

*Amateur*

# RADIO

For all two-way radio enthusiasts

**The story of British Radar**

**Air Band communications**

**AmRad 10GHz system**



**On test: Icom IC505 portable  
50MHz multimode transceiver**

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# R. WITHERS

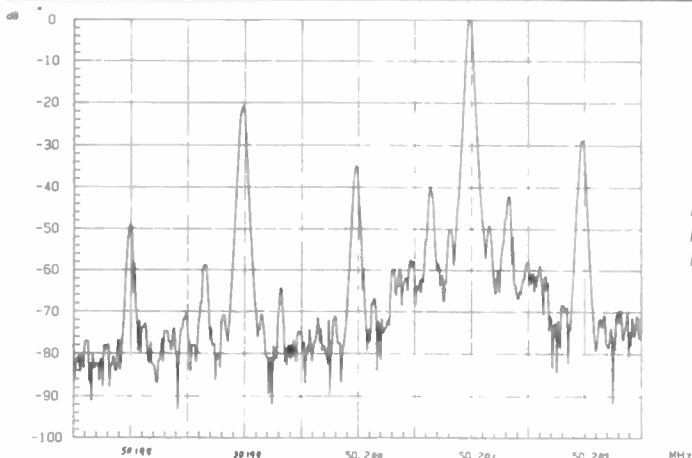


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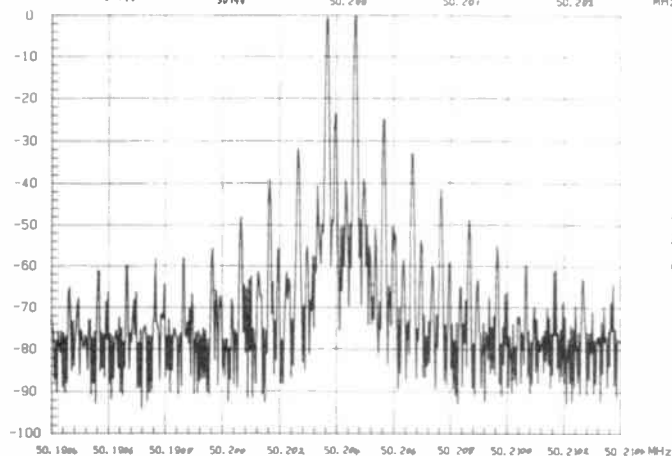
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# G3OSS TESTS



IC505 sideband  
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1kHz mod

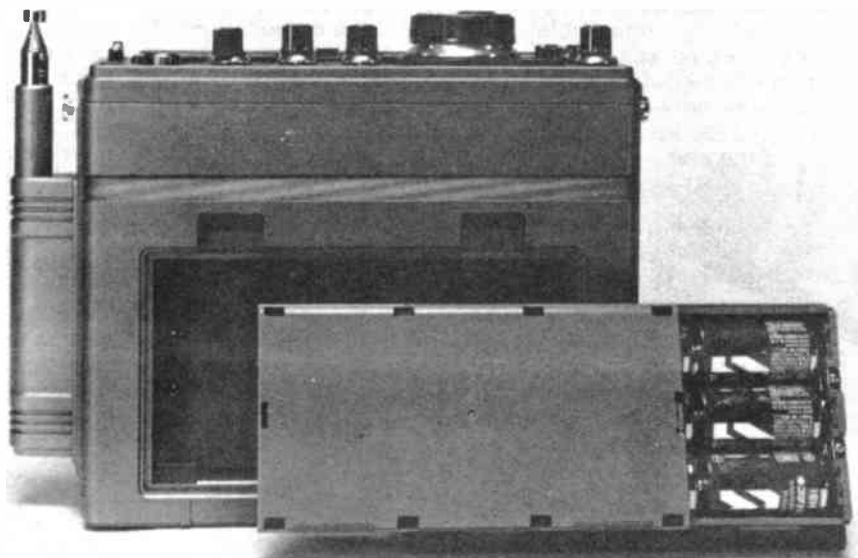


IC505 Two-tone  
test PA on  
(2.5W PEP)

other ways, the set was quite good ergonomically, but I found the SO239 socket, which is flush mounted, awkward to use with some plugs.

The whip, when pushed right in, still picks up, and indeed I had to be very careful about this in the lab as it was picking up some stray noises from various computers and disc drives that were being used for another project by a colleague. You may need to watch out for this if the set is used in close proximity to another receiver if the latter is radiating small signals in the 50MHz band.

There were no bad spurs on receive at all, although in an average QTH you will find some strange carriers etc, due to the radiation from various microprocessors within a range of 100m or so. Unfortunately, this is unavoidable in our present age of indiscriminate, unintended radiations! There was no apparent drift over long periods, either on Tx or Rx. It is unfortunate that there are no interconnections for external equipment (other than the CW key socket on the front and the headphone socket) that will drive a loudspeaker quite normally.



The rig is rather on the plasticky side, and although well-made is rather more crude than a proper mobile or fixed station rig. The transmitted sound quality was thought to be lacking LF and sounded rather peaky in the upper mid-audio region. I heard two other IC505s on the band and must agree that this seems typical of the rig. Transmitted distortion seemed acceptable and I did not note any specific problems, although the reciprocal mixing performance did not seem to be very good. CW reception was satisfactory, but no narrow filter was fitted. Despite the VFO having 100Hz steps and not smaller ones, the average of a few kHz per rotation made a quick QSY rather laborious.

## Laboratory tests

The receiver was extremely sensitive on SSB and the figure of  $-126\text{dBm}$  for 12dB sinad is excellent, showing the rig to be as good as one will ever need for the band. The RF input intercept point did not measure at all well, our figure of  $-20.5\text{dBm}$  being some 21dB inferior to that of the muTek transverter, for example. The circuitry is clearly quite old technology by latest standards, and whilst this RFIM performance will in fact be satisfactory for the time being, you might have some troubles with the rig when band occupancy becomes much greater, especially in a few years time under tropo conditions when everyone will be trying frantically to work the States.

The IF selectivity on SSB was around 2.3kHz for  $-6\text{dB}$ , 3.8kHz for  $-40\text{dB}$  and 4.8kHz for  $-60\text{dB}$ . The skirts are thus not particularly steep and this might be found rather annoying when more stations are on the band. The S-meter circuitry is rather odd, for S9 is reached at the very low signal level of  $-100\text{dBm}$  ( $2.2\mu\text{V}$ ), S5 being 6dB below this, and S1 only 15dB below S9. Audio distortion at 1V out was 2.9% from a 1kHz beat note, but we noted that distortion increased when the audio output level was decreased. Maximum audio output power for 10% distortion was 1.8W into 8 ohms, and 2.4W into 4 ohms.

We checked the AGC action and found that audio output decreased 3dB at  $-105\text{dBm}$ , referring to a much higher level; audio output decreased by 10dB at  $-116\text{dBm}$ . There seemed to be plenty of IF gain, although I did note in practice a tendency to noise pumping when receiving strong signals, and speech stopped momentarily. The receiving section took 200mA standing current from a 13.8V dc supply.

## Two-tone plots

Several two-tone plots were taken of the transmitter tuned to 50.2MHz. With the power stage turned on and with the power supply set to 13.5V dc with PA switched on we noted a maximum PEP output of just under 10W, although a single carrier output of just 9W was maximum. With the PA switched off, the single carrier output was just 2.5W,

# Amateur RADIO



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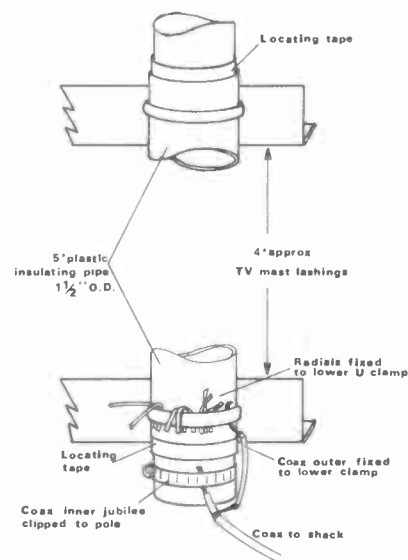
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We regret to inform readers that due to constantly rising production costs, and to enable us to maintain the high standard of content in *Amateur Radio*, the price of the magazine will be £1.30 from this issue.



# SEE AND HEAR ICOM AT THE N.E.C.

This year at the N.E.C. Exhibition Thanet Electronics will be introducing the complete range of ICOM Amateur Radio Equipment. You will be able to try out and purchase accessories, receivers and transceivers in all popular frequency bands. The range and scope of these will enable you to appreciate the superb specifications and quality of ICOM equipment.

**Stand D4**

## IC-735, The Complete HF Radio



The new ICOM IC-735 is ideal for mobile portable or base station operation. It has a general coverage receiver from 0.1MHz to 30MHz and transmits on all amateur bands from 160m to 10m. SSB, CW, AM and FM modes are included as standard. RTTY and Amtor are also possible. The IC-735 has a built-in receiver attenuator, pre-amp, noise blander and RIT to enhance receiver performance. A 105dB dynamic range with pass band tuning and a sharp I.F. notch filter for superior reception. The twin VFO's and 12 memories can store mode and frequency. The HM12 scanning mic is supplied. Scanning functions include programmes scan, memory scan and frequency scan. The IC-735 is one of the first H.F. transceivers to use a liquid crystal display which is easily visible under difficult conditions. Controls that require rare adjustment are placed behind the front panel hatch cover but are immediately accessible. Computer remote control is possible via the RS-232 jack. Output power can be adjusted from 10 to 100 watts with 100% duty cycle. A new line of accessories are available, including the AT150 electronic automatic antenna tuner and the PS55 AC power supply. The IC-735 is also compatible with most of ICOM's existing line of HF accessories. See the IC-735 at your authorised ICOM dealer or contact Thanet Electronics Limited.

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# STRAIGHT &

# LEVEL



## YUASA BATTERIES

Many of the models in Yuasa's NP range of batteries are now produced in the company's factory in Wales, and further expansion is under way which will bring all the models in the range into UK production.

The new range of UXL 10 year life stationary batteries are available in 9 capacities from 30 ampere hour up to the giant 500 ampere hour, which brings the sealed cell into the area of stationary systems.

In addition to their now widely accepted use as standby batteries both the Yuasa NP and UXL are suitable for numerous other applications, both standby and cyclic, where failsafe reliability is essential.

Under cyclical usage more than 1,000 discharge/recharge cycles can be expected and under float (trickle) charge a service life of five years can be expected from the NP range and ten years for the UXL range.

For further information contact: *Yuasa Battery Sales (UK) Ltd, Hawksworth Industrial Estate, Swindon, Wiltshire. Tel: (0793) 486818/9.*

## NEW KENPRO MODEL

Hi-Tech Worldwide Ltd have introduced a new Kenpro model to complement the KT200/400 series.

The unit has the following features built in as standard: 24 hour LCD clock, CTCSS sub-audible tone encode (decode optional) DTME touch-tone with 2 autodial memories, battery economiser on receive (in standby mode), 4 scanning mode/functions, channel spacing steps programmable from 5kHz to 100kHz, 5 watts RF output with 12.8V nicad, 10 memories with scanning and lockout facility, 144-148MHz coverage expandable for export versions, direct frequency access with programmable switch-on call channel.

The unit incorporates the latest receiver front-end JFET low noise devices with a

good sensitivity and blocking performance, quality recovered audio, clear Tx audio from the built in Electret microphone and easy to fit optional accessories such as speaker mic. It also has a built in dc jack for operation without the nicad pack.

The KT220EE costs £209 (prices may vary owing to fluctuating exchange rates).

Further information from: *Hi-Tech Worldwide Ltd, 584 Hagley Road West, Oldbury, Quinton, Birmingham B68 0BS. Tel: (021) 421 6001.*

## MOBILE TRANSCIVER

After the introduction of the Alinco ALM-203E 2 metre handheld transceiver at the end of last year, ICS Electronics Ltd have announced the new ALR-206E 25/5 watt mobile transceiver.

This compact unit has an

easy to read back-lit LCD frequency and 'S meter' read-out as well as all the same programmable features as the handheld transceiver. These are accessed from a keypad on the rear of the microphone.

Programmable features include: band scan, 10 memory channels and memory scan. Frequency selection is by means of a large front panel knob or from the microphone up/down buttons.

A mobile mount is included as standard.

The ALR-206E costs £295 inc VAT. Postage and packing and insurance cost £3.00.

ICS are also selling a complete 30 watt 2 metre handheld system, based on the ALM-203E handheld, and a separate 30 watt FM amplifier with 10dB gain GaAS FET pre-amp.

The price, complete with



# All the latest news, views, comment and developments on the amateur radio scene



## LOWE-DOWN

New products from Lowe Electronics include the Trio TS440S HF transceiver (£950 inc VAT); the Trio TM2550E 2m FM mobile rig (£399 inc VAT); the Trio TR751E 2m multi-mode mobile transceiver; the JRC NRD525 general coverage receiver; and the Trio SWC3 remote head for the SW200 meter (£30.20 inc VAT).

Further information is available from: *Lowe Electronics Ltd, Chesterfield Road, Matlock, Derbyshire DE4 5LE. Tel: (0629) 2817.*

connecting cable, is £249.95 inc VAT, plus £4 postage and packing. This system is ideal for mobile use of the handheld transceiver, as the amplifier can be left permanently installed in the car.

For further details send an sae to: *ICS Electronics Ltd, PO Box 2, Arundel, West Sussex BN18 0NX. Tel: (024365) 590.*

## RECEIVE SOFTWARE

Technical Software has announced that the RX-4 Multimode Receive Program, which can receive Morse, RTTY, Amtor and slow scan TV without needing any expensive hardware, has now been completely revised, with existing performance improved and many new features added.

An advantage with this software is that all four modes are in the same program, only needing one key press to change mode.

On CW there is a choice of software filters as well as a wideband decoder capable of reading at over 250wpm. The autotrack facility is controllable up to the maximum speed and can also be locked completely.

RTTY and Amtor have selectable unshift-on-space and switchable normal-reverse polarity. Tuning these signals is easy and accurate, as the on-screen frequency scale displays the tones directly. RTTY has 4 baud rates and decodes any shift automatically without

switching. Amtor also reads many commercial TOR transmissions.

The SSTV can display 8, 16 or 32 second frames and good pictures are obtained even in the presence of some noise. The grey scale (picture brightness) can be adjusted from the keyboard and the picture storage allows you to over-write one stored frame with a better one, if required, thus making much more efficient use of the available memory space.

All received text is stored as well as printed on the screen.

Stored text and pictures can be recalled to the screen, dumped to a printer

or saved on tape or disc.

The Spectrum version needs no hardware at all, connecting directly to the Spectrum's ear socket. The BBC-B, CBM64 and Vic 20 versions use the same interface as the RTTY/CW transceive program. For CW and RTTY they can also use a suitable terminal unit.

The program costs £25 on tape, £27 on BBC or CBM format disc, and the interface is £5 as a kit or £20 ready-made with all connections.

More details can be obtained from: *Technical Software, Fron, Upper Llandwrog, Caernarfon, Gwynedd LL54 7RF. Tel: (0286) 881886.*

## WIRE STRIPPER

Plasplugs, one of the leading DIY tool manufacturers, has introduced a new automatic wire stripper that will cut and strip the insulation from single, twin or multi-core cable for wiring plugs and electrical appliances.

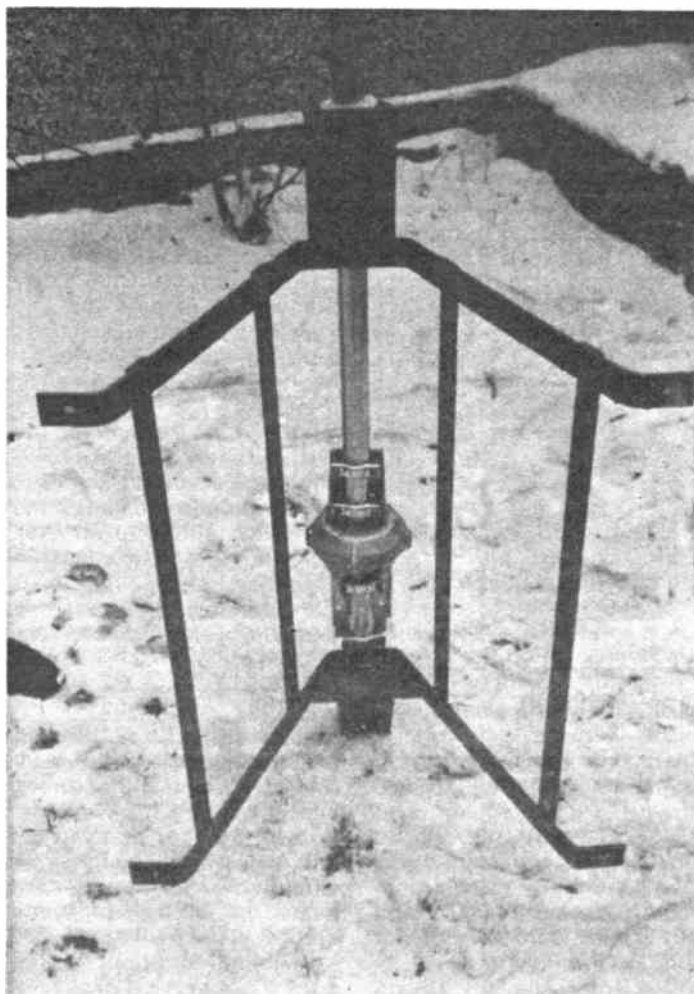
Designed and built to high quality specifications, the wire stripper works on a single action and offers an adjustable trim length.

It is available at £3.95 from all good DIY stores.

More details can be obtained from: *Plasplugs Ltd, Sheridan House, 11 Vernon Street, Derby DE1 1FR. Tel: (0332) 365851.*



## STRAIGHT & LEVEL



### ANTENNA BRACKET

A bracket to support an antenna mast above the rotator, thus taking the strain off the latter, has been designed by Brian Lee of West Yorkshire.

Made in one welded piece, the bracket is extremely rigid and stable. It uses two nylon bearings, which fit snugly round the antenna mast and take the strain which the rotator normally takes, hence prolonging the rotator's life.

The overall length of the bracket is 3 feet, 2 feet of which make up the main bracket, with a 6 inch projection at the top for bearing supports and 6 inches at the bottom for the rotator fixing point, which has a sturdy

stiffening rib at the back. It is easily attached by connecting the U/bolts to the mast stub.

The bracket is supplied with U/bolts and wall fixing bolts and is finished in hammer type paint. 10mm holes are drilled in each of its four corners for wall fixings.

The amount of projection from the wall is fixed according to the customer's specifications, to allow for any obstruction. This is done at no extra cost.

The price for the antenna bracket is £23.50 plus £6.50 postage and packing.

For further information contact: *Brian Lee, 31 Merton Avenue, Farsley, Pudsey, West Yorkshire LS28 5DX. Tel: (0532) 567642.*

### OSCILLOSCOPE ADD-ON

AliDin have just announced an oscilloscope add-on for the ZX Spectrum computer. Called the AliDin Scope, the new peripheral is a plug-in module with three signal input connectors. It connects to the expansion port on the ZX Spectrum and the software is provided on tape or microdrive.

Using the module and software the computer is converted into a digital storage oscilloscope using the TV screen for display. All the usual oscilloscope controls are available, but instead of the knobs and dials, the Spectrum's keyboard is used and the settings are displayed on the screen along with the scales and other useful operating information.

The waveform seen on the TV is a continuously updated waveform, as displayed by any normal oscilloscope. However it may be captured and held on the screen or in memory, while displaying a normal waveform for comparison. A screen copy function is provided, so that waveforms may be recorded

on a printer. The oscilloscope settings, such as timebase, amplitude and trigger mode, will also be printed out since they are displayed on the screen.

Other features such as single-shot capture and trace accumulation are also included.

The AliDin module retails at £49.95, complete with a signal lead and handbook. The software to drive the module in a 'scope' configuration costs £24.95. Further software is to be introduced enabling the AliDin module to work as an intelligent chart recorder or as a waveform spectrum analyser.

For further details contact: *AliDin, 39 Kingsclere Road, Overton, Hants RG25 3JB. Tel: (0256) 770488.*

### BASELINK

British Telecom recently announced its entry into the private mobile radio market with its new service, British Telecom Baselink.

Baselink initially provides a local two-way radio service for businesses who need to

keep their mobile workforce in contact with their office or base.

Customers can either choose to be served by one of a large number of shared radio stations already installed throughout the UK, or a complete Baselink radio system can be provided for exclusive use of one company which can be tailored to each customer's requirements.

British Telecom Baselink will rapidly expand its range of services and lead the development of the UK private mobile radio market. Local coverage areas will expand to provide complete regional services, with national coverage available next year.

Baselink will provide a complementary service to the cellular radio service provided by British Telecom Mobile Phone, which itself provides access to anyone via the world's telephone networks.

Further details are available from: *British Telecom Mobile radio, 10-18 Manor Gardens, Holloway, London N7 6JY. Tel: 01-272 0669.*

### TRANSFORMER KITS

A series of toroidal transformer kits, which enable electronic enthusiasts to produce their voltage outputs to suit their own requirements, has been announced by Electronic and Computer Workshop Ltd (ECW).

Toroidal transformers have many advantages over conventional laminated core types, including smaller size,

lower weight and the virtual elimination of stray magnetic fields.

ECW can supply toroidal transformer kits in five power ratings – 50, 120, 225, 500 and 1000VA – and all types are supplied with prewired primary circuits for use with 240 volts ac mains.

The user can easily wire the secondary to give any fixed voltage output, therefore eliminating the need to purchase specific transformers for a particular project. Full wiring details are supplied with each kit.

The 50VA kit (KT050) costs £12.46, while the top-of-the-range 1000VA transformer kit (KT1000) costs £48.76. All prices include VAT and post/packaging.

More information is available from: *Electronic and Computer Workshop Ltd, 171 Broomfield Road, Chelmsford, Essex. Tel: (0245) 262149.*

### MARCO CATALOGUE

Marco Trading recently launched their 1986 mail order catalogue.

It has 135 pages, is illustrated and includes a much extended range, with the introduction of many new lines and the usual price reductions.

Visa and Access cards are welcomed and the company claim that all orders are despatched by return of mail, subject to availability.

The catalogue is available for £1.00 from: *Marco Trading, The Maltings, High Street, Wem, Shropshire SY4 5EN. Tel: (0939) 32763.*



## 934MHz GEAR

Selectronic has now introduced a new 934MHz hand-held transceiver, the MT370, which features 20 channels, 10 memory channels, full scan facility, a high performance RF output, good audio quality, a high capacity battery pack and a half-wave whip antenna. It is available for £459 including VAT.

The company also has a new range of 934MHz accessories.

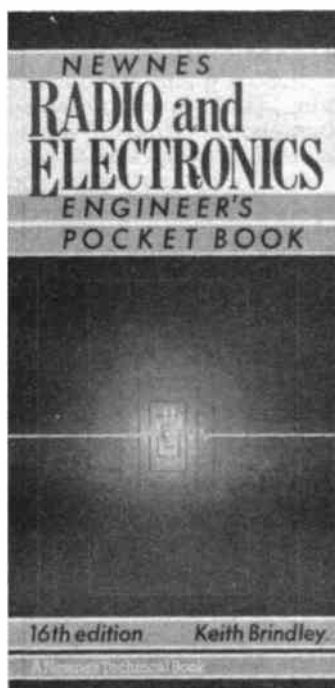
Full details are available from: *Selectronic, 203 High Street, Canvey Island, Essex. Tel: (0268) 691481.*

## DESOLDERING STATION

A new desoldering machine, launched by Tony Chapman Electronics Ltd, will be on show at Internecon Production '86 (8-10 April).

The Zevac DRS-21 is a new generation of rework tool and is designed to desolder and resolder SMD (surface-mounted devices) for PCBs or ceramic substrates. It uses nitrogen as its medium for heat transfer, assuring optimum protection of the PCB and components.

The gas jet directs heated and controlled nitrogen through an interchangeable nozzle to the contacting area of the selected SMD, the positioning of the component to be reworked having been achieved by a stereo microscope. The gas temperature and flow are accurately controlled and fully adjustable to suit all applications.



The DRS-21 has a base plate with an easy sliding X-Y table and a control panel providing monitor control of temperature, gas flow and cycle time.

For further information contact: *Tony Chapman Electronics Limited, Electron House, Hemnall Street, Epping, Essex CM16 4LS. Tel: (0378) 78231.*

## DIAL-SEARCH

The fourth edition of a very useful reference book, *Dial-Search: The Listener's Check-list and Guide to European Broadcasting*, by George Wilcox, is now generally available.

It includes: a check-list of European stations likely to be found on medium wave and long wave using a domestic receiver; a list of MW and LW British stations, giving their VHF (FM) frequencies and broadcasting schedules; a VHF check-list for the British Isles; dial-search maps of Europe, the Mediterranean and the British Isles showing the 300 transmitter sites listed; and articles on *Using the Dial-Search Maps* and *Making the Most of your Portable*.

This edition is available for £3.00 plus 30p p&p from: *George Wilcox, 9 Thurrock Close, Lower Willingdon, Eastbourne, East Sussex BN20 9NF.*

## MATRIX SWITCHES

An RF matrix switch capable of handling signals from dc up to 18GHz has been announced by Anglia Microwaves Ltd.

The Wavecom 2P3T and 2P4T switch will simultaneously switch two input

## POCKET BOOK

The 16th edition of Keith Brindley's *Radio and Electronics Engineer's Pocket Book* is an invaluable compendium of facts, figures and formulae for the designer, student, service engineer and all those interested in the subject.

This edition has been revised and redesigned in an easier-to-use format and is published by Newnes at a price of £5.50.

*Newnes Technical Books, Bridge House, 69 London Road, Twickenham, Middlesex TW1 3SB.*



## RX MODIFICATION

RWC Ltd have announced a modification for the Yaesu FRG9600 scanning receiver. The standard frequency range of 60-905MHz has been extended to cover up to 945MHz (940MHz guaranteed) with adequate sensitivity to cover the 934MHz range.

The modification also includes improved receiver sensitivity and 'S' meter recalibration for more realistic readings.

Customers who purchase the FRG9600 at RWC can have the modification fitted at no cost, (including existing customers). Owners of the FRG9600 can have the mod-

ification and the other improvements fitted for £25 including VAT and return post. They are warned, however, that the warranty will be affected on sets not supplied by RWC.

Further developments are in progress, with a low frequency option under way to enable operation below 60MHz. It may also be possible to include additional bands to be fitted in 20MHz increments.

For further information contact: *R Withers Communications Ltd, 584 Hagley Road West, Oldbury, Quinton, Birmingham B68 0BS. Tel: (021) 421 8201.*

signals to any of three or four outputs respectively. At 18GHz, the new switches display a VSWR of 1.5:1.

Other figures include an insertion loss of 0.5dB (max) and isolation of 60dB (min). Also, Wavecom specifies a phase mismatch between channels of less than 0.1dB.

Utilising an advanced SMA connector design, a proprietary self-lubricating switch technology and precise heat treatment of contacts, the switches are designed for maximum reliability and stability.

For further information please contact: *Anglia Microwaves Ltd, Radford Business Centre, Radford Way, Billericay, Essex CM12 0BZ. Tel: (02774) 58955.*

## 50GHz FOR BETACAPS

A new range of ceramic capacitors from Anglia Microwaves Ltd offers ultra-high Q figures and a frequency range covering microwave and broadband frequencies up to

50GHz.

The BetaCap series of parallel plate capacitors includes capacitor values from 0.1pF up to 5000pF and all types meet or exceed the requirements of MIL-C-5568B and MIL-C-20.

A variety of leadless and leaded configurations can be supplied by Anglia Microwaves to suit most chip capacitor applications. Also, capacitance tolerances of ±1%, 2%, 5%, 10% and 20% are available.

Terminations are high reliability 100 micro-inch gold on nickel barrier or palladium-silver.

These microwave characterised components can also be supplied in a range of working voltages from 50 volts dc to 500 volts dc and feature a dielectric strength of 250% working voltage.

For further information contact: *Anglia Microwaves Ltd, Radford Business Centre, Radford Way, Billericay, Essex CM12 0BZ. Tel: (02774) 58955.*

## WA Sparks G8FBX

We were very sorry to hear of the death of Bill Sparks G8FBX, a regular contributor to *Amateur Radio*, on 6 January this year.

A keen SWL in his youth, Bill became an electro-chemist working for a number of years for Salford Electrical Instruments and latterly as a principal in several electro-plating companies, until ill-health forced an early retirement.

He was a founder member of the Warrington and District Radio Society in late 1946, always taking a keen interest in club affairs and taking part in numerous field day and portable outings, being especially interested in VHF and UHF. He was also keen on home construction and design, contributing related articles to this and other amateur radio journals.

He will be remembered by a large number of recently licensed amateurs who he successfully tutored in the south Lancashire and north Cheshire area, visiting many clubs and individuals as an RAE instructor.

A member of the RSGB and Raynet, he will be sadly missed by all who were fortunate enough to know him. 73 Bill.

## G2FCV

### Radio rendezvous

The Humberside Radio Rendezvous 1986, organised by the Scunthorpe Amateur Radio Club, will be held on 27 April at 11.00am in the Hobbies Centre, Grange Farm, Franklin Crescent, Scunthorpe.

There will be talk-in on 144MHz and 432MHz. The special event call sign will be GB2HRR.

Further information is available from G Parkin-Coates G6OSA on (0427) 873827 (evenings).

### Hobby fair

The Wembley Conference Centre in London will host the Amateur Radio and Electronics Hobby Fair on 5 and 6 July. This is apparently the first two-day fair of its type to be held in the south of England, and is a major new event on the rally calendar.

A wide variety of retailers and manufacturers will be present offering a range of goodies: RTTY, satellite TV and communications, micro-waves, hobby components

and amateur TV will all be included at the fair.

If you are interested in attending, contact: *Amateur Radio Promotions, Woodthorpe House, Clapgate Lane, Birmingham B32 3BU.*

### Wireless revival

This popular annual mobile rally for radio amateurs is being held on Sunday 25 May at the Civil Service Sports Ground, Straight Road, Bucklesham, Ipswich, Suffolk.

With features such as traders, a car boot sale, an aerial testing range and a vintage radio display, plus non-radio stalls, a childrens' play area, a model flying display and other attractions, this rally provides a happy day out for the whole family. The admission price is 80p.

Further details are available from: *Jack Tootill G4IFF, 76 Fircroft Road, Ipswich IP1 6PX. Tel: (0473) 44047.*

### McMichael Mobile Rally

The Chiltern ARC, in conjunction with the Burnham Beeches ARS and the Maidenhead and District ARC, is staging the fifth annual McMichael Mobile Rally at the Haymill Centre, Burnham, Nr Slough, Berks, on Sunday 20 July. Doors open at 11.00am.

A large number of national and local traders have been invited, displaying everything from 'black boxes' through to kits and surplus components.

A flea market will be in operation and there will be many other attractions including amateur TV, an HF station, radio controlled models, mini fairground, refreshments and lots of displays and demonstrations.

The CAMRA beer tent will be on site, making this a very popular rally and a nice day for all the family.

Further information is available from R M Hearn, 70 Herbert Rd, High Wycombe, Bucks HP13 7HN.

### Radio workshop

An RSGB workshop will be held on Sunday 13 April from 12.30pm to 4.30pm at the Wrangholm Hall Community Centre, Motherwell, Clydesdale, Scotland.

The day will take the form of four clinics operating simultaneously, where speakers will give short talks and demonstrations continuously and be available to give

advice. The speakers will be: John Brannigan GM4IHJ, whose subject will be satellites; Gordon McKenzie GM4NUN, who will deal with computers; George Burt GM3OXX, on the subject of QRP and home-brew; and Maurice Hately GM3HAT on HF antennas.

An RSGB information desk and book stall will also be included.

Information is available from: The RSGB HQ, tel: (0707) 59015.

### New venue, new menu

The Crawley Amateur Radio Club is moving its meeting place to The Leisure Centre, Haslett Avenue, Crawley.

The first meeting at this venue will be on 23 April, when G3TNO will be giving a lecture on antennas. Meetings start at 7.00pm, with lectures, commencing at 8.00pm. It is usual that members adjourn to the bar at 10.00pm when the lectures end.

The club's meetings are held on the fourth Wednesday of each month, and items on the agenda include a quiz against the Mid Sussex ARC on 28 May and a lecture by G4TVC on weather satellites on 25 June. On 7 May the club is holding a junk sale and on 9 May stomachs and livers are going to suffer at the annual dinner.

It is hoped that a club shack and courses for the RAE and the Morse test will be established some time in the future.

New members are always welcome and details can be obtained from Jack Darby G4TVC on Crawley 28612.

### Natter nights

The Dover YMCA Amateur Radio Club meets at the YMCA, Leybourne Road, Dover every Wednesday at 7.30pm.

Every alternate week the club has a talk by a guest speaker on subjects of interest to radio amateurs. On the intervening weeks there are 'natter nights' when members can chat about the one that got away.

The shack is open every week with both HF and VHF rigs available for use by licensed members.

The club also meets on the air every Sunday morning at 11.00am on 144.395 SSB and 3745 SSB.

### Stourbridge and District

The Stourbridge and District Amateur Radio Society meets on the first and third Mondays of each month at the Robin Woods Centre, School Street, Off Enville Street, Stourbridge. Meetings begin at 8.00pm.

For further details contact the president, Malcolm Davies G8JTL. Tel: Lye 4019.

### Dorking and District

The Dorking and District Radio Society meets on the second and fourth Tuesdays of the month at 8.00pm.

There are informal meetings as well as talks, demonstrations, special events and social evenings.

For further information and details about venues contact: *John Greenwell G3AEZ. Tel: Newdigate (030 677) 236.*

### BEARS

The Borehamwood and Elstree Amateur Radio Society has a talk on propagation planned this month, on 21 April at 7.30pm.

The club meets on the third Monday of each month and provides slow and test speed CW sessions. The new venue is at 'The Wellington', Theobald Street, Borehamwood, Herts.

Contact Ivor G4XEW on (01) 953 5287 during the day for further information.

### Coach trip

The Biggin Hill Amateur Radio Club has organised a coach trip to the RSGB National Convention in Birmingham on 5 April. The fare will be £6.50.

If you are interested in the trip please contact Ian Daniels, 71 Firsby Avenue, Shirley, Croydon CR0 8TP.

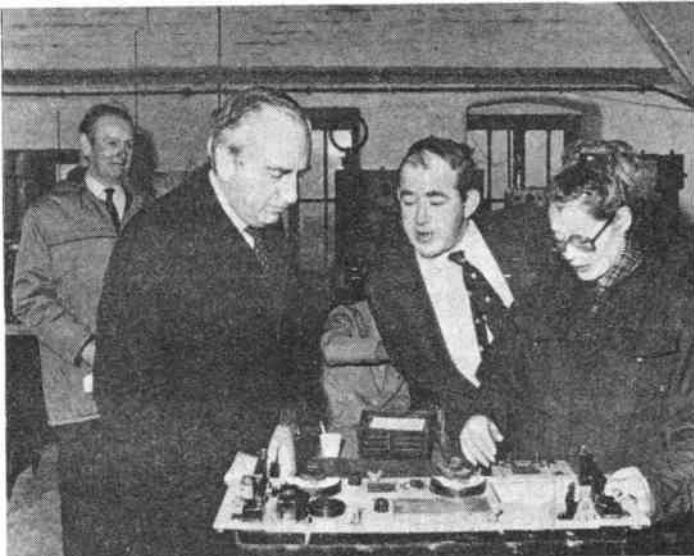
An ATV demonstration and talk is planned for 15 April, the venue, as usual, being the Downe Village Hall, 24 High Street, Downe, Kent BR6 7HL. Details can be obtained from Robert Senft G0AMP, tel: (0689) 57848.

### Fibre optics

If you want more fibre in your daily radio diet (groan!), the Bury Radio Society is hosting a talk on fibre optics by Lawrence G4KLT on 8 April.

The society meets at the Mosses Centre, Cecil Street, Bury, and details are available from Allan Harrison G0CUK on (0204) 706191.





Lord Young visiting the C&M Museum at Fort Widley

### Glissa Job!

On 28 February Lord Young of Graffham, Secretary of State for Employment, visited the Communications and Electronics Museum at Fort Widley in Portsmouth.

The purpose of his visit was to see how the museum's MSC Community Programme was progressing. There are thirteen workers on the scheme, whose task is to identify and catalogue each item from two collections of communication and electronics artefacts.

### Is there life?

The Verulam Amateur Radio Club meets at the RAF Association Headquarters, New Kent Road, off Marlborough Road, St Albans, on the second and fourth Tuesdays of each month.

On 13 May they are holding an activity evening and on the 27th, at 7.30 for 8.00pm, Ian Keyser G3ROO will be giving a talk entitled 'Is there life below 40?' All visitors are welcome.

Further information is available from the secretary, Gerry Wimpenny G4OBH, 30 Faircross Way, St Albans. Tel: St Albans 52003.

### IOW club

The Binstead Amateur Radio Society meets every Wednesday at the Scout Headquarters, Drill Hall Lane, Binstead.

Morse lessons and RAE instruction are given where required, and Amtor and ATV are demonstrated on certain dates according to requirements. The club has its own radio shack built into the

Scout buildings and runs a variety of other activities, including exercises with the Scout group, with whom the club works closely.

The QSL/awards manager is Mr J Willis (G1BZC) QThr, and the president is Mr D F Barnes (G4VJF) QThr.

Further information may be obtained by writing to the club secretary who will be pleased to answer.

The club is currently running the Binstead Amateur Radio Society Isle of Wight Award. The requirements for the award are as follows: VHF – ten Isle of Wight stations to be worked, which must include the G0BAR club call; HF – five Isle of Wight stations to be worked, again including the G0BAR club call. The award costs £2.50 and is in four colours – a nice addition for your shack.

### Scottish Raynet

Amateurs interested in emergency communications may want to attend a Raynet symposium on 3 May, beginning at 10.00am.

The venue will be the Aviemore Centre in Fort William, and the day will include talks on coastguard co-ordination and communications and the Cairngorm Mountain Rescue Team.

Further details are available from the Raynet zone representative, D Garrington, on (0397) 3833.

### Change of secretary

The Fareham and District Amateur Radio Club, has a new club secretary, Alan Chester G3CCB, who can be contacted on (0329) 288139.

## Cap Co SPC300

### COMPETITION WINNERS

It wasn't easy, but after considerable effort on the judges' part (Angus McKenzie G3OSS, Tony Johnston G4OGP and the Editor) the winners of the competition in the January issue of *Amateur Radio* were decided. The correct answers to the multiple choice questions were CBBBCDBB and the most appropriate answers to the written question, in order, were sent in by:

1st Prize  
A complete SPC300

Latae Rolf Evensen,  
Norway

2nd Prize  
An SPC300 module

AR Williams G3KSU,  
Isle of Wight

3rd Prize  
A 1kW 4:1 and 1kW 1:1  
balun

John D Heys G3BDQ,  
Sussex

Runner-up prizes of G4OGP clip-on aerial feeder kits go to: A Siemieniago, Swindon; Peter RA Dolphin, Petersfield; CA Wadsworth, Cornwall; and Roy Targonski, Bilston.

We would like to take this opportunity to thank all of the entrants for their help in making the competition such a success, and Tony Johnston G4OGP and Angus McKenzie G3OSS for their time and effort in deciding on the winners.

## ARE YOU A BUDDING WRITER?

We are particularly keen to receive construction articles, so if you have designed and built a project which you think could be of interest to fellow radio amateurs we would be pleased to receive your contribution.

You do not need to be an expert writer to see your name in print. Accuracy in the design of your project is far more important. If you can put your ideas down on paper, typewritten if possible, and illustrate them with clear drawings and photographs where appropriate, the *Amateur Radio* editorial team will sort out the style, grammar, spelling, etc.

If you have an idea which you wish to discuss with the Editor before submitting in article form, she will be pleased to receive your call.

We will, of course, pay for all articles which are accepted for publication.

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Many listeners have asked for a guide to the wide VHF/UHF spectrum and to meet this request we have recently published this frequency manual. It covers the range 27 to 1300 MHz and has been specially prepared for the UK listener. Anybody who has used a scanning receiver will know that the wide frequency range involved means that it is difficult to know exactly where to listen. This guide takes all the guessing out of monitoring. It lists all the services throughout the spectrum together with both simplex and duplex frequency splits. If you've spent your hard earned money on a scanning receiver or are considering buying one you'll find that this publication contains a wealth of information that has previously remained un-published!

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This frequency manual is without doubt the most comprehensive list of VHF/UHF aircraft listings available in the UK. Of vital importance to the airband enthusiast or indeed any keen VHF/UHF listener it sets out in a very easy to follow manner full details of a whole host of stations. Every known UK airfield frequencies, etc. Included are Civil, RAF, USAF, MOD, Naval fields on both VHF and UHF bands. There are also air to air frequencies, the Red Arrows frequency, and much more! Send today for your copy and find out just how much you have been missing!

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### HF OCEANIC AIRBAND RADIO SUPPLEMENT

Prepared in response to many requests for more information about the air traffic on the hf bands this little guide sets out to explain to the beginner how the hf band works in relation to air traffic. It contains full details of the world aircraft frequency bands in the range 2 to 23 MHz together with control frequencies and those commonly used for Oceanic control. Also included are many VOLMET frequencies, the Search and Rescue frequencies used by RAF helicopters and Nimrods, the HF RT network, London Company frequencies, European control centres etc. An ideal companion for the hf airband listener. Send today for your copy.

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# L·E·T·T·E·R·S

## BAD MANNERS

What a pleasure it was to have been able to participate in the recent auroral opening on 144MHz on 7 and 8 February. It was probably the most intense and widespread event that I remember since that in November 1982. Sixteen countries were worked, including OE, OK and SP, with over 50 squares.

What a pity it was to have yet another good opening marred by what now appears to be an almost customary display of ill-mannered operating by some newly licensed (and some not so newly licensed) G, GM and GW stations, who persistently

responded to specifically directional CQ DX calls.

As the event intensified I continually found myself fighting an impenetrable wall of mainland stations coming back to my CQ DX Europe/Scandinavia calls on CW. I eventually had to move to the SSB segment of the band, where I was able to begin working some real DX after making very much more pointed directional calls, but even on SSB the situation only marginally improved.

What is the point, during such a good event, in persistently trying to establish a contact over the top of what may be some

exceptionally choice DX, in order to return an unwanted S9 signal report to what is essentially a local station for that event?

Our Continental friends have a lesson for us here. It has been my experience that on the odd occasion that mainland stations can be persuaded not to call, most Continental stations are reasonably well behaved and will shut up (not to make too fine a point) until called by square or country, thus making the best of the event.

I realise that G1 is a new country for some mainland stations but we are always up here if you would only turn

your beams. It is surprising how often east and south-east coast squares can be worked from Belfast with just a little enhancement in the band and a little perseverance of the proper kind.

If you really need to work G1 then G14OMK and G16ATZ are QRV most weekends for any tropo skeds, both are QRO and QTHr (sae please). Failing that try G14VIP/P in the May and September 144MHz contests, when we will be delighted to make the contact (giving the WAB if you require) and I can guarantee a QSL card.

**Philip Murphy G14OMK, Belfast**

## SELF-PERPETUATION

Last year the RSGB Council planned to change the constitution of the society to increase the president's term of office to three years. The plan was shelved because it became public knowledge and a number of members protested. This has not stopped the council from continuing its policy of self-perpetuation.

Council members have to stand for election every three years but if they are elected president they stay on council for the presidential year and the subsequent year. John Allaway G3FKM is the only person to have served as president on more than one occasion in the last thirty years. This was in recognition of the outstanding service he had rendered the society.

At the RSGB Council Meeting on 17 January, Joan Heathershaw was elected

president for 1987 even though the society's own rules specify that the president shall be elected in June or July. It is interesting to note that the February issue of *Radcom* reports the fact that G8VR was elected vice president at the meeting but carefully omits any reference to Mrs Heathershaw. By this manoeuvre Mrs Heathershaw remains on council for another two years without having to stand for election. Once again the RSGB Council has neatly manipulated the rules to prevent new members being elected and to maintain the status quo. This is the second time that Mrs Heathershaw has been elected in a questionable manner. What price a third term of office for her?

**Peter L Crosland G6JNS, Worcester**

## CONSIDER THIS

I have read many articles regarding a novice licence. I believe A and B holders have a lot of valid points for and against this idea.

Although my wife and I are both disabled and will not be able to afford ham radio transceivers, I would like to suggest another consideration. I had open heart surgery in December '81 and since then I have been on drugs. The side effects of all these drugs have altered my powers of concentration and memory, so therefore it is

very hard for me to study.

As we would be recommended by a responsible RSGB member, surely a novice licence could be considered for 2 metre status, with penalties appropriate to offenders?

At the start of my interest in early 1980, I was being taught by G4LAM. My average on the syllabus was 75%.

I am now applying to the RAIBC for the loan of a 2 metre receiver of some kind, to keep my hand in the hobby as much as I can.

**T H Johnson, Cornwall**

## TRUE LIGHT

I write with reference to an item in Don Field's *DX Diary*, published in the February edition of *Amateur Radio*. He anticipates the recognition of the South African homelands as separate countries for the various DX awards available. Citing an article in *CQ Magazine* by WA2HZR, he wonders how it is that 'some buildings can be called a country while a self-governing, independent people cannot get country status. . .'

I'm not sure how a building can reasonably claim national status; the powers that be behind DX legislation move in mysterious ways. No problem,

however, on the matter of the non-recognition of the South African homelands' DX status: they are not independent nations. Even superficial scrutiny of the political and economic structure of those regions will reveal them to be one of the most cynical manifestations of apartheid.

It is to be hoped that they are never recognised as qualifying for DXCC status. For as long as the so-called independent republics of the Soviet Union are regarded as having only spurious autonomy, so should the South African homelands be regarded in their true light.

**Dick Jones G1JCD, Farnham**

## ABLE TO LAUGH

I very much enjoyed the tongue in cheek *Expedition to the ARC* by Kevin Fox that appeared in the February issue. The fact that it was written by a ham and that it appeared in an amateur radio magazine really does disarm criticism, and to anyone who does find it a bit hard to take I would reply that it's no bad thing to possess the ability to laugh at oneself.

**H Humphries, Newmarket**

## HOGWASH

Mr Bolton's letter (*Amateur Radio*, February) certainly needed taking with a pinch of salt - it is not often that one reads such hogwash in a technical magazine.

Conversely, Mr Navier's letter

on the same page is an excellent example of constructive comment which Mr Bolton would do well to read and digest.

If I may clear up at least one area of Mr Bolton's most obvious confusion, PL259 connectors manufactured for the electronics industry, and the enlightened radio amateur, still cost as much as they did in 1980, in fact a little more. The cheap and nasty 50p version mentioned in this letter is constructed from 'muckite' metal and has either high-loss plastic or fibre board insulation. To use Mr Bolton's phraseology, whether you use the former or the latter depends largely on what is stored between your ears!

**Nev Kirk G3JDK, Rotherdam**





# DX DIARY

News for HF operators compiled by Don Field G3XTT

Last month I started by saying how good band conditions had been in January. This month I have to say that band conditions during February were, on the whole, dreadful. While the VHF enthusiasts were revelling in auroral DX, we HF aficionados were wondering what had hit the bands. The solar storm which led to the aurora was reckoned to be one of the largest since 1960. The 'A' index, which gives an indication of ionospheric disturbance, rose to a high of 236 on 8 February and the impact of the aurora on the HF bands lasted for several days. Anyone taking part in the RSGB Top Band Contest that weekend was in for a very raw time indeed.

## DX worked

Despite the aurora there was the occasional DX station to be worked during February. Lloyd and Iris Colvin continued their travels with an appearance as W6QL/Z2 from Zimbabwe. There was yet more activity from Aruba in the form of PA0FM/P4 and P4OM, even though latest rumours from the US suggest that this one will not count as a separate country for some years yet.

KC2RS/VP5 showed up from the Turks and Caicos Islands and AZ1A continued his activity from the South Orkneys. 3C1MB was to be heard daily from 2300GMT around 7087kHz, but usually in Spanish.

Phil Weaver VS6CT made a brief visit to Macau and operated as XX9CT, but although he was heard well in

Europe on 40 metres he seemed to have trouble hearing the Europeans. Earlier in the month G4IUF had operated as C56/G4IUF from the Gambia. Mike made about 700 contacts, but complains that 80 metres was disappointing. This was mainly because the DX window was dominated by European stations ragchewing between themselves, so that Mike couldn't make himself heard.

## Top Band

I listened briefly to the CQWW 160 SSB Contest at the end of February and it was clear that conditions were very poor. T11C, YV2IF, VU2GDG and V47A all had contacts with the UK, but life was tough for all taking part. The only bright note, I am told by one of the participants, was the high level of activity on the band during the daylight hours. I thought that the Sunday morning netters had all deserted Top Band for two, but it seems this is not the case.

*DX News Sheet* reports that Dave G3SZA has now worked 189 countries and 39 zones on Top Band, as well as having achieved Worked All States. Quite a feat! Dave's transmitting antenna is a 94ft top-loaded vertical, and he has beverages for receiving.

## Lord Howe Island

Many DXers will have worked VK9NM/LH and/or VK9LM from Lord Howe Island during the past several months. Both these calls are held by Rudi DJ5CQ, who has operated from many rare spots over the years.

Just recently, however, Lady Luck seems to have deserted him. To start with there were problems with antennas, mainly as a result of tropical storms. Wire is in short supply and very expensive on Lord Howe Island, and Rudi has got through no less than five 80 metre dipoles in his time there.

## Taken ill

Last November Rudi was taken ill and had to be airlifted to Sydney by the Royal Australian Air Force in terrible weather conditions for an emergency operation. Finally, and worst of all, came news from Germany that his retirement home, complete with radio shack and 27 years of QSLs, had gone up in flames, and he had failed to insure it before leaving for the Pacific.

Rudi is now back in Germany and if you need a QSL for your Lord Howe contact, or if you want to make a donation to help him, write to Rudi Mueller, Alter Main 23, D-8061 Ebding-Bamberg, West Germany.

## RTTY

Interest in RTTY on the HF bands seems to be increasing rapidly, mainly, I suspect, because of the ease with which home computers can be applied to this mode. Recent RTTY DX on 20 metres has included AZ1A, AH9AC, C31NP, FY7AN, HC5KA, LX1FN, LU8DHT, KL7GU and ZP5JAL.

If any *DX Diary* readers are active on this mode I would welcome reports of stations worked and equipment used.

## Correspondence

My comments in January's *DX Diary* about it being more interesting to speak with Tom Christian on Pitcairn than John Smith down the road provoked a surprising number of responses. Those who wrote to me seem to agree that it would certainly be more interesting.

John G4VOZ, however, feels that the demand for a 'rare' one by the country chasers would actually make a ragchew with Tom Christian or others like him quite impossible. John cites as an example a friend of his who worked for some years on several Pacific islands and gave up trying to QSO the folk back home because he always met with a wall of QRM.

Another reader, Len G4XAQ, would give his eye teeth to work VR6TC but finds it difficult to do so using a mini-beam from a small garden. He does not use a linear, mainly because it wreaks havoc with nearby video recorders.

I sympathise with both these points of view, but go back to what I said in January. If HF amateur radio is to flourish we must push on and try to solve interference problems when they occur, so that we can operate freely with the maximum power the licence allows us. New legislation in the offing regarding RF immunity in domestic electronic equipment may help in this. I have cracked the interference problem at each of the four QTHs I have operated from over the years, and first worked over 200 countries

and 5BDXCC using a mini-beam and dipoles for 40 and 80 metres.

Once that hurdle is overcome I believe it really is possible to ragchew with all but the rarest DX stations, and I have done so many times (yes, often to the irritation of the award chasers on frequency). Frequently, a DX station is only too relieved to find someone who is interested in him as a person rather than as a potential QSL card and will be happy to have a chat. It does help, admittedly, if you both have good signals or the QRM can, indeed, become intolerable.

What, of course, you must not do is to try and engage a DXpedition operator in such a conversation. If an amateur goes to the effort and cost of mounting a DXpedition, then he wants to make as many contacts as possible, usually to the relief of the local amateurs who find the pressure from award chasers taken off them for a while.

Incidentally, G4VOZ comments that the best bands on which to ragchew are 18 and 24MHz. Bad news, I'm afraid, John. The ARRL board of directors has now agreed that contacts on these bands will be acceptable for all ARRL awards, so we will soon see the country chasers hard at work.

## IT9AZS

Last month I reported Salvatore IT9AZS as having been active from Sao Tome as S9OAS and from Togo as 5V7AS. He is now back home and more details are to hand. He was accompanied on the trip by Enrico IT9SXA and Fernando I2RLX (the only CW operator of the three). From Sao Tome they made 6,000 contacts, and received much help from Luiz S92LB. From Togo they made another 6,500 contacts from the Hotel Tropicana in Lome.

The TY licence never appeared, despite them having paid the fee well in advance, so they cancelled the visit to Benin and went straight back to Italy. Equipment used on their trip included an FT277, MN2000, 12AVQ and W3DZZ.

Readers who missed 5V7AS might like to know that Ron 5V7RW, who is a missionary, will be in Togo for 5 more months before returning to the USA.



Ghis ON5NT and Riki 4X4NJ at the 1985 HF Convention

## Sao Tome

Sao Tome has featured in this column several times in recent months, since licences started being issued again after a lapse of some years. Readers may be interested to know a bit more about the place. This DXCC country consists of the islands of Sao Tome and Principe. Sao Tome is the larger of the two, with 80% of the total population of just over 100,000 and 334 square miles compared with Principe's 38 square miles. The islands were used at one time as a staging post in the slave trade and the population is mainly African in origin, descended from slaves imported from West Africa. Portugal established sugar plantations on the islands, and also used them as somewhere to resettle convicts and exiled Jews. Apart from being held briefly by the Dutch in the 17th century, the islands remained under Portuguese rule from their discovery in the late 15th century until 1975 when independence was granted. Some Portuguese remain although 4,000 returned to Portugal at the time of independence. The official language is still Portuguese.

## Economy

Cocoa accounts for 90% of the export trade, and imports are mainly of fuel and engineering goods. Main trading partners are the Netherlands, Portugal, West Germany and the USA. The economy is supported by contract workers from Angola, Cape Verde, and Mozambique, all ex-Portuguese colonies. Air links to the islands are from Angola and Cameroon.

April is a quiet month for

contests. Apart from a couple of RSGB events which RSGB members will already know about, there is really only the Swiss H-26 contest on the 26/27th. This runs for 24 hours from 1300GMT on the Saturday, includes both CW and SSB, and the idea is to work Swiss stations with, I believe, the 26 cantons counting as multipliers.

## News

VO1OC/S2, 6W1HB/701 and D2BCW are all oddities who have been on the bands in recent weeks. The S2 station certainly seems to be operating from Bangladesh, but undoubtedly without a licence. On a recent visit to England the chairman of the Bangladesh Radio Club said that it would be some time before amateur licences are likely to be issued again. Even then they will probably be limited to residents and will not be available to visitors.

The 70 station was heard back in January, passing traffic during the evacuation of Aden. Again, he was almost certainly where he said he was, but unlicensed. He is now reported to be in Djibouti.

The D2 could be a better bet. He has been worked a number of times on 15 metres CW and it is just possible that he is genuine and has a licence. If you hear or work him it seems like a case of keeping fingers crossed.

## DX net

*DX News Sheet* reports that a DX information net runs every Saturday on 14212kHz, hosted by SV1PL and EA6MR. The net runs from 1400 to 1530GMT.

F6EUF is in the Comoros Republic and has been issued with the callsign D68CF. He

will be there until December 1987. Another Frenchman, F6APG, should now be operational from the Antarctic as FT8YA.

F6HMJ, F6HIZ and F9ER will operate from the Iles de Lerins (EU58 for the IOTA awards) on 19/20 April. Still on the subject of the French, FB prefixes are now being issued to French stations for use on the HF bands. Holders of this particular class of licence will be limited to 20 watts of power, CW on 7020-40, 14050-100, 21050-150, and 28000-1000kHz, and SSB on 28400-29000kHz.

From 28 February, US licences located in Region 2 south of 20 degrees north have been allowed to operate telephony in the 7075-7100kHz sub-band. In practice this means stations in Antarctica and in the Caribbean (KG4, KP1, KP2, KP4 and KP5).

## Antilles

Jakob HB9TL will sign PJ4/HB9TL from Bonaire from 11-25 April and P4/HB9TL from Aruba from 26 April to 3 May. Look for him around 14027 and 21027kHz on CW and 14143, 14194, 14204, 21194 and 21275kHz on SSB. I presume QSLs should be sent to his home address.

## ZL1AMO

By the time you read this, Ron ZL1AMO should at last have reached Tokelau. He is scheduled to be there until 19 April, probably with the call ZK3RW. The best bet is to look for him in the mornings on 7001 or 14025kHz. QSL to his home call.

## And finally...

DK1RV has calculated that 273 of the 316 DXCC countries were active in 1985. Did you work them all? 73 and DX.

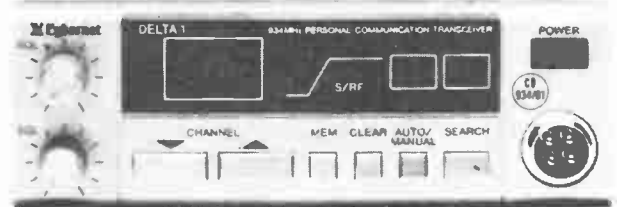


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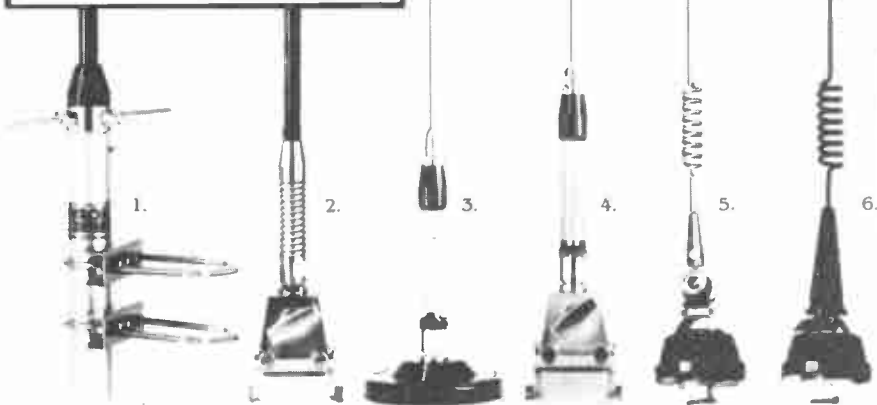
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# ANGUS MCKENZIE

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# TESTS

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Although the IC505 is a portable rig and portable operation is not as yet allowed by the DTI, it gives quite a good performance both on batteries and on 13V external power. It therefore seemed reasonable to review it now as an option for getting going on the 6m band with the knowledge that it will be easy to use for mobile and portable operation some time in the future.

A mode switch on the front panel selects upper or lower SSB, CW or FM (FM is an option which was not fitted to the review sample, nor requested), and the rig includes a miniature booster power amplifier which is claimed to give up to 10W output when switched in with a selector on the back panel. It covers 50 to 54MHz in four separate bands, although it can tune continuously across the MHz sections.

The rig incorporates a large, well-made quarter-wave telescopic whip antenna in the left side cheek, and this has to be completely pushed in when one is using the separate SO239 socket on the back panel for a 50 ohm antenna system. The only other interconnection on the back is a simple 13V dc power socket, a 2m long lead being supplied, fitted with 5A cartridge fuses in both live and neutral wires.

## Front panel

The front panel includes an 8-pin mic socket, an Icom IC-HM7 microphone being supplied which has just PTT; other types of Icom mic would be suitable for use with this rig, however. The main VFO can be selected to A or B and push-buttons can select A=B in the normal way. Six memories are incorporated with normal memory, write and read buttons, the latter also cycling through the memories. The VFO is re-selected when the VFO A/B button is pressed again. A 1MHz up button complements a tuning step button (100Hz or 1kHz steps), and a push-button selects a lock which stops you from accidentally changing the frequency, a simple rotary control providing RIT with a click off position.

A 'call' button is provided to immediately access a memorised calling frequency but, most usefully, you can VFO immediately from this or any other memory channel frequency when selected. You can memorise a new calling frequency by selecting VFO to the new frequency, then selecting call and pressing memory write.

The unit also contains a battery pack, which plugs in underneath, and this holds nine LR14 1.5V cells. Even without the batteries inserted, and with the 13V external power disconnected, the memories retain the programmed frequencies with a long-life cell. The Rx gain control incorporates the main



## ICOM IC505

### 50MHz portable multimode transceiver

on/off switch and by its side the squelch control (operable on all modes) can be pulled out to reduce power to a nominal 0.5W level. A three-position switch selects the meter to read battery or RF and S-meter, and also switches the internal lamps on and off.

A noise blanker on/off switch selects quite an effective blanker, and three additional push-buttons select scan programme, scan memory and split VFO A/B operation. The digital frequency readout indicates in 100Hz increments and shows many status functions. 3.5mm jack sockets on the front panel are used for a normal Morse key and headphones interconnection, an earpiece being supplied for this. There is also enough level to drive an external speaker.

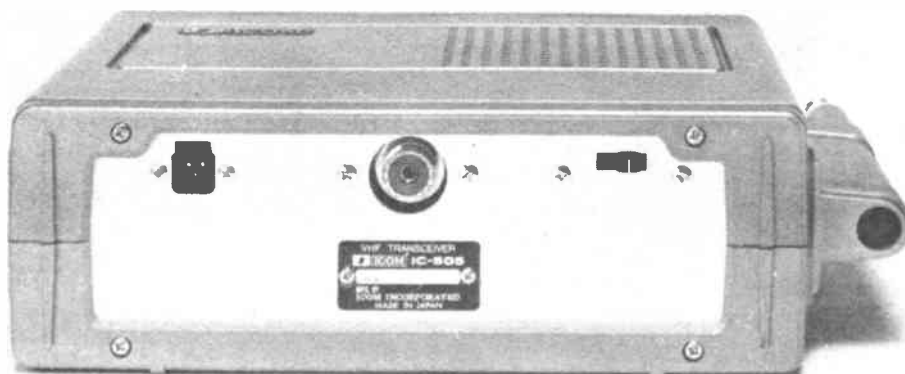
The rig comes complete with a carrying strap, which is detachable, a microphone, 13V lead, spare fuses, a 3.5mm jack plug and instructions. There are no other external connections or accessory sockets. The loudspeaker is mounted in the top of the unit.

## Subjective trials

I used this little rig on the band for two or three evenings and whilst I found the sensitivity excellent, the selectivity seemed to be rather wide. Received audio quality was adequate but not particularly good, the available volume being slightly limited.

The AGC characteristics seemed rather fast for SSB contacts with locals, but about right for CW or for working many stations of varied signal strengths in a net. The noise blanker seemed to work quite well, and whilst I was a little annoyed with the 100Hz synthesizer steps, the RIT control did allow analogue tuning over an adequate range. Speech reproduction was just slightly rough, clearly not as smooth as that from Trio rigs, for example.

I very much liked the handling of the VFO and memories and I much appreciated the call button, which I set on 50.2MHz. Most usefully, you can VFO from the calling frequency and return to it if you switch it out and then in again. In





## G3OSS TESTS

reducing to 0.5W when the squelch control was pulled out. The two-tone tests with PA on showed that the third order distortion was quite high and high order products fell just moderately well. With the high power PA switched off and with the rig thus giving just over 2.5W PEP, products were rather worse throughout. However, running 2.5W PEP with the PA switched on again, the IM performance was clearly improved.

### Poor sideband rejection

A plot showing LSB breakthrough and carrier rejection at maximum power output from a 1kHz audio source showed that the alternate sideband rejection was rather poor. I am rather puzzled that the carrier breakthrough seemed a lot worse in the presence of signal than without it, for with the audio input shorted, and thus no signal appearing at the balanced modulator, the carrier level was well below -60dB ref full output.

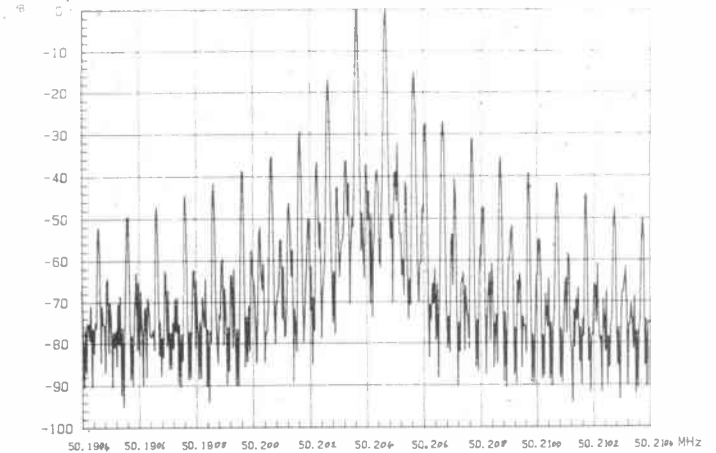
We briefly checked the Tx SSB response and noted a fairly marked peak at 1.3kHz, falling to flat at 1kHz and 2.3kHz. Below 650Hz the response fell extremely rapidly, 500Hz being 11dB down on the 1.3kHz response, and 300Hz being -30dB. 2.5kHz was -6dB, but the response was still the same at 3kHz and by 3.5kHz the output was -34dB, 4kHz being -56dB. I consider that the 1.3kHz peak may well increase readability, but surely the audio LF cut was excessive and the response should have extended down to at least 400Hz.

These measurements would give a logical explanation to the reports of a tendency to thinness in the transmitted quality. When the transmitter was giving 9W continuous carrier output, the current drawn was around 2.1A. This power was maintained reasonably well up to 52MHz (8W), whilst just 7W was available at 53 and just below 54MHz. When the rig was switched to 2.5W output, with PA off, the current consumption was just under 800mA. A frequency error of just 150Hz was noted, which is good for a 50MHz rig.

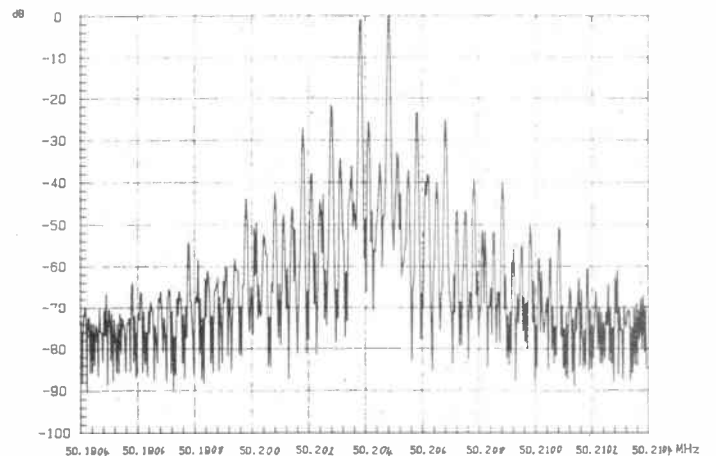
### Conclusions

As a portable rig I feel the IC505 works very well, but this is not really adequate, and because the rig has been moderately

IC505 two-tone test. Full power- PA off (2.5W PEP)



IC505 two-tone test. Full power- PA on



popular this review must consider the suitability for home station operation. The RF sensitivity is fabulous, but the whole receiver has rather an early synthesizer design and the performance falls rather short of what I would like to see for fixed station use.

The Tx side is good enough, but the entire rig is far outclassed by a combination of the muTek transverter with a good HF rig.

The rig will become far more useful in four or five years time when we are getting near the next sunspot maximum, but surely by then there will be far superior rigs available as the world-wide demand will have expanded enormously. At its old price of £350 purchasers were almost getting value for money, although they were possibly buying an inappropri-

ate rig, but the latest price of £489 including VAT is ludicrous. World-wide demand for 50MHz rigs is now so small (near sunspot minimum) that the much smaller production lines are causing the grossly inflated prices. Therefore, the rig is very poor value for money now, as unfortunately is much of its competition, as the use of a transverter will not only give a far superior technical performance, but it will be much cheaper as well.

### Many thanks

Very many thanks to my colleagues, Jeff Ginn and Roy Brooker, for helping with the tests, and to Thanet Electronics for the loan of the review sample, which will be on its way to a happy home by the time you read this, as it is the last one at the old price!

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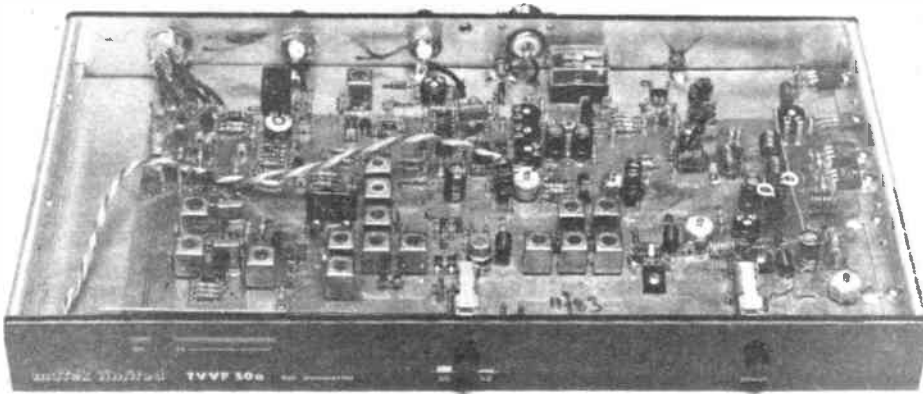
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## MUTEK TVVF50a

### 50/28MHz transverter

In the April 1985 issue of *Amateur Radio* I gave a very favourable review to the muTek TVVF50c 50MHz transverter, which had an IF for direct interconnection with 144MHz transceivers. Shortly after muTek issued the 50c came the 50a with a 28MHz IF, and whilst they sold a lot of the transverters abroad sales were, of course, very limited in the UK as there were only 100 potential users of 50MHz transmitting equipment licensed to operate. Sales of both versions within Britain shot up over the Christmas 1985 period, with the announcement that the band would be open to class A operators from 1 February 1986. As I feel that the 50a has a very high potential for use by stations already equipped with an HF transceiver, I thought that a separate review would be fully justified.

The TVVF50a has an on/off push-button on the front panel, together with another button to select output frequencies from 50 to 52MHz, or 52 to 54MHz. On the back panel are BNC 50 ohm sockets for 28MHz Tx drive, and a separate one for Rx output. The drive socket can be used for transceiving if an internal wire is adapted (instructions are very clear about this). The antenna connection is on an SO239 socket.

#### Socket facilities

A DIN type socket is provided for 13V dc power interconnection and some other very useful facilities. Pin 5 is 13V positive, pin 1 is ground, pin 3 is negative going ALC, pin 4 is the high impedance PTT line (an internal connection change can allow Tx with 12V positive) and pin 2 is normally supplied to provide 30 ohms to ground on Tx and open circuit on Rx. By changing internal connections, pin 2 can provide either 8 or 13V positive when the transverter is switched on, for disabling the PAs on various rigs when the transverter is selected. There is an internal HT fuse, and the rig is reverse

power protected.

RF sensing for Tx is also provided, and the sensitivity is independent of the setting of an input preset for setting input drive sensitivity. Approximately 4mW drive is required to pull the rig over to Tx, and it relaxes to Rx if the power reduces to below 1mW, a short hold time of 1 second being provided which can be changed to be instantaneous if an internal connection is cut. It is better to use PTT, of course, in which case one would normally cut the hold time.

A series of four power output LEDs is provided as in the 50c, and these usefully indicate the instantaneous peak power being achieved. Another LED indicates power on and a final one indicates Tx.

#### muTek's circuitry

The input 28MHz drive is first sampled by the RF sensing circuit which has an intentional hysteresis action as previously explained. The drive then passes through a small relay, and thence to the drive preset which gives an average load impedance of 100 ohms to the input. This preset adjusts for input drive levels from as low as  $-13\text{dBm}$  to  $+25\text{dBm}$  ( $50\mu\text{W}$  to  $300\text{mW}$ ). This preset is immediately followed by the pin diode attenuator which is dc current controlled from the internal ALC line.

This is followed by what muTek describes as 'an active fuse', consisting of a low gain transistor to increase available sensitivity, which is intended to blow if excessive input power is momentarily sent. This is immediately followed by one of the pin diode switches which drops a section of the circuitry into either the Tx or Rx path, this including the mixer of course. A 28MHz bandpass filter is provided, and this is matched straight into muTek's own design of four diodes in a ring mixer.

The local oscillator injection is at a 16mW level and is provided by either of

two JFET low noise oscillators at 22 or 24MHz, dependent on whether the user requires 50 to 52MHz or 52 to 54MHz. The mixer output at final frequency passes through a 50MHz bandpass filter, which has an additional trap at 48MHz. There is another pin diode switch after the filter which is followed by a class A amplifier (2N3866). A 5 pole Tchebyshev bandpass filter follows, which feeds another class A stage (2SC1957). The output from this stage is at 100mW, and this drives into another 2SC1957 in class AB which has heavy negative feedback around it.

The PA consists of two 2SC1945s in push-pull, feeding into a 7 element low pass filter which drives into a directional coupler which has two specific functions. The reverse power output is used to control output power protection, whilst a sniff of the forward power operates both the ALC detector/amplifier and the power LED indicators. The output then goes through a relay to the output socket.

#### Receive matching

The receive path from the input relay is matched into a pair of BF981s in push-pull, with a bandpass filter and matching circuitry, including slight attenuation into the mixer network, switched by the pin diodes. The mixer output again goes through a bandpass filter incorporated around a BFR96 amplifier which has negative feedback. The output level is controlled by a preset which can be adjusted to give the required system gain, the output appearing either on the independent BNC socket or via the 28MHz relay to the drive BNC socket when using transceivers having a single transceiver drive socket.

The ALC loop around the transmitter section is extremely important for it offers two separate facilities. It is arranged to accommodate a wide range of drive levels, and allows the output to limit at around 11W even if the input drive control is maladjusted. Up to around 20dB gain reduction by the internal ALC loop is easily accommodated. However, there is also a negative going ALC output available on one power socket for direct connection to the ALC input of a transceiver.

Most transceivers on the market have their internal ALC loops made ineffective when the PA is turned off by one means or another. Unfortunately it is therefore only too easy to overdrive the transverter drive from the transceiver. When the ALC from the transverter is interconnected with the transceiver's external ALC input it is impossible, under normal circumstances, to overdrive the transceiver. This keeps the entire system intermodulation performance to a minimum, whoever happens to be shouting down the microphone! The ALC line delivers peaks of up to  $-7\text{V}$ , which should be more than enough to back off any modern rigs.

To prevent excessive system ALC it is advisable to set the input drive preset so that during normal use there will not be



## G3OSS TESTS

excessive gain present. I would recommend no more than around 10dB ALC action if noise pumping is to be avoided when you start and stop talking. Furthermore, the presence of too much system gain exaggerates any carrier breakthrough or IF noise present in the transceiver.

You might well wonder how a negative going ALC is derived when there is no negative rail requirement from an external power supply. Chris Bartram, the designer, uses a neat little 7kHz audio oscillator which, when rectified, gives a negative rail from which the ALC is derived. This is a useful trick which could so easily be used by other manufacturers for all manner of applications.

### Subjective tests

I received the review sample a few days after the band was opened up on 1 February, and I was able to use it for the massive aurora period on the following Friday and Saturday. It only took a matter of minutes to set up the equipment, including the RF drive level, and I received reports of extremely high quality transmissions when I was using the TS940S as a drive source. The ALC loop worked superbly well, and several stations commented on the narrowness of the transmission.

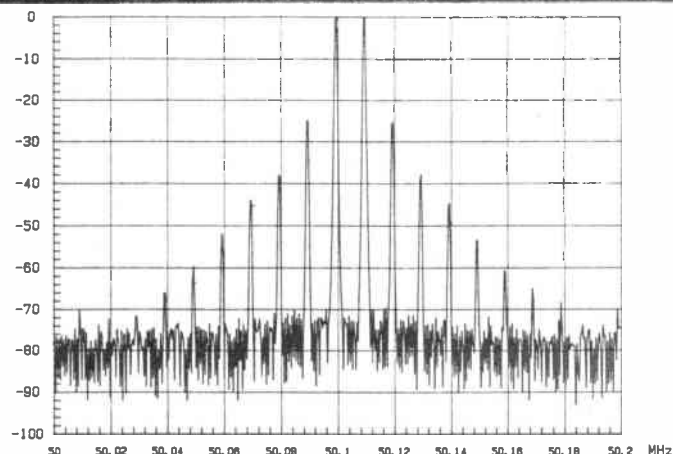
The receive section had perhaps slightly too much gain but I could have rectified this easily by adjusting the internal Rx gain preset, which I did not bother to do. In practice I just put in 10dB attenuation on the TS940S. Beacons came up exactly where they should, and it was quite clear that the transversion accuracy was excellent. Compared with previous 50MHz transverters, I noted fewer strange whistles and those that I did hear could be directly attributed to computer breakthrough from other households.

The system sensitivity was so good that I judged the noise figure to be better than I really needed. Thermostats have always been a bugbear and at least three cause me continued aggro, one of them regularly coming up to strength 9 for about 20 seconds every few minutes, which is why I unfortunately miss some remarks in QSOs. The transverter was extremely stable and seemed completely beyond criticism, which is a very rare statement to make.

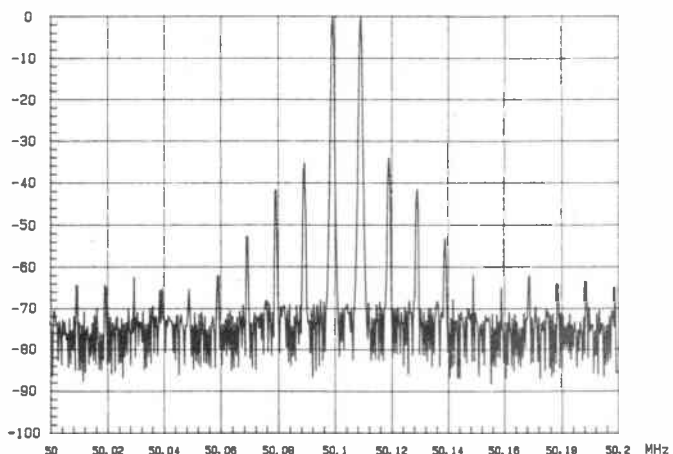
The drive preset is a linear pot, and since the available sensitivity is very high, quite a few users will be using this preset very close to minimum gain. Chris Bartram has suggested clipping out a capacitor around the input circuit which decreases gain, allowing the preset to be turned to a more reasonable position for drive levels of 10mW and above. The provision of the 52 to 54MHz section is primarily intended for the export market, but it is also useful to receive in this area to check band propagation, by receiving TV video around 53.75MHz for example. This can be used to show the presence of tropo-ducting or sporadic-E.

The rig is enclosed in the usual muTek

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two-tone Tx  
products at  
12.5W PEP*



*muTek TVVF50a  
two-tone Tx  
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4W PEP*



metal box, finished in brown, and it is very simple to take the lid off to access the internal presets and circuitry. The standard of workmanship internally is excellent, and it is easy to identify the various presets and connections.

### Laboratory tests

Although I did not actually measure the RF sensitivity, it seemed to be no different from that of the 50c version, and the noise figure must therefore be around the 2dB mark, which is easily good enough for the band under all circumstances. The gain at 50.1MHz was just over 19.5dB, with the internal gain preset flat out, but gain rose to 22.5dB at 51MHz and had fallen again to the same as 50MHz by around 53MHz. The gain fell extremely rapidly below 50MHz and above 54MHz, and one is hardly likely to get any problems because of the excellent bandpass filters employed.

The RF input intercept point measured out at +0.5dBm, which I consider excellent for the band, although muTek are now achieving even better than this on their later 144MHz transverter. This compares very favourably with other transverters for the band, which have been as poor as -20dBm input intercept point.

The transversion error was no worse than 130Hz, and this should be close enough for even highly specialised use, although one could trim the crystal for even better accuracy if necessary. We checked the 6MHz image response ( $6 + 22 = 28$  MHz) and no 28MHz output was detectable, even down at -90dB. The

local oscillator breakthrough on the 28MHz output socket was at the low level of 1mV, and this should not harm any reasonable rig.

I thought I ought to look for any possible beat products and I eventually found that a 72MHz input gave an output level 71dB down on the level that would be produced from the same input level at 50MHz. This is far superior to all the competition I have checked, with a similar IF.

The maximum output achieved from the transmitter was 11W from a single carrier or 12.5W PEP from two-tones. The ALC range was at least 20dB, which is excellent. The maximum input sensitivity was -13dBm at 50MHz for full output, and this is easily sensitive enough for even the lowest output rigs from Yaesu and Icom.

The system gain did increase by 6dB for an input frequency of 30.4MHz (producing 52.4MHz output), but this variation of gain is no problem. It results from the very narrow bandpass characteristics which are provided to eliminate input and output out of band products. The overall gain almost completely collapsed below 26.5MHz and above 33MHz. The PA output itself nosedives outside the band 49 to 54MHz. The second harmonic at 100.2MHz measured at -68dB, and the third at -72.5dB, whilst all other harmonics were below -80dB. No 22MHz or 44MHz outputs were detectable, and there was no trace of any 72MHz output (2 LO + 28MHz).

Several two-tone IM plots were taken, and from those illustrated you will see

that the performance is excellent at full output and superb at one third output, although I am slightly puzzled that the very high order products do come up slightly at low output levels.

No drift was noted over long periods of use, and the average current drawn was never more than about 3.5A.

Because of the present ERP regulations, you may wish to operate the transverter at a greatly reduced power if you are using an external linear to increase power, but wish to avoid any possibility of transmitting excessive

power. The ALC threshold preset can be used to drop the maximum output power to as low as approximately 1W. This may be welcome for the time being, allowing one to obtain, say 2.5W PEP which, when amplified by 10dB would give 25W. Allowing for 1dB cable loss, this would give 20W at the antenna, and thus 100W ERP from a 5 element tonna.

### Conclusions

I most warmly recommend this superb transverter as the most convenient way for class A licensees to get on to the

band, and I feel that muTek have thought of everything for the convenience of optimum interfacing. I praise, in particular, the superb internal and external ALC provision, and the technical performance of the entire unit. This is a product that other manufacturers will find hard to beat, and I am delighted that it is British.

Many thanks to muTek for the loan of the review sample, to my colleague Jeff Ginn for help with the measurements and to the DTI for co-operating so magnificently with the RSGB for UK amateurs to have the band.



If you want to have a general coverage VHF antenna facility, you can either choose, for vertical polarisation, an appropriate discone which can be used for Tx and Rx, or you can use a general coverage antenna, such as the Dressler ARA500, for receive only. Dressler's concept is to have an antenna at masthead which is as small as possible and contains a complex pre-amplifier circuit allowing the antenna element to match over a very wide frequency range.

This pre-amp is fed with dc up the co-ax, and a 7 metre length of fairly thin co-ax is supplied, terminated in PL259s. The dc interface has an SO239 socket for the antenna cable connection and an attached co-ax output lead with a PL259 on it, which can be used with any suitable receiver using an adaptor if necessary.

## THE — DRESSLER ARA500 — General coverage VHF Rx antenna AND THE — GDX2 DISCONE — Available from South Midland Communications COMPARED

On the side of the interface is a 3.5mm jack socket into which the output from the mains PSU can be connected, the power supply giving 12V dc at up to 80mA.

The antenna itself, together with its pre-amplifier, is inside a fat plastic tube around 90mm in diameter and 450mm high. At the base of the antenna there are bolts and clamps allowing it to be mounted at the top of a pole, which can be from 32 to just over 50mm in diameter. The antenna should be mounted above any metal obstacles to avoid any disturbances of its directivity pattern and impedance characteristics.

The pre-amp has been designed to allow the antenna to cover the 50MHz band to about 600MHz with a good performance, but although it is claimed to be satisfactory up to 900MHz, I found that the performance fell off very rapidly in this region. The circuitry is fascinating, for the antenna itself is etched onto a long printed circuit board. On the same board are the wideband, low-noise pre-amplifier and impedance matching networks, the circuit being designed in a way that achieves greater consistency in performance than usual. The complete printed circuit is mounted vertically inside the outer plastic tube, which is impervious to ultraviolet light, thus allowing the entire structure (which is also waterproof) to stay up in the air for years without any harm coming to it.

Incidentally, the aerial's small size means that it could probably be installed on roofs on which local authorities or estate managements would not normally allow aerial erections. You might even get away with a claim that you are interested in birds and that the entire apparatus is an owl rest, with a built-in

heater to keep their claws warm!

The etched antenna feeds into a two stage wideband amplifier, incorporating a matching and balun network. The design is claimed to be unique in the fact that it can handle very high signal levels present across the VHF spectrum without noticeable IM products. The two amplifier stages employ transformer derived negative feedback for improved linearity and input matching. The noise figure is claimed to be between 1 and 2dB from 50 to 300MHz, with an average gain of 15.5dB, from 2 to 3dB from 300 to 500MHz with 15.5dB gain, 3.5dB from 500 to 650MHz with 14.5dB gain, and from 3 to 5dB from 650 to 900MHz, with gain reducing to 11dB at the top end of its coverage. The amplifier employs thick film hybrid technology.

### Subjective performance

I have used the antenna for some weeks at a height of 12 metres above ground, and have compared its performance with that of an enormous Japanese discone which covers the frequency range 50 to 500MHz; I also compared it with a Nevada vertical collinear resonant on 934MHz. Most of the tests were with an AR2002 general coverage VHF/UHF receiver, which I reviewed in the January issue of *Amateur Radio*.

The AR2002 is moderately sensitive across its complete range, and the noise from the Dressler pre-amp overcame the front-end noise of the receiver; thus the installation sensitivity was entirely dependent on the performance of the Dressler. The discone of course contains no pre-amp and was thus directly interfaced to the receiver. In general the discone performance was slightly better



# G3OSS TESTS

at its LF end when compared with the Dressler, as it has more metal up in the air, but at UHF (eg 70cm) the Dressler performed remarkably well.

Both ground based transmissions and aircraft were received extremely well, but since the actual levels of many signals entering the receiver were a lot higher from the Dressler than from the discone, slight intermodulation was encouraged because of the performance of the AR2002 itself. We checked this by doing some very careful measurements on Band II.

## Signal strength comparison

The discone and Dressler antennas were each in turn interconnected with the Marconi 2382 spectrum analyser and plots were taken of various VHF bands to compare received signal strengths.

Looking at plots 1 and 2, covering 85 to 105MHz (Band II FM etc), the levels into the analyser from BBC Wrotham can be seen to be around  $-33\text{dBm}$  ( $5\text{mV}$ ), although Radio 3 was much weaker for some odd reason. The average levels from the discone were around  $-42\text{dBm}$  ( $1.8\text{mV}$ ) from R2, 3 and 4, but note the unequal signal strengths again. This makes it rather difficult to compare the antennas directly, but it is probably due to reflections from other metal objects and masts which I could not avoid in my circumstances, my entire roof tending to resemble a hedgehog type surrealist forest.

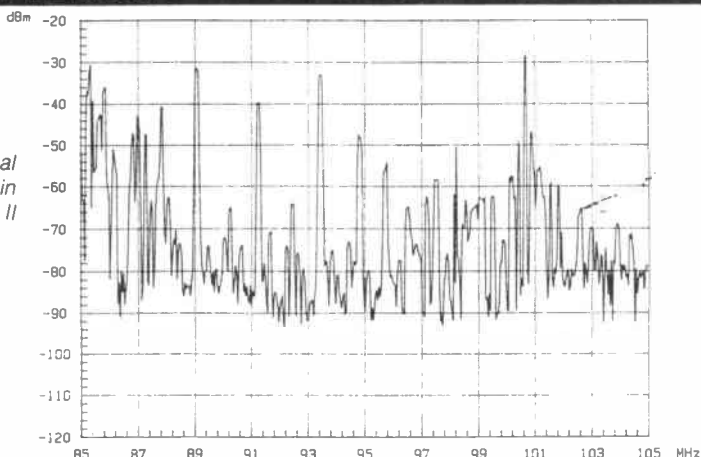
It might be said that the best to worst ratios are not fair and one should compare best with best and worst with worst, assuming that the approximate field strength in the neighbourhood of my roof from Wrotham (vertical polarisation component), excluding the effect of other poles etc, should be about the same from all three networks. The  $6\text{dB}$  higher signal level from the Dressler thus seems fairly typical, although I would accept that an  $8\text{dB}$  difference might be fairer. Taking into account that the Dressler antenna gain is claimed to be around  $15.5\text{dB}$ , we might thus assume that the discone has  $7.5\text{dB}$  more 'metal in the air', which seems about right!

The type of pre-amplifier design has to match what is in effect a vertical antenna, which would have dramatic impedance variations over its coverage. The system noise figure, therefore, complete with antenna related to field strength, will actually vary quite a lot, but this did not seem to be a problem in use.

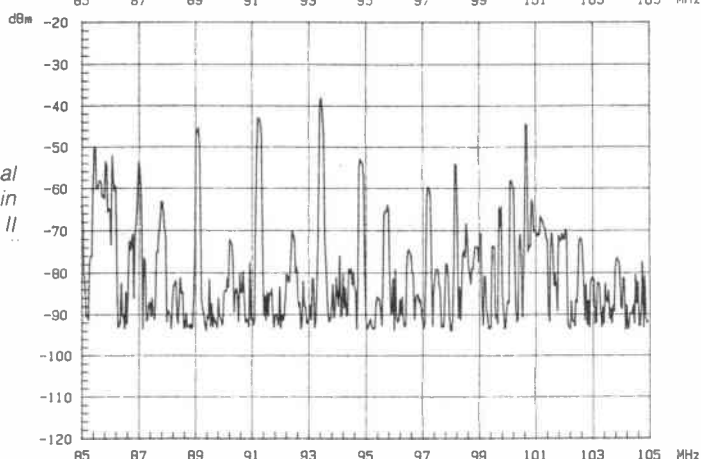
## No trace of IM products

We used the Marconi analyser to have a look for any remnant of intermodulation by tuning the analyser to predictable intermodulation products from various combinations of the strongest detectable transmissions. The noise floor of the analyser, with an appropriate bandwidth for looking at modulated carriers, would be below  $-120\text{dBm}$ , but we could not detect any trace of IM products at all, which is a credit to Dressler. I can thus infer that the intercept point referred to

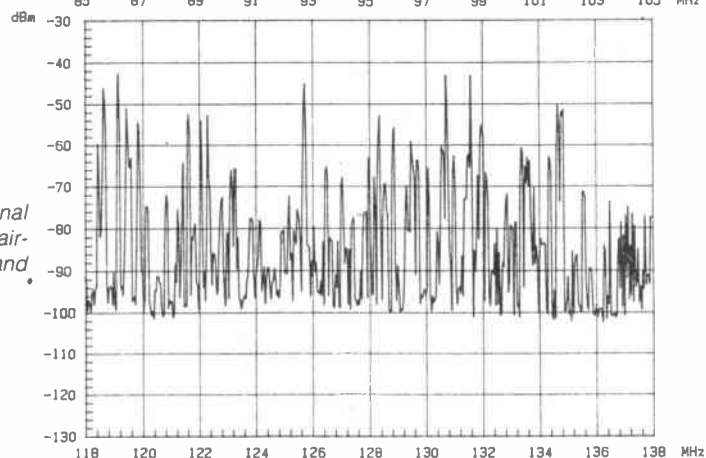
*Dressler ARA500 signal strengths received in Band II*



*VHF discone signal strengths received in Band II*



*Dressler ARA500 signal strengths received in aircraft band*



the output must be significantly above  $+15\text{dBm}$ , and Dressler actually claim  $+18\text{dBm}$  for third order input intercept, which should be good enough for any average user. I suppose you could be in trouble if you live within  $2\text{km}$  of Wrotham, but such a location would bring many other serious problems anyway!

We also scanned the frequency band  $118$  to  $138\text{MHz}$  (plots 3 and 4) which covers the aircraft frequencies. We used the peak hold facility on the analyser, which we left scanning for several minutes on each antenna in turn, but some of the transmissions from the air could well have been producing stronger field strengths than others, so the plots can only be a rough indication. It would seem that the Dressler might be typically producing signals around  $10\text{dB}$  higher than the discone, but one isolated transmission on the latter did produce a

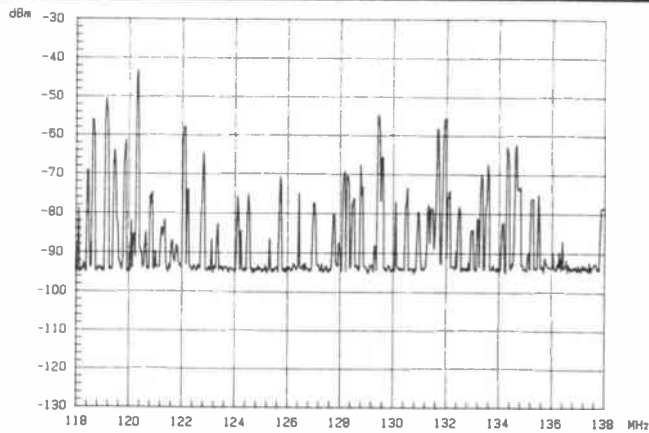
colossal signal strength of  $-43\text{dBm}$  ( $1.6\text{mV}$ ) at around  $120\text{MHz}$ .

## Equal performance

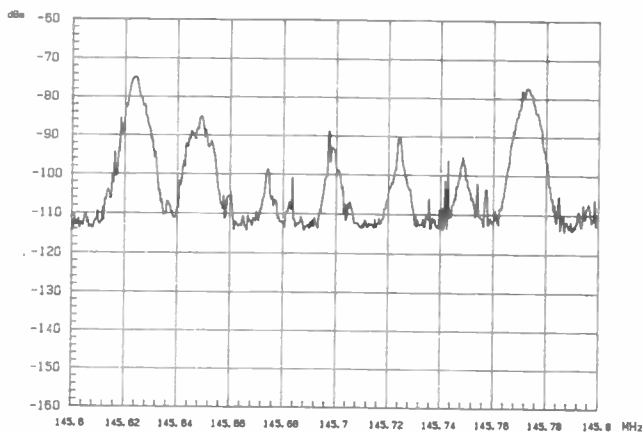
Both the antennas are clearly very good at picking up high angle radiation and it becomes a matter of signal-to-noise that is important. The two antennas were about equal in performance on this band, but if I used an external low gain muTek broadband amplifier on the discone set-up the system noise figure resulting did produce an apparent superiority on the discone. It was possible to hear talk-down over an enormous radius with both antennas.

Plots 5 and 6 show the levels of repeaters in the  $144\text{MHz}$  amateur band, the plot range being from  $145.6$  to  $145.8\text{MHz}$ . There are considerable variations here between the outputs of the two antennas, and differences are

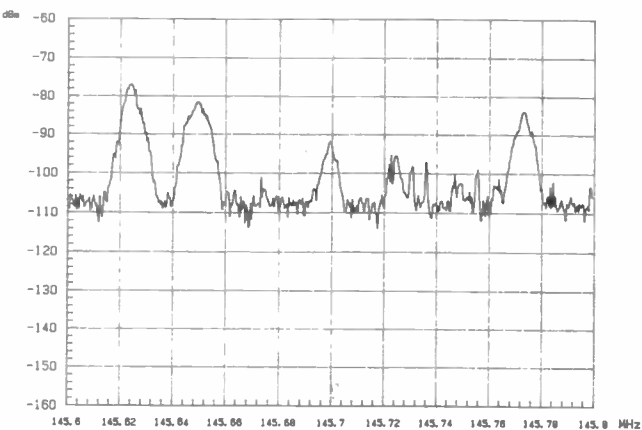
# G3OSS TESTS



*VHF discone signal strengths received in aircraft band*



*Dressler ARA500 signal strengths received from 145MHz repeaters*



*VHF discone signal strengths received from 145MHz repeaters*

clearly not as predictable, the transmissions themselves coming from antennas which are, on average, closer to the ground. The Dressler's superiority in actual output levels is therefore not so clear here, but it is worth noting that the discone is at an advantage as it is much more in the open, towering above one of the corners of my house without any poles near it, although a horizontal log periodic is below it. In general use the Dressler received vertically polarised NBFM signals very well, even when coming in from a surprisingly wide radius, but the discone was clearly superior because of its 50 ohm match and the amount of metal up in the air.

Looking at signals in the VHF mobile band well above 146MHz and taking an average of the levels from dozens of stations, the output from the Dressler averaged about 7dB higher than the

discone's.

This seems to tie in with the average of the lower frequency measurements. It was not possible to do a plot of the UHF spectrum, but comparisons on the AR2002 were reasonably favourable to the Dressler, and many 433MHz repeaters could be received very well, the noise figure of the Dressler being very good here. Above 500MHz there is not much to receive which is vertically polarised until you come to the 934MHz area. Here I compared the performance with that of a UHF discone and a vertical collinear. The Dressler was very poor indeed above 900MHz, even when compared to the UHF discone at a similar height, and if you wish to receive 934MHz signals then I would strongly recommend a dedicated vertical collinear which will bring in signals perhaps 20dB stronger!

## Conclusions

The price of the Dressler ARA500 is at the moment around £100 including VAT, although the importers, Dressler UK Ltd, inform me that the price will be going up shortly due to the pound/deutschmark exchange rate problem. This has to be compared with £63 including VAT for the GDX2 discone available from SMC Ltd. Both the antennas cover the same frequency range and you can always hot up the performance of the discone and typical receiver combination by adding a low-gain muTek or Datong broadband pre-amplifier.

The GDX2 discone is enormous and quite frankly very unattractive to the average nearby householder, although you should be able to get away with it in most locations. It is quite heavy, and sways around a bit in the wind. The Dressler antenna is not recognisable as an antenna and you would almost certainly be able to get away with it even in the trickiest planning situations. The discone antenna takes ages to put together and install, whereas the Dressler is simplicity itself, and the discone would be fairly easily damaged by larger birds landing on it.

## General coverage only

If you are just interested in general coverage reception, the Dressler is to be highly recommended as a way out of a problem, and ordinary monopoles just cannot cover the tremendous frequency bandwidth adequately, even for reception only, especially if you want to pick out the weaker signals. It would be most beneficial to put the Dressler antenna as high above ground level as possible, preferably at the top of a tall pole, and you should not have any significant down-lead losses, even with fairly inexpensive co-ax as an extension, as there is adequate pre-amp gain within the antenna to overcome such losses.

The antenna continued to pick up signals in other amateur radio bands when I was transmitting a given band on another antenna, provided that the proximity to other antennas was kept as distant as possible.

I feel that it is a pity that Dressler could not have made the antenna much more useful at the very top end of its range, and it would have been particularly fascinating if it could have extended its coverage up to at least 1.5GHz with improved pre-amp and RF transformer design, and perhaps they might consider a UHF/microwave version for more specialist requirements.

Don't forget that the pre-amplified signal levels will create a more difficult scenario for the receiver and I would recommend the use of a high-pass filter with a knee around 115MHz for rejecting the very strong Band II signals, which might otherwise cause overload on some poorer VHF general coverage receivers.

Thanks to Dressler UK for the loan of the antenna and to my colleague, Jeff Ginn, for putting it up in very cold and windy weather.



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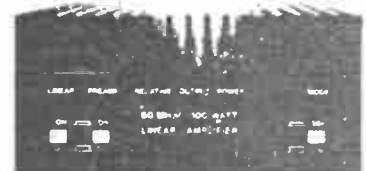


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 Pre-amp Gain..... 12 dB Typical  
 RX Noise Factor..... Better than 1.5dB

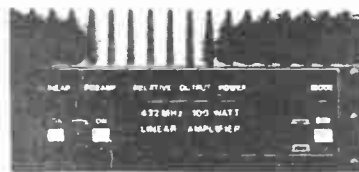
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# SHORT WAVE LISTENER

TREVOR MORGAN GW40XB

As I write we are nearing the end of January, and the bands are still 'rather poor... condition unchanged', as we would say in my profession.

Despite the seasonal changes in the conditions and the extremely low sunspot levels, there has still been some good DX to be found on eighty and forty, with a few contacts on twenty metres when conditions improved a fraction.

## Good training pays

This is the period in the sunspot cycle when those who have trained themselves to listen hard find the DX, while others bemoan the conditions and turn the receiver off.

One of the best training fields for learning listening techniques is down on eighty metres... around 3,560 to be precise.

This is where you'll find those blokes who, against the presently popular pastime of spending as much hard cash as possible for the biggest signal in the neighbourhood, find their challenge in putting out as *small* a signal as they can get away with while still having worthwhile contacts.

Let's face it, if you can't work the world with 400 watts you might as well take up knitting! Even after you've done that, with few to challenge you, what is there left?

Conversely, the low power operators are not so much interested in DX for its own sake, but more in *what* DX can be worked with powers that are not only miniscule in comparison with the growing majority of newcomers to the bands, but a darn sight more social towards other users.

## Be single-minded

So, what has all that to do with listening? Listening for QRP stations, whether it is to work them or just log them as an SWL, calls for patience and the ability to be single-minded. It's not easy (nothing worthwhile ever is) to sit with your ears roasting under

headphones, fingers softly tuning around a narrow range of frequencies, using the filters to tune out the invariable intruder, tweaking up the antenna to peak match and listening... just listening.

Just a few hours on the QRP calling frequencies can teach the SWL more than months on the major parts of the bands. This experience pays dividends when on a busy frequency and everyone and his brother are calling that rare station you need for DXCC, and he is down in the noise.

You sit there for half an hour, an hour, maybe, trying to blank your mind to the 'kilowatters' fighting each other. Then you have him logged and you can resume the hunt.

## Similar problems

Broadcast listeners have the same problems as the amateur listeners when it comes to weak signals among the 'big guns', and it takes dedication to winkle out some of the smaller broadcast stations.

This perseverance pays dividends and will give you more satisfaction than a log full of '5-9' reports. The transmitting station will also be more impressed by your efforts if you can verify his signals at '3-1' despite lousy conditions and a pile-up; especially if he's only running 3 watts! Try the 14060 portion of 20 metres too.

## In the know

Many thanks to all of you who returned the details for the Listeners' Information Exchange. By now you will have received the information package and will know what it's all about. It's taken a lot of work to get the group under way, but your response made it worth the effort. Thanks.

If any new readers are interested in joining the outfit, just drop me a line at the usual address and I'll send you the info.

Our intrepid award hunters have been scanning the bands again this month and claims are climbing the Gold ladder at a rate of knots.

## Frame-up

First in the frame this month is Jukka Kovanen OH3GZ, who hails from Riihimäki, Finland, and claims Bronze and Silver awards for 2-way, mixed modes.

The majority of contacts were made before noon and Jukka offered ZM1, HW5, J28, 9H3, 8P6, K7, 5B4, YB3, 5N2, VP9, and a fine crop of Japanese and Stateside stations for his 500 plus.

It's nice to receive another claim from outside the UK. Welcome aboard, Jukka!

A first claim for a Bronze award comes from Jim Marchant RS87371, from Northfleet in Kent. Jim offered A22 (Botswana), A71 (Qatar), CE5, CP2, HP3, J28 (Djibouti), J88, TR8, TZ2 (Mali) and a choice selection for his 264 total.

Using the Trio R600 combined with the Datong AD370 active antenna, Jim is well in to the hobby. His Spectrum computer assists with the RTTY, CW and SSTV, while the WAB nets get his attention on sideband. Welcome to the column Jim!

## New to the award

Stuart Field RS87096 hails from Barningham, Suffolk, and puts his first claim in for Bronze. Stuart used his Yaesu FRG7700 set-up to pull in 4N5, 5H3, 5Z4, 9M2, A71, HH2, PY7, VP9 and sundry others for his opening score of 280 prefixes.

Stuart, a keen member of Edgware DRC, uses the old standby long wire for HF via the essential ATU, and hopes to have his Commodore 64 computer set up for RTTY and CW very soon. By the way, good luck with the RAE studies, Stuart.

Next in the line-up is Alex Pyne G4UNH, of Bradford, with a claim for 522 prefixes worked. No details are given regarding equipment but a fine list, including 4O0IYY

(QSL via YU2AKL), 5H3HM (Babati), 5T5MS, 5Z4EJ, BV2B (Taipei), J28DN, J87TIY, VK7GK, VU2DK and ZY5TT, was submitted to gain the Silver award. Well done Alex.

Roy Goddard RS87865, of Gloucester, used his Hallcrafters SX28 and G5RV to gather in A35, D44, DU9, J88, J73, TZ6, VP2, VP9, VU2, ZP5, 5B4 and 7P8 amongst the 500 plus prefixes for his Silver award.

Roy also uses a Search 9 with a two element quad and eighteen foot vertical, and is a keen award hunter.

## Double celebration

Finally, for this month, a double celebration for Charles Morgan RS52481, Croydon, who upped his score to 693 prefixes towards his Gold award and announces his success in the RAE. Having gained Distinction in part 1 and a Credit in part 2, he promptly flogged his old Eddystone 840 and took delivery of a nice new Icom IC740 transceiver - now for the dits and dahs, mate!

So to the rest of the mail, and off to a fine start with an important announcement from the Barking Radio and Electronics Society about its 1986 144MHz contest to be held on Sunday 6 April, 1300 to 1700UTC. The contest is open for all modes and sections for high power and 20W maximum. An SWL section is proposed but will depend on the response, so get listening lads! Details from 32 Wellington Road, Rayleigh, Essex SS6 8EZ.

## Getting a bit...

Next we had a letter from Angela Sitton of Stevenage who is taking the RAE in May and has been getting in a bit of listening with the Heathkit HR10B with a 90 foot end-fed. Angela has a few QRM problems generated from various computers in the house. Her observations were interesting in that the Spectrum gives the most, a bit less from the Electron and none at all from the Texas.



This is a problem that we all suffer from in these days of computers, especially as more listeners are using them for RTTY, CW and simple log keeping. Although I have made many enquiries, I haven't found anyone who has successfully dealt with the problem.

#### Cure claims

There have been many claims for cures, including metallic foil, metal based paint and even steel casing of the computer, but I haven't heard of one of them being successful.

Personally, I do not find my own Spectrum obtrusive on most of the bands, but do get QRM on some frequencies when loading or when selecting something from a menu. In other words, when the computer is 'active'. When in a receive mode, any QRM is at a low level and hardly a nuisance. What do you find?

A plea for help has been received from Dave Howes, 149 Warren Wood Road, Rochester ME1 2XG, who is anxious to obtain a Yaesu FRV7700E (for marine reception). He currently has the model A and is open to exchange offers.

#### Dark corner of Malta

Eddie Gauci out in Malta was pleased to receive his package in January, and finds that the 'Gold' prefix trophy and the 'Jamboree' trophy brighten up a dark corner of his shack. Right chuffed he was! Poor old Eddie has to wait four weeks for his *Amateur Radio* to get out to Sliema, but he looks forward to receiving the news.

A nice letter arrived from Martin Moss RS86999, from Ilford, to say that he'd passed the December RAE and is studying hard at the key. Martin was complimentary about the RAE test questions published in the magazine as he found them a great help in his study.

He's now getting his FT101E ready for the onset of operations, and trimming his wires so that his first signals are certain to be good ones. Well done Martin.

This month's featured listener is Peter Cardwell, who operates from Sheffield. Peter started listening about seven years ago with the Yaesu FRG7, which served until his work became too

much and he had to sell up. Later on he bought the Trio JR310 and started experimenting with antenna systems to squeeze the last ounce of signal out of it.

Another change brought the FRG7000 into use with an ATU and pre-amplifier to assist the aerials. Although results were quite pleasing, Peter was still not satisfied and a 27MHz vertical was set up at forty feet, with a pre-amp at the receiver end. This seemed to do the trick and some excellent DX was received. Reading the amateur radio press and specialist books encouraged yet more experimenting.

#### Vast difference

Eventually he added a Hy-gain 18V antenna, which made a vast difference, and Peter found that he could copy all the Americas at any time of the day.

His experimenting didn't cease, however, and a home-brewed T2FD dipole fed with 300 ohm ribbon complemented the vertical by bringing in the Mediterranean area and most of Europe.

In the spring of 1985 a 20m wire beam was constructed, which brought in the real DX, but upgrading the receiving system by adding the FRV7700/V, FF5 filter and FRA active filter brought in just about every call area possible, and new countries were being logged daily.

Now there was only one way to go – after watching the RTTY demonstration at a rally he decided to get in on the act, and a Spectrum Plus was installed bringing the system up to date.

#### Impressive stuff

Soon after joining the Sheffield ARC, Peter attended a lecture and demonstration of Trio equipment. This impressed him enough to encourage him to invest in the R2000 and VC10 converter, which fed by the 18V through the Mizuho KX3 with 108ft end-fed and dipole for back-up, is his station at present.

Also in the shack are the Daiwa 606K filter, SEM pre-amp and a Hammarlund Super-pro (presently undergoing a facelift), and additions to the antenna system including a Discone for 65-520MHz.

Peter says that his station is now complete – except for some more aerials that are in the construction stage, and a possible tower for a beam, and...? But maybe his duties as secretary of the Sheffield ARC will slow him down a bit!

#### Interesting history

I find Peter's listening history very interesting; he has obviously spent a great deal of time testing different equipment and, as a result, has spent a lot of money too. But what I find most interesting is that his story started in 1978, and his experiments with antennas and equipment have taken place over a period when the radio conditions have been on a steady decline due to the reduction in sunspot activity.

Despite this his reception has still managed to improve and his interest has continued to grow rather than waver.

#### Chinese presentation

This month I received a very nice letter from the National Wireless Museum in Ryde, Isle of Wight. Douglas Byrne G3KPO, curator of the museum, sent me some interesting material given to him in China during a visit there to see the museums.

The material, including a pennant and a beautiful rice paper 'tiger', was part of a presentation to Douglas by Radio Beijing (Peking) during his visit.

Doug was shown over the vast studio system used for their international broadcasts, and he was invited to record his comments for future programmes.

With the current growth of amateur radio in that country it must have been as interesting for the Chinese to meet a licensed amateur from Britain as it was for Doug to meet them!

#### Responsive radio

The literature showed how responsive Radio Beijing is to listeners, with pictures of calendars, diaries, key-rings, pennants, and many other items that are sent to those sending regular reports. Listeners' Letterbox is broadcast on Sundays at 1900-2000 and 2100-2200GMT on 6860 and 7590MHz (43 and 39m bands).

The National Wireless Museum is well worth a visit if

you are in Ryde, and can be found at 52 West Hill Road.

As promised, I am pleased to announce the birth of a new award for 1986.

Entitled the 'Lifeboat Award', it is being offered for hearing 250 towns in the United Kingdom that have an active lifeboat in service. A list of the towns with such a service will be available from me for an SAE.

#### Of course!

As you will have guessed, there is an entry fee for this award of 50p that will be donated to the Royal National Lifeboat Institution. The award will consist of an engraved trophy and will also be available to licensed amateurs for two-way contacts as above.

It may seem that 250 stations is a lot to ask, but in my opinion it's no use offering an award that's too easy to get. Some awards are offered for logging a dozen stations that are regularly on the air and offer no real challenge. The same goes for the QRP awards announced earlier, and it will take some listening skill to dig out those stations from the general hash.

#### News travels fast

And finally, just to show that the news travels around in amateur radio, I had a letter from Rolf Little who is currently working out in Jeddah, Saudi Arabia. Rolf is using the Sony ICF6800W with a 20m dipole and active antenna by Dymec.

His QTH is only 300 metres from the Red Sea and has good take-off in all directions. His log keeping is done using the IBM PC computer and he would like to hear from any readers using the IBM.

Rolf misses his home shack back in Newcastle and its Racal RA117E which, he says, is one of the best receivers around. He can be contacted at PO Box 5698, Jeddah, Saudi Arabia.

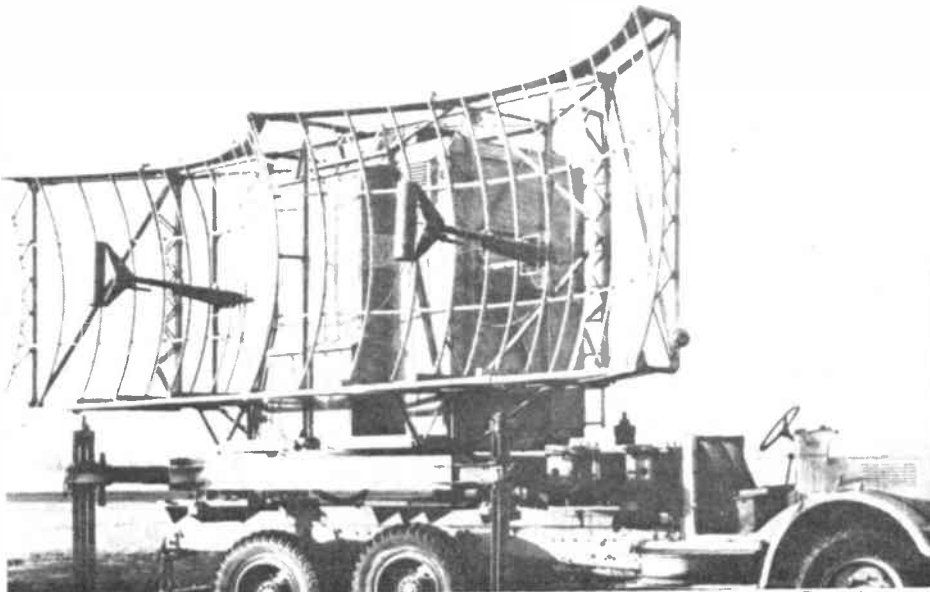
#### That's the lot

Well, that's it for this month. Thanks to all for your continued support and your kind letters.

Next month I'll be looking at some of the basics of listening for some of our new friends, plus the usual letters and featured listener items. Meanwhile, good listening!

# THE S O BRITISH

by Brian Ke



Type 11 mobile radar as used in mobile GCI convoys (photo courtesy of Marconi Radar)

By 1939, as I described last month, Great Britain had an operational radar chain of nineteen CH (Chain Home) stations around its coasts. These were connected by telephone lines to central filter rooms and ultimately to Fighter Command headquarters.

From here available defences, both fighter aircraft and anti-aircraft guns, could be deployed against air attack in the most economic and advantageous fashion. This gave the opportunity of not only meeting each threat with an appropriate response, but also arranging that in prolonged engagements suitable relief was available for re-arming, refuelling or rest.

Effective though CH was, it had deficiencies, the most serious of which was that it was almost blind to low flying aircraft. Fortunately, this was not realised by the Luftwaffe, whose own ground radar equipment, the Freya and the

Wurzburg, both operated within the VHF waveband and did not suffer from this problem.

The attacking German aircraft, suspecting that the British had operational radar equipment of similar characteristics to their own, therefore tended to approach at relatively high altitudes – at which the CH equipment was particularly effective.

For the same reason it did not occur to them for a long time that the sets of 360ft towers around the coast of the United Kingdom had anything to do with the detection of their aircraft and when, early in the Battle of Britain, an attack was launched on the station at Ventnor on the Isle of Wight, the Luftwaffe had no definite knowledge of the purpose of the installation.

The attack was pressed home by Junker Ju87 (Stuka) dive bombers and completely destroyed the equipment

installations, killing many RAF and WAAF (Womens Auxillary Air Force) technical staff. From an operational point of view, however, the adjacent stations were sufficiently close to enable them to maintain adequate cover so that the British radar screen was not breached.

Fortunately, the attack did not demolish the aerial masts, and replacement equipment was rapidly installed in temporary buildings, thus enabling a rapid resumption of service.

In addition to its inability to detect low flying aircraft, CH had three other major deficiencies. Firstly, it was not sufficiently accurate to bring a fighter aircraft within visual range of an enemy at night. Secondly, the operation of the reporting systems was too slow and, thirdly, the original chain looked out to sea and could not handle inland interceptions.

## CHL

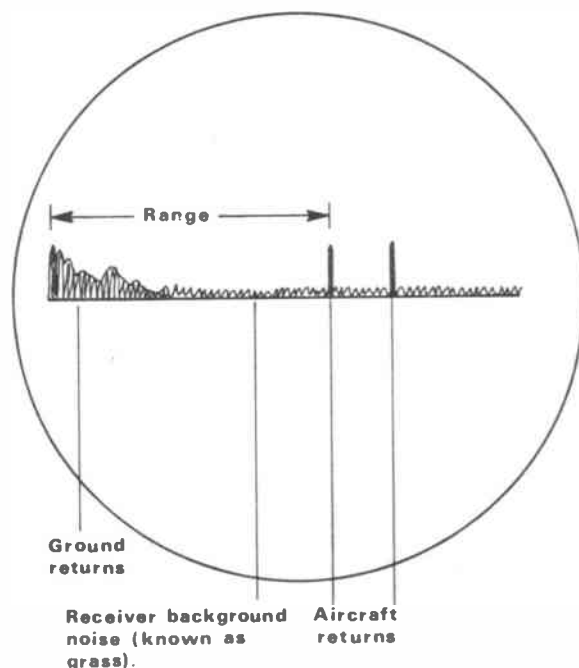
These deficiencies had been recognised before 1939, and in consequence a metric wavelength radar, CHL (Chain Home Low), had been developed from an early army coastal defence equipment.

In this equipment, separate aerials for transmission and reception were mounted on a common turntable rotated manually by the operator. When an aircraft entered the radiated beam, the range was determined on a range display ('A' scope), and the bearing from the position of the aerial. The plot was then fed to the filter network in the same way as those from CH. In this form CHL offered two advantages: it could detect low flying aircraft and, as the aerial head could be rotated through 360 degrees, it could look inland.

However, it still had the disadvantages that, due to the filtering system, plotting was as slow as for CH and it was not capable of determining the height of the target. By the end of 1940 four developments combined to overcome both problems.

The first of these was the invention of a method (known as T & R switching) by which the aerial could be switched from transmitter to receiver within a few

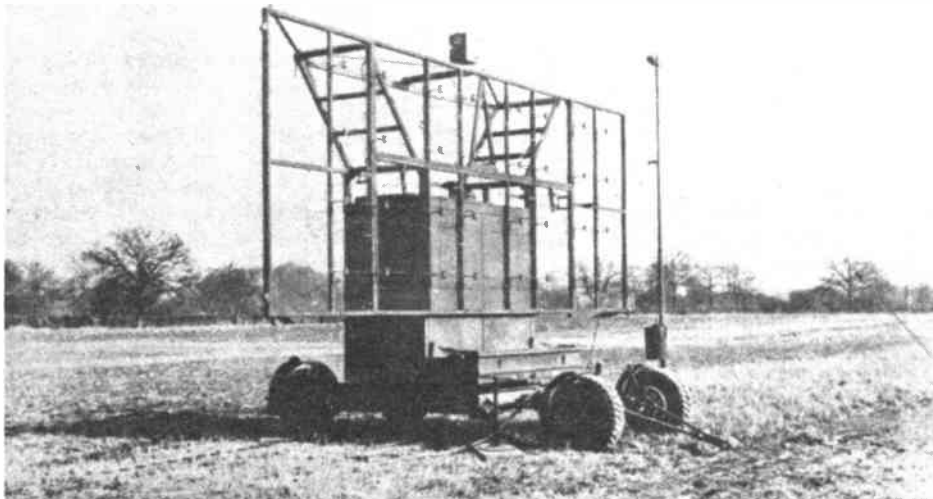
The 'A' scope or range display as used on CH and other early radars





# STORY OF RADAR

## ndal G3GDU



The smaller mobile CHL antenna (photo courtesy of Marconi Radar)

microseconds, thus permitting the use of a single aerial system.

The second invention was the combination of the continuously rotating aerial with a new form of display, the Plan Position Indicator (PPI).

### Standard display

In the standard radar display of that time, the time base was positioned horizontally across the face of the cathode ray tube, with the output of the receiver deflecting the trace vertically. The range of the target was therefore represented by the position of the deflection on the screen. In the PPI display, however, the trace starts at the centre of the screen and moves towards the edge. The trace is adjusted to be barely visible and is brightened by the received signal. The trace rotates in sympathy with the aerial position, north being at '12 o'clock'.

The overall effect is therefore that the screen appears like a map, with the targets as bright spots. This type of display has remained in use to the present day.

With such a display available it was possible to dispense with the cumbersome filter network and control the intercepting aircraft directly from observation of the screen. Although height was not displayed, a system was developed similar to that used on CH which compared the strength of returns on two aerials at different heights which was viewed on a separate display.

### Naval developments

In the months following the Daventry Experiment, the Admiralty gave consideration as to how the new development of radar should be used. As a result, a requirement was set that their equipment should be capable of detecting aircraft at 60 miles with precise location at 10 miles and of detecting ships at 10 miles with precise location at 5. Furthermore, the development should be separate from that of the Air Ministry and should take place at HM Signal School at Portsmouth.

Work started in October 1935 under R F Yeo and a set operating on 43MHz was developed by 1938 with the prototype being tested on HMS Saltburn. The trials were extremely successful and in consequence two development models, designated Type 79Y, were built and installed in the battleship HMS Rodney and the heavy cruiser HMS Sheffield during the summer of 1938.

More efficient transmitter valves soon became available, enabling an improved set (Type 79Z) to be fitted to HMS Curlew, later to become the only radar defence to the naval base at Scapa Flow, which was not covered by the CH network. A 90MHz equipment was then developed (Type 281) which generated 1000kW peak power, achieved all performance requirements which had been laid down by the Admiralty, and remained the standard naval long range air warning set throughout the war.

### The magnetron

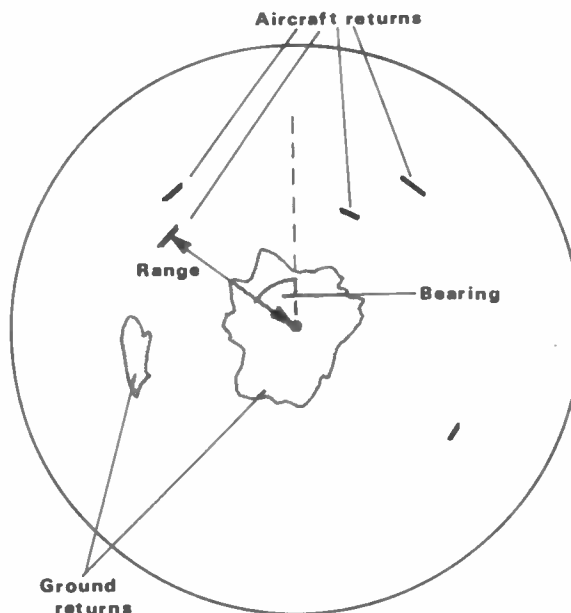
In my article *The RAF Strikes Back*, in *Amateur Radio*, October 1984, I described the invention of the cavity magnetron by John Randall and Harry Boot at Birmingham University. This device, however, was only a laboratory experiment and was in no way suitable for service in the field, so it fell to the GEC laboratories at Wembley to design and construct the practical magnetron.

Industry did not fail the challenge, and by 6 August production type cavity magnetrons had been constructed and tested. Equipment development could now begin.

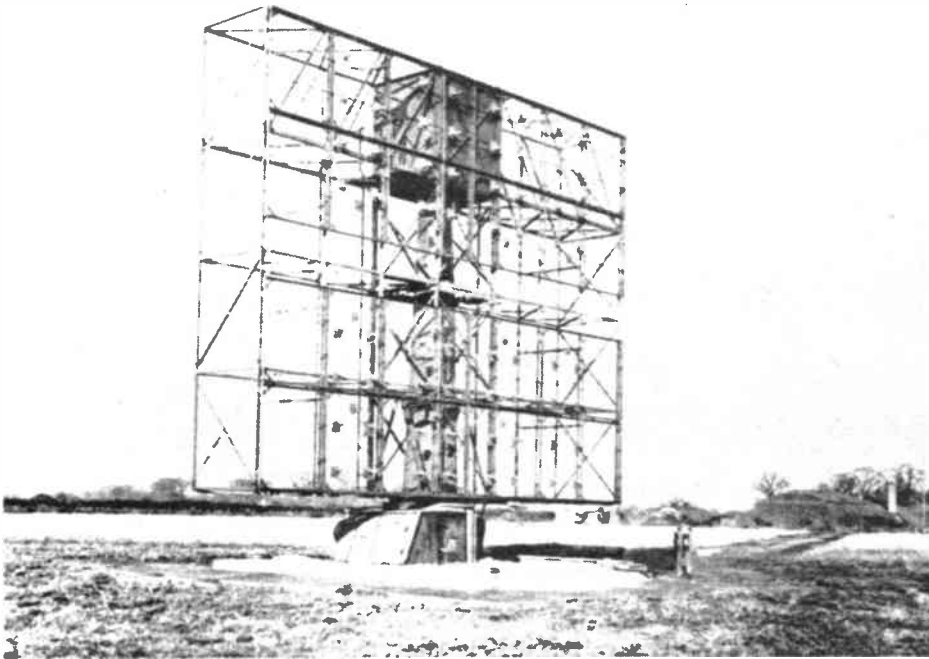
### The Tizard Mission

In the spring of 1940 Britain was virtually without allies in Europe and Sir Henry Tizard realised that she would soon reach the limit of her productive capacity.

The 'Plan Position Indicator' (PPI) or range/bearing display



# THE STORY OF BRITISH RADAR



Aerial of a 1942 permanent station, known as the 'Happidrome' (photo courtesy Marconi Radar)

He therefore made the bold proposal that Britain should hand over her wartime secrets in exchange for the productive capacity of the United States and Canada. Initially, Churchill was not enthusiastic, but with the fall of France he relented and talked directly with President Roosevelt about the proposal.

As a result of these discussions, the members of the Tizard Mission assembled in London in August 1940 and arrived in Washington in early September. They took with them virtually all of Britain's war secrets – including one of the original six cavity magnetrons.

A decision was made to place a production order for magnetrons with the Bell Telephone Company in New York City. Accordingly, the British magnetron was disclosed to their Whippany Laboratory on 3 October, production was immediately started and the whole order for thirty samples was completed in a little over a month. By the end of the war over a million magnetrons had been produced by a large number of manufacturers in the USA and Canada.

The mission also discovered that the USA had a slight edge in receiver technology. Centimetric Klystrons for receiver local oscillators and sensitive crystal diodes were being manufactured, while waveguides and horns were in regular use. These also became available to the British war effort.

## Centimetric radar

With the cavity magnetron now in full scale production, development of operational equipment proceeded with great rapidity.

The use of centimetric wavelengths gave considerable advantages to the designer, for the short wavelength (about 10cm) meant that beamwidths in the order of 1-2 degrees could be attained with aerials of moderate size,

while aerials of similar electrical performance to the existing metric radar equipment were of a size that could easily be carried on a small ship or even a large aircraft.

The army too found considerable advantages, for accurate gun-laying radar was now of a size which could be transported on a medium sized truck.

The aerials could be designed to give a narrow pencil beam; a fan-shaped beam narrow in azimuth and wide in elevation for surveillance; or wide in azimuth and narrow in elevation for height finding.

Very often the same type of transmitter was married to different kinds of aerials to meet differing requirements.

## RAF adoption

Typical of these was the Type 277 which was designed as a 10cm shipborne equipment in 1942. The RAF then adopted the equipment and allied it with a paraboloid antenna on top of a 200ft mast on the coast for detection of wave-hopping intruders, with a horizontal antenna for surveillance (known as the Type 14) and a vertical antenna for height finding (Type 15).

All three types of antenna were small enough to be mounted on trucks. This gave rise to a mobile Type 14 and Type 15 being attended with a mobile operations truck with R/T equipment to form a GCI (Ground Controlled Interception) convoy, which could be rapidly deployed wherever needed.

Permanent stations were also constructed, often employing both metric and centimetric surveillance and height finding equipment feeding an underground operations centre.

Centimetric equipment was also used in airborne equipment, both in the form of H2S for Bomber Command (see *The RAF Strikes Back*), and ASV (anti-surface vessel) for Coastal Command and AI (Air

Interception) for the Beaufighters of Fighter Command.

Further development gave the capability of 3cm operation, leading to greater accuracy with even smaller aerials.

Centimetric wavelengths were used for many other purposes, one of the most important of which was the Mark 4 Oboe, which again was described in the previous article.

## Further metric development

With the success of the centimetric equipment, it may be thought that the metric equipment, such as CHL, would diminish in importance. This, however, was not the case, for although centimetric equipment has advantages in accuracy, it receives strong returns from rain and certain cloud formations which may well conceal the desired target. Metric radars are far less susceptible to such phenomena and for optimum surveillance a combination of both types of radar is desirable.

By the middle of the war both sides were making great efforts to jam the enemy's radar and, as mentioned previously, the German radar equipment operated on metric wavelengths. It was therefore decided to construct a radar which operated on the same frequencies as the German equipment so that any attempt to jam our transmissions would have the same effect on their own.

This was the Type 11 which operated on frequencies around 600MHz, with a peak power of 100kW, from which a range in excess of 60 miles was possible.

For its original purpose this was not particularly successful, but as general purpose surveillance equipment it proved more capable of further development than almost any other wartime equipment.

One of the great difficulties of radar is that if the equipment will pick up returns from aircraft, it will also pick up returns from the ground, from hills or even high buildings, which may well mask the desired target. It was in the Type 11 radar that the first successful means were employed to suppress the ground returns.

It is well known that a radar transmitter emits a short pulse of RF energy which hits the target and is reflected, the receiver picking up the returned pulse with the range being determined by timing the echo.

The technique derived for suppressing the ground echoes was to split the incoming signal into two paths, one of which was fed to a circuit which delayed the received pulse by a time exactly equal to spacing of the pulses. This was then compared with the next received pulse.

If the returned signal was from a fixed object, such as a hill, both signals would be identical and would cancel. If the target was moving there would be a slight difference between the two and the target would be displayed. This technique is known as Moving Target Indication (MTI).



# THE STORY OF BRITISH RADAR

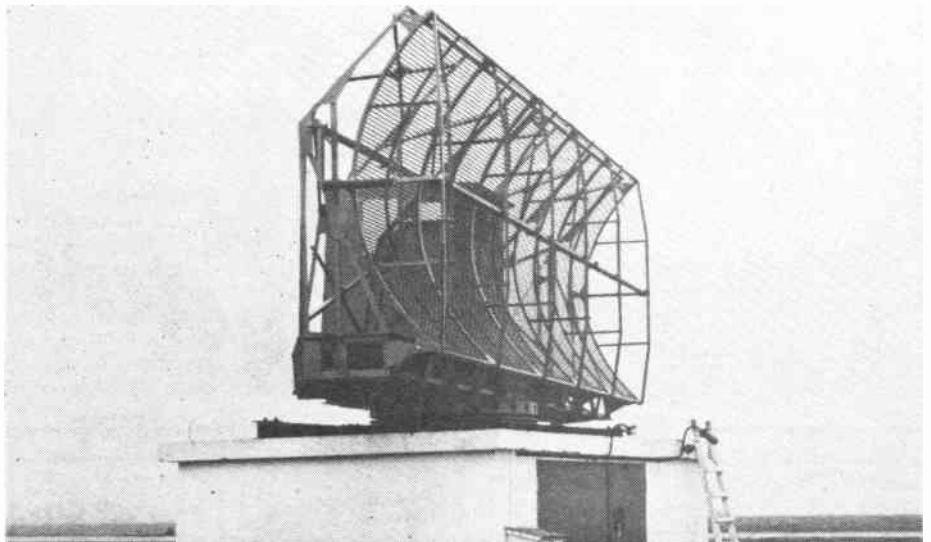
So successful was this technique with the Type 11 that Marconi used it as the basis for developing the S232 radar which served British Air Traffic Control for many years after the war, the last being withdrawn from Gatwick only a few years ago. Using the same principles they developed their highly successful S264 long range equipment, which is still in service in many countries in the world.

## Combating the V1 and V2

By late 1943 the frequency of attacks by manned bombers had greatly diminished, but the air defences of Great Britain faced an even greater challenge—the V1, which was a small, ram-jet powered, unmanned, flying bomb. These were extremely fast, but by efficient operation many could be intercepted by conventional GCI techniques.

The next challenge was the V2, the first IRBM (Intermediate Range Ballistic Missile), which, of course, was impossible to intercept. It could not be tracked on either metric or centimetric radar for it only came within range for the last few moments of flight.

It was found possible, however, to track the V2s during the first part of their flight, at the extreme range of the CH radar, for their dimensions made them resonant to the frequency of that equipment. Although little other than warning could be given, the plot of the



A 1955 development of the Type 14 10cm equipment (photo courtesy of Marconi Radar)

launch enabled our own aircraft to locate and destroy the launch sites and thus reduce the intensity of the attacks.

## Postscript

In these two short articles I have attempted to give some idea of the development and role of British radar over the ten years from its inception to the end of hostilities in Europe. To tell the whole story would take many large

volumes, but if in this narrative I seem to be biased in favour of the RAF, I must plead guilty to serving my National Service in a light blue uniform on a GCI radar convoy using Type 11 and Type 13 equipment. I would also like to acknowledge the assistance given by my friend, Mr Bruce Neale, of Marconi Radar Systems Ltd, in making available many of the illustrations which accompany these articles.

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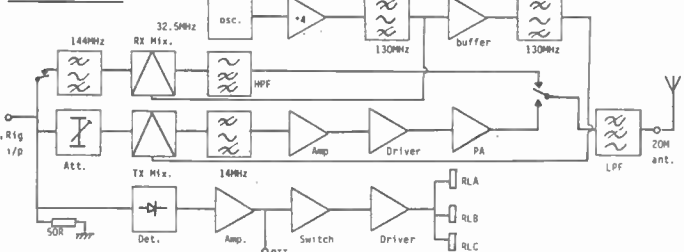
Have you considered building yourself a small rig for portable and holiday use this summer?

### HC220 and HC280 TRANSVERTERS – use your 2M rig on 20 and 80M!

The HOWES HC220 and HC280 offer an excellent alternative to an HF transceiver. At the present point in the sun spot cycle, is there any sense in spending a small fortune on a 9 band HF rig? The two most active HF bands can be worked using your existing 2M SSB/CW rig and our transverters – and at a considerable saving in cost too.

An exciting possibility offered by these new HOWES transverters is HF mobile operation. This becomes much more practical with the combination of a compact 2M rig, and a neat little transverter tucked out of the way.

### BLOCK DIAGRAM



Both the HC220 and HC280 offer a good 10W RF output from mismatch proof transistors. The 2M drive level required is adjustable between .5 and 5W, but it can be easily modified to accept 10W or so. The use of a high proportion of fixed value filter components keeps alignment simple, and the output spectrum clean. No fancy test equipment is needed to align your kit.

On receive, the balanced mixer offers both sensitivity, and a good dynamic range. The 10 element bandpass filtering which is used ahead of the mixer requires no alignment at all – simply wind the right number of turns on the toroids! If you are competent with a soldering iron, you should be able to build a HOWES transverter. The full, clear documentation and the component locations printed on the double sided, solder masked PCB make construction a pleasure.

HC220 2M in, 20M out transverter kit: £48.90.  
HC280 2M in, 80M out transverter kit: £48.90.

Assembled PCB: £79.90.  
Assembled PCB: £79.90.

### TRF3 SHORTWAVE BROADCAST RECEIVER.

Listen to the news, sport, music, political comment from around the world on the new HOWES TRF3 shortwave receiver. The design features switchable input impedance so that it can be used with long or short antennas, and there is an input attenuator for strong signal conditions. Up to 2W of audio output are available but the low quiescent current consumption means that it can easily be battery powered, if you wish. Frequency coverage is 5.7 to 12.8 MHz in three bands using a 50pF tuning capacitor (available at £1.50). This simple TRF design may be firmly rooted in the silicon age, but the old thrill of far away stations heard on a home built set is still strong! Great fun to build and use – educational too!

HOWES TRF3 kit: £13.90.

Assembled PCB module: £18.90.

### DeRx Direct Conversion Communications Receiver.

This simple, but very effective, single band receiver is available for 20, 30, 40, 80 & 160M. Up to 1W audio output, stable FET VFO, and amazingly good performance for a simple set. How about using one with an MTX20 or CTX transmitter for a QRP holiday and portable station? Suitable tuning capacitors for all but the 160M version are £1.50 each – you need two per receiver.

DeRx kit: £14.80. (Please state band required)

Assembled PCB module £19.90

### MTX20 20M CW TRANSMITTER.

The HOWES MTX20 is a 20M CW transmitter giving up to 10W RF output, but this is adjustable, so you can turn it down to take part in the G-QRP Club's activities and awards. The design pays very careful attention to the quality of the output signal. Full key click and RF output filtering are provided.

The HOWES MTX20 is crystal controlled (one crystal provided), but you can wire up a tuning capacitor to VXO the frequency a few kHz, which is very useful. A matching VFO should be available soon. The MTX20, like its smaller cousins the CTX40 and CXT80, has the output transistor's heatsink mounted on the board, and it requires very little alignment. A super, new transmitter, and one that we feel will become very popular indeed.

MTX20 kit: £19.95.

Assembled PCB module: £26.95.

XM1 Crystal Calibrator with B o/p.  
CTX40 (40M) or CTX80 (80M) QRP CW TX  
CVF40 or CVF80 VFOs for CTX  
ST2 Side-tone/Practice oscillator  
AP3 Automatic Speech Processor  
CM2 Quality Mic with 'VOGAD'

Kit: £16.80. Assembled PCB Module: £21.30  
Kit: £12.95. Assembled PCB Module: £18.95  
Kit: £9.30. Assembled PCB Module: £14.90  
Kit: £7.30. Assembled PCB Module: £10.80  
Kit: £15.90. Assembled PCB Module: £21.40  
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PLEASE ADD 80p P&P to your total order value

73 from Dave G4KQH Technical Manager.

Delivery normally within 7 days

# AmRad 10GHz system

by Glen Ross G8MWR

## Learning curve

The purpose of these articles is not just to provide a 'do this, do that, hit it with a hammer' system. The more important point is that you should have an understanding of what you are doing and are trying to achieve.

Fortunately there is more than one way of doing the job and you can make the most of what is to hand. The electronics are simple and straightforward and can be the same no matter what head you may decide to use, or even build.

## The theory

There are several different forms of microwave head available on the surplus market, all at very similar prices and all doing the same job but with widely varying degrees of efficiency. Let us look at the receive function first.

Essentially the head acts as a converter to change down the 10.4GHz signal (which is difficult to deal with as it stands) to a more manageable frequency. This new frequency is very often at 10.7MHz, but frequencies of 30 and 100MHz are also commonly used. The mixer is usually a diode and the local oscillator signal is normally derived from a Gunn oscillator. *Figure 1* gives a block diagram of the idea.

## Gunn effect

This little unit is the key to easy microwave working and a knowledge of it is useful. John Gunn, a research engineer, was working on a semiconductor sample when he discovered that it was giving energy at microwave frequencies. Further investigation showed that the frequency of operation was determined by, among other things, the thickness of the material and the applied voltage.

This last factor is of paramount importance to us because it means that by varying the applied voltage slightly a frequency modulated output is available, the deviation depending on the amount of voltage swing. Typically the Gunn diode operates at about eight volts and 100 milliamps to produce an RF output of about ten milliwatts.

On transmit the system is very simple indeed (see *Figure 2*). The Gunn oscillator is connected to the aerial and a small audio signal is superimposed on the Gunn diode supply to produce the WBFM signal. The various means of achieving this switching, and the fact that normally you don't have to provide it, will become obvious as we look at the various heads available and discuss what they can be used for.

## Elongated

This type of head, which is made by Mullard and is also seen under the RS banner, is the least suited to our requirements. It is illustrated in *Figure 3*. The waveguide is not suitable for connecting up to any other gear so it must be used as it is. The transmit output is excellent, but due to a nearly complete lack of local oscillator injection the Rx performance is abysmal.

However, the unit does make an excellent private bench beacon and test

Fig 1 Block diagram of receive system

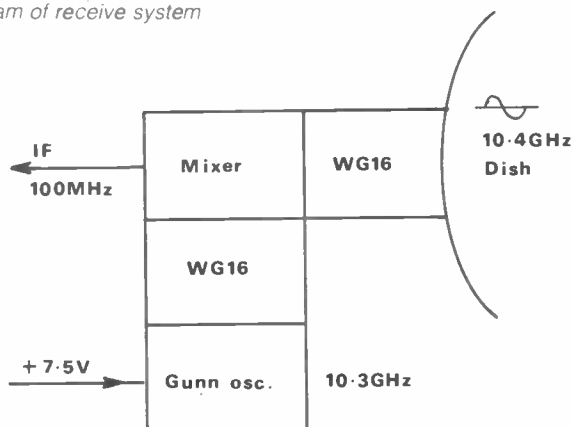


Fig 2 Block diagram of transmit system

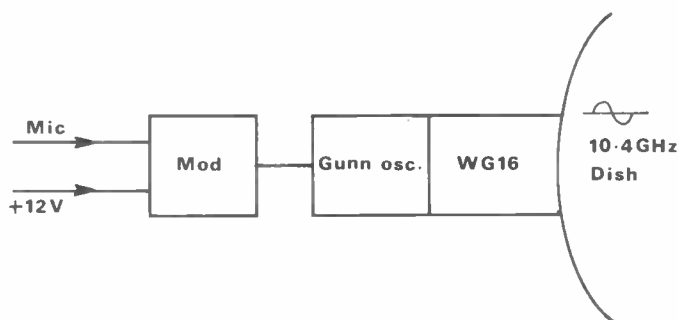
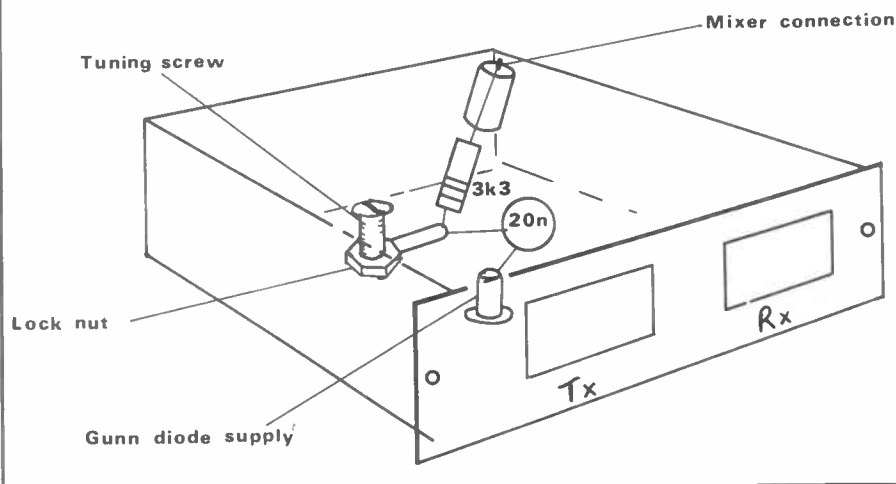


Fig 3 Elongated type of head





# AmRAD 10GHz SYSTEM

rig and a circuit for this use is given in *Figure 4*. Using the boards, which will be described, and two of these heads, distances of only a few yards will be achieved, although this can be improved if the gear at one end is 'state of the art' with a decent size dish.

## Side by side

This type is illustrated in *Figure 5* and is easily available. Its disadvantages and uses are similar to the elongated type, but the range is increased considerably by better injection coupling and also the gain of the small horn which is fitted. The waveguide is still non-standard, but you can get round this in a rough and ready fashion by building up an adaptor, as shown in *Figure 6*.

This is a piece of square extrusion which will be a push fit over the lip, which is reaved by removing the small horn from the unit. A 'V' shaped piece of material is removed from opposite sides of the extrusion and the ends are bent together until a standard WG16 flange can be fitted.

This is not theoretically the correct way of doing the job, and at least 3dB of the available signal will be lost due to unavoidable coupling into the Gunn oscillator. It is, however, the best that can be done and at least enables a decent dish aerial to be connected up to one of these units.

Attempts to improve performance by supporting the unit in front of a dish are not satisfactory because the focal point of the dish is just that - a point - and you can't get both the transmit and receive sections in the same place at the same time. The result of trying this approach is a loss of gain and a dish that 'squints', so making setting up on a bearing a real nightmare.

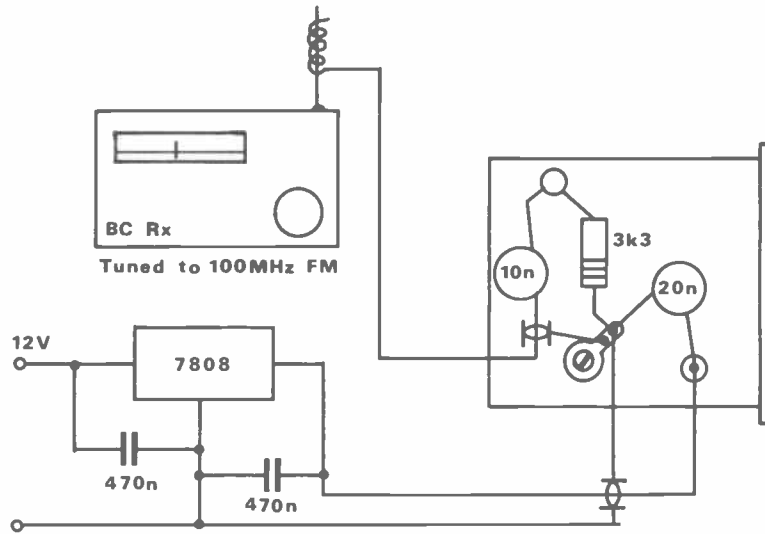
## In-line

The previous types have been real belt and braces jobs, adequate for the intended purpose but with no real communication potential. We now come to the real top technology job, which is shown in *Figure 7*. Why anyone needed to build something this good for use as an alarm is beyond comprehension, but let's just be glad that they did.

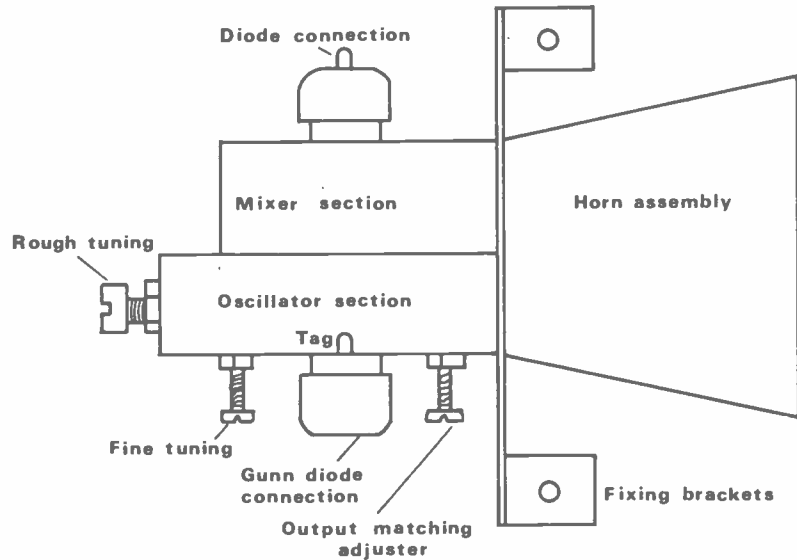
The design starts off with a Gunn oscillator at the rear of the assembly with a piece of attenuator foam on the backplate to kill any unwanted reflections from this surface. This foam must not be removed, otherwise you can suffer restricted tuning range, varying output power and intermittent jumps in tuning, among other things.

The tuning is achieved by a brass tuning screw which has an RF choke machine into its side. The frequency of operation is determined by an iris-coupled cavity. This improves the stability by a remarkable degree and also reduces the power coupled into the mixer to a more manageable level. In front of the iris is a power matching screw which is used to optimise the oscillator performance.

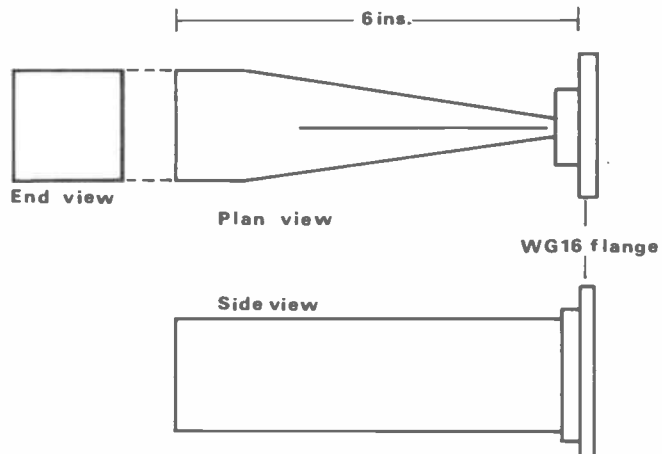
**Fig 4** Diagram of bench test layout



**Fig 5** Side by side assembly



**Fig 6** Square to rectangular WG connector



# AmRAD 10GHz SYSTEM

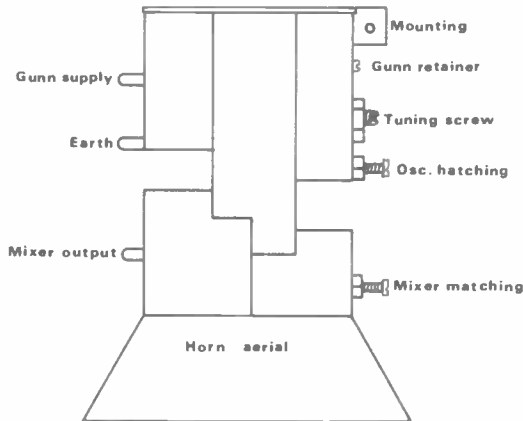


Fig 7 In-line (Solfan) type head

## The mixer

The head comes either in one piece or with a bolted on mixer block, there being little difference in the performance of the two units. In each case the mixer diode is offset from the centre line of the waveguide, so as to obtain more accurate mixer matching to the guide. If a bolted on block is fitted it is essential to make sure that the arrow, which is cast on the side of the block, points towards the aerial, and that the matching screw is set just flush with the inside face of the guide and then locked in that position.

All small components which may come

with the head should be removed except the resistor, usually around 4.7k, which is connected from the mixer to earth. This protects the mixer from damage due to static discharge and should be left connected at all times, even after the unit is fully installed.

## Expansion

The unit comes complete with a small horn aerial which gives a gain of a couple of decibels. Even this can give surprising results. Two of these units, using the small horns and the receiver boards to be described later in this series, have given

5 and 9 signals over a distance of fifteen miles.

Units using a horn at one end and a two foot dish at the other gave similar results at a distance exceeding one hundred miles. The last point brings up the fact that if the small horn is removed you are left with a standard WG16 flange on the end of the unit to which you can connect any other equipment you may decide to use.

## Setting up

If you obtain your own head at a rally it can be tuned roughly to the correct part of the band by undoing the locknut and turning the large tuning screw inwards one and a half turns. The heads can be obtained from the Microwave Society at 81 Ringwood Highway, Coventry at an inclusive cost of £20 each.

For this price the head will be set up in the correct part of the band and a listing of frequency against voltage calibration will be supplied. The power output and mixer performance will be optimised and these parameters will be measured and supplied.

The unit will also be air tested using the boards to be described over a distance of thirty kilometres. If you already have a suitable head the above service is available for an inclusive charge of £5.

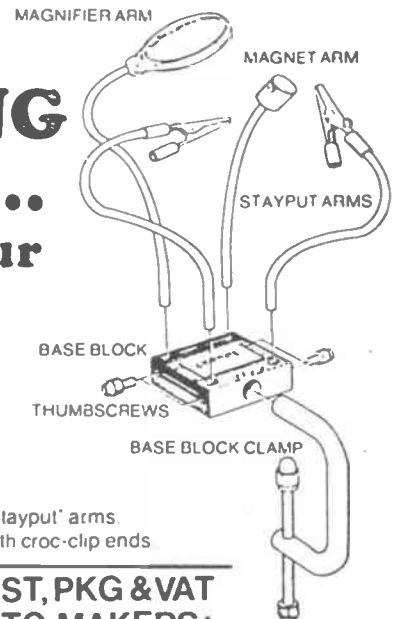
Next month I shall describe the transmit circuitry and give details of the PCB which is available for this project.

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# AN AERIAL TUNING UNIT WITH PILOT LAMP INDICATORS

by B C Howard

The unit was designed to provide the facility of switching each of several aerials to either of two receivers, with the option of including a pi-section matching unit and/or an RF amplifier. Pilot lamps are provided to indicate:

- 1 Which aerial is in use.
- 2 Which receiver is in use.
- 3 When the matching unit is in circuit.
- 4 When the RF amplifier is in circuit.

The design is flexible in that elements of the unit can be excluded and the number of aerials and receivers can be varied, with the appropriate emendations to the switching of the pilot lamp circuits.

The switch S1a selects the aerial to be used, eg vertical rod, horizontal long wire, frame aerial etc, and S1b makes the

appropriate lamp light up. Switch S2a/b determines whether the tuning unit (L1,C1,C2) is in circuit or not, and S2c operates the pilot lamp PL4 if the unit is in circuit. The pi-section unit is tuned by tapings on L1 (S3) and C1 and C2. Consideration was given to the substitution of L1 and S3 with that handy variable inductance of yesteryear, the variometer, but although the circuitry of the latter is simpler, obtaining and constructing a variometer is somewhat more difficult.

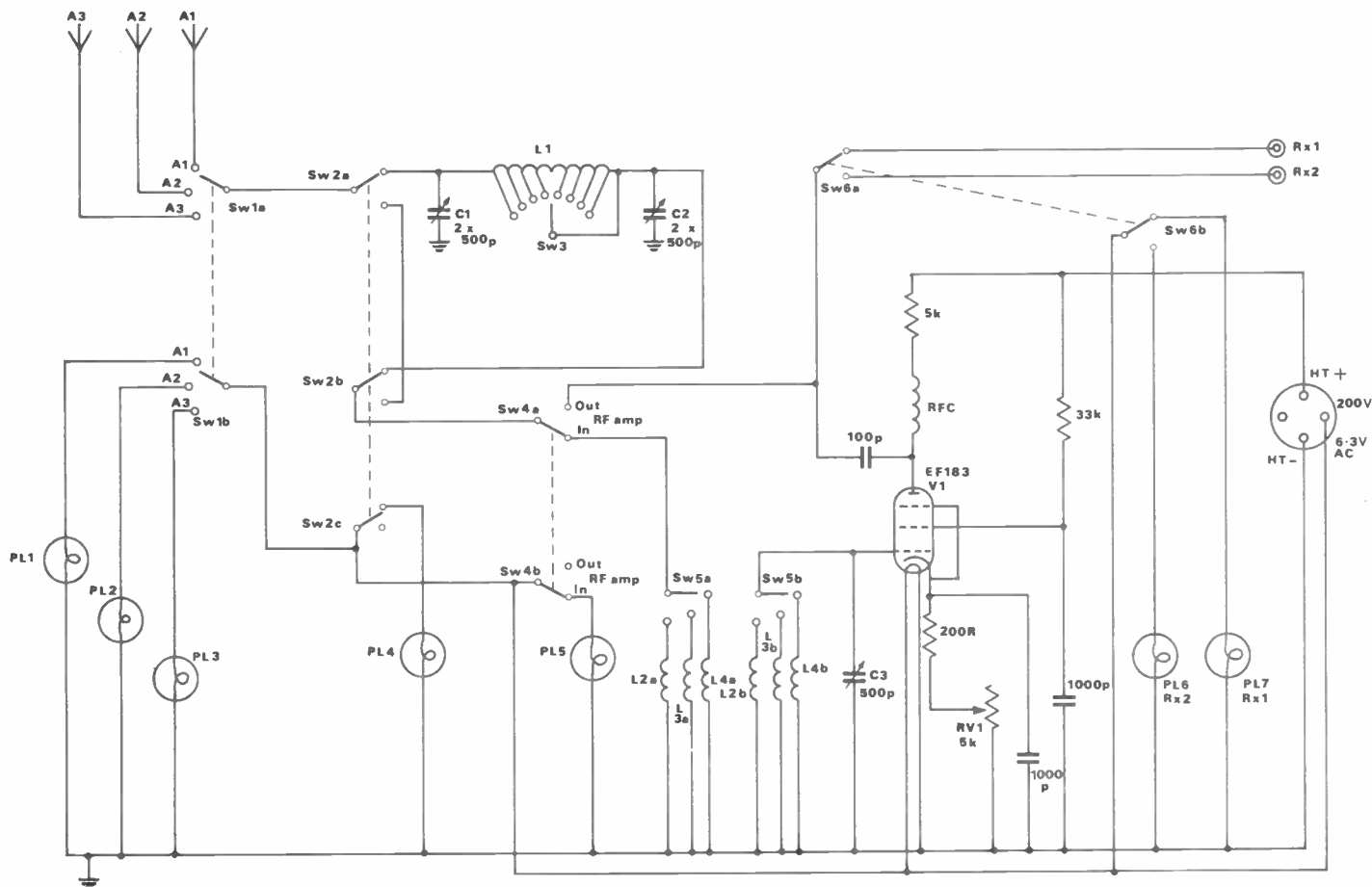
L1 consists of 100 turns of 24swg wire on a former, 1½in in diameter, with tapings at 3, 8, 15, 35 and 65 turns. C1 and C2 are 2-gang condensers (500pF per section) with both sections connected in parallel.

The switch S4a determines whether the signal passes direct to the receivers via S6a or via the pre-amplifier consisting of an EF183 RF amplifier. S4b operates the pilot lamp PL5 when the pre-amplifier is in circuit. S5a/b and C3 determine the L/C combination to tune to the incoming signal which passes to the control grid of the EF183, the RF gain being controlled by R1.

### Output

The output from V1 is fed via the switch S6a to the inputs of the receivers, with S6b operating the appropriate lamp PL6 or PL7. The required power (200 volts dc and 6.3 volts ac) can be supplied by a separate power pack or, where appropriate, from one of the receivers.

Circuit diagram



# AIR BAND COMMUNICATIONS

by T A James

How often have you been searching the frequencies on your receiver and heard something like: 'London control, this is Speedbird one seven four, out of two seven zero, requesting further descent at Brecon'? Or: 'Speedbird control, this is shuttle Two Kilo, off chocks at zero five, with you on schedule. One hundred and two plus one passengers, nil freight and the aircraft is serviceable'.

These are, of course, messages from commercial aircraft to the ground. In the first example to Air Traffic Control, and in the second to its own company's control unit. Speedbird is the callsign of British Airways, and in the first message the pilot is making his first contact with London whilst approaching the Brecon Radio Beacon. He is descending from 27,000ft (flight level two seven zero) and wishes to descend further, which he cannot do without permission.

The second message we have stumbled on is from a British Airways shuttle (Two Kilo is a London-Manchester shuttle). He is telling his own company that he left his loading point 'off chocks' at two minutes past the current hour, that he is on schedule and that he has one hundred and two passengers plus one child. The rest of the message is easily understood.

Interest in listening to air band communications is increasing due to the existence of more receivers able to receive this band, and an ever increasing

fascination with all facets of flying. Can you resist watching an aircraft take off or land?

Could the writer firstly state that he is not an Air Traffic Controller, pilot or communications engineer. He is just interested enough to have bought a receiver able to pick up air band and to ask questions and read books about the subject. The aim of this article is to help interpret the messages from these 'intrepid birdmen' into language that us lesser mortals can understand. All the information has been obtained from already published sources and from questions asked of those who know of such things.

The law regarding listening to air band is, strictly speaking, against such activity, but judging from the amount of equipment available from reputable sources, mostly imported with implied government permission, it looks as though a blind eye has been turned by the authorities. Most air band transmissions are, of course, received whilst searching the frequencies for other amateur transmissions.

## Frequencies

Air band communication is usually carried out on frequencies between 118.00MHz and 136.00MHz, usually in steps of .25MHz. This waveband is fairly exclusive to civil aircraft, commercial and private, but military aircraft communicate up somewhere in the VHF

band, and listening into them would be frowned upon by the authorities.

Nevertheless, military aircraft do communicate on the 118.00MHz to 136.00MHz band when in controlled air space, to enable safety considerations to be met. Frequency charts are published by advertisers in some of the air enthusiasts' press, but due to the technique of passing the aircraft on to another controller and telling them the new frequency, a list of frequencies can soon be built up.

Some frequencies in constant use are:

Pole Hill 134.425;  
London Airways 132.05;  
Bristol Sector 132.80;  
Clacton Sector 133.45;  
Daventry Sector 134.75;  
Dover Sector 134.90;  
Seaford Sector 135.05;  
Scottish Airways 128.50.

Many types of receiver can receive air band, from the small portable hand-held imported radio, costing around £3.00, up to the wideband scanning receivers which can receive many other interesting bands, such as marine, 2m amateur, etc. These sets can be costed in hundreds of pounds.

Beware the cheap hand-held portables though; they claim to receive air band, and do, but the frequencies tend to be packed closely on a short width of dial leading to bad selectivity.

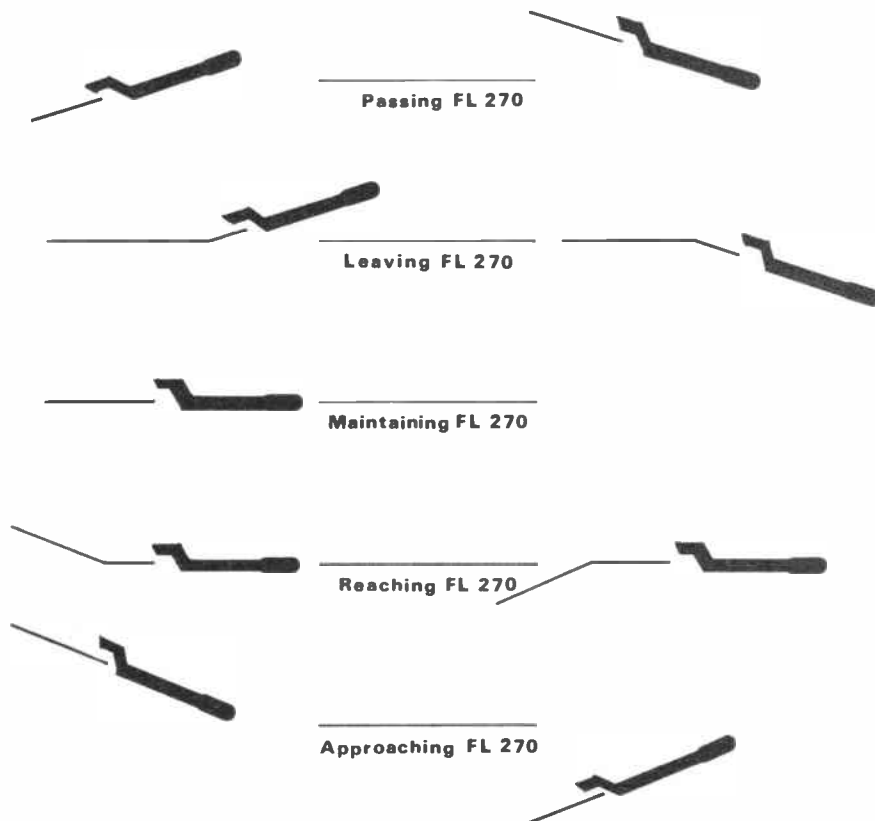
Scanning receivers dedicated to the frequencies covered by air band are, of course, the best listening devices. The receiver the writer uses is a Signal Communications R532, which does not leave much to be desired with its 100 programmable scanning channels. With this type of receiver, suitably programmed aircraft, such as Concord, can be listened to as it is passed down the airways from its arrival into UK air traffic control to its landing.

## Antennas

As with all antennas, one of good quality which is well-sited will increase the receiver's performance. Nevertheless, transmissions from airborne aircraft can be heard up to 200 miles away from a receiver with even the smallest antenna.

Transmission in this band tends to be 'line of sight', so ground stations are sometimes completely blocked out by hills, tall buildings or other obstructions, whilst the aircraft they are talking to can be heard quite clearly. Luckily the aircraft being controlled always repeats the instructions given, so only hearing one side of the conversation is no handicap to interpreting what is happening.

The transmissions are coming in from all directions, so obviously an omnidirectional antenna gives the best performance for all-round listening.



Showing terms used when changing heights



# AIR BAND COMMUNICATIONS

number of passengers, condition of the aircraft fuel requirements, etc. Some messages you hear may even put you off flying, but usually the most revealing information you will gather will be on how many bitter lemon drinks they want loaded at Manchester.

I keep a diary of what I consider long distance transmissions received from my base in the South Midlands. For example I consider an aircraft at 2,000ft on the approach to the Leeds/Bradford Airport to be better than Concord at 47,000ft out over the Atlantic; the latter is easy.

After experimenting with antennas built specifically for airband use, I have

found that high gain antennas built for 2 metre work perform highly satisfactorily, although the one I used was directional. A highly desirable piece of equipment for me would be a rotator; then I could listen to Heathrow Tower and Birmingham Tower without climbing on the roof.

### Going mobile

The writer is lucky in that his daily work as a rep involves travelling over a wide area. Going mobile means listening in all day (between calls) with the added bonus that the car usually heads itself towards the nearest airport/airfield for the obligatory sandwich, instead of in a

layby with all the other Cavaliers and Sierras.

Whereas they are listening to Jimmy Young, I am listening to the tower telling Charlie Alpha 'you are cleared to land on runway two two, the QFE is ninah ninah eight, the wind two OH at three knots, the runway is dry'.

It is near airports that going mobile really pays off with ground movement control, tower, approach, etc; frequencies all competing for your attention.

The writer hopes that he has raised some interest in this subject, but would plead that the foregoing is only scratching the surface of the subject.

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# AIR BAND COMMUNICATIONS

However, if it is intended to listen to a specific area, such as a local airport ground movement control, a directional antenna can be gainfully used.

Even the performance of hand-held portables can be improved by a simple dipole antenna being mounted as high as possible.

## Terminology

Listening to our 'Speedbird One Seven Four', it is obvious that it is using a very shortened form of message, as of course the maximum amount of information must be exchanged in the minimum amount of time, with the least chance of misinterpretation. The aircraft we are listening to, according to my British Airways timetable (courtesy of my local travel agent), is a Boeing 747 which left John F Kennedy Airport at 19.00 hours last night (flight 174), and is due in at Heathrow at 06.40 hours.

To understand what is happening during the transmissions we hear, we must learn a few basic principles of Air Traffic Control and its terminology. There are six basic considerations with an aircraft under Air Traffic Control: namely height, distance, speed, direction, time and identity.

## Height

All aircraft heights referred to are in feet, and will be called 'flight level'. The last two digits of the flight level will be omitted, thus 37,000ft becomes 'flight level three seven zero'. One complication is that aircraft height is measured by a device which is affected by changes in barometric pressure, which of course is a geographically variable factor.

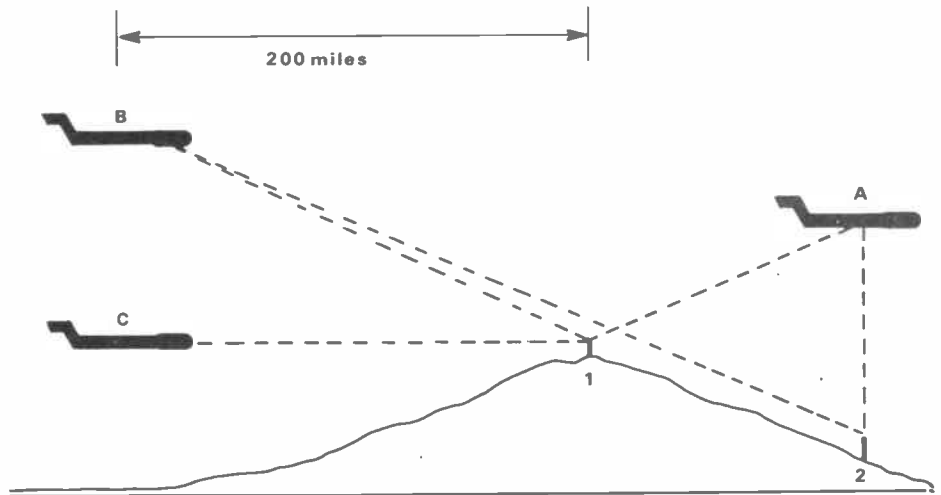
To standardise the reading on all the aircraft in the vicinity, their altimeters are set either on the local 'QFE', which means the altimeter will read zero feet when the aircraft is on the ground, or the local 'QNH', which means the altimeter will show the height above sea level. The 'QFE' is useful if you are landing and the 'QNH' is useful if you are avoiding a mountain. The 'Q' code is quite often used in air traffic control.

## Distance

Most distances referred to are expressed in nautical miles and usually relate to distance from radio beacons. Distance measuring equipment is carried on the aircraft, which receives transmissions from these beacons and computes the distance and bearing from that beacon.

## Speed

The speed of an aircraft is spoken of as 'knots', ie nautical miles per hour. When comparing speeds the 'mach' number system is used. This is comparing the speed of the aircraft to that of sound, thus Concord usually reports its speed as 'mach two' and subsonic jets fly at around 'mach point eight'. You will often hear the controller asking an aircraft to reduce or increase speed to keep the necessary aircraft spacing.



Showing advantage of high ground when air band listening. Receiver 1 will receive more transmissions than receiver 2

## Direction

Transmissions referring to the direction of an aircraft will refer to its 'heading'. This is quoted in degrees of the compass. An aircraft flying due south is said to be on a heading of 'one eight zero' (ie 180° magnetic).

An air traffic controller will sometimes be heard requesting a certain heading of an aircraft; both will then refer to 'radar heading' in subsequent transmissions.

Messages concerning headings are most often heard during busy periods, with many requests such as 'turn left five degrees and report heading'.

## Time

Time referred to in transmissions refers to local time in that aircraft's area and is based on GMT. There is no need, especially on long flights, to refer to the hour, and time will be stated in minutes past the current hour.

For example 'estimating abeam Honily at four five' means going past the beacon near Birmingham at forty-five minutes past whatever hour it is at the time of the transmission.

## Identity

Quite often you will hear the ground controller request an aircraft to 'squawk ident'. This means the pilot has to activate a device called a transponder which will transmit a pre-arranged digital message onto the radar screen of the controller. This is of course to identify the aircraft as there may be many aircraft on his screen at any one time.

## Radio procedure

The main language of aircraft communication is English. Sometimes, however, aircraft can be heard talking to their own company in their national language. The phonetic alphabet is used and regular listeners will learn whether they try or not.

As we have already learnt, every aircraft has its own callsign, but after the initial contact has been made it is quite usual to use only the last two numerals of the callsign. If the aircraft is a non-

scheduled flight, the last two letters of the registration number are used.

If an aircraft fails to make contact with the next controller, he will return to the previous frequency.

Many abbreviations are used, such as 'affirmative', 'say again', etc, but all are self-explanatory.

The radio procedures are rigidly standardised and adhered to. It is easy to pick out the non-professional private pilot from his commercial counterpart just by the speed and clarity of the message.

Another point you will quickly grasp is that there is a definite pattern in aircraft movements throughout the 24 hours. In the early morning the large jets arrive from across the Atlantic. The airwaves will be full of transatlantic accents. Around 8am the continental traffic starts up, leading to what is the busiest part of the day.

Around midday the big jets, having refuelled and reloaded, are back on the airways for their return. They can be heard calling out estimates of their coordinates to Oceanic Control. The early evening traffic will see the return of the continental traffic.

During the late evening in some parts of the UK, 'Speedbird Concord' can be heard returning, having left earlier that day. A special set of rules apply to Concord, but there is not space to go into that in this article.

## Types of transmission

There are many types of transmission: aircraft travelling along 'airways', aircraft in terminal marginal areas, on radar approaches, company frequencies, etc.

The emergency frequency 121.5MHz sometimes produces transmissions but these are usually private pilots who have got lost.

Each type of transmission has its own individual characteristics which, with a keen ear and some imagination, can be interpreted.

Most commercial aircraft contact their company on certain frequencies in the air band to give information on ETA,



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# LOW-COST MULTIBAND ANTENNA

by Phil Webb G4RSY

For many people, operating successfully on the HF bands is blighted by restricted space. This article puts forward a simple, cheap multiband antenna, which is not only compact (see *Figure 1*), but works well on all HF phone bands. With a little care it will function without the use of an ATU, which is a saving in expense and time when changing bands. The concept of the inverted L antenna is not new and the design has always worked well for sound theoretical reasons which pay off in practice. However, this version adds traps for multiband operation.

The bulk of the radiation on the inverted L with its low impedance feed starts from the feedpoint, and for this reason the feedpoint is kept as high above the ground as is practically possible. A low impedance here also means that the mounting insulator is not critical and that the antenna performance is not affected by the weather. Ground losses are kept to a minimum by the height of the antenna and the use of radials and a counterpoise wire for the lower bands.

Other advantages of the inverted L concept are that little radiation is wasted vertically, as happens with a horizontal dipole, and the radiation pattern is held at a reasonably low angle in all directions. The near vertical polarisation

compliment of part of the radiation pattern makes the antenna function very acceptably for local 10 metre FM operation, with enough mixed polarisation for operating local 10 metre SSB with other stations using horizontal beams or wires. When this band is open, comparisons with a 10 metre half-wave vertical dipole show that the inverted L suffers less from QSB due to skip polarisation.

## Design

The antenna uses two traps, one at 7.1MHz and one at 3.5MHz, halving the expense and the length of the conventional multiband trap dipole with arguably better performance. Hard drawn copper wire of at least 16 gauge is used for the antenna but virtually any wire larger than 24 gauge can be used for the radials, old transformer wire being eminently suitable. The 7.1MHz Ralcomm trap was obtained from LAR and the 3.5MHz Spacesaver trap was obtained from SMC. The Spacesaver trap saves around 25 feet of end wire over some conventional traps.

The L/C ratio of the traps is designed to show capacitive reactance of the three phone bands above 40 metres. This facilitates reasonable resonance at these frequencies by electrically altering the effective length of the antenna. The L/C ratio of the 3.5MHz trap is

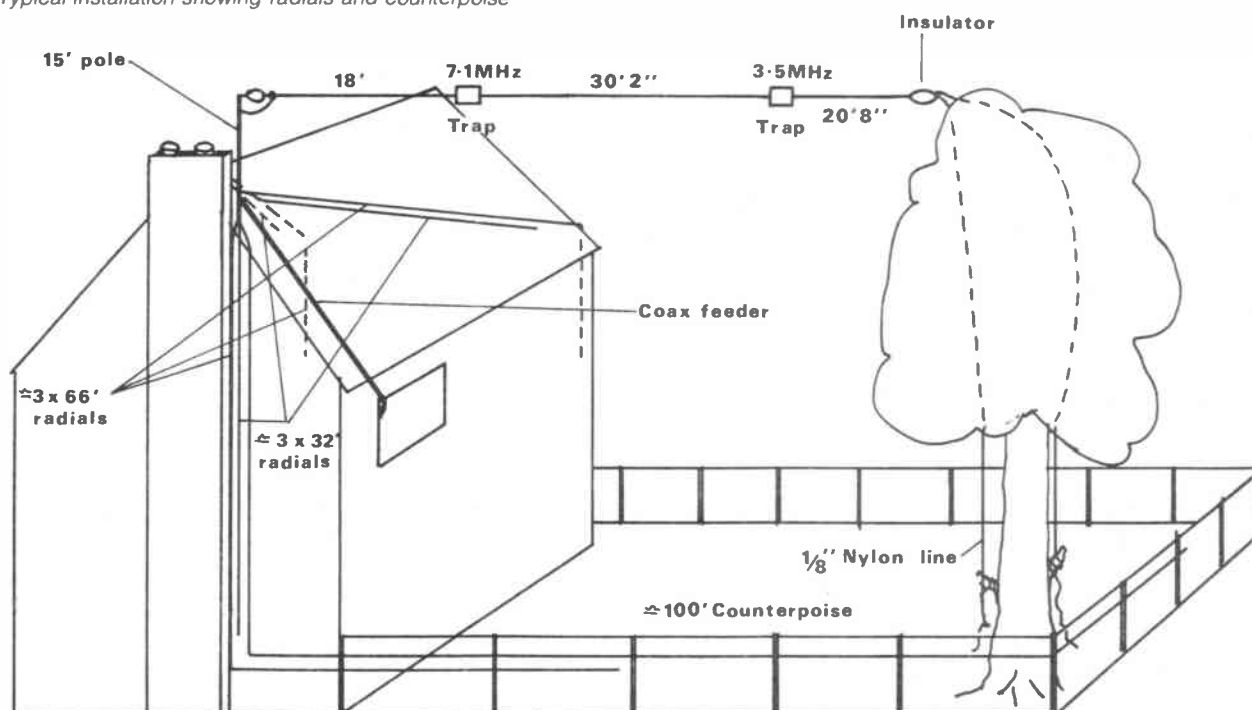
designed with a large value of inductance which minimises the length of the final section of wire. For the trap sceptics, the total losses of both traps should be a good deal less than 0.5dB. An alternative manufacture of trap can be successfully employed but may not produce as efficient a ratio of current distribution as this combination.

On the higher phone bands the antenna is collinear and will possess some of the directional properties of the wire while still maintaining enough useful low angle radiation for good DX. Additional quarter wave radials can be attached below the pole section to encourage more current in this leg and to slightly improve the SWR on these bands. On 20 metres the antenna is  $5/4\lambda$ , on 15 metres  $7/4\lambda$  and 10 metres  $9/4\lambda$ .

## Phone bands

On the three lowest phone bands the antenna functions as a  $1/4\lambda$  with the three traps acting as loading coils to reduce the overall length. On 40 metres the 7.1MHz trap appears as an open switch leaving the first 33 feet of the antenna functioning as a well proven groundplane. On 80 metres the 7.1MHz trap functions as a loading coil and the 3.5MHz trap appears as an open switch, leaving the 63 feet section of the antenna operating. On 160 metres the entire

**Fig 1** Typical installation showing radials and counterpoise





# LOW-COST MULTIBAND ANT

length of the antenna is used, both traps functioning as loading coils with the wire beyond the 3.5MHz trap having negligible radiating properties. This wire may be run down towards the ground if space is at a premium.

## Performance

Performance on 40 and 80 metres is excellent with good coverage in all directions. Performance on 160 metres is still very good when considering the total length of wire between the top of the pole and the second trap; if the end wire is brought down towards the ground, it can be as short as 48 foot or fit into a 35 foot back garden!

Little is against the design of the trapped inverted L, but it is a compromise antenna and the vertical element may prove a little noisy on the receiver in heavily built-up areas. It does not cover the new WARC bands, although the 30 metre SWR is acceptable. The setting up process of adjusting the wire lengths, radials and the counterpoise for the reasonable SWR can be tedious, especially if additional radials are used, so a long time may be spent on the roof. A good friend in the shack is useful here.

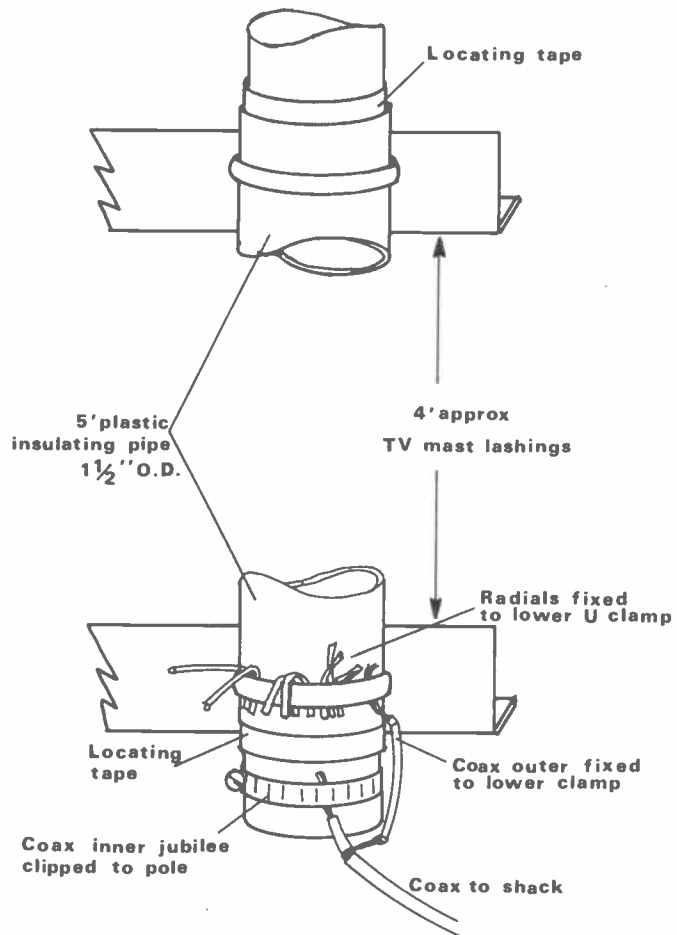
## Construction

The initial construction of the antenna is not critical as all the lengths are found by experiment, but a 15 foot metal pole is really mandatory as a longer pole may strain the chimney stack. Also at this length the 7.1MHz trap is acceptable when the antenna is released at the far end. All the wire lengths given are starting values which may be altered to obtain a low VSWR.

The pole, in this case 15 feet  $\times$  1.25 inches of galvanised steel, has a 5 foot  $\times$  1.5 inch plastic water pipe sleeve fitted around the base, as shown in *Figure 2*. It is useful to place a few turns of masking tape around the pole at each end of the plastic pipe to stop any sliding around while fitting the pole into the clamps. The antenna is held in a pair of heavy duty TV mast chimney lashings placed about 4 feet apart as low down the chimney stack as possible. Check the security of your stack while you are up there.

At the top of the pole an insulator is used with heavy gauge wire or rod held in a jubilee clip (see *Figure 3*). This is bypassed by a length of 55/0.1 extra flexible wire, the insulator acting only as a hinge. Any similar arrangement will suffice, but attaching the antenna wire directly to the pole will certainly cause hardening and breakage as the wire swings in the wind.

At the bottom of the pole the centre wire of the coaxial feeder is attached in place by a jubilee clip, and the other braiding collected and attached to the lower U-clamp with a short length of wire, as shown in *Figure 2*. Run the co-ax away from the clamp and seal the exposed end to avoid the ingress of water. Unless very long lengths of co-ax are used, 100 feet plus, the cheaper RG58/U is adequate.



**Fig 2** Lower section detailing the pole clamps and attachment of feeder and radials

Place the first 7.1MHz trap 18 feet along from the top of the pole and twist up the wire joint; do not solder any joints at this stage. Place the second 3.5MHz trap another 30 feet 2 inches along and continue with another 20 feet 8 inches of wire to the far end ceramic insulator.

## Radials and counterpoise

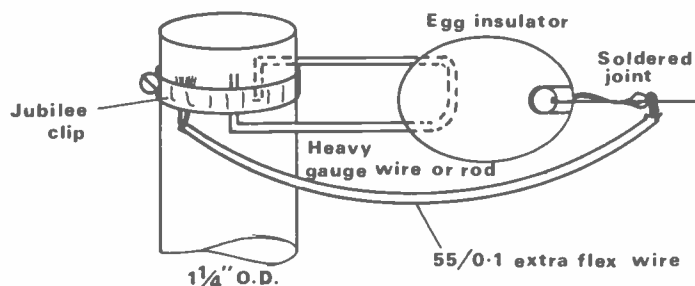
Run three 32 foot radials away from the lower pole clamp for 40 metres, and three 66 foot radials for 80 metres. If black PVC or enamelled colour wire is used it is very unobtrusive when laid out across the roof and the position is not critical. The two lengths may be taped together for convenience if required and doubled back or, preferably, hung down the side of the house and tied off with nylon line. This configuration will suffice for all bands but additional radials for 10, 15 and

20 metres may be tried if the SWR on these bands is unacceptably high. Soldering the radials to the co-ax out of the lower pole clamp will increase the reliability of the antenna.

Run the 160 metre counterpoise down from the roof and along the garden fence or hedge as shown in *Figure 1*. The length of the counterpoise varies somewhat from the theoretical figure owing to the proximity of the ground, but around 100 feet is a good starting length. As with all radials and counterpoise, avoid the far ends from actually touching the ground or other conducting objects as this may destabilise the SWR settings.

The fixing height at the far end of the antenna is not critical but maintaining the wire section parallel to the ground is ideal. Note that the far end of the antenna is a voltage point so keep it high

**Fig 3** Top hinge section detailing the fittings



## LOW-COST MULTIBAND

enough to be out of reach and use a good quality insulator. Whether a tree or pole is used, keeping a loop of nylon line over the top is useful as it enables the antenna to be pulled down rather than let down. If a tree is used allow for any sway when tightening the line, the *Radio Communications Handbook* has some tips on tying off antennas and fixing poles.

Covering all fixtures and fittings, exposed co-ax ends, grading and trap ends, etc in Waxoil, available at the local motor accessory shop, will prove very successful in reducing the long term effects of the weather.

### Adjustments

Before attempting to adjust the antenna it is useful to check for continuity between the far end and the inner of the co-ax in the shack. Check also for the continuity of the counterpoise and radials to the other braiding and check for shorts across the co-ax. If it is all right, hoist it up.

Starting at 40 metres, first find where the lowest SWR is, regardless of what value is shown. If it is better low down the band, say 7.0MHz, then the section of wire between the pole and the 7.1MHz trap is too long. If the SWR is better higher up at a 7.1MHz then this section is too short. Adjust this section of the wire to obtain the lowest SWR in the centre of

the band, paying little concern to the actual value at this stage. Now adjust the length of the 40 metre radials for the lowest SWR, keeping each leg the same length as near as is possible. This may cause the low SWR point to move towards the edge of the band. In this case return to adjustment of the wire section. Repeat these adjustments until an SWR of 1.5:1 or better is obtained in the centre of the band.

### Same procedure

For 80 metres the same procedure is used, but adjust the length of the wire between the traps and the 80 metre radials in the centre of the 80 metre band. An SWR of 1.5:1 should be obtainable.

On 160 metres adjust the length of the end wire for the lowest SWR in the centre of the 160 metre band and then adjust the length of the counterpoise. Again an SWR of 1.5:1 should be obtained.

Having completed the 160 metre adjustments, return to 40 metres and 80 metres, repeating the relevant checks and adjusting as necessary. If the SWR is unacceptable for your equipment on 10, 15 or 20 metres the impedance is most likely too high, so individual radials of 8, 12 and 17 feet respectively in groups of 3 or more can be added to the groundplane and adjusted in length from the lower pole clamp. This may help. Also, various

tails can be added to the wire section to increase the bandwidth as shown in the SMC trap literature. Solder up all joints when alignment is complete.

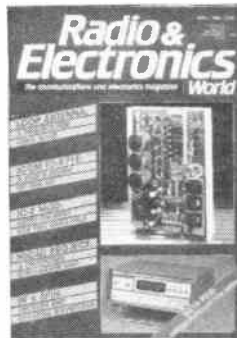
This antenna has no dc path to ground in itself, so a spark arrester across the co-ax in the shack is a good idea, as is earthing your rig properly. If all the adjustments of the antenna seem a chore and you happen to have an ATU, then build it to the figures given and tune out what's left and it will perform just as well. Do note though that without an ATU, the power readings on a 50 ohm power meter placed in the antenna feeder will become progressively more inaccurate as the SWR goes up.

### Infinitely adjustable

To sum up, this antenna is infinitely adjustable with radial trimming and tails, it is not polarisation conscious where it counts, it performs exceptionally well on all the HF phone bands, and is compact, unobtrusive and cheap to build. The small SWR values which may persist make the antenna eminently suitable for a valve PA which will dip a range of load impedances well in excess of what should be obtained. The antenna is suitable for solid-state equipment but where QTH peculiarities or just frustration result in SWR values in excess of 3.1:1, then the use of an ATU is advisable.

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Please note that it is the line socket on the end of the mike

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# COBRA CONVERSION

## PART III

### Roger Alban GW3SPA completes with the conversion of the Cobra multimode CB sets for the 10m amateur band

#### EPROM contents

Those of you contemplating programming your own EPROM will need to understand how to calculate the data to be stored. If we examine *Figure 1*, for example, and require that the set should operate on a frequency of 29.6MHz when switched to channel 30 on the high-band, the VCO will be operating at a frequency of 18.905MHz, and therefore the value of  $F_{in}$  will be 18.905MHz minus 14.995MHz, which gives 3.91MHz.

The value of N in the programmable divider to produce a 10kHz signal into the phase comparator will be 391, the logic levels on the programmable lines can be calculated from examining *Table 2* and the required total binary value will be 391. Therefore, program lines  $P_8$ ,  $P_7$ ,  $P_2$ ,  $P_1$  and  $P_0$  will be at logic level 1 and the remaining program lines will be at logic level 0.

If you are using a commercial EPROM programmer it is usual to find that data to be entered will require to be in hexadecimal for convenience. The conversion from binary to hexadecimal can be accomplished by examining the comparison between the two codes, as shown in *Table 10*. The binary value of 391 is transformed into a hexadecimal num-

**Table 10** Comparison between the Hexadecimal and binary code

HEX	BINARY			
0	0	0	0	0
1	0	0	0	1
2	0	0	1	0
3	0	0	1	1
4	0	1	0	0
5	0	1	0	1
6	0	1	1	0
7	0	1	1	1
8	1	0	0	0
9	1	0	0	1
A	1	0	1	0
B	1	0	1	1
C	1	1	0	0
D	1	1	0	1
E	1	1	1	0
F	1	1	1	1

**Table 11** Conversion of binary code into Hexadecimal code

$P_8$	$P_7$	$P_6$	$P_5$	$P_4$	$P_3$	$P_2$	$P_1$	$P_0$
1	1	0	0	0	0	1	1	1
8				7				

**Table 12** Binary and Hexadecimal address code for channel 30 on high band

$P_9$	$P_8$	$P_7$	$P_6$	$P_5$	$P_4$	$P_3$	$P_2$	$P_1$	$P_0$
0	1	0	0	1	1	0	0	0	1
1	3			1					

ber of 87, as shown in *Table 11*. Remember that the program line  $P_8$  has been permanently connected to the 8 volt supply and will therefore always be at logic level 1.

The advantages of using hexadecimal code is that 8 bits of logic code can be converted into two digits, thus simplifying the entry of data when using a commercial EPROM programmer.

The next problem to solve is in what address this data should be stored within the 2716 EPROM.

You will recall that the 2716 EPROM has eleven address lines:  $A_0$  to  $A_5$  are permanently connected to the channel switch;  $A_6$ ,  $A_7$  and  $A_8$  are permanently connected to the band switch;  $A_9$  is used for repeater shift; and  $A_{10}$  is not used and is therefore permanently connected to ground.

For example, the memory board EPROM address for channel 30 on the high-band will be obtained by initially examining the channel switch code shown in *Table 3*, together with the examination of the logic levels on the address lines  $A_6$  through to  $A_9$ . On the high-band address line  $A_8$  will be at logic level 1; the complete logic address being shown in *Table 12*, together with the equivalent hexadecimal code.

You will see that for channel 30 on the high-band the hexadecimal code is 131. If the repeater shift facility had been selected, address line  $A_9$  would also be at logic level 1 on transmit; this would then make the hexadecimal address code change on transmit from 131 to 331. Address location 331 will therefore contain a hexadecimal code that will shift the transmit frequency 100kHz below the receiver frequency.

#### Programming the 2716 EPROM

The Intel 2716 EPROM is a relatively easy device to program by either using a home-made EPROM blower attached to the home computer, or by using a home-made manual programmer and inputting eight bits of data at a time using a series of switches connected to a power supply. This is an easier way for anybody who does not wish to become involved with home computers, but I can add from experience that it does take a long time and a lot of patience.

To program the EPROM it is first of all necessary to establish that the memory device is completely erased. That is, each individual bit should be at logic level 1. If this is not the case, then the glass window of the EPROM will need to be exposed to ultraviolet light for a minimum period of 15 minutes. It is interesting to note that if the EPROM is

exposed to a constant source of fluorescent light at normal room lighting levels it would take approximately 3 years to erase. However, if the EPROM is exposed to direct sunlight it will take approximately 1 week to erase the EPROM, so it is advisable that the glass window be covered with an opaque label to prevent unintentional erasure after the EPROM has been programmed.

After establishing that all the bits of the EPROM are in the logic level 1 state, the data can be introduced by selectively programming logic level 0s into the desired address locations. Although only logic 0s will be programmed, both logic 1s and 0s can be presented in the data word. The only way to change a logic 0 to a logic 1 is by ultraviolet light erasure which will erase the entire contents of the EPROM memory. Consequently, extreme care is essential when programming by hand.

#### Constant logic level

The 2716 EPROM can be programmed when the  $V_{pp}$ , pin 21, is fed with 25 volts, and function CS, pin 20, is at 5 volts. The data to be programmed is applied 8 bits in parallel to the data output pins; the levels required for the address and data inputs are at TTL levels. When the address and data lines are held at a stable constant logic level, a 50 millisecond TTL program pulse must be applied to the PD/PGM input, pin 18. A program pulse must be applied at each address location to be programmed and you can program any location at any time, either individually, sequentially, or at random. The program pulse must have a maximum pulse width of 55 milliseconds.

A mode select table for the 2716 EPROM is shown in *Table 14*, which lists the six modes of operation. It should be noted that all inputs for the six modes are at TTL levels. The power supplies required for programming are 5 volts and 25 volts.

The EPROM can easily be read with a single 5 volt supply, and the data contained in the various address locations will appear on the data output lines when a particular address logic code is applied to the address lines.

#### Conclusions

The converted set has been in use in the author's shack for the past four months. The signal reports received would indicate that the quality of the FM and SSB audio on transmit was very acceptable. The output power of the set was measured as being just under 8 watts, and was certainly adequate for local contacts.



# COBRA CONVERSION

LOW		HEX		MID		HEX		HIGH		HEX		LOW R		HEX		MID R		HEX		HIGH R		HEX	
0 4	F	1	A	0 8	F	4	2	1 0	F	6	A	2 4	F	1	0	2 8	F	3	8	3 0	F	6	0
0 5	0	1	B	0 9	0	4	3	1 1	0	6	B	2 5	0	1	1	2 9	0	3	9	3 1	0	6	1
0 5	1	1	C	0 9	1	4	4	1 1	1	6	C	2 5	1	1	2	2 9	1	3	A	3 1	1	6	2
0 5	3	1	D	0 9	3	4	5	1 1	3	6	D	2 5	3	1	3	2 9	3	3	B	3 1	3	6	3
0 5	4	1	E	0 9	4	4	6	1 1	4	6	E	2 5	4	1	4	2 9	4	3	C	3 1	4	6	4
0 5	5	1	F	0 9	5	4	7	1 1	5	6	F	2 5	5	1	5	2 9	5	3	D	3 1	5	6	5
0 5	6	2	0	0 9	6	4	8	1 1	6	7	0	2 5	6	1	6	2 9	6	3	E	3 1	6	6	6
0 5	8	2	1	0 9	8	4	9	1 1	8	7	1	2 5	8	1	7	2 9	8	3	F	3 1	8	6	7
0 5	9	2	2	0 9	9	4	A	1 1	9	7	2	2 5	9	1	8	2 9	9	4	0	3 1	9	6	8
0 5	A	2	3	0 9	A	4	B	1 1	A	7	3	2 5	A	1	9	2 9	A	4	1	3 1	A	6	9
0 5	B	2	4	0 9	B	4	C	1 1	B	7	4	2 5	B	1	A	2 9	B	4	2	3 1	B	6	A
0 5	D	2	5	0 9	D	4	D	1 1	D	7	5	2 5	D	1	B	2 9	D	4	3	3 1	D	6	B
0 5	E	2	6	0 9	E	4	E	1 1	E	7	6	2 5	E	1	C	2 9	E	4	4	3 1	E	6	C
0 5	F	2	7	0 9	F	4	F	1 1	F	7	7	2 5	F	1	D	2 9	F	4	5	3 1	F	6	D
0 6	0	2	8	0 A	0	5	0	1 2	0	7	8	2 6	0	1	E	2 A	0	4	6	3 2	0	6	E
0 6	2	2	9	0 A	2	5	1	1 2	2	7	9	2 6	2	1	F	2 A	2	4	7	3 2	2	6	F
0 6	3	2	A	0 A	3	5	2	1 2	3	7	A	2 6	3	2	0	2 A	3	4	8	3 2	3	7	0
0 6	4	2	B	0 A	4	5	3	1 2	4	7	B	2 6	4	2	1	2 A	4	4	9	3 2	4	7	1
0 6	5	2	C	0 A	5	5	4	1 2	5	7	C	2 6	5	2	2	2 A	5	4	A	3 2	5	7	2
0 6	7	2	D	0 A	7	5	5	1 2	7	7	D	2 6	7	2	3	2 A	7	4	B	3 2	7	7	3
0 6	8	2	E	0 A	8	5	6	1 2	8	7	E	2 6	8	2	4	2 A	8	4	C	3 2	8	7	4
0 6	9	2	F	0 A	9	5	7	1 2	9	7	F	2 6	9	2	5	2 A	9	4	D	3 2	9	7	5
0 6	C	3	0	0 A	C	5	8	1 2	C	8	0	2 6	C	2	6	2 A	C	4	E	3 2	C	7	6
0 6	A	3	1	0 A	A	5	9	1 2	A	8	1	2 6	A	2	7	2 A	A	4	F	3 2	A	7	7
0 6	B	3	2	0 A	B	5	A	1 2	B	8	2	2 6	B	2	8	2 A	B	5	0	3 2	B	7	8
0 6	D	3	3	0 A	D	5	B	1 2	D	8	3	2 6	D	2	9	2 A	D	5	1	3 2	D	7	9
0 6	E	3	4	0 A	E	5	C	1 2	E	8	4	2 6	E	2	A	2 A	E	5	2	3 2	E	7	A
0 6	F	3	5	0 A	F	5	D	1 2	F	8	5	2 6	F	2	B	2 A	F	5	3	3 2	F	7	B
0 7	0	3	6	0 B	0	5	E	1 3	0	8	6	2 7	0	2	C	2 B	0	5	4	3 3	0	7	C
0 7	1	3	7	0 B	1	5	F	1 3	1	8	7	2 7	1	2	D	2 B	1	5	5	3 3	1	7	D
0 7	2	3	8	0 B	2	6	0	1 3	2	8	8	2 7	2	2	E	2 B	2	5	6	3 3	2	7	E
0 7	3	3	9	0 B	3	6	1	1 3	3	8	9	2 7	3	2	F	2 B	3	5	7	3 3	3	7	F
0 7	4	3	A	0 B	4	6	2	1 3	4	8	A	2 7	4	3	0	2 B	4	5	8	3 3	4	8	0
0 7	5	3	B	0 B	5	6	3	1 3	5	8	B	2 7	5	3	1	2 B	5	5	9	3 3	5	8	1
0 7	6	3	C	0 B	6	6	4	1 3	6	8	C	2 7	6	3	2	2 B	6	5	A	3 3	6	8	2
0 7	7	3	D	0 B	7	6	5	1 3	7	8	D	2 7	7	3	3	2 B	7	5	B	3 3	7	8	3
0 7	8	3	E	0 B	8	6	6	1 3	8	8	E	2 7	8	3	4	2 B	8	5	C	3 3	8	8	4
0 7	9	3	F	0 B	9	6	7	1 3	9	8	F	2 7	9	3	5	2 B	9	5	D	3 3	9	8	5
0 7	A	4	0	0 B	A	6	8	1 3	A	9	0	2 7	A	3	6	2 B	A	5	E	3 3	A	8	6
0 7	B	4	1	0 B	B	6	9	1 3	B	9	1	2 7	B	3	7	2 B	B	5	F	3 3	B	8	7

Table 13 The EPROM memory address/data codes

## Receiver performance

The receiver performance seemed to be slightly on the deaf side when compared with other converted CB rigs on ten metres. It is thought that the cause of the deafness is the auto-matching transformer L7, at the front-end of the receiver.

To get the tuned circuit to peak on ten metres, the tuning core had to be completely removed from the coil former (there is no external tuning capacitor associated with L7) and it is believed that this tuned circuit is tuned using the natural capacitance of the winding.

Although this slight deafness of the receiver has not affected the performance of the set, the author considers that it might be worth further investigation. The winding on L7 needs to be carefully unwound and the exact number of turns counted. Keeping the turns ratios between the primary and secondary the same, the coil former is rewound with a couple of turns less than the original winding until the tuned circuit can be peaked on ten metres.

Out of all the CB sets modified by the author to date, the Cobra model has proved to be the easiest to convert for

use on the amateur ten metre band. All of the tuned circuits, with the exception of the VCO coil and L7, were retuned without the need either to change the value of the tuning capacitor or to modify the value of inductance of the tuning coil. The beep tone which is heard when the press to talk switch is released can be removed by cutting the wire soldered to the front right-hand side of the component side of the PCB marked 'BEEP'.

## Finally

Finally, I wish you the best of luck with the modification and look forward to working you on ten metres.

Table 14 Mode selection for the 2716 EPROM

MODE	PINS	PD/PGM (18)	CS (20)	V <sub>pp</sub> (21)	V <sub>cc</sub> (24)	OUTPUTS (9-11, 13-17)
Read		V <sub>IL</sub>	V <sub>IL</sub>	+5	+5	D <sub>OUT</sub>
Deselect		Don't care	V <sub>IH</sub>	+5	+5	High Z
Power down		V <sub>IH</sub>	Don't care	+5	+5	High Z
Program		Pulsed V <sub>IL</sub> to V <sub>IH</sub>	V <sub>IH</sub>	+25	+5	D <sub>IN</sub>
Program verify		V <sub>IL</sub>	V <sub>IL</sub>	+25	+5	D <sub>OUT</sub>
Program inhibit		V <sub>IL</sub>	V <sub>IH</sub>	+25	+5	High Z

## PROGRAMMED EPROM

Roger Alban has a supply of programmed EPROMs available for those of you who want to take the easy route through this conversion.

The EPROM costs £8.50, including postage and packing, and is available through the magazine.

Please make your cheque payable to Roger Alban and send it with a note of the quantity required to:  
*Amateur Radio Magazine,  
 EPROM Offer, Sovereign House,  
 Brentwood, Essex CM14 4SE*



## News and comment from Glen Ross G8MWR

What must have been one of the greatest auroras in radio history came upon us on 7 February. The first inkling that something good was going to happen came on the 5th when the sun noise was very high all day, peaking in the evening at around 15dB above the normal level and making GB3CTC, which is normally a steady but weak signal at this QTH, completely disappear. This was followed by a virtually complete black-out of the HF bands which confirmed that something big was just around the corner!

### Northern lights

By early afternoon on the 6th there were reports of an A index of over 60 and it was climbing rather like an express lift. The sun activity commenced around 0900 on the 6th with an M5 flare which reached a peak at about 1030 and continued until eventually dying away at about 1130. A huge flare on the 8th generated a massive magnetic storm and a similar event occurred in the early evening of the 9th. All this was coupled with a proton event in the early hours of the 8th which continued until around 2000hrs.

By the time all this activity affected our atmosphere the alarm bells had been ringing, and even if you were not into amateur radio the resulting visual aurora was something to behold, with reports coming in from as far south-west as Cornwall.

### Ghostly voices

For those of you who have not experienced auroral propagation, perhaps a word of explanation would not go amiss. What happens is that when all the rubbish that has been thrown out of the sun reaches us a few hours later it tends to collect around the poles. The exact mechanism by which the auroral curtain is formed need not concern us here. Suffice to say that the curtain acts as a tolerably good reflector of VHF signals.

It does have one nasty point, though, and that is that it does not behave like a sheet of metal and act as a well defined reflector. Not only is the radio surface ill defined, it is also shifting. Watching a display will give a fair idea of what is going on.

Because of all this the signals that are reflected vary in strength and phase due

to the doppler shift. This is the well-known effect of change of pitch which one gets when an ambulance or fire engine goes past.

Unfortunately, in the radio sense the change in pitch is very variable, and this is what gives the effect of ghostly voices over the air which can make it very difficult to decipher what is being said.

### This is how

The way to get a degree of success in these circumstances is to speak very slowly and distinctly and repeat everything several times. This makes sense when you consider that your received signal will have more wobble on it than a Johnny Mathis vocal or Ackers clarinet. You must also determine where the reflective part of the curtain is and beam into it; there is normally no point in trying the direct path. For paths into Europe start out on around forty-five degrees magnetic, but do not be surprised to find wide variations.

### Down the pub

The event usually consists of at least two phases, so do not be surprised if a couple of hours after the event seems to have ended it all starts up again. You can very often get better results in the second half because most of the less knowledgeable of the brethren have packed it in and gone down to the pub.

Due to the fact that the sun makes a complete revolution every twenty-eight days, the same features that provided the opening may well still exist and provide another one for you to play with four weeks later. Keep a calendar of when events happen and you can get advance warning of the next one, if you are lucky.

### What happened?

As you can imagine, from the description above, the best results were obtained on CW where the doppler shift is nowhere near such a big problem. The highest country score reported was twenty-three by GM6TKS, who amongst others managed a contact with OY9JD in the Faroe Islands. The best known squares score was about fifty-five.

The squares worked ranged from M to the west to K in the east, and from H in the south right up to U in the north. If you

have a look at that lot on a map it will give you some idea of just how widespread this event was.

Some of the countries worked included: SM, OY, OZ, OH, ON, PA, DL, UQ2, EI, GM, GI, LA, UP, SP, HG, GW, YU, OK, YO, RQ2, OE, Y23 and DB. All of this was compiled from early reports of the event, so it will be interesting to see just what the final tallies come to.

### 50MHz

The aurora gave even better results on the new 50MHz band and activity was very high indeed considering the short time the band has been generally available to us. Stations reported as being worked include: OZ6M, CT1WW, EI6AS and PA0XAM. The PA0 presents something of a problem because as far as is known there is no allocation of the band in Holland. Perhaps it was someone deciding to have a bit of fun at our expense, or maybe there is more good allocation news to come.

The general day to day level of activity on the band is still fairly low and the thermostat problem still seems to be one of the major sources of conversation. It is obvious that some stations are running power way above the permitted maximum and this is something which really must stop. We are in a sense on trial and any problems can mean that the band will be *immediately* withdrawn. We have waited a long time to get the facility, and we do not want to lose it just because of selfish behaviour on the part of a few people.

### The awards

Having had the grand slam on the award scene last month, we have now got back to something approaching normal, although I expect the aurora will bring in another big rush of claims. First away this month is G6UVZ, of Gateshead, who claims a 432MHz Gold award. During the last year he has obtained a score of 15 countries, 63 squares and 45 counties. This is good proof that, in general, anything you can do on two metres you can do on 70cms. He also bemoans the fact that few operators seem to beam to the north. This tends to be true, but if you really want the rough end of the stick try living in the far south-west of the country.

### Four and six metres

Here comes the first aurora assisted claim, this one from Tony G4NBS, near Cambridge, who gets a 144 Silver. He says that during the aurora he worked ten countries, including UQ2, and heard French stations as far south as CG square. He also asks about awards for 4 and 6 metres. These can be easily arranged but I would like to hear from you as to what you think the requirements for the various grades should be. Do not forget that these could be covered by the special category awards. As I have said before if you think you have achieved something worth some recognition then let me know.

Another award goes to Cleveland, this one being a 144 Bronze to G1NGF. All the contacts were made running less than 25



## ON THE BEAM

watts and the best DX was F6FUZ at just over 1000kms.

Ian G1MQH claims a 144 Bronze from Bishop Auckland. His was obtained running just 2.5 watts from a FT290 to an eight element yagi. Ian is also planning an assault on both 432 and 1296MHz. This activity will be welcome as we do not hear too much from up that way, especially on 23cm.

### Rude callsigns

Ever since the dawn of amateur radio it has been the normal practice not to issue callsigns that could be offensive. The DTI, in its infinite wisdom, has now instructed the licensing department to issue all callsigns except SOS and the Q code sequence, which could result in some very undesirable callsigns.

When approached on the matter the DTI said that they would give sympathetic consideration to anyone requiring a change of callsign in these circumstances. This seems to miss the point that whilst the recipient of the call may have a warped sense of humour and decide to keep the call, other licencees may well be offended when they hear the call on the bands. The old system was easily administered and there seems to be absolutely no reason for the change other than some petty official doing a bit of empire building.

### Morse matters

We have now come to the end of the Morse experiment and the RSGB asks that all those who took part will let them know how useful they found it and how much use was made of the facility. A very unfortunately worded questionnaire was included in *Radcom* which gave the impression that only class A operators were required to give an opinion as to whether the experiment should be continued.

This was not the intention and you are supposed to have the sense to realise that all questions except the first one after the heading 'Class A operators only' towards the end of the form, were to be answered by all operators.

### RSGB service

The new RSGB Morse testing service is just about to get off the ground. I have received several comments from people who thought that the system was open to abuse on the lines of the old boys act. Any chance of this happening has been laid to rest by the announcement that when you take the test there will be two examiners present to see fair play.

This is an excellent idea, and it means that we have got a bit more of the regulation of the amateur radio hobby into our own hands and it must be seen to be run beyond reproach.

Before leaving this subject I feel we must give credit to Gavin who, against all the odds, got the go-ahead for Morse testing at rallies and then spent so much of his own free time travelling around the country to administer the tests. A lot of people got the A ticket due to his efforts and I feel sure you would not want his efforts to go unrecorded.

### Odds and ends

The special four metre activity station for March will be G4ENB. Volunteer stations are still required to complete the project, and if you are interested please contact G4WND or G4SEU who are both QTHr. The DTI has started a purge on cordless telephones, so if you have one of these things please bear in mind that the maximum fine is £2000 or three months in the nick.

The first 10GHz cumulative contest is from 0900 on 13 April, with activity also scheduled for 3.4GHz on the same event. On 6 April there is the 432MHz CW contest and there is a 70MHz event on the 20th of the month.

### The big switch

That closes us down for this month. Please remember to send all information and comments to me at 81 Ringwood Highway, Coventry or on Prestel 203616941.

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After many requests from readers, G3OSS has arranged to review the trusty Yaesu FT757GX HF general coverage transceiver

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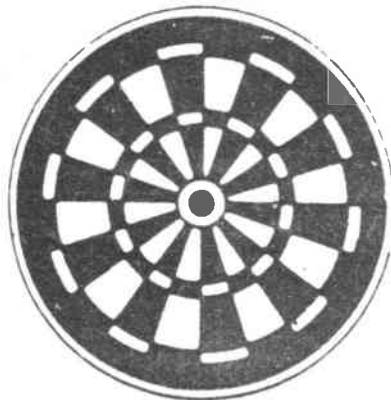
Joe Kasser G3ZCZ explains how to use these repeaters in the sky to obtain the most impressive results

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Lots of other programs, see March issue.

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# SECONDHAND EQUIPMENT GUIDE

by Hugh Allison G3XSE

Whenever your scribe visits a rally, junk sale or car boot sale, the price that an item of amateur radio gear is seen to be sold at is noted. Note the 'sold at' bit; this is not necessarily the advertised price and the price is only noted as a sale from one amateur to another, without 'dealer' involvement.

On occasion this learned column has published a collected list of equipment prices, apparently without much response from the readers. Last year, in consequence, it wasn't published and I've received letters asking when the 1985 list will be printed, so here it is.

## The rules

The following list does not cover prices from a dealer. He will have to cover guarantee work etc out of his mark-up and, in consequence, is entitled to charge more - in some cases 25% or more is justifiable. All equipment must

be in clean, unmodified condition and working. As a very rough rule of thumb guide, non-working examples fetch about a third of the price of a worker.

Only after three examples of an item have been seen to change hands does it appear in the list, and all prices are averaged out. Thus, if the price of a piece of equipment doesn't appear in the list, it doesn't mean that we haven't heard of it, we simply haven't been around when three or more have changed hands. The non-listing of an item should not be taken as any indication of its popularity.

You are obviously free to buy, or sell, any item at any price you wish; the following is a guide only. Neither the author or the magazine know where an example of a piece of equipment is for sale at the listed price, but, having said that, a 'wanted' advert in the back of this magazine has, at times, worked wonders.

Crystal controlled rigs are quoted as

having three to five useful channels; for extra channels you can probably add about a pound a go. Similarly, hand portables that had no rechargeable batteries fitted when new and are offered for sale with Nicads and charger, can be inflated by a fiver. For extra battery packs, also add a fiver.

Finally, an apology: I'm sorry about the Microwave Modules list. I list them by what they do. 'In' means the frequency you drive them at, ie the frequency of the transceiver you already have, 'out' represents the new band you get by virtue of the transverter.

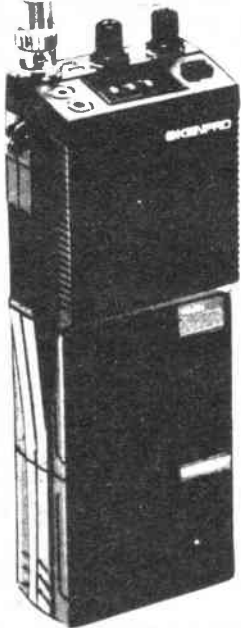
On the subject of transverters, the price shown includes attenuators, hand-book and power leads. Knock the obligatory fiver off if not supplied. The 10 in, 2 out one listed below is the old, diecast box version, not the new 'rack-mount' version that only recently went on sale.

## SECONDHAND EQUIPMENT PRICES

Odds 'n Sods (In no particular order)		Heathkit		Liner	
Mizuho SB2X and SB2M	£55	HW7	£35		
AR88	£35	HW8	£80	2	£50
HRO + 5 coils	£30	HW100	£65	70	£80
HF5 ant (radials add £10)	£25	HW101	£145	10	£60
Datong Morse tutor	£35				
Dentron 100B linear	£175				
Pye Pocketphone (no crystal) Rx	£3.50	<b>Icom</b>			
Pye Pocketphone (no crystal) Tx	£8	IC2E	£90	IC251E	£325
Charger for pocketphones	£5	IC22	£35	IC730	£395
Pye compact	£20	IC22A	£60	IC260	£165
Philips N1500 video	£25	IC240	£85	R70	£385
Philips N1700 video	£35	IC255	£105		
V2000 machines (all)	£45				
AR2001	£200	<b>Trio</b>			
KW2000	£125				
KW2000B	£175	TS120S	£275	TR9000	£260
Codar AT5 Tx	£20	TS130S	£330	TR2200	£40
Codar T28 Rx	£12	TS430	£500	TR2200G	£45
Codar CR70A Rx	£20	TS510	£95	TR2200GX	£55
Atlas 215X (1.8-21MHz)	£195	TS520S	£295	9R59DS	£35
Quartz 16	£65	TS530	£375	TR9130	£320
Nag 144XL linear	£280	TS830S	£480	Lowe Tx 40	
		TS930S	£730	(10 FM)	£35
<b>Microwave Modules</b>		<b>Yaesu</b>			
2 in 10 out transverter	£45	FR50B	£65	FT290	£170
10 in 2 out transverter	£65	FL50B	£65	FTDX401	£155
2 in 70cm out transverter	£90	FT7 (with linear)	£185	FTDX560	£185
2 metre converter, 10 metre IF	£12	FL2100B	£200	FT221R	£250
70cm converter, 10 metre IF	£15	FT One	£935	FT757GX	£480
23cm converter, 10 metre IF	£22	FRG7	£70	FT707 (with FP707PS)	£405
TV converter (70cm)	£17	FL2100Z	£325	FRG7700 (with memory)	£200
2 in 70 out tripler	£18	FRG7000	£135	FT790	£235
2 metre linear 10W in 100 out	£85				

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We're also careful about selecting retailers to represent us. If we're not happy with the service offered by a dealer we won't supply them! (You'd be amazed at the creativity of some of those people who we won't supply in trying to explain why they no longer stock our products!!)

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73! Christ Bartram G4 DGU

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SLNA 144s 144MHz low-noise switched preamplifier using BF981. 15dB typical gain. 0.9dB typical nf, 100W through-power .....	£41.95	LBPF 144u Low-loss 144-148MHz two-pole bandpass filter. 0.3dB typical insertion loss, 100W power handling .....	£24.90
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GMFA 144e High performance low noise figure (0.8dB) high dynamic range masthead-mounting preamplifier. 1.5KW through power when used with ATCS 500 sequencer-controller 200W internal rf switching capability .....	£129.95	ATCS 500 Sequencer-controller .....	£34.90
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		All transverter products .....	£5.65
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■ Yaesu FT101B, offers. Tel: Inverness 791954.

■ Turbo ROM for C64, new from VK, load, save etc, speeds disk functions by 5 times, plug-in 5 mins with instruct. £20 plus post. Icom 720A HF trcvr, gen cov, £650. IC2E h/held plus accs, £140. IC2AT new h/held, 5W, £240. Yaesu NC8C base station for 208, 708 etc, £45. Swan HF mob, £450. Martyn, PO Box 8, Mirfield, West Yorks WF14 0XA. Tel: (0924) 495916 evenings.

■ Icom IC720A good HF gen cov trcvr. Icom IC2E hand-held with accs. Yaesu NC8C base station for VHF/UHF. Handy Swan Astro 150 HF solid-state QRO rig. BT Hawk cordless phone, 300yd range, as new, £110. Turbo ROM for C64 micro, 5 times faster, load, save, etc, £20 plus p&p. Martyn G4SOI, 112 Leeds Road, Mirfield, West Yorks WF14 0JE. Tel: (0924) 495916.

■ Two VDUs, digital decscope, TTY compatible (with Creed model 33), 110, 600, 1200, 2400, 9600 bauds, with cable (no connection details), both working, one suitable for spares, £35 the pair. Tel: Chris G1DEY, 01-888 8903 (Wood Green, North London).

■ Power unit Trio PS5, suitable TR7010, £25 ono. 10 element crossed yagi, £25 ono. Creed 75 teleprinter minus gears, £10 ono. Mag mount, needs some cosmetic attention, £5. 20ft portable mast, £15. Super Rod 2 as advertised by Walters and Stanton, half price at £5.50. Swap any of above for 70cm gear. Buyer to collect or arrange carriage. Roger Woods GW8XAN, 20 Heol AP Pryce, Yorkdale, Beddau, Pontypridd CF38 2SH. Write or tel: Newtown, Llantwit 201694 after 6.30pm.

■ Telephone answering machine, sell or exchange 934 sideband or SW multi-band receiver, WHY? Answering machine is of the remote type. Tel: (0268) 710946.

■ Tokyo hy-power 70cm linear, 3W in 45W out, as new, £125 ono. NEC RGB 12in very high res colour monitor, 640 x 400, perfect, also NEC 12in green screen monitor composite video, perfect, £75. P/ex any of above for Robot 450C or 1200 SSTV unit, must be perfect. Cash adjustment. Tel: Paul G4XHF, Crawley (0293) 515201.

■ AR2001 communications receiver 25-500MHz, no gaps, new, unused and boxed, £200. Also 16 element discone VHF/UHF aerial, as new, £25. Also VHF/UHF active planar discone, complete, £40. Either aerial is ideal for the AR2001. Tel: (04868) 7088.

■ Sale or p/ex, MM 2m converter, 144MHz to 28/30MHz, as new, cost £30+, take £20 ono. Audioline PT345 27MHz base station, excellent cond, cost £150, take £90 ono. RF26B VHF unit, airborne nav, working, offers. Wanted: HF ATU, FC902 or similar. Tel: Peter (0243) 573462 evenings, 10.00-11.00 preferred.

■ Icom IC4E 70cm, in nice condition with four

nicad packs, BP1, 2, BP3, BP4. BC35 multi-charger and DC1 12V conv. CP1 charger, BC25 charger, HM9 speaker mic, LC2 case, LC3 case, AC's books, etc, plus service workshop manual. The value of above; £460. Sell the total lot for £236 plus post and ins. Free gift: logic probe audio visual. Note all fitted into a custom briefcase, shockproof. Also has its own boxes. Tel: (0473) 85526.

■ Brass Morse key with cover, weighs 15oz/440 grams, £12. Tel: Fred, Halifax (0422) 53979 anytime.

■ Revox reel to reel tape recorder, A77. It's got everything - stereo, Dolby 'B', three heads, 7½ or 3¾ ips edit, dubbing, echo, remote control, plus a lot more. Good manual, plus all circuits, cost over £500, prefer buyer collects and sees full potential. Giveaway at £180. Also four boxed blank TDK 3600 tapes available. Roy Mallinson, 4 Fford Tegid Park View, Wrexham, Clwyd. Tel: 355389.

■ FT901D HF rig, all options, AM, FM, FSK, Curtiss keyer. Pristine condition and little used as back-up rig. Would sell with haggle around £500, or would exchange for 2m base station multimode and general coverage Rx in similar condition, or WHY? Tel: G4FKZ, QTHR, (061) 624 2808.

■ Yaesu FT730R 70cm FM rig, plus 3 x ¾ collinear for base (unused). Also mobile aerial, gutter mount and a Yaesu boom mic with switching box, all in mint condition, £220 ovno. Also 13 ele portable tonna, still boxed, £25. Tel: Ian G1HQK, 01-385 2373 before midday or after 21.00hrs.

■ Heathkit SW717 receiver, £87. Also Trio R2000 receiver with VHF converter fitted, £425. Tel: Wood Chockan 378.

■ Two metre receiver, £45. Xtalred R2, R7, R1, S10, S12. Pre-amp 2-30MHz, receive only, £15 including postage. Portable colour TV, Philips, not remote control, £75. Tel: 01-674 0513 after midday.

■ Burndept three channel UHF trans/rec hand-held. Expensive unit, good order, offers. May exchange, WHY? Tel: (0480) 300278 anytime.

■ Commodore 64 computer and tape cassette, joystick, books, games, all as new, bargain £150. Marconi radio 1931 on turntable, not working but all manufacturer's instructions, offers please. Tel: Lyme Regis 3008 evenings.

■ Yaesu 901DM HF transceiver, VOX, FM, Curtis keyer, voice processor, 12V dc power supply all built in, mint, boxed, £500. Kenwood AT200 ATU, mint, £100. Tel: (0563) 34366.

■ FT7B with FM, manual, mobile bracket, 13.5V 20 amp power supply, G whip tribander, 80m/40m coils, whip, base mount, used one week only, KW Ezee match ATU, all in gwo and excellent condition. Offers, or consider haggle exchange for FRG9600 or FRG8800 with FRV8800. Cliff G4JGT. Tel: (0326) 73590 day, (0326) 313688 after 5pm.

■ Icom IC202S SSB/CW 2m portable, xtalled 144.0 to 144.6 and 144.8 to 145, boxed, mobile mount, £115 or swap IC2E or similar 2m FM hand-held or VHF/UHF scanner. Barry Stone G6SRE. Tel: Ashford (Kent) 25991.

■ Hand-held 40 channel CB as new, CB with battery charger dc power cord, plugs, rubber duck antenna, also Dym microphone, cost £162 with extras, will sell for £90. Jack Wingrove, 114 Wakehurst Road, Battersea SW11 6BT. Tel: 01-228 4835.

■ Linear amplifier L92S 27MHz 100W 12-14V, £45 ono. SWR power meter, £5. TVI low pass filter 27MHz, £3. Breml ATU, £4. New resistors, 1K, 3K3, 9K1, 50K and capacitors all for £8. 3 years magazines (Radio Communications, Amateur Radio, Ham Radio), £15 the lot. Tel: Emilio. (0694) 722131 (Church Stretton, Salop).

■ HRC3 video recorder £300. 40 VHS/Ctapes, £110. Video lens, £40. BNOS LPM 1-50 UHF, £165. Tel: Great Yarmouth 667597.

■ Sony 2001 scanning receiver, HF, VHF. One year old, excellent condition £105. Just passed RAE.

Tel: Braintree (0376) 43243.

■ Collector has Larkspur to present tactical radio, including B47, A41 No 3, various Pye, Redifon, Racal, American, to exchange or p/ex any Racal Green tactical items. List available. Sayers, 120 Birmingham Road, Redditch, Worcestershire.

■ CB transceiver storker 9 DX, FM, AM, LSB, USB, good condition, £85. Hitachi stereo radio cassette recorder, 4 waveband, large portable and record deck, £130. Tel: 01-207 2326 or 207 0706.

■ 'Dual' compact-disc player in pristine condition, recently checked by Hayden Labs Ltd (Model CD120), £185 or will p/ex against Yaesu/Icom transceiver and power unit, recent model. Local contact preferred please. (Cheshire/Staffs/Lancs/Manchester/Merseyside). Tel: (051) 355 2833 (Wirral).

■ Yaesu FT730R 70cm only, six months old, never used mobile, mint and boxed, £155. Brand new Jaybeam 70cm 12XY boxed, £25. Tonna 9XY yagi as new for 2m, £25. Daiwa 60W 2m linear, £55. Tonna 2m 4 ele yagi, £8. Brand new heavy duty 7A PSU, boxed, £28. Brand new Yaesu YM48A keypad mic, £29. Yaesu goose neck mic base stn, £13. Ken Mott, 191 Joyners Field, Harlow, Essex. Tel: (0279) 26647.

■ Yaesu FT757GX full coverage transceiver with base and hand mic, £625. Daiwa ATU, £120. All boxed and mint condition. Tel: Nottingham (0602) 894547.

■ FTV107R transverter frame with 70cm and 50MHz to suit FT757, FT77, FT707, plus others used. All only 4 months old, £350. Tel: Alan (0602) 271824.

■ 2m TR9000 and extras, around £300 please. Also 10 channel scanner, Slim Jim and PSU. Quick sale, £30. Tel: Bob, Keynsham 67737 after 6pm.

■ 70cm UHF hand-held transceiver, fully synthesized 430-440MHz. Kenpro model KT400EE, same as IC4E, unwanted present, new December 1985, complete with nicad charger and very small whip antenna, £150 ovno. Also Kenwood TR9000 multimode 2 metre transceiver with mobile mount, £275 or p/ex for digital HF transvr. John Bower, 22 Waterloo Road, Mablethorpe, Lincs LN12 1JP. Tel: (0521) 72686.

■ Ham jumbo home base, first-class order, hardly used, £100. Also Ham Concorde II expanded 40 legal, good con, £95. Also elec guitar, Aria pro II, Gibson copy (Japan), twin pick-ups, five position tone control, colour-walnut brown, beautiful nick, £120 ono. Case included (flight). Tel: (0228) 23408 after 6pm.

■ Exchange Yaesu FT290R (six months old) and Microwave Modules 144/30LS linear (three months old) for 2 metre mobile multimode, prefer FDK multi 750XX, but others considered. Cash adjustment if required, can collect. Peter Wallace. Tel: (0952) 613080 (Salop).

■ Power supplies - Welz base 30 amp, almost new, £159 ono. Breml 3 amp, £11 ono. 2m quad six ele Jaybeam, rotator and controller, plus co-ax and control line, £59. Tel: Frank, 01-429 0381.

■ Yaesu FRG7 0-30MHz receiver plus Timestep DFC and 2m converter, £105. Tel: (05645) 5802 (West Midlands).

■ Racal RA17, good working order, £100 plus postage, or prefer buyer collect. Every copy of *Amateur Radio* from issue one to May 1985 with binders; offers. Tel: Batley (0924) 475474 after 6pm only, or write: Mr L Garforth, 139 Carlinghow Lane, Batley, W Yorks WF17 8DW.

■ KW107 Supermatch ATU, one owner, £85. F Soans, 73 Beverley Rd, Leamington Spa, Warwicks. Tel: (0926) 25395.

■ Icom AT100 auto antenna tuner, excel cond, £235 ono. Tel: John, Gainsboro' (0427) 5266.

■ Antennas galore! Four 25el loop yagis for 23cms plus Tonna power splitter, £95. Four 432/19 Tonna plus splitter & Tonna stacking frame, £125. One 432/19 MET, almost new, £28. Tonna 432 four way splitter, almost new, £30. Peter Crosland. Tel:

# FREE CLASSIFIED ADS

(0905) 620041 anytime on the musical answer-phone!

■ Yaesu FT101Z HF transceiver, modified to cover 11 metre band, CW filter and base mike included, good working order. Sell £295 or p/ex HF receiver plus cash. Tel: 01-733 0665.

■ Trio TR9000 two metre multimode, matching PSU and base stand. Also three antennas and rotator. All very good condition, £300 ono. Tel: Martin, Leicester (0533) 895583 (evenings).

■ Receiver, Heathkit RG1, general coverage, USA, BFO, 1MHz xtal calibrator, handbook, £35. USA6L6 metal valves, KTW61 coated, 6CH6, 6A7 for LM14, £3 each. Y63 tuning indicator, rectifiers 5R4GY, RCA 5U4GB, 5Y3WGT, 1D5, £2 each. Collectors items, AVO test bridge about 1940 with 6B8G valve, circuit. AVO valve tester about 1945, large meter, case with switching, British B9 socket, no valve panel case, circuit. Above for spares or servicing, offers. Ex WD tank whip base, may suit ground plane antenna, £3. 12V dc power pack for PCR receiver, double smoothed circuit, £4. Meters, old Weston USA model 280, 3 ranges, 37.5mA, 150mA, 750mA, in metal case 4x4in approx. French made brass plated meter, 250mA round 2 1/4in dia, £3 each. USA 1mA meter, 2 1/4in dia, £3. Others, 8Ω speaker in diecast box 4 1/2in jack socket by SG Brown, £4. TCC round aerial, high-pass filter 75Ω, C263, £3. B7G xtal 1525kHz. Edwards, 32 Heldhaw Road, Bury St Edmunds, Suffolk IP32 7ES. Tel: (0284) 60984.

■ Linear amp 144MHz, all mode, Microwave Modules MML144/4D, 10W in 40W out, used on FT290 etc, perfect order, includes RF pre-amp, £40. Codar T28 Rx, works OK on 80m but 160m not going, 12V supply required, £8. 144MHz colinear antenna, used but all OK, £10. G2FSR, 4 Warmdene Rd, Brighton BN1 8NL. Tel: (0273) 503958.

■ TS770 2m/70cm dual band multimode transceiver, £500. Extended basic module for Texas TI99/4A computer, £20. Avometer model 8 MkIII, £40. Tel: (0926) 498388.

■ Yaesu FT101ZD Mk3 tcvr, incl fan, fitted FM board, mike and manual. Recently overhauled, bargain at £500, or would swap for FT290R multimode with nicads, charger etc and cash adjustment. Each pay postage. Tel: (0227) 455725 eve's or w/end, ask for Joe and have a chat.

■ Zenit E with Pentacon 2.18-135mm telephoto lens and 50mm lens plus national PE-1405 computer electronic flash. Also Konica C35 automatic sunpak GX17 flash and Beta II 35mm enlarger with 50mm, 1.35 lens. All are in good condition, will exchange for Trio 9R59DS or any HF receiver. Mr N Beadsworth, 34 Heron Way, Clooney Est, Water-side, Londonderry, N Ireland. Tel: Londonderry 46871 after 7pm.

■ Yaesu FT208R 2m FM h/held, trans s/mike, etc, vgc, £155. Trio TH41E 70cms h/held, mint, boxed, £150. Yaesu FT290R 2m multimode vgc, £198. Trio TR8400 70cms FM 10W mobile trans, £150. Trio TS780 dual bander 2m/70cms, 25W base trans, £625. Tel: Weymouth (0305) 786930 anytime.

■ Trio TR9000 2m multimode, vgc, £230. MML 50 watt linear/pre-amp, four months old, £70. BNOS PSU, 12V6A, auto overload, shutdown, £50. PSU powers Trx and linear on SSB, interested? Will sell together or separate. Tel: Dave on Crewe 257578 after 6pm.

■ Active antenna Sony AN-1, comprising telescopic aerial with FET low noise amp for receiving SW and ferrite bar antenna for receiving MW and LW. Control box with connecting leads and 40 feet of coaxial cable, brand new, boxed, unused, £48. Mr T Manning, 24 Croftdown Road, London NW5. Tel: 01-485 4251.

■ NAG144XL 2m valve linear, 200W FM, 250W SSB, £350 ono. G0DCQ, not QTHr. Tel: (04215) 69901 anytime.

■ Grundig SW receiver, model 2100, 10 short wave, LW, MW, FM, excellent condition, £185. Mr William Robbins, Tel: 01-855 2998.

■ BBC model B, with green monitor, tape recorder, modem and Prestel/Micronet chip. AR2001 scanning Rx. Both nearly mint, little used and cheap. Owner emigrating. Tel: 01-254 3944 evenings.

■ Trio JR310 amateur bands HF receiver. Working order, £40. Drae Morse Tutor, new condition, £40 or exchange RTTY bits, WHY? Alan G6YNF QTHr. Tel: (0296) 28109.

■ Transmitter type 9231, ex govt, 200-400MHz, continuously tunable, good condition, weight approx 120lbs, circa 1950, offers around £40 or exchange HF receiver. Tel: Wiltshire (0380) 830428.

■ Exchange FT101ZD, mic, fan, very good working order, for FT225RD or IC251 multimode. John H Sparks G8ZIE. Tel: Darlington 54772.

■ Ten-Tec Z28 ATU with SWR bridge, 1.8 to 30MHz, 200W intermittent, 100W continuous, switched for dummy load, bypass, coaxes, long wire, twin feeder, very good condition, good working order, £55. Tel: Derby 700610.

■ Trio R820 Rx, CW filter fitted, transceiver with TS820, TS520, A1 condition, £400 or will exchange for Trio SM220 monitor scope plus cash. Exchange Trio YG88C CW filter for Trio YG88A AM filter. J P Wright, 12 Norn Hill, Basingstoke, Hants. Tel: (0256) 468649.

■ Realistic Communications receiver 150kHz-29,999kHz, AM, SSB, CW, 76-108MHz FM, auto scan, £125.00, or will exchange for 2 meter transceiver. Tel: Norwich 419044.

■ Hi-Tec Sony receiver, IC2001D, 32 memory, air 116-136, FM 76-108, AM 150-29.999MHz, memory mode, narrow, wide, USB LSB, filter, etc, prog timers, hardly used, as new, £59 off, £290 no offers. Best SW scanner yet. Ferrograph series six stereo reel to reel, three speed, two AKG mics, £60. VHS video recorder, Panasonic NV370, not too job, £225 ono. Mr Alan Fordham, 31C Anerley Park, Penge SE20.

■ Original manuals for the following equipment - Collins 75S-1 Rx, Collins 32S-1 Tx, R390/VRR, Rx RCA M18135 Tx/Rx, RCA AVR-20 Rx, RCA AR77, RCA AR88D, plus AR88LF installation booklet. Also service sheet RCA Victor 86E. What offers? Henderson, 26 Combe End, Crowborough, East Sussex TN6 1NH. Tel: (08926) 62381.

■ Yaesu FT207RB 2m FM hand-held transceiver in very good condition with YM24A speaker/mic, NC-9C charger and 1/4 whip antenna - ideal for newly licensed amateur, £130. Also Mizuho MX-2 2m SSB/CW hand-held transceiver, £70. Buy both and get a free Morse practice oscillator. Commodore joystick model 1311 for Commodore 64 or Vic-20 computers, £5. Tel: Hamilton 286078 after 6pm.

■ FRG7000, offers around £225. JIL scanner SX200, 3 months old, £175. Tel: (0283) 221870.

■ Have new Cobra 148GTL DX, also s/hand 148GTL. Looking for VHF, UHF scanner or WHY? Bill Hall, 1 Crook Hill Terrace, Ryton, Tyne and Wear. Tel: Tyneside 4132707.

■ Levell AF sig gen TM150, as new, £20. IE 0-50V, 0.6A bench PSU, vgc, boxed, £10. 5A variac, £15. Eddystone 770R Rx, needs mains txmr and IF can, hence £20. Eddystone slow motion drives, £1.50 each. Sharp FV1700 6 band gen cov Rx, portable with BFO, AFC, sig meter, complete with mains PSU, h/phones and manual, ideal for SWLs, £35. HP412A VVM with probe, £10. Field strength meter, £2. Professional 134ft folded wire dipole (1.5-30MHz), with insulators, spacers, baluns, pulleys and lanyard, £18. SG Brown headphones, £5. Matched new 813s with holders, £20. PR QQV03-20A, new with holder, £8. DG7-5, 2 1/2in CRT, new with holder, £8. 807s new, £1.50 each. G4FZG, QTHr. Tel: (0242) 580329.

■ Double beam scope, Cossor CDO150, 35meg, solid-state with all probes, photo screens, etc. Complete with all circuit drawings and manual, £160. Collect or buyer pay carriage. E Rowland, 1 Barker Street, Bury, Lancs. Tel: (061 761) 2952.

■ Exchange both my IC211E with remote memory and keypad with muTek front end, immaculate, and my FT730S 70cm FM mobile 10 watts output, for FT757GX or FT901DM or similar. Small cash adjustment possible. Will consider selling separate IC211E, £400. FT730S, £180. Also have FDK Palm IV 70cm hand-held, leather case, toneburst, spare nicads, £85. Tel: (051 327) 5804.

■ Collins KWM-2A spkr, SM-2 desk mic, vgc, spare valves, h/book, £300 (no offers), buyer collects. Tel: (0642) 456327 days.

■ BNOS 1-50 VHF linear, £150. JVC video recorder HRC3, £350. 40c size tapes, £100. Video batteries, 3, £50. Video lens, JVC, £40. Tel: Great Yarmouth 667597.

■ Yaesu FT One, 6 months old, original box and manual. Also Yaesu ATU FC700, prize, £900. Tel: Morecambe 415568.

■ Antenna sale: Jaybeam 10el X/Y, £15. Jaybeam

NEC yagi, £10. Swiss quad, £15. All for 2 metres, plus 48el multibeam for 70cm, £5, and 24el parabean, 70cm (unused), £30. Tel: (0782) 721395.

■ AM unit for FT101Z series, £30. G4ZIP Les. Tel: 01-890 4666.

■ muTek SLNA144S switched 2m pre-amp, £31. Microwave Modules 2m 144/30LS linear, 1/3W in 30W out, £71. Icom HM7 hand mic (with pre-amp), new, £15. NEC 12 inch RGB monitor, very high res (640 x 400), as new, £230. Also NEC 12 inch green screen monitor (comp video), as new, £70. WX sat boards, £15. Tel: Paul G4XHF, Crawley (0293) 515201.

■ Yaesu FRG7 general coverage Rx, 0-30MHz, comes with Yaesu FRT7700 ATU, no mods, both in excellent condition, in original box with instructions, £150. Tel: Tadley 2476.

■ Colt 295, SWR power meter, two mobile twigs, 16ft silver rod, co-ax, 25W burner power pack, mag mount co-ax, Binatone Long Ranger hand-held, 12ch, the lot £130 ono. Tim Gittoes, 1 Oaklands Crescent, Bault Wells, Powys LO2 3EN.

■ Intellivision television game and speech module, plus 10 cartridges, sell £100 or will exchange for 2 metre transceiver. Tel: Norwich (0603) 419044.

■ Regency digital flightscan, 16 channel VHF airband scanner, £80. VHF to UHF converter, £40. muTek BBBA 500V pre-amp with quality BNC connectors, £25. Revcone discone aerial and 15ft mast available. Mr Drew, 227 Southmead Road, Westbury-on-Trym, Bristol. Tel: (0272) 506208.

■ Standard C8800 2m FM trans, low scanning etc, boxed, £145 ono. Trio TH41E 70cm FM hand-held, vgc, £160 ono. Icom IC04E 70cm FM hand-held, boxed, mint, £185 ono. Yaesu FT709R 70cm hand-held, £180 ono. KDK 2025 2m FM mobile trans, £115. Speaker mic for FT708R, FT208R, £15. Tel: (0305) 786930 Weymouth, any time.

## WANTED

■ SSB adaptor for Grundig Satellit 2100 receiver. Please contact with price required. Iceton, 5 Dorlcote Place, Norton, Stockton on Tees, Cleveland TS20 2PP. Tel: (0642) 559845.

■ Brimar cathode ray tube, type C14FM or equiv for old mono TV set. Prefer new one, but little used one accepted. Check in your loft or garden shed! Also wanted, Shibaden or Sony reel to reel video recorder. Colour model preferred but mono version accepted. Must be in first-class order with good head. Will collect if within fifty miles - don't trust post office! Nev Kirk G3JDK, 54 Allendale Road, Rotherham, Yorks S65 3BY. Tel: Wickersley 541606 anytime.

■ Trio TS430S, complete station or faulty radio considered, cash or part exchange m/cycle. Tel: (0455) 44522, Leicester.

■ Has anyone got a BFO lying around they would like to sell me. I need one for my short wave Rx, I am only 13yrs old and can't handle a soldering iron too well. So, if anyone has a BFO, or could make one for me I would be pleased to pay for it. Tel: (0952) 507642.

■ Yaesu FT77 100 watts, also PSU, good condition, good price paid. Write or phone. Mr William McCann, 1 Ross Rd, Belfast 12. Tel: 242663 N Ireland.

■ WW2 radio/radar equipment, German Wehrmacht parts, literature etc. RAF: TR1196 R108Y receiver wireless set No 11. Welcome contact from other collectors for swaps or exchange of info. Will collect UK. Available: BC-RX anno 1928. R Otterstad, Vejdammen 5, DK-2870, Holte, Denmark. Tel: (010 452) 801875.

■ Sony ICF2001 scanning Rx. Tel: (0903) 776570 (West Sussex).

■ Trio 9500 70cms multimode. Fair price paid for good example. Tel: Mike (0799) 27155.

■ Racial Syncl 20 watt transceiver, good condition, sensible price. B J Whitty, 'Fourways', Morris Lane, Halsall, Ormskirk, Lancs L39 8SX. Tel: (0704) 840328.

■ For Yaesu FC102 - FAS1-4R remote antenna selector. Sensible price paid. Tel: (0952) 52126.

■ Information, handbooks, diagrams, specs or anything on the AC Cossor Ltd valve oscilloscope model 1049. Will pay for photocopying or original info etc. Tel: (021) 744 8322. Please help!

■ General coverage receiver wanted, Trio R1000, Yaesu FRG7700 or similar. Anything considered with SSB and digital frequency readout. Details



# FREE CLASSIFIED ADS

and price to: Mike Robinson, 10 Whitbygate, Thornton Dale, Pickering, North Yorks YO18 7RY.

- Nevada 934MHz rig, 934MHz SWR meter plus mobile aerial, 44MHz crystals for any Simplex channels except S-10 and S-12. Mike, 14 Doverfield Road, Brixton, London SW2 5NB. Tel: 01-674 0513 after 12 midday.
- Plessey Radio Communications Handbook by James Bryant, or photocopy. Also circuit for President McKinley AM/SSB CB. Also valve data book(s). All expenses paid. 29SB754. K P Chadwick, 45 Mayfield Park, Clondalkin, Dublin 22, Ireland.
- MMT144/28. 16-25 amp PSU. Tel: Tisted 306 (after 5pm).
- SWL requires good condition amateur band receiver, preferably in the Drake R4 Yaesu FR101 or Trio 599/820 range. Must be in complete working order. Does anyone have one of these old reliable receivers which tunes between 30MHz and 80MHz? Whitaker. Tel: (0423) 879084 after 6pm.
- Vibroplex bug key or any other make of semi-automatic, mechanical speed key, any age, any condition. CR100 knobs, large and small. G3TSS. Tel: Corbridge (043 471) 3125.
- Sansui Hi-Fi cassette recorder, Model D95M. Tel: (0829) 260323.
- Robot 450C or 1200C new type SSTV unit. Must be perfect in every respect. Cash waiting. Tel: Paul G4XHF, Crawley (0293) 515201.
- Trio TS120V, Eddystone EA12, Hallicrafters SX146, Drake 2B or good amateur bands receiver. Would consider Ten-Tec Argonaut in mint condition and unmodified. All letters answered. Price and particulars please to: C A Gledhill, 113 Oak Road, Fareham, Hants PO15 5HR.
- Nevada 934MHz rig, SWR meter and mobile antenna. 50MHz converter with 28MHz IF, cheap 28MHz magmount aerial, DX-TV converters for TV and video recorder. Mike, 14 Doverfield Road, Brixton, London SW2 5NB. Tel: 01-674 0513 after midday please.
- Exchange standard C8800 2m Tx/Rx FM only, 1 watt and 15 watts output, for either general

coverage receiver or scanner. Would also be interested in 70cms Tx/Rx FM or multi, cash difference as required. Asking price on standard for exchange value about £100 to £125. Eric, G11YH, QTHR. Tel: 01-874 7553, shift work so time variable.

- Exchange wanted for Yaesu FRV (A) for good cond model (E). Also best price paid for very good cond World Radio TV Handbook. Dave Howes, 149 Warren Wood Road, Rochester, Kent. Tel: (0634) 404096.
- Books on early radio location, in particular *Instruments of Darkness* by Alfred Price, published by William Kimber, 1967. Genuine desire to read, not a dealer. Mr R Williams, 62 Kingscliffe Road, Grantham, Lincs NG31 8ET. Tel: (0476) 66047.
- Marconi 1017 receiver with ac/PU, also Heath RA1 receivers. Price and condition to: Richard Marris, 35 Kingswood House, Farnham Road, Slough, Berks SL2 1DA.
- Signal Communications Co R532 airband receiver. Also required Yaesu YK-901 keyboard. Tel: Colchester, Essex 394336.
- Racal TRA931 'Syncl 30', TRA967, BCC528, BCC533, MA913, MA934, MA945, MA968, MA978, MA985, MA986, MA988, MA989, MA4008, MA4033, MA4142, MA4190, MA4222, TA940, TA944, TA970, TA4044 or any other Racal tactical equipment urgently sought by collector. Spares, manuals, WHY? Please write with details of anything Green and Racal which you may have. Purchase, exchange or p/ex. Sayers, 120 Birmingham Road, Redditch, Worcestershire.
- West Tower 35 with post base, must be in good condition, cash waiting. Tel: Great Yarmouth 667597.
- FR101S or JR599 custom special receivers, must be mint, state price. L D Ireland, 16 Catheron Road, Carisefell Green, Camborne, Cornwall TR14 0NA. Tel: Praze 831236 or 831149.
- Racal RA117E. Good price paid for model in mint condition and working order. Tel: (0803) 845246.
- Power freaks: I would like to correspond with anyone interested in HF QRO, mobile only

operation, for exchanging views, ideas and equipment supplies and information, only 500 watters or more need reply! May your brace of MRF421s never blow up. Please write in first instance to: G4ZOW, Jenkins, 3 Ryecroft Close, Hemel Hempstead, Herts HP2 4PL.

- Yaesu 7700 or 8800 receivers wanted, also Icom R71E and Trio R2000. Must be in working order. I can collect in London area. A Deidier, 8 Bridgman Rd, London W4. Tel: 01-994 2579.
- Glass encapsulated xtals, 3.5-3.6MHz, HC6U holders. Mr Peter Haylett, Vancouver House, Kimberley Road, Bacton-on-Sea, Norfolk NR12 0EN.
- Service manuals for FT707, FT101ZD, FT757GX, FT1, TS530SP, TS830S. Also dead FT707 and TS430S. Tel: Rodney, Farnborough (Kent) 58825.
- Datong active antenna, outdoor version. Tel: Blackburn (Lancs) 673184 (9.00-4.00).
- dc lead for FT101E, also FM board. G2FSR, 4 Warmdene Rd, Brighton BN1 8NL. Tel: (0273) 503958.
- ATU with power meter SWR and dummy load. To match with FT101E, but any considered. Tel: (0623) 754965 after 1800hrs.
- Manual and or circuit diagram for Lafayette HE30 receiver, your price paid. Manual for Eddystone 840C. Also wanted TW Communicators 70.1-70.7MHz and 160m. John A Ferguson, Drumbee More, Armagh, N Ireland BT60 1HP. Tel: Armagh 524267.
- Pye labgear, Compac 8, HF, SSB, 2-9MHz. Fred Pilkington G31AG, 24 High St, Cheveley, Newmarket, Suffolk CB8 9DQ. Tel: (0638) 730373.
- FRG7700 Rx with FRT and FRVs or quality modern coverage Rx. Also xtal calibrator wave-meter for sale, exchange valves 805S, 813S, 807, HV rec 19/23, KT8S, KT66S, 6F6S, 6V6S, Acorns dial. Exchange Minolta XD5 F245MM for a Sony 2001 Rx. Tel: Deal (0304) 367676.
- Barlow Wadley receiver XCR-30 MK2, FM tuner not essential. 50ft of 75Ω twin feeder cable. Edwards, 32 Heldhaw Road, Bury St Edmunds, Suffolk IP32 7ES. Tel: Bury (0284) 60984.

# FREE CLASSIFIED AD FORM

**Send to:** Amateur Radio Classified Ads · Sovereign House · Brentwood · Essex CM14 4SE

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

For Sale ..... Wanted.....

**USE BLOCK CAPITALS** (One word per box)

To avoid mistakes please write clearly and punctuate your ad

Name/Address Postcode/Telephone							

**USE SEPARATE SHEET FOR MORE WORDS**

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

**CONDITIONS:** Ads will be published in the first available issue on a first come first served basis. We reserve the right to edit or exclude any ad. Trade advertisements are not accepted

# Amateur RADIO SMALL ADS

**MORSE CODE PREPARATION**  
Cassette A: 1-12 wpm for amateur  
Cassette B: 12-25 wpm for professional examination preparation  
Each cassette is type C90  
Price of each cassette (including booklets) **£3.95**.  
Morse key with separate battery (PP3) — driven solid-state oscillator and sound transducer produces clear tone for sending practice. Price of key with electronic unit **£8.95**.  
Price includes postage etc. Europe only  
**MH ELECTRONICS (Dept AR)**  
12 Longshore Way Milton Portsmouth PO4 8LS

**Booth Holdings Bath**  
**GOLF CLUBLANE SALT FORD BRISTOL**  
Tel: 02217 2402  
Open Tues-Sat 9am-9pm  
Closed Monday

**MAXI — Q**  
COILS AND CHOKES PREVIOUSLY MADE BY DENCO SAE PRICE LIST  
**8 BRUNEL UNITS, BRUNEL ROAD, GORSE LANE IND ESTATE, CLACTON, ESSEX CO15 4LU.**  
TEL: (0255) 424152

**JAPANESE IC's (PART OF OUR RANGE)**  
AN214Q £1.80 AN7145 £1.80 AN7146 £1.85 BA521 £1.75 BA532 £1.50 HA1306W £1.80 HA1338A £1.80 HA1342 £1.70 HA1369W £1.50 HA1369WR £1.50 HA1377 £2.20 LA1230 £1.50 LA4480 £1.75 LA4481 £1.75 LC7137 £2.75 M51515 £2.50 M51517 £2.50 MB3705 £1.60 MB3712 £1.50 MB3730 £1.75 MB3731 £2.50 MB3756 £2.60 MB8719 £3.50 TA7205AP £1.00 TA7222AP £1.20 TA7227P £1.60 UPC575 £1.00 UPC1001 £2.00 UPC1156 £1.40 UPC1181 £1.00 UPC1182 £1.00 UPC1185 £2.20. ADD 60p POST AND PACKING AND THEN ADD 15% VAT TO TOTAL  
**T POWELL 16 PADDINGTON GREEN LONDON W2 1LG**  
OPEN MON-FRI 10AM-5PM, SAT 9AM-12 NOON.  
TELEPHONE: 01 723 9246  
ACCESS/VISA. TELEPHONE ORDERS ACCEPTED OVER £5.00

**BEAM VIDEO**  
Throughout the house on Channel 36.  
Price £8.90 + P&P 50p. SAE for leaflet.  
**Electronic Mailorder A**  
62 Bridge Street, Ramsbottom  
Lancs BL0 9AG  
Tel: 070682-3036

**G4MK RADIO SOFTWARE**  
\*\*NEW FOR DRAGON 32/64 AND TANDY COLOR\*\*  
SSTV RECEIVE decodes audio direct from radio with tuning indicator and printer support. Tape £11.25 GREYLINE & MUF/LUF PLOT. Draws great circle world map with propagation data superimposed. Tape..... **£8.00**  
CBM64/128 RTTY TRANSCIVE with Baud rate detector, and unattended mode. Tape £11 disk..... **£14.00**  
CBM64/128 MORSE TRANSCIVE with speed tracking and full type ahead. Tape £10. RTTY + CW disk..... **£22.00**  
DRAGON AND TRS80C PROGRAMS ON TAPE OR CARTRIDGE RTTY + ASCII, Morse and AMTOR transceive. Send SAE for details. State callsign (if any).  
**GROSVENOR SOFTWARE (AR)**  
2 Beacon Close, Seaford, Sussex (0323) 893378

**XXX ADULT VIDEO CLUB**  
For the genuine adult films. Available only from ourselves. Ring  
**0924-471811 (24hrs)**  
For the intimate details or write  
**ADULT VIDEO CLUB**  
P.O. Box 12, Batley, W. Yorks.

**USED AMATEUR EQUIPMENT?**  
**I Buy, Sell & Exchange!**  
SBLING? I pay the BEST POSSIBLE PRICES for your Clean Used Equipment! BUYING? I have the BEST SELECTION of top Quality Used Equipment Available!  
For the Deal You've been Looking for, Phone Dave, G4TNY ANYTIME ON HORNCHURCH (04024) 57722 or Send SAE  
**G4TNY AMATEUR RADIO**  
132 Albany Road, Hornchurch, Essex RM12 4AQ

**DW ELECTRONICS G3 XCF**  
Amateur Radio Supplies  
71 Victoria Rd, Widnes  
Tel: 051-420 2559  
Open Mon-Sat 9.30-6 (closed Thurs)  
We supply Yaesu, Icom, Tonna, Jaybeam, Microwave Modules, Datongs etc

**SP ELECTRONICS**  
48 Limby Road  
Ruckhall, Nottingham  
Tel: (0602) 640377  
Open Monday-Saturday 8.30-5.30

**PNP Communications Communications Interface for RTTY - Morse - AMTOR**  
Our popular range of communication modules is now available, fully boxed and tested under the model number.  
**CTU 20**  
The CTU20R is RTTY only & costs **£62.50** whilst the CTU20RM is for morse as well and costs **£75.25**  
For shortwave listeners the MF2-DX gives the option of 170Hz, 425Hz or 850Hz shift reception and costs **£56.95**  
Send a large (A4) SAE for full Cat  
Please add VAT at the current rate.  
Access & Barclaycard (VISA) welcome.  
**62 Lawes Avenue, Newhaven East Sussex BN9 9SB**  
Tel: (0273) 514465

**Amateur RADIO**  
This method of advertising is available in multiples of a single column centimetres — (minimum 2cms). Copy can be changed every month.  
**RATES**  
per single column centimetre:  
1 insertion £7.00, 3 — £6.60, 6 — £6.30, 12 — £5.60.

# SMALL ADS

**SERVICE MANUALS**  
For most Makes, Models, Age of electronic equipment  
Amateur Radio Test equipment, Audio Television, Video Vintage Military etc Thousands Stocked SAE enquiries  
**MAURITRON TECHNICAL SERVICES**  
Dept AR, 8 Cherry Tree Road, Chinnor, Oxon OX9 4QY.

**AMATEUR RADIO SMALL AD ORDER FORM**

**TO: Amateur Radio · Sovereign House**  
**Brentwood · Essex CM14 4SE · England · (0277) 219876**

**PLEASE RESERVE**.....centimetres by.....columns

**FOR A PERIOD OF** 1 issue..... 3 issues..... 6 issues..... 12 issues.....

**COPY** enclosed..... to follow.....

**PAYMENT ENCLOSED:** (Add 15%VAT).... £ —  Cheques should be made payable to Amateur Radio. Overseas payments by International Money Order

**CHARGE TO MY ACCOUNT**.....

**COMPANY** .....

**ADDRESS** .....

**SIGNATURE** ..... **TELEPHONE**.....

**C P I**



# NEXT ISSUE ON SALE

Amateur

# RADIO

Thursday 24th  
April

## ETESON ELECTRONICS

15B Lower Green,  
Poulton-le-Fylde, Blackpool  
Tel: (0253) 885107

Open: 9.30am-12.30, 1.30-5.30. Closed Wed & Sun.  
Electronic Component Specialists.

## AGRIMOTORS

MERTON CB AND RADIO CENTRE  
MERTON GARAGE AND POST OFFICE, MERTON.  
Nr OAKHAMPTON, DEVON EX20 3DZ

OPEN 6 DAYS 9-8 LUNCH 1-2pm  
(SUNDAYS BY APPOINTMENT)

SPECIALIST IN 934 MHz  
SUPPLIERS OF ALL 27MHz AND 934 MHz EQUIPMENT  
AMATEUR ACCESSORIES CATERED FOR  
08053 200

## SCOTCOMMS

OPEN TUES-FRIDAY 10am-12.30pm, 2pm-5pm  
SAT: 9am-1pm, 2pm-4pm. CLOSED MONDAY

25 Morton Street, Edinburgh 15  
Tel: 031-657 2430

## MORSE READER PROGRAMMES

**SPECTRUM** **BBC 'B'** **DRAGON**  
**CBM 64** **VIC 20**  
**ZXS1 16K** **ATARI 800/800XL** **AMSTRAD 484**

Sinclair computers need NO interface, others use simple one transistor (BC107 or similar) interface. Programmes self tracking 8/30 WPM. All connections to existing sockets. Cassette with full instructions and interface circuit where required £6.00 inc P&P. Interface built and tested £2.50 inc P&P.

## RTTY

FOR YOUR 48K SPECTRUM

Menu driven, 10 programmable memories, split screen, morse ident, four baud rates, etc etc. NO TERMINAL UNIT, just a simple filter! Cassette with full instructions, circuit and filter layout £8.50 or SAE for full details. Filter unit built and tested £6.00.

## JEP ELECTRONICS

NEW ROAD COMPLEX  
NEW ROAD  
KIDDERMINSTER DY10 1AL  
TEL: 0562 753893

## D.P. HOBBS (Norwich) Ltd

13 St Benedicts Street, Norwich Tel: 615786



Open Mon-Sat 9-5.30  
Closed Thurs  
Stockists of:



YAESU, FDK, ICOM, JAYBEAM  
& Electronic Component Specialists

## JAYCEE ELECTRONICS

JOHN GM30PW

20 Woodside Way, Glenrothes,  
Fife KY7 5DP



Tel: 0592 756962



Open: Tues-Sat 9-5

Quality secondhand equipment in stock.  
Full range of TRIO goodies. Jaybeam -  
Microwave Modules - LAR.

## THE SCIENTIFIC WIRE COMPANY

811 Forest Road, London E17. Telephone 01-531 1568

ENAMELLED COPPER WIRE				
SWG	1lb	8oz	4oz	2oz
8 to 34	3.63	2.09	1.10	0.88
35 to 39	3.62	2.31	1.27	0.93
40 to 43	6.00	3.20	2.25	1.61
44 to 47	8.67	5.80	3.49	2.75
48	15.96	9.58	6.38	3.69
SILVER PLATED COPPER WIRE				
14 to 30	9.09	5.20	2.93	1.97
TINNED COPPER WIRE				
14 to 30	3.97	2.41	1.39	0.94
Fluxcore				
Solder	5.90	3.25	1.82	0.94

Prices include P&P VAT. Orders under £2 add 20p.  
SAE for list of copper and resistance wire.  
Dealer enquiries welcome.

## PROFESSIONAL POLICE, FIRE, PUBLIC-SERVICE POCKET SIZED MONITOR RECEIVER

With 54-176MHz VHF plus 10m Amateur Band (11m CB on request) and VHF Aircraft. Excellent sensitivity, VFO, Squelch provision, Whip Antenna etc. Tunes all your local 2-way VHF activity and more.

Complete with accessories and frequency lists @ only £27.95 post paid. CWO/COD welcome. Prompt delivery from:

**D TAYLOR, (Dept GSE8),  
8 EMMERSON ST, CROOK,  
CO DURHAM, UK.**

## RF DEVICES AT ROCK BOTTOM PRICES!

Nobody beats us!

Over 30,000 RF devices at low prices  
**REPLACEMENT RF TRANSISTORS**

MRF454 HF/SSB 80W	£18.20
MFR450 HF/SSB 50W	£11.60
MRF238 VHF/FM 25W	£12.80
MRF475 HF/SSB 20W	£2.99
2SC1969 HF/SSB 18W	£2.50
2SC2043/1307 HF 16W	£2.00
2SC1947 VHF 3.5W	£7.60
2SC1946A VHF 32W	£14.30

## REPLACEMENT RF POWER MODULES

M57704/SAU3 UHF 15W	£36.00
M57712/SAV7 VHF/FM 25W	£39.00
M57713/SAV8 VHF/SSB 15W	£39.00
M57716/SAU4 UHF/SSB 15W	£49.00
M57719 VHF/PMR 15W	£29.00
M57727 VHF/SSB 38W	£45.00
M57749/SAU11 934/FM 7W	£29.00

Send £1.00 p&p and SAE for full list  
All prices inc. VAT  
Many Ic's and other types in stock

**RAYCOM LTD**  
DEPT AR 584 HAGLEY RD WEST  
QUINTON BIRMINGHAM

B68 OBS

021 421 8201-3

(24hr answer phone)

## Ian Fisher Communications of Stanhope

CB Works, Bondside Way, Stanhope, Bishop Auckland  
Co Durham DL13 6QY.

Distributors of 934 MHz equipment. We carry a full range of 934 MHz aerials, the **COMMTEL** Scanner transmitter/receiver, the **UNIACE 400**, also in stock **POPE H100** 11mm and 6mm diameter coaxial cable.

All at very competitive prices  
Open: Mon-Sat 10.30am-6.00pm  
Mail Order service recently commenced  
Ring for details  
(0388) 528464

**CRYSTALS** Made to order for any purpose and large stocks of standard frequencies for computers, modems, etc. Amateur CW (QRP) freqs £4.00 and CB conversion crystals at £4.50.

**PROGRAMMABLE OSCILLATORS (PXO)** for baud rates, MPU, and freq markers £12.50.

**FILTERS** Crystal, monolithic, mechanical and ceramic for all standard IF's. Special 10.695MHz for big improvement to most CB rigs! at £4.50 each.

SAE FOR LISTS. PRICES INCLUDE VAT AND POST

## PR GOLLEDGE ELECTRONICS

G3EDW, Merriott,  
Somerset,  
TA16 5NS

Tel: 0460 73718

VALUABLE  
SPACE FOR  
SALE!

Telephone  
the advertising  
department on:  
0277 219876  
for details

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## Amateur RADIO

## ADVERTISING RATES & INFORMATION

DISPLAY AD RATES		series rates for consecutive insertions			
depth mm x width mm	ad space	1 issue	3 issues	6 issues	12 issues
61 x 90	1/8 page	£66.00	£62.00	£59.00	£53.00
128 x 90 or 61 x 186	1/4 page	£115.00	£110.00	£105.00	£92.00
128 x 186 or 263 x 90	1/2 page	£225.00	£210.00	£200.00	£180.00
263 x 186	1 page	£430.00	£405.00	£385.00	£345.00
263 x 394	double page	£830.00	£780.00	£740.00	£660.00

COLOUR AD RATES		series rates for consecutive insertions			
depth mm x width mm	ad space	1 issue	3 issues	6 issues	12 issues
128 x 186 or 263 x 90	1/2 page	£305.00	£290.00	£275.00	£245.00
263 x 186	1 page	£590.00	£550.00	£530.00	£470.00
263 x 394	double page	£1,130.00	£1,070.00	£1,010.00	£900.00

SPECIAL POSITIONS	Covers:	Outside back cover 20% extra, inside covers 10% extra
	Bleed:	10% extra [Bleed area = 307 x 220]
	Facing Matter:	15% extra

DEADLINES		*Dates affected by public holidays			
issue	colour & mono proof ad	mono no proof & small ad	mono artwork	on sale thurs	
Apr 86	27 Feb 86	5 Mar 86	7 Mar 86	27 Mar 86	
May 86	27 Mar 86	2 Apr 86	4 Apr 86	24 Apr 86	
Jun 86	1 May 86	7 May 86	9 May 86	29 May 86	
Jul 86	29 May 86	4 Jun 86	6 Jun 86	26 Jun 86	

CONDITIONS & INFORMATION		
<p><b>SERIES RATES</b> Series rates also apply when larger or additional space to that initially booked is taken.</p> <p>An ad of at least the minimum space must appear in consecutive issues to qualify for series rates.</p> <p>Previous copy will automatically be repeated if no further copy is received.</p> <p>A 'hold ad' is acceptable for maintaining your series rate contract. This will automatically be inserted if no further copy is received.</p> <p>Display Ad and Small Ad series rate contracts are not interchangeable.</p>	<p>If series rate contract is cancelled, the advertiser will be liable to pay the unearned series discount already taken.</p> <p><b>COPY</b> Except for County Guides copy may be changed monthly.</p> <p>No additional charges for typesetting or illustrations (except for colour separations).</p> <p>For illustrations just send photograph or artwork.</p> <p>Colour Ad rates do not include the cost of separations.</p>	<p>Printed — web-offset.</p> <p><b>PAYMENT</b> 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. Accounts are strictly net and must be settled by the publication date.</p> <p>Overseas payments by International Money Order or credit card.</p> <p><b>FOR FURTHER INFORMATION CONTACT</b> Amateur Radio, Sovereign House, Brentwood, Essex CM14 4SE. (0277) 219876</p> <p>Commission to approved advertising agencies is 10%.</p> <p><b>CONDITIONS</b> 10% discount if advertising in both Amateur Radio and Radio &amp; Electronics World. A voucher copy will be sent to Display and Colour advertisers only. Ads accepted subject to our standard conditions, available on request.</p>





# DEWSBURY

# G4CLX

# ELECTRONICS

## THE NEW STAR MASTERKEY ELECTRONIC CMOS MEMORY KEYER



FOLLOWING THE OUTSTANDING SUCCESS STORY OF THE DEWSBURY ELECTRONICS STAR-MASTERKEY WITH OVER 500 UNITS IN USE WORLD WIDE, BY AMATEURS, AND AT SEA BY PROFESSIONAL OPERATORS, MANY USERS REQUESTED MEMORY FACILITIES, AT A REASONABLE PRICE. SO HERE IT IS. THE STAR-MASTERKEY CMOS MEMORY KEYER.

- \* FEATURES FULL IAMBIC KEYING. \* EIGHT 50 CHARACTER MEMORIES AUTOMATIC REPEAT ON ONE MEMORY (CQ CALLS ETC).
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- \* ADJUSTABLE SIDETONE PITCH & VOLUME. \* COMES COMPLETE WITH BATTERIES.

\* British Built & Fully Guaranteed.

**PRICE £95.00. POST, PACKING AND INSURANCE £3.00.  
VIBROPLEX, HI-MOUND & BENCHER KEYS AVAILABLE.**

**Dewsbury Electronics offer a full range of Trio Equipment always in stock**

We are also stockists of DAIWA - MET ANTENNAS - MUTEK - WOOD & DOUGLAS - TASCOS TELEREADERS - MICROWAVE MODULES - ICS AMTOR - AEA PRODUCTS - DRAE

**Dewsbury Electronics, 176 Lower High Street, Stourbridge, West Midlands.**

**Telephone: Stourbridge (0384) 390063/371228.**

**Telex: 337675 TELPES G**

**VISA**

Instant finance available subject to status. Written details on request.

