

Amateur **RADIO**

For all two-way radio enthusiasts

**Inside Raynet
emergency operations**

**Multipurpose
Morse unit**



**On test: muTek TVVF144A
2 metre transverter**

BACK TO BASICS

R WITHERS COMMUNICATIONS



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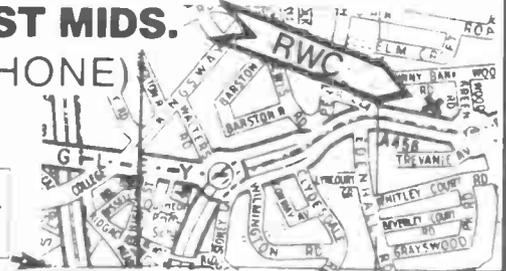


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All offers subject to availability on a first come first served basis. Prices subject to change without notice all correct at time of going to press. E&OE. **TERMS:** No COD. Barclaycard and Access accepted. Post free over £50. under £50 add £2.50 post and handling, unless stated. Please send SAE with all enquiries and for latest secondhand list.

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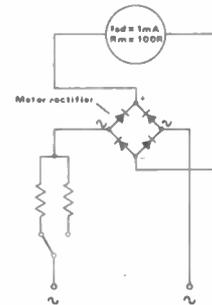
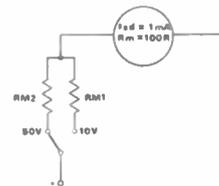
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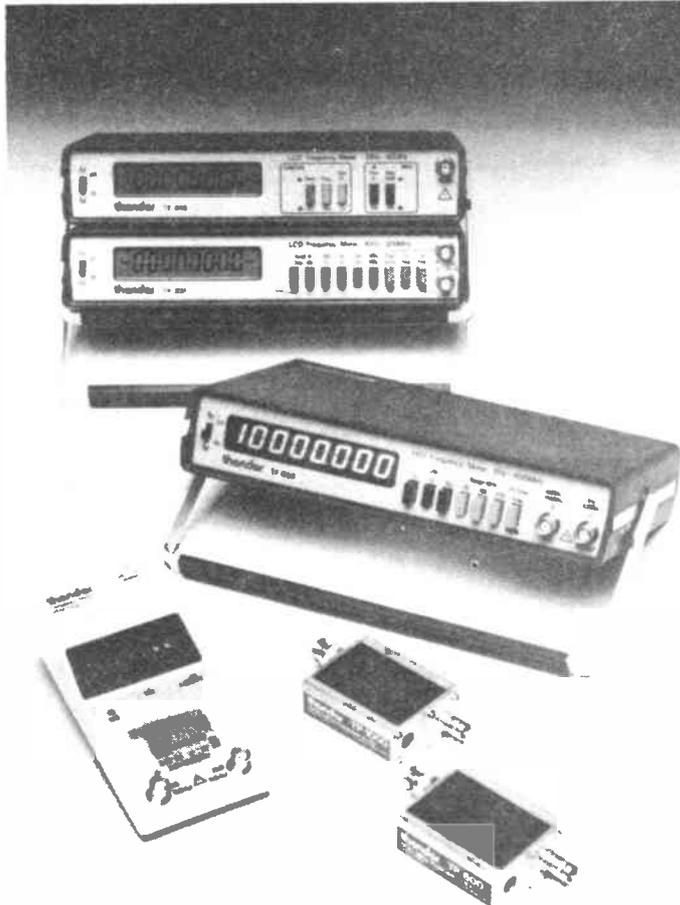
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STRAIGHT & LEVEL



COUNT YOUR BLESSINGS

Thandar recently added the TF600 to their counter range. It has a frequency range of 5Hz to 600MHz and retails at £132.50 + VAT.

The other three counters in the range are: the TF200, 200MHz, LCD with time average period, £175 + VAT; the PFM200A hand-held, 20Hz to 200MHz, 5 gating times and a sensitivity of 10mV, £75.50 + VAT; the TF040, LCD, 40MHz with totalise facility, £120 + VAT.

Two optional prescalers are also available.

Further information is available by contacting: *Thandar Electronics Ltd, London Road, St Ives, Huntingdon, Cambs PE17 4HJ.*

CRYSTAL OSCILLATORS

Plug-in compatibility with the Hewlett Packard HP10544A/B/C and the HP10811A/B series of 10MHz and 10.23MHz high-stability crystal oscillators, used in navigational systems and satellite ground stations, is now available in the UK from Anglia Microwaves Ltd.

Made by Piezo Systems and termed the 2810007 series, the oscillators use double-rotated AT cut stress-compensated crystals to allow the customer to specify a frequency stability better than 2.5×10^{-9} from 0°C to +71°C, or 4.5×10^{-9} from -55°C to +71°C.

Ten minutes after warm-up at +25°C the crystals are operating at better than 5×10^{-9} of their specified value. Their long-term stability is better than 5×10^{-10} /day after a 24-hour warm-up period and better than 1×10^{-7} /year in continuous operation.

The oscillators are available in versions with anti-vibration mounting lugs and can be supplied to meet MIL-STD-202.

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

PHASE CONTROL TECHNIQUE

Now available from House of Instruments is the Trio PD8 Series of regulated dc power supplies.

Comprising four models, the PD8 Series is available with either an analogue or a digital display and in a choice of 20A or 30A current outputs.

The PD Series utilises an efficient phase control system to ensure stable, high current at low voltage and a built-in pre-regulator to keep the V_{CE} of series transistors at a fixed level. A choke input type smoothing circuit provides high accuracy and a 0.5mV rms ripple.

Remote control of output voltage and current is also provided. The output may be controlled in direct or reverse proportion to the resistance connected to the control terminal on the rear panel, or

via external signals applied to the same terminals.

The output voltage of 0-8V is set using a smooth 10-turn potentiometer which provides high setting regulation.

Other features include immediate shut-out of over-voltages and remote sensing, which enables compensation for the voltage drop occurring in the wiring between the power supply and the load. A light-emitting diode (LED) display indicates the operating region for voltage limiting and current limiting operations.

The PD Series is designed for series or parallel operation and is supplied with an instruction manual, power cable and fuses.

More information is available from: *House of Instruments (Anglia) Ltd, Raynham Road, Bishop's Stortford, Herts CM23 5PF.*

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

THE TOOL BOOK

The 1985 edition of *The Tool Book* has been published by STC Electronic Services.

It is a catalogue of the wide range of tools and associated products stocked by this distributor who now has what is probably the largest range of tools, assembly aids, storage equipment, service aids, cells and batteries currently available from any one UK source.

Covering over 80 pages and more than 400 products, each of which is fully described and illustrated together with the latest pricing information, *The Tool Book* introduces a number of new products ranging from the Fortex guillotine to the Mitutoyo electronic calipers with liquid crystal display.

Batteries include the latest lithium types whilst standard screwdrivers compete with component forming machines and complete soldering/desoldering stations for the attention of the reader.

The Tool Book is available, free-of-charge, from: STC Electronic Services, Edinburgh Way, Harlow, Essex CM20 2DE. Tel: (0279) 26777.

RFI/EMI SHIELDING

A new electrically-conductive compound, designed specifically for the production of printed gaskets with RFI/EMI shielding properties, has been developed and placed into production by elastomeric sealing specialists Dowty Seals Ltd, of Ashchurch, Gloucestershire.

Developed for use with the company's Dowprint silk screen-printing process, it can be used to produce individual gaskets or applied directly to customer hardware in any given design or configuration.

The new Dowty compound, manufactured under the company's material reference DS4076, is a silver-loaded, cross-linked vinyl which is highly flexible and resilient. Used in conjunction with the Dowprint application technique, it is less expensive than traditional gasket manufacturing processes, such as punching.

The material has a service temperature range between -65°C and $+125^{\circ}\text{C}$ and provides both hermetic and RFI sealing up to 100dB. Its electrical resistivity is

typically in the order of 2×10^{-3} ohms/cm.

Further information is available from: Dowty Seals Ltd, Ashchurch, Chewkesbury, Gloucestershire. Tel: (0452) 299111.

CUSTOM FILTERS

Kemo (Filters) Ltd offers a design and manufacturing service for custom specified filters with a frequency of up to approximately 1MHz.

The custom service is available for both elliptic and polynomial filter shapes. Options include a choice of passband and stop-band points and a variety of terminations and sizes. Kemo can also provide special requirements, such as pulse response and time delay.

The filters are supplied either in encapsulated modules or boxed in standard die-cast containers. Custom packaging is available for quantity orders.

For further information please contact: Kemo (Filters) Ltd, 9-12 Goodwood Parade, Elmers End, Beckenham, Kent BR3 3QZ. Tel: 01-658 3838.

DISC DRIVE FOR BBC MICRO

RCS Computer services are now offering a low-cost fully packaged disc drive for the BBC Microcomputer.

At just £66 (including VAT) users who have suffered with cumbersome and sometimes unreliable data cassette recorders can now afford to upgrade their systems.

The unit is based on the well-proven Olivetti 5¼ inch drive, giving 100k capacity on a 40-track format. It comes complete with utility disc, manual and all cables ready for operation with any BBC Microcomputer fitted with Acorn DFS or compatible disc interface. For users without a disc interface fitted into their micros, RCS is offering a special package price of £165 including VAT to upgrade a model B microcomputer and supply a disc drive (plus £7.00 postage and packing).

RCS Computer Services is the central repair agent for Acorn. For further information please contact: RCS Computer Services, Leeway Data Products Ltd, North Feltham Trading Estate, Feltham, Middlesex TW14 0RX Tel: (01844) 2044.

NO INTERFERENCE

G2DYM Aerials, manufacture a range of anti-TVI trap dipoles.

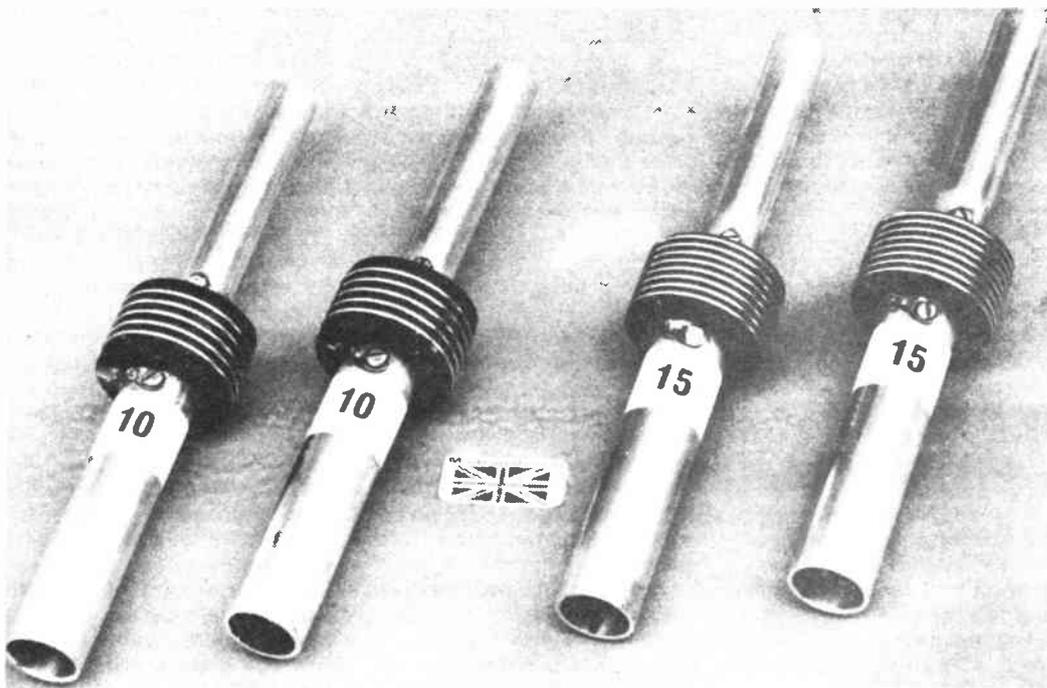
They have announced the addition of new 10 and 15 metre models to their range of aerial trap dipoles for 10, 15, 20, 40 and 80 metres.

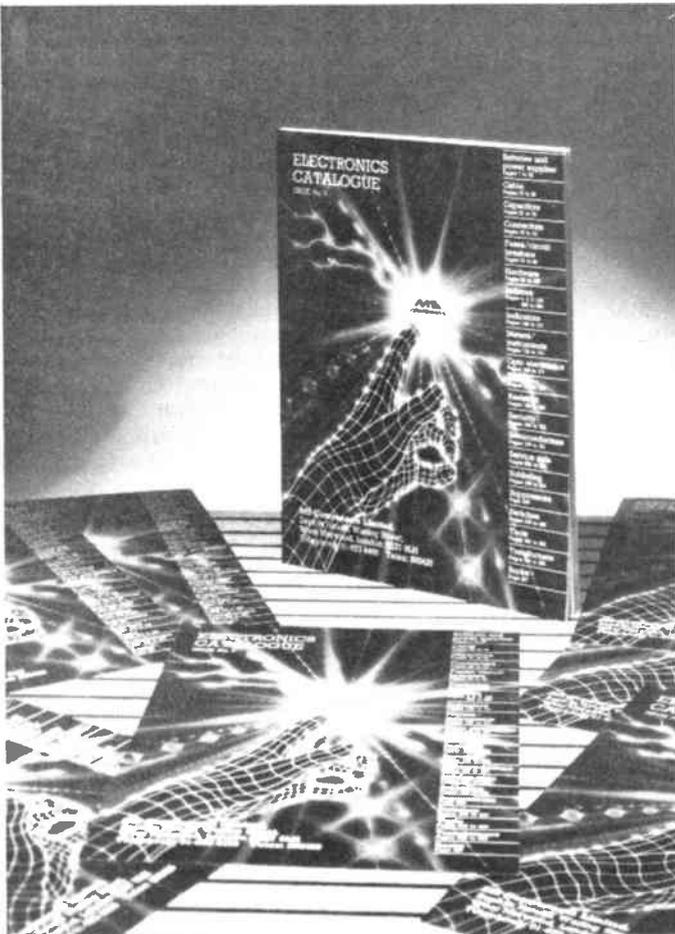
The latest models are available with 6 inches of aluminium tube at each end.

This facilitates the building of two or three element rotary tri-banders, rotary tri-band dipoles and trap verticals, either a quarter-wave or half-wave in height.

These 10 and 15 metre traps can be obtained for £10 each + £1 P&P.

For details or information on the other products in the range contact: G2DYM Aerials, 'Cobhamden Castle', Uplowman, Nr Tiverton, Devon.





LOWE-DOWN

A new monitor receiver, the AOR AR2002, has recently been introduced by Lowe Electronics Ltd (see G3OSS's comments in this issue).

Frequency coverage is 25 to 550MHz and 800 to 1300MHz. An improved keyboard aims to make operation easier and there is a front panel knob for frequency stepping in addition to up/down buttons. Also on the front panel is an LED strip S-meter and a headphone jack.

On the rear panel there is a socket for an optional RS232 interface board.

The AOR AR2002 is priced at £37 including VAT, plus £7.00 carriage.

More information can be obtained from: *Lowe Electronics Ltd, Chesterfield Road, Matlock, Derbyshire DE4 5LE. Tel: (0629) 2817.*

NEW DISTRIBUTOR

Tactico Ltd, the communication systems company in the West Midlands, have announced that they have been appointed the exclusive UK distributor for Microwave Modules professional microwave products.

These products include a range of British designed microwave modules for point-to-point systems for data, speech, telemetry and control signal transmission and reception.

More information is available from: *Tactico Ltd, 65 Logie Green Road, Edinburgh EH7 4HF. Tel: (031 556) 6167.*

BBC SOFTWARE

A new program for the BBC Model B computer, which allows data or teletext compatible colour graphics images to be sent over the air to other similarly equipped computers, has been announced by ICS Electronics.

ASCII Communications program version 1 is a data communication program for radio amateurs. It has been written for the BBC model B computer. It allows ASCII data to be sent over the air to other amateurs. This data can be from the keyboard or from previously stored files.

The radio transceiver can either be interfaced directly to the cassette port of the BBC computer or (for improved performance) via

the ICS Electronics' RM-1 radio modem.

Available on EPROM with comprehensive documentation, the ASCOM-1 software is priced at £39.00 including VAT, plus £1.00 P&P.

For more information contact: *ICS Electronics Ltd, PO Box 2, Arundel, W Sussex BN18 ONX. Tel: (024 365) 590.*

COMPONENTS CATALOGUE

MS Components have just published their latest components and equipment catalogue.

Now containing some 300 pages, the catalogue has been designed for development engineers and buyers in the electrical and electronics industries.

It consists of 20 sections and includes some 10,000 products, ranging from sophisticated electronic instruments to less interesting but nonetheless essential items like sleeving.

Copies are available free to all readers, by contacting: *MS Components Ltd, Zephyr House, Waring Street, West Norwood, London SE27 9LH. Tel: 01-670 4466.*

CABLE CHECKER

Now available in the UK from House of Instruments is the Soar Model 1500 cable checker, a pulse-reflection test instrument that will measure the length of coaxial cable from 5m to 1000m, as well as indicating whether the cable termination is open or short circuit.

The Model 1500 features a 4-digit LCD display which gives a direct readout of cable length in feet or metres, the units being selectable with a convenient front-panel switch. Accuracy is within $\pm 1\%$ of full-scale reading.

Two digital switches are provided to allow easy setting of the instrument's nominal velocity of propagation from 0.01 to 0.99, while interface to the cable under test is via a front-panel BNC connector.

The instrument measures 186 x 57 x 180mm and weighs 1.3kg. Power supply is from rechargeable nickel-cadmium batteries or an ac mains adaptor.

For further information contact: *House of Instruments, Raynham Road, Bishops Stortford, Herts CM23 5PF.*

FAST RESPONSE

Now available from Electronic Brokers is the Claude Lyons Stabilac LVC range of voltage conditioners, designed to correct supply line disturbances without the need for an expensive dedicated line.

Features of the LVC range include a patented electronic circuit to ensure a stable voltage, and a transformer with a high degree of Faraday screening isolates input and output and prevents spikes and transients from damaging sensitive equipment. A filter removes electrical noise and offers protection against conducted radio interference.

Designed as portable, desktop units, the voltage conditioners have a fast correction time of typically 1.5 cycles, an input voltage correction range of $\pm 15\%$ of the set output voltage, and an output voltage of 240V $\pm 6\%$ at maximum load current.

With a 48-63Hz supply frequency, the LVC range has a negligible waveform distortion and, type dependent, a supply current of 0.65 to 10A.

Further information is available from: *Electronic Brokers Ltd, 140-146 Camden Street, London NW1 9PB.*

COMPUTER PROTECTION

The Advance Adline Series of ac line conditioners, from House of Instruments, are designed to protect computers and other digital electronic equipment from the effects of mains variations and spikes.

When installed between the 'normal' mains power and users' electronic equipment, the Adline Series provides total protection against voltage sags, surges and transient spikes.

The range offers four power levels in ratings from 500VA to 5kVA in both 220V and 240V versions.

The Adline Series maintains regulation over an input voltage range of +20% to -28%, and the use of zero-current switching gives them the ability to drive varying-power-factor loads, thus eliminating a common failure mechanism often found in other tap changers.

More details can be obtained from: *House of Instruments, Raynham Road, Bishop's Stortford, Herts CM23 5PF.*

STRAIGHT & LEVEL

FREEBIE

Good news for those of you who are thinking of buying a yagi antenna for 2m: Ant Products are currently offering a freebie power divider/splitter unit with every purchase of a pair of Tiger LY9, LY10 and LY13 antennas.

For more details and a copy of the company's latest catalogue mark the envelope AR and send 50p to cover postage to: *Ant Products, All Saints Industrial Estate, Baghill Lane, Pontefract, West Yorkshire WF8 2HA.*

CAPACITANCE METER

Electronic Brokers now stocks the Thurlby CM200 precision capacitance meter, which has a 1pF to 2,500 μ F measuring range with a basic accuracy of 0.2%.

Featuring a 4½-digit liquid-crystal display, the CM200 has a manual range selection with a rapid reading rate of 3 per second and a maximum settling time of 0.65 seconds.

Special fuse protected input sockets provide for the direct connection of a wide variety of capacitor or standard test leads. A zero control allows up to 25pF of test lead capacitance to be nulled out.

Ease of operation makes this instrument ideal for use

in development, production, quality control and component inspection. The CM200 is lightweight and fully portable and operates from internal batteries (providing many hours of operation) or from an ac line adaptor.

For further information contact: *Electronic Brokers Ltd, 140-146 Camden Street, London NW1 9PB. Tel: 01-267 7070.*

VERSATILE KEYPADS

Designed for switching functions in instrumentation as well as general purpose input of numerical and textual data, a series of membrane keypads is now available from Electronic and Computer Workshop Ltd (ECW).

The standard keypads are available in both 12 and 16 key versions and can be supplied with printed symbols. The 12-key pad is set out as a standard telephone 'touch-tone' pad while the 16-key version has a hex layout. Alternatively, they can be supplied without printing so that the user can insert the necessary symbols.

The keypads can also be supplied with custom symbols for volumes of 100 pieces or more.

Connection is by way of a flexible cable and header.

ECW offers the K12 and K16 keypads at a price of £7.76 including VAT + P&P.

For further information please contact: *Electronic & Computer Workshop Ltd, 171 Broomfield Road, Chelmsford, Essex CM1 1RY. Tel: (0245) 262149.*

ANTENNA DISTRIBUTORS

Ant Products, manufacturers of the Silver 70 and Tiger range of amateur radio antennas have announced that they have appointed three major product distributors in the Lincolnshire and Midland areas.

In the Lincolnshire area J Birkett, The Strait, Lincoln has been appointed. In Nottingham, Castle Electronics have been appointed. They are situated at 40 Burnside Road, West Bridgeford, Nottingham and in Birmingham, Ward Electronics, Bromford Lane, Ward End, Birmingham are the appointed distributors.

The three dealers all carry substantial stocks of Tiger antennas including the new two metre collinear antenna. A catalogue containing detailed information of the Ant Products Tiger and Silver 70 range of antennas can be obtained by sending 50p to cover postage to: *Ant Pro-*

ducts (AR), All Saints Industrial Estate, Baghill Lane, Pontefract, West Yorkshire WF8 2HA. Tel: (0977) 85274.

KIT NEWS

Readers may find the latest copy of *Kit News* from Cambridge Kits of some interest, as in addition to details of the company's products the leaflet incorporates several useful tips and ideas.

Information for VHF operators on how to predict auroral openings is included, plus an extension to the atomic clock, tips on receiver range extension and a circuit for adding an upwards reading S-meter.

To obtain a copy, send an SAE to: *Free Kit News, Cambridge Kits, 456 Old School Lane, Milton, Cambridge CB4 4BS.*

HI-TEC

A new company, Hi-Tec World-Wide has been announced in Birmingham. The company is an approved distributor for Kenpro transistors and will be dealing with some new imported products in the near future.

All enquiries should be directed to: *584 Hagley Road West, Oldbury, Quinton, Birmingham B68 0BS. Tel: (021) 421 6001.*

934MHz EQUIPMENT

Telecomms, of Portsmouth, now offer a complete range of equipment for the 934MHz band (see Angus McKenzie's article this month), including a transceiver and accessories. The company see the market for this product as the more serious-minded enthusiast and the small business.

There are some basic problems with this band; for example, on UHF it is difficult to achieve good receiver sensitivity and a transmitter which will remain stable in both frequency and output.

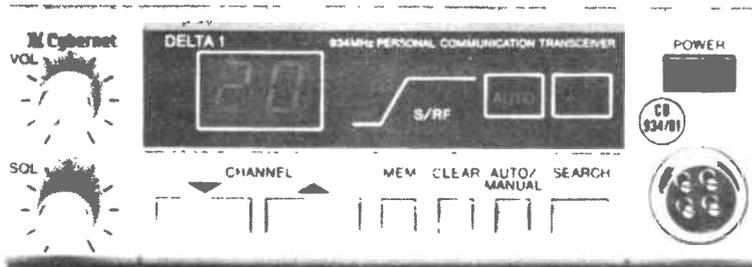
However, on 934MHz there is no ionospheric propagation, meaning no interference from other countries, there is no interference to television or commercial radio, and adjacent channel interference is non-existent. Also, early users of the band have shown that long distance contact, far from being impossible, was, with care, easier to attain on a regular basis than on 27MHz CB.

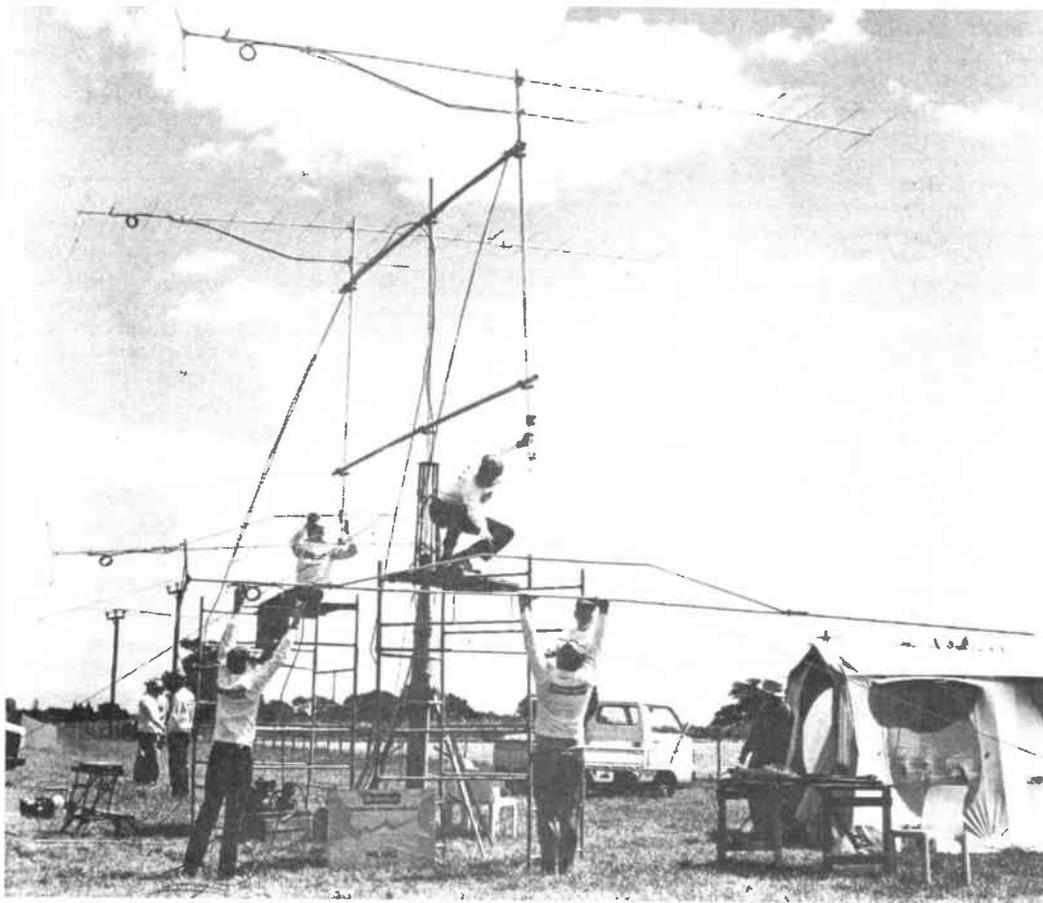
Telecomms have worked closely with the Japanese firm Cybernet to produce a 934MHz transceiver suitable for the UK - the Cybernet Delta One. This set incorporates scan and memory facilities,

high SWR protection and a socket for a large extension S-meter.

The company have now announced a complementary range of accessories for 934MHz - the Nevada 934

Professional Series - consisting of antennas, meters, pre-amps, cables and connectors. Further information is available from: *Telecomms, 189 London Road, Portsmouth PO2 9AE. Tel: (0705) 662145.*





Refreshes the parts. . .

An aerial rig and tent was installed in August 1,500 feet up a Galway mountainside for a Heineken-sponsored attempt to set a new record for long-distance contact.

It looked as though the bad summer had sunk plans by the West Kent Amateur Radio Society to contact North America and make the first ever direct transatlantic QSO on the 2m band. The idea was to bounce the signal through the ridge of high pressure which normally develops over the Atlantic in August. But with the weather pattern the outlook looked bleak.

However, at the time of going to press, the group planned to go ahead with the expedition, with a little assistance from the giant liner QE II. The ship agreed to act as a floating radio link between the British team and the American enthusiasts trying to find their signals.

Four stacked and bayed long Yagi antennas were used. Modes of operation were CW, SSB, Amtor, and HF. Transmission was round the clock from 19-30 August.

AR on Shuttle Columbia

It is reported in the UoSAT Bulletin, no 137, that two German radio amateurs may be operating an amateur radio station aboard shuttle flight 61A during October. Dr Ernst Medderschmid DG2KM and Dr Reinhard Furrer DD6CF will be on board Columbia for the Spacelab-D1 operation, and hope to engage in cross-band, Oscar transponder-type operation.

The equipment is capable of four 2m and eight 70cm channels. Automatic logging equipment is planned for recording all received calls when the astronauts are busy with other Spacelab duties. The package will also have a 1 watt 70cm beacon for determining when the shuttle is within your communications range.

The equipment is apparently designed for cross-band rather than in-band operation.

Fund-raiser

As part of a fund-raising campaign for the rebuilding of the Lion Walk United Reformed Church in Colchester, Angelika Voss G0CCI (ex-G5CCI) is organising a special

event station which will be on the air on Saturday 12 October. The callsign will be GB4URC and the aim will be to contact as many stations as possible within the period 1000-1600 local time on both HF and 144MHz.

People are sought who would be prepared to sponsor the station based on the total number of QSOs completed (eg a few pence per dozen QSOs).

Anyone who can help is invited to contact: G0CCI, PO Box 49, Colchester, Essex. Tel: (0206) 396610.

IRTS Yearbook

The Irish Radio Transmitters Society has published an annual EI callbook for the last several years and the idea has been expanded this year to include not only up-to-date listings of callsigns, but also reference information about the IRTS in 1985.

This year therefore the booklet is being referred to as the *IRTS Yearbook* and the intention is to keep members informed of the society's progress. Ideas and suggestions for inclusion in the 1986 yearbook will be welcomed.

The booklet has a very

interesting introduction, of special interest for newcomers to the hobby. It explores the ideas and concepts behind amateur radio, how amateurs contribute in scientific research and how the hobby is organised internationally. The yearbook also outlines how to become a radio amateur, with specific reference to Irish amateurs, and why, of course, hams in Ireland should join the IRTS.

Detailed information is included about the society itself - its history, awards, officers, the QSL service and the rules which members must abide by.

The IRTS Amateur Radio Yearbook 1985 is available at £2.00 from: *Irish Radio Transmitters Society, PO Box 462, Dublin 9, Eire.*

Worcester & District ARC

The Worcester and District Amateur Radio Club gathers for club nights and informal meetings at 8.00pm at the Old Felows Hall, New Street, Worcester. Club nights are held on a Monday evening and informal gatherings on a Wednesday.

On club nights they arrange various lectures and demon-

strations. On the agenda for August they have a talk on contesting by Richard Marshall G4ERP on the 5th and an informal meeting on the 21st.

Those interested in joining the club should contact: *DW Batchelor G4RBD, Hon Secretary, 14 Oakleigh Heath, Hallow, Worcester WR22*

Brighton update

The Brighton and District Amateur Radio Society wishes to inform the readers of *Amateur Radio* that its meetings are now held on the first and third Wednesdays of each month at 8.00pm.

The venue is: *'Seven Furlong Bar', Brighton Racecourse, Brighton, Sussex.*

Cellular radio

The Biggin Hill Amateur Radio Club has organised a lecture on the latest in telecommunications, cellular radio, by Richard Owen of British Telecom. This will take place on 15 October.

All meetings are held at St Mark's Church Hall in Biggin Hill at 8.30pm.

For more information telephone the Honorary Secretary, Robert Senft G0AMP on (0689) 57848.

Natter Night

The Sutton and Cheam Radio Society meets on the third Friday of each month at 7.30pm at the Downs Lawn Tennis Club, Holland Avenue, Cheam.

Events planned for October include a 'Natter Night' on 7 October in the Downs bar and a talk on propagation on 18 October by Charlie Newton G2FKZ.

Further information is available from: *Alan Keech G4BOX, 26 St Albans Road, Cheam.*

Making electricity

The Central Electricity Generating Board (CEGB) will be presenting a lecture

entitled 'Making Electricity' on 18 October for the Radio Society of Harrow.

The society holds regular activity nights, when the society station, G3EFX, is operated and Morse classes are held. During October these will take place on the 11th and the 25th.

All meetings are held at The Harrow Arts Centre, High Road, Harrow Weald. Telephone Dave Atkins G8XBZ on Rickmansworth 779942 for details.

ELHOEX '85

In view of the success of the ELHOEX '84 exhibition the Hornsea Amateur Radio Club has decided to repeat the

event this year, with a similar but improved format.

ELHOEX '85 (Electronics Hobbies Exhibition) is a presentation of the many facets of amateur radio, ie HF, VHF, UHF, ATV, RTTY, Amtor, computing, etc. All the radio clubs in the locality will have a stand, displaying their particular speciality.

There will also be trade stands, a book stall, repeater group display, tombola, raffle, junk sale, bring-and-buy and more.

The date will be Sunday 20 October at the Floral Hall in Hornsea, East Yorkshire.

For more details contact: *N A Bedford G4NJP, 39 Hamilton Road, Bridlington, East*

Yorks YO15 3HP. Tel: (0262) 673635.

TV repeater

The Cambridgeshire Repeater Group has news of GB3PV, the proposed 1296MHz TV repeater for the Cambridge area.

Apparently the receiver has been completed and tested, and work is now progressing on the transmitter and micro-processor logic. A feature will be electronically generated text in addition to the test card, which will give information on the repeater and possibly local news. 1kW ERP is hoped for.

The proposal has been sent to the RSGB for approval.

More ham aid

On 25 May this year, Frensham Heights School, a pioneer progressive school situated near Farnham in Surrey, celebrated its 60th anniversary. For the occasion the school's flourishing amateur radio club obtained a 'special event' callsign, GB4FHR, and went on the air for 12 hours.

Working in two hour shifts, four members of the club endeavoured to make as many contacts world-wide as they could between the hours of 8.00am and 8.00pm.

The main object of this marathon transmission was to celebrate the school's anniversary and to look forward to a further 60 years of educational success. A more serious objective motivated the exercise, however, Teachers, pupils and parents had been asked to sponsor the club for the number of contacts made during the day, the money being earmarked for famine relief in the Sudan.

Conditions were not very good and nearly all the contacts made were in Europe. By 7.00pm four tired operators were looking forward to a little silence and some of what remained of the evening's sunshine.

As guest member Don Murray G1DGI, operating under supervision from G4VCG, was signing with a Dutch amateur, an English voice broke in with an unfamiliar callsign - ST5ALR. He had overheard Don explaining the sponsorship scheme and he was overjoyed to make contact: he was situated at El Obeid in central Sudan and was a field-

worker with an aid organisation. Suddenly flagging spirits were revived: the club had made contact with the very country whose plight had motivated the sponsorship plan.

Excited details were transmitted by ST5ALR and it was arranged that he would send information about the particular activities in which his group were involved in drought-stricken El Obeid. With promises of further con-

tact on the air, the two stations signed.

Whilst Mr Bob Geldoff's mighty achievements have yet to be rivalled, the jubilant members of Frensham Heights Amateur Radio Club are looking forward eagerly to participating in direct aid to that troubled part of the world. Already there is talk of the possibility of some kind of organised amateur radio famine relief project involving further sponsored

transmissions and contacts with amateurs in the field.

The club would be very interested to hear from anyone who feels that they might be in a position to offer advice or help in the setting up of such a project. The two governing factors must be practicality and observation for international licensing conditions. Write to: *Dick Jones (G1JCD), The Radio Club, Frensham Heights School, Rowledge, Surrey*

Todmorden Raynet

On 17 August this year the Todmorden Round Table organised a huge charity walk through Summit Tunnel on the Lancashire/Yorkshire border.

Only eight months previously the tunnel had been closed completely after a locomotive with a cargo of petrol derailed and caught fire, causing severe damage.

During and after this incident neither fire nor police officers could establish radio

communications from one end of the tunnel to the other. However, a week prior to the charity walk Todmorden Raynet, who had been called upon to assist the St John's Ambulance Brigade establish communications for use during the event, conducted a feasibility exercise with a British Rail engineer and found that, using 70cm, communication was possible from the centre of the tunnel to each end.

The engineer was

astounded at the group's efforts - he had felt that if professional people could not succeed in establishing communications in these circumstances then Raynet were wasting their time.

The whole exercise was an outstanding success. Over 6,000 people participated in the charity walk and Todmorden Raynet showed that, although an amateur organisation, they could provide a service in some of the most unusual circumstances.



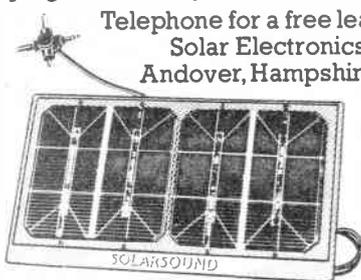
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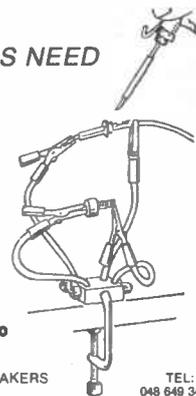
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DDM 28 length 5.8m.....£14

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DD 10/18/24 length 15m.....£60

DD 14/21 length 10.7m.....£40

DD 7/21 length 21m.....£34

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L·E·T·T·E·R·S

DISTURBED

I am very disturbed at the high turn-over of staff in the Radio Regulatory Division of the DTI, which deals with amateur radio matters.

It would appear that civil servants spend less than one year in the RRD before moving on. Apparently this is common civil service practice.

Amateur radio is given low priority, after all 'it's only a hobby'. It is obvious, therefore, that the RSGB, consisting of people who have been in amateur radio for over 60 years, must exert undue influence on the DTI officials that they meet. The Government should run amateur radio matters, not the RSGB. After all, it is the Government who collects the £12 licence fee.

Ian Abel G3ZHI, Yorks

PHONE PATCH

During the last two weeks I have been unfortunate

enough to be the first person on the scene of two serious road traffic accidents. Both accidents were in remote rural areas with no telephones nearby. I was able to use my 2 metre radio to call for assistance and this was rapidly at hand. It was indeed fortunate that both incidents took place during the early evening when there were a number of amateurs able to assist at once.

Turn the clock back to an incident at 3.00am on a wet morning last March in California (yes it does rain there!) and a similar situation when I encountered a six car pile-up which blocked the road. I was immediately able to summon help through the phone patch on the local repeater and as a result two critically injured people are alive today. I subsequently found that the nearest phone was ten miles away and as a stranger to the road I would never have found it.

A number of repeaters are

currently being fitted with phone lines to enable the RSGB headline news to be read. This is an ideal opportunity for phone patch facilities to be installed on an experimental basis. This might only save one life but would surely be worth it.

PL Crosland G6JNS, Worcs

WHOSE AIR?

It has recently been noticeable that those who write to the magazines wishing to deprive the non-licensed from using a novice band already have their own call signs. Maybe the writers are not aware of the situation?

Many professionals, SWLs and other listeners can cope with 20wpm (or more) and know exactly how to make a crisp QSO, unlike, unhappily, some of today's 'hams', who often seem to be sending with a left foot.

On the other hand, slick radio amateurs provide us

with hours of very pleasant listening indeed. Many unlicensed people would appreciate the temporary use of a novice band for various reasons.

For example, they perhaps find it almost impossible to swot for the amateur exam, the drawbacks being lack of suitable time to prepare for it, pressure of work, and in one case no immediate wish to take part in today's too frequent rubber stamp QSOs. That's not as amateur radio should be.

Another point is that apparently few CBers read CW, therefore there is no question of adding to the 'undisciplined operators' who already exist. Listen to them calling a DX station - smack on frequency, ignoring the 5 up, etc. All have Tx's, but don't use the Rx correctly. Nevertheless, the use of a band to 'polish up' would be a great help. Live, and let live, fellows!

G Curtis, Middlesex

C. M. HOWES COMMUNICATIONS EASY TO BUILD KITS BY MAIL ORDER

ARE YOU ENJOYING THE SIMPLE LIFE?

QRP (low power) operating is becoming more and more popular. This move away from expensive high power equipment to simple, often home-built gear is offering many amateurs a satisfying challenge. Most experienced operators also have the proverbial "black boxes" in the shack, but QRP offers them the opportunity to build their own equipment and put a little fun back into the hobby. At C. M. HOWES COMMUNICATIONS, we have kits to build simple low power equipment including easy to construct receivers that will appeal to the newcomer as well as the licensed amateur. If you haven't tasted the pleasures of the simple approach yet, why not choose a worthwhile project from our range? Established customers may like to note that we now have 40M band versions of our popular CTX, CVF and DcRx kits available for you to add to your collection!

DcRx DIRECT CONVERSION COMMUNICATIONS RECEIVER

The HOWES DcRx receivers are simple, easy to build single band designs. You can choose versions for the following bands: 20, 30, 40, 80 or 160 Metres. They all work from a 12 to 14V DC supply (a battery is fine) and provide plenty of audio output to drive a loudspeaker or headphones. The DcRx has been the first introduction to shortwave listening for many an aspiring amateur. Read the SWL column in the August '85 issue of "Amateur Radio" and find out what Trevor Morgan has to say about the DcRx and how one of his correspondents has claimed a Bronze Award for prefixes and countries heard on his HOWES DcRx20. You will be amazed just how well a simple design can work. A case and a couple of tuning capacitors are the only major items to add to finish your receiver. We have suitable capacitors for all but the 160M version at £1.50 each.

DcRx kit £14.80. Assembled PCB module £19.90.

CTX QRP CW Transmitters

Two versions are available at the moment, one for 80M and the new 40M version. These super little rigs produce up to 5W RF output on 80, and 3W on 40. They come complete with one crystal, but there is also provision for an external VFO for full band coverage (HOWES CVF40 or CVF80). Read the reviews in the August '85 issue of Practical Wireless and the March '85 Shortwave Magazine. A CTX transmitter makes a ideal introduction to HF operating. A few months spent using simple CW only equipment will help to make you into a first class operator. I can only admire the skills of some of our customers, many only having recently passed the Morse test, the sheer number of countries they manage to work with their HOWES QRP equipment puts me to shame! But then I started on HF a few years ago with a black box and a microphone - something I now regard as a mistake!

CTX40 or CTX80 kit £12.95. Assembled PCB module £18.95.

CVF VARIABLE FREQUENCY OSCILLATORS

The HOWES CVF40 and CVF80 VFOs are designed for use with the CTX transmitters. They enable you to tune the whole band instead of being "rock bound". Dual buffered outputs are provided so that you can also connect your DcRx and form a transceiver. IRT, voltage stabilisation, FET oscillator are some of the features of the CVF designs. These kits require a tuning capacitor of about 50pF (we can supply these at £1.50 if required).

CVF40 or CVF80 kit £9.30. Assembled PCB module £14.90.

AP3 AUTOMATIC SPEECH PROCESSOR

Add more "punch" to your signal with the AP3. Automatically compensates for changes in speech levels, so giving accurately controlled clipping levels and hence clean audio quality. This kit is one of our big sellers, and they enjoy a very good reputation on the air. Suitable for high or low impedance mics, and can even be used with ICOM rigs with a couple of simple mods which we can give you.

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XM1 kit £16.80. Assembled PCB module £21.30.



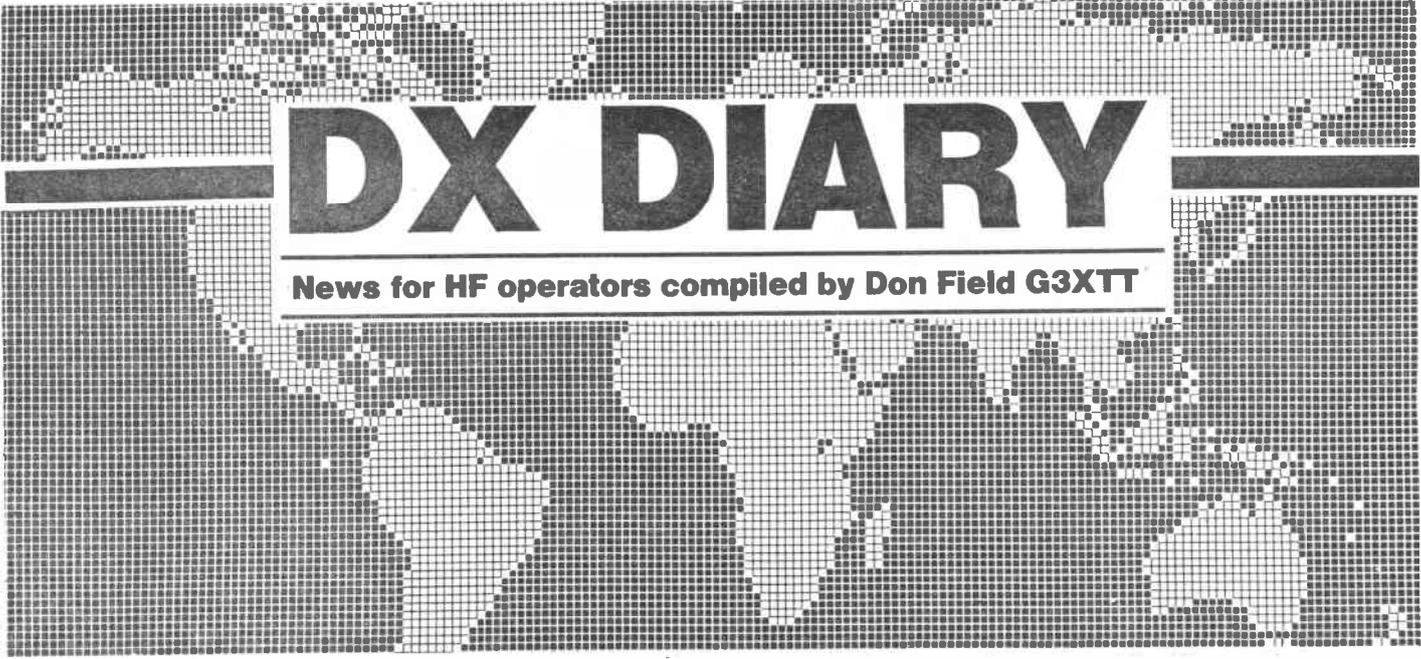
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73 from Dave G4KQH, Technical Manager.



DX DIARY

News for HF operators compiled by Don Field G3XTT

October is the month of contests and DX; one of the best months of the year for the avid HF enthusiast. A vigil at dawn and dusk can produce some fascinating DX on the lower frequency bands, especially as, towards the end of the month, there will be the usual crop of DXpeditions to coincide with the CQ Worldwide DX Contest. Indeed I hope to be out there with them, on the island of Jersey in fact.

DXpeditions

At the time of writing, some of those DXpeditions have already been notified. As well as our own effort from Jersey (listen for GJ6UW), others will include:

Wake Island. KB6DAW/KH9 and NY6M/KH9 hope to be active from 22 October to 4 November, using the former call on SSB and the latter on CW. They hope to make over 15,000 contacts. I hope so, as I still need that one!

Galapagos Islands. HC8A and HC8E were active in August, and worked many UK stations on 20, 40 and 80 metres. However, if you missed them don't worry: a group of no less than fourteen US amateurs expects to be there for a major contest effort as HC8X. They will operate before and after the contest with their own calls portable HC8.

While these are the only contest efforts that I have been notified of at the time of writing, there is no doubt that there will be many others. The contest itself is a 48-hour affair taking place over the weekend of 26/27 October. For some hints and tips about

the contest have a look at G3TXF's article in last October's *Amateur Radio*, and my own column in the same issue.

Pitcairn Island

Jim VR6JR, continues to be very active on 40 metres around 7042kHz, from about 0530GMT daily. He expects to be on the island until the end of the year, and is intending to be active on 80 metres when propagation allows. Indeed, he was able to make his first UK contacts on 80 as early as mid-August. Jim's home call is G3OKQ, and that is where QSLs should be sent.

Pitcairn's most famous radio amateur is, of course, Tom Christian VR6TC, a descendant of Fletcher Christian of Mutiny on the Bounty fame. Tom's wife Betty is also licensed, though rarely active. A third resident amateur on the island is VR6KY, Kari, a Norwegian girl who fell in love with one of the islanders during a visit and went back there to live.

Hello Sailor!

Pitcairn is very isolated indeed, Tahiti (its nearest neighbour) being some 1,350 miles away. It is a volcanic formation and there are actually four islands, though only the largest (if 2 square miles can be called large!) is inhabited. The islands were first discovered in 1767 by a British naval vessel and named after the sailor who made the sighting.

Pitcairn's fame, of course, derives from its association with the Bounty mutineers who settled there with their

Tahitian consorts in 1790. From then on the island has a rather chequered history of disagreements over land and women, but despite this the population grew so that, in 1856, some of the islanders left for Norfolk Island where their descendants live to this day.

Pitcairn is administered on the UK's behalf by the British High Commissioner in New Zealand and life is lived very much at subsistence level. There is some income from the sale of postage stamps and curios to passing ships, but gone are the days when whalers and ocean liners used to be frequent visitors. Often several months can go by without any passing ships, which is why Tom Christian's role as radio officer (in addition to his amateur radio activities) is so vital.

Even so, absentee land ownership and depopulation threaten the future of the island community, and it may be that a time will come when the islanders choose to emigrate en masse. After that, who knows when we will get a chance to work VR6?

DX news

S92LB (mentioned in my August column) is now acceptable to the ARRL for DXCC credit, and QSL cards have been turning up in the mail. He seems to be active most evenings on 14183kHz from about 2000GMT, and sometimes earlier on 15 metres.

N7DF/TT8 is currently active from Chad. Until September he was restricted to short wire antennas

because he was living in a block of flats. However, by the time you read this he should have his own place and was promising some better aerials, including one for Top Band.

Special prefixes

Several prominent world figures are radio amateurs, among them King Juan Carlos of Spain (EA0JC) and Rajiv Gandhi (VU2RG). The one who has been most noted for his amateur radio activities is, however, King Hussein of Jordan (JY1).

He has been active himself for about fifteen years and has hosted many overseas amateurs at his station in the Royal Palace at Aqaba. He has also sponsored several DXpeditions, for instance the last major operation from the Iraq/Saudi Neutral Zone (8Z4A) in 1979. We now have news that, to celebrate his 50th birthday, Jordanian amateurs will be allowed to use the special JY50 prefix during November.

While on the subject of special prefixes, ZM6ARU will be active from New Zealand from 9-18 November. This is related to the IARU conference which I mentioned last month. A special award will be available in connection with the IARU conference.

To qualify, European amateurs need to work ZM6ARU and two other stations using the ZM prefix. Alternatively, if ZM6ARU is not worked, a total of seven ZM-prefixed stations must be worked. Send log details plus \$1 for surface mail or \$2 for

airmail to NZART Awards Manager, 152 Lytton Rd, Gisborne, New Zealand.

Canadian Award

In July I mentioned the special prefixes to be used by Canadian amateurs to celebrate 100 years of Parks Canada. The Canadian Radio Relay League (CRRL) is now sponsoring an award in connection with the same anniversary. It is known as the National Parks 100 Award, and to qualify 100 points have to be earned during 1985 as follows: 2 points for contacts with the majority of Canadian amateurs, 10 points for contacts with Canadian stations using the special prefixes and 20 points for stations operating from the Parks Canada sites.

Send a certified (by two amateurs) copy of your log with \$1 or 3 IRCs for postage to CRRL National Parks 100 Awards Manager, Garry Hammond VE3XN, 5 McLaren Ave, Listowel, Ontario, Canada N4W 3K1. Incidentally, Garry also publishes an international awards directory and the 1985 edition is available from him for \$12 including air mail postage.

DXpedition Award

The Clipperton DX Club of France has recently introduced a new award to encourage amateurs to work DXpeditions (as if any encouragement was needed!). Contacts are valid from 1 January 1984 and a DXpedition is classified as a valid operation from a distinct geographic location lasting for less than three months. 1 point is scored for each band and mode, so you can score a maximum of 12 points for a particular DXpedition by working them on both CW and SSB on 10, 15, 20, 40, 80 and 160 metres.

Three classes of award are available: Class 3 requires 100 points, Class 2 requires 250 points and Class 1 (Honor Roll) 500 points. Detailed rules are obtainable by sending an SAE and 2 IRCs for postage to F6EYS, P Bittiger, 8 rue du General Ganeval, F-67000 Strasbourg, France.

RSGB Awards

The RSGB HF awards programme has now been revised and details were made available at the HF Convention. I have spare copies if any

readers are interested. Although there is a wide range of RSGB HF awards, the principal ones are based on working Commonwealth Call Areas, Islands and ITU Zones respectively.

Taken along with the WAB awards mentioned last month and *Amateur Radio's* prefix awards, as well as awards issued by various local and specialist clubs, there is now a very worthwhile and challenging range of home grown awards available to UK amateurs.

80 metre DXing

With the onset of autumn, it is time for a reminder that the band segment 3775-3800kHz is reserved, by IARU agreement, for DX working. In practical terms this means that, from at least an hour before sunset until at least an hour after sunrise, UK stations should refrain from using this part of the band for working stations within Europe. This is vital if 80 metre DXing, one of the more exciting aspects of HF operation, is to succeed.

To take an example: a UK station running low power to a low dipole an hour before sunset may believe he couldn't possibly be causing trouble to anybody. His low antenna, however, means he will be putting out high angle radiation and could be causing enormous problems to, say, a Swedish station who is already in darkness and trying to copy someone in New Zealand.

During November to February, it has to be assumed that the Scandinavians in particular have round-the-clock DX propagation, so during these months UK stations should

avoid the top end of the band altogether, except when working DX themselves.

Of course the message is just as true in summer as in winter. Through much of the summer G stations could be heard ragchewing through the evening at the top of 80 metres, seemingly oblivious to the fact that there was propagation to Australia or other distant parts if only they had kept the channel free.

The 80 metre DX fraternity themselves are by no means whiter than white in the way they use the DX segment of the band. Some do their best to 'hog' a frequency for hours on end, calling interminable CQs seemingly to prevent anyone else from using the channel. Others take part in unwieldy list and net operations, even when they cannot really hear the DX station on the channel.

For serious 80 metre DXing I can do no better than recommend a move down to the CW end of the band. Much of my best 80 metre DX has been worked on CW in the bottom 5kHz, without all the hassle that attends SSB operation on the band. In any case, where weak signals are concerned it will always be true that CW has both a theoretical and a practical advantage over SSB, provided that narrow bandwidth filters are used and, of course, that the operators concerned can actually send and read CW!

Contests

As well as the CQ WW Contest, other October contests include the VK/ZL events, the RSGB 21MHz CW and 21/28MHz SSB contests and the WA-Y2 (East German) Contest.

Roger G3KMA, one of the country's leading DXers, at this year's Birmingham Convention



The VK/ZL contests take place on two consecutive weekends in October, the SSB leg on 5/6 October, and the CW leg on 12/13 October. Both run from 1000GMT on the Saturday for 24 hours. These contests are an opportunity to work Australian, New Zealand and other Pacific stations.

Unfortunately at this stage in the sunspot cycle propagation to those parts of the world is, to say the least, variable. However, 20 metres should offer possibilities, as should 40 metres both at our dawn and at theirs. I remember working 5W1BZ on 40 one year in the SSB event, so it is always worth taking a look.

The RSGB contests are, of course, for members only, and are publicised in *Radio Communication*. The East German contest is a combined CW/SSB event on 19/20 October lasting 24 hours from 1500GMT on the Saturday.

Yemen

Non-amateurs are often surprised that countries such as China and Russia allow amateur radio operation. Two countries which don't are the Yemen Arab Republic (4W) and Yemen People's Democratic Republic (7O). There have recently been rumours that 6W1HB/7O, who has been heard on the bands, is genuine and will be getting his own 7O callsign. For my own part I am extremely doubtful.

As far as I am aware there has been no genuine amateur operation from YPDR since the British withdrew from the port of Aden and granted the country its independence in 1967. Prior to that time there had been some activity using the pre-independence prefix of VS9.

Amateur radio activity from 4W continued until about 1972 when the government started to clamp down. Up until that time a number of 4W stations had been on the air and although none had an official licence (they made up their own calls), amateur radio operation was tacitly accepted. For the future, who knows?.

That's all for this month. Enjoy those autumn and winter evenings when the DX is on the bands. Unfortunately summer always comes around too quickly for the DXer!

Thanet Electronics



IC-735, The Complete HF Radio

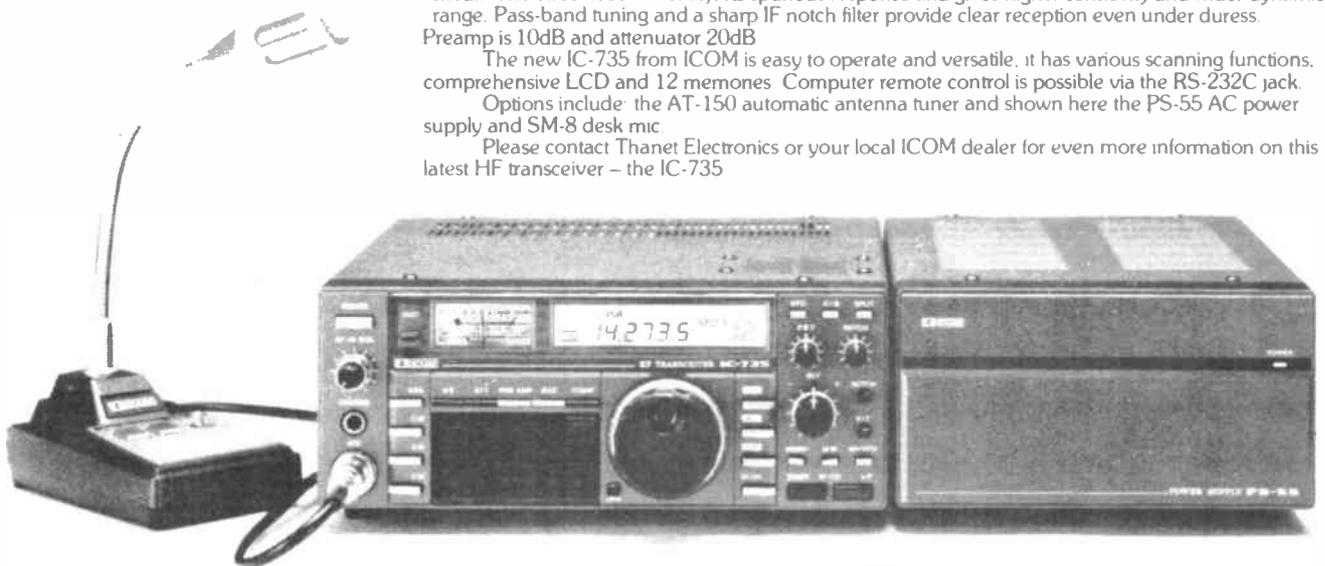
This new HF transceiver from ICOM is compact enough to make mobile or portable use a possibility. The IC-735 covers all Amateur frequencies from 1.8MHz to 30MHz including the three new bands 10, 18 and 24MHz. Modes include SSB, CW, AM and FM, all circuits are solid-state and output is approximately 100 watts.

Tuning ranges from 100kHz to 30MHz, made continuous by using a high-side IF and a CPU control system. RTTY operation is also possible. Dynamic range is 105dB with a 70.451 MHz first IF circuit. The direct feed mixer rejects spurious response and gives higher sensitivity and wider dynamic range. Pass-band tuning and a sharp IF notch filter provide clear reception even under duress. Preamp is 10dB and attenuator 20dB.

The new IC-735 from ICOM is easy to operate and versatile, it has various scanning functions, comprehensive LCD and 12 memories. Computer remote control is possible via the RS-232C jack.

Options include: the AT-150 automatic antenna tuner and shown here the PS-55 AC power supply and SM-8 desk mic.

Please contact Thanet Electronics or your local ICOM dealer for even more information on this latest HF transceiver – the IC-735.



IC-3200E Dual-band

A new exciting set is the ICOM IC-3200E FM Dual-band transceiver (144-430-440 MHz).

The IC-3200E employs a function key for low-priority operations to simplify the front panel LCD display is easy to read in bright places, showing frequency, VFO A/B, memory channel duplex mode and S/R meter information.

Other features include a 10 channel memory able to store operating frequencies, Simplex or Duplex. A memory lock-out function allows the memory scan to skip programmed channels when not required. The IC-3200E has a built-in duplexer and can operate on one antenna for both VHF and UHF. Options include IC-PS45 DC power supply, HS-15 mobile mic, SM6 and SM8 desk mics, SP-10 external speaker and UT-23 speech synthesizer.



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Electronics



IC-505, 50MHz A New Dimension for the U.K.

At last, permits are now available in the U.K. for the 50MHz (FM) band. If you wish to use this less crowded amateur frequency the IC-505 SSB CW portable transceiver has already gained an excellent reputation world-wide.

The IC-505 features microprocessor frequency control, dual VFO's and 6-channel memories with memory scan. LCD ensures clear visibility even in sunlight. The 505 accepts a standard dry-cell pack, rechargeable nicad battery pack (BP10) or 13.8V external power supply.

Standard accessory circuits such as split switch, noise blanker, squelch and CW break-in are incorporated in the 505.

Other accessories available include the EX-248 FM unit, BC-15 charger unit and the LC-10 carrying case.

All these features make the IC-505 a great transceiver that will enable you to operate on the 50MHz band, after all the rest of the world does!



IC-271 & 471

ICOM can introduce you to a whole new world via the world-communications satellite OSCAR. Did you know that you can Tx to OSCAR on the 430-440 MHz IC-471 and Rx on the 2m IC-271.

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

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

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Tyrone Amateur Electronics, Co Tyrone, N Ireland, 0662-2043
Reg Ward & Co Ltd., S.W. England, 0279-34918
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Listed here are authorised dealers who can demonstrate ICOM equipment all year round. This list covers most areas of the U.K., but if you have difficulty finding a dealer near you, contact Thanet Electronics and we will be able to help you.

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RAYNET

**What is it? Who are the people behind it and what do they do?
Read on. We have the answers.**

Raynet? What's Raynet? You may well ask. A lot of amateurs know something about Raynet, usually by rumour or secondhand knowledge. Often both are misconceptions. The only way to find out about Raynet is to buzz off to a couple of groups, meet the people and find out.

With this in mind and having signed in triplicate for the company bicycle, I pedalled off at speeds approaching mach 2 to zone 6 and Buckinghamshire in particular.

Organisation

The official definition of *Raynet* is 'to provide third party emergency communications on behalf of duly authorised 'user services', as set out in the amateur licence'. In layman's terms, Raynet (Radio Amateur Emergency Network) was established in 1953 to provide communications support to emergency services in times of disaster.

The amateur radio licence permits Raynet members, as radio amateurs, to handle 'third party' messages for the Police, County Emergency Officers, the British Red Cross Society and the St John's Ambulance Brigade (all known as 'user services') during emergencies and public events.

In March and June 1984 the DTI made several amendments to the amateurs' licence. The most common activities that organisations such as Raynet take part in are non-emergency situations such as sponsored walks and marathons, and exercises with other groups like those organised by CEPO's (County Emergency Planning Officers) in Civil Defence disaster relief operations. These facilities have been granted on a specified number of operations per year.

Having mentioned Civil Defence, I can clear up one of the most common misconceptions and state that Raynet is

strictly non-political, non-sectarian, non-religious, non-profit making, totally voluntary and has no connection with military services.

The nice thing about Raynet for me was the involvement with other voluntary groups and taking part in something practical which involved amateur radio; which makes a nice change from sitting in the shack completely isolated. The types of activity are pretty varied, depending very much on what is happening in your local area and how closely your local group works with people like the Red Cross and St John's Ambulance. Often Raynet works with these user services on sponsored walks and marathons.

I observed a sponsored scout walk which went through the night. At various stages venture scouts erected tents as checkpoints which were also manned by a Raynet member. When each group of walkers arrived at the checkpoint, the scouts checked them in, leaving the Raynet man to relay 'status' to the walk HQ. Through the night the progress of each walker was plotted, and any that arrived exhausted at a checkpoint were held over while the Raynet member reported back and organised a pick up by a St John's or Red Cross ambulance/minibus. This all worked very well and no-one got lost... well done Mid Thames Raynet!

Marathons work on a similar basis, with

the Raynet HQ sited close to the user service tent and Raynet members manning checkpoints. Marathons have a higher number of exhausted participants dropping out than sponsored walks, so ambulances cruise round the route with a Raynet member operating a mobile link. This provides an efficient method of retrieving the drop-outs, and in one extreme case took a patient direct to hospital when time was of the essence.

These public events are a good form of practice for the disaster relief and emergency work. This type of work depends greatly on the local authority and on the individual CEPO.

The Buckinghamshire groups are very lucky in their close working relationship with their particular CEPO. These activities are catered for in exercises and include the types of emergency one hopes will never happen for real; floods, traffic, train and air disasters, air crashes, ambulance strikes and wartime emergencies.

Exercises are often county or nationally organised and take place from bases provided by local authorities. Raynet has the job of relaying information from one county base to another in a simulated emergency situation where it is assumed that normal communications are not operating, or are overloaded.

Typical bands for this are 2 metres and 70 centimetres, RTTY and phone modes being utilised. Again this is team-effort



Training – all part of Raynet activities



Efficient communication is essential when time is tight

radio, operators taking two hour shifts and working in teams comprising paper punchers, operators, loggers and runners. This type of exercise is good for the non-licensed Raynet member as there is involvement on the organisation side with antenna erection, etc.

Up to now, I've only looked at Raynet's activities with other groups, both voluntary and professional. In order to offer a reliable service to the 'user services', local Raynet groups hold their own training programmes and exercises. These are group sessions, either within the local group or in conjunction with a neighbouring group.

The exact form and frequency of group training sessions depend on local group controllers, but the aim is to provide a common basis of operation with other groups. This involves practising procedures so that all groups use the same terminology in a given situation and can co-ordinate with the user services. Map reading sessions are practised; this may seem rudimentary, but on the other hand, many people join Raynet having not used an Ordnance Survey map since cubs or brownies!

The O/S map is in standard use by emergency services and it is important to be able to find the exact point of the emergency, which is more likely to be in bleak moorland and deserted countryside than in town areas with adequate methods of communication. The third area of internal training is the organisation. In order for groups to be mobilised efficiently and sent to the correct destination the organisation has to be quite thorough, so Raynet has a well defined structure (which we'll look at next), every member having their own place in the scheme of things.

The training session helps the Raynet

member understand who does what, why and when. In the event of a call-out each member is listed in sequence, so that if one member is unavailable his duties would be passed on to the next, and so on. Therefore, it is essential that each group member can change roles and deputise as required.

Organisational structure

Raynet is sponsored by the RSGB and is controlled by the RSGB Council through the Raynet Committee, where the country is divided into zones. Raynet zones follow the Home Defence regions for England and Wales quite closely. However, for Raynet purposes and to take account of the geographical distribution of members, Scotland and Wales are treated as separate zones.

The zone is the responsibility of the *Zonal Representative*, and is quite a large area. Buckinghamshire, which provided the research for this article, is in zone 6, along with Berkshire, East Sussex, Hampshire, Isle of Wight, Kent, Oxfordshire, Surrey and West Sussex.

Not surprisingly this is too large a patch for one rep, so this is further broken down to a *County Controller*, who as the handle implies, looks after the local groups in the county which, in turn, are headed by a local *Group Controller*. The Group Controller has a couple of deputies who organise the rank and file members.

In some well populated areas, with active Raynet members, there is a further subdivision of the local group. This system is not purely bureaucratic but has practical use in call-out situations.

Let's take a hypothetical, but plausible, situation. There has been a long, wet summer with torrential rain (plausible enough). The County Water Authority

notify the CEPO at Shire Hall that they have an amber alert. The alert system is like traffic lights; green is fine, amber means cause for concern and red is for rivers bursting banks and flood action.

The CEPO will make whatever official arrangements he needs to, and may well decide to enlist the voluntary help of Raynet. This is done by a phone call to the County Raynet Controller. He (or she) decides how many and which local groups to call in. He will then call the relevant group controllers or their assistants, establish use of one of the Raynet frequencies, decide on a base of operation and issue instructions for individual members to be called out.

The local Group Controller has a list of all his active members laid out like a family tree; this same list is issued to each member of the group so that everyone knows where he is in the chain. Our specimen local group has three deputies whom the Local Controller calls (at this stage all calls are by telephone). The deputies each have two columns of names and phone the first name at the top of their column and, in turn, these people then ring the next member down the list and so on. If, for any reason, the member cannot be contacted they are by-passed for the next one on the list.

Practical system

This system means that no one member has more than three phone calls to make, and that each member knows he only has to worry about contacting people below his name in the column on the list. One neat trick I saw with a Buckinghamshire group was that they had condensed the call-out list to handy wallet size so that it could be carried around at all times. There is not much use being called out whilst at work with your call-out list at home!

Back to the amber alert... Members having been called out tune in to the allocated frequency and call into the control point to be given instructions. In this instance, it would probably be a map reference (hence the training sessions), with an instruction to monitor the level of the river and report back.



Raynet – a practical way to use amateur radio

Marathons are more exhausting than sponsored walks



In this way, the Water Authority would very quickly have strategic points of the river monitored for breaching banks, while keeping its trained personnel for emergency repair work.

There are variations on the call-out procedure, according to the type of emergency and local conditions. Sometimes Raynet members may be told their destination by phone and report back to control on arrival.

So there briefly are some of the activities of Raynet. It can be seen that Raynet is one cog in a machine and therefore quite a lot of paperwork and committee work go into the group and County Controller's jobs. I am not a great lover of committees, but did regard the county committee meetings as essential for the planning of events so that things ran smoothly and the Raynet member, as a Radio Amateur, is seen in public as efficient and responsible, rather than some gibbering idiot.

Encounters with Joe Public

It is as well to remember that often the meeting of a Raynet member is the first time that Joe Public encounters amateur radio. There is always the odd bore at any committee meeting who drones on and on, because he either likes the sound of his own voice or he simply doesn't know when to stop. I'm told, on the QT, that this used to happen in the Bucks County

committee meetings, but has stopped since they introduced the time out system. This operates just like a mobile repeater, a couple of minutes and then cut-off. One chap was well known for running over time, so after two minutes he was given a firm poke in the ribs with a screwdriver! That night, apparently, any other business was concluded before last orders.

Membership

This article is an introduction to Raynet and is intended to give you a feel of the organisation. If you are interested in joining, or finding out more specific details about your local group, contact the RSGB for the names and addresses of local contacts, or alternatively your local radio club is likely to have several Raynet members amongst its own members.

What sort of people join Raynet? Short answer is: all types. Ladies and gents, licensed and not, young and old, rich and people like me (poor). Gladly the days of Colonel Blimp are over. At one time Raynet seemed to be full of ex-military types playing Comms Officers. Today the Raynet groups I saw had a large cross section of members who all had a community spirit and wanted a practical outlet for their hobby, amateur radio.

I must admit that Raynet does give even the shy ham a chance to meet new

people and get involved in the community. Membership is at the discretion of the controller and is open to anyone over fourteen, and once accepted, members between fourteen and seventy-five years are automatically included in the Raynet insurance scheme for public liability and personal injury.

Members are issued with an identity card as proof of membership, which is also recognised by the user services as identification. Included in membership is a very comprehensive manual which covers almost everything you need to know about Raynet.

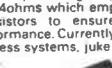
Bureaucratic boy scouts?

At first Raynet may seem to be an officious bunch of bureaucratic boy scouts out to be do-gooders. I found them to be sincere and friendly people. Raynet is a sociable way to enjoy your radio and to help others.

Thanks to Mid Thames Raynet for tolerating me, special thanks to Dave Thorn G8EOW and Milton Keynes Raynet for organising the cover photograph at such short notice. Special thanks to Milton Keynes St John's Ambulance for their uncomplaining help as they slowly sank into the mud (see cover pic). Thanks to Cathy Clarke G1GQJ, Russ Needs G4NUG and finally, thanks to John Booth, Bucks CEPO, for his information and help.

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ANGUS MCKENZIE

TESTS

muTek have already acquired a very good name for the quality of their VHF and UHF pre-amps, front end boards and more recently, their 50MHz transverters. Chris Bartram, their designer, has been working on a 2m transverter for over a year, and whilst I looked at the prototype a few months ago, only in late July did a production sample arrive for review.

The transverter contains only one functional switch: dc on/off. The front panel has LEDs to indicate Tx/Rx, and four separate Tx power levels: 1.5, 3.75, 6 and 9W output, the final one glowing more brightly when full power of just over 10W is reached. On the back panel there are 50 ohm BNC sockets for 28-30MHz in and out, and a 50 ohm N-socket for the 144MHz antenna or linear connection.

Sockets

A 5-pin power socket (270 degree DIN) contains pins for $\pm 13V$ dc, hard PTT, ALC return to the main transceiver and a pin which provides 30 ohm impedance to deck on Tx and open circuit on Rx. This is operated by a transistor switching circuit which can draw up to 30mA or so from 13V, although the manufacturers state that it can switch a 30V line provided this is not too low an impedance.

The hard PTT line is of a fairly high impedance, so it does not require much current to pass through an external relay control.

The ALC level is intended to reach a sufficient negative voltage to cut down the RF power output from most transceivers currently on the market, and the circuit was further improved in late July to cope with Trio rigs which require around $-6.5V$ to turn the RF drive back by at least 10dB.

There are some important presets accessible internally. The Tx drive input goes through an RF sensing circuit so that the input BNC can be used for transceive connection. Approximately 5mW power is required here to pull the rig over to Tx, but there is some hysteresis so that it will not drop back until the level is below 1mW. The signal passes through a relay and then into a Tx input preset gain, which should be adjusted appropriately for the required sensitivity.

Input levels from well below $100\mu W$ to 300mW can produce full output. The receive converter gain can also be preset to achieve a maximum of around 22dB, down to 8dB when fully backed down. This last position is not quite so silly as you might think, for if you are regularly using a very good masthead pre-amp you will find that the overall system gain, taking into account low



MUTEK TVVF144A

2m transverter

cable losses, could be around 20dB (12dB in the masthead pre-amp etc, and 8dB in the converter). 20dB system gain is about ideal in front of a good HF transceiver which has good sensitivity and a good RF input intercept point on the 28MHz band.

Circuit description

As normally supplied, the transverter employs separate Tx and Rx BNCs at 28MHz, but an internal link can be changed so that the Tx drive socket gives transceive operation. The RF sensing circuit is driven from the Tx input line both before and after the relay, the line from after the relay being around 6dB more sensitive, thus holding the transceiver over to Tx with a hysteresis effect. This helps to prevent incredibly strong received signals from putting the transverter into the Tx mode!

A pin diode ALC attenuator follows the drive preset and the ALC internal attenuation range is 25dB maximum, which gives plenty of headroom. The output from this attenuator is taken to a BF199 amplifier provided to give sufficient amplification to cope with the modern low output transverter drives from Icom and Yaesu equipment. Heavy negative feedback is provided around this amplifier which also acts as a fuse to prevent the mixer being blown up with a grossly excessive input drive level. The amplifier is followed by a pin switching diode and a 28MHz filter (2-pole bandpass), which is then matched into the mixer.

The ring diode mixer, muTek type HLRM200, incorporates four matched diodes. The same mixer is used for Tx and Rx with pin diode switching. The 144MHz output is impedance matched via the pin switch into a MosFET amplifier type 3SK74. This is followed by a 2-pole bandpass filter driving a 2N3866 in class A with negative feedback. A 2SC1947 in class AB drives the PA which is a 2SC1946a, also in class AB. The PA output is filtered with a 7-pole Tchebyshev low-pass filter which feeds a directional coupler, provided to give an ALC feed and to give reverse power protection. The RF output feeds through a broadband matched open frame relay.

The local oscillator uses a fifth overtone 116MHz crystal in a very low noise J310 oscillator, feeding another J310 buffer, which is matched into the ring mixer to give a drive level of 10mW. The Rx converter path from the input relay is protected by an inductance and back to back diodes. The RF pre-amp consists of two BF981s in the same configuration that muTek uses in one of their masthead pre-amps.

The output feeds through a 3-pole bandpass filter and a pin diode switch and is then impedance matched into the mixer. The mixer output with matching passes through a 2-pole bandpass filter, then a pin diode switch into the IF amplifier, a BFR96 with negative feedback. A variable attenuator is provided on the output immediately prior to the 28MHz relay.

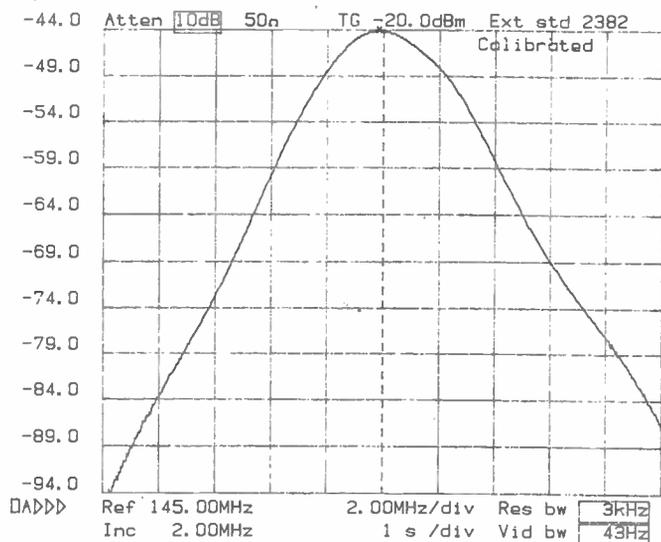


Fig 1
Rx response plot

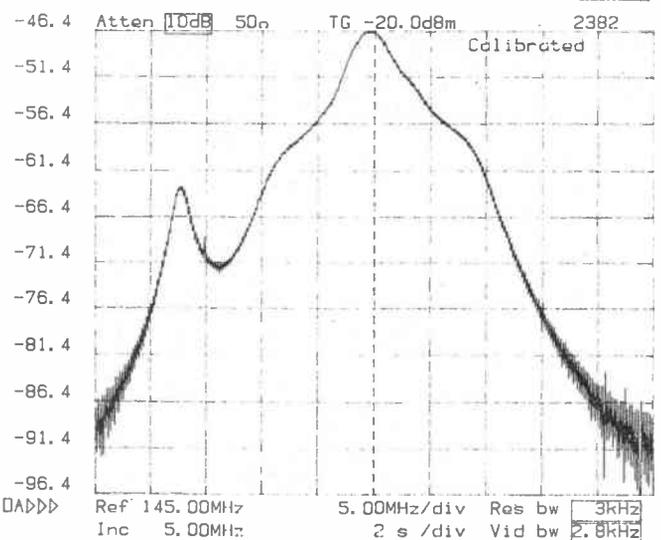


Fig 2
Rx pre-amp response at mixer plot

The ALC loop takes the rectified RF from the directional coupler, processes it with carefully designed attack and decay times and feeds it back to the input pin diode attenuator. The ALC also feeds a separate ALC drive, cunningly designed to provide a negative going voltage for feeding back to transceivers, despite the fact that the rig requires no negative dc voltage from an external source! The power LEDs are also driven from voltages derived from the directional coupler.

Subjective tests

I have tried so many transverters in my time and I have absolutely no doubt that the receive section on this one is far superior to any other one that I have ever used.

In the London area there are some mighty strong signals from stations transmitting at least 10kW ERP, and very strong out of band signals give the majority of black boxes and transverters such an almighty headache that there is a sort of crackly background audible right across the band for much of the time. This background noise reaches horrendous proportions in a contest!

What is particularly fascinating about the muTek is that this background

crackle seems to vanish, to be replaced by what I would describe as a fairly constant hiss until the local thermostats come on, or old bangers pass nearby. I have to admit that strong stations sound that bit cleaner if the transmissions are well controlled, and thus a bad transmission stands out all the more clearly!

There seems to be a remarkable absence of spurious caused by out of band intermodulation products, and when I investigated one or two whistles or pulsing noises they came from in band computer rubbish, or even ambassador telephones!

The frequency stability was remarkable and as good as I have known from any transverter. The gain seems just about right with the masthead pre-amp switched off and the provision of a gain preset is very welcome if you regularly want to use a masthead. I tried switching in and out my muTek GaAsFET masthead amplifier and there was only a very marginal difference on the received signal to noise ratios. The loss between the masthead and the transverter input, in my installation, is around 2.5dB or so, and I would only want to put on the masthead for winking out the very weakest signals when the band noise was at its lowest.

The transmitter section performed extremely well after the input drive level was appropriately set. The ALC time constants were just about right and we found that we could use around 10dB of ALC backing off around the transverter to good effect. As originally designed the external ALC did not back off the Trio TS940S, but the prototype that I checked in June worked very well with the 940. muTek have now redesigned the external ALC circuit so that it will derive at least -6.5V to back off Trio rigs which require more negative dc than most others. This double protection of internal and external ALC control will make this transverter almost idiot proof.

The power output LEDs are very useful, and can allow you to set up the drive level very accurately as well as reassuring you that you are putting out a reasonable amount of power. Although the rig is RF sensed, the use of hard PTT is essential if low drive transceivers are used as these will not give sufficient output to pull the RF sensing circuits over.

Good reports

I obtained some very good quality reports from many stations around the London area, one station commenting that when I was driving the transverter into the Dressler, running at 400W PEP output, I was still only just over 4kHz wide, even when he was receiving me on the end stop of his S-meter.

One station however complained bitterly when I was beaming at him and it was very obvious that the problem was in his receiver, which must have been jumping up and down rather violently whenever I spoke! The transmission was said to be cleaner than many when I was running the linear, and it was of course very clean indeed running barefoot.

The transverter is supplied in the usual muTek brown metal case, a rural colour which some might say is appropriate to a Devonshire manufacturer!

Laboratory tests

We had to apply some very esoteric testing techniques to show how good this transverter actually is. Having obtained an overall response plot of the receive converter from 2m input to 10m output (Figure 1) which showed an extremely narrow, virtually ideal band-pass response, we felt it important to establish how sharp the front end response was in order to show the degree to which strong out of band signals were rejected before they could hit the mixer.

Figure 2 therefore shows the response at the mixer input and it was necessary to use a Hewlett-Packard active probe with a 10 times divider on the tip to provide a very low capacity. The probe tip was placed across the mixer input resistor. You will see that the front end response at 140MHz is already 10dB down, whilst the 150MHz level is -8dB. By 130MHz the response is around -25dB, whilst at 160MHz you can see the response is -30dB.

We did note however that the response humps up again to be -17dB at around 127MHz , below which it attenuates very rapidly. I consider this to be an extremely good front end response which should greatly help in attenuating strong local annoying signals from aircraft and PMR.

The front end sensitivity is very good, the noise figure being just over 2dB . The RF input intercept point, when measured for a 60dB ratio, was at $+2\text{dBm}$, improving to $+3.5\text{dBm}$ when checked at lower ratios, ie higher levels still.

Into perspective

To put this into perspective, the input intercept point is some 15dB better than on the new Microwave Modules transverter and 22dB higher than that of their older model. This will mean that intermodulation products developed will be perhaps 30dB lower in practice, and you are therefore not likely to detect any at all.

The overall gain plot shows the maximum gain of 22dB in midband, but this can be substantially reduced if required. Local oscillator breakthrough on the output was at only $400\mu\text{V}$, which is not likely to cause a problem to any receiver. The image response around 261MHz ($145 + 116$) was below -77dB and immeasurable! One awkward spurious which sometimes develops in poor transverters is ($4 \times \text{LO}$) - ($3 \times \text{RF}$) which can be in-band.

An input signal of -20dBm (22mV !) was required to develop a spurious in-band signal which was at -70dB and can be virtually ignored, thus proving the mixer distortion to be extremely low. We allowed the muTek to warm up for five minutes before measuring the transversion frequency accuracy and the 28MHz output was a mere 50Hz low. Over a period of two hours testing on Tx and Rx the frequency accuracy was always within 100Hz , which really is superb.

For testing the transmitter section we used two Marconi 2019 signal generators, locked to the Rugby standard where appropriate and combining in a hybrid coupler before the signals entered the 28MHz input drive socket. The PA output on 2m fed a Bird Thru-line wattmeter and then a 30dB power attenuator into the Marconi 2382 spectrum analyser.

On single carrier tests we noted that around 4mW input drive was required to pull over the RF sensing circuits, but the muTek did not fall back to Rx until drive was reduced to below 1mW .

As supplied, using hard PTT, -7dBm was required (100mV) for a full output of 11W . The input preset, however, had many dB gain to spare so that even the lowest output transverter drives from modern rigs should provide enough drive power.

We plotted an overall Tx response from input to output (Figure 3), which shows once again a very narrow passband. Therefore, unwanted transmitter spurious in the main transceiver are not likely to be reflected into the 145MHz output.

Fig 3
Tx passband response plot

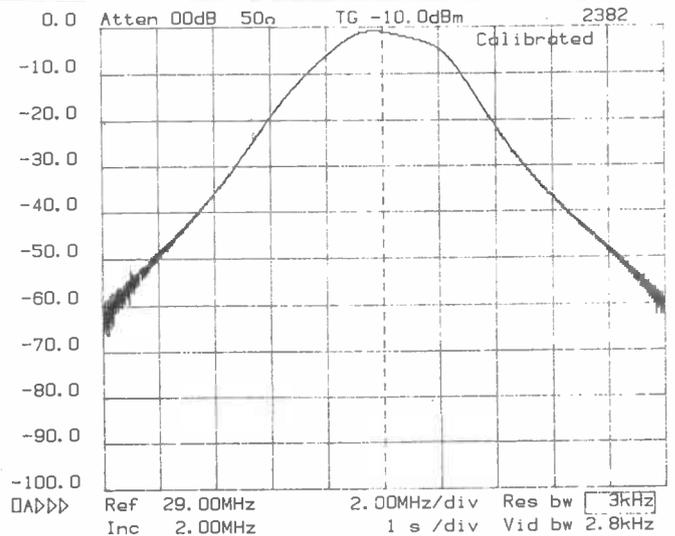


Fig 4
10W PEP plot

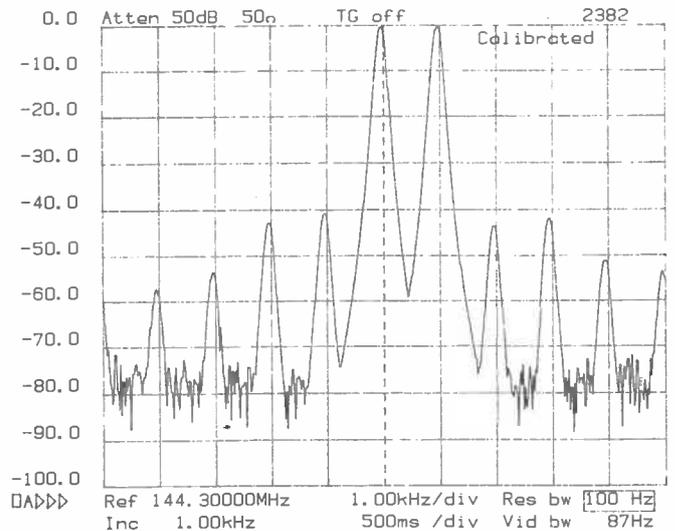
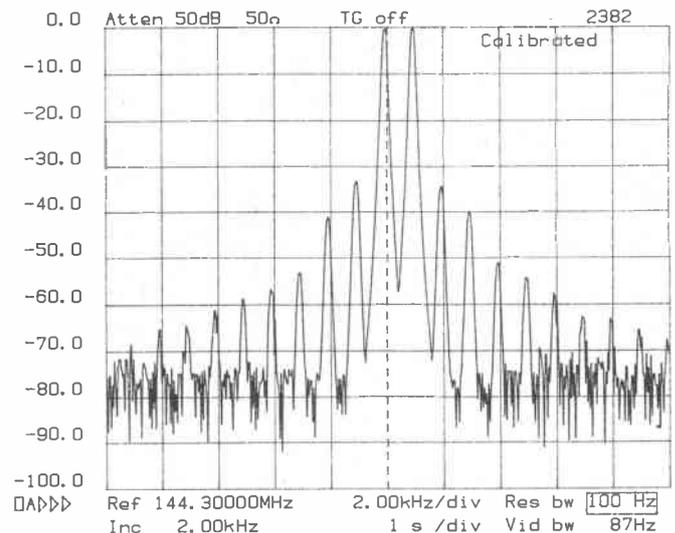


Fig 5
12.5W PEP into ALC plot



Local oscillator breakthrough on the output was between 94dB and 89dB below full output, depending on whether the transverter was being driven or not. The ALC loop coped with at least 20dB excess drive and the gain recovery time was around 1s or so, which seems ideal. We tried to look for an output image signal just below 88MHz when the rig was driven fully to 11W output but we could

not detect any image whatsoever, which must therefore be below -100dB !

I don't like being defeated but it is a credit to Chris Bartram that he has indeed defeated me here! We also looked for other spurious and gave up after a while, so I feel fairly sure that you are not likely to find any significant ones. For example, we looked for five times input frequency on the output and this was

G3OSS TESTS

below -75dB, so we gave up hunting further! We checked the harmonic outputs at full output power and second harmonic was below -70dB, third harmonic was at -60dB and fourth at -65dB. No other harmonics could be detected.

Two-tone tests

Two-tone tests were taken with input carriers 1kHz apart, which is stretching the measurement system but well within the capabilities of the Marconi analyser. The plot shows that at 10W PEP, just below the ALC full threshold, third order products were at astonishingly low levels with high order products falling down reasonably well.

We then drove the rig around 10dB into ALC, achieving 12.5W PEP output maximum, and the products were still very good.

The products would be contributed, almost entirely, by the PA stage itself and these are significantly better at 10W than the Microwave Modules performance was at the same power: a model that is designed to give 25W output. However, this is not to say that the Microwave Modules transverter is in any way poor, but that the muTek is extremely good.

We did not note any Tx/Rx frequency drift and an examination of various other factors indicates that this transverter is a very fine product indeed. The maximum current drawn on full output was 2.3A.

Conclusions

This superb product is not only extremely well engineered but is beautifully made and proved to be extremely reliable. I cannot criticise any of the measured parameters and it is obvious that this transverter, above any other one that I have tested, is the most suitable one for the most discriminating users.

It would be ideal for obtaining the finest DX performance, even in the presence of strong local signals, but to use all its features fully you will need to have a good HF transceiver, preferably with an RF input attenuator to optimise the system gain under all conditions. Rigs such as the latest Icom models and the Trio TS930 and 940 would be ideal and a combination of these will provide a magnificent 144MHz station.

Recommendation

I recommend this muTek transverter very highly indeed for it sets a standard of performance that is not easily equalled, let alone beaten. Quite clearly, a comparison with the new Microwave Modules model is appropriate. The latter can provide up to 25W output if you need it and is relatively clean on Tx, whereas the muTek delivers 12.5W maximum on speech and slightly less on CW/FM.

However, most valve linears need no more than 10W input and often less

power for full output and I strongly recommend a valve linear rather than a solid-state one in order to preserve a good intermodulation performance. When we come to the receiver sections, you are buying a bomb proof machine with the muTek, whereas the Microwave Modules model is a lot inferior, although it should be adequate unless you live in a very 'hot' area.

The choice is yours

The Microwave Modules does have a repeater shift facility which could be useful for FM if your HF transceiver has only a single VFO, and the muTek is around £20 more expensive than the Microwave Modules, which seems relatively little extra to pay for such an outstanding product.

Of course you will have to make your own mind up, but what more can I say than I have purchased the review sample after many years of using a Microwave Modules transverter and the improvement in the Rx performance is astonishing and well worthwhile.

Chris Bartram has been so helpful in providing me with an early prototype and the first production sample for evaluation and I find muTek so receptive when discussing technical details. I would like to thank Nigel G1LSA and Mark G4RCD for helping me with all the measurements and subjective evaluations.



BNOS LPM432-1-50

solid-state
linear/Rx pre-amp

that are not suitable for low impedance interconnections. The linear worked quite well with the FT790, a rig which goes very well with it in all respects.

Three push-buttons on the front panel select linear on/off, Rx pre-amp on/off and SSB/FM, this last switch altering the hold time on Tx when RF auto switching is used. Three LEDs indicate the functions being switched on. A row of eight LEDs indicates relative power output, most useful to show you how much you are driving out of the linear.

The RF sensing hold time is unfortunately a little on the short side at around 0.5s on SSB and it is particularly for this reason that I prefer to recommend use of the external PTT input. No problems were experienced with the RF sensing sensitivity, however, and the rig would change over on quite low input powers. On the FM position changeover is almost instantaneous. I used the rig with my own FT790, which was set to give 1W PEP and transmission quality reports were all good except for the fact that some synthesiser whine was noted from the FT790, obviously not the fault of the linear.

The RF pre-amp worked well and gave a noticeable improvement to the system sensitivity. I particularly liked the provi-

Some time ago in *Amateur Radio* I gave a very favourable review to the BNOS 2m linear in the 3W input and 180W output version. This new model for 70cm is specified at 1W in and 50W out and can be used for all normal modes. The unit is supplied in an attractively designed metal case with an enormous heatsink right across the top. A mobile mounting bracket is supplied with it with locking nuts either side allowing the linear to be withdrawn from the mount.

On the back panel there are 50 ohm N-type sockets for RF input and output

and captive high current dc power leads for 13V interconnection fused in the positive line only at 10A. This fuse value is rather near the wind, although it did not blow at all, for the amplifier actually takes 10A when giving full output on FM.

A 3.5mm jack socket on the back panel is fitted for hard PTT and this is strongly recommended when the linear is used for SSB or CW operation. Most helpfully, the PTT line is high impedance, which means that when shorted to ground it only takes an extremely low current and thus it can be used with many PTT lines

sion of N-type sockets for RF interconnections and the fact that the dc power leads were supplied very tightly twisted will clearly help any RF feedback problems that could possibly develop with some poorer power supplies, although I had no trace of a problem with the BNOS power supply which I used for all the tests. All the switches were substantial and easy to use, and the power indication LEDs were much appreciated.

A linear such as this would allow the FT790, or indeed any 1W FM hand-held, to be used under mobile conditions to great effect, the only limitation then being the lack of acoustic power developed by the average handy-talky receiver under mobile conditions. It is worth noting that although very few amateurs have ever tried SSB mobile on 70cm the system would be very effective provided a horizontally polarised antenna was used. G3JVL, Mike Walters, can supply an Alford slot antenna for 70cm mobile, which would be very effective although fairly large!

I accessed very many repeaters with the set-up driving a simple discone at 40ft, for 50W is quite a lot of power to use on the band! When the Rx pre-amp was switched out there was a noticeable through loss because of a mismatch somewhere, and this is a little unfortunate.

I was very impressed with this unit which would be very easy to take in and out of the car, and it seemed to give a better performance than other solid-state 70cm linears that I have tried. Part of the improvement must again be due to BNOS's well controlled dc biasing circuits for the PA transistors.

Two other models of this amplifier are available, one requiring 3W input for full output, which just adds a 5dB attenuator to the input circuit of the model reviewed and a 10W version, which omits the driver transistor and thus has a better intermodulation performance. Other versions of these linears are available which exclude the Rx pre-amp and power LEDs, thus saving quite a lot of money.

Laboratory tests

I originally looked at one of these units some months ago in combination with the Yaesu FT790 as a drive source. In this combination the high order intermodulation products were at fairly low levels as a result of partial cancellation with the products of the drive source. 0.7W input to the linear gave 48W output on FM. Higher input drive levels showed compression on the output, but the linear did give at least 50W output when fully driven.

Two-tone intermodulation performance on SSB, with two audio tones being driven into the FT790, measured very well, showing the linear to be very good. 0.8W PEP drive gave 54W PEP output. When the linear was switched to the straight-through mode we noted a 1.8dB power loss from input to output, and I feel that this is slightly excessive. Under

drive conditions, the input SWR measured extremely well at 1.1:1 and the RF sensing seemed very sensitive. Full power on FM required 10A dc and the average power for full two-tone SSB output measured at 7A average.

Just before writing this review Marconi loaned me a 2177 broadband power amplifier and we rechecked the two-tone intermodulation performance using the Marconi as a drive source. The intermodulation products of the Marconi were far below those of the BNOS, so the true performance of the linear could be better evaluated. The two-tone plot shows an adequate overall performance at 48W PEP output but high order products did not reduce quite as fast as I might have liked, although they will be satisfactory in practice provided the amplifier is not pushed too far. The performance at 12W PEP can be seen to be slightly better.

We checked the FT790 sensitivity, both direct and via the linear throughpath with pre-amp switched off. The through-loss caused a mismatch and the system sensitivity degraded by 3dB until the pre-amp was switched on, at which point FM sensitivity of the system improved to 1dB better than that of the FT790 on its own.

On SSB the system sensitivity showed

a slightly better improvement and generally better than that of a normal multi-mode 70cm box. The intercept point of the pre-amp was at -11dBm, which is quite good for the frequency involved and far better than that of nearly all rigs likely to be used with it. The maximum gain of the pre-amp was 17dB, reached at 434MHz, the gain being 3dB down by 426.5 and 440MHz. Unity gain was reached at 368 and 467MHz, showing the pre-amp to be rather on the wide side.

BNOS inform me that the throughloss is caused because there must be two sets of relays to allow for the RF pre-amp to be switched in and out and their specified throughloss is actually 1.5dB \pm 0.5dB.

Conclusions

I can warmly recommend this linear for use with low power rigs, including the Yaesu FT790, and the system would work particularly well in a mobile installation. My only reservation is the deterioration in the received performance sensitivity when the pre-amp is switched out. If the pre-amp is switched in the system intermodulation performance will be degraded quite a lot and I suggest that the pre-amp gain is a little on the high side.

Fig 1
48W PEP
output plot

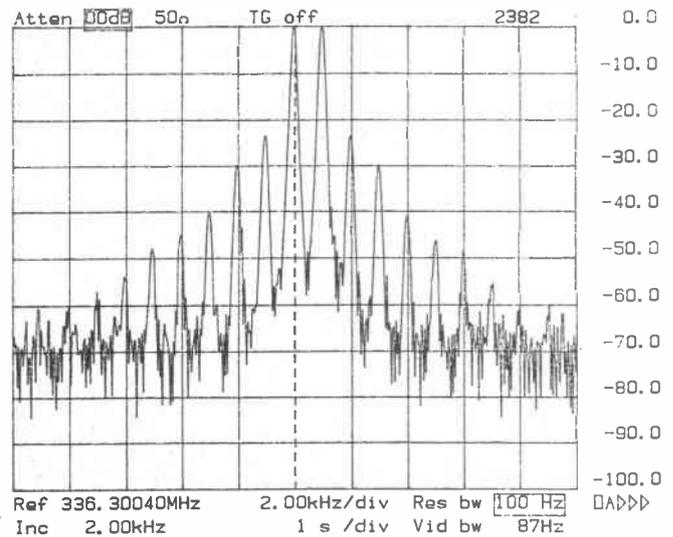
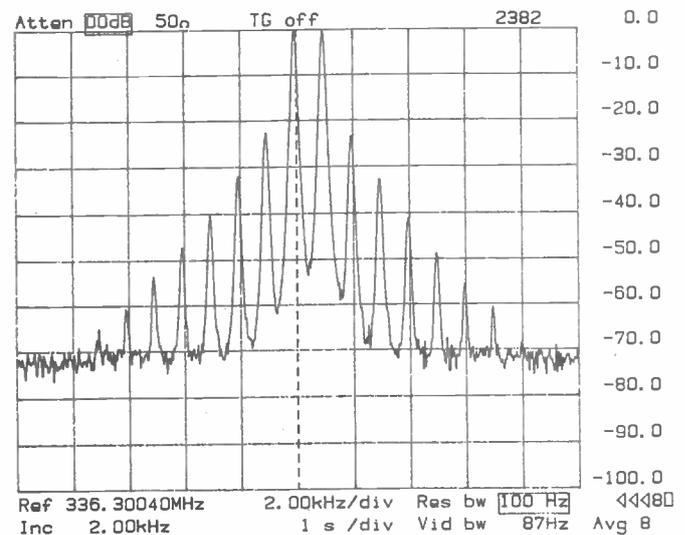


Fig 2
12W PEP
output plot



AR2002 communications receiver

I reviewed the AR2001 model in this magazine in late 1983, and at the time I found it gave the best performance of all the scanning receivers available, although I found its ergonomics rather poor. Another receiver, known as the Regency, was available through various channels other than the main importers and has been said by some to be equivalent to AOR's new forthcoming model, but this is not correct.

The Regency model included an additional UHF range but it employed the same membrane type touch pad that I criticised before. The AOR2002 is a complete redesign in terms of its control facilities, and it includes an additional frequency range from 800-1300MHz. The new model includes a separate UHF front end and the mixer feeds directly into the second IF at around 40MHz.

Not only are the membrane touch sensitive points replaced by sensible buttons, but there is a tuning knob which can be selected to give 5, 12.5 and 25kHz steps.

It is infinitely easier to whizz up and down a band and find a transmission using this knob rather than the up and down buttons which were very slow in changing channel.



The new model includes a 5x4 button matrix, up and down buttons, and a tuning knob which rotates in very light click steps. On the back panel the aerial input socket is a BNC with a 10dB switched attenuator by its side. A 3.5mm external speaker jack socket is included and the dc input socket (external mains supply included) is on a special connector.

A 16-pin remote socket provides interconnections for the unit to be operated by an external computer. A small BNC whip with a right angle bend is also supplied. There is a 3.5mm headphone jack socket on the front panel and a digital display indicates frequency, mode, channelling, and other status

functions. The S-meter is in the form of a row of 7 apples and 3 cherries.

Very brief subjective tests on a prototype sample that arrived in the UK during August show that the performance of the 2001 model has been maintained and that the 800-1300MHz range is quite sensitive. The general performance seems far better than that of the Yaesu FRG9600, reviewed recently. Brief sensitivity tests on many bands up to 1GHz gave an average sensitivity on FM of around 0.22µV or so for 12dB sinad, which is very satisfactory. The rig is about 16dB more sensitive than the FRG9600 on 70cm! A more lengthy review will be forthcoming as soon as possible.

M M M A COOL 100

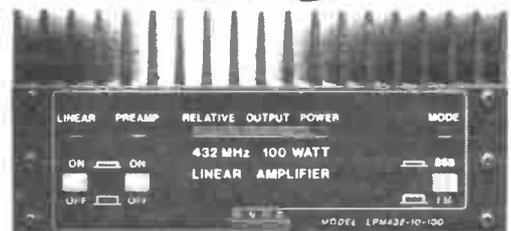
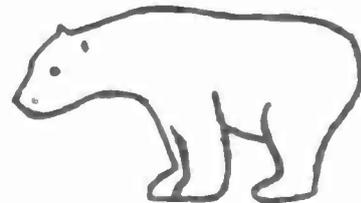
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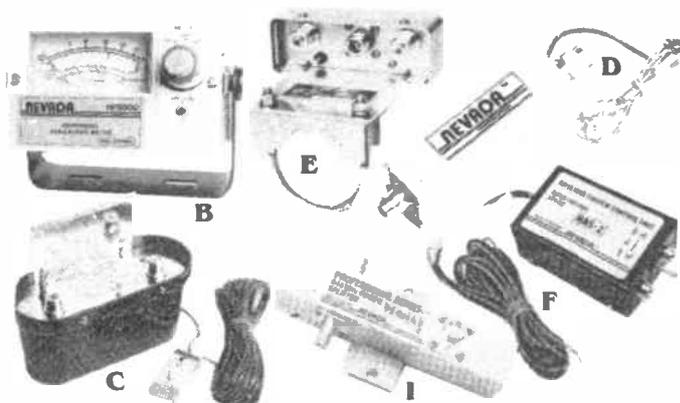
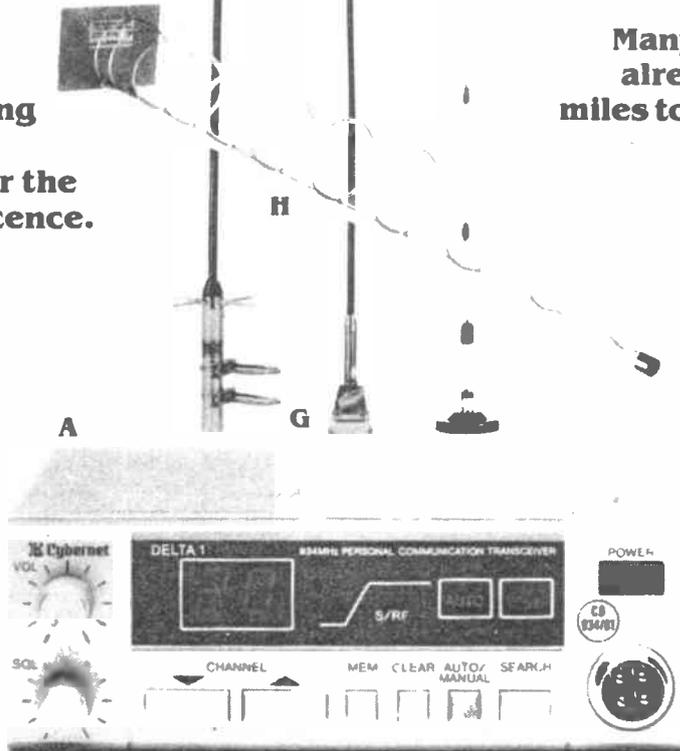
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Professional Series

MULTIPURPOSE MORSE UNIT

by Tony Smith G4FAI

Here's a useful aid to learning Morse, and when you have passed the test it can help in CW operation or experimentation.

This project started life as a Morse tape converter. No matter how well recorded originally, single tone Morse tapes and records are susceptible to wow and flutter and do not always reproduce well, especially on inexpensive equipment. The unit described simply uses the signal from such recordings to key an audio oscillator to provide good, clean, stable Morse, faithfully following the original code impulses.

Other uses include a facility to record on-the-air Morse practice transmissions to replay through the system later. The unit can be used with a Morse key, as a practice oscillator, and will monitor transmitted CW over-the-air by the addition of a small antenna.

The circuit

There are three distinct parts to the circuit, each of which could be used separately for specific purposes if required. Tr1 is an audio (or RF) activated switch. An incoming Morse audio signal is rectified to dc by diodes D1 and 2 which biases Tr1 to switch on and off in time with the Morse signals. Such a device, controlled by tape, is sometimes used as an auto-keyer to operate a transmitter (QRP in this case), calling CQ during extended operating periods. Switching SW1, to take T1 out of circuit, enables the antenna to pick up RF close to a transmitter, and transmitted Morse signals will again operate switch Tr1.

Audio oscillator

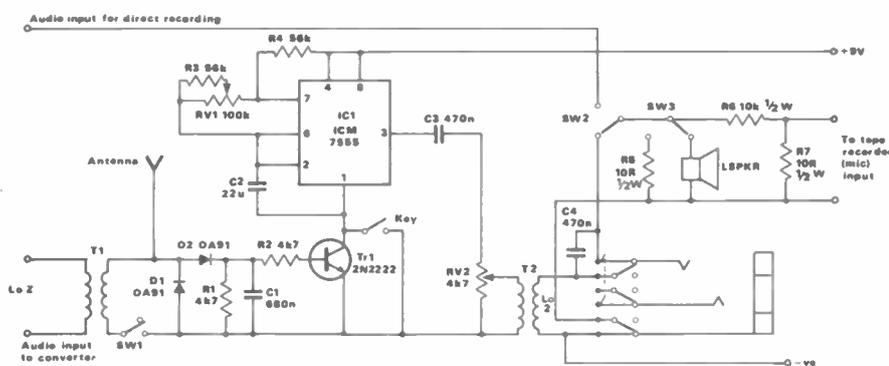
The second part of the circuit is the audio oscillator. IC1 is the low power version of the NE555 timer and in this circuit power consumption is less than 2mA at 9 volts. Although a CMOS device, the 7555 is fully static protected and requires no special handling precautions. VR1 provides tone control and VR2 gain control. Keying of the oscillator from an external audio or RF source is controlled by Tr1 and use of a Morse key shorts out Tr1, enabling the oscillator to be used for Morse sending practice. C3 is the loudspeaker output capacitor.

When a plug is inserted in the headphones socket, the speaker is muted and C4 is automatically placed in series with C3. This reduces the audio output to the 'phones, thus avoiding any need to adjust the gain control when changing from speaker to headphone operation.

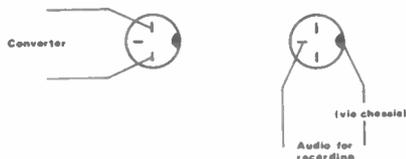
Simple circuit

The third part is a simple circuit enabling tape recordings to be made direct from any low impedance source, eg from another tape recorder or from a radio receiver. SW2 routes a signal either from such an external source or from the oscillator to the loudspeaker, and any signal in this circuit can be recorded via the microphone input of a tape recorder. Whilst recording, SW3, if required, will mute the speaker.

T1 and 2 are transistor type, centre tapped, output transformers. The centre tap is not used. As described, the circuit is intended for use with 8-30 ohm unmodified stereo headphones. If mono



Circuit diagram



Input socket wiring

Assembled multi-purpose Morse unit



MULTIPURPOSE MORSE UNIT

Drilling details are illustrated. The front panel is covered with white Contact and the panel markings are made with rub-on lettering. Separate connecting leads should be made up for each function required. The plugs used will depend on the equipment to be linked to the unit.

Using the unit

From tape: Improved Morse signals can be obtained from tape recordings, provided they are good strong signals to start with. SW2 and 3 should be down, and SW1 up. The earphone or external speaker socket of a recorder should be connected to the input socket of the converter and the gain control of the recorder adjusted to give the best signal through the unit. Signals can be heard via the loudspeaker or through headphones.

From a receiver: Strong signals from a receiver can also be heard through the converter, with an amazing disappearance of all background noise! If there are adjacent stations on the band giving problems, a great improvement can be effected by using a simple CW filter before putting the signal through the converter.

Direct recording: SW2 is switched up and an audio source connected to the input socket. The output socket is connected to the microphone input of a

tape recorder and the recording made at as high a level as possible. For taking recordings direct from an amateur band receiver, speech signals can be recorded as well as Morse. It should be borne in mind, however, that if such recordings are subsequently replayed through the converter, only Morse will activate the unit intelligibly. The recording facility will only function via loudspeaker operation, which can be muted during recording if required.

	Function	Up	Down
SW1	select external source	audio in	RF in
SW2	route source to speaker	external	internal
SW3	speaker	mute	on

Switch details

Practice oscillator: SW2 should be down, and a mono jack plug connected to a Morse key inserted in the key socket. A speaker or phones can be used. When using the speaker, the output socket can be connected to a tape recorder, as with direct recording, and a recording made to assess how one's keyed Morse is progressing.

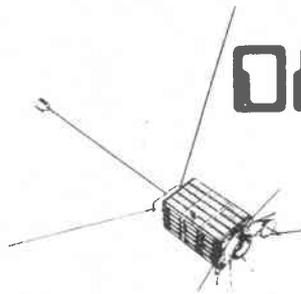
RF CW monitor: SW1 and 2 should be

down, and a short rigid wire antenna, about 300mm, inserted in the spring loaded press terminal on the rear panel. When placed near a transmitter, antenna tuning unit or feeder wire, transmitted CW signals will activate the oscillator, making it a useful facility for home-made transmitters requiring a side-tone, or for experimental work.

The amount of RF pick-up will vary according to the strength of the radiated signal, the type and location of the antenna installation and the amount of RF in the shack. Some experimentation may be required to obtain the best results and it may be necessary, in some cases, to increase the length of the monitor antenna, or to connect it to a length of wire wound round the transmitter feeder cable.

Need not be abandoned

The only way to pass the test is to practice constantly with whatever material is available and this multipurpose unit provides a few ways to vary the conventional learning process. It is entertaining to use and need not be entirely abandoned once the A licence has been obtained. When not needed for anything else it can be used as an external speaker from a receiver, permanently wired to a cassette recorder, ready to record CW or telephony signals at any time.



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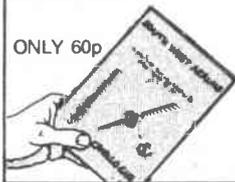


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SHORT WAVE LISTENER

TREVOR MORGAN GW40XB

Well, what a month! I believe someone once told me that July was in the summer season, but I'm sure they were pulling my leg. If the weather wasn't enough to put you off playing with aerials or jaunting around the countryside on field days, the state of the bands was nothing to write home about either. I mean, swapping 439 reports with Germans is not exactly working DX... especially with the linear going.

There were some bright spots however and the award hunters have been in full flight chasing additions to their lists.

Longleaf

Although *Amateur Radio* didn't have a stand at Longleaf, I had the pleasure of meeting some of the readers who noticed my call sign badge while I was frantically looking for a slow motion drive that I saw on my first trip around the tents but couldn't find again.

MORAL: if you don't snap it up when you first see it... someone else will for sure! Anyway, better luck next time, and thanks Roger, Dave and Peter for the chats!

Being a member of the G-QRP Club has advantages, not least of which is the info in the quarterly *SPRAT*. Besides being full of circuits and tips, they also give details of publications available.

Aerials

Last issue, they mentioned a book on aerials. Now, if there's one thing I enjoy in this hobby more than anything else it's wire-bashing or playing about with aerials. There are many books devoted to the subject and designs are published in the radio press frequently. However, if you are anything like me, when you want to try that idea published a couple of months ago you can never find the darned magazine you want.

You either lent it to a mate, or it was one you missed. Consequently, I was pleased to learn that a book

by Dennis Hoult G400 had been re-issued by Spalding Amateur Radio Society.

Entitled *Digest of Horizontal Wire Aerials*, this book contains literally dozens of wire antenna designs collected from the annals of *Amateur Radio* ranging from simple dipoles to more ambitious arrays as favoured by our American cousins, as well as diagrams and circuits for antenna tuners.

Varied
selection
of
best bent
wire

Dennis gives some good advice in the preface on evaluating antenna performance and follows this up with what must be the most varied selection of 'best bent wire' I have seen for a long time. It is a veritable mine of information for the listener as well as the licensed amateur.

Do your own thing

Having just built that nice cheap DCRX, why spend a fortune on an aluminium bed frame when you can do your own thing with chuckouts from British Telecom? To find out how, purchase this nicely presented book costing £3, available from Spalding and District ARS, Chespool House, Gosberton Rise Gate, Spalding, Lincs PE11 4EU.

This month's mailbag

So to this month's mailbag and the first to hand is a six pager from George Wrigley in Germiston, South Africa. George asked about the RTTY interface and I replied by taped message which he appreciated, commenting on reply that hearing a voice from 6,000 miles away was quite a kick - know what you mean, George!

Using his FRG7700 through 2x40m endfed wires on top of

a three storey building, his first year's listening has really got him hooked and he's now a member of the SADX Club with another 180 or so amateurs. His radio equipment shares his flat with his brewery which keeps him supplied with nourishment between contacts. George's interests lie mainly in the broadcast side of listening and he's chasing the DX on the tropical bands.

Welcome

While overseas, let's welcome Tom Millar ZL4BL from Dunedin, New Zealand. Tom uses an IC730 through a trap vertical while working RTTY through the Spectrum; hence his letter. Tom was a keen listener before becoming licensed and as it still holds an interest he has a separate Panasonic RF600 receiver.

Commenting on the bands, he says, 'Radio conditions have been rather strange lately!' Glad you said that, Tom, I was beginning to wonder if it was me!

Rag chewing

Don Pye BRS87167 had welcome guests at his QTH in London in the guise of K7RDH and XYL KA7UBC. Plenty of rag chewing and partaking of the local brew didn't stop them playing with the wireless to catch OH0MM/OJ0. Nice one, Don! Having got his RAE tucked away he's now cracking the dots and dashes. Best of luck, mate!

Peter Hunter enquired about the RAIBC and I'm pleased to mention those involved as they do a lot of fine work for those who cannot, for a variety of reasons, help themselves. If you wish to support them write to Cathy Clark G1GQJ, QTH.

Squeeze it in!

Peter also queried the use of his G5RV as he has little space to squeeze it into at his QTH. Personally I've used the G5RV under conditions which would, theoretically, be impossible, but when it comes to antennas theory can

often be thrown out of the window and practical use has shown that they can frequently be used, even for transmitting, in the most unlikely places. The answer is try it.

Next, our congratulations to Basil Woodcock BRS44266 for his success in getting the RNARS Silver Jubilee Award to add to 'Mercury' and '21st Anniversary' awards from the same source. As Basil says, you can't always chase DX and working these awards is a way of keeping your ears live when the DX is hard to find.

Silver Jubilee Award

The RNARS Silver Jubilee Award comes in four classes: *Class 1:* (UK & Eire) Work/hear five special event stations and 25 members. *Class 2:* (Europe) Five special stations and 15 members. *Class 3:* (DX) Two special stations and 25 members. *Class 4:* (VHF) Two special stations and 10 members. Send log data certified by a licensed amateur plus £1 to: Don Walmesley G3HZL, 3 Meon Court, 609 London Road, Isleworth, Middlesex TW7 4EW.

72
years old
and
still going
strong

Charlton Cole in Pontnewydd spent twelve years in the Navy. He states that he's having a bit of trouble absorbing the necessary technical bits for the RAE (Crikey, so would I at 72!), so if anyone in the area could give him a hand he'd be grateful. Meanwhile, Charlton is busy listening with his FRG7700 so he has the right idea. If you can help, he's at 5 Tynnewydd Court.

This month's featured listener is Martin Moss from Ilford. Martin first became

interested in amateur radio through a friendly local amateur who encouraged him to make up the Howes DCRX kit in October 1984.

Successful listening

Having a lot of success listening on the one band stirred Martin into action and he began studying for the RAE by correspondence course as his work shifts didn't fit in with the local courses. Another follower of George Dobbs' writings, Martin has done a bit of work with the soldering iron aside from his well worked DCRX, but has now spruced up the shack with an FT101E, which is serving as an all band receiver until the licence pops through the letterbox.



Martin Moss RS86999

antenna arrays, yet you can quite easily have a near perfect QSO with a Czech amateur who is running 50 watts from a homebrew rig into a simple dipole!

Forget the politics

Disregarding the political scene, there's a lot of fun to be had working these stations and many of them have excellent programmes devoted to the amateur and the short wave listener. My mailbag regularly contains leaflets and schedules from stations I sent reports to when I was an ardent broadcast listener. For instance, Radio Berlin International has a DX programme on Mondays in its European broadcasts on a number of frequencies, including 6080 and 6125 at 2030GMT. Poland Broadcasts has a listeners DX club programme on Wednesdays at 1400 and 1730 repeated later in the week. Frequencies include 7285 and 6095.

DXers programmes

The Eastern bloc are not the only ones transmitting programmes for DXers. Sweden, Finland, South Africa, Holland, Australia and Japan are amongst those who spare a bit of their air time for the listener or amateur. Radio Nederland (Holland) is renowned for its response to listeners and it's worth a few hours listening to the thousands of broadcast stations present on the bands.

As said, politics aside, there are awards to be obtained for listeners who are prepared to put in a bit of serious listening, and even stations in Britain such as the small local radio stations will respond to a well written report. So, if the DX is a bit thin on the ground on the amateur bands, why not give the general coverage receiver a dust off and try working a few broadcasters for a change?

That's it

Well, that's it for yet another month. Please keep the claims coming in and pass the message on to those who haven't got in on the act yet!

Next month we'll be looking at the Daiwa AF606K active filter to see what it can do for the serious listener (and the amateur), and we have a really interesting 'profile' of one of our readers for you.

Until then, good listening and better bands!

Despite conditions the claims keep coming in

Despite the conditions on the air over the past couple of months, the award claims keep coming in.

Roy Clayton from Scarborough claimed his Silver award for working two way CW. His 'catch of the month' was CE0FFD on Easter Island. His Ten Tec Century 21 and HF5V were put to the test over the period since January but the superb receiver on this rig performed well and despite his 25W signal he's on the way to his Gold award.

On the off-chance

John Heys G3BDQ checked his logbook 'just on the off-chance' and found he had more than 400 prefixes under his belt! Although DX was slow, he chased the Europeans around the bands for the other hundred necessary for his Silver award.

John is another Ten Tec user, putting his Corsair's power into 'my G3BDQ steeple' which is a grounded, multi wire, top loaded, top fed vertical with at least half a mile of wire out plus a score of earthing rods with chicken wire mats to boot!

You'll find his house tucked into a corner of all this somewhere! His receiving is

helped by the use of a Daiwa AF filter which cuts his bandwidth to 80Hz.

Mike Newell G1HGD gets on the lists with his claim for Bronze with a nice mixed bag including A05, CJ0, 3D6, 5B4 and sundry others. Mike uses a Hallicrafters SX140 and a 300 ohm ribbon dipole that he got with his hi-fi system! Just goes to show that you can receive with just about anything if you've a mind to.

Crack for silver

Simon Lipscomb is in the process of moving but this didn't stop him putting in his quick follow up to the Bronze with a crack for Silver. Simon also had a catch in the 'funny' callsigns with FG/KK9A/FS, who turned out to be over in Guadeloupe (perhaps the FS stands for French Settlements?).

Keith Forward G1JNK tossed in 562 prefixes to make sure of the Silver and has threatened me with a gold claim before Christmas. While still nursing his injured leg he's bemoaning the state of the bands but, regardless, turned in an interesting batch including A92, A4X, HC2, PZ5, VQ9 and VP9.

Radiator shape

S Nixon of Shildon sent in his first claim for the Bronze with a nice mixed list, all heard with his Trio 9R59DS and a long wire which has to be set up in a 'radiator' shape to fit the space available.

Last but not least, Robin Lipscomb from Kings Lynn puts in 261 for his Bronze claim.

Just for good measure, Robin's list was attained using a Howes DCRX for 80 and 20 metres with an SEM pre-amp feeding antennas for each band separately.

An interest in the broadcast bands

Made a slip-up last month and 'promoted' Gary Hendricks to Gold when he only claimed his Silver. Sorry Gary! Anyway, he's sent in another batch of prefixes and is well on the way, so no harm done. I really must leave the sauce alone while typing!

A lot of mail mentions the broadcast bands and it appears that many of you work these bands as well as the amateur bands. Working the broadcast bands has its own techniques. Despite the fact that many broadcasting stations use kilowatts or multiples of them, it's surprising how difficult it can be to hear, say, Radio Prague, which broadcasts hourly in different languages using massive powers and enormous



PEOPLE'S REPUBLIC OF CHINA

by
Jim Smith P29JS

I have been interested in DXing since my first licence, VS1BQ (Singapore), back in 1947. In those days there were many DXCC countries active which are no longer available. I worked many stations in China, all on CW and most with names like Tong, Chin and so on. However, by late 1949 they were no more. For almost 34 years this DXCC country became almost extinct. There were a couple of minor exceptions and BY was always a good prefix for the bored pirate operator to use.

After several years of non-activity any DXCC country quickly moves up the DXers needed list.

In due course China moved to the top of the list and stayed there. Other examples of rare DXCC countries would be Albania and until recently Heard Island and San Felix.

Long term interest

Writing DX notes, information, etc has been a long term interest of mine. To be successful at DXing one has to know what is going on. In early October 1983 I sent a long telex to an Australian amateur radio magazine. It started like this:

Urgent stop press... People's Republic of China on SSB for the first really legal

operation from this very rare DXCC country for over 30 years. Who says DXing is dull?

Thereafter followed a longish text with full details of the BY1PK activity out of Beijing (Peking).

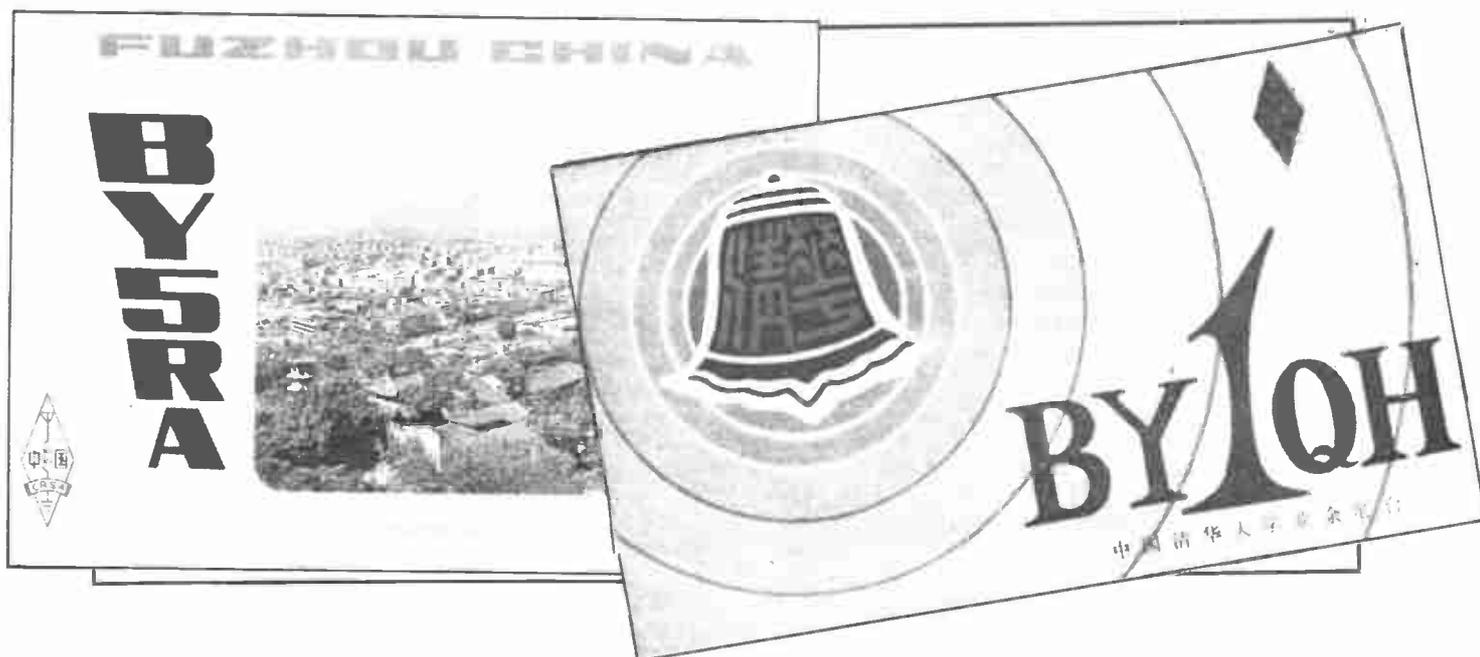
Whichever way one looks at it, 30 years is a long time. The reason for non-activity from this huge country need not concern us here. However, I would like to say this – the activity from BY has brought something back into amateur radio and DXing. In elaboration I would say that the operators (and there are not too many as yet) have brought back some of the courteous operating which so often these days seems non-existent. They seem to give to amateur radio the more reasonable behaviour of so many years ago. Some of the behaviour on the DX bands these days has to be heard to be believed. No wonder DX stations lose their cool from time to time. Threaten, cajole and when all else fails switch off. Tomorrow is another day.

Time and effort

In my estimation three people should be singled out in respect of BY activity: Tong Xiao-Yeng of BY1PK, Tom VE7BC and Kan JA1BK. All have put a tremendous amount of time and effort into the situation. Of course that is an oversimplification. Many more have been involved and in particular within China itself. However, the main thing is that these people put amateur radio on the list of recognised sports within China. The BY stations have the full approval and backing at government level. The operators that we hear these days have been trained.

One further thing is that, as a general rule, visiting foreign amateurs are allowed to operate. Whilst such operation is under supervision and monitored logs kept of every QSO, I still feel this is more than reasonable under the circumstances.

By sheer determination, effort and interest Kan, Tom and officials within



China have amateur radio on the move again. Tom in particular (being Chinese) played an important role in establishing a relationship with China. A considerable amount of financial input was also required. Virtually everything was brought in from outside; equipment, cable, wire, tools, antennas etc. Everything needed to set up an amateur station, starting from scratch. Imagine the mind-boggling paperwork required to clear 100 yards of co-ax cable through customs!

Reasonable

Most of us are used to customs officers who are reasonable and rational. However the mention of amateur radio equipment is not always greeted with smiles and the understanding is often that you are a complete nut to have such a hobby. Certainly, a mention of a transceiver in Albania would ensure you did not enjoy your two weeks vacation in Tirana. Enough of all this.

At this time there are several stations active in China: BY1PK, BY4AA, BY8AA, BY5RA, BY5RF, BY1QH, to name a few.

BY5RA became active on 17/18 August 1984. This activity was linked to the 35th anniversary of the liberation of Fuzhou in the province of Fujian-sheng. It is with this station that I have a regular weekly 'sked'. He checks in with me each week on a Thursday at 0700 UTC and his time-keeping is immaculate.

First we exchange greetings and he also talks to Kirsti (VK9NL), my wife, on Norfolk Island. After that the net proceeds and he stays until the end. If he has worked a couple of new countries he discusses QSLing. Lin then thanks me cordially with a promise to meet me next week. In short, there is a delightful charm that is hard to describe.

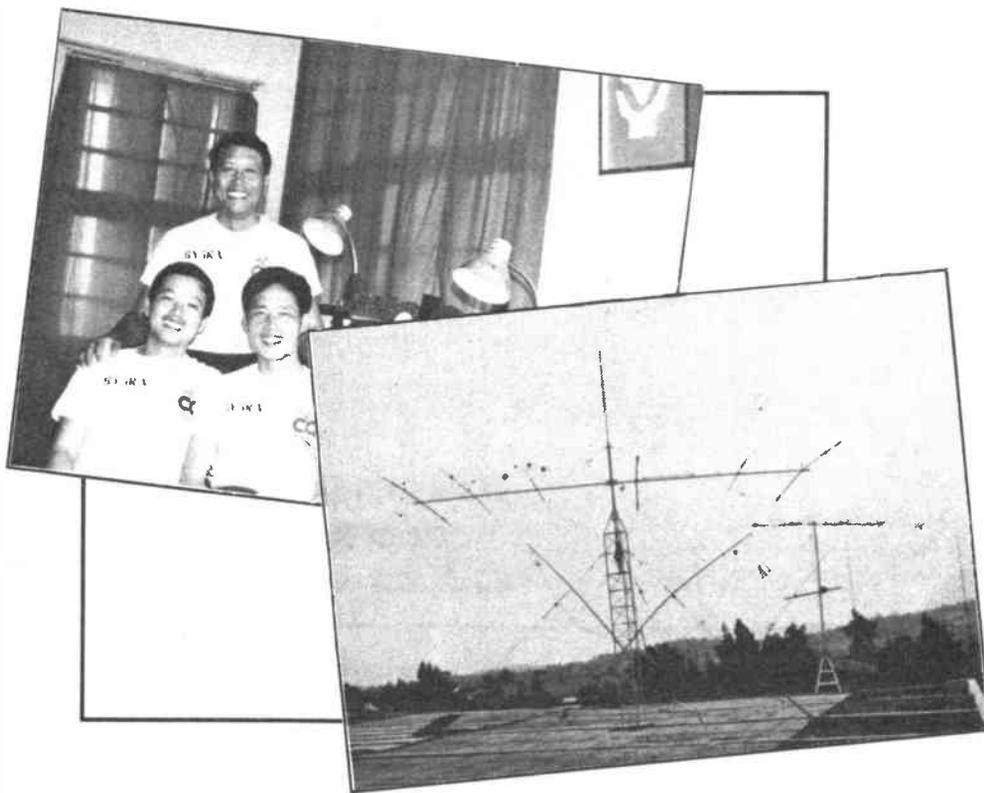
BY1PK and his operation back in October 1983 was a major step for amateur radio in BY. I finally got through and was really happy to get China in my log on Norfolk Island.

Very active

Since then this station has been very active and I had to chase BY once again when I returned to PNG for a new one from here a couple of weeks ago. In a special week of operating some old timers were on the air. It was very exciting to speak with John (ex-C1TH) who I had worked years ago from Singapore, a very nostalgic moment for me. This was from BY4AA in Shanghai.

There are of course many things that could be discussed. The YL operator who occasionally is on from BY4AA, Chen, is a delight to listen to and certainly attracts a lot of attention. In addition a special call, BT8CD, was allocated for an RDF contest from Chengdu for the period 20 to 24 October 1984.

With the multiple stations available on all bands and most modes, gradually the demand will fall off but the new DXer will need the QSO. With the decline in sunspot activity it is ironical that BY will once again be difficult to work. The poorer propagation however is helping to cut down the 'pile ups' to easier proportions. On the 220 net on numerous



occasions stations needing BY simply have no propagation to BY5RA. Two or three years ago this situation would not exist. As a result the BY operators have time to settle in and get more operators trained. By the time we move up the next sunspot cycle they will be even more organised.

It is also important to say that their QSL policy is excellent. In the early days of operation there were many pirates

signing the BY callsigns. However things have settled down a bit now and a QSL card usually arrives very quickly. Most BY stations appreciate a post card of your area—they really are interested in the 'outside world'.

In closing, let me wish the new amateur radio operators from BY every success. Let us hope that as members of the IARU they enjoy amateur radio—it is a great hobby. 73 P29JS.

Chinese callsign allocation block for each of the Chinese provinces

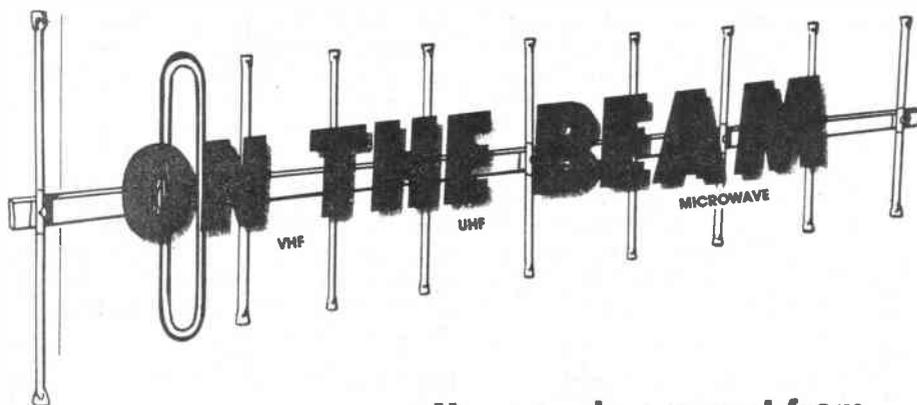
1AA-ZZZ	Beijing Shi
2AA-IZZ	Heilongjiang
2JA-QZZ	Jilin
2RA-ZZZ	Liaoning
3AA-FZZ	Tianjin
3GA-LZZ	Nei Mongol
3MA-SZZ	Hebie
3TA-ZZZ	Shanxi
4AA-IZZ	Shangai Shi
4JA-QZZ	Shandong
4RA-ZZZ	Jiangsu
5AA-IZZ	Zhejiang
5JA-QZZ	Jiangxi
5RA-ZZZ	Fujian
6AA-IZZ	Henan
6JA-ZZZ	Anhui
6RA-ZZZ	Hubei
7AA-IZZ	Hunan
7JA-ZZZ	Guangxi
7RA-ZZZ	Guandong
8JA-ZZZ	Guizhou
8RA-ZZZ	Yunnan
9AA-FZZ	Ningxia
9GA-LZZ	Quighai
9MA-SZZ	Shaanxi
9TA-ZZZ	Gansu
0AA-MZZ	Xinjian
0NA-ZZZ	Xizang (Tibet)

Note: there are variations in the spelling of provinces

QSL INFORMATION

BY1PK	PO Box 6106, Beijing, PR of China
BY4AA	PO Box 205, Shanghai, PR of China
BY5RA	PO Box 730, Fuzhou, PR of China
BY8AA	PO Box 607, Chengdu, PR of China

Note that for BY1PK for that initial operation during 3 October to 5 October 1983 and a later operation during 18 March to 24 March 1984 QSL cards should go to Tom VE7BC.



News and comment from Glen Ross G8MWR

Spaceman

After the catastrophe of our first man in space it is great to be able to report the tremendous success of the second attempt. Dr Tony England WOORE, was not troubled by the lunatic element that bedevilled the first mission and strong signals were received from him. So strong in fact that several people report getting fully quieting signals on a handheld and a rubber duck aerial.

The main activity on this mission was slow scan TV and many people have reported getting excellent signals from him. Those with colour capability were very impressed by shots of the Earth taken from space. Dr England also received some colour TV pictures transmitted to him from the RSGB, and this may well be a European 'first' (he may have received Stateside pictures earlier in the mission).

Some voice operation was also undertaken and several contacts have been reported. This time it seems you may really have worked the shuttle and not some idiot with a tape recording. A magnificent effort that received a lot of coverage both on TV and in the national papers.

Six metres

The heat is on! Following last month's comments on the idea of releasing 50MHz to class B operators rather than class A, if there was a requirement to limit the numbers on the band, I have been deluged with letters supporting the idea. In fairness there have also been a few against, all from A operators, which was not entirely unexpected. The letter from Nev G3JDK is typical in that, whilst it is friendly and helpful, it misses the point of the argument. He objects to the idea that A class operators may not be well informed on matters of VHF.

The point is that I did not say that *all* A operators are devoid of this knowledge, only that *many* of them have never been on the bands above 30MHz. There are some of them who are at the top of the tree and very well respected in the world above 30MHz, and their achievements are well-known. It is true to say that

possibly most of the people you hear on, say, eighty metres have had little or no experience of VHF, whilst all class B operators have at least some knowledge of the various propagation modes, even if it may be rather limited.

The point I was making was that there are good reasons for considering giving the allocation to the class B people and it should not be assumed that the band should go to class A automatically. From the letters received it is obvious that many class Bs think they are not getting a fair crack of the whip.

Nostalgia corner

Nev continues by making the point that for many years after the war amateurs had to make their own gear or modify ex-government equipment to get on the air at all, and this was certainly the case. However, the number who operated on VHF prior to around 1970 were very few indeed. I speak from personal experience as I was first licensed immediately after the war and even operated on the old five metre band before we lost it to TV.

He also mentions the point that the influx of oriental gear has lowered the general standard of VHF operating and here he is on much firmer ground. In the 50s and 60s you did not consider that you were on the band unless you were running 60 watts or so to an eight over eight at 40 feet, with a receiver that was virtually 'bomb proof' and could boast a noise figure of 2dB.

Nowadays, vast numbers of operators run 10 watts to a Slim Jim in the roof space from a transceiver which, if you are lucky, may have a noise figure of about 6dB, and then complain that they can't get out of their own backyard. If more people would install a lightweight rotator and a small beam they would start to discover just what two metres can be capable of.

Wallpaper

Our award scheme is still attracting the punters. First in this month is Irwin G11JUS (Newtownabbey), the first award winner in Northern Ireland. He goes for a

two metre Bronze award, the distance requirement being more than met by a contact with HG8CL at 2080kms. He says that a decent tropo opening would help. Don't we all! Irwin also comes out firmly against the 'intermediate' licence proposal.

Barry G1ELY (Kirkham) also qualifies for 2m Bronze, but asks if all contacts have to exceed 500kms – if they did you would have a hard time working the counties.

Michael G6XRK (Romford) claims a 2m Bronze and is only short of a Silver by three counties, his best DX being to EA1OD in XD square. Remember that you do not need QSLs, just send a log extract which has been confirmed as accurate. Full details from me for the cost of an SAE.

VERON awards

More information is to hand about the VERON awards. As well as the certificates mentioned a couple of months ago, they also offer the 23X23 for contacting 23 Dutch stations on 23cm, the 13X13 for 13 Dutch stations on 13cm, and if you really want a headbanging job how about the PAMC certificate for working a thousand different Dutch stations?

Another one you might like to go for is a real beauty to hang on the shack wall. It is the Flanders Fields Award. To claim it you must work ON7FF, a special event station set up on the battlefields, on 10, 11 or 12 November – the operators will give you details of how to claim. Please send information on any awards you know about.

Maldenhead

This began in a blaze of publicity at the start of the year and has been slowly dying the death ever since. Most people were happy with the original system and did not see the point in changing it as far as VHF was concerned.

The fact that squares repeated did not concern them because it was obvious that an IT9 in HX square could not be in the same lettered square in the Arctic Circle: it was simply a matter of using some common sense.

The biggest revolt seems to be coming from the Continent. As we reported earlier the Dutch National Society have dropped Maidenhead officially, but that is not the end of the story. Probably the most prestigious magazine circulating among the VHF enthusiasts, both here and on the continent, is *Dubus*, which recently carried out a survey in which 83% of those who replied said, in effect, that they wanted to return to the QRA system.

G8VR writing in *Radcom* reports adverse criticism of Maidenhead, as does G3FPK writing in *Short Wave Magazine*, who also says: 'It is time to come off the fence'.

I have done so: in future G8MWR will use QRA in all his contacts except in contests where Maidenhead is required. As far as this column and our certificates are concerned you may use either, but QRA will be encouraged (it makes claim checking so much easier when you know where the squares are!).

ON THE BEAM

Newsletters

Two very interesting ones received this month. The first is from *AMRAC* (Amateur Radio and Computers). They are interested in Amtor and Packet Radio as well as RTTY and use 144.675 as a calling frequency, usually moving to 144.525 or .55 to continue the contact. On Packet Radio they use both the Cambridge BBC and AX25 protocols. An interesting point is that they advocate the use of 12.5kHz spacing to avoid QRM and suggest that this spacing might be more commonly used if the RSGB did not stick to 25kHz spacing in all the band plans.

They mention one amateur who thought that it was illegal to use 12.5 because it wasn't in the plan. More information on their activities from Trevor Tugwell on 04895-81032.

Four metres

The second newsletter received is from the 70MHz lads, who you will have realised from the past few issues are not adverse to making their presence felt. This is a new venture by G4SEU and G4WND who would be pleased to receive news and ideas – if my experience is anything to go by you will be snowed under. The letter is free if you send a supply of SAEs large enough to take A4 paper.

GM4ZUK, located in Grampian, has

worked several stations on MS, perhaps the best being GB2XJ on the Lizard in Cornwall. He will also be available for the 70MHz Trophy Contest, as will G14ONL (Londonderry) and GM3TAL (Loch Fynne). Another interesting one is GM3UKV operating from the Isle of Islay. SM6PU, OZ9QV, CT1WW and HB9QQ are all looking for crossband contacts and are calling on 28.885MHz. Jerry ends up by saying: 'Why wait for 50MHz when you can use 70MHz now?'

Things to do

We have already mentioned the Trophy contest for 70MHz. The really big contest is the one on 5/6 October which covers all bands from 432 to 24GHz. Plenty of scope here for everyone to have a go. The 8 October sees a leg of the 70cm cumulative with the next one on the 24th. The 1296/2320MHz cumulatives start on the 16th.

The month finishes with a 70MHz contest on the 27th. Sunday the 15th is the last of this year's 10GHz contests and there is also a 24GHz event on the same day. The microwave contests this year have been notable for the very high activity and the atrocious weather, even by microwave standards.

Convention

One of the major events in the VHF calendar is the Midlands VHF Conven-

tion, which this year is held on 12 October. The event has been held in the past at the BT Training School at Stone, but it is believed that this year it is having a last minute move to a site at Telford.

This is one event that you really should not miss if you can possibly get there. Warn the family that you will be late home because this event runs, as they say in the Midlands, 'from early till late', usually meaning around 10pm. There is good car parking, food, drink and company with the usual talk-in facilities.

Workshop

The other event to note is the annual Microwave Society Workshop at the Daventry club on Monday 23 October, starting around 8pm. They will have gear working on 10GHz FM and SSB as well as new designs for 24GHz plus plenty of test equipment to set up your gear. The club is just off the M5, car parking is available and there will be talk-in on S22.

The big switch

That wraps it up for this month. Thanks to you for all your letters with information and comment. It would be nice to see a few more club newsletters. Information on anything covered in the article can be obtained for an SAE. The address is 81 Ringwood Highway, Coventry, or use Prestel, as more of you are doing, on 203616941. Good hunting, til' next time.



**NEXT
MONTH**

Amateur
RADIO

all the regulars. . .

DX Diary

On the Beam

Back to Basics

SWL

Straight and Level

Your letters and
features covering
the whole of
Amateur Radio

■ ANGUS MCKENZIE TESTS

G3OSS puts the new Trio TS670 50MHz transceiver through its paces in anticipation of the new frequency allocation

■ A SIMPLE WIRE BEAM FOR 20m

Build this antenna and be heard instead of remaining just another station in a pile-up. Bill Mantovani G4ZVB shows you how

DON'T MISS THE NOVEMBER ISSUE

On sale 31 October

BACK TO BASICS

Bill Mantovani G4ZVB with what you should and shouldn't do with your equipment! A look at log-keeping and INTERFERENCE

This month we look at the licence requirements for log-keeping, the avoidance of interference and the rules covering the inspection of the amateur station and, if it should ever be requested, its closure. It is also very necessary for the licensee to be fully aware of who may operate his or her station and the conditions that must be observed. The responsibility for this falls squarely on the licence holder's shoulders as does the onus on making sure that the transmitting equipment is not operated by someone who isn't authorised to do so.

The licence actually states that '... the licensee shall not permit or suffer any unauthorised person to operate the station or to have access to the apparatus comprised therein. The licensee shall ensure that persons operating the station shall observe the terms, provisions and limitations of this licence at all times.'

Now, if you remember from last month, save for exceptional circumstances only the licensee, another amateur or a holder of the Amateur Radio Certificate are the persons authorised to use the station. This means that even if a member of the local constabulary were to ask to operate the station you would be acting quite correctly by refusing.

This immediately brings to mind the problems experienced by fellow contributor Hugh Allison G3XSE, as detailed in 'Justice/Injustice - The Sequel' (*Amateur Radio*, Feb '85). It would be a breach of the amateur licence conditions if you were to permit an unauthorised person to operate the station, whatever their office.

The log

The conditions governing the keeping of a log book are well defined and can feature prominently in the RAE exam paper. The principal ruling is that an *indelible* record must be kept of when the station is operated. This serves a number of purposes. If, for example, someone reported experiencing interference in the vicinity of the amateur, it could be established from the log whether that amateur had been transmitting at the time of the interference. It also provides the amateur with a record of the stations worked over the years and if kept properly, will become quite a useful reference document.

The log should consist of a book (*not loose-leaf*) with, for a fixed station, the following information recorded in it (as quoted from the licence, with explanatory notes as applicable):

- The date.
- The time of commencement of period of operation of the station (please note that this means the time of the start of the first transmission for that date - it is not necessary to enter anything in the log if the station is used solely for receiving).

c) The callsigns of the stations from which messages are received or to which messages are sent, times of establishing and ending communication with each such station, frequency band(s) and class or classes of emission in each case (including tests and CQ calls). Therefore, you should log not only the callsigns of the station or stations that you contact, but also the callsign of those stations that you call but who do not come back to you!

Logging CQ calls

This is often forgotten, as is the logging of CQ calls to which you receive no reply. The comment 'no reply' can be entered in the 'remarks' column in the log book for these transmissions. Note too that it is only necessary to log the frequency *band*, not the specific frequency that transmissions are made on (although there is nothing wrong with recording exact frequencies for the operator's own benefit), but the type of emission used has to be recorded using the appropriate international symbols (given last month).

Thus, 'A1A' or 'J3E' is correct but 'CW' or 'SSB' is not. The reference to 'tests' we shall come to a little later on in the article.

d) Time of closing down the station (this means the time of the end of the last transmission for that period of operation).

e) The address of the temporary premises or the alternative premises or particulars of the temporary location when the station is established other than as provided in clause 1(1)(a)(i) hereof (that is, when the station is established at a place other than that referred to in the licence as the 'main address' and is therefore being operated with the suffix '/A' or '/P' added to the callsign).

f) No gaps shall be left between entries and all entries shall be made at the time of sending and receiving.

Filling in the log book is sometimes seen as a chore when instead it should be regarded as a means of recording useful information, rather like keeping a note book. The standard log book layout also includes spaces for the inclusion of bits of information other than the minimum required under the licensing conditions.

All times must be recorded in GMT and if the station is at any time operated by (ie, a transmission is made by) any other authorised person other than the licensee then it is the licensee's responsibility to ensure that the station log is signed by that person with his full name and that his callsign or the number of his or her Amateur Radio Certificate is entered.

As stated, all entries should be made at the time of sending and receiving, not left until some time later. This, however, is not always possible when operating as a pedestrian or when mobile, for obvious reasons, so in these two circumstances only does the licence allow for entries to be made in the log at a time other than the above. Entries for these calls '... should be made as soon as practicable after the end of a journey and must consist of date, geographical area of operation, frequency band(s) used and time of commencement and end of journey'.

Many amateurs have a separate log book for mobile operation and this is quite permissible. Log-keeping is really quite an important part of amateur radio operating so please do learn these requirements as you will undoubtedly be questioned on this subject.

Non-interference

Now for our old friend interference again. The licensing conditions state that '... the apparatus comprised in the station shall be so designed, constructed, maintained and used that the use of the station does not cause any undue interference with any wireless telegraphy'. In this day and age of 'black boxes' the radio amateur has things a little easier than in the times when most of the amateur equipment was homebrew.

Most of the precautions for suppressing any possible interference will have been carefully taken by the manufacturer and it is very rare for the modern transceiver to cause interference because of its design or construction. As for maintenance and operation, that part is still up to the radio amateur.

If you are one of those people who prefers to design or build equipment then all of the above requirements must be observed.

When using the transmitting equipment, the licensee must always take

BACK TO BASICS

every precaution to avoid over-modulation (the results of which were covered in the separate topics of transmitters and interference earlier in this series), and to try and limit the bandwidth of the transmitted signal to the minimum required for the class of emission in use. Again, this is not so much of a problem with modern shop-bought equipment, unless it develops a fault, but is a design requirement for the home constructor.

Radiation

The radiation of harmonics or any other spurious emissions can cause particular problems for other users of the frequency spectrum, as we have already seen, as can 'key clicks' when using telegraphy. The onus is on you, the licensee, to ensure that the risk of such interference from your equipment is eliminated or adequately suppressed, not just when the equipment is new, but at all times.

To this end, the licensee is expected to make tests on his equipment from time to time and the details of those tests should be recorded in the station log as stated earlier. These tests are not too involved and the simple wavemeter, or so-called field strength meter (a wavemeter with a short antenna), is all that is required for checking that the transmitter isn't radiating something that it shouldn't.

It's not just the transmitter that could cause problems though, the siting of the antenna may also cause interference and the background notes in the licensing conditions make a reference to this. So that interference isn't caused by the close coupling of the transmitter antenna to any existing television or other receiving antenna, it is suggested that the station antenna be sited as far as possible from such antennas. This all sounds very much like common sense, which it is, but this is sometimes forgotten in cases where the amateur finds himself restricted for space.

This can be a particular problem for anyone wishing to use an indoor antenna, such as one sited in the loft.

This type of antenna can cause interference in a number of ways: not only because it would probably be very close to the TV or FM tuner antennas, but also because there could be some pick-up of the radiated signal by the mains electricity wiring which might then conduct this interference throughout your own house, as well as into your neighbours!

Be very careful if you ever contemplate using an indoor antenna and always be aware of the possible interference problems. If, however, you have no close neighbours then you can count yourself lucky, but in this case you would also be very likely to be in the enviable position of having few problems with siting your antenna outdoors anyway. In some cases it might not be possible to use an indoor antenna at all, but don't despair, the ingenuity of the radio amateur always seems to find a way around these problems in the end.

Antenna height

Whilst on the subject of siting antennas, most of you will probably be aware of the fact that planning permission will usually have to be sought from the local council before masts over a certain height can be erected, especially if the mast is free-standing at the bottom of the garden for instance. The rules concerning the erection of such a mast or tower are not something that comes within the scope of the RAE and this point has been mentioned for information only. However, the licensing conditions do have a note in them concerning the permissible height of the antenna if the location of the station or QTH falls within a certain distance of an aerodrome.

The ruling is that if the station is situated within 0.80km of the *boundary* of any aerodrome the height of any antenna or mast supporting it (this includes a tower for supporting an HF beam or the like) must not exceed 15.24m (about 50ft) above the ground. Also, if an antenna is sited in such a place that it crosses above, or is liable to fall or be blown onto any overhead power wiring (this includes

electric lighting) or power apparatus, then that antenna must be guarded to the reasonable satisfaction of the owner of the power wire or apparatus.

All common sense really, especially on the grounds of safety for the radio amateur or anyone else. There have been, and these will no doubt will continue to appear, constant warnings to amateurs about the dangers of erecting antennas close to electricity lines etc, and these should be heeded.

Frequency control

As you have no doubt gathered, one of the important aspects of the amateur radio licence is that transmissions outside of the allocated bands are certainly not allowed. It is therefore a condition of the licence that the station should have equipment which is capable of proving that the transmitter is not operating out of band and, to further support this, the frequency stability of the transmitter itself must also be adequate.

Obviously, there could be some conjecture over what this equipment should consist of, so at the back of the amateur licence (and in Appendix G of the latest issue of *How to become a Radio Amateur*) there are notes about frequency checking equipment in amateur stations. Read and understand these notes as they also serve to recap on some of the points we covered a couple of issues ago.

It must be remembered that, if so requested by a duly authorised person, you, the licence holder, will be expected to demonstrate that you can indeed conform with the above mentioned licence requirements on frequency control and verification.

This could happen, for example, if your station were to be inspected. This is quite a normal procedure, as the licensing conditions do state that your station, amateur licence and log book shall be available for inspection at all reasonable times by a person acting under the authority of the Secretary of State. Now,

Example of a typical log book entry

AMATEUR RADIO STATION LOG										
DATE	TIME (GMT)		FREQ (MHz)	MODE	STATION called/worked	REPORT		QSL		REMARKS
	start	finish				sent	recvd	sent	recvd	
3 Aug '85	10.00	station opened								
	10.00	10.03	3.5	A1A	ON4XXX	459	559	☆		Mike, Antwerp - 25W G5RV ant
	10.10	10.12	3.5	J3E	CQ					
	10.12	10.20	3.5	J3E	G2ZZZ	59	59	☆		Fred, London no reply
	10.25	10.30	14	J3E	CQ DX					
	10.30	station closed down								
5 Aug '85	14.20	station opened								
	14.20	14.25	1.8	J3E	CQ test					testing new homebrew Tx
	14.25	station closed down								
5 Aug '85	17.30	station opened /A at the Technical College, High St, Anytown - demonstration								
	17.30	17.31	14	J3E	CQ					
	17.31	17.38	14	J3E	WD1XXX	58	56	☆		Al, Connecticut
	17.38	17.50	14	J3E	KE6ZZZ	55	44	☆		Bill, California - 1kW linear + 7el beam
	17.58	17.59	14	J3E	PY8AAA					no reply
	17.59	station closed down and removed								
7 Aug '85	12.00	station opened								
	12.00	12.45	3.5	J3E	G2XYZ	59	59			Albert, B'ham - J Smith, GD0DDD J Smith
	12.45	station closed down								

some amateurs may tell you that they have never had anyone round to inspect their station, but no matter – the obligation is still there that you will be expected to be able to demonstrate certain things if, and when, someone does.

Test equipment

Anyway, certain items of test equipment, and certainly frequency checking equipment, are a must for any amateur wishing to explore this fascinating hobby of ours to the full, though there will always be those who seek no more than being able to have a chat with their friends over the air every now and then.

There is nothing wrong with the latter at all – everyone is free to take what enjoyment they wish out of amateur radio – but it would be incorrect of someone to think that just because he (or she) only goes on the air once in a blue moon they have little use of even the minimum items of test equipment. After all, we have just seen that the licence conditions call for tests to be made from time to time to ensure that all is in order and that these tests have to be entered in the log. Maybe it sounds like I am labouring the point but you do sometimes hear licensed amateurs declare that they don't possess a single piece of test equipment, nor (which is incorrect) do they have need of such.

Actually, anyone making such a statement would probably be wrong anyway because most bought equipment usually comes fitted with a crystal calibrator at the very least, and anyone who builds equipment should already have the necessary test gear handy. The calibrator is used for marking the edges of the amateur bands and thus it can be seen if the equipment is tuned outside of these points. Frequency checking is made much easier these days with the advent of the 'black box' type transceiver, with its digital display, digital memory, microprocessor control etc, so it would be difficult not to know that you were transmitting out of band and would not occur unless this were done as a deliberate act.

Older equipment, though, is not necessarily as sophisticated, nor is home-brew equipment usually. Therefore, it is best to heed the guide-lines given in the aforementioned Appendix G or at the back of the current licence to ensure that you do indeed comply with the appropriate requirements. You can certainly expect some sort of question on this, or at the least questions on frequency measurement and control, so read everything carefully and double check anything that you are unsure about. To help you there follow a few additional comments plus a short recap on frequency measuring equipment.

Useful guidance

The licensing conditions require that you must be able to verify that your transmissions are within the authorised band and that a suitable method of

frequency control be used in the transmitting equipment. In order to comply with this some form of crystal reference source is suggested as follows. The transmitter VFO itself could be crystal controlled, in which case an absorption wavemeter of suitable accuracy and frequency range can then be used to check that the correct harmonic of the crystal frequency is selected. However, if the transmitter is not crystal controlled, then to ensure the correct accuracy a wavemeter based on a crystal oscillator should be used for frequency checking.

Whatever type of meter is used it must be capable of providing measurements to the required accuracy. This means that the accuracy of the instrument itself should be suitable; it is no good using a meter with a small, cramped scale, for example. For the absorption wavemeter, or similar, its frequency coverage must extend up to at least the second-but preferably the third harmonic of the frequencies to be measured so that the presence of any unwanted harmonics from the transmitter can be detected.

Wavemeters

For instance, a wavemeter capable of measuring frequencies as high as 90MHz would be able to detect any spurious radiation of up to the third harmonic (and in most cases higher) for an HF transmitter covering up to, and including, the 10m band. The upper limit of this band is 29.7MHz so the third harmonic of this frequency would be 89.1MHz.

As the frequency rises into the VHF and UHF region, so it becomes more difficult to design a wavemeter that will have a high enough accuracy for the frequency coverage required. You can imagine that the scale would begin to get very cramped indeed, to say the least, if the range had to be from 144MHz (the start of the 2m band) up to at least 432MHz (the third harmonic frequency). Things would be even worse for the higher bands, so for VHF and UHF transmitters the suggested method is to accurately measure the frequency of the VFO or fundamental oscillator and then check that the correct harmonic has been selected.

Frequency measurement

If this isn't immediately clear to you then look back through the *RAE Manual* to the block diagram of a transmitter for 144MHz and see how the transmitter frequency is derived from a low frequency crystal oscillator.

Sometimes it is possible to use a separate receiver for frequency measurement, but only if that receiver is itself accurately calibrated. Modern receivers are usually accurate enough and can be used for checking for harmonics if the frequency range is suitable. It is not all that advisable, though, to directly tune the receiver to the transmitter frequency if the two are in close proximity, even if the receiver antenna is disconnected, as the front end circuits will be grossly overloaded.

However, an accurately calibrated receiver is useful for frequency measurement in many ways.

A crystal calibrator or heterodyne wavemeter can be used to set the calibration of the receiver, a marker frequency of 100kHz usually being adequate for checking frequencies up to about 4MHz for a general coverage receiver. Any higher than this and the spacing between the 100kHz marker points becomes a bit too small for accuracy, so a further crystal marker of 500kHz or even 1MHz should also be used.

A little easier

Things are a little bit easier for an amateur bands only receiver where the bandspread of the scale will be sufficient to allow just the 100kHz marker to be used throughout the HF bands with enough accuracy. In this case, an additional crystal of 25kHz may also be included to provide extra markers between the 100kHz points.

Now, on to a point which was touched on when we covered measurements a few months ago. When making these frequency measurements the accuracy of the measuring equipment used must always be taken into account, especially when operating very close to the edge of a particular band.

For instance, on the 80m band you might have the transmitter set to a frequency of, say, 3.795MHz, so to ensure that this was in fact correct and not actually just outside the band edge (3.8MHz) the measuring equipment used to prove this must itself have an accuracy of about plus or minus 0.05 per cent. The reading given by the meter could then be out by as much as 3.8kHz, which is still acceptable.

However, if the accuracy of the measuring instrument was only plus or minus 1 per cent then the resultant reading could, in theory, be anywhere within the range 3.757 – 3.833MHz, which if the meter were reading high would show the transmitter to be set outside of the band edge. Worse still, the meter could be reading on the low side and, at its extreme, you might set the transmitter just outside the edge of the band but the meter would still show the frequency to be under 3.8MHz.

If you were operating at the centre of a band as wide as 80m then you could, however, use a meter with 1 per cent accuracy because even at its worse tolerance, the band edges would not be exceeded.

Contravention

A good deal of care is needed when working close to the edge of a band, as we have seen. To transmit outside of these limits is obviously a contravention of the licensing conditions, but it is sometimes possible to do this unknowingly if suitable precautions have not been taken in both the design of the transmitting equipment or the way it is operated.

BACK TO BASICS

For instance, the top end of 80m is used for DX work and it is quite common to find stations working as close to 3.8MHz as is possible. This is because in some countries, such as the USA, the band extends a little bit higher. Thus, by calling CQ DX on 3.799MHz, a European station, for instance, will hope that he can attract the attention of those amateurs working around 3.8MHz.

However, it must be remembered that the transmitted signal has spread either side of the carrier frequency due to modulation and that if this bandwidth is wide then a part of the emission could very easily fall outside of the band. Thus, if amplitude modulation were used on a frequency of 3.799MHz, the bandwidth of the transmitted signal could be anything up to about 5-6kHz and part of the upper sideband would definitely fall outside of the band edge.

The same would be true if frequency modulation were used, worse in fact if the deviation were not restricted (narrow band frequency modulation or NBFM), because of the number of sidebands produced by this mode.

However, both CW and SSB modes would be acceptable, although for the latter only if it were set to the lower sideband position. The bandwidth of a CW signal will be much less than 1kHz and so provides no problem, but it must be ensured that there are no spurious

emissions from the CW transmitter due to 'key click' etc.

Another instance where the operator could be unwittingly radiating signals outside of the band is if the transmitter controls have been set to produce over-modulation of the carrier. The resultant splatter, as well as causing annoyance to other users, could be well out of band even though the transmitter is set to a frequency some way inside the band edge.

Station closure

Finally, we come to any possible demands for the station to be closed down. This could happen at times of national emergencies or if it is suspected that transmissions from the station are causing interference to other services. It might be something serious and involve a government wireless station, or simply that a neighbour has complained to the Radio Investigation Service about your transmissions playing havoc with his TV viewing. Either way, the licence requires you to close the station down at any time on the demand of a person acting under the authority of the Secretary of State. This demand could be an oral one, such as by telephone, but in this case it will always be followed up by confirmation of this request in writing.

A point of note about the latter, not

strictly to do with the RAE but more for your own guidance. It is always best to treat any reports of interference sensibly, and not as some people might do by carrying on transmitting at their pleasure until told to close down. If a neighbour complains to the RIS that this interference is excessive or unreasonable then the first thing that you can expect is to either be told that you cannot use the equipment at certain times, or be closed down altogether depending on the severity of the interference until the RIS have had time to investigate the complaint.

It is obviously a far better situation if the amateur discusses the problem with the neighbour first, provided of course that the neighbour is reasonable, and the two of you come to an agreement on how the problem should be tackled. No-one likes to be restricted from pursuing their hobby as they wish, but it is far better to come to a compromise than to have to be told that you cannot transmit at all until investigations have taken place. By now the neighbour may be quite justifiably annoyed and difficult to reason with.

Acknowledgements and references

Radio Amateurs' Examination Manual - G L Benbow G3HB (RSGB)
How to Become a Radio Amateur - Department for Trade and Industry City and Guilds of London Institute

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QUESTIONS & ANSWERS

RAE PRACTICE DEvised BY R.E.G. PETRI G8CCJ

MEASUREMENT

- The basic indicating device, used in the majority of sensitive analogue instruments is most likely to be a:
 - moving coil meter movement
 - sensitive hot wire ammeter
 - thermo junction
 - precision wavemeter
- The basic moving coil meter movement is only suitable for measuring:
 - ac currents
 - ac voltages
 - peak ac voltages
 - dc current
- Figure 1 represents a moving coil meter movement where R_m equals the combined resistance of the coil, plus an internal swamping resistor which reduces the effects of temperature change. The meter shown will indicate full scale deflection (fsd) with a current of 1mA flowing in its coil. What voltage will be developed across its terminals for fsd?
 - 0.001V
 - 0.01V
 - 0.1V
 - 1.0V

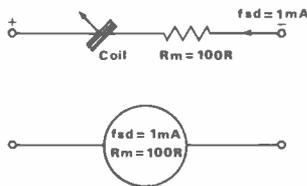


Fig 1

- The meter movement shown in Figure 1 has an fsd of 1mA. When it is required to measure larger quantities of current it must be used in conjunction with a:
 - multiplier
 - shunt
 - amplifier
 - attenuator
- You modify the meter movement shown in Figure 1 to have a full scale deflection of 10mA by fitting a shunt resistor as shown in Figure 2. What is the value of the current flowing in the shunt resistor when the meter indicates full scale deflection?
 - 10mA
 - 9.0mA
 - 0.9mA
 - 0.1mA

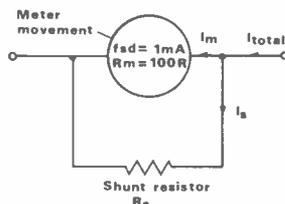


Fig 2

- Having calculated the pd (volts) across the meter for fsd in Q3 and the current flowing in the shunt when the meter indicates an fsd of 10mA, use Ohm's law to calculate the value of the shunt resistor in Figure 2.
 - 11.11 ohms
 - 111.11 ohms
 - 0.99 ohms
 - 9.99 ohms
- Figure 3 shows the moving coil instrument of Figures 1 and 2 adapted with R_{s2} to read an additional current range of 100mA fsd. What current will flow through the shunt resistor R_{s2} when the meter indicates a half scale deflection of 50mA?
 - 50.5mA
 - 50.0mA
 - 49.5mA
 - 99.0mA

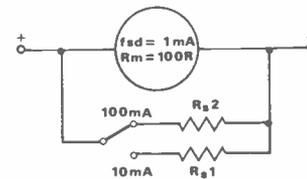


Fig 3

- Referring to Q7, what is the value of shunt resistor R_{s2} ?
 - 0.10 ohms
 - 1.01 ohms
 - 10.1 ohms
 - 0.09 ohms
- In order to prevent the meter movement passing the full circuit current when the instrument is switched from one current range to another, the switch contacts should:
 - break before they make
 - be graphite insulated to reduce static
 - be lubricated with conductive silicon grease
 - make before they break
- When the basic moving coil movement shown in Figure 1 is to be pressed into service as a voltmeter, it will require a resistor added in series to limit the current to fsd for that particular range. This resistor is known as the:
 - voltage shunt
 - multiplier
 - mode changer
 - divider
- The moving coil meter movement shown in Figure 4 has an fsd of 1mA and a resistance of 100 ohms. What value will the multiplier resistor R_M be if the instrument is given a range of 10 volts fsd?
 - 9,900 ohms
 - 99,000 ohms
 - 1,000 ohms
 - 10,000 ohms

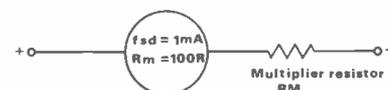


Fig 4

12. To extend the usefulness of the meter described in Q11, it is decided that a 50 volt fsd range should be added, as shown in Figure 5. What will be the value of RM2?
- 500,000 ohms
 - 50,000 ohms
 - 49,900 ohms
 - 4,900 ohms

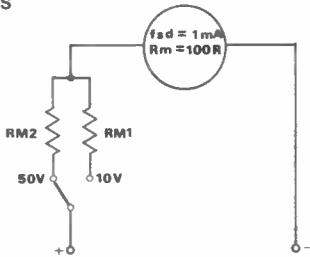


Fig 5

13. In the circuit arrangement shown in Figure 6 the moving coil meter will measure:
- two ranges of ac voltage
 - two ac current ranges
 - RF power (terminated)
 - dc power (terminated)

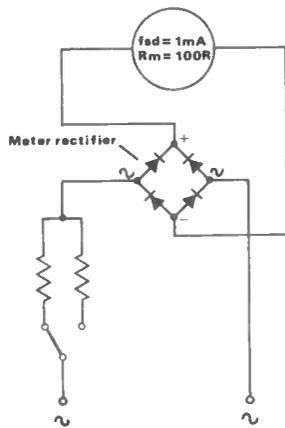


Fig 6

14. Figure 7 shows a moving coil meter used as an instrument to measure:
- dc power
 - ac power
 - characteristic impedance
 - resistance

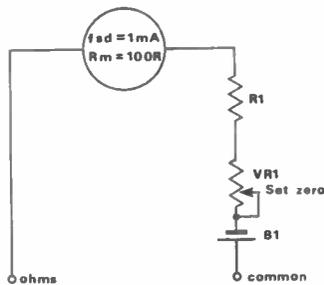
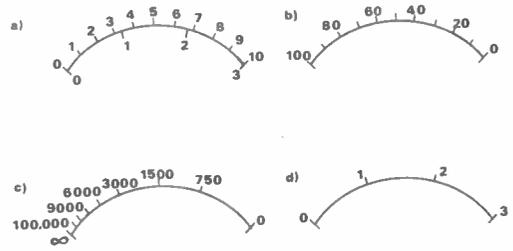


Fig 7

15. How is the instrument shown in Figure 7 set up before proceeding to measure an unknown resistance?
- Adjust zero screw on meter face to make pointer coincide with nearest value of resistance and then connect unknown resistor
 - Adjust zero screw until pointer rests on zero, short circuit ohms and common terminals and adjust VR1 to indicate zero ohms on meter scale. Replace short circuit by unknown resistor, read value directly from scale
 - With ohms and common terminals open, adjust VR1 for minimum reading on the meter scale and then connect unknown resistor, read value directly from scale
 - Remove battery or cell B1, short circuit ohms and common terminals, adjust VR1 for maximum deflection on meter and connect unknown resistor, read value directly from scale

16. Four typical instrument scales are shown, which one is typical of the instrument referred to in the previous two questions?



17. Ignoring the small current I_B , a quick glance at Figure 8 will lead you to assume that there will be about 5 volts (with respect to chassis) present at the R1/R2 junction. You could confirm this fact using a very high resistance voltmeter. However, your multimeter, about 1942 vintage, was purchased for a fiver at a car boot sale, and although looking impressive only has a sensitivity of 500 ohms/volt. Anyway, you switch the impressive looking meter to the 10 volt fsd range and hook it across R2. Approximately what voltage will it indicate?

- 20 volts
- 5 volts
- 2.86 volts
- 2.5 volts

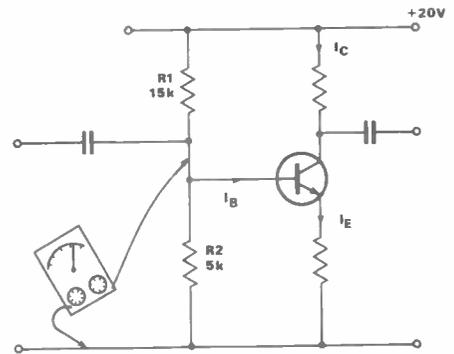


Fig 8

18. Referring to Q17, the moral of the story is:
- never buy a meter at a boot sale
 - never buy a meter manufactured before 1942
 - never use a meter of low sensitivity (low ohms/volt) that loads the circuit under test
 - never use a meter of high sensitivity (high ohms/volt) which has negligible loading effect on the circuit under test

19. Figure 9 shows a small signal amplifier stage with a selection of meters connected. Meter M1 will measure the ----- and will be a -----
- emitter current/dc power meter
 - collector current/rms voltmeter
 - base current/milliammeter
 - collector current/milliammeter

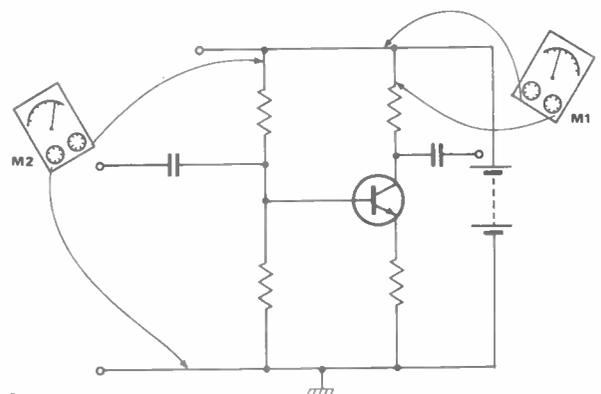


Fig 9

20. Referring to *Figure 9*, the meter M2 will measure the ----- and will be a -----
 a) supply voltage/voltmeter
 b) supply current/ammeter
 c) base-emitter voltage V_{BE} /high resistance voltmeter
 d) power dissipation/wattmeter

21. It is possible to measure radio frequency currents with a sensitive moving coil meter when it is used in conjunction with a:
 a) dummy load
 b) hot wire module
 c) thermocouple
 d) moving iron

22. *Figure 10* shows a moving coil meter connected to a thermocouple element. It is capable of measuring dc, AF and RF currents. What causes the meter deflection when current is passed through the heater element H-H?
 a) The emf generated at a bi-metallic junction when its temperature is raised
 b) The transference of electrostatic energy when the junction temperature of two similar metals is raised
 c) Murphy's law
 d) Magnetostriction of the bi-metallic junction due to the magnetic field surrounding the heater wire

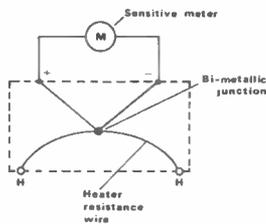


Fig 10

23. *Figure 11* shows a simple thermocouple power meter suitable for measuring the terminated output power of a transmitter. Select one set of characteristics below that are true of this type of instrument.
 a) Has limited frequency response/fast rise time
 b) Sluggish in operation/wide operating frequency range
 c) Junction very sensitive to magnetic fields/will give a linear deflection
 d) Very expensive to calibrate/can use very insensitive meter movements



Fig 11

24. *Figure 12* shows the schematic diagram of an instrument suitable for the measurement of:
 a) the true frequency of a carrier wave
 b) dc input power to a transmitter
 c) harmonic distortion on the output signal of AM and SSB transmitters
 d) forward and reflected power by means of a directional coupler

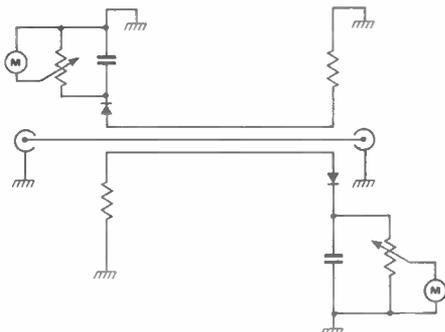


Fig 12

25. You are using the through-line power meter shown in *Figure 12* to measure the output power of your VHF transmitter. It indicates a power of 50 watts. The manufacturer's quoted accuracy is $\pm 10\%$. This means that your output power could lie between:
 a) 25-100 watts
 b) 25-75 watts
 c) 40-60 watts
 d) 45-55 watts

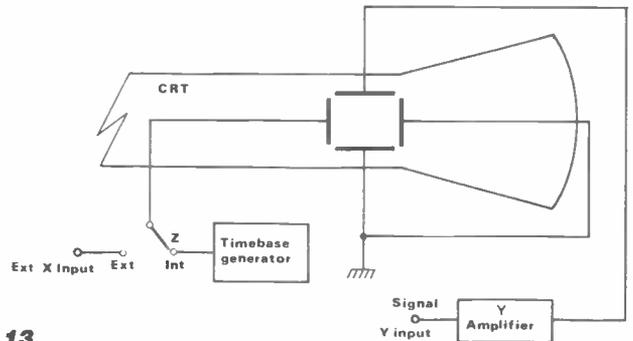
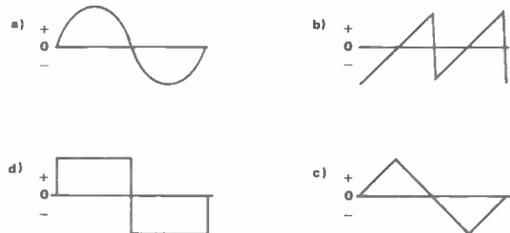


Fig 13

26. Referring to the oscilloscope diagram shown in *Figure 13*, which one of the waveforms shown below would you expect to find at point 'Z', the output of the time base generator?



27. The time base generator of a cathode ray oscilloscope provides the:
 a) horizontal deflection for the trace on the screen
 b) vertical deflection for the trace on the screen
 c) power for the signal amplifier
 d) focussing voltage for the cathode ray tube
28. The time base range switch on a cathode ray oscilloscope is set to 100ms/cm, ie 1cm of trace is drawn in 100ms. The trace length on the screen is 10cm, therefore the spot is deflected across the screen in 1000ms (1 second). A signal of 25Hz is applied to the Y amplifier. How many complete cycles of the input signal will be displayed?
 a) 250
 b) 100
 c) 25
 d) 5

29. What is the percentage modulation of the amplitude modulated waveform shown in *Figure 14*?
 a) 100%
 b) 75%
 c) 60%
 d) 50%

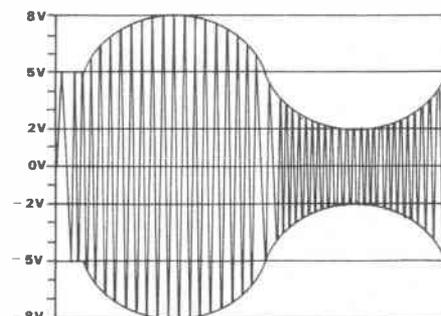


Fig 14

30. Figure 15 shows the circuit of a simple absorption wavemeter. The value of the inductor in this case is $20\mu\text{H}$. The tuned circuit is loosely coupled to a radio frequency source and VC1 is adjusted for maximum deflection on the meter, which occurs when the value of VC1 is 140.7pF . What is the approximate frequency of the source being measured?
- 1MHz
 - 3MHz
 - 5MHz
 - 10MHz

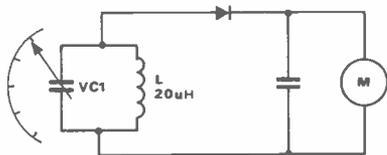


Fig 15

31. Which one of the following instruments will most accurately measure the output frequency of a transmitter?
- Absorption wavemeter
 - Slotted line
 - Digital frequency meter
 - Through-line reflectometer
32. The accuracy of a digital frequency meter (frequency counter) depends on:
- the brightness of the display
 - the frequency of the signal being measured
 - the number and type of digital integrated circuits used in its construction
 - the stability and accuracy of the internal crystal reference
33. The grid dip oscillator, GDO, or FET dip oscillator can be used to:
- check the resonant frequency of a non-activated tuned circuit
 - measure the characteristic impedance of a coaxial cable
 - measure the noise present on a received signal
 - check the phase angle of mains interference

Back to normal. Just turn the magazine etc. . .

ANSWERS

1 - a; 2 - d; 3 - c; 4 - b; 5 - b; 6 - a; 7 - c; 8 - b; 9 - d; 10 - b; 11 - a; 12 - c; 13 - a; 14 - d; 15 - b; 16 - c; 17 - c; 18 - c; 19 - d; 20 - a; 21 - c; 22 - a; 23 - b; 24 - d; 25 - d; 26 - b; 27 - a; 28 - c; 29 - c; 30 - b; 31 - c; 32 - d; 33 - a

That is all for this month. I hope the questions have given you something to think about.

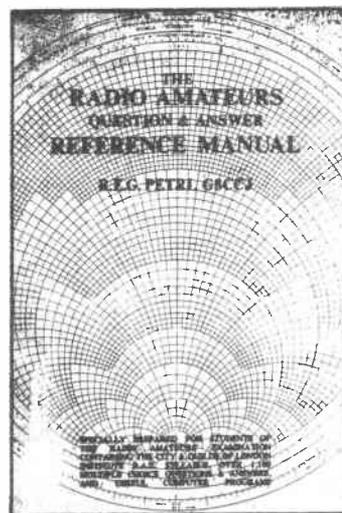
By now the radio amateur examination classes will have started. Some of you will, of course, be fairly familiar with the subject and just be brushing up on your knowledge, but the majority of you will be trying to get to grips with basic electronic theory and calculations for the first time in your life.

It is quite possible that your initial enthusiasm and

confidence has taken a knock; don't worry too much at this stage, you'll soon begin to appreciate what is going on and you might even enjoy the course.

However, a few words of advice which I always give - don't go home from an evening's lecture and forget about the RAE until the next lecture.

Read any articles on the subject that you can get your hands on, and above all read your lecture notes until you understand them.



Now, just in case you've not already purchased it (or even heard of it!), I've written a Q&A book specially for the RAE student. It contains about 1,100 questions (with multiple choice answers of course). The questions have been divided into sections and selected to progress with each part of the RAE syllabus. It also contains the C&G syllabus for 1986-88 and some computer programs written in BASIC for the Commodore 64 (which will run on most machines with suitable mods) to assist with the RAE calculations and provide Morse tuition.

The book, *The Radio Amateurs' Q & A Reference Manual (Second Edition)*, is available at £5.95 plus £1 P&P (UK) from:
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THE MURPHY B40

A look at a real 'old timer'
of valve communication receivers

by M C Smith

When valved communication receivers come up for discussion there are some receivers which always seem to be mentioned; the AR88, the RA17, the CR100 and the R1155 seldom escape notice. While these are all good receivers, and all seem to be readily available through the small ads columns, they are not the only vintage receivers worth considering. One receiver which is often overlooked and rather harder to find is the Murphy B40. This is unfortunate, as the B40 has a lot to offer the SWL or licensed amateur.

The B40 is a general coverage (640kHz to 30.5MHz) 10 valve single-conversion superhet with an IF of 500kHz. It was built by Murphy for the admiralty in the early 1950s and is believed to have cost over £500 then. This is not surprising when you consider the many features built into this superb piece of equipment and its incredibly solid construction.

In this connection, I had to smile when I read in the *Amateur Radio* article on the Collins 75A-4 (June 1983) that this receiver, at 35 pounds, was a 'permanent fixture' on the author's desk. The B40 weighs in at an incredible 114 pounds!

The B40 comes in four versions, logically called the B40A, B40B, B40C and B40D. The technical differences are outlined in *Table 1*, but the B40D is by far the most common and easily the best overall, and so this article will concentrate on that particular model. At this point it is worth mentioning that there exists a superficially similar receiver, the B41, which covers 15kHz to 700kHz. Unless you specifically want an LF

receiver beware of buying this model by mistake.

Technically

Technically speaking the B40D is, as mentioned before, a single conversion superhet. It has 2 RF stages, with the gain of the first being varied by a control appropriately labelled *anti-cross-mod.*

By the time the signal reaches the triode-heptode frequency changer it has already passed through three tuned circuits operating at signal frequency, which contribute to its immunity from cross-modulation effects by reducing in amplitude all undesired signals. The oscillator drive to the frequency changer is provided by a pentode VFO/CO. The provision for this stage to act as a crystal oscillator enables spot frequencies to be accurately tuned, while in VFO mode the oscillator covers 640kHz to 30.5MHz in five switched bands. These are:

- Band 1 640kHz-1.65MHz
- Band 2 1.60MHz-4.00MHz
- Band 3 3.90MHz-10.00MHz
- Band 4 9.50MHz-18.50MHz
- Band 5 17.5MHz-30.50MHz

The output from the frequency changer is passed to the first of the three IF stages, which amplifies the signal before passing it to the switchable 1kHz crystal filter. The output from this feeds the two remaining IF amplifiers. In order to provide switched 3kHz/8kHz selectivity when the crystal filter is not in use small extra windings are switched in or out of series with the main IF winding on 2 of

the IF transformers, in order to alter their frequency and so stagger-tune the whole IF system, broadening the frequency response.

The detector which follows the IF stages is a simple diode type, as opposed to the product detector found in a more modern receiver. This is because the receiver was originally intended for AM/CW use, where the superior properties of the product detector (SSB reception quality independent of relative signal/BFO levels) were not so important. In fact, the widespread use of the product detector only began in the late 1960s with the rise of SSB. However, the receiver is still capable of good quality SSB reception, and the deficiency is not noticeable.

The BFO itself has preset frequencies for all modes, selected automatically by the mode switch. It also incorporates a crystal to give a precise 500kHz for tuning and calibration purposes. The BFO is mixed with the signal via an extra winding on the final IF transformer. The audio from the detector is passed to a diode noise limiter which chops off all audio above a threshold determined by a front panel control. While this is sometimes useful in reducing some interference, it is nothing like as effective as a modern noise blanker. Finally, the audio is amplified in the two stage AF section, which provides outputs for headphones/internal speaker and external speaker with volume controls for each.

Controls

Having run through the circuitry, I will now relate this to the controls and connectors actually present on the B40D, referring to *Figure 1* from top left. The monitor speaker, connected in parallel with the headphones, provides low-level loudspeaker output, but the small size limits frequency response and sound quality. The AGC switch allows gain control of the IF stages to be either automatically via the AGC line or manually from the *gain* control. The noise limiter switch and control allow selection and control of the diode noise limiter referred to above. The *bandwidth* control selects a 1kHz crystal filter or 3kHz or 8kHz selectivity positions. The *system* switch is essentially a mode switch, with the settings listed in *Tables 2 and 3*.

By the system switch is the *AF gain* control which adjusts the output of the AF stages by attenuating the signal fed to them by the detector. Beneath the system switch are switches for *LS* and *mains*, whose functions are obviously to switch the mains input and internal speaker on and off. The LS switch is necessary as the speaker is not silenced by plugging in headphones.

On the right hand side of the front panel, at the top, is the *crystal* switch, which allows the VFO frequency to be determined by a crystal placed in the socket concealed by the cover just above the switch. A light in this cover shines through an orange cross to show when the crystal is in operation.

Below the crystal switch is the *OSC trim* control, which is a fine-tuning

Table 1

MODEL	B40A	B40B	B40C	B40D
FEATURE				
OSC trim control	Not fitted			Fitted
FSK positions on system switch	No			Yes
Form of 1KHz filtering	Audio ('note') filter	Crystal filter in IF		
High reduction tuning drive	No	Yes		
AGC switching method	manual position on system switch	Separate AGC on/off switch		
Provision for high impedance aerial	Pin D on aerial socket		No provision	

MURPHY B40

control acting on the VFO. It is calibrated 5-0-5 and is approximately a 10:1 on the main tuning knob. Under the OSC trim control is the *RF gain* control in the shape of the anti-cross-mod control. This adjusts the gain of the first RF stage over a limited range by altering the grid bias on the first RF valve. Below this is the *band switch*, which selects one of the five bands available; the band being tuned is indicated in a window above the switch. It incorporates a microswitch which shorts the antenna input while the control is being rotated, so silencing the receiver.

The next control down is the *gain* control, which acts in rather an unusual way. When the AGC switch is in the off position, it controls the IF gain by varying the voltage on the AGC line. When the AGC switch is in the on position, AGC line voltage is controlled by the AGC generator. However, the gain control is a dual potentiometer and the other section is now switched in to control the output level to the internal speaker and headphones, but not that to the external speaker line. This control therefore has the effect of varying both local and remote volumes when the AGC is off, but only local volume when it is on.

Connectors

At the very bottom of the front panel on this side are situated three connectors; two parallel connected 600 ohm headphone sockets (1/4in jacks) which will accept mono or stereo plugs, and a screw terminal for earth connection. The headphone sockets are non-switching types, so inserting a plug does not silence the speaker. The earth terminal is used for making a direct earth connection to the receiver chassis.

In the middle of the front panel is situated the tuning assembly, consisting of cylindrical tuning scale and tuning knob with 0-100 logging scale. Two features are worthy of mention; there is a *dial lock* lever to the right of the tuning knob, whose function is to lock the tuning mechanism to prevent accidental detuning, and above the tuning scale is a cover which conceals a knurled ring which can be used to adjust the cursor to coincide with standard frequencies or calibration marks. A nice touch is the way in which the individual band scales are back lit, with only the band in use being illuminated. The actual scales for each band go twice around the tuning drum, in helical fashion, with the drum moving slowly up and down as it revolves, so showing the required section of the display in the window.

Sockets

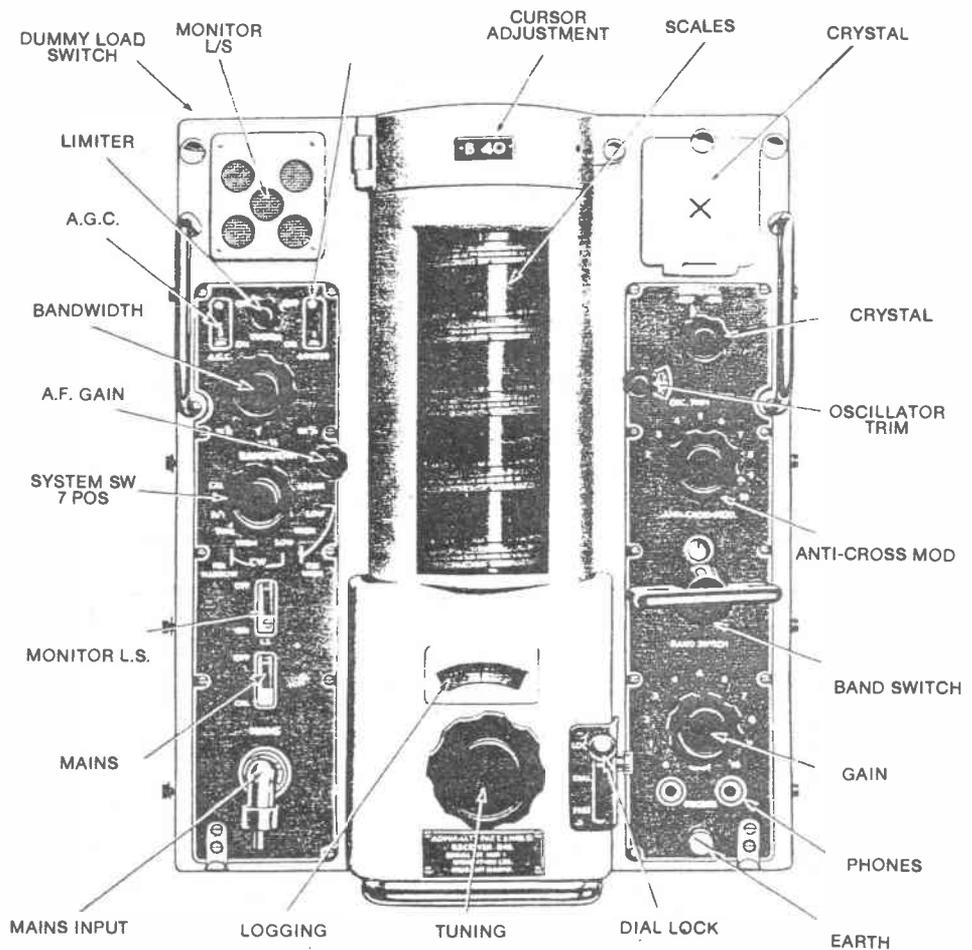
There are several sockets along the back of the receiver which are listed in *Table 4*.

The external speaker line is operated by a switch on the rear of the receiver, which connects a dummy load when the speaker is not in use. It is vital that this switch is placed in the forward position when no speaker is connected to prevent

MURPHY B40 SYSTEM SWITCH SETTINGS

CAL	Sets BFO to 500KHz crystal controlled and also feeds this 500KHz signal to the second signal frequency tuned circuit, as well as disabling the first RF stage by removing the bias from the screen grid. This causes the receiver to be silent except for calibration 'pips' every 500KHz
R/T	Disables BFO. Used for reception of AM signals
Tune	As for AM but with 500KHz BFO to zero beat with AM carrier to enable AM signals to be accurately tuned in
CW/FSK Narrow high/low	These positions provide BFO injection at a suitable frequency for the reception of CW and narrow shift (less than 200Hz) FSK signals. High and low positions place the BFO on either side of the passband to avoid interference
FSK wide high/low	These positions provide BFO injection at a frequency suitable for reception of wide shift (200-100Hz) FSK

Table 2



MURPHY B40

Fig 1 Controls and connectors on the Murphy B40

damage to the second AF stage, a power tetrode. Also mounted on the rear is a potentiometer which controls the brightness of the dial lamps.

In use

Having completed the physical and electrical description of the B40, the question remains 'What is it like in use?'. The short answer is 'superb', but it is

probably easier to give an accurate impression by describing the reception technique required.

Starting at the antenna, I use a long wire feeding an ATU whose unbalanced output is connected with earth to pins A and B and the signal lead to C. After 30 minutes warm-up time to eliminate drift, the required band is selected and the receiver tuned to the vicinity of one of

MODE SELECTION

MODE	PINS	PD/PGM (18)	\overline{CS} (20)	V _{PP} (21)	V _{CC} (24)	OUTPUTS (9-11, 13-17)
Read		V _{IL}	V _{IL}	+5	+5	D _{OUT}
Deselect		Don't Care	V _{IH}	+5	+5	High Z
Power down		V _{IH}	Don't Care	+5	+5	High Z
Program		Pulsed V _{IL} to V _{IH}	V _{IH}	+25	+5	D _{IN}
Program verify		V _{IL}	V _{IL}	+25	+5	D _{OUT}
Program inhibit		V _{IL}	V _{LH}	+25	+5	High Z

Table 3

the calibration marks, which are at 500kHz intervals (in amateur use this will mean tuning to the bottom of the band). The system switch is then set to CAL and the OSC tune control set to 0. The receiver is then tuned around the calibration point until a beat note is heard in the speaker, then further adjusted until the pitch of the tone drops to zero and nothing is heard in the speaker.

This is *zero beat*, and at this point the receiver is tuned to an exact multiple of 500kHz. The cover above the tuning scale is then opened and the knurled rim moved to make the cursor coincide with the nearest 500kHz point. The receiver calibration is now correct for the band in use.

Receive

To receive a signal, the system switch is set to the required mode (on my B40 the high and low positions have been set up to give LSB/USB reception) and the signal tuned approximately with the main tuning control. The required CW beat note or correct SSB tuning is obtained using the OSC trim control.

AGC can then be selected if required, and the gain and AF gain controls used to provide a comfortable listening level. If

any overloading is detected, the anti-cross-mod control can be backed off slightly.

If an interfering signal is present, the situation may be improved by switching the *limiter* switch on with the associated control fully clockwise. Then rotate the control anti-clockwise until the required signal just begins to limit and then back it off a little.

As the main tuning rate is rather fast, particularly on the higher bands, and the scale markings then become rather cramped, the logging scale immediately above the tuning control comes into use. For fixed frequency transmissions (RSGB news, calling channels, QRP frequencies, SSTV frequencies etc) it may be sufficient to simply note the logging scale reading when the frequency in question is being received, and then use this as the point to return to in future. It is also possible, using an external 10kHz calibrator, to plot a graph of frequency against logging scale at 10kHz intervals. Any correction required by cursor adjustment when in CAL mode can then be added or subtracted to the logging scale for that frequency, and any required frequency easily tuned or the frequency of a received signal accurately determined.

Servicing

Having covered the technical and operational details of the receiver, there only remains the servicing side of things to cover. It is not intended to offer detailed information on repair or servicing, although it is worth giving some guidance on how to gain access to the circuitry.

To remove the B40 from its case, undo the two bolts at the very top of the front panel. Remove all plugs from the rear panel and using the handles on the front panel slide the receiver out of its case. You should now be left with a front panel with all the electronics hung on the back. This is separated into 3 sections: RF, IF and AF/power supply.

IF and AF sections

The IF and AF sections may be removed to facilitate cleaning or repair. First remove all multiway plugs connecting the unit to the rest of the receiver and then undo the bolts holding the unit in.

For the IF unit, which is situated at top right (as seen from the rear), the bolts are situated at the bottom of the unit. If the bandwidth, system, AF gain and limiter knobs are now removed, the IF unit may be lifted clear.

In order to remove the AF unit, which occupies the bottom of the receiver, the two bolts apparent on each end of the retaining bar are removed and the unit pulled out backwards by means of the handle at the top of the unit.

The RF section is built into the front panel, and is therefore, to all intents and purposes, fixed. However, most of the circuitry is accessible without removal so this is no real problem.

The alignment of the receiver, should this be attempted, requires special tools for adjusting the inductors and capacitors safely – these are located in spring clips on top of the RF section. Spare fuses (mains 2A, HT ½A) can be kept in the clips on the side of the IF unit.

Well, that concludes my description of the B40 – I hope that it will have persuaded some people to have second thoughts about their choice of HF receiver, and perhaps gone some way to show that a valve receiver is still a viable solution to the problem of high-quality HF reception at reasonable cost, even in these days of £500 rice boxes!

Finally

It only remains to make a mention of one company who, I am sure, will be of use to anyone with an interest in this receiver. Centre Electronics of 345 Stockfield Road, Yardley, Birmingham can supply B40s and spares, including whole AF or IF units. They also sell Eddystone and a variety of other valve receivers besides. I have no commercial connection with this company – they are simply a firm who have continually given good service to me and who I wholeheartedly recommend to anyone buying or renovating one of these superb receivers.

Table 4

MURPHY B40 REAR SOCKETS

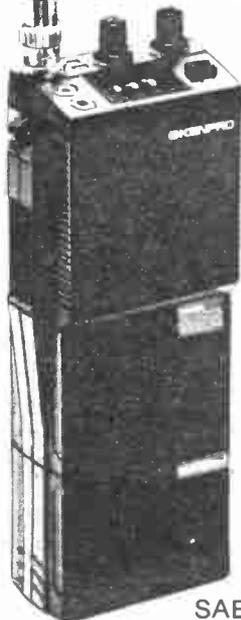
Aerial input plug	A 4-pin mark 4 plug with a balanced low impedance input and an earth available on three pins. This allows use of balanced or unbalanced antenna systems
RIS socket	A co-ax socket of doubtful use. It provides a connection to the suppressor grid of the first RF valve
REC socket	A co-ax socket whose uses are manifold. This is an IF output from just before the detector. This signal, which has passed through the IF gain and selectivity stages can be used to feed an outboard FM detector, to experiment with synchronous detection or provide true product detection for SSB signals
REB socket	This co-ax socket provides dc voltage proportional to signal level, derived from the detector stage. It can be used to power an S-meter
Audio output plug	This is a 6-way mark 4 plug, providing three outputs: 2.5W into 600 ohms, external speaker line 35mW into 600 ohms, intended for input to a ships control system 14mW into 600 ohms, an extension of the headphone/internal speaker line

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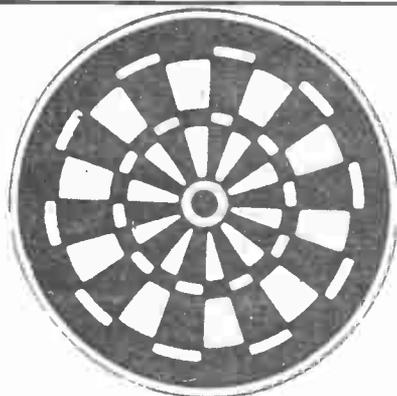
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SECONDHAND EQUIPMENT GUIDE

by Hugh Allison G3XSE

Your scribe has received a steady stream of letters over the years from newly licensed amateurs who are wondering what they can expect by way of a rig for a certain amount of money. Although it is not possible for the magazine to actually get them an example of what ought to be available at their chosen price (although you might strike lucky with a 'wanted' advert), at least it is practical to give an *idea* of what can reasonably be expected from the secondhand market.

Reading between the lines of the letters received it is fairly obvious that quite a lot of newly licensed people are interested in getting their feet wet without spending the earth, so here is a guide, for those with limited resources, of VHF equipment.

£0 to £25

First and foremost, bargain of the decade, Pye pocketphones. Don't sneer at these, a newly licensed amateur can get a lot of valuable operating experience through his local seventy centimetre repeater with a pair of these. At nearly every rally your scribe has attended there have been stacks of pocketphone receivers priced between £2 and £5.

Batteries, and rechargeable ones at that, are also in plentiful supply between 10 and 50 pence. If you are lucky you might be able to pick one up on the local repeater channel, if not it will cost you another £2.50 for a crystal.

Transmitters cost more than the receiver and are not quite so plentiful, although asking around should produce one for £8 to £12. Rechargeable transmitter batteries are about £1 each and chargers are a couple of quid. Quite often there are stacks of complete pocketphone set-ups on the bring-and-buy stalls, normally between £12 and £15 and these are well worth considering. The Compact is a pair of pocketphones in one case and these are more expensive, normally about £20. I would only recommend pocketphones for people who live in the primary service area of their repeater.

For two metres in this price range you are restricted to either obscure, old, and I mean old, Japanese rigs or converted PMR (Private Mobile Radio) gear, normally Pye. To deal with the Japanese rigs first, nearly all of those available would come from the era when the rigs were straight imports to Britain of genuine made-for-the-Japanese-market machines. Apart from the more obvious

shortcomings like wide deviation (25kHz or more), there are odd little things like the microphone being biased towards squeaky oriental voices which means these have a tendency to sound 'boomy' when used by Westerners.

On the subject of deviation, the receiver can be brought down by fitting a narrower filter, (if you don't, you can end up receiving two channels at once: they really can be wide). The transmitter at first glance would appear easy, just wind back the deviation pot. There are however two problems with this plan.

The first problem is that the pot will probably be a cheap and nasty one that drifts. Since the rig was designed for, say, 50kHz max deviation and we require only one tenth of this, the setting of the pot can be quite critical. A lot of the pots do tend to drift, so one day you might be getting over deviation pips etc, and the next day be inaudible. Fit a fixed, good quality resistor and a decent, lower value pot to cure this.

The second problem with early Japanese rigs is the mic gain control. There isn't one. Normally the deviation pot is also the mic gain. There will probably be insufficient gain, but nothing a small PCB with a single transistor pre-amp and pot cannot cure. Ex-CB so-called 'power mikes' are another excellent way to fix low mic gain rigs like these.

Converted PMR gear may well be valued. Nothing wrong with that as such but the equipment will demand amps of current. Sure, an old car battery might be man enough to run the rig, but I'm not happy about something containing a pint or two of sulphuric acid being in the shack. High current 12 volt power supplies are expensive things and make a mockery of the attempt to have a cheap

rig, like say an old Pye Cambridge at £15 being run by a 12 volt, 10 amp PSU costing £30+. Rigs in this price range also include Westminster, Motophones and Europas, etc.

An oddball bargain rig in this price range is one of the early Heathkit machines. Beware the very early ones, the famous 'twoer', for example, was AM, but early FM boxes from them can be quite fun. Sure, the receivers are a little deaf and you have phono plugs to deal with (in the aerial circuitry, honest), but they are easy to work on, especially if you have the handbook, and can be surprisingly reliable.

£25 to £50

Quite a lot of the crystal controlled hand-portable made-for-amateur-use rigs fall into this price range: Standards, Yaesu FT202s, Trio 2200 and 2200Gs etc. All a watt or two out but another £15 should find you a secondhand 10 watt PA if required, thus making a reasonable (though inconvenient to use) mobile or base installation. Proper mobile boxes will be fairly basic machines, like FT2s or FT2Fs, and I've also seen the gorgeous FT2 Auto go for about £50. Icom IC22 (note not the IC22A) and early KDK rigs are also more or less in this price range.

At £50, give or take a fiver, is the Liner 2. This gives you SSB or CW and is a real pain to tune across the band (you have to go in 10kHz steps and then 'clarify' in between). Extremely prone to chucking out spurious carriers, often in embarrassing places like on police frequencies, the temptation to tweak a good example is to be avoided. Although good value for money, I personally never use one until I've checked it on a spectrum analyser and this has uncovered some real shockers over the years, so try and buy

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■ Icom IC-R70 communications receiver (1984). Unmarked, as new. £400. Owner going 2 metres so would exchange for Yaesu 221, 225, FT101ZD with FTV901R (2 metres), or similar. Must be mint. Cash adjustment either way. Tel: Brightlingsea, Essex. (020630) 4544.
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■ Silent key G2CLP lattice tower, beam motor, emotorator control, £175.3 element triband Thunderbird, £130. FT101ZDFM Mk 3, £450. FDX multi 3000, FM/SSB, 2 metre, £350. SWR power meter 100W, £15. 4 x 6SJ6C, £10. Lists available. G3FWA/G3KKB QTHr. Tel: Bedford (0234) 48272/870526.
■ Trio TH41E, speaker mike, 13.8 volt to 8 volt converter, very good condition, £175. Mr Burton. Tel: Stevenage (0438) 359428.
■ Trio general coverage communications receiver 0-30MHz, £180. Hitachi radio cassette recorder, stereo, good as new and boxed, £120. Tel: Borehamwood 01-207 2326 or 207 0706.
■ Yaesu FRG7 receiver 3.5MHz to 30MHz, vgc, with FM modulator fitted. Manual, circuit diagram. Also home-brew 2m converter and many books, maps and SWL aids. ATU. Offers around £125. Will separate. Thornton. Tel: Romford (Essex) 62642.
■ FT101 instruction book, many extras, £250. Also Amtec ATU 300, £35. Tel: (0283) 221870.
■ Yaesu FT980 general coverage HF Tx/Rx, one year old, as new, including Curtis keyer, 300Hz CW filter, 9kHz FM filter. Full break-in, suitable for Amtor, recently realigned by importer. Manual, service manual, boxed, £1,145 ono. Bruce G4WVX, QTHr. Tel: (06286) 64415.
■ Icom IC-04E 70cm hand-held. Excellent condition, complete with Ni-cad pack, charger, 1/4 wave, plugs and documentation. Boxed. £235 ono. Tel: Colchester (0208) 396372.
■ Trio 144MHz transceiver, TH21E with spare battery pack and charger, £120. Tel: Farnborough, Kent 58825.
■ 7.5A power supply unit. Ex-computer type. Variable 0-19V current limit, £29. Welz SP-15M SWR power meter, brand new condition, boxed, used only a couple of times, £39. *Practical Wireless*, August 1983 to May 1985, five without covers, any offers? Tel: (0253) 45431.
■ AVO model 40 Mk 2. Good condition but movement is US. OK for spares or possible repair, £12 ono, plus £3 extra for postage and packing. Please write first with your offer to: Mr D Evans, 29 Malton Road, Woolton, Liverpool L25 8QU.
■ Single paddle Morse key. New, unused. Heavy black polished steel base. Highly polished brass fittings. Silver and brass contacts. Nice piece of equipment to adorn any shack. £25 plus £2 p&p (UK). Gordon G4ZPY. Tel: (0704) 894299 or write to: Gordon Crowhurst, 41 Mill Dam Lane, Burscough, Ormskirk, Lancs L40 7TG.
■ Belcom LS202E 2m multimode hand-held transceiver. Case, QRO, battery pack and charger, £160. Lowe TX40G 10m FM rig. Hardly used, £40. BNOS L144 10-100 linear, new, £115. All items in makers' original packing. G4ILO QTHr. Tel: Colchester (0206) 572685.
■ Minimitter HF comm receiver. Covers amateur bands except new bands, needs alignment, CW, manual, £7. Marconi 10/10 Teleprinter, CW, manual, £6. Tel: (0376) 29040 after 6pm.
■ 2-mtr beam, 19 ele Yagi (144 19/T). Absolutely as new, never been assembled. Genuine reason for sale, cost £55. Sell at £40. G4XIO. Tel: East Sussex

(0323) 846016.

■ Trio TS530 SP HF transceiver, £550. T Williams, 84 Bleaswood Road, Oxenholme, Cumbria LH9 7EZ.
■ Trio SM220 station scope, new, boxed, bargain £200. Fitted with Trio adaptor. Thru-line watt-meter, 144-435MHz, SW-120W, N-type sockets, £15. Advance 77B RMS millivoltmeter, 0-001 volt to 300 volts -60 to +50dBm, £10. SSM HD4 2 metre Low FET high gain pre-amp, £7. Plus postage on above. Give us a ring anytime. Tel: (0473) 85526.
■ JVC CD4 four channel compact disc demodulator. Offers or exchange WHY? Tel: 01-733 0665, ask for Paul or leave a message on (021) 772 2677.
■ TR9000 2m multimode, good condition, boxed, £280 ono. Moving to HF. 17 Clifton Lane, Rotherham, South Yorkshire S65 2AA.
■ Plustron TVRC5D dual band TV radio/cassette recorder. Swap for one SSB adaptor made by Grundig, to suit any Satellit model receiver. Also swap a Sharp SG400E music centre, Dolby system 70W output, used only for a short period, for Icom R70 or Trio 2000. Tel: (061) 743 1570 after 5pm.
■ Icom 745 with AT500 auto ATU, plus FM board and keyer. Cost £1,300. Accept £900. Also Tono 5000 RTTY Amtor terminal with built-in display. Cost £900. Accept £600 ono. Clive G4TIH. Tel: 01-834 7296.
■ Sony ICF2001, £90. Sony ICF7600D, £120. Datong FLI audio filter, £30. Leader wave/dip-meter, £32. Microwave Modules 144MHz converter, £15. PA valves 6JS6C, £8 per pair. SEM Ezitune, £20. All prices Irish pounds. Write to: N Cameron E14DZ, 16 St Mary's Crescent, Westport, Co Mayo, Eire.
■ FRG7000 comms receiver, plus FRT7700 ATU YH55. Phones and manual, exc condition, £190. Bearcat 220FB, 20 channel scanner, with manual. Exc condition, £110. Both buyer collects. Tel: (0792) 864994.
■ Yaesu FT101ZD complete with fan, mic, dc PSU and low pass filter, £375. Tel: (05255) 2207 (Bedfordshire).
■ FL200B SSB transmitter, Yaesu Sommerkamp 10-80m. FR100B communication receiver. Yaesu Sommerkamp HF 10-80m, both in good working order. The pair £185 ovno. D G Jenkins, 40 Fraser Street, Bedminster, Bristol BS3 4LY.
■ Hallicrafter Skychampion receiver. Yaesu FRG7700 with FRT7700 receiver. Grandstand base, 40 channel CB Audioline, 40 channel CB. Commtel 934, 12 element and colinear. Offers? Sid. Tel: Canterbury (0227) 451525.
■ G3PLX Mk 2 board, converts RTTY to Amtor, £80. Philips N1501 video recorder, two tapes, £35. Pye Pocketphones PFI on SU18 with xtals for RB2 and RB4, nightcall, spare Ni-cads, £30. Creed 75 (115V) £5. Modem 300/300 baud (big and heavy) £30. Transtel dot matrix printer, 50 and 75 baud baudot. £55. G4VFT QTHr. Tel: Horndean (0705) 591853.
■ Icom 290E multi-mode. Tx/Rx HM10 mic. SM5 base mic, 9 ele tonna, all vgc, no mods, manual, £290. No offers. Or swap HF rig 707, TS120V 101E, 101Z or sim, WHY? Prefer London area. Cannot deliver. New G0. Please tel: 01-200 3825.
■ 50 x 60 Astral telescope. Haley's comet is coming! Will swap for 70cm converter or 2 metre RF pre-amp. CB transceiver or pair 6146s. G8BSK, 290 Priory Road, St Denys, Southampton SO2 1LS.
■ FT290R, listen on I/P 144-149MHz, Ni-cads, case, mains charger, rubber helical, mobile mount, £230 ono. Must go this month, good condition. Datong gen coverage converter PCI, converts 2m rig to 0-30MHz, good results with above. GW1BNE QTHr. Tel: (0443) 423295 (24hr Ansaphone) or (0582) 33885 and ask for Andy.
■ Trio TS780 all mode dual band VHF/UHF transceiver. Little used, £690 ono. FDK 2 metre 750E multimode transceiver with 70cm 430 expander, £390 ono. Perfect condition. D J Gray. Tel: Nottingham (0602) 264533 (home).

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■ FT707 HF Tx/Rx eight bands, SSB, CW, AM plus 100 watts FM. FC707 ATU, FV707 DM memory bank, FP707 PSU, all mint condition and boxed, £595. May split. G0BEE. Tel: 01-958 6400.

■ Trio 9130 25 watts, FM, SSB, CW, £360 ovno. Tel: Bognor Regis 829602.

■ KDK2030 two metre FM, 25W out. Very good condition, 15 months old, used very little, original packing, complete with mounting bracket and scanning mic. Ten memories, 144 to 146. Can be heard working. £100. Prefer buyer collects. G3BGR, 33 Arden Road, Worcester WR5 3BD. Tel: (0905) 356576.

■ Icom IC240 mobile FM 22 CH, 144-146MHz, Belcom SSB, VFO, RIT, liner 2, desk mic (Shure), power supplies, 5-6 amp and 6-8 amp. Both regulated and stabilised. New Z-L special, 5 ele beam, Eagle 30W mono-public address amp, IC240, £80 ono. Liner 2, £60 ono. Shure mic, £15. Eagle amp, £30 ono. Power supplies, £7 (5A), £9 (6A). Tel: Wolverhampton 20636.

■ Parts: all used, tested, good working order. First local OSC: high band, £8. 10.7 amp, £6. Second mixer/amp, £8. Second local OSC, £7. Discriminator/amp, £8. Mute/standby, £10. Audio amp, £12. Tx OSC multiplier, low band, £17. First PA: high band, £5. Second PA: low band, £10. Modulator, £8. Transducer, £5. Aerial, £5. Volume switch, £5. Steve. Tel: Portsmouth (0705) 831641.

■ Oscilloscopes: Gould OS300 dual beam with case, probes, manual. Condition as new, £250. Hameg HM203 dual beam with case, probes, manual, seldom used, vgc, £140. Analogue multi-meters various, all vgc, overhead protector 3M type G213. Seldom used, spare lamps, £250. Logic monitor GSC type LM1. Unused, still sealed in original package. Tel: (0324) 713037.

■ Mullard 5 inch double trace CRT D13/27GH with base screen mount and graticule, £5. 6 x ECF82 valves, few hours use, £3. Wearite 'P' coils, PA4, PHF4, PO4, PHF5, PO5, PA3, PHF2, £3. Crossover unit 3 ohms, £1. Postage extra. Tel: 01-452 7618.

■ Sealine 56 channel VHF marine R/T 25W dual watch, simplex, semi-duplex, £210. CTVR-40 40 channel 46MHz LT 5W, convertible to 50MHz, no details, mint, £125 for quick sale. Tel: Mr Fred Greene. (0246) 211254.

■ Yaesu FT230, one month old, boxed as new, never used on Tx, £200 ono. House purchase forces sale. Tel: (0723) 364149.

■ Lowe SRX30 comms receiver 1.5-30MHz, as new, £100 or exchange for Sony ICF2001D or for Uniden CR2021 comms receiver. Also have LCL2740 FM signal meter, needs repair, in box with circuit diagram, manual, £7. Also HAC Mk3 DX kit, £12. (Includes instructions). Buyer collects. Mr K Pullen, 210 Hollett Road, Penfilia Estate, Treboeth, Swansea SA5 9ER, S Wales.

■ Swap my 26 inch Ferguson Colorstar transistor TV, sliding doors, legs, teak colour cabinet, vgw. For a short wave receiver in gwo, WHY? Cannot deliver. QTHR. Mr Aldridge. Tel: 01-200 3825. NW London.

■ 5 element 144MHz Yagi, £5 + £2 p&p. Good condition. Tel: Worksop (0909) 771015.

■ Trio R2000, worth over £400 fitted with VC10 1.30MHz to 118-178MHz full scan worth over £100. Tonna 144/9xpf 9ft antenna with poles. All fully working and operational, can test. £450 ono. Mick. Tel: (0295) 710148 after 6pm.

■ FRG-7 analogue dial and manual, £115. Drake SPR-4, has 23 crystals and manual, £300. CWR610E video output and Novex 12/500MG amber VDU, £250 the two. Buyer to collect. Please write to: Radford, 10 St Paul's Avenue, Hyson Green, Nottingham NG7 5EB.

■ Zetagi BV131 linear amp converted to 10 and 15 metre bands. Also works well on 11 metre band. 100W AM/FM, 200W SSB. Excellent condition. £80 or nearest offer. Ring any time after 4.30pm and ask for Paul. Tel: Congleton 275158.

■ Yaesu FTV901R transverter, 144MHz module fitted, mint condition. £150. Datong D70 Morse tutor. £35. muTek SLNA 144S pre-amp. £20. G6YEK QTHR. Tel: Paignton 527603 (evenings).

■ BC348 Rx with built-in mains supply. £25. TCS Rx with power unit and speaker. £25. AT5 Tx with Codar mains power supply. £30. G4FUY QTHR. Tel: Reading 733633.

■ Trio general coverage receiver, digital display 0-30MHz boxed. £190. Hitachi stereo cassette radio

recorder, four band. £130. CB transceiver ST9, DX, FM, AM, LSB, USB, good condition. £100. Tel: 01-207 0706, or 01-207 2326.

■ Trio TS430S 160m-10m with new WARC bands plus general coverage receiver. Please ring Dave or Brian. Tel: (0772) 321608.

■ National HRO receiver, table model MX, in original mint condition with type 697 PSU, eight boxed coils covering 50kHz-30MHz, plus bandspread coils for 40/80 metres. Numerous spare valves and parts including new dial and S-meter, manuals and other literature, provides complete details of Rx and its servicing. A rare opportunity to obtain this equipment in exceptional condition. £120. Mr R A Parker, 57 Minet Drive, Hayes, Middlesex UB3 4ES.

■ Trio TS510 Tx/Rx plus PS510 PSU. £190. Z-match ATU H/B. £10. Bremi BRL200 linear. £40. National HRO receiver plus PSU, full set coil packs. £60. National HRO MX receiver, collectors' item plus PSU, SPU697 unused in original wrapping. Full set coils, valves, original manual. £120. Solartron PSU 0-500V and 6.3V at 5 amp variable and stabilised. £20. Tel: St Albans 39333.

■ Kenwood station monitor scope SM220, spotless, new. £200. PRO30 handport scanner, 68-512m with service manual special, realign front end for mag review. Bargain £200. Tel: (04738) 5526, anytime 9am to 9pm.

■ FT290R with muTek and Nicads. £220. FT208R, speaker mic. £150. NC-8 PSU/charger for FT208R. £25. Sony ICF2001 receiver and multi-voltage transformer. £70. Mizuho Sky-coupler KX-2 receive ATU. £15. Hansen SWR-35 SWR/power meter. £15. Amplivox headphones/boom mic. £10. HB9CV and ½ aerials, both 2m. £15. Will G6TXA, QTHR. Tel: 01-785 2252.

■ Fidelity 3000FM. £70 or exchange for 9R59DS and ATU. N Beadsworth, 34 Heron Way, Clooney Estate, Waterside, Londonderry, N Ireland. Tel: 46871 (after 7pm).

■ Trio general coverage receiver, type 9R59DE, complete with Rama digital readout, vgc. £70. Jaybeam 12XY/70cm complete with cables, N-type plugs. £25. 70cm phasing box for above antenna, ie vertical-horizontal, clockwise-anti-clockwise. £10. Sherratt, 32 Springfield Way, Cranfield, Beds MK43 0JN. Tel: Bedford 751475.

■ 1932 McMichael 4 valve mains radio in polished wooden case on turntable. Not at present in working order. Any offers? Tel: Sheffield 663105.

■ Altron AT32 32ft telescopic tiltover lattice tower, unused with base ground socket, winch and all fittings. £300. C S Beynon GW3WSU, Bungalow No 1, Racal-Decca Tx Station, Llancrean, Barry, S Glam CF6 9AE. Tel: (04668) 261.

■ Icom 745 transceiver. £720 (list £900). Icom desk mike. £20 (list £35). Drae 24A power pack. £95 (list £125). Microwave 2m transverter. £90 (list £110). All above as new, boxed, with handbooks etc. Will separate. (G6ZGZ). Mr Byford, 24 Humphries Close, St Cleer, Liskeard, Cornwall PL14 5DP. Tel: (0579) 42384.

■ Grundig Communicat receiver, Satellit 600 Prof, hardly used, superb global reception, latest model, 1984. £280. Carlos Oims. Tel: 01-499 1673 (after 6pm or at weekends).

■ Kenwood TS430S, 150kHz-30MHz, used Rx only. £620. Kenwood power supply PS430. £70. ATU AT250. £200. Kenwood mic and Yaesu lightweight headphones. C/W radio, all boxed, vgc. Paid £1,120, will accept £850 ono for the lot. Tel: 01-310 1717.

■ KW2000A transceiver and power supply, with service manual, in working order, needs a set of PA/6146 valves. £85. 3A Chapel Lane, Lathom, Nr Ormskirk, Lancs L40 7RA. Tel: 894860.

■ Trio TS130V HF transceiver, covers 80m through to 10m with new bands and digital display. An excellent rig for SSB and CW, in top condition with original packing and manual. G4ABT, Nottingham. Tel: (0602) 847728.

■ Marine VHF radio telephone, Rediphone Sealand 66, navy type 1202, fully synthesised 24V/240 ac, vgc, cost new about £5,000. Exchange for r/c aircraft or helicopter or HF transceiver or anything interesting in radio. Colwyn Bay, Clwyd, N Wales. Tel: (0492) 514568.

■ KW204 Tx mtr with manual, spare 6146s. £90. G3RNB, Williton Lodge, Williton, Somerset TA4 4DL. Tel: (0984) 33115.

■ Sharpe GF525 twin deck radio cassette, 6

months old, immaculate. £100 or exchange Best 2m Tx/Rx or 80m SSB/CW Tx/Rx. Write with details. Chris, 188 Trehafren, Newtown, Powys SY16 1QB.

■ Sommerkamp FT7B 50W mobile or base HF Tx/Rx. Complete with manual, mic, mobile mount, headphones, homebrew ATU and SWR unit, commercial half size G5RV aerial and leads. £280. G4ANW. Tel: (0730) 61859, soon.

■ HF antennas for all locations, Moxon. The ARRL antenna book. VHF handbook for radio amateurs, Brier and Orr. Oldfield, 49 Stansfield Street, Todmorden, Lancs OL14 5EB. Tel: Todmorden 6165.

■ Yaesu FT290, with case, fitted muTek, Nicads and charger. £275. Also rotator and 5 ele beam collin. £30. Vic comp with 8K mem exp, super exp plus various items software. £75. All mint condition. John Garrott, PO Box 1, Cardonald, Glasgow G52 3TQ. Tel: (041) 883 5442.

■ Philips PAL colour TV pattern gen, model PM5508, UHF/VHF, good condition, cost £350, sell for £95. Or exchange for 2m transceiver. Tel: Stirling 64161.

■ FTV707 transverter with 2m module. £100. CTE speedy linear. £65. D Smith, 19 Ronay Street, Cambus Court, Cambusnethan, Wishaw.

■ Yaesu FT901 DM-HF transceiver, voice processor, lmbic keyer, reject filters, memory, VOX, FM, absolutely mint condition, Kenwood AT200 antenna tuner, mint, Kenwood MT50 dynamic microphone. £850. May take 2 metre multimode p/ex. Tel: Cosham (0705) 370576 (anytime).

■ Exchange Yaesu FT730 10W 70cm rig with two 3½ collinears (one base and one mobile, complete with gutter mount). All under six months old. Also Yaesu boom mic and switching box for above. Swap for FRG7700, FT77, FT707, R2000, WHY? Ian G1HQK QTHR. Tel: 01-385 2373.

■ 144MHz wavemeter. £25. 100W linear. £50. Camera Fujica (ST605N) and case f=55mm. Hoya auto zoom lens f=80-205mm. Printiflex auto vario converter and case 2-3X. Rowi zoom slide duplicator, boxed, never used. One filter. Camera equipment. £150 ono. Chatham area. Tel: Medway 682809.

■ Selling vintage books: *Admiralty Handbook of Wireless Telegraphy*, vols one and two, 1938 edition, 1940 reprint. *Wireless Direction Finding*, Keen, 4th edition, 1947. *The Elements of Radio Communication*, Brown and Gardiner, 2nd edition, 1946 reprint. *Basic Mathematics for Radio Students*, Colebrook, 1945. *Modern Practical Radio and Television*, vols one, two and three, plus circuits and data book, Quarrington, 2nd edition, 1950 reprint. Oldfield, 49 Stansfield Street, Todmorden, Lancs OL14 5EB. Tel: Todmorden 6165.

■ HF linear amp, very high amplification 5 in 500W out (meter won't measure more!) spare valve QV08/100 (new £145), internal PSU, fan, must go, offers, p/ex or WHY? Yaesu HF ATU FC901 will handle 500W, offers? Try 10m FM new Harrier CB. £20. Used Sapphire, vg rig. £15. 19 set owner's origin army manual. £10 plus carriage. Lots of other stuff. Martyn Bolt G4SUI, 112 Leeds Road, Mirfield, West Yorks WF14 0JE. Tel: (0924) 495916.

■ Yaesu VHF handheld FT208, Nicads charger, soft case, rubber duck, manuals, power 2.5W or 300mW digital display 10 memory (Model B). £140 ono. Yaesu 70cm handheld, as above, power 1W 430-440MHz, very good condition. £160 onp. Speaker mikes for rigs, one each. £15. NC8C base station charger PSU, vgc. £50. Lots of other stuff. Martyn Bolt G4SUI, 112 Leeds Road, Mirfield, West Yorks WF14 0JE. Tel: (0924) 495916.

■ Grundig Satalit 3400 portable receiver with frequency counter built in, cost over £400 new, a superb piece of equipment, would accept £195 or exchange for FT790 or similar 70cm gear. Maybe even a transverter. Brian Barwick, 100 West Wood, Golcar, Huddersfield HD7 4JY, not QTHR.

■ Trio JR310 SSB receiver. Covers 160, 80, 40, 30, 20, 15, 10, 10 bands. Nice condition and good working order. Buyer must collect Saturday or Sunday. Fitted narrow band filter and variable audio filter. £95 cash only. Original packing box. Also Trio manual with circuits. Alternative aerials selectable on front panel, also link or direct coupling to sets aerial coils. Mr Walker, 35/37 Brighthouse and Denholme Road, Opposite Rag-galds Inn, Queensbury, Bradford, West Yorkshire.

FREE CLASSIFIED ADS

■ RTTY 16K ZX81 with Maplin keyboard in smart custom metal case, scarab system interface board tape program and cassette recorder. £40 ono. Pye Cambridge 6 channel AM boot mount, on 160ish MHz. Ideal for converting to 2 metres, complete with mic, speaker, control box and lead. £25 ono. Mr Dimmock, 13 Stephenson Way, Bourne, Lincs PE10 9DA. Tel: Bourne 423433.

■ Daiwa SR1000 channel receiver, 151-149MHz FM. Ideal for someone studying for RAE. Brand new and boxed. 5/8 module aerial only, £65. G1NOL, QTHR. T J Jones, 54 Thornbera Rd, Bishops Stortford, Herts. Tel: (0297) 56017 after 6pm.

■ Trio TR2300 + VB2300 PA FM transceiver + charger etc. + Heather-lite mobile mike, all £140. Yaesu FRG-7 receiver, no mods, £125. All excellent condition. G4MET. Tel: (0457) 64322.

■ Marconi CR100, good condition, offers. Tel: (0934) 21248.

■ Microwave Modules 10 metre pre-amp MMA28, £10. KW202 receiver, KW204 transmitter, 100 watts CW/SSB, 160 metres - 10 metres, and KW107 Supermatch, £290. First 16 issues of *Radio and Electronics World*, Oct 1981 to Jan 1983, any reasonable offer? Microwave Modules 700cm linear amp. MML 432/50, £75. Microwave Modules 2m linear amp. MML 144/100-S, £95. Tel: (0926) 498388.

■ Trio 7730 2m FM 25W transceiver, installed in glove compartment of 1980 Austin Maxi 1750HL, 42,000 miles, rare automatic, good condition, regularly serviced, Pioneer stereo with electric aerial, Waso ultrasonic alarm, Kenwood boom mic, SO239 wing mount, £1,850. Also Trio 8400 70cm FM 10W transceiver, interchangeable with 7730, £150 extra. Either rig without car £175. G4OHB. Tel: (021) 449 3530.

■ Super Star 360 FM, many mods, legal stamp, etc. £125. Ham International Concorde three, £150. Zetagi mobile linear, B300 model, £65. CTE speedy linear, mains as new, £45. Various power mikes from £7. Alcom half-wave twig, £7. Tel: Reading, Berks 411501.

■ CB home base. The lot for £50 + P&P. Over 10 items. Bob. Tel: Keynsham 67737, after 6pm please.

■ Hygain V, 26.065-28.045, FM/AM/SSB, modified FM modulator, £120. Ham International Viking 2, 26.065-28.045, FM/AM, £85. Both as new. Modifiable for 10m. Wanted: 2m receiver. Tel: (0295) 69367.

■ Pair of TT21s, unused and boxed, £60. Also 4 over 4 skelton slot antenna for 2m, £20. 64 Ainley Road, Birchencliffe, Huddersfield. Tel: (0422) 73470.

■ Commodore 64 home computer with C2N tape recorder. Plus various software games and joystick, £130. Tel: 01-527 7528.

■ Barlow Wadley Mk2 XCD30 crystal controlled receiver. .5kHz-50MHz. Portable or PP 9 volt, AM, USB, LSB, or swop for CB USB LSB FM. Tel: (4716) 604716.

■ Absolute bargain, Yaesu FT77 (100W), £350 - never used Datong D70 Morse tutor, £35. Buyer arranges carriage. Tel: (0656) 61868 (evenings only).

■ Music centre £150. Search nine receiver £43.50. Two metres Sony ICF2001 portable communications receiver, £80. Handheld CB £25. Mobile CBs, one at £25, one at £30, both legal 27/81. CB base station box £8. Commtron nato CB legal FM + USB AM. Might be good for ten metres, £30. Mike, 14 Doverfield Road, Brixton, London SW2 5NB. Tel: 01 674 0513, 6.30-8.30pm.

■ Trio R2000 receiver 0 to 30MHz. Mint condition, as new, cost £480 accept £375 ono. May exchange for Yaesu FT7B with cash adjustment, must be mint. Tel: Irvine 217611.

■ For real HF DX Hygain Long John Model 205BA five element 20m beam, £175.00. Moseley Elan 3 element 10 & 15m beam, £50.00. Both ono. Thurlow, G3WW, QTHR. Tel: (0354) 740255.

■ 70cm Pye PF70, with batteries and charger, £70. BNC coaxial relay, 2-pole 2-way, 24V coil, dc to 1GHz, 10 watts max, £10. VHF noise figure test set with PSU, £15. CW stereocode processor £15. 3cm waveguide hardware and components. Pre-war wireless hardware, valves, books and mags. Please state wants with SAE. Alan Williams G3KSU, QTHR. Tel: Ryde (0983) 65551.

■ Pair pocket-phones, Xtal RB8, plus night call, charger amplifier, spare nicads, three Rxs. Trio JR310 amateur receiver bwo, £90.00. Kenwood

TR8300 UHF Tx/Rx, even repeaters plus three simplex manuals, etc, £90.00. Contact John G6UGU QTHR. Buyer inspect, collect or carriage extra. Will take FL110 P/X on any item. Tel: (0302) 841530.

■ Yaesu FT270 RH synthesised 2mtr FM transceiver 45W high power SW low. 3 months old very little use, £280 ono. Also Kenwood World clock model HC-10, £25 ono. G Boughy, 56 Lynn Ave, Talke, Stoke-on-Trent ST7 1PA. Tel: (0782) 328561.

■ Realistic DX302 communications rec as new with aerial trimmer and manual, £100 or offers. Tel: Tamworth (0827) 59091.

■ Belcom LS102L as new with instructions, £225 ovno. Also, FT101 instruction book, £250. Ham multi mark 2 suitable for 10 metres. Hygain 5 suitable for 10 metres con, £100. Tel: (0283) 221870.

■ Oscilloscopes for sale: Cossor 1045K 4 inch single beam, £30 working. Cossor 1035 4 inch double beam, not working (power supply VS), £10. All with circuits. Tel: 01-748 1410.

■ General coverage receiver, Sony ICF2001, AM/SSB/CW with FM broadcast, PLL synthesizer, scanning, memory etc. World-wide stations and amateurs. Press-button the frequency to receive your stations. Complete with Sony mains adaptor, £90 carriage paid. Tel: (0258) 55495.

■ Yaesu FT101ZD converted for 11m & 45m. Also FC902 ATU SP901P speaker patch plus Shure 444mic, YH55 headphones, FF501DX L/P filter, £590. Also brand new Yaesu FRG7700 gen cov receiver with FRT7700 ATU, £315. All items boxed. Tel: Tommy Clements (051) 727 6840.

■ Swap KDK2025 FM, FT2FB, York JCB863, Maxcon HE, plus two mobile whip aerials for any HF Tx/RX or Tx in good condition. G0CJM (Roger) PO16 0DQ (3A).

■ AR2001 25-550MHz general coverage VHF/UHF scanner receiver, boxed, unmarked as new with guarantee. Complete with 30-500MHz discorne antenna H100 co-ax, power supply etc, £300. Tel: (021) 747 6842.

■ Icom R70 comm receiver fitted with FM unit and FL44A filter, service manual, Global AT1000 ant tuning unit, Datong DC144/28MHz converter and Slim Jim aerial, £450.00. Tel: Barnsley 382763.

■ Magpie autoscanner, crystal filter version, only seven months old, as new in box. In mint condition, £100 ono. Colin Richardson, 10A Jubilee Avenue, Grantham, Lincs. Tel: Grantham 67698.

■ Trio R2000 comms receiver 100kHz to 30MHz with ten memories and auto scan. Boxed with manual in mint condition still under guarantee £350 - going transceive. G0DBX. Tel: Louth (0507) 604419 evenings.

■ Olympus SLR gear available to swap for FRG7, or FTV901R transverter 2m or other FT902DM options. G1OLA. Tel: (020630) 4544 (Brightlingsea, Essex).

■ Pye West Minster, good worker, will convert to 70MHz 2m etc, £65. Split charge relay ideal for mobile or camping new, £15 (Lucas). Toshiba music centre SW, Rx good sound system, £350 ono. HF linear QRO uses QV08/100 tubes - check new price, £250 ono. Yaesu FP12 PSU spkr, £65. Yaesu hand-helds for VHF, UHF with all accs. Sell as pair, offers. Martyn Bolt, 112 Leeds Rd, Mirfield, West Yorks WF14 0JE. Tel: (0924) 495916.

■ FT290R 2metre multimode transceiver, carrying case, shoulder strap, mobile slide mount, batteries, charger, 3 antennas, 1/2, 1/2, halo. Microwave Modules 30 watt linear amp, cost over £425, for quick sale £250, no offers. G6XBS. Tel: (0702) 556891 evenings only.

■ Icom IC25E 2mtr FM scanning mic, 25W, five memories, as new, original packing, £195. G6OCH, QTHR. Tel: 01-647 6334.

■ Tentec omni A trncvr, PSU, £450. FT301SD trncvr, 10 watts, 160-10, AM, SSB, CW, narrow filter fitted, mobile bracket, manual, £300. Sphinx Tx 160-80-40-20 AM, SSB, CW, new tubes £55. Drake 2B Rx, 160-10, very selective, £99. 10 mtrs mini 3 element beam £20. 70cms triple colinear GPV7 £25, RG68U co-ax, offers. Tel: (021) 430 6764 (John).

■ Vic 20 intro to basic, £3.00. Pye Cambridge dash mount, £15. Packs of resistors, new, many valves, 30 pence per pack or 4 packs for £1.00. Acorn electron Morse tutor program, £2.50. New semi-conductor packs, £3 per pack or 2 packs for £5.00. RTTY gen Tx board £5.00. Over voltage crow bar protection module for 13.8V PSU, £5.00. G Martorano, 81 Sapcote Drive, Melton Mowbray,

Leics. Tel: (0664) 500228.

■ Hallicrafters S27 VHF Rx 27.3 to 143MHz, ex US navy AM, FM, SSB, CW works well, £75 with manual. Barry Stone G6SRE, Ashford (Kent) 25991.

■ Scanner receiver SX200N, excellent condition. Original packing and manual, £195. Tel: G3IWE, Warrington 601485.

■ Colt Excalibur home base transceiver LSB USB AM FM, immaculate condition, £150. Tristar 747 mobile CB transceiver LSB, USB, AM, FM, £60. Avanti Sigma TV 1/2 vertical home base antenna, £30. Zetagi 28-30MHz 200W linear £50. KW204 160 to 10m Tx 150W SSB/CW, new mains transformer, some spare valves, mic, manual £100. Mr C J Graham, 8 Oaktree Drive, Ecclefechan, Dumfries DG11 3EH. Tel: (057) 63494.

■ Complete 2 metre station. Icom IC211E with muTek front end, matching SP3 speaker, Addonis desk mic, RTTY, TV, Scarab RTTY, prog and interface for Spectrum 10 amp PSU, Hirshman rotor and Bearing SWR/PWR bridge, ant power splitter, 2 9 ele crossed beams, co-lin ant all in excellent cond, £500. Tel: 01-803 5235.

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■ FT101E unmarked with FM, plus UK CB, fan, all mode, £400. Sommerkamp 788DXCC all mode high power mobile, £250. FT101ZD little used, £500. Alumast by Western Electronics, base, rotor-mount. Unused, £250. Tel: Hayle 754369.

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■ Any info, circuit, service manual etc for Ultra Electronics portable Tx/Rx type 3A4A83. 3 channel, believed low band AM. Also require info, service sheet etc for old Furzehill scope type 1684D/2. All letters answered and all costs refunded. Nick G6AJY, 30 Auckland Road, Kingston upon Thames, Surrey. Tel: 01-549 1983 evenings

■ Codar AT5 transmitter and ac PSU, also ATU 160m to 10m. Mike Wyse G3IWE. Tel: Warrington 601485

■ Six metre or four metre converter for Yaesu FR101 receiver and any advice on possible frequency counter for FR101. Tel: Eric on Wrexham 262757

■ Any information or circuit diagrams for an HRO solid-state receiver, or anyone who might be able to help - the synthesiser won't lock. Brian. Tel: 01-736 6581, evenings

■ FT290R mobile mount. Hogg G0ANF. Tel: Penzance 63084

■ Sinclair frequency meter type PFM200 20Hz to 10MHz, 5MHz to 200MHz and mains unit, GWO please. AR Brackenborough, 41 Poets Corner, Margate, Kent CT9 1TR. Tel: (0843) 225445

■ Please, someone must have a Yaesu YK901 keyboard to link up with YR901 RTTY reader. Phone any evening. Tel: Colchester 394336 (Essex)

■ Does anyone keep a file of modification articles for the FT101 series transceivers? Any articles or references promptly returned. All costs refunded. All replies answered. Also wanted service manual FT101B. GW4BCB, Dr K R Johnston, 68 Heol Isaf, Radyr, Cardiff

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■ Yaesu FT101ZD or Yaesu FT102. Dave or Brian. Tel: (0772) 321608

■ Radcom and QST magazine reviews of Yaesu FT301 Tx/Rx and accessories, expenses paid. Tel: St Albans 39333

■ FRG-7 Trio 9R59DS 5RX30D or SRX30 and marine r/t. N Beadsworth, 34 Heron Way, Clooney

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■ Racal RA73 converter (100kHz to 455kHz). Tel: Vernon Keck (0532) 866435

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■ Service manuals or any data on Hallicrafters SX42 LF to VHF receiver. Photo-copying and post paid for. Also any mods. Mr A A Dean, 3 St John's Cottages, Charlton, Musgrove, nr Wincanton, Somerset.

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Amateur RADIO

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LS37	24p	LM382N	2.00
LS74	33p	LM386	0.99
LS122	68p	M387	2.00
LS138	44p		
LS139	58p		
LS151	70p	LM389N	1.60
LS155	55p	LM3914N	3.10
LS157	45p	LM3915N	3.45
LS158	58p	555NE	0.80
LS160	62p	C-mos555	0.88
LS161	68p	741	0.35
LS162	70p	SAS560S	1.85
LS163	68p	SAS570S	1.85
LS166	1.50	TA7205AP	1.30
LS170	1.40	TA7222P	2.32
LS244	0.80	TA7222P	2.32
		TDA1004	4.95
		TL072	0.75
		TL081	0.35
		TL084	1.10

TRANSFORMERS	
British made transformers at very attractive prices.	
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240v	6-60v 500mA 85p 60p 48p
Carriage 45p per transformer £1.60 per 10	

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TRANSISTORS		DIODES	
Type	Price (£)	Type	Price (£)
AC127	0.28	BB105B	0.30
AC128	0.30	BB105G	0.48
AC128K	0.34	BC110B	0.42
AC141	0.58	BC107	0.10
AC141K	0.38	AorB	0.12
AC142	0.56	BC108	0.10
AC142K	0.38	A Bor C	0.12
AC151	0.45	BC113	0.42
AC152	0.45	BC114	0.12
AC176	0.30	BC115	0.12
AD149	0.72	BC143	0.28
AD187	0.28	BC117	0.22
AD187K	0.38	BC118	0.18
AC188	0.38	BC119	0.28
AC188K	0.38	BC125	0.14
ACV41	0.90	BC140	0.27
AD142	0.80	BC141	0.28
AD143	0.88	BC142	0.24
AD149	0.72	BC143	0.28
AD161	0.42	BC147	0.18
AD162	0.52	AorB	0.14
AD161/162	1.20	BC148	0.10
AF114	1.20	AorB	0.12
AF115	2.10	BC149	0.10
AF116	2.10	BC157	0.12
AF119	1.85	BC158	0.12
AF121	0.56	BC159	0.12
AF124	0.42	BC160	0.30
AF125	0.58	BC161	0.30
AF126	0.58	BC168B	0.20
AF127	0.38	BC169C	0.12
AF139	0.40	BC170	0.18
AF178	2.28	BC170B	0.18
BA139	0.80	BC171	0.10
AF279S	1.40	BC171	0.14
AL100	5.40	AorB	0.08
AL102	4.40	BC172	0.18
AS90	5.20	AorB	0.12
AU110	2.80	BC177	0.24
AY102	4.32	BC178A	0.30
BA110	0.68	BC182	0.10
BA121	0.42	A Bor C	0.09
BA129	0.38	BC182L	0.12
BA148	0.16	A Bor C	0.09
BA154	0.12	BC183	0.10
BA155	0.12	A Bor C	0.10
BA157	0.28	BC183L	0.10
BA164	0.14	A Bor C	0.10
BC184L	0.10	BD136	0.26
A Bor C	0.10	BD137	0.28
BC207	0.18	BD138	0.30
BC208	0.45	BD139	0.30
BC212	0.10	BD140	0.28
A Bor C	0.10	BD144	1.82
BC212L	0.09	BD145	1.82
A Bor C	0.10	BD150A	0.68
BC213	0.10	BD160	1.58
A Bor B	0.10	BD165	0.48
BC213L	0.10	BD183	0.70
AorB	0.10	BD201	0.52
BC237	0.11	BD202	0.57
BC238	0.14	BD204	0.57
BC239C	0.16	BD222	0.80
BC251	0.14	BD225	0.40
A Bor C	0.14	BD232	0.45
BC301	0.30	BD234	0.30
BC302	0.30	BD235	0.30
BC303	0.30	BD236	0.38
BC307A	0.18	BD237	0.38
BC323	0.90	BD410	0.76
BC327	0.18	BD434	0.58
BC328	0.16	BD438	0.58
BC337	0.12	BD439	0.88
BC338	0.12	BD507	1.05
BC339	0.12	BD518	0.88
BC340	0.38	BD520	1.20
BC344	0.40	BD699	1.89
BC347	0.58	BD707	0.74
BC348	0.12	BDX18	1.60
BC349	0.12	BDX32	1.48
BC359	0.10	BF115	0.32
BC359C	0.10	BF117	1.05
BC359C	0.10	BF119	0.82
BC359C	0.10	BF120	0.38
BC359C	0.10	BF125	0.42
BC359C	0.10	BF127	0.44
BC359C	0.10	BF154	0.23
BC359C	0.10	BF157	0.46
BC359C	0.10	BF158	0.30
BC359C	0.10	BF160	0.23
BC359C	0.10	BF167	0.32
BC359C	0.10	BF177	0.42
BC359C	0.10	BF178	0.26
BC359C	0.10	BF180	0.27
BC359C	0.10	BF181	0.27
BC359C	0.10	BF182	0.32
BC359C	0.10	BF183	0.32
BC359C	0.10	BF184	0.32
BC359C	0.10	BF185	0.32
BC359C	0.10	BF194A	0.15
BC359C	0.10	BFY50	0.22
BC359C	0.10	BFY51	0.22
BC359C	0.10	BFY52	0.22
BC359C	0.10	BFY90	0.80
BC359C	0.10	BFY90S	1.34
BC359C	0.10	BR100	0.25
BC359C	0.10	BR101	0.40
BC359C	0.10	BR103	0.50
BC359C	0.10	BRY39	0.30
BC359C	0.10	BRY89	0.50
BC359C	0.10	BSX19	0.32
BC359C	0.10	BSX20	0.30
BC359C	0.10	BSX59	0.78
BC359C	0.10	BSX76	0.65
BC359C	0.10	BT100A/02	0.90
BC359C	0.10	BT101 300	2.75
BC359C	0.10	BT101 500	3.20
BC359C	0.10	BT102 300	0.30
BC359C	0.10	BT106	1.15
BC359C	0.10	BT108	1.25
BC359C	0.10	BT109	1.15
BC359C	0.10	BT116	1.20
BC359C	0.10	BT119	3.30
BC359C	0.10	BT120	3.50
BC359C	0.10	BT121	2.98
BC359C	0.10	BT138/600	0.30
BC359C	0.10	BTY79 400R	2.80
BC359C	0.10	BU100A	2.30
BC359C	0.10	BU104	1.60
BC359C	0.10	BU105	1.20
BC359C	0.10	BU105/02	1.58
BC359C	0.10	BU108	1.78
BC359C	0.10	BU108AAE	0.60
BC359C	0.10	BU126	1.40
BC359C	0.10	BU133	1.40
BC359C	0.10	BU204	1.30
BC359C	0.10	BU205	1.30
BC359C	0.10	BU206	1.50
BC359C	0.10	BU208	1.40
BC359C	0.10	BU208A	1.40
BC359C	0.10	BU209/02	2.05
BC359C	0.10	BU326S	1.75
BC359C	0.10	BU407	1.10
BC359C	0.10	BUX80	3.70
BC359C	0.10	BUY20	2.75
BC359C	0.10	BUY69A	2.60
BC359C	0.10	BUY69B	1.98
BC359C	0.10	BY122	0.80
BC359C	0.10	BY126	0.10
BC359C	0.10	BY133	0.08
BC359C	0.10	BY135	0.38
BC359C	0.10	BY164	0.48
BC359C	0.10	BY179	0.58
BC359C	0.10	BY182	0.80
BC359C	0.10	BY184	0.38
BC359C	0.10	BY187	0.88
BC359C	0.10	BY207	0.16
BC359C	0.10	BY210/400	0.21
BC359C	0.10	BY210/600	0.24
BC359C	0.10	BY210/800	0.28
BC359C	0.10	BY227	0.47
BC359C	0.10	BY228	0.48
BC359C	0.10	BY238	0.88
BC359C	0.10	BYX10	0.20
BC359C	0.10	BYX36/150	0.40
BC359C	0.10	BYX36/600	0.48
BC359C	0.10	BYX48 300	0.70
BC359C	0.10	BYX55 350	0.98
BC359C	0.10	BYX55 600	0.30
BC359C	0.10	BYX71 600	1.18
BC359C	0.10	BYZ12	0.78
BC359C	0.10	CI06D	0.48
BC359C	0.10	E1222	0.32
BC359C	0.10	E5024	0.30
BC359C	0.10	GET782	0.60
BC359C	0.10	ME12002	3.34

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