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Radio & Electronics World

The communications and electronics magazine

XMAS QUIZ

WIN A HIGH QUALITY SCOPE

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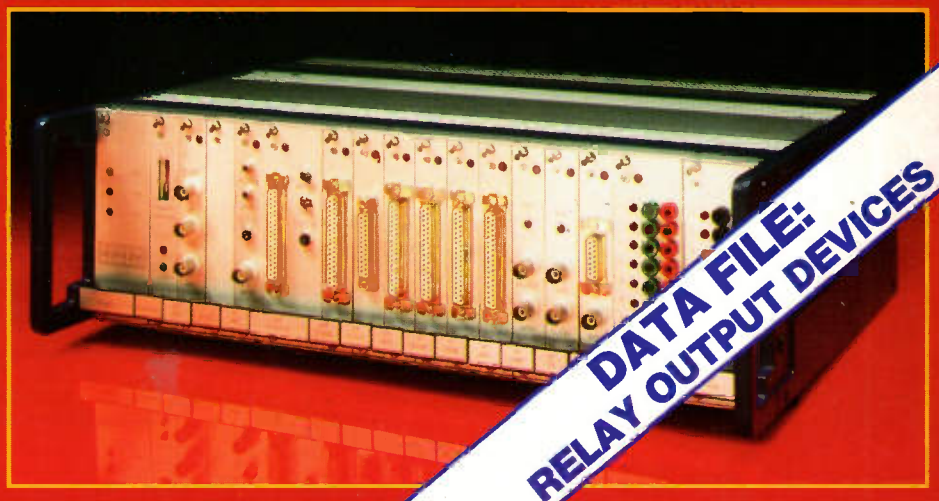
DO IT YOURSELF EXTENSION WIRING

COMPUTERTALK:
A MINIATURE LINE-POWERED MODEM



HF ATU:
A RECEIVE ATU FOR SHORT WAVE

DATA FILE:
RELAY OUTPUT DEVICES

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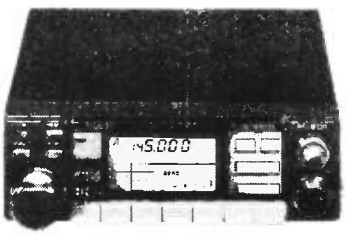

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Publisher
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Safety in the shack

Some of the constructional projects featured refer to additions or modifications to equipment; please note that such alterations may prevent the item from being used in its intended role, and also that its guarantee may be invalidated.

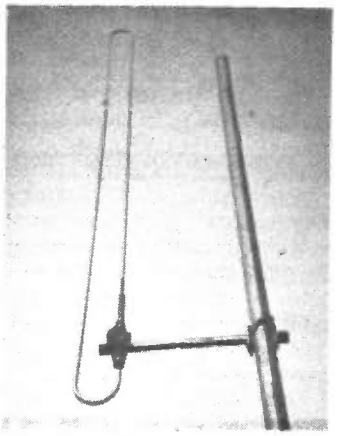
When building any constructional project, bear in mind that sometimes high voltages are involved. Avoid even the slightest risk – safety in the shack please, at all times.

Cover Photographs

Top – Reach for the sky (p9)

Bottom – The missing link (p8)

SPECIAL FEATURES



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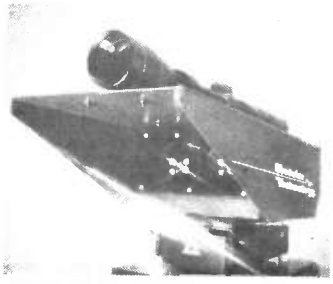


Beam me up, Scottie – page 21

NEXT MONTH

☐ **Next Issue**
Cover date February 1987 on sale Thursday, 8 January

☐ **Publication Date**
Second Thursday of the month preceding cover date

We regret to inform readers that owing to continually rising production costs and to enable us to maintain the high standard of content in ***Radio and Electronics World,*** the price of the magazine will be £1.35 from this issue

PRODUCT NEWS

Featured on these pages are details of the latest products in communications, electronics and computers. Manufacturers, distributors and dealers are invited to supply information on new products for inclusion in Product News.
Readers, don't forget to mention ***Radio & Electronics World*** when making enquiries

INTELLIGENT DMM

The 1905a from Thurlby Electronics is a low cost intelligent bench multimeter particularly suited to use on a simple programmable test system within production, quality assurance or component inspection areas.

The instrument incorporates a wide range of keyboard programmable calculating and data logging functions which greatly extend its measurement capabilities. The scale length is ±210,000 counts (5½ digits), the resolution 1μV, 1mΩ or 1nA, and the basic one year accuracy is 0.015%. AC functions are included as standard, and current measurement extends up to 5A.

Examples of the intelligent functions include linear scaling with offset (Ax+b) enabling, for example, the output of a load cell to be displayed directly in kilogrammes rather than in terms of the electrical output.

The △% function enables the percentage deviation from an entered nominal to be displayed to a resolution of 0.001% up to ±400%. The limits comparison function allows high and low limits to be entered via the keyboard following which the display will show (in addition to the measurement result) a two-letter code of HI, LO or PA (pass) depending on whether the result is above, below or between the two limits.

The 1950a is a highly compact instrument measuring only 9 × 9 × 3 inches and weighing only 4 pounds. Its price is £349 + VAT.

Thurlby Electronics Ltd,
New Road,
St Ives,
Huntingdon,
Cambs PE17 4BG.
Tel: (0480) 63570.

VAW/dB MULTIMETER

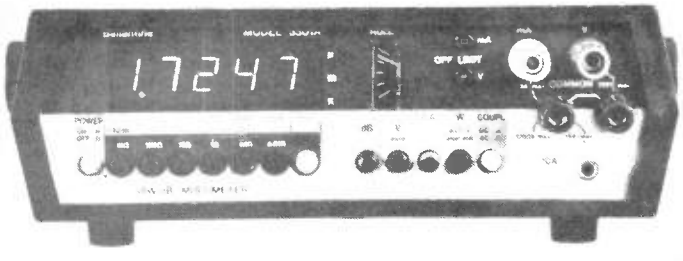
Now available from PPM Instrumentation is the Ballantine 3501A, a four-function 4½-digit multimeter which gives true rms measurement of ac and dc voltage, current, power and dB levels.

There is a wide range of dB measurement options, the standard scale being 0dB to 1mW in 600 ohms. Further characteristic impedance levels between 50 ohms and 1k are available, making conversion tables redundant. Relative gain/loss levels are thus simplified and outputs can be read directly.

When used as a wattmeter real load delivery is computed using applied voltage, load current and power factor data. Power ranges cater for measurements from microwatt level to a maximum 7.5kHz. Power ranging is semi-automatic.

Voltage and current functions give selectable ac or ac/dc coupling, floating-input and true rms measurement. Voltages are autoranged between 200mV and 750V. Current ranges are push-button selected and are between 200μA and 10A.

PPM Instrumentation Ltd,
Hermitage Road,
St Johns
Woking
Surrey GU21 1TZ.
Tel: (04867) 80111.



SPECTRUM ANALYSER

The Avcom PSA-35 portable spectrum analyser is a lightweight instrument which operates from ac line or internal rechargeable batteries. The frequency coverage is from less than 10MHz to over 1500MHz and from 3.7 to 4.2GHz in 6 bands (including the current 12GHz for LNBs). The instrument has a built-in power block and power for LNAs and BDCs.

The PSA-35 will accurately measure wideband signals commonly used in the TVRO industry. Optional extras include a signal sampler, a terrestrial interference survey horn and a portable carry case.

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

REVISED SCOPES

Telonic Instruments is introducing updated versions of the Kikusui COS 5000 range of general purpose oscilloscopes.

The new range, designated the COS 5000TM series, encompasses bandwidths from 20MHz to 100MHz in seven models. Top of the new range is the COS 5100TM, a 200MHz 3-channel (two main input channels plus one auxiliary) dual timebase oscilloscope with sweep delay.

Vertical sensitivity covers the range 1mV/div to 5V/div on both the main input channels, whilst channel 3 provides sensitivities of 0.1V/div to 0.5V/div. Vertical display modes are CH1, CH2, CH3, individually or simultaneously, add, and trigger view. CH2 has an invert facility. Internal trigger source may be either CH1, CH2 or both alternately, which would enable two asynchronous signals to be displayed simultaneously.

Telonic Instruments Ltd,
Boyn Valley Road,
Maidenhead,
Berks SL6 4EG.
Tel: (0628) 73933.

HAND-HELD DMM

A recent addition to the Levell Electronics range of instruments is a 4½-digit hand-held DMM, type HC4510. This meter has a 0.4 inch high liquid crystal display with polarity and low battery indication.

The dc ranges are from 200mV to 1000V and 2mA to 10A with a basic accuracy on dc volts of 0.05%. The ac ranges are from 200mV to 750V and 2mA to 10A with a response from 45Hz to 1kHz. Resistance ranges are from 200 ohms to 20M.

Ranges for testing continuity (with buzzer) and diode forward voltage drop are also incorporated. A further feature is the data hold switch which locks the display.

The instrument is housed in a robust ABS case 170 × 87 × 42mm and weighs 360g.

The HC4510 costs £69 + VAT including mainland UK delivery.

Levell Electronics Ltd,
Moxon Street,
Barnet,
Herts EN5 5SD.
Tel: (01) 449 5028.

REAL-TIME SCOPE

New from Advance Bryans Instruments is the DS-1520 series oscilloscope which features a 20MHz bandwidth for normal dual-channel real-time applications, as well as an advanced 2MHz digital storage specification.

A feature of the DS-1520 is the 2048 × 8-bit memory for each channel, which allows for greater expansion than is possible with most conventional storage oscilloscopes. When plotting out waveforms, the DS-1520 memory gives twice the length of plot compared to an ordinary 1K memory.

The instrument has six operating modes: real-time; refresh; single-shot; roll (pre-trigger and split memory); gating; and external start. Two separate, custom-designed 2MHz A/D converters are provided to ensure no jitter and high accuracy.

The DS-1520 series is available in four versions to meet most output requirements. Systems requiring hard copy graphics are easily achieved by interfacing the oscilloscope to X-Y recorders or digital plotters. The oscilloscope can also be used as part of a measuring system via an IEEE-488 controller.

Advance Bryans Instruments Ltd,
14-16 Wates Way, Mitcham,
Surrey CR4 4HR.
Tel: (01) 640 5624.

SIGNAL ANALYSIS

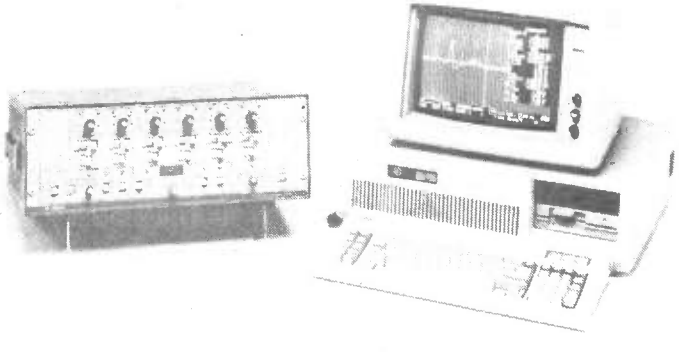
Gould Electronics Ltd has introduced a new advanced data acquisition/signal analysis system. Combining a powerful, specially programmed, general purpose microcomputer with a multi-channel signal digitiser, the new DASA 9000 aims to provide the measurement instrumentation industry with an advanced, modular, user-orientated measurement tool.

The heart of the DASA 9000 subsystem is a Gould-enhanced IBM personal computer with a 13-inch colour monitor, complete system software and an optional A4 or A3 Gould multi-pen plotter. The system accepts up to eight analogue inputs which can be sampled simultaneously. Each channel's dedicated 8-bit converter and intermediate memory storage, switch-selectable up to 32K, support 10 user-selectable sample rates from 500 to 333,000 samples per channel.

The DASA offers expanded graphics capability which includes scrolling and page jumping and instantaneous display of signal levels and time-from-trigger position. PC/XT versions include a 360K floppy drive and 10M hard disc, while PC/AT versions have a 1.2M floppy drive and 20M hard disc.

The DASA 9000 supports up to 14 multi-channel waveform digitisers, providing a maximum of 112 channels. The triggering capability of the waveform digitisers is enhanced by pre-trigger data capture in five steps from 0 to 100% of memory.

Gould's new proprietary IOS (Instrument Operating System) 2.0 software integrates all communications, data storage, display and analytical functions of the system from the keyboard.



Gould Electronics Ltd,
Instrument Systems,
Roebuck Road,
Hainault,
Ilford,
Essex IG6 3UE.
Tel: (0925) 815950.

POWER MONITOR

The new DCC 2000 battery power monitor, now available from Sait Marine Limited, gives comprehensive, accurate and up-to-date information on levels of available power in an electrical system.

The DCC 2000 is a hermetically sealed unit which uses its own computer to monitor the input of power from the alternator and consumption by the electrical system. It displays the difference as available amp-hours on a digital counter. Also featured is an accurate digital system which provides volt/amp measurement at the push of a button.

The accuracy of the monitoring function also means that the user is able to assess energy conversion potential within the installation.

Sait Marine Ltd,
Wireless House,
31 River Road,
Barking,
Essex IG11 0BX.
Tel: (01) 594 5642.

Seasons Greetings to ICOM users the world over

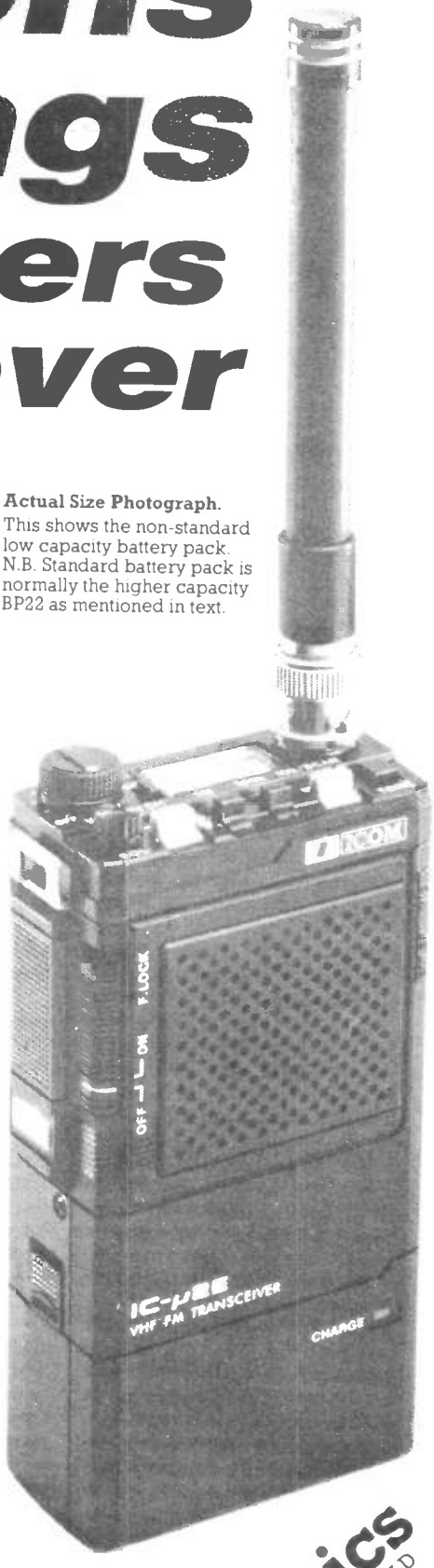
NEW! IC-MICRO TWO, Mini-handportable.

This is the smallest handportable transceiver from ICOM. The MICRO-TWO, 2 metre FM measures only 148 x 61 x 31mm. with BP22 battery pack (not shown here). The MICRO-TWO is a hand-size transceiver which will equally fit most pockets.

On the top panel a clear LCD readout gives frequency and memory channel number. Tuning is made easy using up/down toggle switches to select 1MHz, 100kHz or 12.5kHz steps as well as the 10 memory channels. Full repeater and reverse duplex operation facilities are featured including repeater access tone. An automatic power saving function reduces battery power consumption when in receive mode. Output power is 1 watt or 100 milliwatts (low) with the BP22 nicad pack.

The ICOM MICRO-TWO is the ultimate in 2 metre miniature handheld transceivers, yet despite it's small size the receiver sensitivity and performance has not been compromised. This handy transceiver comes complete with the BP22 nicad pack (not shown here), A.C. wall charger, helical antenna. Most existing ICOM accessories can also be used.

An optional extra, the BC50 desk charger will rapidly charge the BP22 battery in just one hour. Other options include the BP23 long-life, low-power and BP24 medium-life, high-power nicad battery packs. Contact us or your local ICOM dealer for more details on this exciting new product.



Actual Size Photograph.
This shows the non-standard low capacity battery pack. N.B. Standard battery pack is normally the higher capacity BP22 as mentioned in text.

Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet Electronics

Sea Street, Herne Bay, Kent CT6 8LD
Tel: (0227) 363859.
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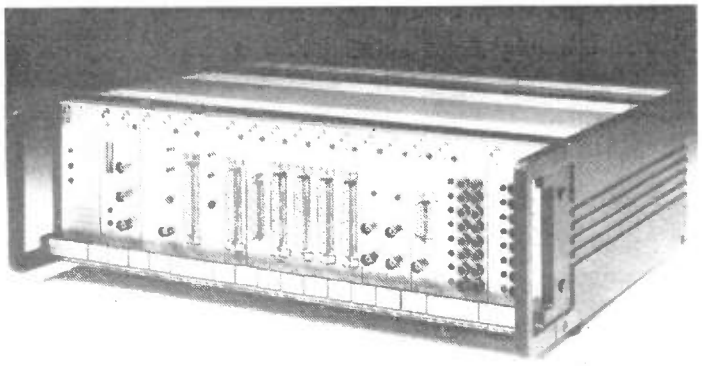
PRODUCT NEWS



DATA ACQUISITION

Microlink, the modular data acquisition system for use with the IBM PC and compatibles, has been enhanced with the release of new hardware and software.

With the addition of 20 new modules Microlink now offers a choice of more than 50 modules, meaning that almost any instrument or transducer can be connected through Microlink to a computer. New modules include units for slow speed data acquisition, for high speed waveform capture and synthesis, for strain gauge inputs and for the most complex timing and counting applications.

In high speed data acquisition, new modules are available with specifications that were previously only available in expensive dedicated systems. Modules are available which can capture up to 1 million samples per second per channel, with up to 128K of memory per channel, and up to 16 channels of data can be collected in a single Microlink cabinet.

New Microlink scientific software packages are also available. The transient capture package incorporates programs for waveform analysis, for waveform comparison and for Fast Fourier Transforms. The data logging package provides printer and plotter outputs, and data conversion to dBase II or III, Lotus 1-2-3 and DIF formats. Microlink software can also be customised to meet specific laboratory or process monitoring applications.

Biodata Ltd,
10 Stocks Street,
Manchester M8 8QG.
Tel: (061) 834 6688.

RADIO TEST SET

The Stabilock 4040 radio communication test set manufactured by Solartron Instruments, which offers a two-way radio measuring capability ranging in frequency from 0.4 to 960MHz, is now NATO approved.

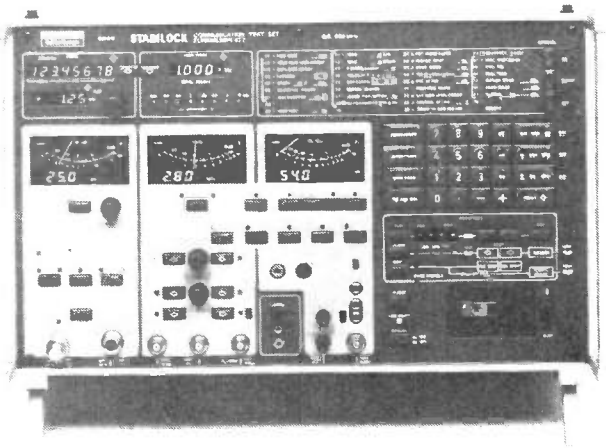
The 4040's adjacent channel power meter allows test routines such as harmonics, spurious signals, selective power and adjacent-channel power to be measured simply and accurately without the need to use a spectrum analyser or a separate selective RF millivoltmeter.

The basic 4040 model features a continuous carrier frequency range up to 960MHz, extendable to 1.85GHz, a selective call tone coder/decoder plus automatic measuring sequences for all principal two-way radio set properties such as sensitivity, centre frequency, bandwidth, squelch and modulation sensitivity.

The test set may also feature an optional mini-cassette drive for the storage of complete radio-set test programs up to 900 steps to cater for fully automatic testing applications.

Measurements on cellular radio and radio data systems can be undertaken using the 4040 in association with Solartron's 4922 radio code analyser and a 4040 duplex FM demodulator.

Solartron Instruments,
Victoria Road, Farnborough,
Hants GU14 7PW.
Tel: (0252) 544433.



RF SIG GEN

The SMX signal generator from Rohde & Schwarz is an economical signal generator which provides RF signals with fine resolution in the frequency range 0.1 to 1000MHz. The maximum total error of the level adjustable between −137dBm and +13dBm in 0.1dB steps is as low as ±1.5dB.

Ease of operation, accurate output level and high grade modulation characteristics as well as the low spurious FM (<3Hz at 250MHz) make the SMX ideally suited for all in-channel measurements on narrowband communications systems, eg mobile radio.

The SSB phase noise at 20kHz offset from the carrier remains below −118dBc at 500MHz (1Hz test bandwidth) and is further reduced towards lower frequencies (−130dBc at 125MHz). The two modulation modes, AM and FM, can be set independently on the SMX. An automatic software correction provides for high accuracy of the FM deviation setting. A deviation of up to 800kHz can be set as a function of the carrier frequency. The modulation frequency response with FM is smaller than ±0.5dB up to a modulation frequency of 100kHz. The distortion is 0.1% for 1kHz. Internal and external modulation sources can be switched on simultaneously for two-tone modulation.

Rohde & Schwarz,
Mühldorfstrasse 15,
D-8000 München 80,
W Germany.
Tel: (0 89) 41 29 26 25.

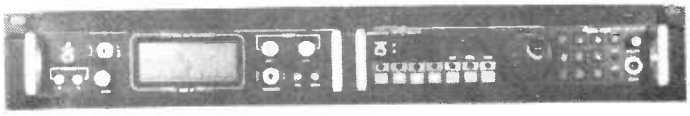
VHF/UHF RECEIVERS

The latest series of compact Reaction Instruments surveillance receivers offers fast scanning capabilities in the frequency range 20MHz to 1200MHz. Facilities include search, step and scan operation with the ability to monitor active channels and hand off to slave receivers.

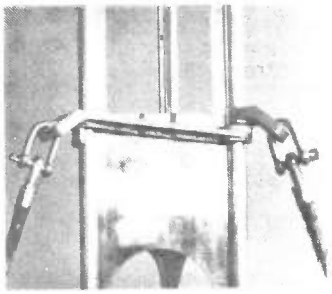
System configuration is highly flexible: one model, the 685 receiver, can be used as a hand-off receiver, or linked to the companion IF pan display 695. From this basic building block, optional search controller and signal activity monitor units can be added.

The spec provides for 1kHz tuning resolution, and up to 4 IF bands with simultaneous AM/FM detection, as well as SSB and pulse detection, an excellent noise figure (8dB), and low phase noise performance. Other features include full external control via IEEE-488 or RS232, and extremely small panel size with a height of 44mm.

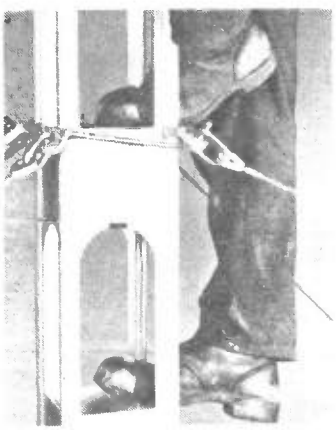
Tony Chapman Electronics Ltd,
Electron House,
Hemnall Street, Epping,
Essex CM16 4LS.
Tel: (0378) 78231.



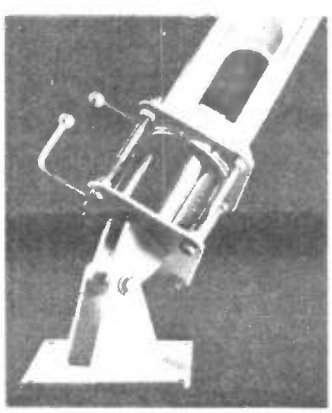
RADIO MASTS



A new way of building antenna or floodlight support masts rapidly on site has been developed by Francis & Lewis Ltd. Their new Ex-Masts are built of standard aluminium sections that pack flat for ease of transport and storage. Enough sections for a complete 30-metre four-sided mast pack into a volume of just 0.43m³, facilitating transport by air freight, light truck or roof-rack.



The sections slide together without needing bolts to construct three or four-sided guyed masts up to 30 metres high. Besides supporting many different configurations of lightweight VHF/UHF antennas and small microwave dishes, the masts are suitable for carrying temporary floodlighting installations and instruments such as anemometers.



The interchangeable aluminium sections come in four standard lengths, allowing joints to be staggered. The sections have weight-saving holes designed as climbing steps at 381mm intervals and the same components are used for both three and four-sided (triangular or square cross-section) masts.

Guy wires can be attached at any height using guy-cleat bars developed for use with the Ex-Mast. Slotted in between the mast sections, the cast aluminium bars overlap each other at the ends and automatically lock their neighbours into position as soon as stress is applied. Again there are no bolts to lose, damage or drop.

Stainless steel spring clips that fasten the guy-cleat bars to the mast sections are available for extra security where required. Guy wires can be anchored to the ground using duckbill anchors of heat-treated tenz-alloy aluminium.

Footings for the masts are completed by a universal compact baseplate suitable for both three and four-sided masts. There are also pivoting baseplates with porcelain insulators and earthing spark gaps to protect against lightning strikes.

With standard configurations, design windspeed is 45 metres/second, and maximum horizontal loading is 70kg at the top of a four-sided mast. Masts can be constructed to withstand higher windspeeds and loads by modifying stay sizes, span lengths etc.

Ex-Masts can be supplied custom-engineered to meet particular environmental and imposed-loading specifications or as standard packs for masts designed to carry a certain number of VHF antennas.

Francis & Lewis Ltd,
The Runnings,
Kingsditch Industrial Estate,
Cheltenham,
Gloucestershire GL51 9NJ.
Tel: (0242) 513882.

MINIMAL RADIO

Now available from Thanet Electronics is Icom's latest compact mobile transceiver, the IC-48E. This rig, similar to the miniscule IC-28E 2m transceiver, operates on 70cm FM with a power output of 25/5 watts.

There is a 21-channel memory and duplex and memory skip functions, with scanning possible via the hand mic controls.

Also new from Icom is the IC-μ2E, a 2m FM hand-held transceiver measuring 148 × 61 × 31mm (approximately 5¾ × 2½ × 1¼ inches) including the BP22 nicad pack supplied with it. It features 10 memories, with an LCD showing the frequency and memory channel number.

Tuning is in 1MHz, 100kHz or 12.5kHz steps, and repeater and duplex facilities are provided. The output power is 1W/100mW.

The IC-μE is supplied complete with BP22 battery pack, ac wall charger and helical antenna.

Thanet Electronics Ltd,
Unit 9, Sea Street,
Herne Bay,
Kent CT6 8LD.
Tel: (0227) 363859.

DRAGON/TANDY AX25

Grosvenor Software have produced some new software for the Dragon 32/64 and Tandy Color computers to allow packet radio operation using the AX25 protocol (a data transmission format that includes error checking and automatic retransmission, with any station able to operate as a digital repeater).

The software is available on ROM cartridge or on disc, and eliminates the need for a terminal node controller (TNC), thus reducing costs considerably. All that is additionally required is a modem (Bell tones, 300 baud for HF and 1200 baud for VHF).

It supports AX25 Version 2, Level 2 and can also communicate in Version 1. Up to eight intermediate stations can be specified as relays, and six contacts can be conducted simultaneously. The text for any contact is individually selectable on the display.

Text files and programs can be reliably transferred to disc under DragonDOS, and received text can automatically be spooled to disc. The software 'listens' on frequency before transmitting to avoid collision. The operator can choose whether to delay transmission while any carrier is heard, or only while valid AX25 signals are heard.

AX25 systems comprising software and a 1200 baud modem are available for £99, with an HF modem adaptor promised soon. The software alone costs £49 for those who want to build their own modems.

For more details of this and other G4BMK software (RTTY, ASCII, AMTOR, SSTV etc), send an sae to the address below.

Grosvenor Software,
2 Beacon Close,
Seaford,
East Sussex BN25 2JZ.
Tel: (0323) 893378.

PRODUCT NEWS

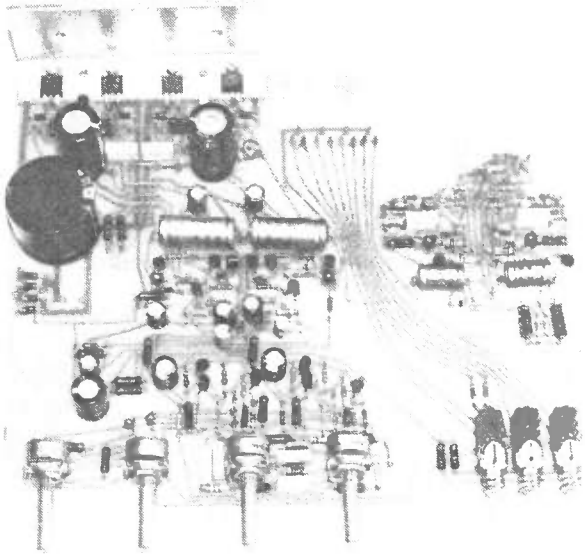
LOW NOISE PREAMP

New from Camtech Electronics is a low noise, low cost mast-head preamp for 1200-1350MHz. The circuit is based on two noise matched NEC bipolar RF transistors and makes extensive use of stripline techniques.

The preamp offers a gain of 14dB with a noise figure of less than 2dB. The on-board tunable image rejection filter offers a 3dB bandwidth of 85MHz. Power consumption is 18mA at 12V dc.

The Camtech 23cm preamp is available in kit form for £22.50 + £1 p&p or built and tested for £29.75. A boxed version complete with BNC connectors costs £41.75 + £2 p&p.

Camtech Electronics,
8 Wortham Place, Haverhill,
Suffolk CB9 0HP.
Tel: (0440) 62779.



HI-FI AMP

Audiokits Components, specialists in audio circuit design and components, have released the Audiokits Module, a high quality stereo hi-fi audio amplifier. Supplied as a ready-built board, this amp will provide up to 30W rms per channel from a 40V ac supply, and will work well on supplies down to 15V ac.

It features a cascode drive stage for improved linearity and high frequency response, a two-transistor constant-current source and diode-stabilised biasing in the preamp.

The Audiokits Module is available for £37.50 + £2 p&p, with discounts available for orders of five or more.

Audiokits Components,
6 Mill Close,
Borrowash,
Derby DE7 3GU.
Tel: (0332) 674929.

HIGH CLASS HI-FI

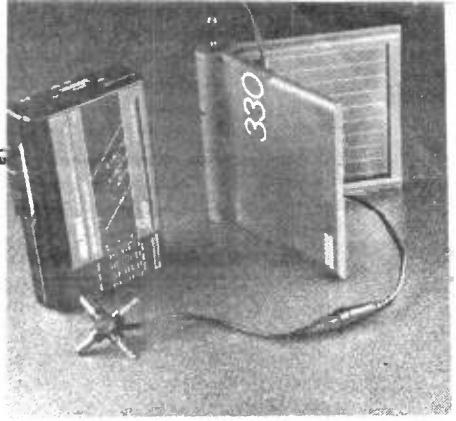
Revox have combined a number of their established hi-fi units with a new timer controller to produce the 200 System, described in the publicity material "the ultimate in hi-fi systems."

The new B203 timer controller will link up to 8 units to allow control from an infrared remote control handset or from a home computer. The B203 is programmed to perform complex procedures at the touch of a single button.

The units it controls in the 200 System include the B225 CD player, B215 microprocessor controlled cassette deck, B285 programmable scanning AM/FM receiver and B291 linear tracking turntable. The whole system is engineered to the highest standards to appeal to "the very top end consumer", and weighs no less than 115 pounds.

The ultimate hi-fi also has a price to appeal to the over-the-top end consumer. Systems range from £4750 excluding speakers from a selected range of hi-fi specialists.

FWO Bauch Ltd,
49 Theobald Street,
Boreham Wood,
Herts WD6 4RZ.
Tel: (01) 953 0091.



SOLAR CHARGER

The Chronar MiniCharger provides a means of battery charging for users of personal stereos, cameras, portable shavers, etc. Supplied with two AA (or HP7) size rechargeable nickel cadmium batteries, the MiniCharger can also be used to run a radio or cassette directly.

Using the two nicads supplied, the solar cells will recharge in about the same time (12-14 hours) as a conventional mains charger, even in artificial light (although best results are obtained by placing the panel in direct sunlight).

The MiniCharger is small and light enough to fit into a pocket. Its construction is rugged and versatile, the front cover doubling as a tilted stand. Also included is a connector lead with multi-way adaptor to suit a range of products.

Chronar Ltd,
Sales & Marketing Office,
49 Albemarle Street,
London W1X 3FE.
Tel: (01) 491 0535.

CORDLESS HEADPHONES

The new AR980 TRX from Kewmode is an infra-red transmitter/headphone combination that provides a 'spatial sound' (ie simulated stereo) effect for mono sound signals from a TV.

The transmitter plugs into the audio output socket of the TV, video recorder or hi-fi unit, and is powered from the mains supply. The IR signal it produces is effective up to a range of 40 feet.

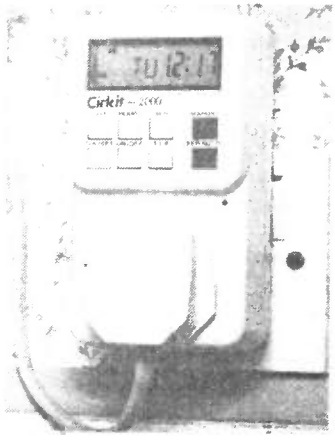
The Kewmode AR980 TRX retails for around £39.95.

Kewmode Ltd,
Unit C,
Faircharm Industrial Estate,
Evelyn Drive,
Leicester LE3 2BU.
Tel: (0533) 893158.

PLUG-IN TIMER

Electrical appliances rated at 3kW or less can be programmed to switch on and off automatically, as many as six times per day for each day of the week, by means of a new plug-in electronic time-switch from Cirkit.

Called the Cirkit 2000, the new product features a digital display to show the day of the week and the time as well as selected settings, which can be programmed for periods as short as one minute by means of push-button controls.



In the event of mains power failure a built-in battery back-up facility is brought in automatically to avoid interruption to the programme, and there is a manual override button which enables subsequent switching to be brought forward, again without any disruption to the programme.

Accuracy of the Cirkit 2000 is within ±1 second, enabling it to be used to control critical timing functions such as photographic and laboratory processes.

The new timer has a retail price of £32.95 + VAT.

Cirkit Distribution,
Park Lane,
Broxbourne,
Herts EN10 7NO.
Tel: (0992) 444111.

TIMESHARE

The M806 from Fernwood enables up to 8 personal computers or terminals to automatically share one RS232 printer or plotter.

An optional buffer of 6 to 256K improves computer utilisation and the choice of XON/XOFF or handshake line control offers maximum flexibility.

In mode 1, control is by detection of data or handshake signal from the computer, with queuing if the printer is busy. In mode 2 each port is polled sequentially by raising one handshake line and checking for data response. Disconnection is by timeout, control characters or handshake line.

Protocol and interface conversion can be provided by customised firmware to match users' requirements.

The free-standing version is housed in a metal case and requires 240 or 120V ac mains.

Fernwood Electronics Ltd,
Kingwood,
Henley-on-Thames,
Oxon RG9 5NB.
Tel: (0491) 7549.

SPEECH ICs

A new family of speech processing ICs from NEC covers both speech recognition and speech synthesis. Some 30 devices, including complete modules and evaluation boards, offer the design engineer a choice of approaches to speech processing technology. Speech synthesis devices cover bit rates from 8k to 32kbits/second, using adaptive differential pulse code modulation (ADPCM) and repeated phoneme (RP) algorithms. Speech recognition devices provide both speaker-dependent and speaker-independent operation. RAM storage of pattern matching programs allows a variety of DP algorithms to be implemented for recognition of connected or isolated words.

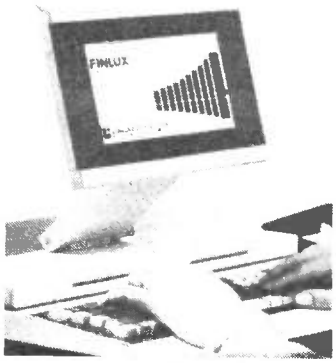
The family also includes a speech compression codec, allowing bit rates to be minimised whilst retaining acceptable speech quality.

NEC Electronics (UK) Ltd,
Cygnus House,
Linford Wood Business Centre, Sunrise Park Way,
Linford Wood,
Milton Keynes MK14 6NP.
Tel: (0908) 691133

ULTRA-THIN SCREEN

An ultra-thin half page solid-state display uses a new electroluminescent technique developed by the electronic division of the Finnish Lohja Corporation.

The display screen, known as the Finlux MD 640.200, is primarily intended for use in portable computers, desk-top terminals and process instrumentation. It is easily interfaced to MS/DOS systems of the type used in the IBM PC.



The MD 640.200 is a half-page screen with 640 × 200 picture elements to support both text (25 lines of 80 characters) and high resolution graphics. The picture is crisp, stable and free from flicker, with contrast and readability close to text on paper quality. The image is yellow on black or vice versa.

The dimensions are 228 × 158 × 35mm, which includes the display panel, drivers, a control board and a power converter. These modest dimensions allow manufacturers incorporating the display in their equipment more space for their own electronics without increasing the overall size. The completely solid-state display is well able to withstand shocks and vibration.

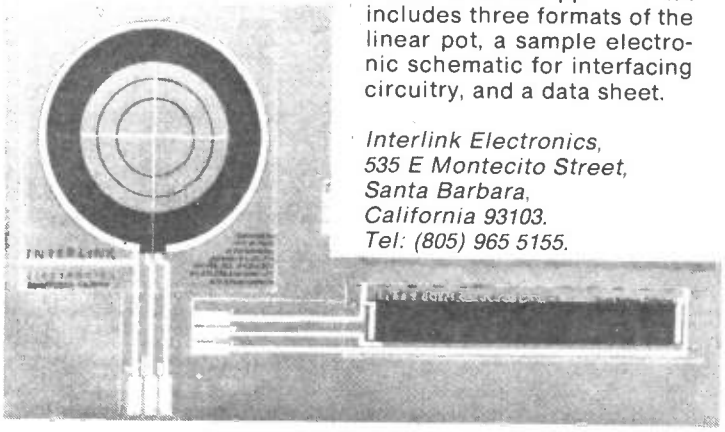
Lohja manufactures these screens using a patented atomic layer epitaxy process, a technique evolved by the company itself. The resulting extremely uniform thin-film layers on the surface of the glass screen base ensure outstanding reliability of the finished display.

Lohja Corporation,
Olarinluoma 9,
SF-02200 Espoo,
Finland.
Tel: +358 0 42 001.

THICK-FILM POT

Interlink Electronics has developed a thick-film linear potentiometer which provides a unique solution for a low cost, very low profile position and pressure sensor. Measuring only 0.015 inches high, the linear potentiometer may be integrated within a membrane panel or into any design where space is critical.

The device employs Interlink's proprietary force sensing resistor technology to measure both the position of an object and its pressure upon the surface. Simple interface electronics convert the resistance change to dc voltages which may be used to control external circuitry or equipment.



The new device has a maximum working voltage of 1.5V, with a maximum dc current of 1mA. The typical force range is 20g/cm² to 10kg/cm², with a resistance range of 10MΩ to 1000Ω.

A linear pot kit for evaluation purposes is offered by Interlink for $30 ppd. The kit includes three formats of the linear pot, a sample electronic schematic for interfacing circuitry, and a data sheet.

Interlink Electronics,
535 E Montecito Street,
Santa Barbara,
California 93103.
Tel: (805) 965 5155.

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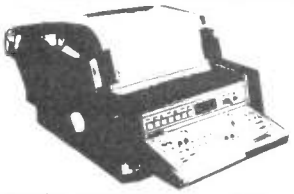

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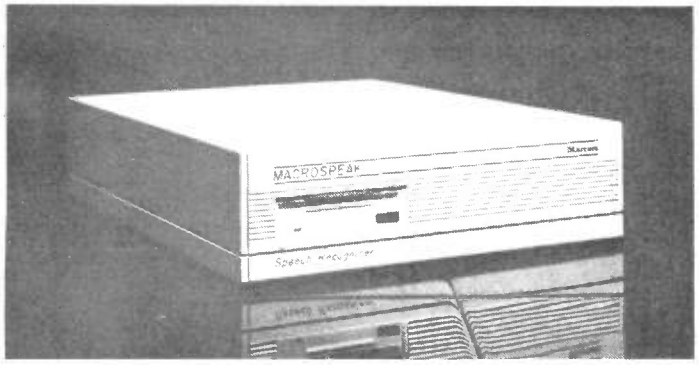


Say what?

Marconi Defence Systems has launched a new speech recognition computer peripheral. Macrospeak is the product of eighteen months development conducted at the company's Portsmouth-based Speech Systems Division. It surmounts many of the problems that have, to date, limited the widespread use of commercial speech recognisers.

The spoken word has long been viewed as the ultimate replacement for the computer keyboard in man-machine operations, yet the human voice has been notoriously difficult to recognise. The nature of speech is a poorly-understood process, a problem compounded by the voice pattern that is unique to each and every individual. For this reason speech recognisers of the past have suffered severe practical limitations.

Macrospeak benefits from twenty years of work by Marconi in speech processing. Since 1981, this work has focused on the company's SR-128 equipment, the world's first stand-alone connected speech recogniser.

Macrospeak uses a spectral technique known as 'whole word dynamic time warping pattern matching' to compare spoken with stored words. The algorithm is implemented on two custom 3-micron silicon-on-sapphire LSIs designed by the Speech Division and produced by Marconi Electronic Devices.

The first is an arithmetic processor which calculates the distance between the acoustic input and the stored spectral patterns on a frame-by-frame basis. The second contains the algorithm which undertakes the pattern matching process. A 68000 32-bit processor completes the heart of the system.

In simplified terms, the recognition process compares the spoken words against the spectrogram, or three-dimensional voice template, compiled during the initial teaching session. Inputs are matched against time, frequency and energy parameters that have been loaded into memory from disc. Recognised words are passed to the internal macro processor which converts them into output characters. The entire process is performed in real-time, even in the continuous speech mode.

Although Macrospeak responds directly to a large vocabulary of user-defined words, its capability can be further enhanced by using the built-in macro facility. This feature can be programmed by the user who initially types in each macro command against menu-driven prompts. These are then stored in memory and may be saved and loaded from the disc. Macro capacities for the 160 word standard and 640 word upgrade models are 200 and 800 commands.

Engineering trials

British Telecom is to start engineering trials next year of advanced modulation equipment which could increase the capacity of its digital microwave radio network by up to a third. Four contracts worth a total of £1.5 million have been awarded to GEC Telecommunications, STC Telecommunications, the Italian firm Telettra, and to NEC of Japan.

The equipment operates in the lower 6GHz frequency band and uses a technique known as 64 QAM – quadrature amplitude modulation. It will be installed on three radio links and is due to start operating by June 1987. BT will then evaluate the performance of the equipment for general use in the network (it will enter service in 1988).

The microwave network forms a major part of BT's trunk system. Together with optical fibres and coaxial cables, it forms the country's high capacity communications highways, carrying phone calls, computer data and TV pictures between the main centres of population.

BT is converting the network to digital operation as part of its modernisation programme. Digital operation will bring many benefits, including clearer speech and faster call set-up. It also enables the network to carry other services – data, text, facsimile, etc – together with speech on the same microwave, cable or fibre carrier.

BT's present methods of superimposing speech or data in digital form on a radio link enable the main microwave bands allocated to the company to each carry six digital channels. These channels operate at 140 million bits per second, giving an equivalent total band capacity of nearly 12,000 simultaneous phone calls.

The 64 QAM equipment to undergo trails next year will allow eight channels, equivalent to 16,000 calls, to be fitted into one band, increasing its capacity by 33 per cent. The price per channel of 140Mbit/s 64 QAM equipment is less than two-thirds that of earlier systems.

64 QAM is the latest evolution in the development of digital modulation techniques aimed at making more efficient use of the radio spectrum. Early digital systems used by BT employed 4-phase modulation called quadrature phase shift keying (QPSK) and this is used on the 11GHz equipment. To improve efficient use of the spectrum the 4GHz band will use a QPSK technique where the bandwidth is deliberately restricted to less than the theoretical requirement (reduced bandwidth QPSK). This requires elegant techniques to compensate for the inevitable distortions due to the reduced bandwidth.

An alternative is to modulate the carrier not only in phase but also in amplitude – generally termed quadrature amplitude modulation (QAM). In 16 QAM the carrier can take any one of 16 discrete states, and this reduces the symbol rate (which determines the amount of radio spectrum bandwidth required for transmission) to one quarter of the bit rate to be transmitted. 16 QAM will be used in the upper 6GHz frequency band.

The 64 QAM technique again makes use of amplitude and phase modulation to produce 64 discrete carrier states, thereby reducing the transmission symbol rate to one sixth of the channel bit rate and hence reducing the required transmission bandwidth to about 23MHz.

Capitalism rules, OK?

At Comex '86, the mobile radio conference held by the Federation of Communications Services during November, details were revealed of a DTI-commissioned report prepared by CSP International Ltd. This report recommends that the allocation of radio frequencies for all forms of communication should be handed over to the private sector and be run on a profit-seeking basis.

The response from conference delegates was reported as being 'guarded', with some reservations being expressed about likely increases in costs and the possible detrimental effects on pan-European standards. It is worth noting that no other European country is proposing similar 'privatisation'.

MAP standards

The subject of the IEEIE Measurement, Control & Automation Professional Group lecture on 19th January will be *Manufacturing Automation Protocol (MAP) Standards*. On this occasion the speaker will be Mr G Brocklebank, BSc, MInstMC, MBCS, Manager of the Process Computing Group of Unilever Engineering.

MAP is a specification for an interfacing process designed to enable the implementation of communications between programmable equipments of differing manufacture with a minimum of purpose-written software. Based on established or emerging international standards, MAP was originally conceived by General Motors as a means of containing the escalation of costs associated with installation of communications for automation projects.

This IEEIE lecture will be held at 6.00pm on Monday, 19th January 1987, in the Faraday Room, IEE, Savoy Place, London WC2.

Electronic symbols

The BSI has published a revision of *Electrical and electronic graphical symbols for schools and colleges*, which makes available to teachers and students a selection of symbols from BS 3939 (*Graphical symbols for electrical power, telecommunications and electronics diagrams*).

This booklet, together with an associated wall chart, brings the 1981 edition into line with BS 3939 : 1985, which is itself identical with IEC 617 published by the International Electrotechnical Commission. Although in this revision the actual symbols are unchanged, they are shown with one thickness of line in most cases, often simplified (eg by omitting envelopes on semiconductor devices), and are designed on a grid pattern. These changes should prove helpful to those using the symbols in computer-aided design.

While all BSI publications are subject to copyright, schools and colleges are permitted to reproduce pages from the booklet only for use within single educational establishments.

The price is £7.50 +VAT for the booklet and wall chart. The BSI is at 2 Park Street, London W1A 2BS. Telephone (01) 629 9000.

Fifty farad caps

ERA Technology has constructed and tested a prototype wound capacitor of extremely high capacitance per unit volume. This type of construction can deliver 50 farads from a package the size of a cotton reel (approximately 16cm^3 or 1 cubic inch).

The prototype is capable of retaining its charge over many months or it may be charged continuously at a very low current drain, and will display stable discharge characteristics.

The energy storage density of about 6 joules/cm^3 at low direct voltages has been obtained by making use of the capacitance of the double layer of charge formed when an electrode is immersed in an electrolyte. If the electrode material has a large specific surface, the capacitance and stored energy can be increased accordingly. Electric double-layer capacitors are already commercially available in capacitances of a few farads.

Companies interested in capacitor development should contact Mike Weller at ERA Technology, Cleeve Road, Leatherhead, Surrey KT22 7SA. Telephone: (0372) 374151, extension 278.

This hand-held radio terminal is the latest addition to the 'Computatruk' paperless warehouse control system from Process Computing Ltd (tel: 01-900 6466)

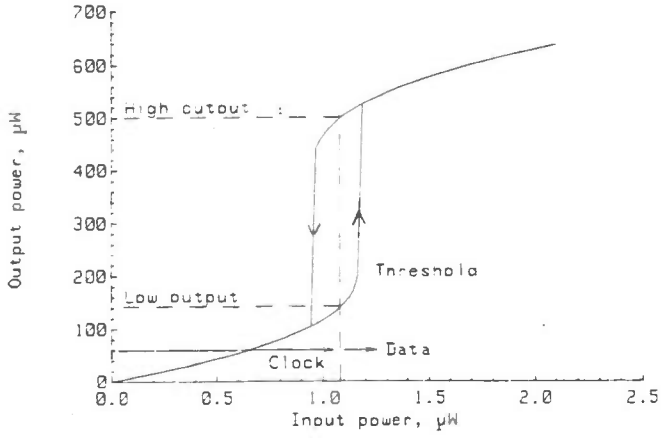


Fig. 1. Bistable amplifier characteristic (theoretical).

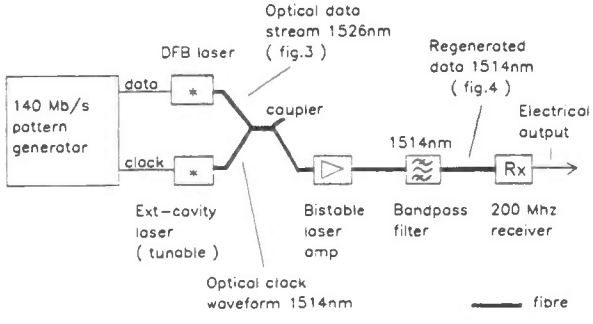


Fig. 2. Experimental all-optical regenerator.

All-optical regenerator

The world's first all-optical light regenerator for use in optical communications has been successfully demonstrated by British Telecom Research Laboratories at Martlesham Heath.

The regenerator, still in the experimental stage, both amplifies and re-times light pulses directly without converting them from light to electricity, as occurs in conventional repeaters.

In present long-distance optical links regenerators are installed every 30km or more to recover and reproduce the pulses of laser light which travel along the fibres of glass.

All-optical regenerators, when developed commercially, promise considerable savings in the cost of optical communications links, especially for undersea systems. Regenerators will be significantly cheaper and simpler to make, and their power requirements will be reduced.

The all-optical regenerator was developed by two BT research engineers, Rod Webb and John Devlin. Its key component is a microlaser which under certain conditions can behave like an optical logic switch. An optical clock signal is fed to the laser to hold the switch state just in the 'off' condition.

When a pulse of light from the incoming fibre arrives at the laser it has sufficient optical energy to switch on the laser, but only when the optical clock signal is also present. This triggers the laser to generate a more powerful burst of light in synchronism with the clock which is then injected into the outgoing fibre.

The BT all-optical regenerator differs from previously demonstrated optical amplifiers in two important respects: bistable operation leads to a signal output level which is relatively constant over a range of input levels; and the signal is re-timed by an optical clock.

The all-optical regenerator has been operated at 140 million pulses a second. Its inventors are now working to improve performance and achieve higher rates by ensuring that all the components in the equipment are working at their most effective operating conditions.

SPECTRUM WATCH

NIGEL CAWTHORNE G3TXF

It's been more than twenty years since a TV channel frequency plan was drawn up for broadcasters in Africa. Since then many new African sovereign states have emerged and TV broadcasting in Africa has developed considerably, with an ever increasing demand for frequencies.

The first session of the African (and neighbouring countries) Broadcasting Conference (AFBC) was held in Kenya in October to start work on a new TV plan for Africa. Most Middle East and African nations were represented among the 49 countries and 200 delegates attending AFBC(1) in Nairobi.

The purpose of the two-session conference is to revise parts of the 1963 plan relating to TV. The current plan, which provides for the installation of 10,604 stations for Africa (4,969 FM and 5,635 TV), was drawn up in Geneva in 1963. Not all African countries were able to participate in the 1963 conference. In addition, VHF/UHF propagation data applicable to the African region was either incomplete or totally non-existent then. It is therefore high time that a thorough review was made of broadcasting frequency plans in Africa.

A new plan for sound broadcasting was drawn up for the whole of ITU Region 1 (Europe, Africa, Middle East and USSR) and certain Region 3 countries (Afghanistan and Iran) in 1984. The 1984 FM plan covering 53,000 FM stations (13,000 for Africa alone) will come into force in July 1987.

Technical bases

The first session of the African Broadcasting Conference was to prepare the technical bases and propose planning methods to assist the second session in establishing a new frequency assignment plan for the VHF/UHF TV bands between 47MHz and 960MHz.

Algeria, Oman and the UAE were three countries which were reported by conference observers as making particularly positive contributions to the conference. Delegates were from both broadcasting authorities and PTTs. The Libyan delegation, however, were unfortunately unable to attend the conference as they had been barred from entering Kenya.

IARU observer

Although the conference was not directly concerned with frequencies of direct interest to radio amateurs, the International Amateur Radio Union (IARU) was present at the conference as an observer. The IARU representative was Dick Baldwin W1RU. The IARU makes a point of attending all the major frequency planning conferences, as this gives an excellent opportunity to make contact at senior level with officials who may have some direct influence on the well-being or otherwise of amateur radio in their home countries. Frequency planning discussions which may concern amateurs can also be monitored.

The Nairobi session of the TV conference lasted for three weeks. During the inter-sessional period before the second part of the conference the ITU will undertake a number of studies, particularly into the VHF/UHF propagation conditions in the Gulf and African regions. An accurate understanding of the different propagation phenomena in the area is essential to plan the efficient use of frequencies so as both to optimise use of the spectrum within a country and to avoid undue interference between broadcasters in neighbouring countries.

For Bands I and III the conference recommended that planning be based on 7 or 8MHz channel spacing without overlapping the adjacent bands not allocated to broadcasting. A 'theoretical lattice' planning method, which provides a maximum density of stations on a logical frequency re-use basis, will be used for the UHF bands IV and V.

Individual administrations' frequency requirements have to be submitted to the International Frequency Registration Board (IFRB) in Geneva by February 1988. These will be fed into the IFRB's computer to produce the first draft, which will be sent to administrations early in 1989. The second, detailed planning session of the African Broadcasting Conference is scheduled for October 1989.

Cellular saturation

Predictions of when the present generation UK cellular networks (Cellnet and Vodafone) will saturate vary, but by some time in the early '90s the quality of service on the networks will probably have started to deteriorate because of overloading. With cellular systems there is no magic point beyond which the network is overloaded. Once the maximum cell infrastructure (in terms of base stations and radio channels) has been implemented, as further subscribers use the service the average quality of service will progressively deteriorate.

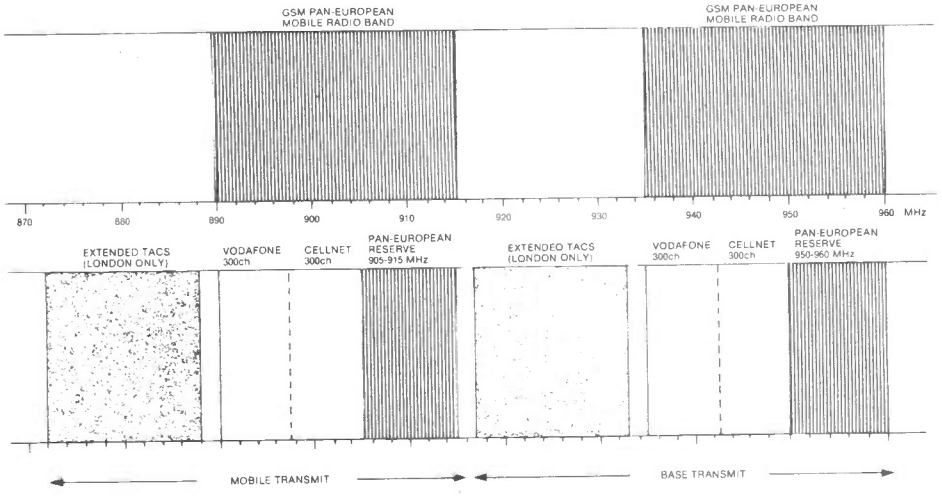
The mobile radio industry and PTT administrations are already making plans for the next generation of cellular networks in Europe. Unlike today's patchwork of incompatible networks, for the next generation the hope is that the same system will be used across all of Europe.

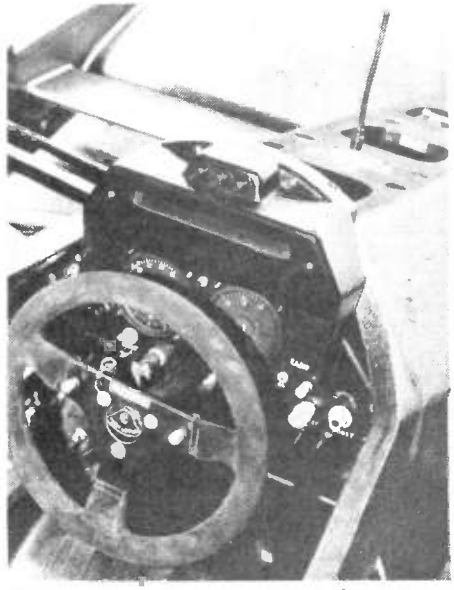
Stockholm seminar

Major decisions on pan-European cellular are to be made over the next few months. The goal is simple. It is to define the outline technical parameters of a common European cellular radio network. The second Nordic Digital Mobile Radiocommunications Seminar (DMRII) in Stockholm in October coincided with an unprecedented level of activity within both European industry and the Groupe Spéciale Mobile (GSM). The GSM was set up by the European PTTs to coordinate the drafting of technical specifications for pan-European cellular.

The GSM's Tomas Haug, in opening the

Fig 1 *The allocation of additional cellular frequencies (for the London area only) at the lower end of the existing Vodafone and Cellnet bands takes pressure off the Pan-European reserve bands (905-915 MHz and 950-960 MHz)*





Mobile radio on the move: Ayrton Senna keeps in touch with his pit crew using a Philips Pocketfone system

conference, underlined the two major advantages of a pan-European network: international roaming throughout Europe and a Europe-wide market.

Today's 450,000 European cellular subscribers operate in a number of watertight compartments. The largest common area is the Scandinavian NMT-450 network, which, including Iceland, now has 300,000 subscribers. The UK's 110,000 TACS subscribers form the second largest piece of the European patchwork. International roaming (apart from within Scandinavia and between the Netherlands and the Benelux countries) is not a feature of the present generation, but it is a primary goal of the next.

Common frequencies

A pre-requisite to pan-European cellular is the availability of common frequencies. The GSM's Haug warned that one of the major risks to the present GSM activity is that first generation cellular operators start to use the pan-European 900MHz reserve frequencies.

The GSM, said Haug, has to be seen to be sticking to its timetable if the European countries are not going to break ranks. If the GSM's timetable slips dramatically, cellular operators would be under overwhelming pressure to encroach, at a national level, into the GSM reserve in order to meet the growing domestic demand for car telephones.

Haug's other major concern was that the CEPT's concensus approach in decision making might lead to an over-complicated solution, by virtue of 'trying to please everyone'. According to the GSM's own timetable an outline specification has to be agreed at the GSM meeting in February 1987 and a detailed specification by the end of 1987.

The GSM's task is to establish specifications for key system interfaces. These are the interfaces between the user and the mobile, between the mobile and the base station, between the base station and the mobile switching centre (MSC), between MSCs, and finally between the MSCs and other external networks. The GSM is not concerned with the specifications of individual items of equipment. That will be left to manufacturers.

The GSM is currently undertaking a programme of tests aimed at providing data on which to select the key technical parameters. The tests, which are scheduled to run into early 1987, will analyse each of the eight digital radio systems proposed.

Digital mobile

Today's analogue mobile radio systems work on the basis of one signal per carrier and of carrier frequencies being spaced evenly across the operating band. This is 'frequency division multiple access' or FDMA. A station is identified by the frequency it is transmitting on. However, in 'time division multiple access' or TDMA systems a large number of stations transmit on the same frequency but at different time intervals. A TDMA station is identified by using a synchronised clock.

The eight systems currently under discussion for pan-European cellular all use variants of TDMA. One proposal from Philips, called MATS-D, uses different transmission techniques for mobile-to-base and base-to-mobile. The mobile-to-base link uses narrowband FDMA with 25kHz carrier spacing, whereas the base-to-mobile link uses a wideband 64 channel per carrier code division TDMA technique with carriers spaced at 1.25MHz. Philips argues that this type of hybrid solution is essential if the majority of the system costs are to be in the base station equipment and not in the mobile unit. Economically priced mobiles are one of the keys to the success of pan-European cellular.

All in all, there are a total of five narrowband and three wideband TDMA proposals being studied. Among these are four proposals from Scandinavia. The others are from consortia involving companies from France, Germany and Italy. The eight proposals (nine, if the MATS-D proposal is considered as two) do not include any from the UK. The UK would like to see itself as an 'honest broker' in the selection of an appropriate system for pan-European cellular.

UK companies are currently undertaking a series of DTI-sponsored digital mobile radio test projects to obtain practical measurement data which will be made available to the GSM to assist in the evaluation of proposals. Test measurements have already been done on a 'simple TDMA' system in both Chelmsford and London by a combined BT/Racal/GEC team. A second phase of tests will be on a 'complex TDMA' system using a coherent receiver with adaptive equalisation and frequency hopping at 160 hops/sec.

Test-bed tigers

British Telecom Research Labs' David Cheeseman, on behalf of the BTRL/Racal/GEC cellular 'test-bed' project team, warned the Stockholm conference delegates that "there are tigers in the dark". Cheeseman urged delegates to "get out on the road" and do practical tests and not to rely solely on computer simulations of mobile radio systems. REW

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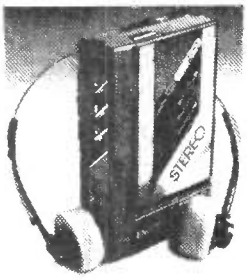

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AMATEUR RADIO WORLD

Compiled by Arthur C Gee G2UK

The editorial comment in the October issue of the RSGB's journal, *Radio Communication*, announced measures being taken to update the society's administration. Reading through it, your scribe cannot but help contemplate the quite fantastic progression which has taken place in the society since he first become a member some fifty or so years ago. Even in the last ten years the membership has increased from 19,600 in 1976 to 37,500 today. The financial turnover over the same period has increased from £106,000 to £1,085,000! These figures alone indicate the tremendous amount of work that has to be tackled.

Over this period there has been steady upgrading of the administration to keep up with all the developments which have come along with ever increasing rapidity. This includes such matters as the transfer of records from manual sorting to a computerised system, a move of HQ from a small terraced building in central London to the present modern self-contained site at Potters Bar, where all the society activities can be integrated, and a change of staff from primarily clerical to a mainly technical bias.

The bovine years

Fifty years ago the society's affairs were mainly devoted to producing its monthly journal (the famous old 'Bull' as it was affectionally called), keeping up a meagre few thousand membership records, arranging meetings around the country, and such routine matters as a small specialist society needed to keep it running. As is the case today, much of the society's work was done by voluntary committees, but the number of topics requiring such administration was indeed small.

There was a Contest Committee and some specialised technical committes and so on, but just think what is needed to cover today's interest. Apart from the usual run of interests there are a whole host of topics of a specialist nature; TV, RTTY, the new data communication specialities, VHF/UHF, microwaves, satellites, computing, emergency services, mobile activity and so on. Then there are the committees required to sort out such matters as licence regulations, international co-operation, and so on and so on!

So, if you are one of those members who criticise the society without thinking, or one who gets many of the benefits for our hobby without being a member, just take a look at what the RSGB does do for you and see if you can help in some way either on the local or national scene. If you are not a member, just have a good think about whether or not you really ought to join. At least you would then be helping the society financially.

The 10MHz band

When the 10.100 to 10.150MHz band was first released to radio amateurs on 1st January 1982, there was great rejoicing at the acquisition of a new band for amateur activities. As the band was an extremely narrow one and as it was to be shared with commercial stations for some while to come, use by radio amateurs was limited to the CW mode only. There was much harsh comment about this from the SSB fraternity and much discussion on this took place in the amateur radio media.

However, as experience of the band's characteristics was gained its attractions were found to fall somewhat short of what had been hoped for. As time passed there seemed to be no sign of the commercials beginning to move out. Propagation conditions were not exactly encouraging. QSB was severe and DX openings were mostly during 'unsocial hours'. So it is not surprising that the band is now thought to be 'greatly underused'.

This has encouraged the SSB lobby to renew their request for the band to be opened for some SSB activity. This, it is said, would encourage a much greater use to be made of the band. However, the 'anti-SSB' lobby seem to have reacted sharply to this suggestion! Reading the various comments on the subject in the amateur radio literature, one cannot but feel that allowing SSB would be a very retrograde move indeed, with things as they are at present.

'55 – Heil Hitler?'

In a recent issue of *The Westlink Report* your scribe came across a reference to an old radio amateur friend, Evert Kaleveld PA0XE/DL0XJ. The reference was eye catching not only because it is many years since I last heard of him but also because of the title to the paragraph referring to him, *viz* '55 – Heil Hitler?'

It seems Pat Hawker G3VA, in his *Technical Topics* feature in *Radio Communication* for June last, referred to some correspondence he had had with Evert relating to the origins of such amateur radio abbreviations as '73' and '88', which apparently date back to 19th century American telegraph codes.

A less well-known abbreviation which is favoured by German radio amateur operators is '55', which means 'vielle Erflug' – 'much pleasure'. Why '55' asks Evert? He suggests the explanation is that in the immediate post war years, when all amateur radio operation by German nationals was covert, some misguided humourist took pleasure in simply modifying the 'HH' (Heil Hitler) abbreviation, which had apparently been obligatory for German amateurs from 1933 right up to May 1945, adding an extra dit to the four dits of each H, thus creating 55!

Strange that the Russian amateur satellite which occasionally reappears should be sending nothing but a series of 55s from its 10 metre beacon!

Operation Raleigh

We have referred previously in this column to the 'Operation Raleigh' project.

You may recall that Operation Raleigh is a follow-up to Operation Drake, which was a four year round-the-world self-training project aboard a sailing vessel called *The Eye of the Wind*. This project went off so well that Operation Raleigh was mounted as a follow-up. It takes young people from all walks of life and of various nationalities on world-wide cruises visiting islands and remote parts of the world, participating in numerous scientific and community projects. The vessel is equipped with full radio as well as amateur radio services.

The vessel used is the *Sir Walter Raleigh* and the amateur radio callsign allocated to her is GB2SWR/MM. Amateur radio operators were called for to provide back-up ship-to-shore communications with field parties.

The ship will be visiting the Funafuti Atoll area during the period September 1986 to April 1987, and the New Zealand Director of Telecommunication Operations has authorised the special callsign

ZL6OR for use by the expedition during their stay there.

Solar cycle sunspot predictions

The prediction of natural phenomena is at best a chancy busines, particularly when the phenomenon concerned is the sunspot cycle. There are many predictions as to when the present cycle – number 21 – will give way to the beginning of the next. The latest prediction from American forecasters is based on the following considerations.

Predicted times of solar sunspot minima are based on the length of previous sunspot cycles. Over the last 136 years the cycle appears to fall into a bimodal distribution of about 123 months and 140 months, averaging 133 months. Using this, the minimum smoothed mean monthly sunspot value for the current cycle should occur about July 1987. A cycle of 140 months would result in a minimum sunspot number for February 1988.

Prediction time for the next solar maximum is based on average time between minimum and maximum, which is about four years. Forecasters put the maximum for the next cycle (22) as being in mid-1991, with a maximum sunspot number of 100, which is somewhat below average. Last June was the tenth anniversary of the beginning of cycle 21, but it is not necessarily the beginning of cycle 22.

Raynet earthquake activity

Raynet was able to participate in the aftermath of the El Salvador earthquake. Information on damage to communications and messages on behalf of the International Red Cross were passed. Raynet was able to inform the British Foreign Office that there were no British Casualties.

Indian radio amateurs have recently been active in two Raynet-type situations. VU2SUS heard a distress call on 14.164MHz from a Himalayan mountaineering team, which had lost contact with its base in Nepal. The team's radio amateur operator, HB9CUN/9NI, asked for the Nepal Ministry of Tourism to be contacted requesting a rescue helicopter to be sent to their location at Mekalu.

The second incident in which numerous radio amateurs took part concerned severe flooding in the state of Andhra Prudesh. Amateur radio was the only means of communication which proved to be reliable. Flood relief officers were quick to express their gratitude to the many amateurs who took part in the emergency operations and have presented special certificates to those who took part (RSGB news bulletin).

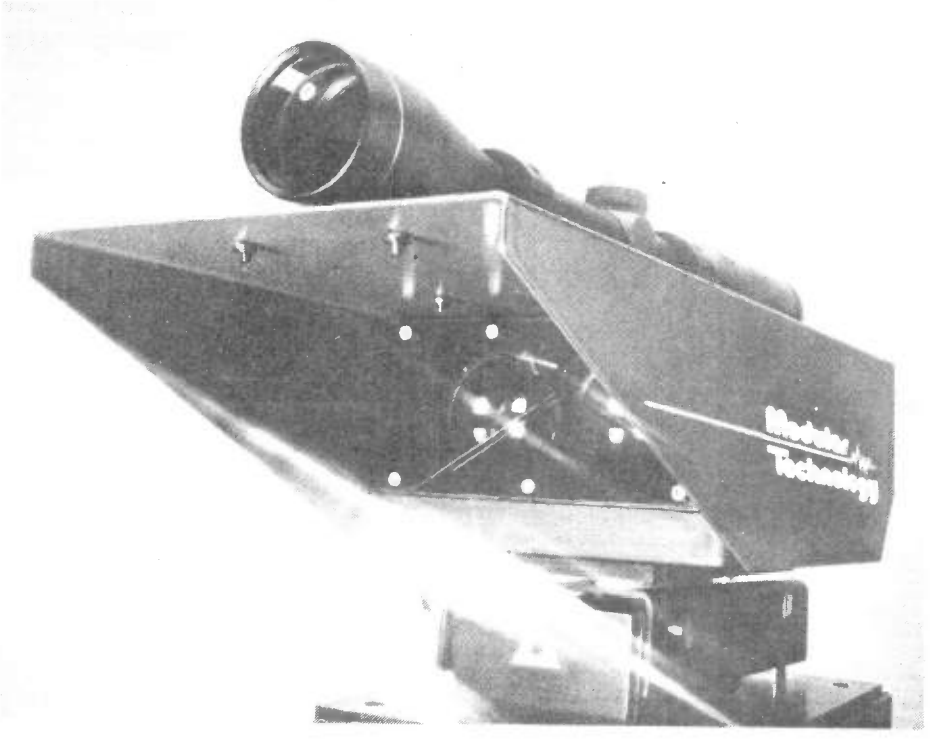
Israel special event stations

The Israel Amateur Radio Club is planning an event to take place during the Easter season next year. During Easter 1987 special event stations will be established at five historic and Biblical sites, *viz* Bethlehem, Jerusalem, Nazareth, Mount Tabor and Mount Beatitudes. Amateurs from around the world are invited to participate.

Further details from The Israel Amateur Radio Club, PO Box 4099, Tel Aviv, Israel 61040. REW

INTERLASER

It may look like something lethal out of *Star Trek*, but it's actually a communications system



A new communications device launched in September by Modular Technology, a subsidiary of Zygal Dynamics, uses an infra-red beam to transmit information by line of sight over a range of up to 1 kilometre.

The idea is not new, of course. There is a direct parallel with the Aldis lamps used for many years to communicate between ships at sea, which used an on/off 'binary' coding (morse), albeit at fairly low data rates by today's standards. The German 'Hellschreiber' system of World War 2 was an even closer relation, this making use of electronics to modulate a light beam.

The modern development which makes high speed data transmission using such techniques feasible is the semiconductor laser. Such devices are easy to modulate (unlike earlier gas lasers) and their output can be detected using PIN or avalanche diodes. They are widely used in the now familiar optical fibre transmission systems, to which Modular Technology's new product is comparable. It is, if you like, an optical fibre transmission system without the fibre.

The main advantages over competitive routes of communication are cost and convenience. A line leased from British Telecom is subject to rental charges and may take some time to arrange, while a privately installed cable run involves a high set-up cost. Microwave links, although very similar, require licencing which may be restrictive, and can be subject to interference.

This is not to say that there aren't disadvantges. The most obvious is that this system can only be used where a direct line of sight exists between the locations to be linked. Temporary interruptions such as birds crossing the beam might be regarded as acceptable, since such a break will be of little importance where error-correcting techniques are used.

There is also a certain amount of noise due to ambient light, the effects of which must be filtered. The effects of scintillation must also be minimised. This is a twinkling effect caused by variations in temperature between different air molecules (and is why the stars twinkle at night).

The weather could pose a few problems. Fog and rain will cause some scattering of the beam, reducing the level of power reaching the receiver. This is not, apparently, the problem one might expect, since it takes a very heavy fog to seriously degrade performance. Modular Technology suggest a link availability over 1km of 95%, and the rule seems to be that if you can see down a link you can communicate down it.

The system is available in two forms, the LH50 Laserhead and LH550 Ledhead. The first uses a diode laser to provide a range of up to 1km, while the second offers a shorter range (200m) and lower price using an LED. Both units are, apart from this, essentially the same.

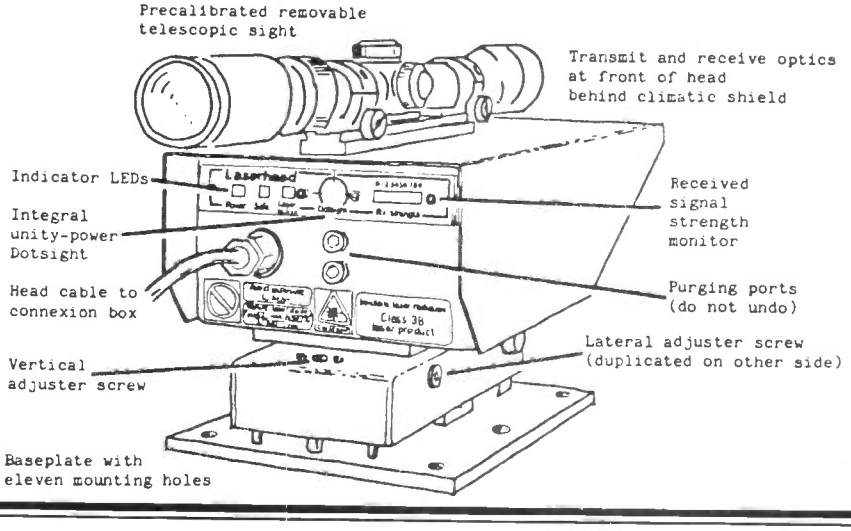
The unit incorporates a receiver and transmitter in one package. The light output is collimated using lenses, and this provides a spread (or beam width) of around 1m at 1km (any tighter and there would be less leeway to allow for slight distortion of the mounts). Alignment is by telescopic sights.

The link will happily handle data transmission rates of up to 2.5 megabits per second, and is ideal for use with statistical multiplexers. A bandwidth of around 6MHz allows video links and a 'talk-back' channel for camera control. Using PCM (pulse code modulation) 30 audio channels per link are possible, while 60 are possible using ADPCM

The unit is housed in a weatherproof case for mounting on the outside of buildings.

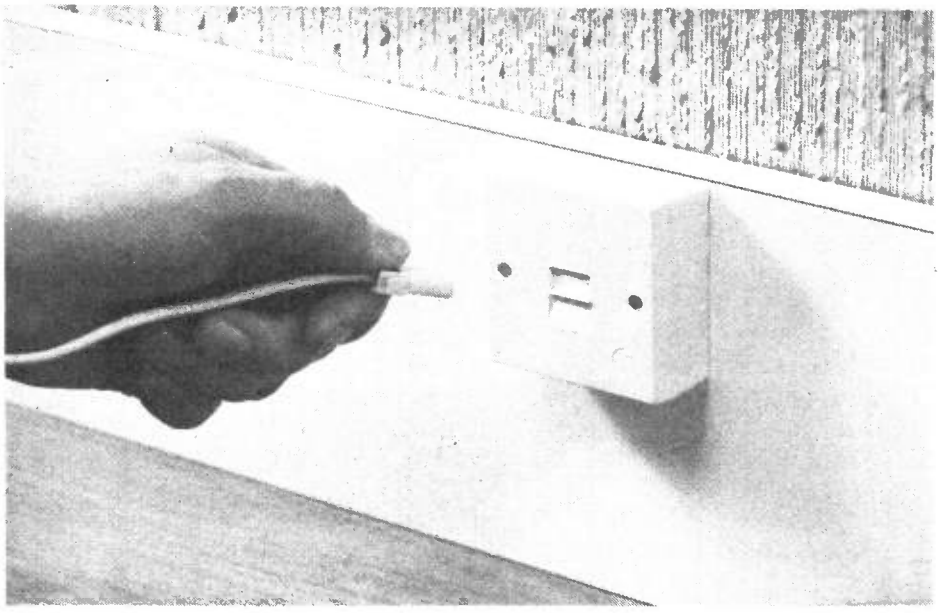
The LH50/550 would seem to be ideal for applications where a cable run is too costly or impractical, since it is versatile and immune to RFI. At a cost of £2500 for the Ledhead and £5000 for the Laserhead the costs are not excessive in comparison either, as long as the system can provide the required reliability.

Modular Technology, in case you're interested, are at Zygal House, Telford Road, Bicester, Oxon, OX6 0XB. Telephone: (0869) 253361. REW



WISE UP TO PHONE WIRING

Ralph Walker



At last it's legal . . . from 1st December you are allowed to install your own telephone extensions! You can now put telephones just where you want them, whenever you want to, and of course you can save a lot of money as well. All the same there is some skill involved, and it is as well to know the exact rules of the game too. So, if you want to get hooked up, read on . . .

What's legal . . .

Liberalisation applies to extension wiring only: the first or 'master' socket must still be installed by your telephone company. For most of us this is British Telecom, but Mercury Communications also have a number of public network customers, and if you live in Hull you'll know that it's the municipal telephone department that runs the network there. Channel Islands readers had better consult their local administrations – the OFTEL announcement makes no mention of liberalising either Guernsey or Jersey.

The extension wiring that you may now install must be plugged into an existing BT socket (it doesn't have to be the master if you already have other sockets). This means that you are not allowed to 'hard-wire' your new wiring into BT's master socket, and if you do not have the new-style sockets you will have to have the installation changed over (for a charge, at the time of writing, of £28.75).

Network termination point

That's the fancy name given to the point at which the network provider's maintenance responsibility ends, and currently this is the master socket. For this reason master sockets are still installed by the network provider and you cannot wire directly into them. This may change in due course.

Any faults which occur on wiring you install yourself are your own responsibility, and there will be no friendly 'GPO man' to fix them. So if you make a mess of the job BT will charge you to sort it out!

Incidentally, this article is concerned only with telephones connected to a direct exchange line. Government liberalisation has a different effect on phones connected to switchboard extensions and so-called 'key systems', and purely private internal networks (unconnected to BT) are not bound by these rules. A free booklet, *Telecommunications Wiring in Business Premises and Homes*, explains all this, and you can get a copy from OFTEL, Atlantic House, Holborn Viaduct, London EC1N 2HQ.

Incredible but true

You could be £60 better off over the next five years! That's what Maplin Electronics say in their catalogue. Having a phone socket fitted by BT costs £28 + VAT, while the quarterly rental for a standard telephone is £3.74 (£14.96 a year): you can buy a smart new telephone from Maplin for £11.50. In less than a year, then, you have saved money, and the savings look just as impressive if you install your own sockets and wiring.

So, is it easy? Well, er, yes . . . I imagine most people can plug in a telephone, and even the wiring is straightforward enough if you can follow instructions.

Most people are familiar with the new-style phone plugs and sockets. They are similar to the Western Electric design used in America and Eire, but include a number of improvements. The socket incorporates a shutter to stop little fingers entering and being zapped by the 75 volts ringing voltage, while the plug is designed to pull out of the socket if snatched hard enough – like when you trip over the phone lead!

The plugs, sockets and wiring are designed to have six conductors, although only four are used for standard phone wiring. All the same, if you choose to install six-wire cable you could use the spare lines for, say, a baby alarm or hi-fi distribution system, and wire up plugs for the alternative plug-ins accordingly.

Series or parallel

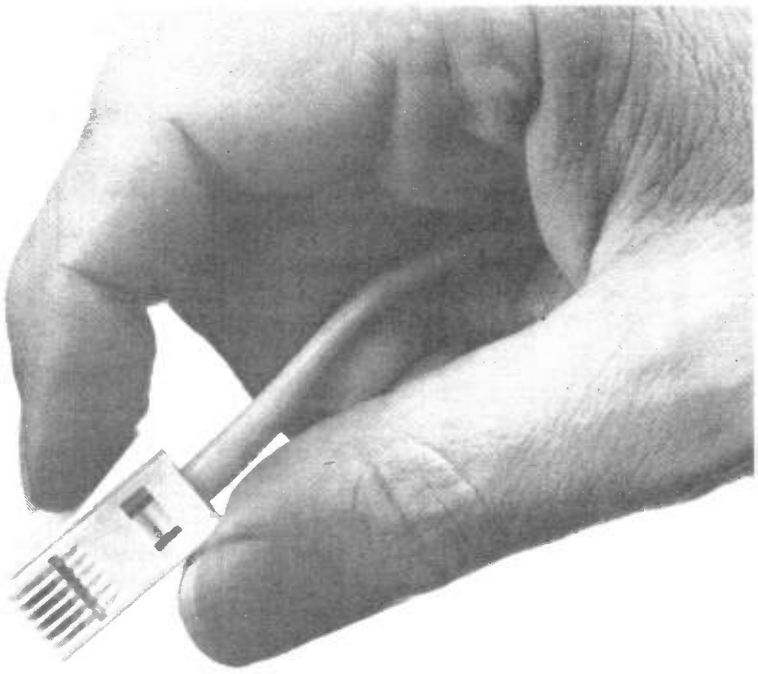
There is a limit to the number of bells that a telephone exchange can ring simultaneously, and this is not helped by having lots of low impedance bells in parallel. That, however, is the effect of wiring several old-style phones across the line, and another drop-off is the 'bell tinkle' effect you get on all the phones except the one dialling out. In the past, extension wiring required rewiring the bells in series to avoid bell tinkle.

All these defects are cured with the New Plan wiring system. Bells and ringers, now wired in parallel, are high impedance, allowing at least four to be plugged in simultaneously (there is no limit to the number of sockets on a system). Speech and ringing wires are effectively separate, so you don't suffer from bell tinkle. The bell circuit capacitor and line testing resistor are kept in the master socket, reducing component count in the phones.

By the way, New Plan wiring is not applicable to shared service ('party') lines and certain other special arrangements.

Look out for the green spot

Only approved phones and answering machines can be used in phone sockets: they carry a green circle approval sticker to show they have been through the testing procedures. Prices are coming down so fast now that there is little point in buying unapproved apparatus; very often the latter is not so well made and gives poorer speech transmission. What's more, its two-wire circuitry is not properly compatible with the New Plan wiring. The parts you use for extension wiring must also be approved, but there is no shortage of these.



Again, no matter what anyone else tells you, it is not technically legal to fit new plugs and cords on old-style phones, even if they are genuine BT or Post Office models. Absolute legality may not worry you, but you may well consider it worth buying new electronic phones anyway. They tend to have more features and they are not expensive now.

What you need

To wire your own home you will require:

☐ one or more extension ('secondary') sockets, with which will be supplied wiring instructions.

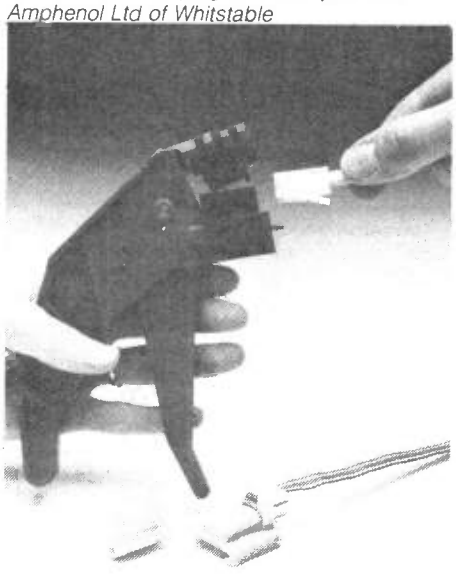
☐ some approved cable, which can be cut to length as required. The cable will probably have a plug fitted at one end, ready to fit your existing socket.

☐ cable clips and similar accessories.

Many shops will sell complete kits of all the parts you need, though you may want extra 'loose' components to complete your job.

The sockets will use either screw terminals or IDCs (insulation displacement connectors). The latter are a new(ish) type of terminal which slices through the plastic insulation of the wire and then grips the metal conductor. IDCs are far quicker to hook up but need a special tool to push the wire into the connectors. The plastic tools are throw-away ones and that's about all they are fit for; a professional version is also available, but as its cost approaches £20 it is really only for the enthusiast who intends to wire up homes as a spare-time occupation (it is perfectly legal to wire other people's extensions for reward. What is illegal is to install or wire into the master socket, unless you are an 'official' telephone engineer and doing this as part of your official work).

The latest phone plug and IDC jack tool from Amphenol Ltd of Whitstable



Connecting the sockets involves wiring terminal 2 to terminal 2, 3 to 3, and so on, following the colour code shown in the table. If you are using four-core cable ignore terminals 1 and 6.

Socket terminal	Cable Colour Code The principal colour is shown in capitals, followed by the stripe	
	NEW	**OLD**
1	GREEN/white	
2	BLUE/white	BLUE
3	ORANGE/white	BROWN
4	WHITE/orange	GREEN
5	WHITE/blue	ORANGE
6	WHITE/green	

The total length of wiring between the master socket and each extension must not exceed 164 feet (50 metres), and the total length of wiring installed cannot exceed 328 feet (100 metres). This is to prevent misoperation.

Sockets should not be put in damp places such as bathrooms or in unprotected locations outside, as the sockets may corrode internally and cause high resistance faults. Avoid putting sockets in dangerous places too; often the skirting board is not the best place and waist level will be easier to reach.

Normal telephone cable is not 100 per cent waterproof even though it is sheathed in PVC, so it should not be run outdoors bare. It is also unwise to run phone wires close to mains wiring or to share conduits or back boxes with this. Phone sockets should be placed at least 2 inches (50mm) away from mains outlets.

The actual wire itself is not overly flexible and you should take care not to kink it when bending. The individual cores are fairly brittle and will not stand up to repeated flexing. Instead they tend to break inside their sheathing – but who knows where?! For this reason I wouldn't recommend this kind of wire for model railway layouts and the like. The instructions recommend the use of cable clips every 300mm (about 12 inches).

Suspicious sockets?

There are no other restrictions on how you lay the cable, and spurs are perfectly permissible. BT sells a special terminal block which enables you to cut into existing wiring, add a spur and reconnect everything.

Many shops will be selling BT components and these are a guarantee of quality, though there are many other good quality parts around. Note that BT sockets will carry the word 'Wiring' as well as the (T) symbol: sockets with the (T) symbol alone are used only by BT itself and are probably stolen if offered for sale!

Apart from phone shops and DIY stores there are many other places to buy wiring components. By mail order you can get all the parts you need from RS Electromail and Maplin, for instance, or if you prefer to pick and choose visit a Tandy shop or an amateur radio rally (where you'll probably find the lowest prices!). In any case, do shop around; ordinary secondary sockets should not cost more than £3 and cable no more than 25p a metre.

Technical risks

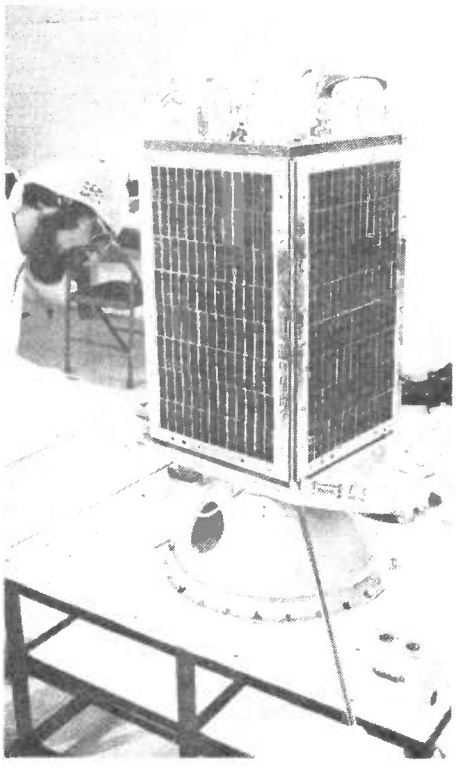
If you stick to the rules and follow the instructions nothing should go wrong. When you have plugged in your new extension ring a friend to ensure that all is well. Make sure, too, that incoming calls work by having your friend ring you back. The voltages involved – 50V dc and 75 to 100V ac – are not usually lethal, but they are not pleasant either. Miswiring will mean at worst that you will lose calls and have to call in the professionals to sort out your misdeeds.

Mixing in mains is quite another matter, and telephone linemen up their poles prefer safety belts to belts of mains voltage. The electronics back at the exchange don't take too kindly to mains either.

Good luck, even if you don't think you need it! REW

AN INTRODUCTION TO
COMMUNICATIONS SATELLITES
PART 2

Alan Pickard continues his series with an outline of two systems receivable on an amateur basis



In the previous introductory article we surveyed the overall satellite scene, concentrating on definitions, telecomms principles and also engineering, scientific, astronomical and navigational implications.

We will now look in detail at some specific systems at an amateur level rather than at commercial systems, as these are by definition beyond the scope of the home enthusiast on economic and technical grounds, and also restricted in a security sense. The two systems to be examined are the UoSAT series of satellites and the NOAA series.

Objectives

Whether wishing to set up a system at home or in a school/college department, the reasons for doing so may vary. In the case of weather satellites the reasons may be a genuine interest in the study of weather conditions or simply the fascination of 'taking pictures' at 100km altitude, however poor the resolution! A further reason could be the sense of satisfaction in receiving weather pictures independently of the BBC and putting the home computer to yet another good use (this will appeal to the many radio amateurs who already use their machines as tools for receiving RTTY etc).

The UoSAT system may not be considered to be as glamorous or as novel as the weather systems series, but it represents a realistic scientific application. These craft can provide interesting and useful scientific data from space, for example data on magnetic fields, temperature and regular readings concerning voltages and currents related to the on-board electronics.

The recent accident at Chernobyl was also 'investigated' by UoSAT-1's radiation detector, and although nothing conclusive was recorded it could have been a case of 'no news is good news' – there is no incentive for hoping for a more interesting or tangible result! It is, however, interesting to consider a scientific satellite's potential usefulness in this area (a limitation of course is the much higher altitude of the UoSATs, ie 500km for UoSAT-1 and 700km for UoSAT-2. However, these altitudes are still more useful than the commercial geostationary orbits at 36,000km).

Having convinced ourselves of both the 'necessity' of building a satellite receiving station and of its technological and scientific merit, we can now think about what each type of system entails.

The intention of this article, incidentally, is to encourage readers to set up a basic system and use it to learn about the subject, rather than spending too much time on unnecessary or excessive theory. Once established, the practical operation will provide the incentive to find out more.

UoSAT series

The UoSAT series were designed and built by the University of Surrey. There are currently two in orbit, UoSAT-1 (also known as OSCAR-9) and UoSAT-2 (OSCAR-11). OSCAR stands for Orbital Satellite Carrying Amateur Radio.

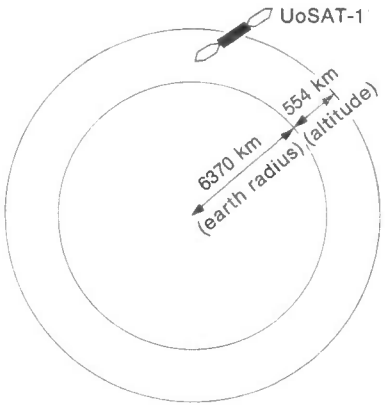
UoSAT-1 was launched on 6th October 1981 at 1127 GMT from the Western Space and Missile Centre, Vandenburg Air Force Base, California. The launch vehicle used was a Delta 2310 rocket, but the UoSAT was a secondary payload to a somewhat more sophisticated spacecraft, the Solar Mesosphere Explorer Mission Spacecraft, launched by NASA (at least UoSAT keeps good company!).

UoSAT-1 maintains an altitude of 554km and takes 95 minutes for one (polar) orbit. Its speed can therefore be calculated using the Earth's radius to find the length of one complete orbit. Taking this radius to be 6,370km, the distance covered is 43,505km (from pi × d) and therefore the speed can be calculated as approximately 7.6km/sec (see *Figure 1*).

Work on this satellite was begun in January 1979 and its cost was around £100,000, mostly funded by British industry, which also provided a lot of technical assistance. NASA launched the satellite free of charge.

The lifetime of this craft was projected to be about four years, which puts its capital cost at something like £68 per day! The craft's lifetime can be defined as the time after which it is unable to

Fig 1 *Information required to calculate speed of UoSAT knowing orbit time*



maintain its speed and therefore its orbit. At this point it will re-enter the Earth's atmosphere and burn up.

UoSAT-2 was launched on 1st March 1984 at 1759 GMT from the same launch site as UoSAT-1. This time a Delta 3920 rocket was used and the satellite was a secondary payload to the LANDSAT-5 Earth resources satellite, again launched by NASA.

UoSAT-2 orbits at 700km altitude with a polar orbit time of 98 minutes. As before the speed may be calculated from this information and is about 7.5km/sec.

This craft was completed in only five months. Its lifetime is longer, because of its higher altitude.

Technical summary

Both UoSATs provide facilities for measuring near-Earth electromagnetic fields and also the relationships between solar and geo-magnetic disturbances. This is done in order to investigate the effects on radio-wave propagation between HF and microwave frequencies.

Major systems on board UoSAT-1 provide telemetry information which is beamed to Earth in digital form and can be decoded by (home) computer. It is also equipped with a CCD (charge-coupled device) slow-scan TV camera for taking pictures of the Earth's surface. Unfortunately, this has not been very successful so far due to the spacecraft's spin.

UoSAT-2 is similar, but beams down more data in a form which can be readily decoded by the BBC micro.

Both UoSATs transmit telemetry information at 145.825MHz. Other frequencies are transmitted, from 7.050MHz to 10.47GHz. Obviously the higher frequencies require highly directional dish aerials. To receive telemetry at 145MHz requires a 2m narrowband FM receiver which must be able to cope with a Doppler shift from 145.830MHz (approaching) to 145.810MHz (receding).

UoSAT-1 transmits 'Digitalker' information (synthesized speech) on this frequency, plus a bulletin board transmitted as ASCII text at 1200 baud. This binary information is encoded as 1200/2400Hz phase-synchronous AFSK (this is similar to the BBC micro's cassette interface format, except inverted in sense).

UoSAT-2 transmits telemetry in the same way but its signals are directly compatible with the BBC micro (no inversion required).

Figure 2 is a block diagram showing the equipment needed to receive UoSAT signals.

Figure 3 shows a system specifically for OSCAR-10 (non-UoSAT) using a hardware decoder (a *Wireless World* design). An interesting comparison between these two systems is that the UoSAT decoding is carried out exclusively by software, whilst the OSCAR-10 system uses a hardware decoder and software for display purposes.

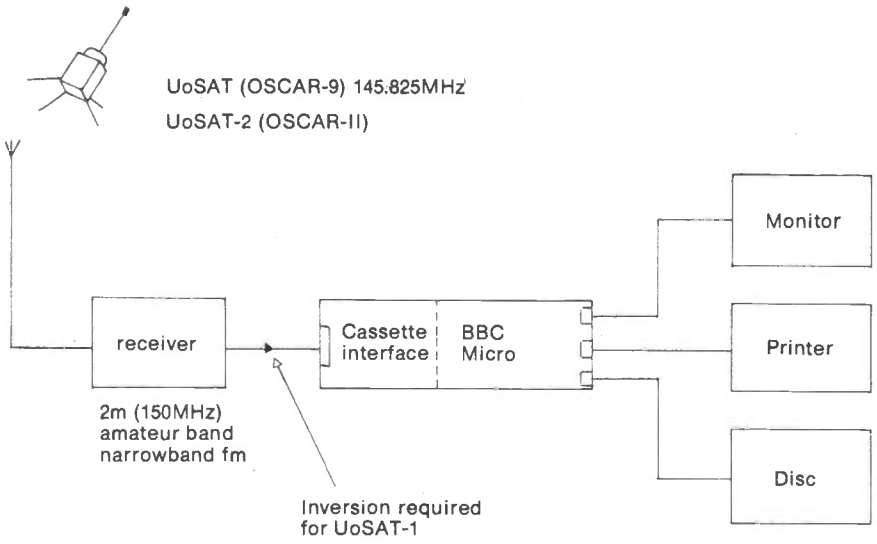


Fig 2 *A suitable system for decoding UoSAT signals*

In the next article I hope to give more details of specific products and complete systems available which can be bought/built to achieve reception, decoding and display. Details will also be included concerning alternative micros.

NOAA series

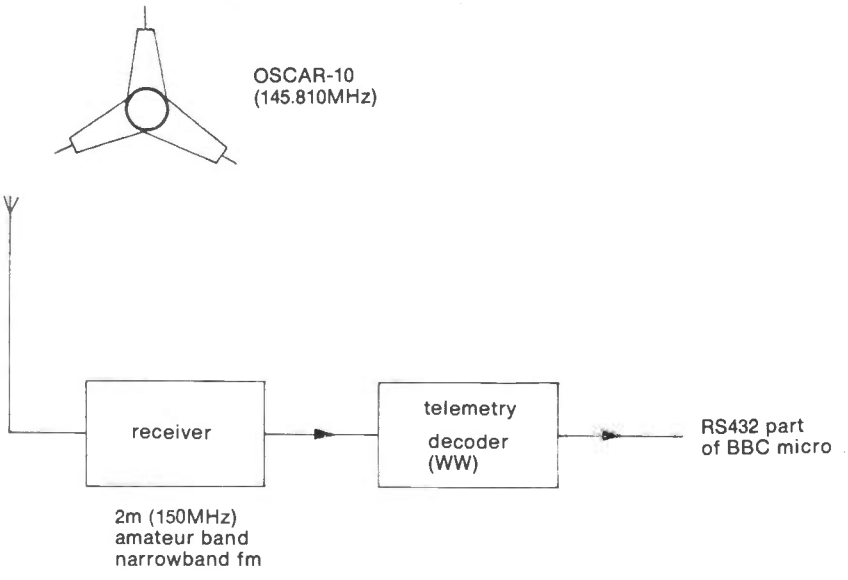
The term NOAA stands for 'National Oceanic and Atmospheric Administration', which is the name of the organisation which controls these birds. The actual name of this series of satellites is TIROS (Television Infra-Red Orbital Satellites).

There are currently four satellites available, NOAA-6, 7, 8 and 9. Each of these spacecraft have 101-minute orbits, spread around the globe such that they do not interfere with each other.

NOAA-6, 8 and 9 transmit at 137.5MHz, whilst NOAA-7 transmits at 137.62MHz. Each NOAA transmits weather pictures in the APT (Automatic Picture Transmission) format. This format produces one visible and one infra-red image side by side, transmitted at 120 lines per minute. The lines of picture information build up a picture in a slow raster form, but the picture is a continuous strip following the path of the satellite over the ground. To receive these weather pictures a wideband AM receiver is required tuned to 137.5 or 137.62MHz.

Figure 4 shows the equipment needed to track NOAA satellites. Again, more detail concerning each system will be given in the next article. In the meantime, a decision needs to be made by the reader as to which system type is of interest. The UoSAT series provides a means of receiving scientific data direct from space as well as the facilities for

Fig 3 *An alternative system for OSCAR-10 signals*



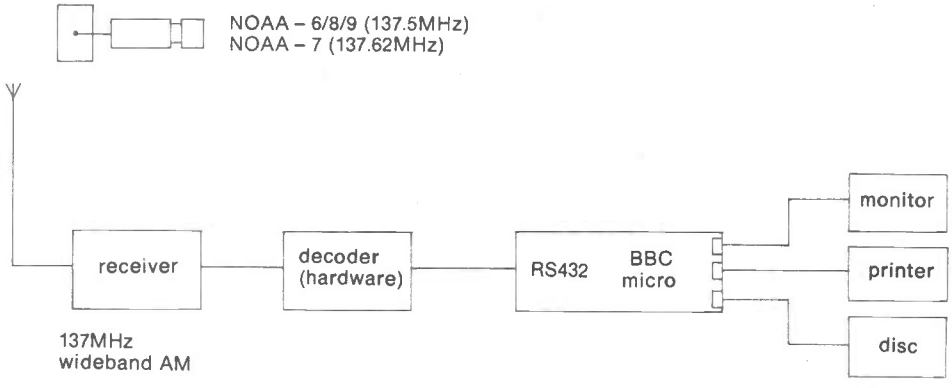


Fig 4 *Requirements for the NOAA weather satellites*

two-way amateur radio communication via space. The NOAA series is limited to weather information, but has the potential for spectacular results on screen and printer. There is also tremendous scope for using or developing sophisticated tracking and display software.

The next stage

In the first article in the series we looked at what satellites were in functional terms. In this one we have focussed on two systems receivable on an amateur basis and their technical specifications.

The next article will concentrate on hardware and software details in connection with commercially available systems and packages.

There are currently several organisations, especially in the educational sector, dealing with satellite tracking. There are also a large number of firms which deal with the hobbyist market. In short, there is already a rather large and complex infrastructure in existence which the potential newcomer may find difficult to penetrate. One of the aims of this series is to alleviate this.

Satellite tracking and the reception (and transmission) of signals is a fascinating and growing part of microelectronic and radio technology, as well as being educational in other spheres. It is therefore worth taking the trouble to establish the most effective methods of obtaining the most useful information which is currently available from a number of sources. Future articles will therefore attempt to explain system detail and provide appropriate references to organisations and suppliers.

References

Satellites in Education
by Craig Underwood,
UK Co-ordinating Committee in Education,
Department of Electronic and Electrical Engineering,
University of Surrey,
Guildford GU2 5XH.
Price £3.50.

R J C Broadbent,
AMSAT-UK,
94 Herongate Road,
Wanstead Park,
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51. 1 – 12V 2 CO miniature relay very sensitive
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53. 2 – mains operated relays 3 × 8 amp changeover (s.h.)
54. 10 – rows of 32 gold plated IC sockets (total 320 sockets)
55. 1 – locking mechanism with 2 keys
56. 1 – miniature uniselector with circuit for electric jigsaw puzzle
60. 5 – ferrite rods 4" × 5/16" diameter aerials
61. 4 – ferrite slab aerials with L & M wave coils
63. 1 – Mullard thyristor trigger module
66. 1 – magnetic brake – stops rotation instantly
67. 1 – low pressure 3 level switch can be mouth operated
69. 2 – 25 watt pots 8 ohm
70. 2 – 25 watt pots 1000 ohm
71. 4 – wire wound pots – 18, 33, 50 and 100 ohm your choice
77. 1 – time reminder adjustable 1-60 mins clockwork
85. 1 – mains shaded pole motor ¾" stack – ⅛ shaft
89. 1 – mains motor with gear box 1 rev per 24 hours
91. 2 – mains motors with gear box 16 rpm
96. 1 – thermostat for fridge
98. 1 – motorised stud switch (s.h.)
101. 1 – 2½ hours delay switch
102. 1 – mains P.S.U. 9V DC
103. 1 – mains power supply unit – 6V DC
104. 1 – mains power supply unit – 4½V DC
107. 1 – 5" speaker size radio cabinet with handle
111. 2 – musical boxes (less keys)
112. 1 – heating pad 200 watts mains
114. 1 – 1W amplifier Mullard 1172
115. 1 – wall mounting thermostat 24V
118. 1 – teak effect extension 5" speaker cabinet
120. 2 – p.c. boards with 2 amp full wave and 17 other recs
121. 4 – push push switches for table lamps etc.
122. 10 – mtrs twin screened flex white p.v.c. outer
124. 25 – clear plastic lenses 1¾ diameter
127. 4 – pilot bulb lamp metal clip on type
128. 10 – very fine drills for pcbs etc.
129. 4 – extra thin screw drivers for instruments
132. 2 – plastic boxes with windows, ideal for interrupted beam switch
134. 10 – model aircraft motor – require no on/off switch, just spin to start
136. 2 – car radio speakers 5" round 4 ohm made for Radiomobile
137. 1 – 6½" 4 ohm 10 watt speaker and 3" tweeter
142. 10 – 4 8A spanners 1 end open, other end closed
145. 2 – 4 reed relay kits 3V coil normally open or c/o if magnets added
146. 20 – pilot bulbs 6.5V.3A Philips
154. 1 – 12V drip proof relay – ideal for car jobs
155. 3 – varicap push button tuners with knobs
169. 4 – short wave air spaced trimmers 2-30f
171. 1 – shocking coi kit with data – have fun with this
172. 10 – 12V 6W bulbs Philips m.e.s.
178. 3 – oblong amber indicators with lilliputs 12V
180. 6 – round amber indicators with neons 240V
181. 100 – p.v.c grommets ⅜ hole size
182. 1 – short wave tuning condenser 50 pf with ¼" spindle
184. 1 – three gang tuning condenser each section 500 pf with trimmers and good length ¼" spindle
188. 1 – plastic box sloping metal front, 16 × 95mm average depth 45mm
193. 6 – 5 amp 3 pin flush sockets brown
195. 5 – B.C. lampholders brown bakelite threaded entry
196. 1 – in flex simmerstat for electric blanket soldering iron etc.
197. 2 – thermostats, spindle setting – adjustable range for ovens etc.
199. 1 – mains operated solenoid with plunger 1" travel
200. 1 – 10 digit switch pad for telephones etc.
201. 8 – computer keyboard switches with knobs, pcb or vero mounting
206. 20 – mtres 80 ohm, standard type co-ax off white
211. 1 – electric clock mains driven, always right time – not cased
216. 1 – stereo pre-amp Mullard EP9001
232. 2 – 12V solenoids, small with plunger
236. 1 – mains transformer 9V 1 amp secondary C core construction
241. 1 – car door speaker (very flat) 6½" 15 ohm made for Radiomobile
241. 2 – speakers 6" × 4" 4 ohm 5 watt made for Radiomobile
243. 2 – speakers 6" × 4" 16 ohm 5 watt made for Radiomobile
244. 1 – mains motor with gear-box very small, toothed output 1 rpm
245. 4 – standard size pots, ½ meg with dp switch
249. 1 – 13A switched socket on double plate with fused spur for water heater
266. 2 – mains transformers 9V ½A secondary split primary so ok also for 115V
267. 1 – mains transformers 15V 1A secondary p.c.b. mounting
291. 1 ten turns 3 watt pot ¼ spindle 100 ohm
296. 3 car cigar lighter socket plugs
298. 2 15 amp round pin plugs brown bakelite
300. 1 mains solenoid with plunger compact type
301. 10 ceramic magnets Mullard 1" × 3/8 × 5/16
303. 1 12 pole 3 way ceramic wave charge switch
304. 1 stereo amp 1 watt per channel
305. 1 tubular dynamic microphone with desk rest
308. 1 T.V. turret tuner (black & white T.V.)
310. 2 oven thermostats
311. 1 Clare Elliot sealed relay 12V
312. 1 pressure pad switch 24 × 18 (Trigger Mat)
313. 5 sub miniature micro switches
314. 1 12" 8 watt min fluorescent tube white
315. 1 6" 4 watt min fluorescent tube white
316. 1 round pin kettle plug with moulded on lead
453. 2 – 2½ in. 80ohm loudspeakers
454. 2 – 2¼ in. 80ohm loudspeakers

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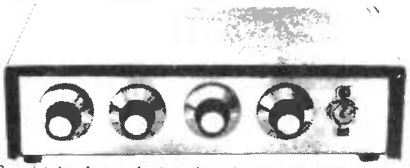
SOUND TO LIGHT UNIT



Complete kit of parts of a three channel sound to light unit controlling over 2000 watts of lighting. Use this at home if you wish but it is plenty rugged enough for disco work. The unit is housed in an attractive two tone metal case and has controls for each channel, and a master on/off. The audio input and output are by ¼" sockets and three panel mounting fuse holders provide thyristor protection. A four pin plug and socket facilitate ease of connecting lamps. Special price is **£14.95** in kit form.

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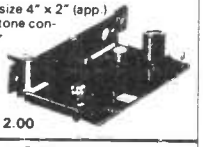
MINI MONO AMP on p.c.b. size 4" x 2" (app.)



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2P75 – 1 2 hour timer, plugs into 13A socket
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2P85 – 20v–0–20v ½A Mains transformer
2P88 – Sangamo 24 hr time switch 20 amp (s.h.)
2P89 – 120 min. time switch with knob
2P90 – 90 min. time switch with edgewise engraved controller
2P94 – Telephone handset for EE home telephone circuit
2P95 – 13A socket on satin chrome plate
2P97 – mains transformer 24V 2A upright mounting
2P98 – 20m 4 core telephone cable, white outer
2P99 – 500 hardened pin type staples for telephone cable
2P101 – 15V mains transformer 4A upright mounting
2P105 – capillary type thermostat for air temperature with c/o switch
2P107 – membrane keyboard, telephone type
2P108 – mains motor with gear box giving 110rpm
2P109 – 5" wide black adhesive pvc tape 33m, add £1 post if not collecting

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5P6. 12V alarm bell with heavy 6" gong, suitable for outside if protected from direct rainfall. Ex GPO but in perfect order and guaranteed.
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5P13. Ping pong ball blower – or for any job that requires a powerful stream of air – ex computer. Collect or add £2 post.
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5P18 – motor driven water pump as fitted to many washing machines
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5P23 – miniature (appr. 2½" wide) tangential blow heater, 1-2kw
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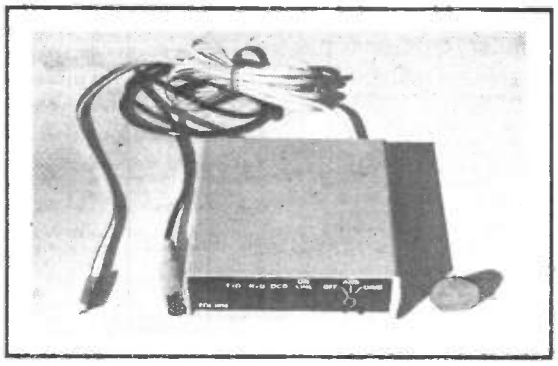
LIGHT CHASER KIT motor driven switch bank with connection diagram, used in connection with 4 sets of xmas lights makes a very eye catching display for home, shop or disco, only £5 ref 5P56.

A LINE-POWERED &



TRANSFORMERLESS MODEM

R J Redding G3VMR

In the space of five years the modem has changed from being an exotic item rented from the telephone company to an accessory in the High Street computer shops. At one time the great worry was safety and approval of mains equipment, but units are now available which require no power supply at all. The impetus has been the need to link computers, and the home computer and electronic mail trends have consolidated it into a very large market. This is by no means the end, since modem techniques extend to radio and satellite operation and undoubtedly the transmission of newspapers in data form will come.

As the term 'modem' is now on so many lips, it pays to look at how it arose. With 50 years of hindsight, I proffer the following.

The mathematician Fourier showed that any wave shape or energy pulse is made up of a series of sine waves of different frequency and phase. If energy is imparted into a medium or transmission line, distortion will upset the shape but the fundamental frequency will remain. Of all the parameters that could be used for the transmission of information, the most convenient and the one least likely to be lost is the frequency.

By the way, frequency has a number of other interesting properties, eg it is both analogue and digital and we can add, subtract, multiply and divide with absolute precision. This has barely been recognised in some circles, eg industrial measurements and process control, which persist in dealing in milliamp signals!

When we have on/off signals for binary (digital) data, then the effect of transmission is that we lose the higher frequency components of the square waves, and end up with an indefinite sine wave. There is a limit to how far we can reconstitute the original pulse, as process control engineers have discovered. A better way is to represent the two (or more) digits by the presence or absence of individual frequencies within the available spectrum, since any frequency that can be recovered out of the noise will be authentic.

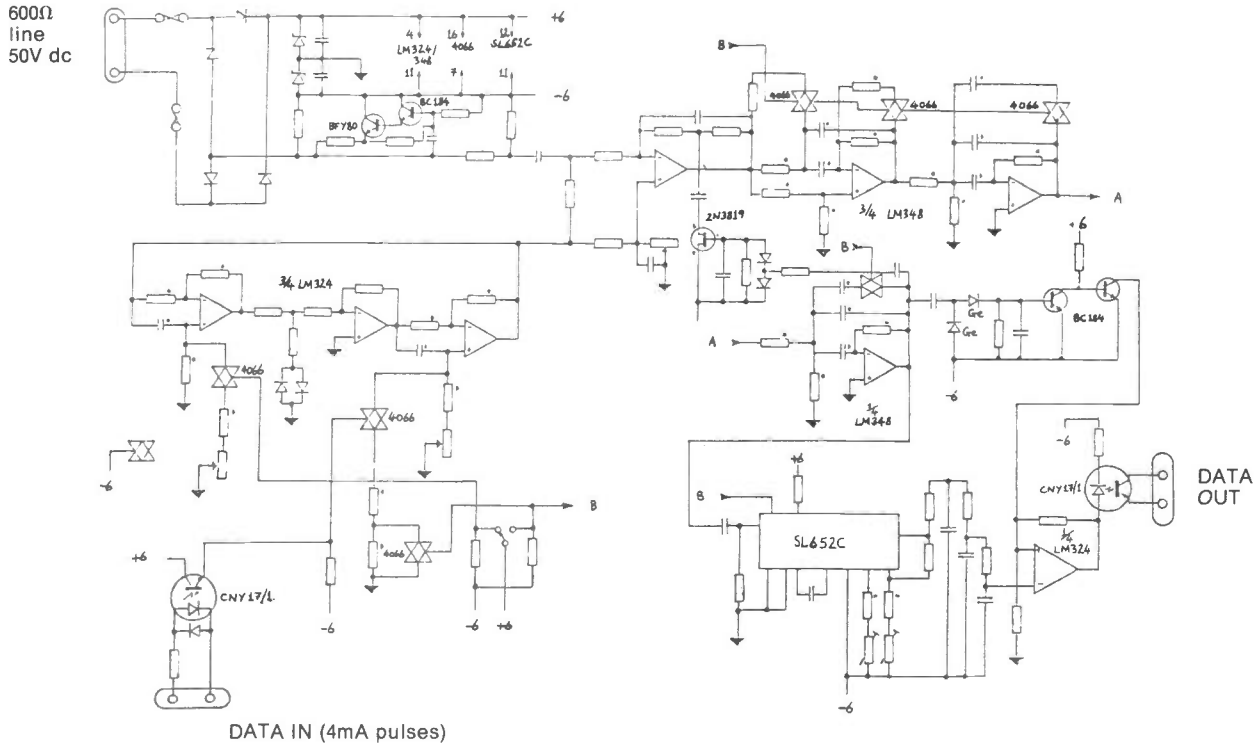
This is the modulate-demodulate principle. It is not strictly limited to binary data, for the same tricks are useful for slowly moving and randomly changing analogue quantities. Chopper stabilisation of dc amplifiers, high frequency bias in magnetic recording, and the superheterodyne principle are all variations of the same theme – the higher frequency carries the information better.

Approval problems

However, to revert to computers and modems, the original aura of Post Office monopoly and the approval of modems is losing its impact.

The design described below evolved from an attempt to avoid the problems of approval by eliminating the power supply. In the event it resulted in a unit which, having no inductors or trans formers, became a single electronic circuit which could be made on a chip of silicon. The implication of an inductorless system seems far reaching, in the fields of line theory, avoiding

Fig 1 *The original circuit diagram (vintage 1983)*



switching surges and radio practice.

Origins

The origins of the unit follow true amateur tradition. The writer was tolerated in a special interest group of a home computer club who were struggling with translating programs from one machine to another. This ran into trouble because no two cassette recorders were alike. The next idea – to transfer memory dumps by a serial output – involved communication, unless the machines could be brought into the same room, hence an interest in modems.

Acoustic type units were built but simply caused too many errors to be of any value. I suggested using radio, and this led to a group sending data by radio, but more about this later.

The risk of invasion of the telephone line by a power supply could be tackled by a variation on the 'Safety Barrier' technique that I had invented 25 years ago for electronic process control in hazardous areas. So I induced people to make a direct-connect modem, saying that barriers could look after the safety aspects.

In the event this was unnecessary, because we could reduce the power requirements to the level which one has to maintain anyway in order to hold-in the line relay in the telephone network, roughly 9 volts and 10 milliamps minimum. The circuit, 1983 vintage, is shown in *Figure 1*.

Line-powering

People still think that line-powering is illegal or stealing when, in fact, it is an economy measure! The ordinary telephone is line-powered, the carbon granules (and they are still used!) modulating the current which has to be sufficient to hold-in the line selector's relay.

When we substitute a modem for the telephone to send data, we are not necessarily increasing the consumption. It can in fact be argued that adding a conventional modem brings in a transformer for isolating purposes. This transformer must have a primary of low impedance and, even if the telephone is replaced to avoid noise on the line, the modem is a low impedance across the circuit and hence the current must rise! The design of such a line-isolating transformer is largely a matter of dissipating the heat so generated.

Line-powering is not in itself patentable but the means by which it is done may be, and it happens that the writer is well versed in the problem of inductive surges in connection with 'intrinsic safety'. The elimination of the transformer seemed well worth the effort, and in fact an inductorless modem was evolved and became the basis of a patent specification which has now been granted in a number of countries.

One particular claim is that the entire modem can be made as a single electronic chip, to include the interfacing to both the telephone line and the terminal for computer equipment.

The significance of having no inductors is considerable. Firstly, it means that the surges and risks to semiconductor devices in circuits is avoided at source.

Secondly, the circuit can be manufactured by modern integrated circuit techniques and in fact virtually becomes a single slice of silicon. It is important to realise that this refers to the entire modem as a connection between the telephone line and the interface of computer or terminal unit, because there have been for many years a number of integrated circuits called 'single chip modems'. These are, however, the modulate/demodulate part of the circuit and usually also require a separate filter chip and an interface both with the telephone line and with the terminal unit.

Practical design

Circuitry currently in production for modems is now fairly standard and usually employs one of a number of available single chip modems. However, a practical modem has to have a considerable number of additions, as shown in *Figure 2*, and the biggest practical problem is meeting the requirements for approval by the telephone authorities.

Although this ought to be just a technical exercise, it often becomes a costly and lengthy battle which occasionally hits the headlines. It would seem that the original Post Office monopoly has now turned into a public one which is even more expensive. However, the

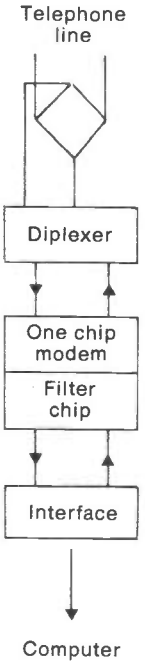
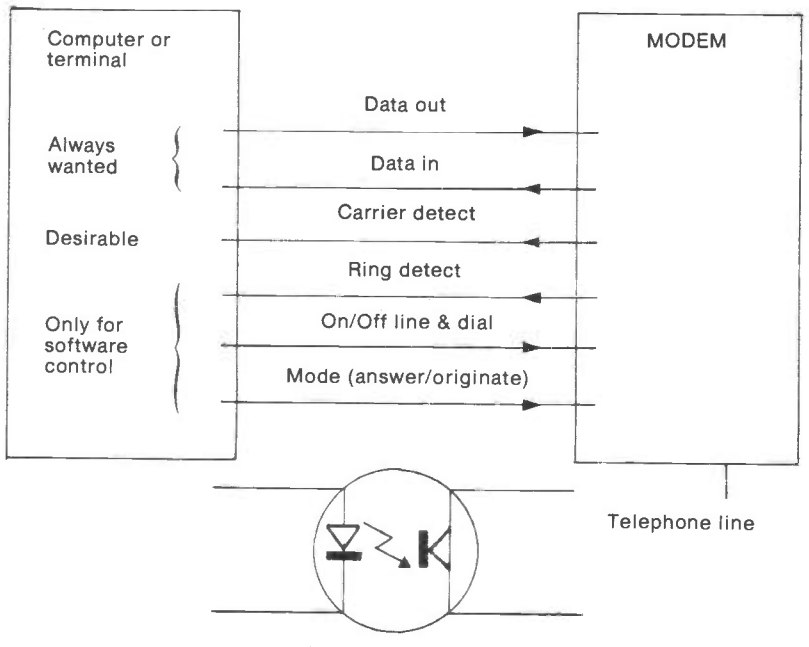


Fig 2 *Essential features of a modem*

cause of the problem is commercial – we won't make up our own minds what is good and sensible – we must have an authority to approve or certify that it conforms to a 'Standard' (after my S5/8 interface article, I refrain from further comment).

The salient points for approval are highlighted in *Figure 2*. Firstly, the diplexer, which gets signals into and out of the line, must be a highly insulating transformer so that no power in the modem can get onto the telephone line. Secondly, the power supply must be designed to limit the power into the

Fig 3 *Connections and opto-isolation*



circuit. Thirdly, the data interface must have some isolating feature, since it might be used with a cathode-ray VDU with a high voltage on it. One has to legislate for the worst case; it is no good saying it is only for use with a hand-held computer!

Such isolation has now become standard, and uses opto-isolators as shown in *Figure 3*, one for each boundary crossing.

Benefits of line-powering

In the line-powered modem, we avoided the mains transformer and went to a lot of trouble to eliminate the usual hybrid transformer, for reasons that will be discussed later. The circuitry outlined in *Figure 1* is based on an 'inductance simulation circuit' using the gyrator principle of simulating an inductance by an amplifier, and means that the entire circuit can be made as an electronic assembly of semiconductors, resistors and capacitors and there are no inductors or transformers at all. This in turn means that the unit can be small in size and, in principle, can be made in the form of a single chip of silicon.

Two versions which are now on the market are shown in the photos. One is an economical unit using standard sized components in a plastic box, and the other is a surface mount assembly contained in a small plastic case. The latter is only 10mm high so that it can be included inside a computer, the box ensuring that there is no breakthrough from any of the contents to the modem circuitry. BABT approval is well advanced for both designs.

At one time many people felt that the idea of line-powering would offend the Post Office etc, with the suggestion that we were stealing power. In practice, it is turning out that because the unit has to work with the minimum current on the worst line, that is all it needs, and in fact the drain on the telephone line is less than with a conventional modem if it includes a transformer because that draws a heavy dc load! The design of such an isolating transformer is mainly concerned with dissipating the heat that results and avoiding saturation! Perhaps this shows that an elegant elimination can be good for all concerned.

The absence of a transformer has a further significance, namely that there are no inductive surges as a result of variations in the line current. Since these include dialling pulses, the absence of inductance is a real boon, and in fact when one of the line-powered units was investigated by one organisation, it tried to wreck it by pulses but couldn't. The reason is that, without inductors, any current surges are taken by Zener diodes.

There is reason to believe that because the system is linear the performance is enhanced accordingly. It is worth remembering that the *raison d'etre* of modems is the non-linearity of a telephone line over the audio frequency range. REW

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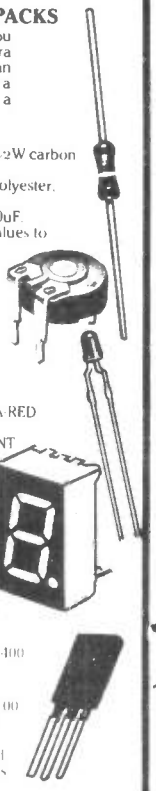

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The kit can be assembled in three to four hours, and includes a roller tinned printed circuit board, 66 components, case, mains lead, components for a tester so that you can be sure the ioniser is working, and full instructions. All you will need to supply is a little Araldite and a mains plug.

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What I meant to say was that I can quite safely guarantee that you'll be paying less than a third of the usual price from magazine advertisements – a more realistic estimate is that you would pay about five times as much if you bought the ICs individually. What more could you ask?

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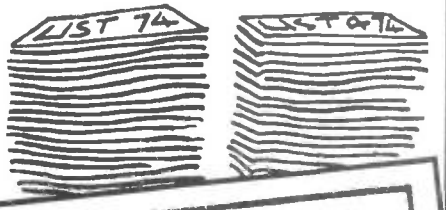

IC OF THE MONTH
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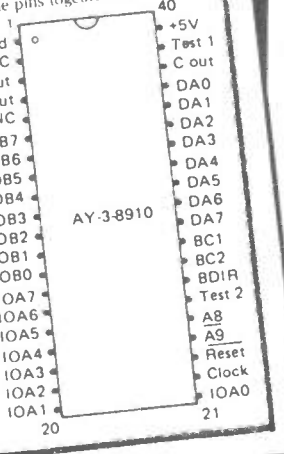
The data leaflet explains how to connect and program the IC and has a number of demonstration programs to get you started. After that, it's up to you to work out your own sounds, or just program it at random and see what comes out! The IC is less than half price while stocks last, so what are you waiting for? If you don't buy one at once, I must ask you to provide a good excuse, signed by a responsible person (the Pope will do).



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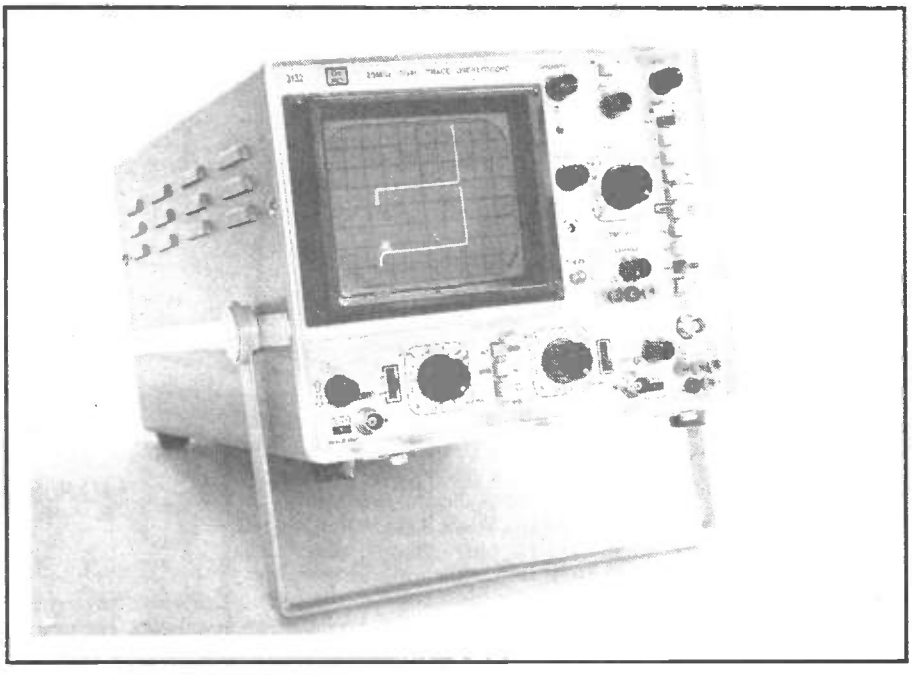
THE Radio & Electronics World CHRISTMAS HISTORY QUIZ

Compiled by Brian Kendal G3GDU

Why not exercise the old grey matter as well as the drinking arm over the festive season? Brian has put together a challenging little series of questions (too clever by half, that bloke), and the star prize of a 'scope has been donated by Brian Hollingworth of Crotech.

Entries are invited for scores of 100 or more on a sheet of paper with your name and address, and you've got until 31 January. We might even throw in a few more prizes if we're feeling generous. Oh, by the way, your genius of an editor scored less than 100. A lot less . . .



At Christmas time we all tend to reminisce, so this quiz is designed to let you do just that. Some of the questions are very easy whilst others are intended to make you look hard into the history books. The subjects covered include personalities, technical developments and events of the 100-year history of radio.

The marks for each question are given in brackets and the highest possible score is 220. The editor has promised to provide a small prize for the winner, so we will not be giving the answers until the issue after next. In the event of more than one winner, we shall arrange a special (very difficult) tie-break.

1. What had Heinrich Hertz to do with pitch? (5)
2. What was the significance of Lavernock Point and Steepholme Island? (3)
3. Why tap the coherer? (2)
4. Who was G Kemp's employer? (3)
5. What was and who invented the 'Telemobiloscope'? (5,5)
6. Which famous doctor had cause to regret the invention of wireless? (3)
7. What ever happened to the Wireless Society of London? (2)
8. What was the 'Grid Audion' and who invented it? (3,3)
9. Who was the first man to transmit a wireless signal from an aeroplane in flight to ground and where? (5,5)
10. What wavelength did Marconi use for his Salisbury Plain demonstration? (4)
11. What is a Nipkow disc? (2)
12. What was a 'Round' valve? (3)
13. For what was Paul Godley famous? (3)
14. What was and who now holds the callsign of Hiram P Maxim? (3,3)
15. Who lived at 'Coombe Dingle' and how did he affect British broadcasting history? (2,2)
16. A man whose name is well known in modern semiconductor terminology developed a four-electrode valve during World War 1; who was he? (5)
17. Who or what was 'Armstrong's nightmare child'? (3)
18. Alan Blumlein, one of the greatest geniuses in radio history, patented a device in about 1930 which did not become generally available until nearly ten years after his death, but is now used in almost every home. What was it? (5)
19. Under what circumstances did Blumlein die? (5)
20. Who is normally credited with the invention of the superheterodyne receiver? (3)
21. What was a 'Catkin' valve? (5)
22. The Marconi-Osram KT series of valves were well known – what did 'KT' stand for? (3)
23. Who manufactured the 'Melody Maker' receiver? (2)
24. Which is the odd one out: ML4, PM2, UX4, PX4? (3)
25. In what context was Mazda not International? (3)
26. Why would the Baird high definition TV system, which competed with that of EMI, have had problems giving time-checks? (5)
27. Where did the experiment take place which demonstrated to the British Government that radar was feasible? (3)
28. Before World War 2, what condition was specifically associated with amateur transmitting licences in the G2 + 3 letters series? (3)
29. Who developed what radio device at Birmingham University in 1940? (3,3)
30. When and why did World War 2 British bomber crews play with cat and mouse? (4,4)
31. Who or what were VIs? (3)
32. Who or what was Colossus? (3)
33. Why did British World War 2 bomber crews find that if Monica failed they might have to get assistance from Walter, and if so then Rebecca was no help? (10)
34. We've all heard of a Drake TR4 – but what was a TR9? (4)
35. Why should Crowborough have been proud of its Aspidistra? (5)
36. Which amateur band was the first to be withdrawn after World War 2? (3)
37. Which is the odd man out and why: Dynatron; Magnetron; Phantastron; Sanatron? (3)
38. What was Taylor Supermodulation? (3)
39. In the late 1940s, many amateurs built the 'Inexpensive Televisor' from wartime equipment. Which equipment was used and what was its original purpose? (4,4)
40. The Clapp oscillator was developed independently by a British engineer. What was his name and company? (4,4)
41. What were the operational limitations placed on a newly licenced radio amateur in the United Kingdom in 1950? (2,2)
42. What was the 80 metre 'Pond'? (3)
43. What is, or was, a Wobbulator? (3)
44. What are ½th second echoes? (2)
45. Using 'Q' code, encode: 'The time is'; 'What is the tone of my transmissions?' and decode: QBA?; QTE. (2,2,2,2)
46. Name two heads of state who hold radio amateur transmitting licences. (2,2)
47. What is a 'red spot'? (3)
48. The term picofarad has been in use for many years, but what was it called before? (2)
49. Loran disappeared from Top Band several years ago. What frequency does the latest version use? (5)
50. Experiments by Canadian scientists using an amateur satellite led to a major United States/USSR co-operative space venture. For what purpose is this and what is the name of the system? (4,4)

73s de Brian REW

DATA FILE . . .

Ray Marston presents a further selection of relay-output circuits

In the last two editions of *Data File* we have taken a fairly detailed look at the four best-known types of electro-mechanical and electronic relay devices. In this edition of 'The File' we continue this theme by looking at a further selection of useful relay-output circuits.

LDR basics

Light-sensitive relay circuits can easily be made to activate when light intensity goes above or below a preset value, or when a light beam is broken by a person or object, or when a light source is reflected onto the face of a light sensor by particles of smoke or fog, etc. The best-known and easiest to use type of light-sensitive device (photo-sensor) is the light sensitive resistor (LDR), which uses the symbol shown in *Figure 1.*

LDR operation relies on the fact that the conductive resistance of a film of cadmium sulphide (CdS) varies with the intensity of light falling on its face; the resistance is very high under dark conditions, and low under bright conditions. *Figure 2* shows the basic construction of the LDR, which consists of a pair of metal film contacts separated by a snake-like track of cadmium sulphide film that is designed to give the maximum possible contact area with the two metal films. The structure is housed in a clear plastic or resin case that gives free access to external light.

Practical LDRs are sensitive, inexpensive and readily available devices that have good voltage and power handling capabilities, similar to those of a normal resistor. They are available in a variety of sizes and package styles, the most popular size having a face diameter of roughly 10mm. Typically, such a device has a resistance of several megohms under dark conditions, falling to about 900Ω at a light intensity of 100 lux (typical of a well lit room) or about 30Ω at 8000 lux (typical of bright sunlight).

Figures 3 to *11* show a selection of practical light-sensitive relay-output switching circuits that use LDRs as their opto-sensors; each of these circuits will work with virtually any LDR with a face diameter in the range 3 to 12mm.

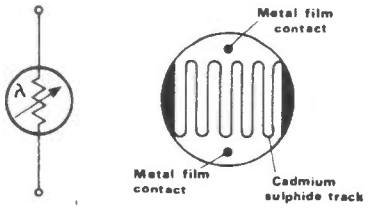


Fig 1 **Fig 2**

Symbol and structure of the LDR

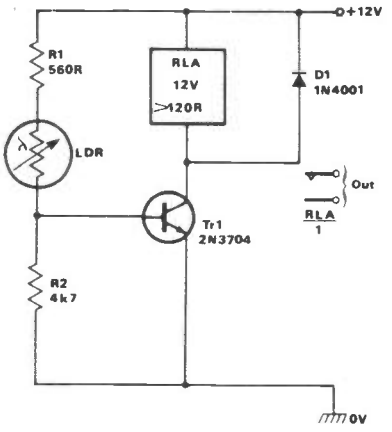


Fig 3 *Simple light-activated relay switch*

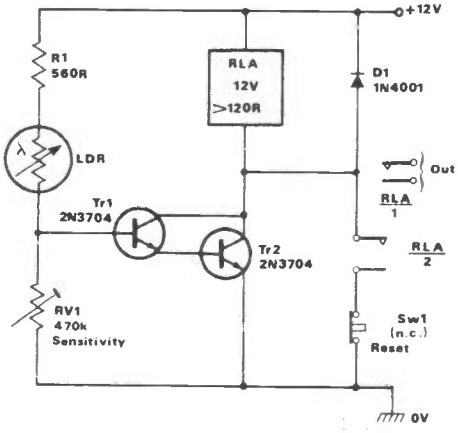


Fig 4 *Sensitive self-latching relay switch*

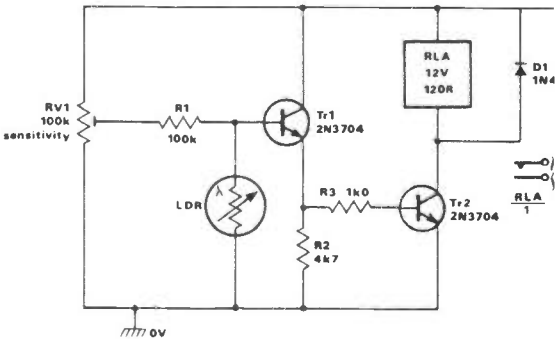


Fig 5 *Simple dark-activated switch*

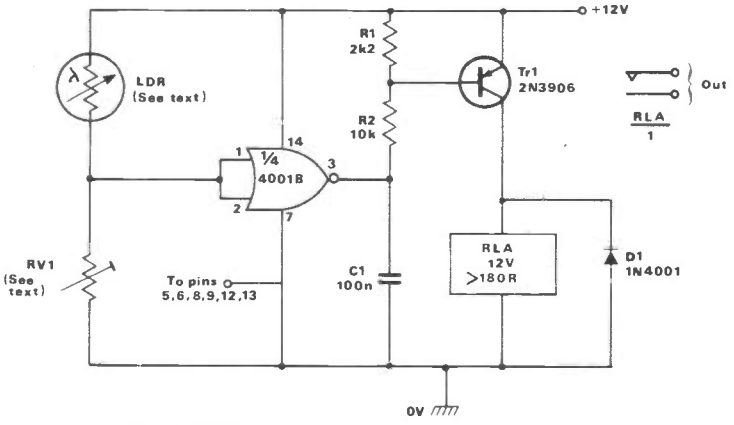


Fig 6 *CMOS-aided light-operated relay switch*

Light-activated relays

Figures 3 to *7* show a selection of relay-output light-activated 'switch' circuits based on the LDR. *Figure 3* shows a simple non-latching circuit that is designed to activate when light enters a normally-dark area such as the inside of a safe or cabinet, etc.

Here, LDR and R2 form a light-sensitive potential divider that determines the base bias of Tr1. Under dark conditions the LDR resistance is high so zero base bias is applied to Tr1, and Tr1 and the relay are off. When a significant amount of light falls on the LDR face its resistance falls to a fairly low value, applying bias to the base of Tr1, which thus turns on and activates the RLA/1 relay contacts.

The simple *Figure 3* circuit has a fairly low and non-adjustable sensitivity. *Figure 4* shows how these defects can be overcome by using a Darlington-connected pair of transistors in place of Tr1 and by using sensitivity control RV1 in place of R2. The diagram also shows how the circuit can be made self-latching via relay contacts RLA/2; normally-closed push-button switch SW1 enables the circuit to be reset (unlatched) when required.

Figure 5 shows how an LDR can be used to make a simple 'dark-activated' relay switch that turns on when the light level falls below a value preset by RV1. Here, potential divider R1-LDR generates an output voltage that rises as the light level falls, and this voltage activates Tr2 and RLA via emitter-follower Tr1.

The light 'trigger points' of the *Figure 3* to *5* circuits are fairly susceptible to changes in supply voltage and ambient temperature. *Figure 6* shows a CMOS-aided light-operated relay circuit that does not suffer from this susceptibility. Here, one of the four available NOR gates of a 4001B CMOS IC is used as a linear inverter between the light-sensitive LDR-RV1 network and the input of relay-driving transistor Tr1.

When the 4001B CMOS NOR gate is

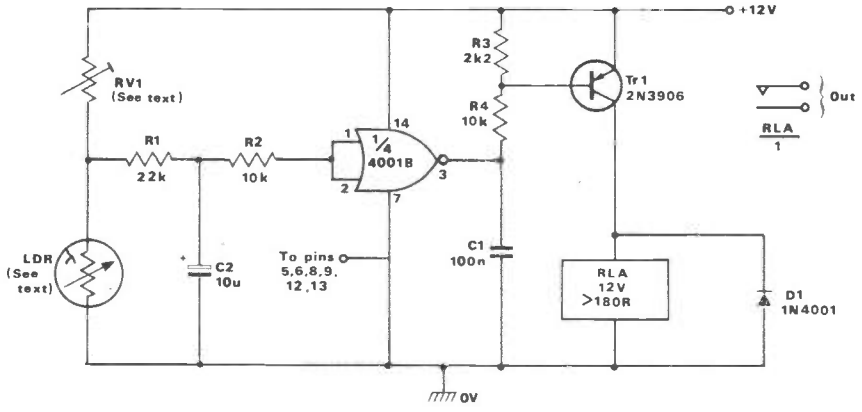


Fig 7 *CMOS-aided dark-operated switch with transient suppression*

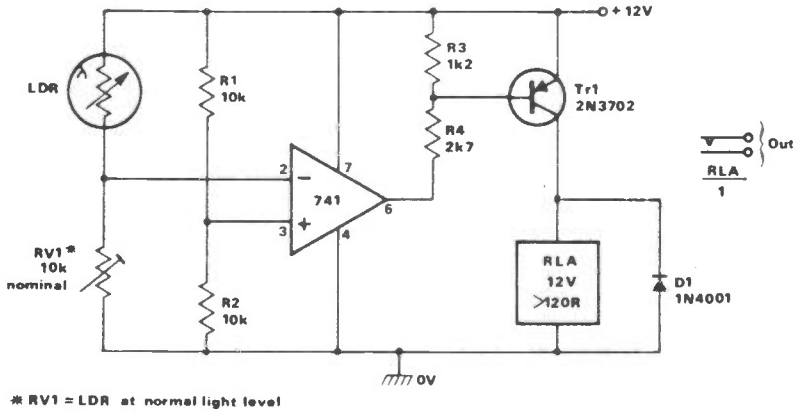


Fig 8 *Precision light-activated relay switch*

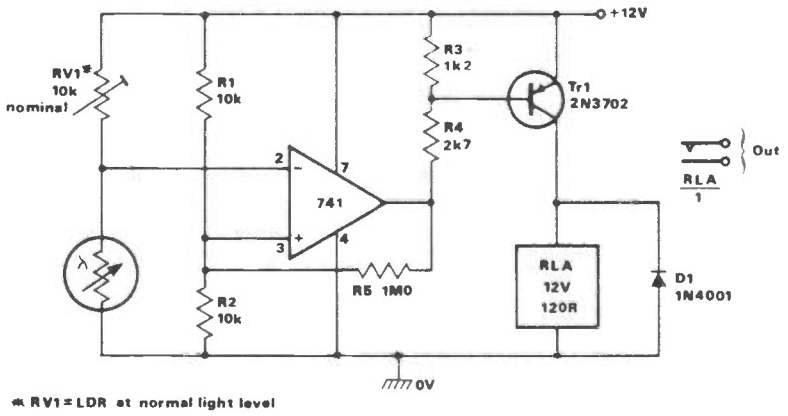


Fig 9 *Precision dark-activated switch with hysteresis*

wired as an inverter it gives 'linear' action only when its input is within a few dozen millivolts of a value known as the 'threshold voltage' point; at all other times the gate output is saturated (driven to either ground or positive supply voltage). This threshold point is actually a fixed fraction of the supply voltage value (the value is typically 50%, but may vary from 30% to 70% between individual devices), and is very stable.

Thus when it is wired in the configuration shown in *Figure 6* the inverter input acts like the 'fixed potential divider' side of a Wheatstone bridge (with LDR-RV1 forming the 'variable' side of the bridge), and as a bridge-balance detector that goes into the linear mode when the bridge is very close to its 'balance' point. Note that this balance point is not greatly influenced by variations in supply voltage or ambient temperature.

The action of the *Figure 6* circuit is such that when the light level is below the desired 'trip' value the gate input is low, so the gate output is driven to the positive supply rail value and Tr1 and the relay are off. When the light level is above the trip value the gate input is high, so the gate output is driven to ground voltage and both Tr1 and RLA are driven on. When the light level is very close to the desired trip level the gate is driven into the 'linear inverter' mode, and minute changes in light level can cause the relay to switch on or off. The trip level can be preset via RV1.

The action of the above circuit can be reversed, so that the relay goes on when the light intensity falls below a preset level, by simply transposing the RV1 and LDR positions as shown in *Figure 7*. This circuit also shows how a simple transient suppressing network can be wired between the output of the light-sensitive divider and the input of the CMOS gate, so that the circuit responds to mean light levels but is unaffected by sudden light transients (such as are caused by lightning flashes, etc). This circuit can be used to turn porch lights or car parking lights on at dusk and off at dawn.

Note in the *Figure 6* and *7* circuits that the LDR can be any type that gives a resistance in the range 2k to 2M at the desired 'trip' level, and that (when adjusted) the RV1 value should balance that of the LDR. Also note that C2 is used to ensure stability of the CMOS inverter when it is operating in the linear mode.

Precision circuits

The CMOS-aided circuits of *Figures 6* and *7* give a semi-precision light-sensitive switching action that is adequate for most practical purposes. Greater precision can be obtained, if necessary, by using the op-amp circuits of *Figures 8* to *10*.

In *Figure 8*, LDR-RV1 and R1-R2 form a light-sensitive Wheatstone bridge that has its output fed to a very sensitive 741 op-amp 'balance' detector; R1-R2 feed a fixed half-supply voltage to the non-inverting input of the detector, and LDR-RV1 feed a light-dependent voltage to the inverting input of the detector. If these two voltages differ by more than a few millivolts the op-amp output is driven to saturation (to near-zero or near-positive rail values), thus driving Tr1 and RLA either on or off. If the two voltages are within a few millivolts of each other, the state of the relay depends on the direction of bridge imbalance.

The actual balance point can be preset via RV1, and is independent of variations in supply voltage or temperature. Because of the very high gain of the op-amp, the *Figure 8* circuit has a far greater sensitivity that the CMOS-aided circuits described earlier.

The *Figure 8* circuit is configured so that the relay turns on when the light goes above a preset level. It can be modified to give the reverse action, so that it acts as a precision dark-activated switch, by either transposing the inverting and non-inverting input connections of the op-amp or by transposing the LDR and RV1, as shown in *Figure 9*.

This diagram also shows how a small amount of hysteresis can be added to the circuit via feedback resistor R5, so that

the relay turns on when the light level falls to a particular value but does not turn off again until the light intensity rises a substantial amount above this value. The hysteresis value is inversely proportional to the R5 value, and is zero when R5 is open circuit.

A precision combined light/dark switch that activates a single relay if the light level goes above one preset value or below another can be made by combining op-amp 'light' and 'dark' switches in the manner shown in *Figure 10*. To set up this circuit, first adjust RV1 so that roughly half-supply volts appear on the RV1-LDR junction when LDR is illuminated at the 'normal' or mean level. RV2 can then be set so that RLA turns on when the light falls below the desired 'dark' level, and RV3 can be set so that RLA turns on when the light rises above the desired 'light' or brightness level.

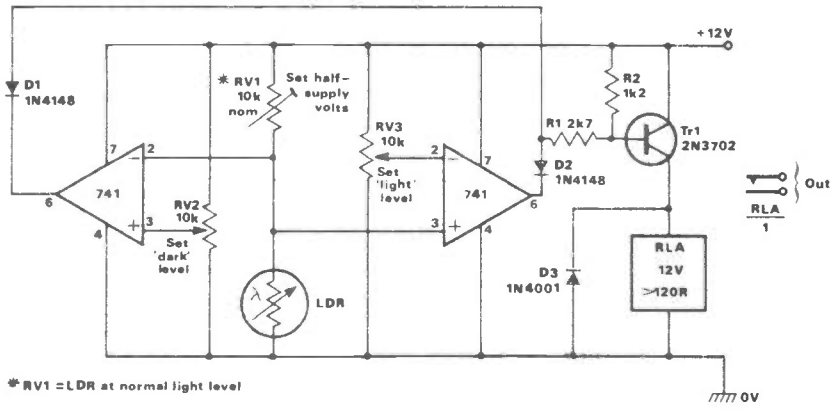


Fig 10 *Combined light/dark-activated single-relay switch*

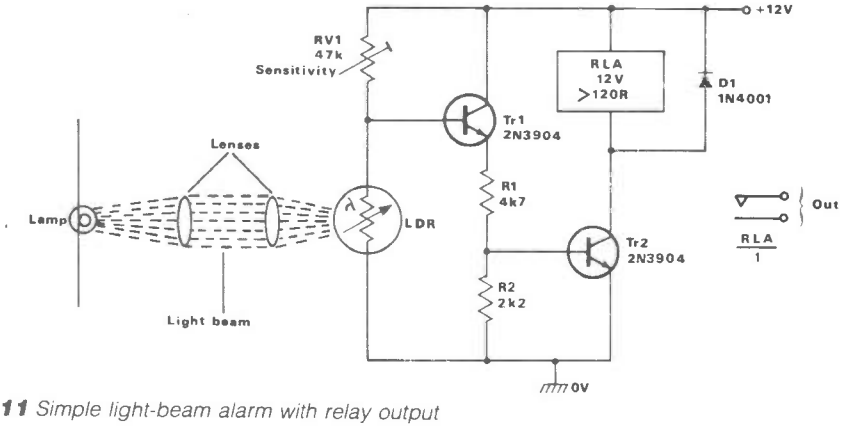


Fig 11 *Simple light-beam alarm with relay output*

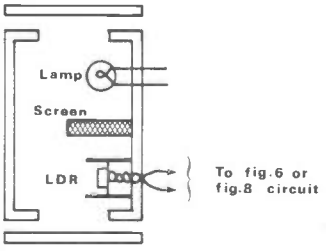


Fig 12 *Sectional view of reflection-type smoke detector*

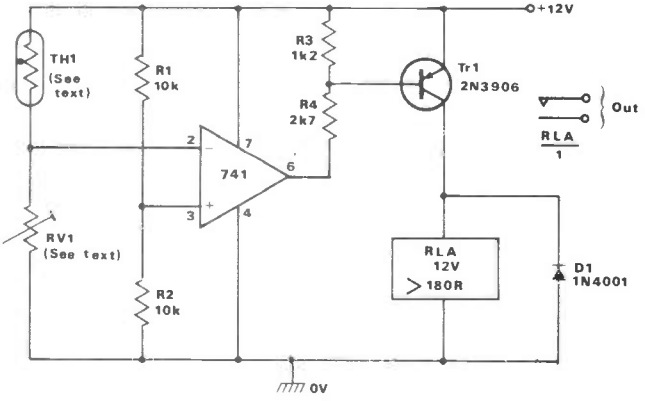


Fig 13 *Precision over-temperature switch*

'Light-beam' alarms

One popular application of the LDR is as a light-beam alarm or switch which activates when the passage of a beam of light is interrupted by an object or person. *Figure 11* shows a simple circuit of this type; the two lenses focus the lamp-generated light-beam onto the LDR face, and the LDR circuit acts like a dark-operated relay switch.

Normally, with the light-beam uninterrupted, the LDR face is illuminated by the beam and presents little resistance, so little voltage appears at the RV1-LDR junction and Tr2 and the relay are off. When the light-beam is broken the LDR resistance increases, so a significant voltage appears on the RV1-LDR junction and thus activates the relay via Tr2. Note that in practice most modern 'beam' alarms use a modulated infra-red signal to generate the light-beam, and use an infra-red photo-diode or transistor to detect the beam.

'Smoke' alarms

Another popular application of the LDR is as a 'smoke' alarm which activates when smoke causes a light source to reflect onto the face of an LDR. *Figure 12* shows a sectional view of a reflective-type smoke detector, which consists of a lamp and an LDR mounted in an open-ended but light-excluding box with an internal screen that prevents the lamp-light from falling directly onto the LDR face.

The lamp is a source of both light and heat, and the heat causes convection currents of air to be drawn in from the bottom of the box and to be expelled through the top. The inside of the box is painted matt black, and the construction lets air pass through the box but excludes external light.

Thus if the convected air currents are smoke-free no light falls on the LDR face, and the LDR presents a high resistance. If the currents do contain smoke, however, the smoke particles cause the light of the lamp to reflect onto the LDR face and so cause a great and easily detectable decrease in the LDR resistance. The detector circuitry thus needs to act like a light-operated circuit, and can take the form shown in *Figure 6* or *8*.

Heat-sensitive circuits

Each of the light-sensitive switching circuits of *Figures 3* to *10* can be converted into a temperature-sensitive switch by simply replacing its LDR with a negative temperature coefficient (ntc) thermistor. These are simple resistor-like devices that present a resistance value that is inversely proportional to temperature, ie the resistance falls as temperature rises and vice versa.

Figure 13 shows how the precision light-activated relay switch of *Figure 8* can be converted into a precision over-temperature switch. The thermistor used here can be any ntc type that presents a resistance in the range 1k to 20k at the required trigger temperature, and the RV1 resistance should equal this value at the same temperature. The above circuit can be made to act as an 'ice' or under-temperature switch by simply transposing TH1 and RV1.

Ordinary silicon diodes can also be used as temperature-sensing elements when forward biased. Typically, they give a forward voltage drop of about 600mV at a forward current of 1mA; if this current is held constant, the voltage drop changes by about −2mV for each degree Celsius

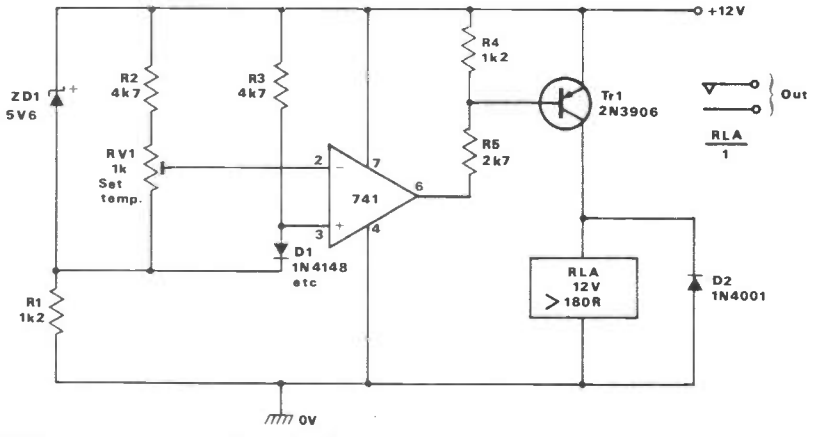


Fig 14 *Over-temperature switch with silicon diode sensor*

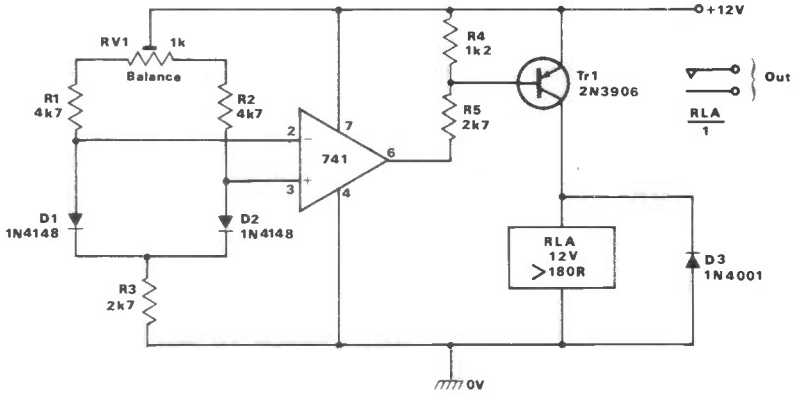


Fig 15 *Differential temperature switch*

increase in diode temperature. All silicon diodes have inherently similar thermal characteristics, and *Figure 14* shows how such a diode can be used as a sensor in an over-temperature switch.

In *Figure 14,* ZD1 and R1 are used to generate a constant 5.6 volts across the R2-RV1 and R3-D1 potential dividers, causing a virtual constant current to flow in each divider. A constant reference voltage is thus developed between the ZD1-R1 junction and pin 2 of the op-amp, and a temperature-dependent voltage with a coefficient of −2mV/°C is developed between the ZD1-R1 junction and pin 3 of the op-amp. Thus a differential ntc voltage appears between pins 2 and 3 of the op-amp.

To set up the *Figure 14* circuit, simply apply the desired 'trip' temperature to D1 and then carefully adjust RV1 so that the relay just turns on. The circuit has an 'on/off' sensitivity of about 0.5°C, and can be used as an over-value switch at temperatures ranging from sub-zero to above the boiling point of water. Note that the operation of the circuit can be reversed, so that it acts as an under-temperature switch, by simply transposing the pin 2 and pin 3 connections of the op-amp.

Finally, *Figure 15* shows how a pair of silicon diodes can be used as temperature-sensing elements in a differential-temperature switch that turns on only when the D2 temperature is more than a preset amount greater than that of D1, and is not influenced by the absolute temperatures of the two diodes. The magnitude of this differential temperature trip is fully variable from zero to about 10°C via RV1, so the circuit is quite versatile. It can be set up by simply raising the D2 temperature the required amount above that of D1 and then carefully adjusting RV1 so that the relay just turns on under this condition.

Miscellaneous circuits

To complete this edition of *Data File, Figures 16* and *17* show two miscellaneous types of relay-switching circuits. The *Figure 16* design is that of a simple relay pulser, which repeatedly switches the relay on and off at a rate variable (via RV1) between 26 and 80 cycles per minute via the CMOS astable multivibrator circuit built around the two 4001B NOR gates.

The *Figure 16* circuit can be used as an emergency lamp flasher by using the relay contacts to switch power to the lamps. *Figure 17* shows how the circuit can be modified so that it starts pulsing or 'flashing' automatically when the ambient light level falls below a level preset via RV2. Note that if this circuit is used as a lamp flasher care must be taken to ensure that the LDR face points away from the lamps, so that a photo-coupled feedback loop is not set up.

Fig 16 *Relay pulser circuit*

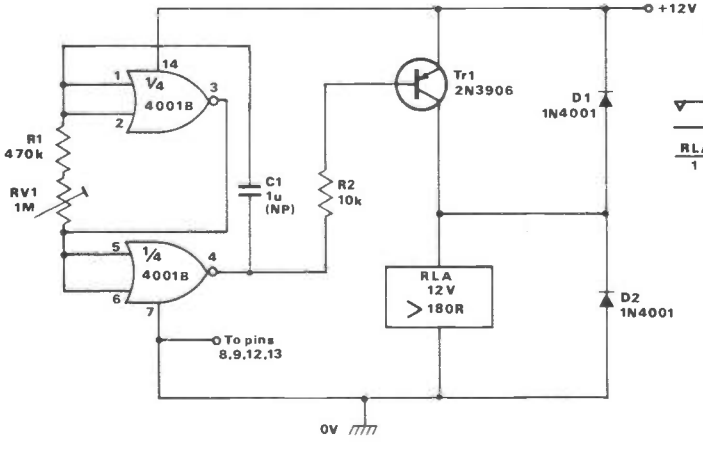
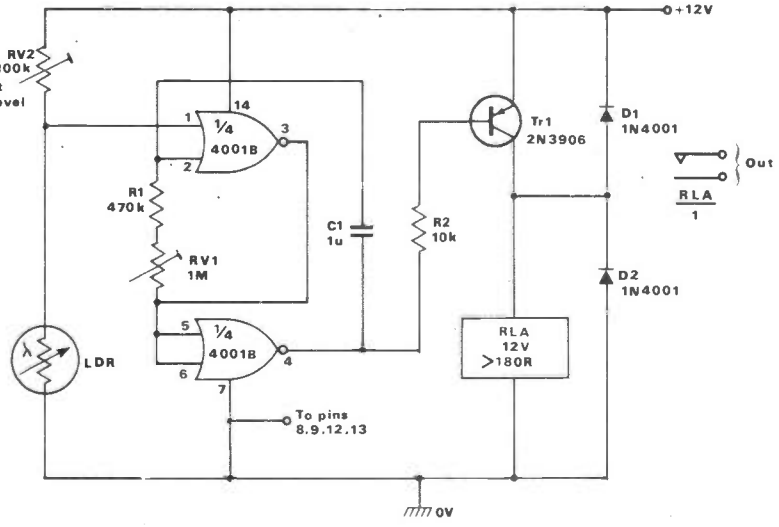
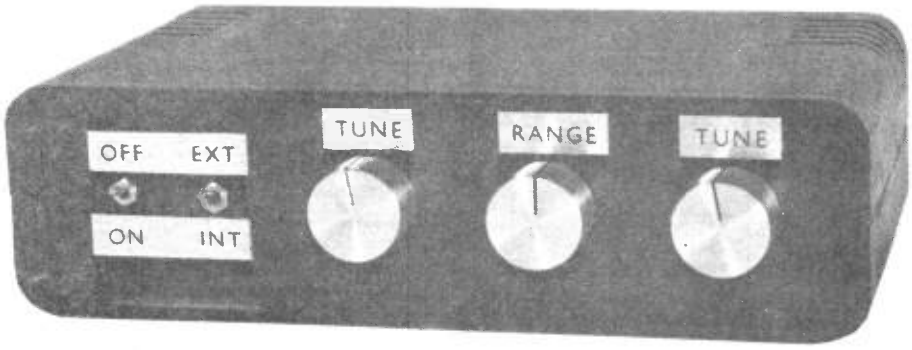


Fig 17 *Light-activated relay pulser*



AN ATU AND NOISE SOURCE



An aerial tuning unit from R A Penfold which includes a noise generator as a tuning aid

Although there is a multitude of alternatives to choose from these days, the so-called 'long-wire' antenna still seems to be the most popular type amongst short wave listeners. This type of aerial has in its favour that it can be installed in any but the most confined of spaces, and it will work reasonably well over a wide frequency range. The main drawback of a long-wire antenna is that it works no more than reasonably well at most frequencies, and for most of the time users of these aerials are getting somewhat less than optimum results. This slight lack of efficiency is not of great importance for much of the time, but can make all the difference when chasing weak DX stations.

Boosting the signal

The standard approach to optimising results with a simple wire antenna is to use an aerial tuning unit (ATU). The claim that a device of this type, which is purely passive, can boost signal strengths by two or three 'S' points is often treated with scepticism by those who have never used one. In fact an ATU can often boost signal strengths by about two S points, but it does not genuinely provide any gain. It is an impedance matching device, and is really just a form of matching transformer. The gains in signal strength are obtained by providing a more efficient signal transfer from the aerial to the receiver, and strictly speaking it is more a matter of reducing losses than providing gain.

To the user this is all academic, and either way an ATU often gives a useful boost in signal strengths, and as an added bonus it gives improved RF selectivity with an attendant reduction in spurious responses.

The usual approach

A conventional ATU is based on a large, air-cored, multi-tapped inductor. This can be rather awkward from the constructional point of view, and building the present design has been simplified by the use of ten ordinary inductors of appropriate values. This seems to give good results, with a level of performance which is comparable to a conventional ATU. However, it has to be stressed that the unit is only intended for use with receivers, and the use of small ready-made inductors (with their limited voltage and current ratings) makes it unlikely that the unit would function satisfactorily with anything but a true QRP transmitter.

An unusual feature of the circuit is the inclusion of a noise generator. The main purpose of this is to provide a signal which can be used when adjusting the ATU for peak sensitivity. The noise signal gives a reasonably strong output right across the short wave spectrum, and it gives a virtually constant output amplitude at any given frequency. Therefore it can always be used to provide a stable signal for adjustment purposes, unlike most short wave stations which are prone to severe QSB of one type or another.

A noise output is provided, and the unit can double as a general purpose RF noise source. A noise source can often be useful when aligning receivers, and it is especially useful in cases where peaking the RF circuits 'pulls' the oscillator and causes detuning. With an RF signal generator or a radio station as the signal source, peaking the RF circuits is virtually impossible since the detuning effect has a more profound effect on signal strengths than do the RF adjustments. In a severe case, significant adjustment of the RF tuned circuits results in the receiver being 'pulled' right off the alignment signal.

A noise source provides an output level which is not constant over the full short wave spectrum, but which will not vary significantly over a restricted range of frequencies. Any detuning is therefore irrelevant when using a noise source for alignment purposes, and the RF tuned circuits can be adjusted for peak signal strength easily.

Aerial matching

While it may seem strange to talk in terms of a length of wire having source impedance, like any signal source the output from a long-wire aerial reduces when it is connected to a load. In this case the load is the input impedance of the radio receiver, which can be as little as 50Ω or 75Ω, and is not usually more than a few hundred ohms. The output impedance of the aerial depends on its length, and on the frequency involved. Optimum signal transfer is obtained when the output impedance of the aerial equals the input impedance of the receiver.

Short long-wires

Most long-wire aerials are, strictly speaking, only genuine long-wire types at the high frequency end of the short wave range. A long-wire aerial is one that is more than half a wavelength long, but in practice most are only about 10 to 20 metres in length, and are less than a half a wavelength long on the LF bands, or even on some of the HF bands. The practical outcome of this is that the aerials tend to have a much higher output impedance than the load impedance provided by the receiver, and an inefficient signal transfer is obtained.

In addition to the normal low impedance input some modern receivers are equipped with a high impedance input which is designed specifically for use with simple wire antennas. Provided no problems with overloading are experienced these will work well with virtually any simple wire aerial. Even where a high impedance input is available, the use of an ATU plus the low impedance input may well give superior results by ensuring an optimum signal transfer, regardless of what impedance mismatch is present. Of course, at certain frequencies a given receiver and aerial will provide a good impedance match, and it is only fair to point out that an ATU can give no improvement in signal strengths at frequencies where a good impedance match is already present.

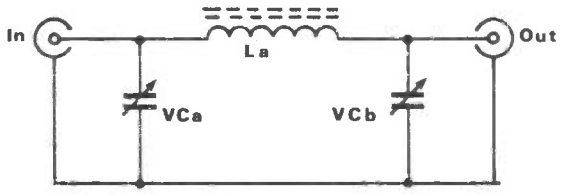


Fig 1a *Most ATUs are based on this pi-network circuit*

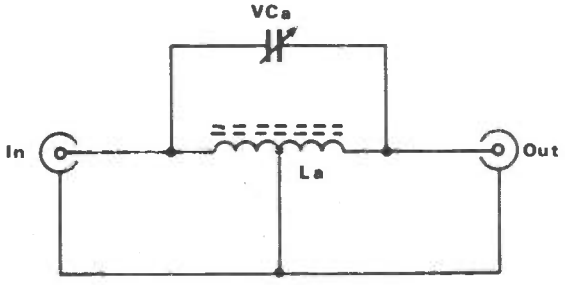


Fig 1b *It is a form of single-wound transformer analogous to this circuit, which is only usable in practice if the tapping point can be varied*

The conventional ATU configuration, and the one adopted for this design, is the well-known pi network shown in *Figure 1(a)* . At first sight this tends to look as though it can only hinder the aerial signal rather than aid it, and it has to be considered as a single-would tuned transformer. What tends to make this configuration look a little strange is the use of a capacitive tapping rather than an inductive type. If it is redrawn with an inductive tapping, as in *Figure 1(b)* , the circuit is then a straightforward (tuned) single-wound matching transformer. A capacitive tapping is used in practice simply because it is easier to have cariable capacitors than variable inductors.

The input impedance is controlled by CV1, while the output impedance is adjusted by means of CV2. Adjusting an ATU of this type for optimum results is slightly more time consuming than one might think, and this is due to the fact that it is a tuned circuit. For optimum results the combined series capacitance of CV1 and CV2 must bring L1 to resonance at the reception frequency.

Circuit operation

Referring to the complete circuit diagram of the unit which appears in *Figure 2* , the aerial tuning unit circuit is essentially the basic pi network just described. It differs only in that a range of ten switched inductors (L2 to L11) is utilized in place of the single type of *Figure 1(a)* . This enables a wide range of aerials, input impedances and operating frequencies to be accommodated, and the unit will match virtually any aerial to practically any short wave receiver. A somewhat reduced range of values would probably give acceptable results, but including a comprehensive range of values gives the best chance of achieving a perfect match between any given aerial and receiver over a wide range of frequencies.

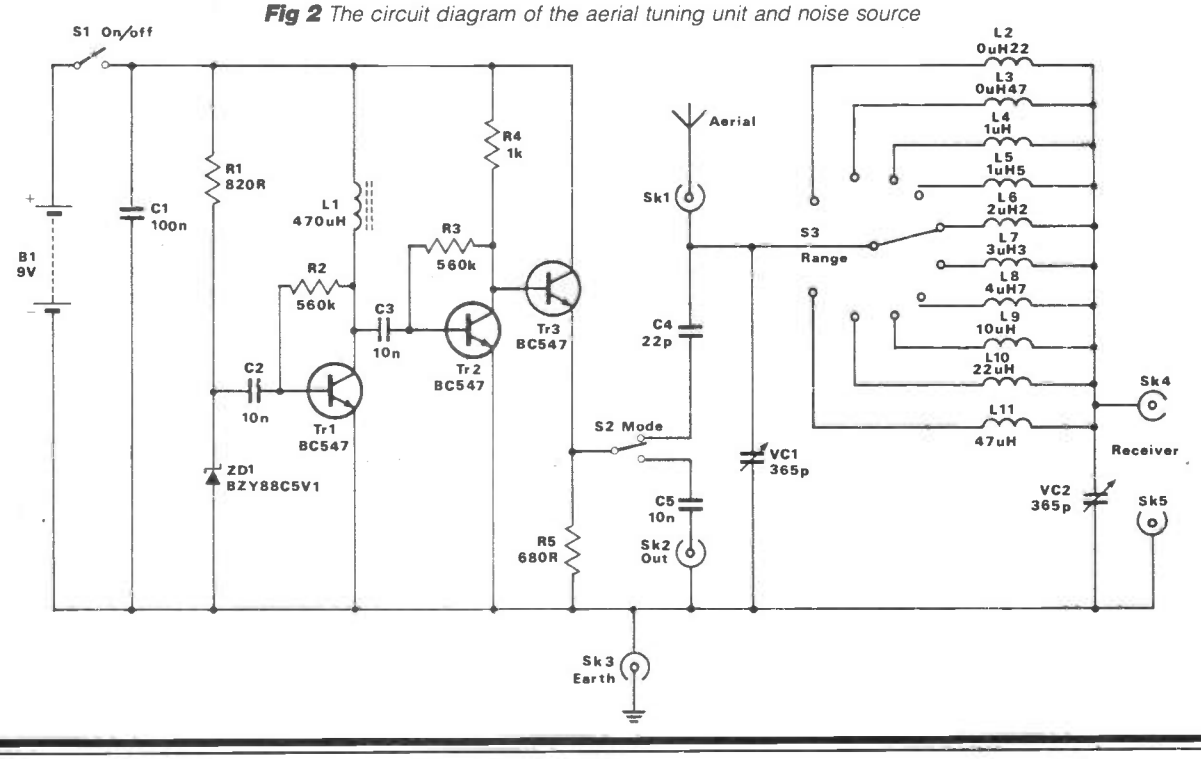
Turning to the noise generator, probably the cheapest noise source suitable for the frequency range involved here is an ordinary Zener diode. In a Zener diode stablizer circuit the noise spikes generated across the diode are suppressed by a capacitor, but in this case they are left unbypassed and are coupled to the input of a common-emitter amplifier based on Tr1. From here they are fed to a second common-emitter stage, this time using Tr2, and then finally to the emitter-follower output stage (Tr3).

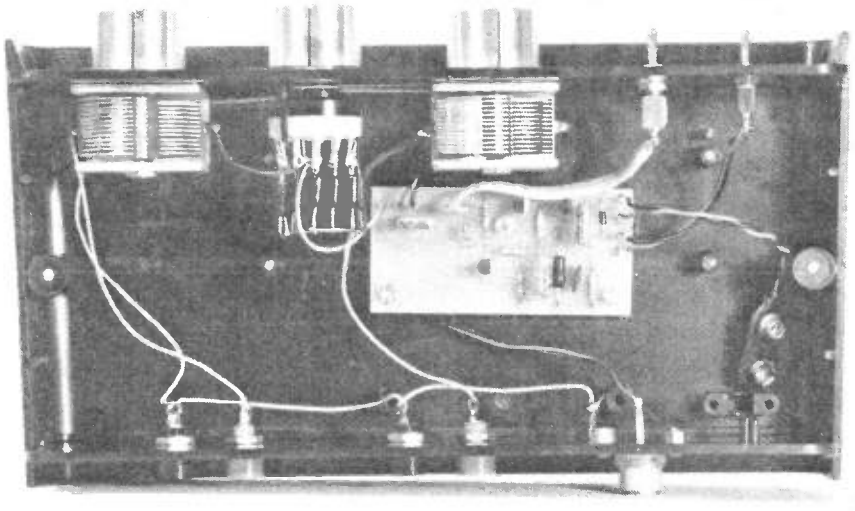
A small noise

The noise voltage generated by D1 is quite small, typically only about a millivolt or less peak to peak. However, after two stages of amplification this is boosted to about 150mV peak to peak (as measured using a 20MHz oscilloscope). The output voltage over a restricted range of frequencies (such as the few kilohertz of a short wave receiver's passband) is very much less than this, but the unit will provide a strong S meter reading at any frequency within the short wave range on any reasonably sensitive receiver.

S2 enables the noise signal to either be

Fig 2 *The circuit diagram of the aerial tuning unit and noise source*





coupled through to the noise output socket (SK2) by way of C5, or loosely coupled to the aerial input socket via C4. A loose coupling here ensures that the noise signal is not radiated from the aerial at a significant strength, but the coupling is tight enough to give good signal strengths over the 1.6 to 30MHz range. In fact the noise source gives a strong ouput from the VLF range to frequencies of 50MHz or more.

Although one might not expect CV1 and CV2 to peak the noise signal at the same settings which peak aerial signals, there does seem to be an exact correlation here.

The current consumption of the noise source is fairly high at around 18mA, but assuming that it will not be used for prolonged periods a small (PP3 size) 9 volt battery is suitable as the power source.

Construction

A printed circuit board is used as the constructional basis of the noise generator, but the ATU is hard-wired. Details of both the printed circuit board and the hard-wiring are provided in *Figure 3* . Neither the board or the wiring should present any real difficulties, but try to keep all the wiring in the ATU circuit as short and direct as possible, otherwise inductance in the wiring could comprise results at high frequencies.

Mounting the inductors on S3 is quite easy provided the tags of the switch and the ends of the lead-out wires are tinned with solder prior to making the connections. It is easier to use axial rather than PCB-mounting inductors, but the latter can be fitted to S3 and wired up without too much difficulty. It is probably easier if the inductors are fitted to S3 before this component is mounted on the front panel.

The case for the prototype is a plastic type which has approximate outside dimensions of 230 ×123 ×64mm, but this is somewhat larger than is really needed, and a metal case is equally suitable. The exact layout of the unit is not too important, other than that CV1, CV2 and S3 should be positioned close together so that the ATU wiring can be kept suitably short.

SK2 is a coaxial socket, while the other sockets are 4mm types, but this arrangement could obviously be changed to one more appropriate for your particular set-up if necessary.

CV1 and CV2 are Jackson type 'O' air-

PARTS LIST

Resistors All ¼ watt 5% carbon

R1	820Ω
R2,3	560k
R4	1k
R5	680Ω

Capacitors

C1	100nF ceramic
C2,3,5	10nF polyester
C4	22pF ceramic
CV1,2	365pF air-spaced

Semiconductors

Tr1,2,3	BC547
D1	BZY88C5V1 (5.1V 400mW Zener)

Inductors

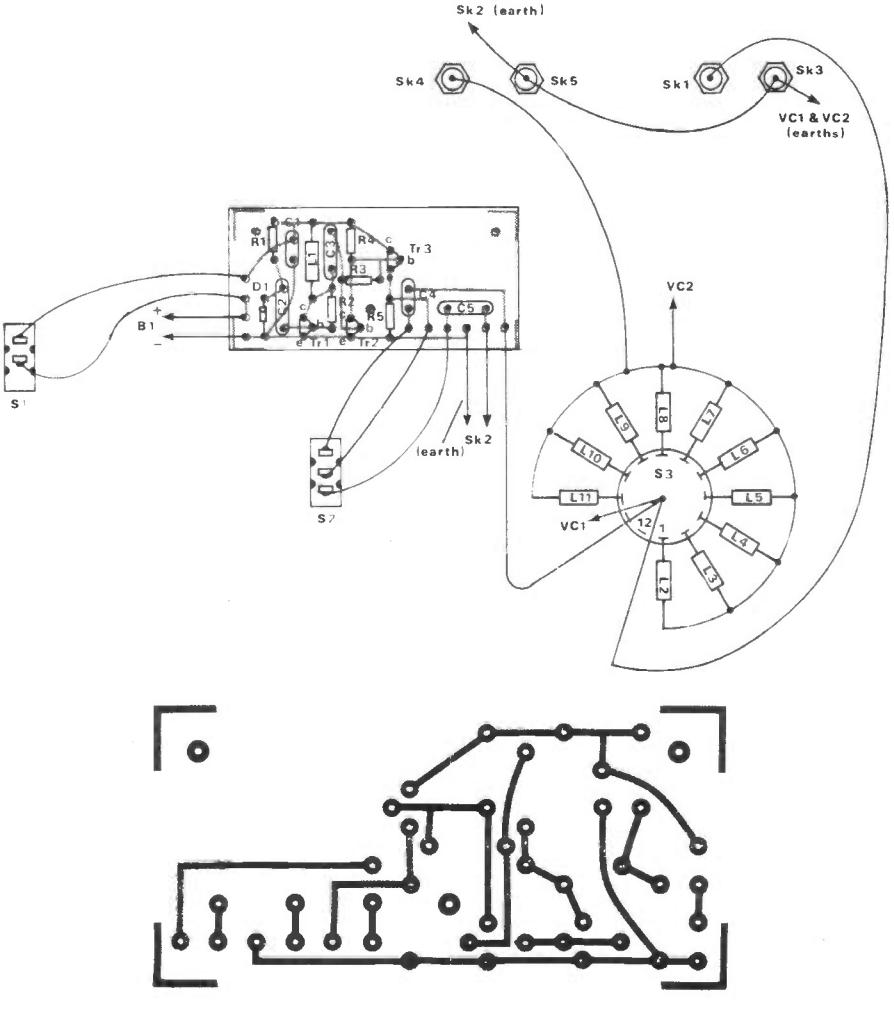
L1	470μH
L2	0.22μH
L3	0.47μH
L4	1μH
L5	1.5μH
L6	2.2μH
L7	3.3μH
L8	4.7μH
L9	10μH
L10	22μH
L11	47μH

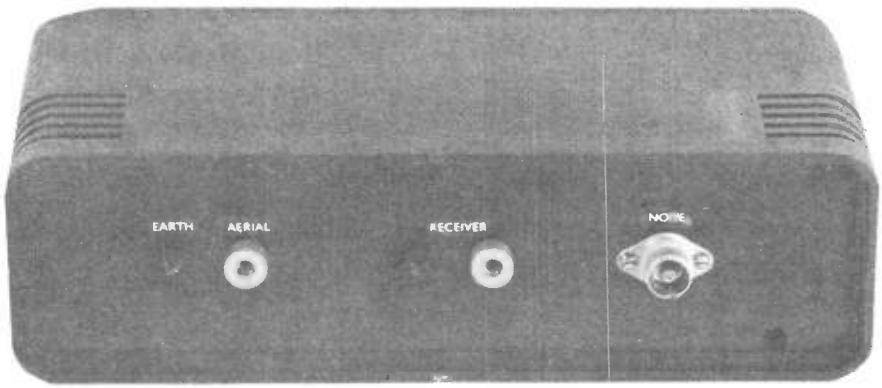
Miscellaneous

S1	SPST miniature toggle
S2	SPDT miniature toggle
S3	12-way 1 pole with end stop
SK1,3,4,5	4mm sockets
SK2	Coaxial socket
B1	9 volt battery (PP3 etc)

Case about 230 ×123 ×64mm
Printed circuit board
Three control knobs

Fig 3 *Details of the wiring and the printed circuit board*





spaced variable capacitors. These require three short 4BA countersunk fixing screws which fit through holes drilled in the front panel and into the ready-made threaded holes in the front plate of each capacitor. It is important that these mounting screws are suitably short so that they do not penetrate the front plates and damage the moving vanes of the capacitors. A safer method of mounting is to simply glue them in place using a good quality general purpose adhesive.

Of course, it is not essential to use the specified types for CV1 and CV2, and any air-spaced capacitors having maximum values of around 350 to 500pF should be suitable. It is worthwhile using inexpensive surplus types if you can find them, since doing so will probably cuty the cost of the unit by around 50%.

In use

SK4 and SK5 connect to the aerial and earth sockets (respectively) of the receiver, and the earth connection must be included. The connecting cable, which can be coaxial or just ordinary twin cable, should be no longer than is absolutely necessary. The aerial connects to SK1, and if an earth is used this should connect to SK3.

In general, small inductances are required on the high frequency bands and large inductances are needed for the low frequency bands. However, it is really a matter of experimenting with various settings of CV1, CV2 and S3 to see what gives the best results for each band, using the noise source as a tuning aid where required. The tuning of CV1 and CV2 is always quite broad, and in some cases there might be a wide range of settings of these (and S3) which give good results. This occurs where there is already a reasonably good impedance match, and the unit is not able to effect any substantial improvement.

If you set up the unit for peak performance at the centre of a band, it should not be necessary to alter the settings when operating at the band edges. It is a good idea to try out the unit on each band, making a note of the correct settings for the controls on each one. The unit can then be quickly set to suit the desired band on future occasions, without having to go through the whole trial and error business to find the optimum settings.

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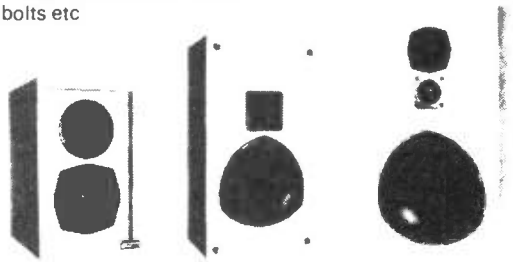

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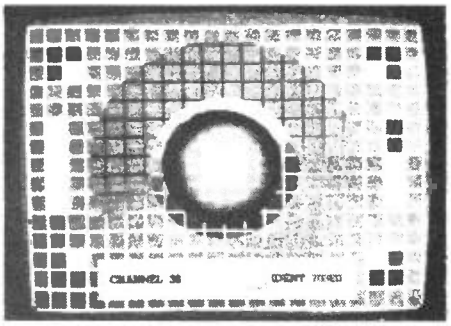


Compiled by Keith Hamer and Garry Smith

Early September normally signals the end of the sporadic-E season. However, this year was an exception. A lull at the end of August was followed by a dramatic upsurge in activity. In fact the month was most unusual, with exotics and other rare stations continuing to fill our screens. The most notable days for intense openings were the 4th, 5th, 7th and 20th. The latter opening lasted for most of the day and, in fact, heralded the end of the 1986 sporadic-E season.

Tropospheric DX was also exceptional. The 20th marked the beginning of settled anticyclonic conditions over a large area of Europe. This created a seemingly endless supply of DX on all bands, notably from East Germany, Czechoslovakia, West Germany and Switzerland.

Sporadic-E conditions

The sporadic-E opening on the 4th produced mid-morning activity featuring the USSR, Finland, Sweden and Norway. Kevin Jackson of Leeds spotted the 'NORGE VARANGER' PM5534 test card at 1053 GMT on channel E2. This was a remarkable achievement since the transmitter is located in the far northern tip of Norway, well within the Arctic Circle. During the same opening the Russian UEIT test pattern was observed carrying the identification 'Leningrad' but, of course, in the Cyrillic alphabet.

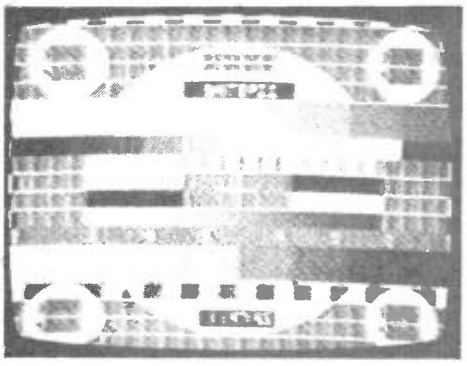
Signals from the USSR were also noted on the 5th, when Simon Hamer of Powys resolved the EESTI TV programme schedule on channel R2. Unfortunately he just missed the PM5537 colour blockboard pattern. A little later Polish signals took over, and their 'dt' news programme carried a report on the TUC conference in Brighton.

DX-TV signals appeared from central Europe during the morning of September 7th. Here in Derby the Italian PM5544 test card from RAI was resolved on channel IA shortly after 0800 BST. Also noted were Czechoslovakian and Russian programmes (including cartoons) on channels R1 and R2. The Austrian PM5544 appeared on channel E2a at 0935 followed by reception on channel E3 from the 100W Birkfeld relay, which radiates the ORF-1 service.

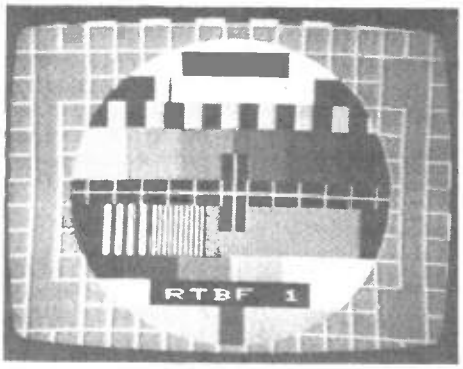
The opening on the 20th was a real whopper and an interesting one at that! DX via sporadic-E and enhanced tropospherics was present for most of the day. The main highlights, brought to our attention by Kevin Jackson and Mark Dent, included test transmissions from Rumania (noted on colour bars and the FuBK test card) and a mystery in the form of the 'JRT BGRD 1' PM5544 from Yugoslavia on channel E4 at 0825 BST. The test card which carries that particular identification is normally only seen via the Kapaonik transmitter on channel E3. We can only suggest that the pattern had been accidentally introduced into the Zagreb network by a switching error. Alternatively a low power relay may have been received, such as the one at Niksic-Ostrog (sounds more like an unappetising Yugoslavian dish!) to the south-east of Belgrade radiating 20W ERP.

Unidentified signals of Arabic origin were noted by Chris Howles of Lichfield on the 20th. Reception occurred on channel E3 and could well have been late-season DX transmissions from JTV in Jordan.

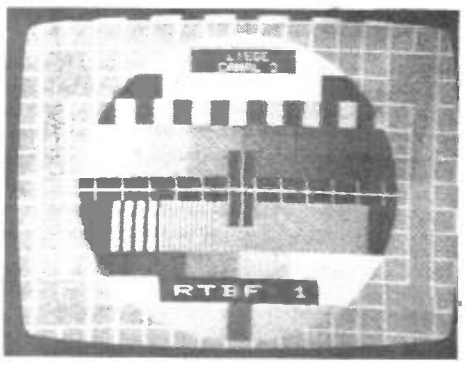
PHOTO FILE ● PHOTO FILE ● PHOTO



UEIT test card from the USSR outlet at Ozhgorod



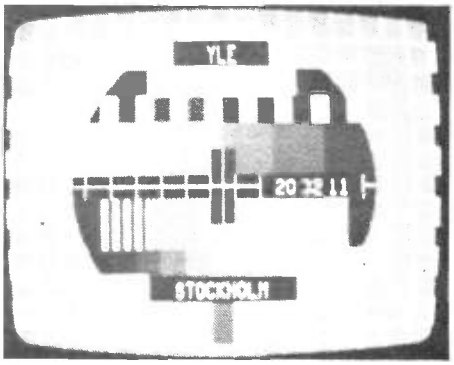
Belgian PM5544 from the French language service



Test card including transmitter identification and channel information

A 'Senderdia' radiated by ZDF in West Germany

Can anyone identify this mystery caption?



PM5534 used by the new Finnish transmitter located near Stockholm, Sweden.

Pics: Thomas Graf, Jukka Kotovirta, Sandor Rottenbacher and HS Publications

Trop activity

Tropospheric DX was extremely active until the 30th, although the good conditions persisted for several days more depending upon how far south one was located. John Bray of St Neots telephoned to query an FuBK noted on channel E7 sporting no less than 15 letters of identification across the centre. We can confirm that reception was from Bayerischer Rundfunk in West Germany radiating the test card with the transmitter name 'BROTJACKLRIEGEL'. This outlet is located close to the border with Czechoslovakia and Austria. Many of the trop signals noted by enthusiasts were, in fact, from this general area. Kevin and Mark noted Bayerischer Rundfunk (BR) transmissions at over 1164km (about 720 miles) from Wendelstein (channel E10), Grünten (E43), Bamberg (E56) and Hof (E57).

There were many reports of sustained colour signals in SECAM from East Germany on E5 (Inselsberg), E6 (Brocken) and E12 (Sonneberg). There were two reports of Czechoslovakian reception in Band III. Roger Pates of Nottingham telephoned to query an FuBK test card carrying 'DDK 2' identification on channel R9. This was CST just prior to the station opening sequence. Kevin Jackson also noted Czechoslovakia on channel R12 originating from the vertically polarised outlet at Usti Nad Labem. This was on September 30th. Needless to say, DX from Belgium, the Netherlands and France was also present. Canal Plus signals from France were so strong day after day that eventually they were regarded as a pain in the array!

Vertically polarised transmissions were noted by Simon Hamer thanks to the excellent tropospheric conditions. They originated from Denmark on channel E11. This was confirmed by the PM5534 test card carrying the identification 'DR DANMARK'. There are at least five vertically polarised relays in Denmark operating on this channel, all with 50W ERP.

Log for September

This month we are featuring parts of the very impressive log sent in by Kevin Jackson. The period between the 5th and 19th is covered by Mark Dent (also of Leeds) while Kevin was having a break from DXing, hiking through Yorkshire.

4/9/86: SVT (Sweden) E2 showing the 'TV1 SVERIGE' PM5534 test pattern at 1006, also noted on E4 at times and seen on E3 at 1015. Two E4 SVT transmissions were resolved at 1017 from Oestersund and Alvsbyn; TSS (Russia) R1 with the UEIT test pattern bearing the identification 'LENINGRAD' in the Cyrillic alphabet at 1018; NRK (Norway) E3 transmitting the 'NORGE HEMNES' PM5534 at 1028; RAI (Italy) IA on teletext pages at 1054; YLE (Finland) E3 (Tervola transmitter) radiating the 'YLE TV1' FuBK at 1059; NRK E2 'NORGE VARANGER' PM5534 at 1153. All via sporadic-E.

5/9/86: TSS R1 on the UEIT test card at 1032 via sporadic-E.

11/9/86: TVE1 E2 with teletext pages at 1214; RAI IA programmes at 1214; TVE1 E3 with 'VALENCIA REGION' programmes at 1332; TVE1 E3 with 'ASTURIAS REGION' programmes at 1333; TDF (France) Canal Plus L3 programmes at 1334; TVE1 E4 (2 stations) on programmes at 1343; RTP (Portugal) E3 with the 'RTP LISB1' FuBK at 1416; MTV (Hungary) R1 radiating a multiburst pattern (frequency gratings) at 1449; CST (Czechoslovakia) R2 on 'CST BRATISLAVA' PM5544 at 1454; CST R1 showing the EZO pattern with 'RS-KH' identification.

16/9/86: TVE1 E2 with teletext pages at 1230 but regional programmes on E3 and 4; TVE2 E2 using a vertical stripes test signal at 1255.

19/9/86: BRT1 (Belgium, Flemish speaking network) E10 and 43; RTBF1 (Belgium, French speaking network) E8 and 11; NOS1 (Netherlands) E6; TDF Canal Plus L5; RTL (Luxembourg) E7; SWF1 (Südwestfunk, West Germany) E9; ZDF (West German 2nd network) E30, 34, 35 (2 stations), 37 (2 stations); SWF3 E40, 48, 56. All via tropo DX.

20/9/86: RTU (Italy, Radio-Tele-Uno) IA on test pattern at 0903. Lots of Yugoslavian FM radio stations noted too; RAI IA (2 stations) with programmes at 0903; BR1 (Bayerischer Rundfunk) E2 with 'ARD-ZDF' caption at 0923; TDF Canal Plus L3 programmes at 1005; TVR (Rumania) R2

on colour bars at 1027 and later seen using the FuBK pattern; CST R2 'PRAHA' caption at 1039; MTV R1 programmes at 1040; TVE2 E2 programmes at 1050; MTV R2 programmes at 1058; RAI IB with 'TG1' news logo at 1104; JRT (Yugoslavia) E4 (Zagreb network) on programmes and later the FuBK test pattern showing 'JRT ZGRB1' identification; JRT E3 on 'JRT BGRD' PM5544 at 1135; TVE2 E2 with 'tve tve2' GTE test card at 1221; ORF (Austria) E2a, 3 and 4 showing 'ORF FS1' PM5544 at 1245; JRT E3 displaying the 'JRT RTV – LJNA' PM5544 (Ljubljana network) at 1346 – all SpE.

Reception reports

The recent trop opening certainly impressed Simon Bryant of Farnham in Surrey. He logged no fewer than 16 transmitters located in Belgium, the Netherlands and West Germany in the space of about four hours. Reception in colour was logged from Westdeutsches Fernsehen on channel E9 (from the Langenberg transmitter), BRT-1 from Belgium on E10 (Wavre) with the 'BRT TV1' PM5544 test card followed by the opening sequence, RTBF-1 (Belgium) on E8, NOS-2 (Netherlands) on E27 (Lopik) and E45 (Wieringermeer) and NOS-1 on channel E39 (also from Wieringermeer).

Simon's equipment consists of a Contec KRB 1542 VHF/UHF colour receiver fed from an Antiference XG 14 array fitted with a mast-head amplifier. He has managed to identify a number of signals, including the mystery 'RTC' captions seen between commercials during sporadic-E openings. They originate from RTP in Portugal.

David Oliver of Kings Heath (Birmingham) has been active during the summer with various sporadic-E successes. An opening on September 7th brought Czechoslovakia flooding in on channel R1 and programmes from Spain on channel E2 from the TVE-1 Navacerrada outlet situated near Madrid.

Frame jitter and frame roll are two problems currently being encountered by David. This is even more pronounced on weak DX signals. He has been considering the use of a video sync processor circuit which he hopes may help. Unfortunately David doesn't feel confident enough to undertake the construction of such a unit and wonders if anyone could assist him. The BATC design published in issue 129 of *CQ-TV* takes his fancy, so perhaps a willing ATVer might like to help out or offer advice. David can be contacted at the following address: 100 Mays Lane, Kings Heath, Birmingham B14 4AG.

Spanish TV signals in Band I have plagued Iain Menzies at his location in Aberdeen during the past season, much to his disgust and horror. Reception has even dared to continue well into September. Well, we all have our pet hates. To compensate, he did note a couple of rare stations in the form of a 35W Portuguese channel E4 relay on the 6th and the Italian channel IC outlet at Torino on the 20th. The latter was destined for closure more than a year ago but evidently it's still going strong! The MUF rose as high as 144MHz on that particular day. No doubt there were a few exceptional 2m contacts via a combination of enhanced tropospheric conditions and sporadic-E propagation.

Bob Brooks of South Wirral logged the Icelandic PM5544 test card twice on channel E3 during September. The identification was the usual 'RUV ISLAND'. The first sighting occurred on the 11th during a good opening which lasted from 1150 until 1600. Also noted were Portugal on the 'RTP LISB 1' FuBK test card from the E3 outlet at Lousa (the RTP opening sequence was logged at 1500 BST), NRK (Norway) with the 'NORGE GAMLEM' PM5534 and Switzerland (SRG-1) showing programmes from the E3 transmitter at Uetliberg. Spanish programmes from TVE were also received on E3 during the morning period. Other Band I channels revealed transmissions from Italy (RAI), Czechoslovakia (CST) and Austria (ORF).

Bob's second glimpse of Icelandic TV occurred on the 21st with a solo appearance at 1145. It is interesting to note that DX reception from RUV is usually regarded as a late evening phenomenon. Perhaps test transmission hours have been extended? Maybe the BBC should take note of less well financed TV services such as RUV!

Radio (Tele-Uno) activity

The 20th was an extremely active day, with DX from stations in Italy (RAI and Radio-Tele-Uno), Yugoslavia, Spain and West Germany. Bob has queried a news programme or presenter with the logo 'TTT' in the background. This was noted on channels R1 and R2 at 0823. We feel sure that this was from TVP in Poland.

Despite Bob's location many miles from the east coast, tropospheric DX provided some interesting catches, especially on the 30th. The pick of the bunch included the Danish Vestjylland channel E10 outlet, which was positively identified by the 'DR DANMARK' PM5534, and the Hessischer Rundfunk 1st network transmitter at Grosser Feldberg in West Germany. This was identified by the FuBK test card which carried the inscription 'HR1 FFTM'.

Finally, Sandor Rottenbacher has written from Göd-Felsö in Hungary with a mystery. He noted a caption on June 20th which included a large stylised 'AL' symbol in the centre with the letters 'CHF' to the right of centre. Unfortunately Sandor has not included any details about the channel or time of reception. If anyone can identify this station please write in and we will pass on all the information.

Service information

Tunisia: The RTT transmitter at Remada, which operates on channel E4, has an ERP of 40kW. The FuBK test card has been received by several enthusiasts in the UK.

Sweden: The new SVT-1 transmitter at Vislanda on channel E39 has an ERP of 1000kW. The YLE outlet in Stockholm, which relays programmes from Finland, also operates on E39 with 1000kW ERP.

France: The old transmitter at Buttes de Chaumont has been replaced by an outlet at the Fort of Romainville near Paris. The identification on the TDF PM5544 test card now reads 'CENACO' at the top (an abbreviation for 'Centre National de Communications') and 'ROMAINVILLE' at the bottom. The previous identification, 'CENEX-BCH', signified 'Centre Nodal d'Exploitation des Buttes de Chaumont'.

France's first TV network, TF-1, is to be privatised from January 1st, 1987. There are rumours that the new services of 'La Cinq' (TV 5) and 'TV 6' will be discontinued. Antenne 2, FR-3 and Canal Plus are to remain unchanged.

Netherlands: The following main transmitters are to be used for the planned NOS-3 service: Arnhem (channel E43); Goes (E35); Lopik (E30); Markelo (E51); Roermond (E34); Smilde (E44); Wieringermeer (E42).

The following relay stations are also to be used: Eys (E48); Hulsberg (E43); Losser (E34); Wolder (E59); Noorbeek (E52); Pietersberg (E23); Slenaken (E32); Wijk aan Zee (E21).

Norway: The first main high power UHF transmitter to be used by NRK is located at Gulen. It operates on channel E29 with 1000kW ERP. The transmitter is currently being used for measurement purposes by the Norwegian PTT and is not always operational. The identification 'NORGE' appears at the top of the PM5534 test card with 'GULEN' in the lower black rectangle.

Regional news bulletins are being radiated by NRK between October 31st and December 19th from ten local studios. Transmissions are on Fridays at 1715 local time, although not all regional centres will broadcast every week. A full regional service is expected to be introduced by Norsk Rikskringskasting following further trials.

Italy: A new Italian private TV station has been noted on channel IA. It is known as 'Radio-Tele-Italia'.

There is yet another private station on channel IA. Enthusiasts in the Netherlands have noted programmes on this channel carrying the identification 'TAI' in the corner of the picture. Photographs confirm that reception was not from the state-owned TV service, 'RAI'.

This month's service information was kindly supplied by Gösta van der Linden (Rotterdam) and the Benelux DX Club (Netherlands). REW

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ATV ON THE AIR

Andy Emmerson G8PTH puts you in the picture

Europe now has its own international ATV organisation, called EATWG. Its full title, European Amateur Television Working Group, means that apart from AMSAT this is probably the first time that a speciality mode has organised itself internationally. EATWG is an umbrella organisation which will promote and protect the interests of ATVers. It seeks to gain official recognition from national radio societies and also from the International Amateur Radio Union (IARU), and it may serve as a model for similar interest groups for other modes.

As I have said before, ATV finds itself threatened from several directions, not only by governments who wish to confiscate parts of the amateur spectrum for other uses (look at Belgium) but also by misguided amateurs who consider that a wideband mode is not in the interest of amateurs as a whole. They do not realise that wideband modes are the sole justification for a full 10MHz allocation at 70cm, for instance, even to the point that in Switzerland it is the national radio club, USKA, and not the official authorities, who have banned ATV on 70!

In many European countries there are, and have been for decades, significantly more ATVers than satellite enthusiasts, and it is therefore vital that when IARU decisions are made they must be based on full information and data.

Together at last

This kind of task is exactly what EATWG will undertake, together with the promotion of ATV operation and maintaining co-operation between the different users of the amateur UHF and microwave bands. Co-ordination of bandplans, technical standards and also contests will now be carried out on an international basis. We have a healthy financial base and a strong organisation incorporating all the active ATV groups of Europe. Meetings will now be held annually and a regular newsletter will be circulated in the meantime.

To Basel and back

The first meeting of EATWG was held over the weekend of 20/21st September in Basel, Switzerland among extremely pleasant surroundings. Our host was USAT, the Swiss ATV club, and the conference was held in purpose-built rooms at an exhibition centre surrounded by beautiful parkland. There was even a greeting and good wishes on the programme from the Gemeindepraesident, the leader of the local council.

Proceedings went out live over the local DB0RV television repeater as well as being recorded on tape. Organisation was first rate, and trips were also arranged to a TV facilities company, the repeater site, an electronics training centre and radio and electronics emporia. The hospitality of our Swiss hosts was also magnificent – we were wined and dined in superb fashion and each speaker was given a hand-painted plate as a memento of this auspicious occasion.

Personalities

A total of 35 amateurs attended the proceedings and representatives had come from Britain, France, Belgium, Holland, Italy, Austria, Germany and, of course, Switzerland. The British contingent numbered Trevor Brown G8CJS, Graham Shirville G3VZV and myself. For my sins I was elected chairman of the new working group and as a result my head has swollen even larger than before!

The BATC is the largest ATV group in Europe (probably the world), and we therefore offered to support the costs of EATWG by up to £1,000, a small sum to protect the interests of ATVers. Other organisation of EATWG is being undertaken by our German ATV partners in AGAF.

It was particularly pleasant to see Marc Chamley F3YX, who has done so much for ATV in Europe and who designed our 24cm FM TV system, at the meeting. Some people have seen the video of his complete mobile TV studio and 70/24cm relay station in an estate car . . . well, this is no longer. Marc now has a set-up twice the size in a red Peugeot diesel van, still complete with rotator mast on top! Output is 100W on 70 and 10W on 24, all from batteries (no generator is used).

Other technically gifted people came too: Hansruedi Schaer HB9TJ brought his point-to-point TV relay system which requires no licence – it uses LED lasers! With just 5mW output he can cover a 3km path: the only tricky bit is finding the narrow beam at the distant end. Another fellow had brought a QRO transmitter for beaming the conference proceedings up to the repeater on 70cm. Using a Thomson TH308 triode this beast easily produced 300 or 400 watts power – even the blower had another blower trained on it to keep it cool! With a normal gain antenna this chap had many kilowatts of output on 70cm . . .

State of the nations

Apart from the discussions relating to the organisation of EATWG (which predictably went on well past midnight), each of the national groups gave a presentation on the situation concerning ATV in their country. Many interesting points came out in these talks, and some details follow.

F3YX reminded everyone that the international TV calling frequency, 144.750MHz, is a repeater input in France and 144.17MHz SSB is used instead. He also made the point that this frequency gives no disturbance to a 70cm TV picture: its third harmonic is lost in the sound rejection trap. On 70cm he said that one can achieve an apparent gain of 6 to 8dB by narrowing the receiver bandwidth to 1.0 or 1.5MHz.

More than 50% of French stations can now receive PAL colour as well as SECAM, though not necessarily in negative modulation. PAL gives up to 6dB improvement on weak colour signals.

The French ATVers hold a convention called SITRA every two years at Poitiers, on the third weekend of September. Marc pointed out that the next will take place in 1987, and several people got out their diaries immediately. The normal French vision frequencies are 438.5MHz (AM) and 1255MHz (FM). A second 24cm channel might be used at 1245MHz: this would replace the 1227.5 used in the days when the French 24cm band extended only as far as 1260MHz.

Robert Zak OE1RZB explained that FM-ATV is not yet permitted in Austria despite the arguments of amateurs that they should exploit new technologies. There is one TV repeater in Austria, OE5XLL, located a thousand metres above sea level 10km north of Linz. It has already been worked from Munich under good conditions. Currently it operates under remote control on two metres, with an input on 434.25MHz and output on 1280MHz. Additional inputs planned include 23cm AM and FM, and 13cm FM.

No international bandplan

It was clear that no single bandplan for TV would suit all countries, either on 70cm or 23cm. The different systems for FM voice repeaters and the activities of

primary users rule this out, and Paul Veldkamp PA0SON pointed out that the official IARU scheme for 70cm is unworkable. In this, 439.25MHz is given as a vision carrier centre and the upper sidebands would clearly exceed the band. And if our plans don't make technical sense, how on earth can we expect national licensing authorities to listen to us?

Being positive

Moving to FM television, the meeting agreed that sync should occupy the lowest frequency (positive modulation). This is what is already observed by all ATVers (and by video recorders!). Holland and Germany follow the CCIR-405 pre/de-emphasis norms, but F3YX found that you need pre-emphasise only the colour subcarrier and then only by 6 to 8dB. For best signal to noise ratio French stations employ ±3.5MHz deviation and occupy a bandwidth of 10 to 12MHz. The Dutch by contrast use a bandwidth of 22 to 25MHz. Luckily our receive systems can tolerate these variations for international DX!

F3YX added that he devised his FM system in 1976 and there are now 150 stations using it in France. On 70cm there are about 1000 ATVers. Three repeaters are planned, at Marseilles, Toulouse and Paris. These will be 1255MHz FM in and 438.5MHz AM out (they may have 24cm outputs later).

Egbert Zimmerman DD9QP gave a graphic explanation of FM television and proved how you need less power for a noise-free picture than with AM. Originally they had settled on 1275MHz as the FM frequency, but this is now 1260MHz because of radar interference. He mentioned an unconfirmed proposal to put an FM TV transponder on the D2 flight of the space shuttle. The equipment, to be built by Bremen University, would have its uplink on 1267 ±2MHz and a 10W downlink on 2425 ±25MHz. Many questions are still open, but using computer-controlled antennas contacts would be perfectly feasible.

HB9TJ said his laser TV system is perfectly safe and can carry one TV signal with stereo audio or several audio signals multiplexed together. The only problems are rain, air turbulence and birds flying across the beam. Wavelength is 800-900nm, using an infra-red semiconductor laser, and he gave out a block diagram of the system (send me an sae for a copy).

In Holland PA0SON said their first TV repeater, PI6ATR, is now operational. Input is 1252MHz FM and output 1285MHz (AM). It is located at Aalten but will move to Raalte. Another FM in and out machine is being built at Eindhoven, and more will follow if these are successful. They suffer only one 23cm radar, on 1297.5MHz about 20km south of Utrecht.

Their 13cm band is shared with other users, including private point-to-point TV links – interesting! ATV has in fact come a long way since the first experiments in 1953, when they radiated on two metres (there's an idea!). Activity soon shifted to 70cm, where the bulk remains. The normal ATV frequency is 434.25MHz, though 439.25 is used in the west of the country due to QRM from English voice repeaters.

Dutch amateurs have successfully asked the government to move Syledis out of the amateur band above 440MHz, but they still suffer some interference from Syledis systems of Belgium and Britain. In general they have very good relations with the authorities.

Trade scene

On the Continent most amateurs build their own ATV equipment. Indeed, PA0SON said only three of the 500 or so ATVers in Holland used commercial equipment and they were laughed off the air when they came on!

For 24cm some interesting Japanese made equipment was on sale: unfortunately it is for AM, not FM. There was a 1W transmitter by Raly Tusinki, and receive converters by this firm and the more well-known Adonis. From Prokom in Denmark came a superb looking vestigial sideband filter for 70cm. It has an insertion loss of under 2dB at 434MHz and greater than 60dB of attenuation at 430MHz. Fitted with either BNC or N-type connectors, it costs around £100.

Contest calendar

The Winter Cumulatives are for all modes (TV, that is) and all bands, from 1900 to 2359 local time each session. The dates are Thursday 8th January, Friday 16th, Saturday 24th and Sunday 1st February. More dates next month. There is not enough room for pictures this time but I hope to have some photographs of Switzerland ready for the next issue. Until then have lots of fun, watch out for openings and send in some letters and photos for the column! REW

NETWORK 934

Andy Emmerson G9BUP

The Tonna antenna company is as well-known in France as, say, Jaybeam is here. They make a wide range of TV aerials as well as a broad selection of antennas for radio amateurs. Less well-known is the fact that they also make beams for 934MHz, for the Swiss market. I understand that these are now to be imported to Britain, so a user report might not be out of order.

The Tonna products are deservedly popular in amateur circles, combining gain with lightweight construction. The latter means that the antennas are not quite as robust as some English products, but many users are prepared to accept this compromise.

For 934MHz, Tonna make two yagi beams, a short one (96cm long, for rear mounting) and a long one (2.10m, with normal trombone clamp mounting). The smaller job has 13 elements and a gain of 14.7dBi, while the longer one offers 18.3dBi gain with 23 elements. These figures are for isotropic gain, so you should subtract 2.15dB to get the gain over a normal dipole. Neither of these is licensable for transmitting at present, though there are persistent rumours that the DTI will relax the antenna regulations shortly. Let's hope so!

Tonna antennas come unassembled, so you will spend an interesting hour making up the parts in the box. First job is to press the elements into the plastic insulators: these are a tight fit and it is best to do this over a hard surface. The elements are made of something like copper welding rod and are relatively soft, so try not to bend them!

The rods are colour coded (on their ends) and this code will enable you to snap them into the holes in the aluminium boom in the correct order. Unfortunately no instruction sheet was enclosed with my samples, but I have made up Tonna aerials for 1250MHz and the coding was identical.

The active element is pressed into place and requires an N-type plug to be attached. Tonna supply one but unfortunately it is of the MIL-spec, non-captive type. These do not always grip the braiding of the cable properly, and my advice is to give (or throw) it away. Use a Greenpar, Coline or Radiospares plug with the 'top hat' ferrule which you know will stay in constant touch with the braiding. You don't want to fix another plug in a year's time, do you?

Both antennas make up into neat and efficient aerials, and if they become available at a reasonable price I would consider them two of the best buys on the market, far better than the TV aerial types. Watch this space for more information.

Testing, testing

Our friend Mitch MDC01 of Milton Keynes is the latest 934 enthusiast to acquire a test and development call. Now the proud possessor of G9CBE (citizen's

band experimentation?), he intends to carry out further investigation into the design of the antennas he sells under the Marksman name.

A test and development licence is a useful thing, allowing you to carry out all kinds of research which for one reason or another might not be allowed with a normal CB licence. Up to now the price of a 'T&D' as it's called has been little more than the normal ticket, but the price is about to go up to much closer to the £50 mark. This may deter some experimenters, though for a commercial organisation the price is a small one for the opportunities it gives.

A number of 934ers hold T&D calls and you may hear them on the air from time to time. A test and development licence is not used for normal communications, so you should not interrupt stations obviously engaged in commercial work. Apart from G9CBE, other holders of G9 calls on 934MHz include Clive G9BWZ in Gloucestershire, Fred Judd G9BTN in Norfolk, Jim Finch G9BSP in Southampton, the Citizen's Band Association (G9BRY), G9BWB in Kent – and myself. Many other G9 calls have been issued, but they are for other frequencies and many were for experiments now completed.

Commercial break

LMW Electronics of Ratby, near Leicester, has a new range of 934MHz preamplifiers which are selling like hot cakes. Unlike hot cakes, you will not get your fingers burnt if you try one of these jobs: Chris Smith (LMW 01) is a microwave engineer by profession and produces good kit. The new products are based on the NE41137 dual-gate GaAs-FET, which gives a gain of typically 16dB with a noise figure typically better than 2.5dB.

As I have said before, too much gain is worse than insufficient, and a variable gain control is highly desirable. The LMW products offer a number of options so you can choose the features you need in your preamp. The 934PP1 module is a simple 'gain block' intended for installation inside the rig. There is no on-board switching and it is intended for the qualified enthusiast. It comes as a 1 × 2 inch PCB, ready-built and aligned, and the price is £22.45. You can also have an outboard version, which goes behind the rig. This contains switching to bypass the preamp on transmit, and if you wish you can also have variable gain and a switch to select one of two antennas.

There is also a mast-head version in a waterproof housing, which will give greater sensitivity as it overcomes the signal loss in the feeder cable between rig and twig. N-type connectors are used for minimum loss.

For people suffering interference from cellular radio this new preamp will come as a blessing. For a start the preamp is far less prone to overload than a previous product from East Anglia, while the variable gain facility will enable you to find a setting which gives the best compromise between most sensitivity and least interference. This option is not available on the mast-head unit, however.

RF switching is employed, so the preamp is entirely automatic in operation and you can transmit through it with no risk of damage. If you forget to connect the 12 volts, no problem – the preamp will 'fail safe'. You may choose to switch out the preamp anyway and the unit will then operate in 'straight-through' mode, with a through-loss of around 1dB. If you have both a collinear and a beam, then you will want the antenna switch option.

Prices, including VAT, are £82.75 for the set-side unit and £92.75 for the mast-head version. Add £7 for the antenna switch option and £3.00 for the variable gain facility (not on mast-heads). Postage is £1.00. LMW Electronics live at 102 Stamford Street, Ratby, Leicester LE6 0JU and can be reached on (0533) 386364.

By the way, if you wonder why I plug some firms' products and not those from some others, the explanation is simple. I like to report on all new goodies for the 934MHz operator but I can only talk about the things I know of. These firms are enlightened enough to send me product information and samples, and if you would like to see your gear featured as well please get in touch! A letter care of the editor will do the trick.

SWL corner

I don't normally mention short wave equipment in this column, but I have just tried out an interesting new antenna which I thought I would mention. Many 934 people are also keen short wave listeners, and if you are . . . read on!

One of the hassles of the HF bands is the size of the aerials necessary to get a good signal, and many SWLs who want something a bit better than a (so-called) long-wire try a (so-called) compact antenna such as the G5RV design or a Joystick. Well, here's something different, a folded dipole about 6 feet long.

I must admit I am no connoisseur of HF antennas, so all I can say is that it looks well made, with a sealed loading coil, and comes from a firm with some experience in antenna manufacture. Rated from 2 to 30MHz, it can be used indoors or outside, with or without an ATU (antenna tuning unit). Obviously it will work much better with an ATU.

When I tried one it did a good job across the full 2-30MHz range, and the manufacturer has letters from users saying it outperforms inverted Vs, long-wires, G5RVs and Joysticks. Obviously the results you get will depend on circumstances, but if you are looking for something compact this might just be the job.

The name of the antenna is the Royal Blue and you can get it for £25 from Photo Acoustics in Newport Pagnell or from their stand at rallies. Alternatively you can send £25 plus an additional £3 for post and packing to the manufacturer, Marksman Products, PO Box 40, Milton Keynes, Bucks MK6 2UT. The telephone number is (0908) 668916.

Sign-off

That's it again for another month. Keep alert for tropo lifts in case we have a fine spell, don't let the short days and dark evenings get you down, and get those letters and photos rolling in – I'd like to hear from you! REW

MEDIUM WAVE DXING

by Steve Whitt

Welcome to the final issue of the year and to a MW DXing column that this month will be concentrating on the latest news from Europe affecting the MW DX scene. For some reason this month sees quite a lot activity in this area, and in particular some of the better heard European stations are undergoing significant change.

Belgium: BRT, which is the Flemish language service in Belgium, has adjusted the times of its English programmes in order to incorporate new German programming. *Brussels Calling* can now be heard daily on 1512kHz at 1830-1855 and 2200-2225, with the DX programme *Radio World* now being aired on Saturdays.

Finland: During the winter period and until 28/03/87 R Finland is broadcasting in English at 0730-0755 daily, 0830-0930 Saturdays, 1930-2000 not Saturdays, 1955-2000 Saturdays, 2030-2055 daily, 2200-2225 not Saturdays, and 2200-2300 Saturdays using 254, 558 and 963kHz. As reported in previous issues of *R&EW*, work still continues on the new 600kW transmitter for 963kHz that is due on early in 1987.

Germany (FRG): After just one year on the air VOA Europe is expected to close down at the end of the year due to budget cutbacks. It started programmes aimed specifically at Europe in October 1985. Normal English language programming is likely to continue, however, from the Munich transmitter on 1197kHz.

R Free Europe now has telephone talk shows for listeners in Hungary, Bulgaria and Czechoslovakia since these countries have recently acquired direct dial access to international phone lines.

United Kingdom: A few months back I reported that Red Dragon R in Swansea was airing a special DX programme; well, now it seems that Radio 210 in Reading is also active in this area. It has a DX programme on Tuesdays at 2130hrs local time on 1431kHz/97MHz. I've not been able to hear this so I'd appreciate information or comments from any readers in the Reading area.

Viking R is planning to join up with R Hallam and Pennine R in an agreed merger, but local programming will continue. The three stations will probably share their news gathering facilities and marketing departments in an attempt to reduce overheads. In a related vein, the IBA has announced that it will be reducing the transmitter rental fees that ILR stations have to pay by around 30%, thus helping some of the less profitable (and indeed loss making) local stations in the UK. The two perennial problems that face ILR stations are firstly the fact that they cannot operate their own transmitter facilities (they must rent from the IBA), and secondly the difficulty in attracting sufficient high paying advertisers, who still find television to be the more effective medium.

International waters: R Monique, the Dutch station operating on 963kHz via the R Caroline transmitters, has a new address: PO Box 600, Gerona, Province of Gerona, Spain. Whilst on the subject of Caroline, it is reported that metal fatique has been discovered affecting the 300 foot mast aboard their ship, the *Ross Revenge*, caused no doubt by the ravages of the North Sea. Meanwhile, reception reports for the other maritime station, the Voice of Peace, should be personally addressed to a specific individual at the station otherwise they are thrown away!!

World Radio TV Handbook

Undoubtedly the most essential reference book for any DX shack (for either the MW or the SW listener) is the *World Radio TV Handbook* published by Billboard. The 1986 edition is still in the shops but the new 1987 version is just being compiled and I am informed that there is intended to be no price rise in 1987. This means that when this book hits the bookstands around March or April it should cost £17.95. This is quite expensive, but a number of radio clubs usually band together to obtain a specially negotiated pre-publication price for their members, and it would probably be worth joining such a club for this reason alone.

Try contacting the Secretary of the British DX Club at 54 Birkhall Road, Catford, London SE6 1TE (mainly a SW club but also covers MW and VHF) or the Medium Wave Circle (Club Secretary) at 69 Alderley Way, Cramlington, Northumberland NE23 9UQ (specialises in MW DX only).

Special event stations

One aspect of local or community radio in the UK that has gone largely unreported is special event radio. This is part of a two-year experiment by the Home Office to provide an extremely local radio service for festivals, conventions, county shows, sporting events and the like, and it is intended that during 1986 and 1987 around 25 licences per year will be issued in circumstances where radio would form the best means of communication at a particular site.

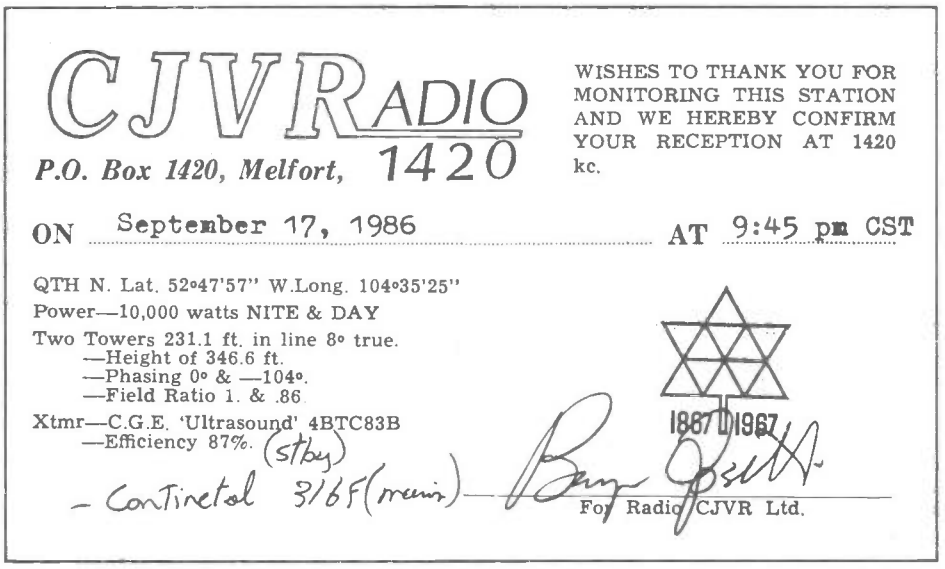
Special event radio stations are presently allocated MW frequencies and are only permitted to use an absolute maximum power of 50 milliwatts (yes, 50mW) effective monopole radiated power. This very low power coupled with the fact that stations will not be on the air for more than a fortnight at a time (in fact stations have operated for periods ranging from a few hours up to two weeks) makes them rather difficult DX targets.

There are currently no stations operating, but the Home Office will soon be deciding on permits for 1987 of which I hope to bring you details in the near future. In the meantime, below is a list of all the stations that operated this year.

DX File

Some of the finest MW DX in a long time occurred from the 10th – 13th and around the 24th – 26th October, during which period the DX path was open to the

Spring Harvest	Butlins, Minehead, Somerset
Capital Venture Day	Battersea Park, London
Motor racing	Silverstone, Northants
Greenbelt Festival	Castle Ashby, Northants
Race meetings	Santa Pod Raceway, Bedfordshire
Motor racing	Brands Hatch, Kent
Air Fete 1986	RAF Mildenhall, Suffolk
International Air Show	Army Air Corps Centre, Hampshire
TVS Airshow South	Hurn Airport, Hampshire
Cowes Week	Cowes, Isle of Wight
East of England Show	East of England Showground, Peterborough
Faith 86	East of England Showground, Peterborough
R Thamesmead Festival	Southmere Park, Thamesmead, London


CJVR RADIO 1420
P.O. Box 1420, Melfort,

WISHES TO THANK YOU FOR MONITORING THIS STATION AND WE HEREBY CONFIRM YOUR RECEPTION AT 1420 kc.

ON September 17, 1986 AT 9:45 pm CST

QTH N. Lat. 52°47'57" W.Long. 104°35'25"
Power—10,000 watts NITE & DAY
Two Towers 231.1 ft. in line 8° true.
—Height of 346.6 ft.
—Phasing 0° & —104°.
—Field Ratio 1. & .86
Xtmr—C.G.E. 'Ultrasound' 4BTC83B
—Efficiency 87%. (stby)
- Continetal 316F(rewin)

1867 1967

For Radio CJVR Ltd.

The first QSL card to be received from the Anglesey DX-pedition reported in this column last month

west coast and prairie states of the USA and Canada.

As luck would have it I completely missed the first event, but looking at what other MW DXers heard as well as my own log there were certainly some gems around. For example:

590 VOCM, St John's NF was heard as early as 1930hrs
780 WBBM, Chicago IL
870 WWL, New Orleans LA
930 CJYQ, St John's NF heard on a standard car radio and whip aerial
1010 WINS, New York NY as late as 0730hrs
1090 KAAY, Little Rock AR; first time for this station and state in many years
1090 KING, Seattle WA; also first time in many years
1200 WOAT, San Antonio TX
1510 WMRE, Boston MA as late as 0830hrs

In addition, KBC in Seoul, South Korea was heard on 1566kHz around 2000hrs and even as I write this column I managed to hear R Caribbean in St Lucia on 840kHz with a mixture of Caribbean soca music and European pop hits.

Finally, to round off this section I'll return briefly to the Anglesey DXpedition reported last month. In the aftermath of the trip quite a few tape recordings were analysed and reception reports sent off to a variety of stations. Indeed, on closer inspection of some tapes a couple of unnoticed station identifications were unearthed; for example, the first UK reception of CHIN, Toronto on 1540kHz was found this way. The very first QSL card to be received was from CJVR in Melfort, Saskatchewan.

That's it for 1986, so I'll look forward to your letters, comments and queries and any MW news items you care to send in during the forthcoming year. REW

NEXT ISSUE

Radio & Electronics World

The communications and electronics magazine

THE MF10 FILTER CHIP

James Dick takes a look at a versatile filter IC

LOGIC CIRCUITS

The start of a series from D Stewart about the mysteries of AND, OR, NOT, NAND etc

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Signature .....

On these pages we present details of interesting contacts from clubs and individuals. We would be happy to receive any similar items from readers

Synthesis in Southgate

If you've recovered from the New Year revelries by 8th January (*You're joking! I'm always hung-over 'til at least February – Ed*), you might like to stroll along to the Southgate ARC's meeting on that day, where Brian Oughton G4AEZ will be unravelling the mysteries of phase-locked loops and frequency synthesis. The place to be is Holy Trinity Church Hall (Upper), Green Lanes, Winchmore Hill, London N21 at 7.30pm.

The good old days

The latest issue of the British Vintage Wireless Society's bulletin includes a lengthy and illuminating dissection of the 'Television in the Home' exhibition mentioned in last month's *QSO*. It seems that there were a fair few mistakes in the show catalogue, and the bulletin's editor Robert Hawes makes some interesting points about the perpetuation of myths through the medium of the printed word.

The BVWS bulletin is one of the best-produced around, having undergone a major revision recently. It always contains a wealth of authoritative material on old radio equipment, and is well worth reading if you've even a casual interest in this field. For further details contact Gerald Wells, BVWS Membership Secretary, Vintage Wireless Museum, 23 Rosendale Road, West Dulwich, London SE21. Please bear in mind that if you want to visit the museum you should make arrangements with Gerald beforehand (telephone: (01) 670 3667).

2m contest

The Derby and District ARS has organised what is hoped will become an annual VHF contest. This 144-145MHz event will take place on 15th March 1987 between 1300 and 1700 GMT, on all modes permitted by an operator's licence (the band plan must be observed).

Contestants will exchange callsigns, RS(T) reports, serial number (starting at 001) and administrative county. Contacts with the club station, G3ERD, will count as 10 points, with all others 2 points. The final score will be the total number of contact points multiplied by the number of counties. Contacts on recognised calling frequencies and via repeaters are not allowed.

The awards will be in three sections: full legal limit; low power (25W maximum output); and SWL. Certificates will be awarded to the winner and runner-up in each section.

For a copy of the rules send an sae to DADARS at 119 Green Lane, Derby DE1 1RZ.

Down Wimbledon way

On the calendar for the Wimbledon and District ARS are a couple of meetings which should prove popular. On 30th January the Metropolitan Police are giving some instruction in crime prevention, so that you can retain possession of that shiny new black box you got for Christmas.

A month later, Pat Hawker G3VA, author of the excellent *Technical Topics* column in *RadCom*, will be giving a talk about IBA TV broadcasting on 27th February.

WDARS meetings are held on the second and last Fridays of each month at 7.30pm in St Andrews Church Hall, Herbert Road, Wimbledon, London SW19.

Enquiries should be directed to George Cripps, 115 Bushey Road, Raynes Park, London SW20 8DG.

Crawley TV

News from the Crawley ARC: the licence for the video repeater, GB3CT, has come through and it went live on 2nd November. If you want more details there is a club net every Friday at 2030hrs on S22, 145.550MHz, or contact

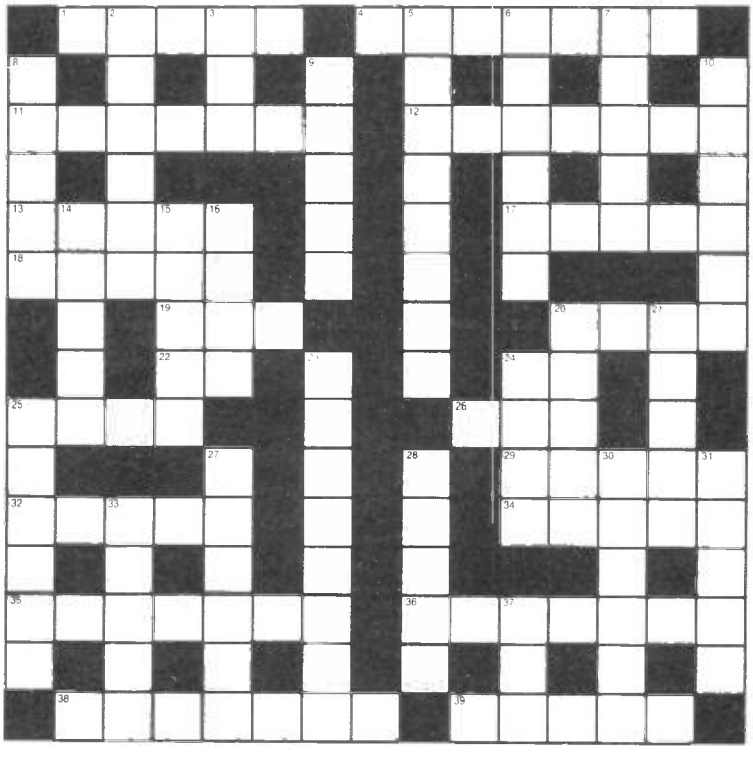
Test your radio knowledge with this crossword by Jack Burrows. Turn the page for the answers.

ACROSS

1. Amateur's messages can be expressed in (5)
4. Channel watcher (7)
11. Figure of eight (7)
12. Components in group (7)
13. Audio frequency gives (5)
17. Record data (5)
18. Acid and alcohol form this compound (5)
19. Smoothes and is insoluble in water (3)
20. Simultaneous signal (abbrev) (4)
22. Direction of electron flow (2)
24. Electric current (2)
25. Energy can be expressed in (4)
26. A TV ruling body (3)
29. No QRM (5)
32. Raise aerial (5)
34. Disc opening program (5)
35. Use SINPO code for this (7)
36. Turned outward (7)
38. Make unidirectional (7)
39. Wavelength uses poet's measure? (5)

DOWN

2. Radiated signal (6)
3. Heart waveforms measure (3)
5. Measured in farads (8)
6. ..... cadmium (6)
7. Absolutely accurate (5)
8. Result of interference (5)
9. A diode has this electrode (5)
10. Containing iron (6)
14. Amateur radio in space (5)
15. Lamps containing gas (5)
16. Evidence of a leak (4)
20. Shows meter reading (5)
21. Miniature valve base (5)
23. Attenuation of sound frequency (6,2)
24. Non-artists do this to circuit boards (4)
25. Work capability (6)
27. Licence conditions are (6)
28. Time between lead and lag (5)
30. Reflects radio waves (1,5)
31. Mobileers use them (5)
33. Wipe out (5)
37. Put in place (3)



QSO

Dave G4IQM on Crawley 882641.

Calling all CARS?

The initial meeting of the Clacton Amateur Radio Society (CARS) will be held at 7.30pm (for 8.00pm) on Wednesday 14th January 1987 at The Eldorado Club, The Broadway, Jaywick, Essex.

For further information contact Reg Taylor, 14 Meadow Way, Jaywick CO15 2SQ.

Good ideas dept

Brian G3CVI of Chelmsford Amateur Radio Society has instigated a practice well worth emulating. He has offered to run a library service for club members, with the nominal sum charged for the loan of a book contributing towards the purchase of new books. Give this man a pat on the back.

Barry rally

The 7th Welsh Amateur Radio Rally organised by the Barry College of Further Education Radio Society will be held on 1st March at the Barry Leisure Centre (telephone (0446) 744770).

As well as the many trade exhibitors there will be the usual bring and buy stand, at which a nominal display charge is made (no commission), the RSGB book stall, and morse testing facilities. The Leisure Centre's swimming pool, licensed bar (extended hours) and cafeteria will all be available.

The rally will open at 11am (10.30 for the disabled), with talk-in on S22. For more info contact Mike Adcock GW8CMU on (0446) 711426.

Packet demo

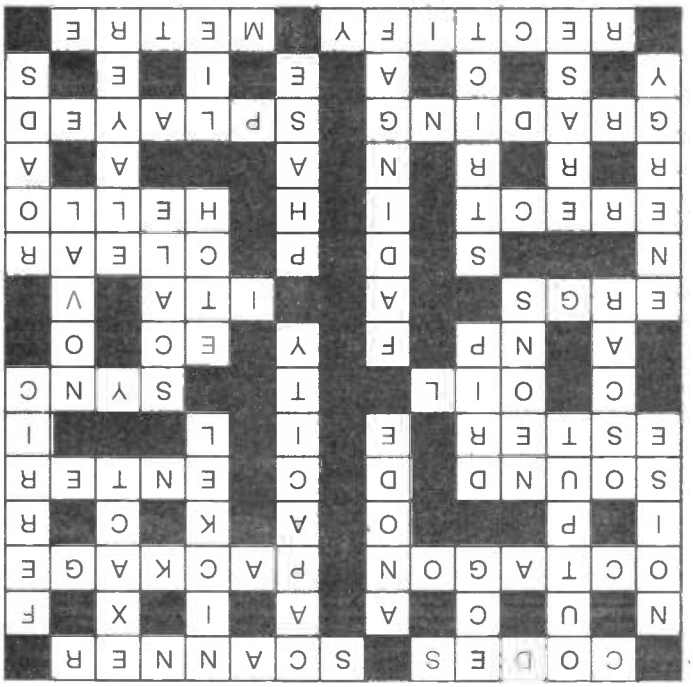
Exponents of packet radio in the Harpenden area might like to wet their whistles in the Silver Cup Public House, St Albans Road, Harpenden on Tuesday 3rd February, where Stan G4OAV will be talking about AX25 on the BBC B. This pub is the venue for meetings of the Harpenden ARC twice a month, and on Tuesday 17th February they will be holding a practical AX25 meeting.

The club also runs 'on-air' morse classes every Sunday courtesy of Keith G0CXP and Ian G0CPN. Further details from EP Simons G1BJC, Batford Farm, Common Lane, Harpenden, Herts AL5 5DN.

More packet

Martin Stubbs G8IMB will be talking to the City of Bristol RSGB Group about packet radio on 23rd February at the Small Lecture Theatre, University of Bristol, University Walk, Clifton, Bristol. Meetings start at 7.30pm and are usually held on the last Monday of each month. Further info from Colin Holister G4SQQ, 34 Battersby Way, Henbury, Bristol BS10 7SU. Telephone (0272) 508451.

Answers. How many did you get right?



LETTERS

Letter from America

Dear Sir

On a recent holiday in England, and through an advert in *Radio & Electronics World* (Anchor Surplus), I bought an MK328 receiver. This is an excellent set, and has provided hours of enjoyment.

I was not able to find the TR165 battery in England (Tandy) or in the States (Radio Shack). My receiver is now working on a battery pack made up of two Mallory RM640R cells and two Mallory PX32 batteries, which fit nicely in the battery compartment. The RM640s *must* be insulated: I used heat-shrinkable tubing.

I wonder if readers of *R&EW* can tell me, by a short note, who manufactured the set, whether schematics are available, some of the MK328's history, and where one can get L & MO plugs from.

Thank you

Eugene P Reed WB7NGI
6120 Shenandoah Avenue
Las Vegas
Nevada 89115 USA

Ring any bells?

Dear Sir

I am engaged on a programme of research into a very low frequency, transmitting radio station established in Germany during late autumn 1941.

The station, called Goliath, was near the village of Kalbe (Saxony, Prussia) and partially straddled the river Milde.

I seek any information, no matter how small or seemingly trivial. Any drawings, photographs, technical details or personal memories by German or Allied personnel would be especially welcome. Any documents loaned to me would be treated with care and postage refunded.

Yours faithfully

T F Bernascone

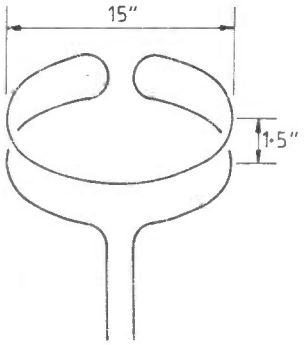
(Goliath Research Project)
Teesside Polytechnic
Borough Road
Middlesbrough
Cleveland TS1 3BA

There's always one . . .

Dear Sir

Having borrowed one of your magazines from a colleague from the local university I note the plethora of very expensive commodities and services.

Thus this design was 'stolen' from the local Tandy store which your readers might like to construct.



The measurements were by eye and there was absolutely no attempt at construction exactness and the materials used were old 15 amp cable.

I received adequate reception with one in stereo (FM – hardly AM and not PM (?)), thus I made a second and voltage added the whole lot indoors.

The reason for these extremes is that I be one of Maggies's Army or Maggie's Millions thus cannot afford the cost of £12 for an aerial.

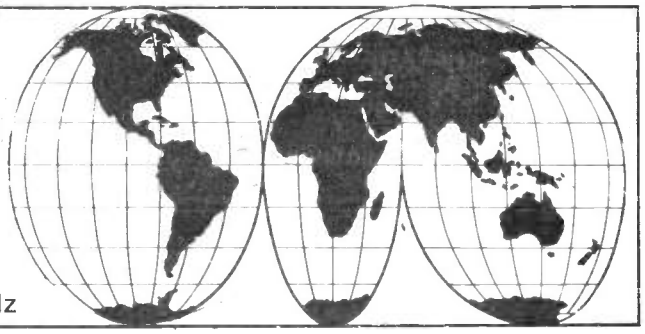
The other reason – I design in electronics and have sent all the concepts abroad: money cannot be made in England.

Hence the name

Davy Jones Locker

Is this man serious? Has he suffered brain-death? Is this the general level of our readership these days? (It's certainly about the level of our editorial staff . . .)

SHORT WAVE NEWS FOR DX LISTENERS



By Frank A Baldwin

All times in UTC, **bold** figures indicate the frequency in kHz

Continuing our review of some of the Indonesian stations currently operating on the 60 metre band (**4750 – 5060**), the attention of interested readers is drawn to **4875**, at which frequency RRI (Radio Republik Indonesia) Sorong in Irian Jaya (West Irian) at 5kW is on the air from 0800 to 1515. This includes an English programme on Saturdays timed from 1200 to 1230. The frequency can, however, vary to **4870.5**. With good conditions for the reception of signals from Indonesia prevailing, together with a little luck, some of us may manage to log part of the afternoon transmission during this winter, the most favourable time of the year for South-East Asian and Far Eastern transmissions to reach these shores.

The recently reactivated RRI Bukittinggi, located in the Padang Highlands of Sumatera (Sumatra) and listed on **4910** with a power of 10kW (formerly 1kW) has, until now, rarely been reported in the European SWL press. It is on the air from 1700 to 2315 and from 0330 to 0600.

Often reported

RRI Jambi in Propinsi Jambi (Province Jambi), Sumatra is to be heard on **4927**, where it operates with a power of 7.5kW from 2200 to 0100 (Sunday until 0445) and from 1000 to 1500. The final closing time, however, can vary from that shown up to 1700, and it is these occasions that provide the most favourable opportunity for hearing the signals from Jambi, often being reported world-wide.

Another Indonesian transmitter often appearing in DXers' reports is RRI Surakarta, Jawa (Java) on **4931.6**. With a power of 10kW it is scheduled from 2230 to 0200, from 0500 to 0800 and from 1000 to 1705 but is often on the air around the clock.

Rarely heard here in the UK or in Western Europe is RRI Bandung, Java on **4945.8**. It transmits from 1730 to 2200 and from 0500 to 0800. At 1.5kW its signals seldom filter through those emanating from co-channel occupants such as the 250kW RSA Johannesburg with the Lozi programme from 1500 to 1956 wrecking the late afternoon opportunity, and the many Latin American stations including the 20kW Colombian Caracol putting paid to the late evening chance of success. Nevertheless, the channel is visited from time to time in the hope – it springs eternal – that a logging will eventually result.

Quite often recorded in many a DXer's logbook are the occasions on which the transmissions of RRI Banda Aceh, Sumatra have been heard. This 10kW transmitter is on the air from 2200 to 0200 (Sunday through to 0500), from 0500 to 0800 and from 1000 to 1525 but sometimes signing off at 1700 or 1805 on **4954.7**. This channel is an alternative to that of **3904.8**, this latter frequency being less reported than **4954.7**.

Tuning up to **5046** around 1530 may result in a logging of RRI Yogyakarta in Java. With a power of 20kW it is regularly logged here in the UK. The schedule is from 0800 to 2200 and from 0200 to 0500 with an English newscast timed from 1130 to 1145.

Out of band transmitters

Having commenced this 60 metre band Indonesian update in the previous issue with an out of band transmitter (RRI Ujung Pandang on **4719.2**), we end by calling attention to two Indonesian stations outside the high end of the band. The oft-reported RRI Sibolga on a variable **5256** is on the air from 1000 to 2200. Despite its low power rating of 1kW it is regularly heard world-wide, and was logged by the writer and other European DXers during the 1985 season.

Finally, to exit with a test of DX ability and a gift of good fortune, try **5500.5** from around 2200 to 2300 in an effort to hear the signals from RRI Biak in West Irian. At 1kW it is scheduled from 2100 to 2300 and from 0900 to 1600.

Next month

An update of the Indonesian transmitters operating on and around the 90 metre (**3200** to **3400**) band, last reviewed in our February 1984 issue, and some details of the nusantaras (networks).

AROUND THE DIAL

The drums of Africa and the local style music of other areas of the world are but a few of the multifarious sounds to be heard if you tune to some of the frequencies at the times indicated below.

AFRICA

Botswana

Radio Botswana, Gaborone on **4820** at 0357, the sounds of cow bells, cows lowing and the herdsmen's cries, these all being part of the tuning signal which can be heard prior to the choral rendition of the National Anthem. The subsequent station identification and frequency announcements in SeTswana were made at 0400. The schedule of this 50kW transmitter is from 0400 to 1100 and from 1500 to 2100 with newscasts in English timed at 0510 and 1110 Monday to Friday inclusive (Saturday and Sunday at 1125), and at 1610 and 1910 Monday to Friday inclusive.

Egypt

Cairo on **9475** at 1803, quotations from the Holy Quran in the Arabic service for Europe, scheduled from 1800 to 2350. The city of Cairo, in Arabic *El Kohera* (the victorious), is the capital of the Arab Republic of Egypt and the largest city in Africa. At the head of the Nile delta it is the commercial, manufacturing and transportation centre of Egypt. It was founded by the Fatimite General Jauhar in the year 969.

Kenya

The Voice of Kenya, Nairobi on **4885** at 1824, OM with a talk in vernacular during a transmission of the North-Eastern and Coastal Service which is in vernaculars and Somali during the period 0200 to 0600 and in vernaculars, Somali, English and Swahili from 1430 to 1800. The power is 100kW.

Liberia

ELWA, Monrovia on **3230** at 2019, OM with a talk in vernacular. The Home Service on this channel is scheduled from 1810 to 2220 daily and additionally on Sunday from 0615 to 0800, the power being 10kW.

VOA (Voice of America), Monrovia on **15445** at 1950, YL with the VOA identification, this being a VOA relay, during the English transmission to central Africa, scheduled from 1600 to 2300.

Madagascar

Radio Nederlands Relay, Talata Volon on **15575** at 1450, OM with an interesting talk all about musical boxes in the English Service directed to the Far East and timed from 1430 to 1525.

South Africa

RSA (Radio South Africa), Johannesburg on **4945** at 1816, YL and OM with a drama in the Lozi programme which is radiated on this frequency from 1500 to 1956 with a power of 250kW.

RSA, Johannesburg on **4990** at 0407, OM with a newscast about local affairs in an English programme aired daily from 0300 to 0426, with a power of 250kW.

Swaziland

TWR (Trans-World Radio), Mpangela on **3200** at 1815, OM with a religious song in vernacular, some piano

music, choir with a hymn then OM with a sermon. This 25kW transmitter is on the air from 0400 to 0530 in German and English, from 1600 to 1645 in English, from 1700 to 1745 in Zulu, from 1745 to 1845 in Xhosa, Shona and Ndebele and from 1900 to 2015 in English.

NORTH AMERICA

USA

VOA, Greenville on **15410** at 1908, OM with the news and a commentary in the English presentation to West Africa, scheduled from 1600 to 2200.

AFRTS (Armed Forces Radio and Television Service), Greenville on **15430** at 1905 featuring a broadcast by the President about the drugs situation in the USA. This was a transmission in the English programme for the North Atlantic area timed from 1100 to 2200.

SOUTH AMERICA

Brazil

Radio Nacional de Manaus, Manaus on **4845** at 0303, OM with local news items followed by some announcements and the station identification in Portuguese. This 250kW Radiobras station is on the air from 0900 to 1400 and from 1800 to a variable closing time around 0300 (Sunday until 0100).

Ecuador

Radio Rio Amazonas, Macuma on **4870** at 0243. OM with a talk in Spanish. The schedule is from 1000 to 0405 and the power is 5kW.

Radio Federation, Sucua on **4960** at 0008, YL with a folk song presumably in Shua, a local vernacular (at any rate it was not in Spanish), OM with announcements in Spanish at 0015 then some local style folk music. The power is 5kW.

HCJB, Quito on **6230** at 0433, OM with a religious song during the English transmission for North America timed from 0200 to 0700 daily.

Peru

Radio Inca del Peru, Lima on **4762.4** at 0228, pop records in the local style then OM with the station identification in Spanish at 0230 followed by more pops. This station operates from 1100 through to 0410 (Saturday and Sunday around the clock) and is rated at 5kW. Well worth logging.

Venezuela

Radio Tachira, San Cristobal on **4830** at 0429, OM with a folk song in Spanish, some piano music then OM with the station identification at 0432. Radio Tachira works to a 24-hour schedule at 10kW.

PACIFIC

Australia

Radio Australia, Melbourne on **7205** at 1442, OM with announcements and recorded pops in the English programme directed from the Carnarvon transmitter to southern Asia from 1430 to 2040. The English transmission for Europe on this channel is timed from 1530 to 2040.

Radio Australia on **15415** at 0925, a programme of recorded pops then YL with the station identification at 0930, followed by more pops in the English presentation to the southern part of the Far East timed from 0900 to 1100.

NEAR AND MIDDLE EAST

United Arab Emirates

Dubai on **17775** at 1439, Arabic type music and YL with some songs in an Arabic language programme for Europe timed from 1400 to 1500. Dubai currently features English to Europe and North Africa on this channel and in parallel on **11940**, **17865** and **21605** from 1030 to 1100 and from 1330 to 1400. Between 1600 and 1645 Dubai transmits in English on **9640**, **11955**, **15320** and on **15435**.

Pakistan

Radio Pakistan, Karachi on **4815** at 1805, local style music complete with songs in Urdu. At 10kW this transmitter is on the air with programmes in Urdu from 0215 to 0545 and from 1400 to 1900. After Karachi came under British control in 1843 it became the major port of north-west India. It was the capital of Pakistan from 1947 until 1959, when Rawalpindi became the seat of government. Islamabad, the present capital of Pakistan, lies below the Himalayas to the north of Rawalpindi.

Radio Pakistan, Islamabad on **17660** at 1457, OM with a song in Urdu during the Arabic/Urdu/English series of programmes directed to the Middle East from 1215 to 1615. OM with the station identification at 1500, pips time-check then OM with a newscast of local affairs.

Syria

Damascus on **9950** at 0554, OM with a song, YLs with the chorus and some local style music in an Arabic programme for the Middle East, scheduled from 0230 to 0600.

EUROPE

Albania

Radio Tirana on **9500** at 0530, the interval signal, YL with the station identification and a newscast in Spanish during the French/Spanish/English transmission to Europe, timed from 0500 to 0655. Tirana in central Albania is the capital city. Founded in the 17th century by the Turks, it has many fine mosques of the 17th and 18th centuries. The modern city was built in 1920, when it became the capital.

Spain

REE (Radio Exterior de España), Madrid on **9650** at 0644, OM talk about local industry in the Spanish offering to eastern Australia, scheduled from 0600 to 0800.

Madrid on **15375** at 1910, YL with announcements of prevailing temperatures at various Spanish cities and resorts then OM with a local pop song in the English programme for Africa timed from 1830 to 1930.

CLANDESTINE

Radio Venceremos on **6556** at 0207, local style music followed by OM with a harangue in Spanish. This clandestine has been operating on and around this channel since early 1981, claiming to be located within El Salvador. The policy is one of support for the Farabundo Marti National Liberation Front, which is hostile to the government of El Salvador. Programming in Spanish, it is best heard here in the UK during the 0000 to 0115 and the 0200 to 0315 slots.

Radio Camilo Cienfuegos on **9940** at 0202, YL with the station identification followed by a talk in Spanish. Radio Camilo Cienfuegos is a CID (Cuba Independent and Democratic) transmitter which broadcasts to Central America on a 24-hour basis, during which some air-time is provided for the programmes of the Surinam Liberation Council (Radio Free Surinam) which are radiated in Dutch and Sranan Tongo. These latter transmissions are timed from 0720 to 0750 and 2230 to 2300.

NOW HEAR THESE

Reykjavik, Iceland on **11855** at 1308, OM with a newscast in Icelandic, the signal being lost under co-channel interference at 1318. The schedule is unknown at the time of writing. On the Faxa Fiord in south-west Iceland, Reykjavik is the capital city. Founded in 874 and chartered in 1786, it is Iceland's chief port, fishing and fish processing centre. A hot water supply system completed in 1945 uses the natural hot water springs.

Radio Andina, Huancayo, Peru on **4996** at 0450, OMs with a folk song, OM with the station identification in Spanish at 0500, some announcements then an orchestral rendition of the National Anthem after which the folk songs continued. By government decree, the National Anthem must be radiated by all Peruvian radio stations at 0600, 1200 and 0000 local time.

NOW LOG THESE

Schulungssender des Osterreichischen Bundesheeres, Fleckendorf, Austria on **3378** at 1010, OM with a pop song in German, this also being logged on the parallel channel of **5035**. This Austrian Army 10kW transmitter is on the air Monday to Friday inclusive from 0930 to 1430 and features morse code lessons during the schedule.

Radiodiffusion Television Togolaise (*La Voix de la Nouvelle Marche*) Togblekope, Togo on **5047** at 2026, OMs with a song in vernacular complete with local style orchestral music. This 100kW transmitter carries Home Service programmes in French and vernaculars from 0528 to 0805 and from 1710 to 0005 and features an English newscast at 2000. REW

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■ Circuit diagram for WS 2.9 and S8. Andy. Tel: Plymouth 261635

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■ Microwave Modules MML144/30LS. Write to S Mohan, 75 Pennine Road, Glossop SK13 9UL

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■ Any info or circuit for Chapman tuner, MW/SW model S6/BS made by Reslosound Ltd. It is valved, and any info would be welcome. Mr Butt, 3 Rutland Street, Ashton-under-Lyme, Lancs OL6 6SB

■ Please help. Old broken or working multimode transceiver, 27-28MHz for winter conversion to 10 metres. Must be cheap (condition unimportant), complete if possible. Write or phone, ask for Terry G1FFH. Also wanted: IC audio chip No.AN7131 for Realistic FM27/81 home base or rig with chip in, must be cheap; desperate. (Model No.3000FM). T S Firth, 126 Tombridge Crescent, Kinsley, Pontefract, W Yorks WF9 5HE. Tel: Pontefract 612413 any time

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■ Wanted in good condition, Joystick antenna with tuner. Will pay fair price + postage. Mr V Webster, 20 Dundela View, Belfast BT4 3DB, Northern Ireland. Tel: (0232) 655653

■ Video sync processor design as published in BATC (British Amateur TV Club) *CQTV* magazine No.129, ready constructed and in full working order. Would also be interested in a commercially produced video sync processor unit. Details and asking price please to Mr D J Oliver, 100 May Lane, Kings Heath, Birmingham B14 4AG

■ Reward! For circuit diagrams, handbooks, WHY for following items to enable repair: Sony open reel VTR type AV3700 (spares/non-worker required, worker considered), Racal DFM type 806-R2, AVO sig gen type CT378B, MPIO 40TSS 5¼ f/height disc drive type 51/SOR92A. Has anyone had problems mating a 5¼ Shutgart drive with a PNP Communications Dragon 32 i/face? All letters/costs refunded, info appreciated. G1AGM QTHR. Tel: (0229) 29152 evenings 5-9 or weekends

■ Service information, circuit manual, any help with the following: P58 VHF/UHF receiver, also R1132A receiver. Will buy or borrow to copy and return promptly. Please help, expenses reimbursed. The P58 receiver as far as I can make out was made by BTH so any info on the maker would be welcome. Mark G1RGL, 107 Spicer Close, Brixton, London SW9 7UE. Tel: (01) 733 2338

■ Amateur interested in DXTV and amateur TV is interested in items for these hobbies such as aerial amps etc. I am also looking for a video sync processor to reduce picture jitter/roll when receiving/recording weak signals from abroad when using a standard domestic TV. Details please to D J Oliver, 100 May Lane, Kings Heath, Birmingham B14 4AG

■ Urgently wanted: *Television* and *Electronics & Wireless World* magazines, 1975 onwards. Good price paid. Contact immediately. J G M Andrew, 738 Pershore Road, Birmingham B29 7NJ. Tel: (021) 471 4084

■ Crystals wanted 8MHz range: 8.700, 8.600, 8.775, any size up to FT243, HC25U preferred, any help appreciated. Ron G3VCJ. Tel: (042) 43 4726

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C P I

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Radio & Electronics World

The communications and electronics magazine

ADVERTISING RATES & INFORMATION

DISPLAY AD RATES

depth mm x width mm	ad space	1 issue	series rates for consecutive insertions: 3 issues	6 issues	12 issues
61 x 90	⅛page	£91.00	£86.00	£82.00	£73.00
128 x 90 or 61 x 186	¼ page	£160.00	£150.00	£145.00	£125.00
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263 x 186	1 page	£590.00	£560.00	£530.00	£475.00
263 x 394	double page	£1140.00	£1070.00	£1020.00	£910.00

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colour rates exclude cost of separations

depth mm x width mm	ad space	1 issue	series rates for consecutive insertions: 3 issues	6 issues	12 issues
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issue	colour & mono proof ad	mono no proof and small ad	mono artwork	on sale thurs
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Mar 87	15 Jan 87	21 Jan 87	23 Jan 87	12 Feb 87
Apr 87	12 Feb 87	18 Feb 87	20 Feb 87	12 Mar 87
May 87	12 Mar 87	18 Mar 87	20 Mar 87	9 Apr 87

CONDITIONS & INFORMATION

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Display Ad and Small Ad series rate contracts are not interchangeable.

If series rate contract is cancelled, the advertiser will be liable to pay the unearned series discount already taken.

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Except for County Guides copy may be changed monthly.
No additional charges for typesetting or illustrations (except for colour separations).
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Printed — web-offset.
PAYMENT
Above rates exclude VAT.
All single insertion ads are accepted on a pre-payment basis only, unless an account is held.
Accounts will be opened for series rate advertisers subject to satisfactory credit references.
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FOR FURTHER INFORMATION CONTACT
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LENGTH:- 6.6 MTRS

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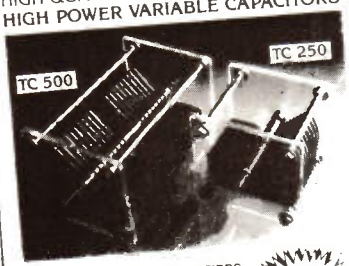

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OUTPUT:- 25-30 Watts
SUPPLY:- 13.8V DC
FREQ.- 26-30 MHz

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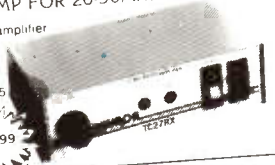

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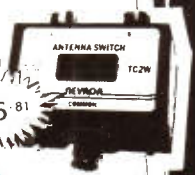

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T6040 40p
T6047 40p
T6049 40p
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