Enthusiasts wishing to try this form of propagation should watch the weather forecasts on BBC 1 at 1758 and 2125, at which times the Atlantic chart is shown featuring high and low pressure systems. During periods of anticyclonic weather, the Earth warms up during the day because of lack of cloud cover. In the evening the heat which has accumulated during the day is allowed to escape quickly because there is little or no cloud to keep it in. This heating and cooling process leads to inversions of temperature. The troposphere then acts as a waveguide which directs TV signal of above approximately 60MHz back to the Earth.

DX signals can sometimes be received for several days via enhanced tropospheric conditions.

This form of propagation has the advantage that signals are not usually subject to rapid fading and little phase distortion occurs. This is not the case with reception via Sporadic-E, trans-equatorial skip or F2-layer propagation. Although reception via trop can be quite spectacular, DX programs being enjoyed in full colour at times, signals are only noted infrequently. For more frequent reception enthusiasts can turn to meteor shower propagation. Unfortunately signals can be seen for only very short periods, typically 2 to 5 seconds.

Meteor showers

When meteors enter the Earth's atmosphere they burn up in the E-layer leaving an ionised trail which can reflect TV signals. Meteor shower propagation (often abbreviated to 'MS') can occur at any time of the day or night. Band I frequencies are most likely to be favoured via MS, but occasionally intense ionisation in the E-layer can produce reception in Band III.

Although reception of TV signals via meteor showers is completely random there are certain times of the year when showers appear more frequently. The table shows the predicted meteor shower dates for 1985 and it can be seen that the best showers for DX-TV reception are the Lyrids, Perseids and Geminids. It should be stressed that enthusiasts require a good deal of patience to receive long-distance signals via this mode of propagation. The meteor shower dates were kindly supplied by Peter Sturgess (Derby).

Service information

Denmark: According to reports from Copenhagen, the planned second network of Danmarks Radio (DR) will not come into service until at least the end of the decade.

United Kingdom: The digital version of the famous BBC test card 'F' now includes stylised identification. The test card is transmitted prior to 'Ceefax AM' which starts at around 0600 on weekdays. Test card 'F' is also radiated prior to 0900 on BBC 2 following 'Open University' programmes. Regular BBC trade test transmissions were discontinued in May 1983.

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**B.A.T.C.**
Presented by
Andy Emmerson G8PTH

ATV ON THE AIR

Time flies and it is time for our three-monthly round-up of live TV activity again. It really does not seem long since I was writing the last one, but I suppose that means I must have been enjoying myself! Anyway I have a load of letters to condense into a few hundred words here – my thanks to all of you who wrote in. As I write it is mid-December and we have just had a pretty respectable lift on 70 and 23. The local grapevine worked as well this time: whoever is first on phones someone else and so the message is passed on – this way nobody misses out.

Seventy centimetres

Much of our 70cm news is from foreign parts, so let’s start with a couple of short reports from foreign ATVs. In Australia John Ingham VK5KG says all local activity is on 70cm, but as they have the use of 420 to 450MHz that may be understandable. A recent development is aeronautical ATV mobile by Geoff Summers VK5GO. He has used both fixed wing model planes and helicopters – sounds like fun.

John is also organising a small group of ATVers to assist with airborne ATV for bush fire spotting on board the State Rescue helicopters.

In Belgium Jose Robat ON7TP writes about the Liege ATV group of which he is a member. About ten folk transmit a two-hour programme of news, techniques etc every Saturday at 2pm.

North of the border

I am not sure whether Scotland counts as foreign, but who cares? At the Scottish Amateur Radio Convention twenty-three new TVers were signed up for the BATC. Included among the new stations are Des GM1BVK from Mount Vernon and Bill GM4UBJ in Motherwell after a long apprenticeship as an eyegew. On receive are GM4UGG (Robbie, Hamilton), GM1AYT (John, Milton of Campsie), GM4YAA (John, Paisley), GM6KTP (Ken, Hardgate), GM3ZDH (Bob, Carmunnock) and GM4XLU (Eddie, Cumbernauld). The number of stations now receiving ATV in central Scotland is estimated to be around 50, with about a dozen stations transmitting.

More significant is the greater level of activity. GM3KXQ received pictures from GM1FAJ/M in the Bathgate Hills via a reflection off hills on 17th September. 3KXQ uses a Wood & Douglas pre-amp into a modified 70 to 2 transverter, the antenna being a double quad in the rooftop. GM6HFF and GM4UBJ have exchanged P4 both ways, while GM6AQR (George, Longridge) received UBJ at P3. Gordon GM3ULP and Bill GM4UBJ, both in Motherwell, swap P5 with ease. GM4YAA (ex-GM6KCC) in Paisley has given P1 to GM4BUU and GM3ULP and P2 to GM4UBJ over what is a very difficult path, and again must be reflection off the hills. 3UL has had good reports from GM4CXM, GM4PSV and GM3ZDH. Thanks to Norrie’s news agency for this lot.

Returning to the December 10th/11th opening, it seems to have been a patchy affair with lots of ducting (which went straight over the heads of some stations). For some people, especially coastal stations, it was excellent and for most people 70cm was favoured. John GB8LWS in Fife had a field day on the 11th, making two-ways with ON7XM, ON1KRG, DL9GX, DL6ZAC, DG1KAO, DF7KN, ON6XN, ON1AHT and ON4PT. ‘All went dead at 22.39’; nice to see some German stations worked anyway.

The quarter metre band

We start in North Britain this time, so back to the GM4BVU news service. The Moray Firth ATV Group (GM4AVT) held a demonstration of 23cm ATV on November 18th in the Community Centre, Lossiemouth. Ewan Crawford GM4GUQ of Inverness gave a live talk on how the transmitter – kindly loaned by Wood & Douglas – was designed. The programme was transmitted from another building outside the Community Centre. Attendance was very good and included ATV enthusiasts from the Fort William Group. A static display of video equipment was on show during the afternoon. It was a very successful meeting and the first time 23cm ATV had been seen in the Moray area.

Peter G4RNA writes from High Bradfield near Sheffield. He is assisting G3PYB with the latter’s design work for you-know-who by putting out an FM TV signal on 1290MHz. As the QTH is 1250 feet above sea level even QRP should do well!

24cm mobile

Allan G8CMQ has been doing a lot of 24cm mobile operation lately. He is running 10W into a single quad element with both horizontals bent 90 degrees.
into a 'V' type formation in order to achieve horizontal polarisation. The whole affair is mounted atop a 4ft mast and guyed on the car roof. At the end of October this set-up was installed for a Jamboree on the Air event and during the session P5 pictures were received back at the JOA main station. These were re-transmitted on 70 to other amateurs. Signal strength remained quite constant over a 5 mile radius although terrain and greater distances made the signal vary considerably. The JOA station, G82WES, was run by G1AED.

A few days later Allan and Mike G8LES sent mobile pictures to G66XG in Romsey. Later, while static mobile in the New Forest, a good contact was made between the mobile and G4WHO in Wimborne, Dorset, a distance of some 20 miles. Pictures from the mobile were also picked up by G1DSD in Havant, who also re-radiated them on 70 for the benefit of other TVs. Allan adds that he is TX-only whilst mobile, not wishing to upset the local constabulary.

He also took his 10W mobile set-up to St Boniface Down (near Ventnor on the Isle of Wight) on 18th November. P4 or better results were received in Southampton, Havant, Chichester, Worthing and Brighton. G6MP was the Brighton station; this was a distance of 55 miles and John could see Allan P1 using just a 2 metre quarter-wave whip! Allan says thanks to all who participated, viz G6MP, G4WTV, G8KOE, G5NBX, G6CSX, G1DSD, G6R5V, G1APD and G4JQJ.

As Allan was using an omni-aerial all stations could see at once, which makes it a super site for a repeater. Who is going to ask the CAA nicely, then? Another good site is Stoney Cross in the New Forest — Allan made a 20 mile haul to G4WHO in Wimborne from there, again using 10W and an omni-quad.

Odds and ends

More snippets of news from the south coast. The lift of 11th December enabled G6MPE to hook up with F3LP in Le Havre. Another person who has worked France recently is Peter G4LXC (ex-G8EIM and author of several CO-TV articles), he has moved to Hove and worked F1EDM with P5 results for 1.5 watts. He mentions that G3BV is scheduled to move up to Race Hill, Brighton, from where it should give improved coverage all along the south coast (and to France!). The aerial system is a dual Alford Slot.

Final shots in the events of the dual quad antenna from the 'UHF Compendium' works very well, giving 11dB gain. Use aluminium mesh or expanded metal for the reflector panel.

Slow-scan events

Some more info from John Cowie GM6KJD in Aberdeen who answered my call for more SSTV reports. John uses an FRG7700 and a 10 metre wire antenna; this feeds audio to a homebrew interface box and then to a BBC microcomputer running homebrew software. Pictures are then saved to disc and dumped to the printer. The interface itself is very similar to the analogue board in a 1983 RadCom, except that the ADC is a ZN49E. This generates three bits of video and syncs for the user port on the BBC micro.

After many months of design, Vero-board fabrication and keyboard bashing John says he feels leapt in the air when he received the first results! Since then he has improved the program and has also written a Tx routine, although unless some activity starts on 2 metres this is of little use. Reception is mainly on 14.230MHz, with European SSTVers and a lot of inconsiderate phone operators.

John says the main disadvantage of the Beb for SSTV is the limit of 8 bits for the greyscale, though faces are still recognisable. He asks if there is a norm for gamma of SSTV pix — some received images have a lot of black-crushing, which has caused John to design a black-stretcher in the interface. All in all he enjoys the challenge of snatching frames out of warbly tones on 20 metres.

G3WW signs in ...

G3WW is our only other purveyor of SSTV news, so here goes with the news from Wimblington. More and more Ws are appearing on 20 metres using the new Robot colour system, and have been worked two-way using either 12, 24, 36 or 72 second single frame colour, the last two being today (8/12/84) in the persons of WA2WFF and N2WA, near neighbours in Patterson NJ. Both use Robot 1200C models with Tandy TRS-80 computers for control and graphics generation. They will be able to work both our G2BAR and G4UFV, also 1200C-equipped.

Recent short-skip on 20m enabled G3WW and G3WIL to swap Robot 450C colour pictures, while on 2 metres G2BAR and G3WW have played out each other's 'replays' in colour.

The various SC model scan converters around Europe supplied by Volker Wrasse (DL2RZ) continue to give their owners 2x SSTV QSOs with G3WW in 8, 16 and 32 second b/w frames and 24 (and now 48) seconds single frame colour. Eight seconds b/w and 3x3 or 2x2 RGB remain the standard type of SSTV transmissions.

Shuttle SSTV?

There seems to be a possibility of SSTV being transmitted from next April's scheduled 51-H space shuttle flight of Tony England W0ORE. In the USA 'concern' — a surprisingly mild word for it considering the letter which the editor of ARRL magazine has written to ARRL's KD1N thereon — has been expressed over the picture mode formats to be used! Maybe the RSGB can reserve the UK two metre SSTVers a QRM-free frequency? 'Some hope!!' opines Richard.

Richard received a letter from Maurice Webb G1AMR on Merseyside saying that SSTV is on the increase around there. All are using ZX-Spectrum computers and Maurice has sent pix to five other stations, none of whom could send him any back but they hoped to record his signals. He has had two-ways with G3CC, G4NJ, G8NCE, G3KLL, G6YBC, G6FCR, G1BIF and G6HDD (the last three using Spectrums).

G3WW was apparently the only person to write to the RSGB protesting at the loss of 'SSTV Scene' (speaks for itself!) but recommends the new magazine 'SSTV Today', Write to him at the callbook address for details.

Richard comments on the latest update of the Wrasse SC-1 (with 'excellent 48 sec single frame colour') and the robot 450C, as well as the DRAE SSTV receive-only converter. He concludes that there is no real 'best-buy.' all three offer different facilities at different prices, so you tend to get what you pay for...
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Please note: All diodes at 10p or less in this list 20.

**Phillips DIY Home Security Alarm Kits**

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**Sendz Components**

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**Special Offer**

- **Bridges**
  - SK6015 LSA
  - S6015 LSA
  - SK6015 LSA
  - S6015 LSA
  - 20 x 20mm 250V 1A
  - 10 x 20mm 250V 1A
  - 10 x 20mm 250V 1A
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**Miscellaneous**

- **GEC remote panel**
  - 20 x 20mm 250V 1A
  - 10 x 20mm 250V 1A
  - 10 x 20mm 250V 1A
  - 10 x 20mm 250V 1A
  - 10 x 20mm 250V 1A

**MARCH 1985**

please mention RADIO & ELECTRONICS WORLD when replying to any advertisement
VIP radio amateur

It may surprise some people to learn that the new Premier of India, Rajiv Gandhi, is a radio amateur and holds the callsign VU2RQG.

He became interested in amateur radio after seeing his uncle's station in operation, and passed the 1st Grade examination in 1974. Since then he has been active on 21/28MHz and, more recently, 144-146MHz.

During his school years he had an interest in electronics, and was a keen homebrewer. Consequently he made his first homebrew HF CW/SSB transceiver and a two-element cubical quad antenna within three months of obtaining his callsign. This set up remained in use until 1980.

Rajiv Gandhi has a keen interest in computers, and as well as promoting their use in schools is making a constant effort to relax the burden of import duty and tax, etc, on the Indian electronics industry (through his efforts Indian radio amateurs currently enjoy duty-free import of amateur equipment, accessories and components).

On a more personal level of involvement he has displayed an interest in packet radio (with the aim of using his FT-1 and TR7850).

He was also instrumental in gaining permission to set up a repeater on 144-146MHz, which now has the callsign VU2RQG. Equipment for this has yet to arrive from abroad. When it does, this will be the first repeater in India.

His wife, Sonia, passed the 1st Grade exam in 1975 and has the callsign VU2SON. Their son Rahul (14) and daughter Priyanka (12) are currently studying for the exam, and hope to be on the air in the near future.

Amateur radio can be an immensely useful hobby in India, where it has been shown that communication between amateurs can be maintained during cyclone and flood emergency periods after civil communication has failed.

Canal Plus litigation

It seems that all is not sweetness and light in the offices of Canal Plus, the new French TV service described in January's R & EW. A court order was recently issued to prevent the technical radio magazine Radio Plans from publishing information which would allow the illegal decoding of the TV transmissions (ie without paying the subscription).

The object of the code is, of course, to prevent anyone who has not paid for a decoder unit from watching the channel. The eight figure code is changed every month, each subscriber having his own code. The technical staff of Canal Plus had previously claimed that the decoder unit was pirate-proof. As Keith Hamer and Garry Smith have mentioned, the Canal Plus service can be received in parts of southern England, although not in exactly watchable form (due to the lack of a decoder).

For those interested, a Parisian daily newspaper, Le Quotidien, has published a drawing of the electronic code (minus instructions on code-breaking). Consequently this paper is being sued by Canal Plus (whom Le Quotidien calls 'Banal Plus', a reflection on its programming).

Used equipment auction

After many years of trading in secondhand amateur radio equipment, G3RQC Electronics has launched another service to would-be buyers and sellers of secondhand equipment.

The service is to operate alongside List-a-Rig which is an advertising service. List-a-Rig is free to anyone who sends G3RQC an SAE. There is a small charge if you wish to enter your for sale/wanted advert onto the list.

The new service is to be called G3RQC's Auctions. The auctions will be monthly and conducted in the first instance via post. Potential sellers of equipment will send details to G3RQC together with a small fee which is returned if the equipment is not sold. In return G3RQC will include full details onto List-a-Rig together with national advertisements.

Each month there will be a list of equipment placed in the amateur radio press. Participants in the auction will be requested to send their bids to G3RQC who will then forward them onto the owner of the equipment. The owner then selects the highest bid and contacts the bidder direct to conduct the sale.

Further details can be obtained from David Cole G3RQC, 65 Cecil Avenue, Hornchurch, Essex RM11 2NA.

RTTY contest

Peter Adams G6LZB has sent us some information on the BARTG Autumn RTTY Contest 1984:

'The vast increase in our membership, certainly showed in the number of stations active throughout the contest. However, I still only received 22 logs for the single operator section and 13 for the multi-operator section. I wonder why stations don't send them in? 'Conditions certainly improved during the contest and a number of stations worked well into the Continent. The best DX contact appeared to be the one between GW2OP and PE11ML at 622km. 'With such a large number of stations active, the possibility of claims for the VHF Century Award seem very good'.

Here are some of the comments lifted from logs: 'Had trouble getting my back off the bed'. - G6YYP

A wonder which Lucky devil worked Jack in Luxembourg after I had phoned him for a sketch. Perhaps that station would like to refund the cost of two phone calls! - G8RYB

'Pity about some of the high power stations working on the same frequency as other stations'. - G6KHA

'Most enjoyable—marred by some stations' apparent incapability to listen after QSY to check frequencies not in use'. - G4VXF

G6LZB reports that 191 British stations participated in the contest.

The Spring VHF/UHF RTTY Contest will take place between 1800 GMT on Saturday 13 April and 1200 GMT on Sunday 14 April 1985.

Weather satellites

All those interested in weather and other remote sensing satellites are invited to an informal meeting to be held at the VHF Convention at Sandown Park on the 23rd March 1985. The meeting is convoked by Henry Neale, Fishersgate, Sutton St James Spalding, Lincolnshire. After his recent appeals for interested people to contact him he has received 276 letters. If you write to Henry expressing an interest in remote sensing satellites please enclose an SAE.

Repeater group

We have received information from the Cambridge Repeater Group, one of the more active groups of its kind, that GB3PS (RM3) is now on the air from Barkway.

The repeater transmits on 1297.055MHz A continuous, information bearing FSK (inaudible on FM) callsign every 15 seconds.

Also, GB3PY (RB14), mentioned in QSO December 1984, has been successfully moved to a new site on the roof of the Pye Telecom Site One complex in north Cambridge. It was reported in the latest newsletter that: Such was the amount of volunteer effort that the repeater was removed from Madingley at
dinner-time and fully reinstated at Cambridge by 5pm.

One of the other repeaters at the time, GB3PT (RB12), is experiencing little activity at the moment. This repeater runs stacked dipole aerials similar to GB3PY.

Apparently, work on the new receiver for GB3PI (R6 Barkway) is progressing well and hopefully this will be fitted within the next couple of months.

The Cambridge Repeater Group will be holding a Junk Sale Extravaganza on 24 February at 10.30am. The venue is Pye Telecommunications Ltd, St Andrews Road, Cambridge.

Anybody interested in the group can find members in the Green Dragon, Water Lane, Cambridge every Friday lunchtime.

**AV Contest**

Congratulations to G8MNY for coming first on 70cm and to G8VCB for winning the 23cm section in the September AV contest. Certainly conditions were not at their best: G6WOP, who could almost see the Channel, worked no continents and ON7ZI and G8UFFO were the only DX stations available in the south - and then for only a few minutes at a time!

However, the level of activity on both 70 and 23 was better than ever and shows just how much interest continues to grow in AV.

We received the following comments from contestants:

'We hoped this year would have better weather but a storm in the middle of the night took out the 70cm mast at 4.6 feet, which snapped in two but was put back up to 28 feet within an hour at 0345' – G8MNY.

'Diabolical weather! How about fixing up the international AV contest for summertime?' – G8WOP.

'Conditions were horrible but I enjoyed it.' – G8VBC.

'The 23cm receiver could have been better if we had worked some QSOs on 23cm once the masthead problem is the right way round!' – Anon.

TV enthusiasts' attention is drawn to the annual Summerfun Contest scheduled for 0900 to 1600 GMT on Sunday 16th June, this being the first ATV contest using the new Maidenhead locators.

Please note that the contest organiser (G3VYZ QTH) prefers entries on BATC log sheets, available from him on receipt of an SAE.

Another date for your diary is May 5th, when the British Amateur Radio Club will hold its annual rally/exhibition at Rugby.

**Packet radio**

At the RSGB VHF Convention at Sandown Park on 23 March 1985 lan Wade G3NRW, of the British Amateur Radio Teleprinter Group (BARTG), is presenting a talk entitled 'How Packet Radio Works'.

The lecture is aimed at beginners to packet communications, and lan first takes a brief look at the problems of RTTY and AMTOR which initially prompted the development of packet radio, then moves on to the basic features of the AX. 25 packet radio protocol. Many practical uses of packet radio will be described, together with details of the hardware and software needed to run it. The talk is illustrated throughout with slides, tape recordings and visual aids, including a very special piece of string...

lan has already presented this talk on behalf of BARTG to several clubs in the southeast of England, and finds that interest in this exciting new mode of data communication is increasing rapidly. For more information contact him at 7 Daubeney Close, Harlington, Dunstable, Beds LU5 6NF.

**Mobile rally**

The Maidstone Amateur Radio Society will be holding its bi-annual mobile rally on 26 May at 11am. The venue is the MCA Sportscentre, Meikrose Close, Cripple Street, Maidstone ME15 6BD.

**Racial user group**

Readers who are users of Racial products will be interested to know that the organiser of the Racial User Group, Peter Barker G8BBZ, has changed address.

He can now be contacted at 15 Epping Green, Woodhall Farm, Hemel Hempstead, Herts HP27 7JP.

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**NOTES FROM THE PAST**

**Learning from experiments...**

Among the interesting letters received this month is one concerning Lossev's experiments with oscillating crystals. The correspondent still has his notebook (circa 1924) containing a summary of Lossev's original articles dealing with experiments with natural and synthetic zincite used with steel catwhiskers.

For those with a taste for experimental work with transistors he recommends a collection of papers 'Some Conducting Materials' (Henshch 1951). Published by Butterworth, which includes one on 'Crystal Triode Action In Natural Lead Sulphide'. It seems that galena can produce the transistor effect almost, but not quite, as well as germanium - the natural being somewhat superior to the synthetic in this respect.

Since galena is cheap and easily obtainable, there would appear to be considerable scope in this field for those with a taste for original research.

It is by no means unusual for important and original ideas to spring from this kind of experiment. Frequently discoveries only remotely related to the work on hand are made. The history of invention is studded with examples of major discoveries being made by people with infinite enthusiasm for following up a specialised interest, and when concentrating on some significant (and often unexpected) result suddenly perceiving a new use to which it can be put.

**Hide and seek**

The new low-power BBC relay station serving the Folkestone area, which came into service on 23rd December on 206 metres, is temporarily being operated from a caravan measuring only twenty by seven feet. With the building situation in its present state, a similar caravan relay station, which will be sited near Barntaple, is also to be put into service very shortly. While this neatly solves the housing problem, I think we can take it for granted that the BBC won't play ball and fit them out with inalterable aerials so they can join in the fun and games when local clubs have their field days!

A reader asks if any special equipment is necessary to enable photographs to be taken of cathode ray tube traces and TV pictures. Oddly enough, I did make some of the earliest published pictures of TV - back in early 1937, I believe. I remember I took an exposure reading and obstinately decided it was all cock-eyed, and then proceeded on trial and error lines - only to find out that the meter was near enough right after all.
BACK ISSUE SERVICE
All issues from October 1981 onwards are still available, with the exceptions of January and February 1982, and December 1983. All orders must be pre-paid, the cost of each issue being £1.00 inclusive of postage and packing. A contents index spanning the issues from October 1981 to September 1983 is available on receipt of a stamped addressed envelope. To ensure that you don't miss any future issues, we suggest that you place a regular order with your newsagent or complete the subscription order form found in this issue.

JULY 1984
Projects — VLF converter, a unit for the very low frequency, Teleprinter Terminal Interface, Multifunction Test Instrument, a versatile piece of test equipment. Building the Fortep Test Instrument, a very low frequency; Telex printer.

AUGUST 1984
Projects — High Quality Directional Coupler, a coupler for frequencies above 432 MHz, Q455-A Linear Amplifier, a 100 watt value linear amplifier, S9 THI-TH and extending mast, a home construction project. One night's work, adapting a portable typewriter, BBC Micro volume control, TV and video interface.

SEPTEMBER 1984
Projects — Low Power Transmitter, an 80m CW design; AM RAD, an experimental signal generator; Spectrum Analyzer, further update on this project; Five Station Scanner, an add on unit for the 720 channel audio control receiver.

OCTOBER 1984
Projects — Bake Mic, construct this processor controlled accessory. One night's work, build an indoor UHF TV aerial.

Features — Mods, the link between computers and radio. Non-linear elements, a note on modulators. Dateline, continuing the look at alarm systems. BSVT for the BBC Micro, getting started in this mode. Testing! Testing! how to use your test gear: multimeters.

NOVEMBER 1984
Features — Cellular mobile radio, computing attenuators for calculating resistance values, small aerials, coping with problems of space, 27-28MHz conversions. Data File, concluding the series on security systems. FEAs — a beginner's guide. Non-linear elements, log and eritno. QSO, interesting contacts from clubs and individuals. ATV on the air, with a look at a range of aerials for the average pocket.

DECEMBER 1984
Features — Cable TV goes on the air. Simple speech processor, a simple decoder to increase a station's talk power. UO-OA 2 telemetry, decoding satellite signals using this BBC Micro program. Tasting Ernest review, Tasting Testing oscilloscopes. ATV — getting started. Data File, LED circuits and opto electronic principles. Morse test, self study course. Computing Maidhead, three programs relating to the Universal (Maidhead) Locator. QSO, club and event news. ATV on the air, with news from the airwaves.

JANUARY 1985
Features — Canali Plus, Europe's first VHFL/UHF pay-TV service. Phased Vertex treys, a computer program for the design and modelling of antenna systems. Russian Satellites, the first part of a series looking at the equipment used to decode signals from the navigation satellites; RF small signal amplifiers, some of the obstacles encountered when constructing radio frequency devices. Principles of Z80 Morse Decoding, Data File, a look at LED sequencers and analogue-value indicator circuits.

FEBRUARY 1985
Features — Satellite TV, some fascinating experiments involving TV transmissions from an aircraft in flight, Direct Broadcast by Satellite, the systems of TV reception via satellite. Touch-sensitive joystick, Zapping Klingons is made quicker and easier with this project. The horseshoe Hail Syndrome, Brian Dale questions the policies of major manufacturers with regard to chip production. Long Waves Live on! Nigel Cowthorne details the problems of design for long wave broadcasting. Low-pass Filter, clean up your signals with this relatively cheap high power project: Russian Satellites. Part two, an explanation of the complete receive section. Data File, more opto-electronics from Ray Marshall.
SYNCHRONOUS RECTIFIERS
Dr CJD Catto examines the use of synchronous rectifiers and phase-sensitive detector devices

SPECTRUM WATCH
This new series continues with Nigel Cawthorne taking a further look at what’s new on the airwaves

DATA FILE
Light-sensitive and light-controlling circuits form the basis of Ray Marston’s informative feature next month

WEATHER SATELLITES
Terry Weatherley describes a new ROM for the BBC Micro which aids in the display of weather satellite pictures on this computer

934MHz – DEAD OR ALIVE?
Some popular misconceptions are laid low by Andy Emmerson’s review of 934MHz activity

PLUS all the usual features!
New products ● News ● Reception reports...
DON’T MISS the April issue – on sale 14th March

To be sure of your copy of Radio & Electronics World, complete the newsagents order form in this issue or take out a subscription
**FOR SALE**

- **icm IC120 transceiver** – covers 1260 to 1300MHz FM. Perfect condition but no activity route. (G3UHR) Tel: (0372) 640251 (home) or 071444 (office).
- **Grundig Stenorette digitlphone plus speech**. Philips AG8018G T50801 reel 3 speed recorder. Cabinet and instructions etc. (G2G89) Tel: (0758) 430000.
- **Elektro MW19i MKII ZA14497 transceiver fully complete and with mains power pack. Offers tel: (0372) 640251 (home).
- **Entertainment's clearout. Relays assorted types.** Some new. 10 sent for £0 cash or pick to call and choose. Multicore cable, new, 20 way terminal, £5.50. Resistor, capacitors, insulation, assorted, mostly new. £2.50 cash post free. Other details tel: (021) 472 3688, Bailey, 47 Seymour Close, Sally Park, Birmingham 29 JD.
- **Tektion storage oscillograph type 544, dual trace, 10MHz 10MV, good condition with manuals £245.** (G2G89) A Portico, 23 Water Street, Wirral L22 4LL.
- **Tektronix scope with Tektronix 144A1 convertor, £17700 ATU, FR7770 active antena, all boxed and in excellent condition £375.** Tel: (0372) 640251 (home).
- **R1000 communications receiver. 200kHz-30MHz includes dc kit. Can deliver/demonstrate South-East England £25.** Must be in good condition/working order. GOLAF.
- **A9021 20MHz FM transceiver**. (G3UHR) Tel: (0506) 630070 (evenings).
- **TR-80 model 1, level 2, 16k, with numeric keypad**. (G3UHR) The best complete unit, £10. All documentation includes 10 cassettes of software, two volumes + of OSI/Computik Users Group Newsletter, and some tips from Premier. NASCOM II (Z80 based) with 32K RAM, PSU, and sound board, in custom wooden rack for access and protection. Cassette interface 300/1200/2400 baud, and many cassettes of software. Full documentation Ex-mainframe core memory system boards for 32K by 13 bits. All core planes and circuit boards except power regulator card (complete data included in the full documentation). PSU/ test unit (gives all 5 required power rails), but no card frame. Stack of valves from experiments on radio, TV and analogue computers, including singles and multiplies, diodes, triodes, tetrodes and pentodes; mostly miniature, but some subminiature or larger types. Price for complete cans included. 16K RAM cards (1 kit, 1 built) from Greenwell's ('metal computer') Interak range. Can be stretched to 32K per card using spare gaps if don't mind piggybacking 16K RAM chips. Cards are international standard size (4½ x 8 in), with 43 way ibus edge connector. Homebrew 5-way backplane available, although though ibus card is (much) better. Boards assume a 288 processor controlling refresh. Contact Jim Henry Tel. 0372 640251 (home) or 071444 (office).

**FREE CLASSIFIED ADS**

We are pleased to be able to offer readers the opportunity to sell their unwanted equipment or advertise your wants.

Simply complete the order form at the end of these ads, feel free to use an extra sheet of paper if there is not enough space on the form. We will accept ads not on our order form.

**DEADLINE AND CONDITIONS**

Advertisements will be inserted in the first available issue on a first come first serve basis. We reserve the right to edit or reject any ad. Trade advertisements are not accepted.

Please mention RADIO & ELECTRONICS WORLD when replying to any advertisement.

MARCH 1985

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**Classified Ads**

- **For Sale**
  - Various items including video equipment, radios, and computers.
  - Prices range from £5 to £310.
  - Items include cassette players, transceivers, and computer accessories.

- **Wanted**
  - Audio equipment, including amplifiers and speakers.
  - Offers for unwanted equipment or advertising for wanted items.

**Deadline and Conditions**

- Advertisements are not accepted.
- All ads should be delivered to the office by this date.

**Contact Information**

- Tel: 0808 310683 (Worchester)
- Tel: 0808 310683 (Worchester)
- Tel: 0808 310683 (Worchester)
ATU. 160m = marine – 80m Rx, AR22 2m synth Rx, LPM 885 SWR/wattmeter 20 – 1000W, 2m and 70cm mobile antennae. P&N nicad charger, icom tspk/mic. W/mach motor. Seafarers log needs attn. 16ft x 2in Ali pole. Components of all types for disposal. All items vgc, with manuals, nicads and chargers as appropriate. Lockwood G3XLL, Gis-llith, Epy, Suffolk IP23 8HX. Tel: Meliss 596. Sharp MZ3828, computer, 72K RAM, 40/80 character display, typewriter style keyboard and Phymadic pad, monitor and cassette deck built in. 'Basic', 'Assembler', books, software. £399ono or swap for amateur radio gear. Tel: Abingdon 27703. Quantity of analogue panel meters, all ex-WD and mostly in original packing. All movements and ranges 0-1mA 0-10mA 10-0-10mA 50uA 0-300V, all sizes available. Must clear garage. £2.00 each for meters, plus postage or better buyer sort through and collect. Also Phillips Pal colour pattern generator type PM5508 in excellent working condition £120. Mike Townsend, 16 Laton Avenue, Henwick Park, Worcester. Tel: (0905) 426068 (anytime). 144MHz PA boards, 1 watt drive, 80 watts plus output, 24V supply. £25. Switching power supply, output 24V 10A £42. 1no and 10 disc ceramics, 50 for £1.00. 2V lead-acid battery and charger £1.95. Tel: 0277 214406.

WANTED

- RGB decoder panel complete, in working order, for Echo CTX/202. Panel as used by RTTY. £60.00. Components of all types for series. Details, prices etc to Barlow, 18 South Ave, Heywood, Lancs. Postal charges and exps will be paid. Tel: Heywood (0706) 626404.
- Change wheels for AVO wave oscillator or complete wave ensembler. Enamelled copper wire, especially fabric covered. HP410C in any condition. Sultan frequency standard. USM140 main frame. Large sheets glass fibre PCB, both SS and DS. S.J Branson, 111 Park Road, Peterborough PE1 2TR. Tel: (0733) 678504.
- Manual or copy or circuit for Dumont oscilloscope type 241, D E Simmons, 132 Osaby Road, Wistaston, Leics. Tel: 866605.
- 1no low inn 2Ω and 10m 10m Rx/Tx. WHY. Contact G4ANW tel: (0733) 61859.
- FT707 with PSU, must be in good working order. WHY. Tel: Formby (07048) 77322.
- Oscilloscope suitable for amateur Scopex or Crotech ideal. J Anderson, 22 Landau House, Chatsworth Road, London NW2 4BW.
- Any useful ham related software for Osborne 1 80 column. Also for Microlog ATR6600 or Sharp PC-1251. Particularly Oscar 10, log listings, and search, propagation, etc. G3AG, 'Upper Durford', Petersfield, Hants. Tel: (0730) 892143 or 895334.
- Tektronix EHT Transformer, circuit designation TAO1, part number 120-0306-00 for oscilloscope 545B or details of number of tureos to rewind same. Also 6AUSGT valve; Bic ThruUine elements, particularly 250H; Info on Atari disk drive; Heathkit barograph 1D2000E; Bare Commodore 64 – no cassette unit or books etc needed; Pan and Tilt head; IEEE to RS232 bi-directional interface unit. A McCann, 105 Todd Lane North, Lostock Hall, Preston, Lancs PR5 5JP. Tel: (0722) 37815.
- B40D must be immac and most recent model. Enquiries to Mr Baines, 53 Maple Road, Penge SE20.
- Low Band AM transceiver suitable for 86MHz. Prefer Pye Motsafone but would consider valve set if very low price. Tel: (0603) 256178.
- Non-working HRO receivers or parts for spares. Condition unimportant. Also original HRO PSUs and speaker units. Tel: St Albans 39333.
- Circuit and construction details for varicap type tuner, to cover 200MHz to 400MHz AM with IF O/P on 144MHz 2 metre band or complete Rx circuit with IF/AF stages. Also any mods to trick the lock of the Fairmate AS-3220 scanning Rx to cover the freq gaps. A Blair, 55 Burnmoorfield Road, Rowsland Gill, Tyne and Wear NE39 1QQ.
- Personal radio as used by HM forces etc. In working condition, with or without crystals, plus original rechargeable battery and manual. Reasonable price will be paid. Mr Martin Byrne, 4A Portnall Road, London W9.
- DF loop 27MHz and 144MHz, either kit or ready made. L Williams, 16 Clan-Yr-Ystrad, Johnstown, Carmarthen, Dyfed. SA31 3NY. Tel: (0267) 234777.
- Handbooks or circuits for Hitachi VM910/K monitor. Pye 848008 monitor, Hewlett Packard signal generator 606C. G3XNT. Tel: Kings Lynn 826339.
- Circuit diagram req for Leson power base mic, type DT251 with built-in processor. Chris Dadds, 55 Worlaby Road, Scarboth, Grimsby, South Humberside. Tel: (0472) 70399.
- Ex-goft manuals for wireless sets: TR1196, CNY, B2, AM111, ZC1, W512, W513, W521, WA40, WSA41, good price paid, others wanted but too many to list WHY. Bob Warner, 45 Easty Close, Ashton, Kent. Tel: (0223) 36185.
- Circuit diagram for 16mm GS&P Bell Howell cine gun camera, ex govt electric, 24Vdc drive mag load. Also 16mm Beaulieu 16. One with faults considered no lens required. Have Bendix Rx GC WW11 aircraft Rx and Hewlett Packard scope (no valves) for spares or repair. Wanted old microphones pre-war. Tel: More 1 (0225) 706796.
- Circuit diagram for WKS1001. Please contact Mr Martin Fuller, 37 Greenfield Close, Eccles, Nr Maida Vale, Kent. Tel: M/Stone 70485.

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Classification: (tick appropriate box) If you want to insert ads under more than one classification use separate sheets for second and subsequent ads

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USE BLOCK CAPITALS (One word per box)

To avoid mistakes please write clearly and punctuate your ad

Name/Address
Postcode/Telephone

USE SEPARATE SHEET FOR MORE WORDS

Ensure that you have included your name and address, and/or telephone number

CONDITIONS: Your ad will be published in the first available issue. We will not accept trade advertisements. We reserve the right to exclude any advertisement.
SPC 7-6

MARKET v. 4
Tel: 061 941 3057  Telex: 666387
Rd, Tel: 02273-63859
Colin G11ZD  Gavin G11ZL
MON - FRI 9.00 - 6.00
3 FARNDON GREEN; WOLLATON PARK, NOTTINGHAM; TEL: 0602 280267
31 Cattle Market Street  NORWICH
(0603) 667189 MAIL ORDER ACCESS/BARCLAYCARD

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TU3 Bar graph LED 8.10k
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LONDON
BONEX LTD
RF component specialists Toko coils & Inductors
102 Churchill Road
London W3 6DH
Tel: 01 992 7748

NORFOLK
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For the intimate details or write
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Radio & Electronics World
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print your copy here

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ADDRESS:____________________________________________________
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Single County Guide 3 £47.00  6  £88.00  12  £158.00
Double County Guide 3 £94.00  6  £176.00  12  £316.00

PAYMENT ENCLOSED £_______

Cheques should be made payable to Radio & Electronics World. Overseas payments by International Money Order

Conditions — Payment must be sent with order form. No copy changes allowed. Ads accepted subject to our standard conditions, available on request.

Registered No 2307662 (England)

MARCH 1985

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CBM64, VIC20, ATOM, DRAGON 32/64, TANDY COLOR COMPUTER
Advanced machine code programs with split-screen type-ahead operation, any baud rate, saveable memories etc.

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Available for Dragon 32/64. Large SAE for software/hardware details.
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Tel: (0323) 893378

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WDO SOFTWARE
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Brentwood · Essex CM14 4SE · England · (0277) 219876

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NUMBER OF ISSUES:

FOR A PERIOD OF

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CHARGE TO MY ACCOUNT

COMPANY

ADDRESS

SIGNATURE

TELEPHONE

CPI

SALE!”

Valuable Space for Sale!

MARCH 1985

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<th>6 issues</th>
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SERIES RATES

Series rates also apply when larger or additional insertions are made to an initially booked size. An ad to a minimum space must appear in consecutive issues to qualify for series rates. Previous copy will automatically be credited if no further copy is received. A hold ad is acceptable in maintaining your series rate contract. This will automatically be debited if no further copy is received. Dates, Ad and Small Ad series rate contracts are not interchangeable.

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AVAILABLE NOW VIA LOMBAR TRICITY

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FREE *HBSCV
*NI-CADS
*CARE
£199 *CHARGER
5 LEFT-POST INC

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INC 2X1000 *6W CRIS *
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0.5 RV HF MULTIBAND DIPOLE ANTENNA
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18mm FOCAL LENGTH

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SUPER QUALITY £12.50

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MAGNETIC MOUNT 50CM MOUNT 3M COAX + PLO9
SPECIAL PRICE £9.95

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