SEPTEMBER 1985 £1.10

Amateur RADIO

For all two-way radio enthusiasts

934MHz equipment: some recommendations

Beginners' Workshop: build a VFO

G3OSS tests: Icom IC735

BACK TO BASICS

R WITHERS

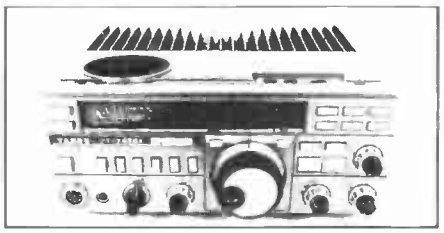
584 HAGLEY ROAD WEST, OLDBURY, QUINTON, B68 0BS BIRMINGHAM. M5 JUNCT 3

COMMUNICATIONS

BIRMINGHAMS MAJOR INDEPENDENT SERVING THE UK

YAESU

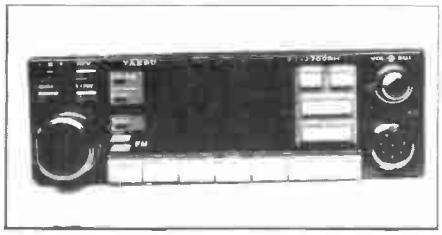
AN HF BEST SELLER
FT757GX



★ 100 Watt multimode ★ AM,FM, CW, SSB
★ Gen coverage RX ★ Computer compatible
★ Available with RWC mod fitted

YAESU

THE ULTIMATE 2mtr/70cms MOBILE
FT2700RH



* Full duplex * A big 25 watts on VHF/UHF.
* 10 channel memory * Scanning * LCD display/'S' meter.

NEW PRODUCTS EXCLUSIVE TO R.W.C.

ICOM

NEW EXCLUSIVE DUAL BANDER
IC3200E

* Simplified front panel * Simplex/Duplex memory
* Built in duplexer * Smallest in its class.

ICOM

THE HIGH-TECH ALL BAND HF TRANSCEIVER
IC745

* 16 tunable memories * Gen. coverage RX
* Scanning * Deep IF notch filter *

RAYCOM MODULAR RF AMPLIFIERS

A complete range of linear and fm amplifiers for use with both VHF and UHF hand portables and multimode portables such as the YAESU FT290R and FT790R. Power output from 15W to 45W depending on model. (eight are available) All units feature Mitsubishi or Toshiba power modules as used in the majority of mobile and base radio transceivers. Two versions are also available for business radio applications.

PRICE from £39.50 for the 15W vhf model + £2.00 post

UHF UNITS (430-440MHz)

	ORDER CODE	PRICE
25W FM/CW	U25F	£79.50
15W FM/CW/SSB/AM	U15L	£69.50
15W FM/CW	U15F	£59.50

(FULL RANGE OF POWER MODULES IN STOCK)

VHF UNITS (144-149MHz)

	ORDER CODE	PRICE
45 FM/CW	V45F	£62.30
35 FM/CW/SSB/AM	V35L	£59.50
25 FM/CW	V25F	£48.50
15 FM/CW/SSB/AM	V15L	£49.50
15 FM/CW	V15F	£39.50

Raycom Limited

A.R.M.

A.R.M. MULTI P6 ANTENNA

Probably the most versatile Antenna ever designed

PRICE £39.25
+ £2.50 carriage

This is one of the most exciting new products to be launched by RWC and is the result of many months of development by Antenna Research Manufacture based in Devon. The antenna has been designed to meet the growing popularity in multimode portable and mobile operation and is capable of being used on both vhf and uhf in both horizontal and vertical polorization modes, both portable and mobile. The antenna has the facility of being used as both omni-directional modes as well as having capability of DF function. No ground-plane or radials are required and the antenna can therefore be used in a variety of applictions on frequencies between 140-450 mhz. Colinear elements £4.75.
★ SEE THE REVIEWS ★ or SAE LEAFLETS

10 Mtr MOD BOARD

PRICE £22.50
+ £1.00 post free packing. Kit now available at £17.50

This is a complete modification board designed to fit all CB radios that incorporate the SANYO LC7137 series of synthesizer chip, the unit comprises of a small pcb with six microchips and fits almost all current legal (CB 27/81) radios, the unit is supplied with full fitting instructions and can be fitted easily by most enthusiasts, with the current upsurge in interest in this band demand has been high as this means that over 90% of current CB radios can now be used on 10 mtr amateur band. See other ads for more information. Over 300 sold in 2 months! Complete radios available & other kits.

ANNOUNCING THE SUPER YAESU FT757GX —

MOD BOARD UNIT from Raycom

- The modification serves two major purposes
- (1) to improve VFO tuning and eliminate 'TUNING GLITCH'
- (2) to increase tuning speed from 5khz per dial revolution to 50khz per dial revolution (selectable on the 500khz step switch)
- UK price is £29.50 for the built and tested pcb with complete fitting instructions and £39.50 plus carriage for a unit factory fitted and tested. Instant fitting service available. Phone now.

£1000.00 instant credit available for licensed amateurs. Details upon request. Call now!

We also sell and service Cellular Radio, and PMR (Business) radio equipment.

Tel: 021 421 8201 (24hr answerphone)
Telex: 334303 G TXAGWM

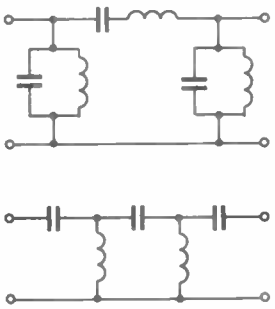
Access AMERICAN EXPRESS VISA

HP/PERSONAL LOANS AVAILABLE
(written details upon request)

RWC CREDITCARD

Amateur RADIO

Editor:
Anita Ley
Editorial Assistant:
Jane Berry
Advertisement Manager:
Margaret Hall
Advertisement Executive:
Marian Vidler
Subscriptions:
01-684 3157
Accounts:
Clare Brinkman
Publisher:
Peter Williams
On sale: Last Thursday of the month preceding cover date
Next issue: Cover date October 1985 on sale 26 September 1985
Published by: Amateur Radio Magazines, Sovereign House, Brentwood, Essex CM14 4SE, England
(0277) 219876
Printed: In England
ISSN: 0264-2557
News Trade Sales by: Argus Press Sales & Distribution Ltd, 12-18 Paul Street, London EC2A 4JS.
01-247 8233
Front cover: Icom IC735 reviewed this month (p18) Photo by Jay Moss-Powell G6XIB and Pete Galvin



SERVICES

Thanet El

ICOM ICOM

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-290D/290E Mobile

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

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

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

ectronics

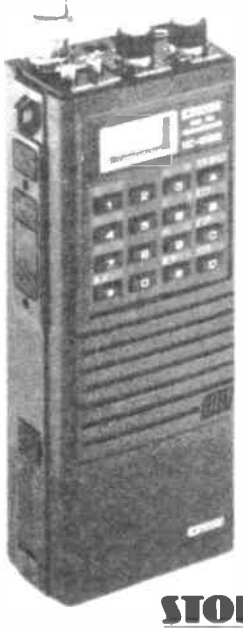
ICOM ICOM

IC-02E, IC-04E Handheld

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

The IC-02E has an LCD readout indicating frequency, memory channel, signal strength, transmitter output and scanning functions.

HS-10 Headset also available, with earphone and boom microphone, which operates with either of the following:- HS 10-SB Switch box with pre-amplifier giving biased toggle on, off and continuous transmit. HS 10-SA Voice operated switch box, with pre-amplifier, mic gain, vox gain and delay. The IC-2E and 4E continue to be available.



Authorised Icom dealers in the UK

Alyntronics, Newcastle, 0632-761002
Amateur Radio Exchange, London (Ealing), 01-992 5765
Amcomm, London (S Harrow), 01-422 9585
Arrow Electronics Ltd, Chelmsford Essex, 0245-381673 26
Beamrite, Cardiff, 0222-486884
Booth Holding (Bath) Ltd, Bristol 02217-2402
Bredhurst Electronics Ltd, W Sussex, 0444-400786
Dressler (UK) Ltd, London (Leyton), 01-558 0854
D W Electronics, Widnes Cheshire, 051-420 2559
Hobbytronics, Knutsford Cheshire, 0565-4040 Until 10pm daily.
Photo Acoustics Ltd, Buckinghamshire, 0908-610625
Radcomm Electronics, Co Cork, Ireland, 01035321-632725
Radio Shack Ltd, London NW6, 01-624 7174
Scotcomms, Edinburgh, 031-657 2430
Tyrone Amateur Electronics, Co Tyrone, N Ireland, 0662-2043
Reg Ward & Co Ltd, S W England, 0297-34918
Waters & Stanton Electronics, Hockley Essex, 0702-206835

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.

IC-27E Mobile

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

Please note that we have a retail branch at 95, Mortimer Street, Herne Bay, Kent. Tel: 369464. Give it a visit, BCNU.

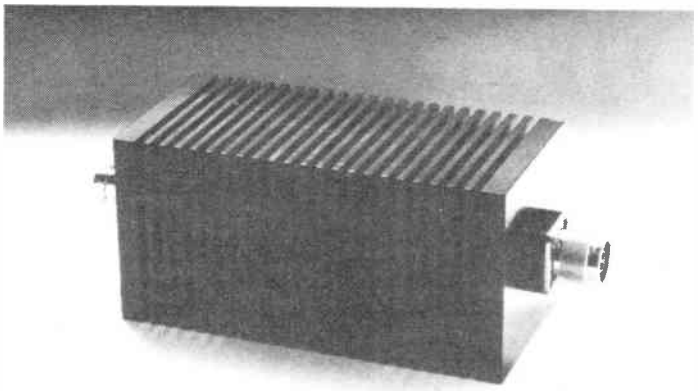
This must be the smallest, 2M, FM mobile available today, measuring only 38mm H x 144mm W x 177mm D. It has all the features that you probably require included in this microprocessor controlled unit. In addition, if you feel lonely and can't find anybody on the band, just press "speech" and the optional built in speech synthesizer will tell you the frequency you are tuned to. This is a boon to the blind operator or to those that tuck their rigs out of sight.

Brief features:- 25/1 Watt output, green LED readout, scanning (memories and programmable limit band scan), priority scan, programmable duplex splits, 25 and 5Khz tuning steps, 10 memory channels with lithium back up cell, normal and reverse repeater switch, dual VFO, internal speaker and optional speech synthesizer.
Just ask for a leaflet and we'll be glad to send you one.

STOP PRESS» Contact us regarding 50MHz equipment for new issued!

ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet ICOM Thanet Electronics
Dept AR, Herne Bay Kent
Tel (0227) 363859

STRAIGHT & LEVEL



ATTENUATORS

Tony Chapman Electronics Limited, of Epping, are the sole distributors in the United Kingdom of a comprehensive range of attenuators for use in HF through to the microwave communications industry, manufactured by JFW Industries Inc of Indiana in the United States .

JFW manufacture what is one of the largest ranges of attenuators and accessories available in the UK today. All products are designed and engineered to the most exacting standards and provide dependable, quality performance over a wide range of applications.

The 50FH series offers power levels of up to 100 watts, with standard attenuation values of between 3-30dB operation, in most models to 2,000MHz, which makes these suitable for VHF/UHF and microwave applications where high power levels need to be attenuated for measurement purposes. An accuracy of ±0.3dB and a choice of N-BNC or TNC connectors make these attenuators ideal for extending the range of thermistor type power meters.

Designed for IF signal processing and general instrumentation, model 50P-076 provides up to 127dB in 1dB steps controlled via 12V dc with attenuation steps 1,2,4,8,16,32 and 64 sections. Type specifications are 10MHz through to 1500MHz. There is 50 or 75 ohm impedance, VSWR 1.5:1.

Other models in the 5DP series can provide alternative ranges of attenuation with and without full solid-state TTL control.

For further information contact: *Tony Chapman Electronics Ltd, Electron House, Hemnall Street, Epping, Essex CM16 4LS. Tel: (0378) 76138/9.*

ELECTROMAGNETIC SHIELDING

Inco Selective Surfaces Limited, through research and testing, have created an electromagnetic shielding coating (EMS360) which will effectively screen components against electromagnetic radiation.

EMS360 is a multi-layer metallic coating, deposited by a high rate vacuum sputter process on to plastics used in the manufacture of enclosures for the electrical and electronics industry.

The intermediary high conductivity copper gives a cost effective electromagnetic shield, and a hard top coat achieves maximum resistance to corrosion and abrasion. To ensure the integrity of the coating, all layers are deposited in one vacuum cycle.

The advantages of EMS360 coating are the uniformity of film thickness due to the vacuum deposition process, however complex the component size and shape, and the low temperature of the components during application, which prevents distortion and minimises thermal stresses in the coating.

For further information please contact: *Inco Selective Surfaces Ltd, Wiggin Street, Birmingham B16 0AJ. Tel: (021) 454 4871.*

INTERFACE KIT

The Centronics parallel interface for dot matrix and daisy wheel printers can be used with the ZX Spectrum, using an easy-to-assemble interface kit available from Electronics and Computer Workshop Ltd.

The Centronics interface kit – K2614 – is just one of a series of I/O expansions that enable Spectrum owners to expand their machines to communicate with the outside world, plugging into a standard interface motherboard, the K2615. With the Centronics kit the printer can be plugged directly into a standard 2 x 18 way socket, and non-standard parallel printers can also be controlled provided that they have a Ready or Busy TTL-level output.

The construction and operation manual supplied with the kit explains in a clear, step-by-step way how to construct the unit, and this should cause no problems to most home constructors.

The manual also includes a USR routine for simple program listing and a BASIC HEX loader program to simplify the entering of the machine code.

The Centronics interface card kit costs £31.98 and the ZX Spectrum motherboard costs £26.84.

For further details contact: *Electronics and Computer Workshop Ltd, 171 Broomfield Road, Chelmsford, Essex CM1 1RY. Tel: (0245) 262149.*

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

ASTRID

MM Microwave Ltd, the Yorkshire based radar and communications sub-systems specialists, have entered the consumer satellite market with ASTRID (Automatic Satellite Telemetry Receiver and Information Decoder). ASTRID is a complete and ready to use satellite receiving system with built in decoder, enabling signals to be received and data displayed on home computers.

In operation, ASTRID receives all the data transmitted by the UoSAT satellites and automatically records it on a standard cassette tape recorder.

Information being transmitted by the satellites includes: news bulletins; satellite status; experimental data; messages on the electronic mailbox; orbit information; digitalker speech telemetry; experimental CCD television camera signals.

Assessment of this data enables a deeper understanding of the rapid developments in space technology and encourages active participation in real experiments. ASTRID extends the range and scope of a home computer, bringing space technology within everyone's reach.

Software available from AMSAT-UK allows graphic display of satellite 'tracks' over maps, error correction of received data, disc storage of data for computer analysis and data presentation of particular telemetry channels. ASTRID is priced at £144 complete.

For more details contact: *MM Microwave Ltd, Satellite Group, Thornton Road Industrial Estate, Pickering, North Yorkshire. Tel: (0751) 75455.*

TECHNICAL SURPLUS

A new shop, Technical Surplus, has recently opened in Birmingham, just down the road from Ray Withers Communications, in fact.

Technical Surplus stocks a wide range of surplus radio, electronics, CB and military equipment – all very good for the constructor.

The shop is open from 9.00am to 5.00pm Monday to Saturday at: *576 Hagley Road West, Oldbury, Warley, Birmingham B68 0BS.*

SATELLITE TERMINAL

Wave Devices Ltd, of Covent Garden, London have announced the introduction of the ASAT- 1214 small aperture satellite communications terminal for use in business and industrial applications. The terminal is manufactured by Avantek, the microwave specialist from California, USA.

The two-way terminal is designed primarily for voice and data transmission and is easily installable. It can transmit and receive at rates from 9.6kbps to 1.544Mbps, and features an antenna as small as 1.2 metres in diameter and less than 5 feet in height. With integrated electronics, it transmits up to 10 watts in the Ku frequency band, between 14.0 and 14.5GHz, and receives between 11.7 and 12.2GHz.

The ASAT-1214 suggests many applications where data is distributed or collected over significant distances. These would include financial data transfer, inventory and shipment control, oil well and pipeline monitoring, point-of-sale systems, electronic mail, video conferencing and voice communications.

For further information contact: *Wave Devices Ltd, 9 Betterton Street, London WC2H 9BF. Tel: 01-240 7052.*

dc/dc CONVERTERS

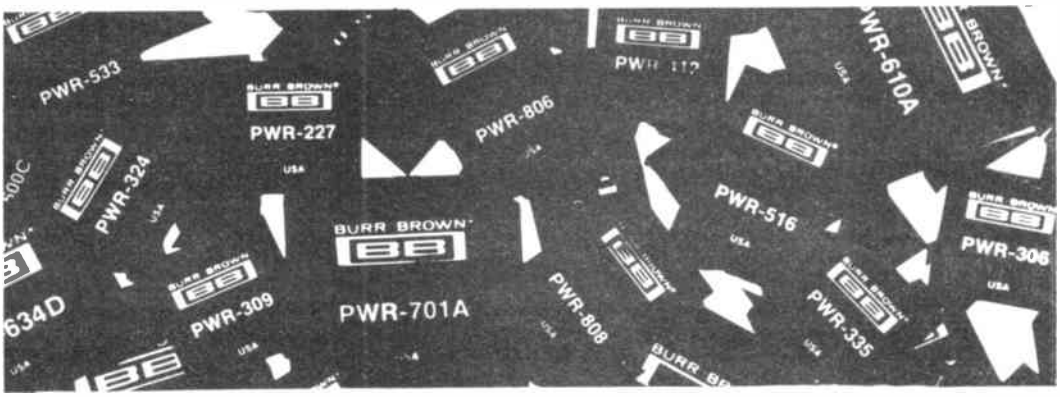
Burr-Brown have just introduced a new 400 model line of low-cost dc to dc converters which are claimed to offer more complete dc/dc circuit functions and to withstand more environmental stress than many other dc/dc converters.

Known as the PWRxxx series, these dc/dc converters are available with single/multi-channels, regulated/unregulated outputs and single/dual outputs. Features include UL544, VDE 750 and CSA C22.2 dielectric, input and output filtering and six-sided shielding.

Across the range the PWRxxx family offers input voltages of 5V dc to 48V dc, output voltages of 5V dc to ±15V dc, power rating of 450mW to 5W and a minimum isolation voltage of 1000V peak.

Each of the PWRxxx devices is housed in a rugged non-conductive package.

For further details contact: *Burr-Brown International Ltd, Cassiobury House, 11-19 Station Road, Watford, Herts WD1 1EA. Tel: (0923) 33837.*



STRAIGHT & LEVEL

LINEARS FOR 4 & 6m

BNOS Electronics Ltd have announced the introduction of 100 watt linear amplifiers for the amateur 4 and 6 metre bands.

In their LPM Series format, these models join their 2m and 70cm cousins as the LPM70-10-100 and the LPM50-10-100. The usual BNOS bargraph power meter, low noise pre-amplifier and RF PVOX/PTT switching facilities are built in, as is the BNOS overdrive protection feature. The mobile mount is supplied as standard.

The specifications are as follows: The frequency band for the LPM70 is 70 to 72MHz and for the LPM50 is 50 to 54MHz. Input power for both models is 10W recommended, 15W maximum and 500mW minimum.

Output power is 100W rms ±0.5dB. Power requirements are 13.8V dc, 14A ±15% and insertion loss is 1.5dB ±0.5dB. There is an Rx pre-amp gain of typically 12dB and the Rx noise factor is better than 1.5dB. The amps sell at £172.50 each.

For further details contact: *BNOS Electronics Ltd, Bigods Hall, Great Dunmow, Essex CM6 3BE. Tel: (0371) 4677.*

RADIOTELETYPE PRESS BROADCASTS

Press transmissions are undoubtedly the most popular RTTY stations among short wave enthusiasts, and the availability of sophisticated decoding units linked to home computers has made them readily available to all. Watching the news bulletins of the foreign press agencies, the amateur finds himself in the front row of international affairs.

In order to find the frequencies and times of transmissions, the new second edition of Michiel Schaay's book, *Radioteletype press broadcasts*, will prove to be of great help.

Not only are hundreds of transmissions listed, but a chapter is devoted to each of the forty-five most interesting press agencies, giving a detailed insight to how they operate. This provides a much better understanding of the bulletins being received. A total of sixty-three agencies are covered, among them Associated Press, Prensa Latina, TASS, Press Trust of India, AFP, ANSA, and some more unusual ones such as Bakhtar News Agency from Afghanistan, Service de Presse Kampuchea and a clandestine station, Kwacha Unita Press from Angola.

The second part of the book has a comprehensive listing of transmissions for each hour and half hour, plus cross references.

As the book was written in Europe Interbooks believe that it will be of particular interest to British short wave enthusiasts. The first edition was a best seller.

This book is available for £11.85 from: *Interbooks, Lynton, Stanley, Perth PH1 4QQ. Tel: (0738) 828575.*

COMBLINE FILTERS

Time Microwave, based in Santa Clara, California, has introduced a new series of combline bandpass filters.

The passband frequency ranges from 4.0 to 8.0GHz, 5.0 to 8.0GHz, 8.0 to 12.0GHz, and 12.0 to 18.0GHz.

The model BPF172 features a VSWR of 2.0:1 maximum, insertion loss of 1.0dB maximum, and rejection of 30dB minimum at dc to 3.4GHz and at 9.2 to 18.1GHz.

The BPF172 has SMA male and female connectors and is 2.44 inches x 0.70 inches x 0.70 inches excluding connectors.

Filter models BPF176, 177 and 178 feature a VSWR of 1.5:1 maximum and all SMA female connectors.

The stop-band rejection for the model BPF176 is 50dB minimum at dc to 4.0GHz and at 16.0 to 18.5GHz.

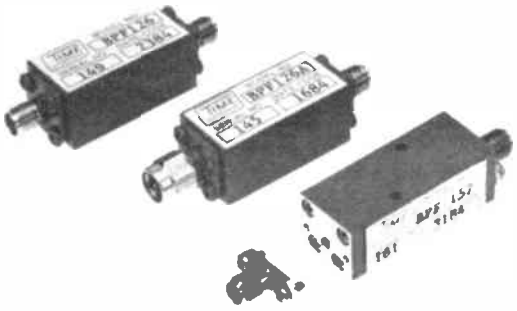
Model BPF177 has a stop-band rejection of 50dB minimum at dc to 6.0GHz and at 24.0 to 26.5GHz. The model BPF178's rejection is 50dB minimum at dc to BPF178's rejection is 50dB minimum at dc to 3.0GHz and at 10.0 to 15.0GHz.

The BPF157 and BPF126 models have also been introduced. The passband frequency range for these units is 10.46 to 10.59GHz and 13.2 to 13.4GHz. The VSWR for both filters is 1.5:1 maximum with an insertion loss of 1.0dB maximum.

The BPF157 features removable SMA female connectors, and a size of 1.45 inches x 0.63 inches x 0.05 inches. The stop-band rejection of this unit is 20dB minimum at dc to 10.225GHz and 20dB minimum at 10.825 to 22.0GHz.

Model BPF126 measures 1.24 inches x 0.60 inches x 0.55 inches, excluding the SMA connectors. Stop-band rejection is 20dB minimum at dc to 12.8GHz and 20dB minimum at 13.8 to 23.5GHz.

For further information, please contact: *Time Microwave, 398 Martin Avenue, Santa Clara, CA 95050. Tel: 408/970- 8463.*



SPEED CONTROL

If you have ever tried to drill a PCB with an ordinary electric drill you will know the problems involved and have suffered the cost of broken equipment. For PCB work with the smaller drills of 0.6mm a speed of at least 15,000rpm is required to ensure a clean cut hole.

Now Croydon Discount Electronics is offering a kit which consists of a motor fitted with chuck and precision collets to take drills from 0.4mm to 2.5mm and supply three bits, 0.6mm, 0.8mm and 1mm. There is also a mains speed control unit which controls the drill from a few hundred rpm up to 15,000rpm.

The kit is easy to assemble and comes complete with instructions for £11.95.

For more information contact: *Croydon Discount Electronics, 40 Lower Addiscombe Road, Croydon CR0 6AA. Tel: 01-688 2950.*

ELECTRONICS BOOK

STC Electronic Services' stock catalogue, *The Electronics Book – Summer Issue*, is now available.

The catalogue contains almost 700 pages and covers more than 40,000 products from more than 250 manufacturers. In excess of 12,000 new products have been introduced this year ranging from Commodore business computers to capacitors from Vitramon.

The Electronics Book is available free-of-charge from: *Publicity Department, STC Electronic Services, Edinburgh Way, Harlow, Essex. Tel: (0279) 26777.*

CLUB NEWS

Datacom

The British Amateur Radio Teleprinter Group (BARTG) has published the summer 1985 issue of its magazine, *Datacom*. It consists of 120 pages of news, views and technical articles on all aspects of RTTY, Amtor, Packet Radio and FAX.

Special features include full technical and constructional details of the ST5C terminal unit and of a unit to convert from a parallel Centronics interface to serial RS232.

There are suggestions for circuits and ideas for audio notch filters, sidetone monitoring of RTTY transmissions, driving teleprinters on low voltage, improving efficiency in RTTY transmitters, etc.

In this issue the results of BARTG's survey on the use of RTTY on 45.45 and 50 bauds is published. BARTG believes that this will be of particular interest to RTTY repeater builders, emergency network planners and DX operators.

Datacom gives details of how Amtor can be used through the Oscar 10 satellite, as well as Packet Radio news, and information on the new TNC2 Terminal Node Controller.

Datacom is published quarterly and supplied free to members. Send an SAE for details to: *Mrs P Beedie GW6MOJ, 'Ffynnonlas', Salem, Llandeilo, Dyfed, Wales SA19 6EW. Tel: (0558) 822286.*

SPRAT

We recently received the latest issue of *SPRAT*, the journal of the G-QRP Club, (which, incidently, is edited by our very own Rev George Dobbs G3RJV, who is a regular contributor to *Amateur Radio* with his *Beginner's Workshop* feature).

The club is now going strong in its tenth year. Readers interested in low power communication will find it worthwhile joining the club, if only to receive this very useful little journal. This edition contains an account of this year's RSGB Convention, which was held at the NEC in Birmingham, an article on the construction of a QSK transceiver for 80m CW, a review of the Micron 6 band QRP transceiver kit, and lots more.

For more information contact: *Alan Lake G4DVW, 7 Middleton Close, Nuthall, Nottingham NG16 1BX.*

Clever Trevor

Trevor Morgan GW4OXB, who readers will know from his regular *Short Wave Listener* column in this publication and as the organiser of the *Amateur Radio Prefix Award* scheme, is at it again!

He has recently proposed the idea of organising a listener's award with the aim of raising money for Bob Geldof's Ethiopian appeal.

The White Fang Fellowship's JOTA SWL Contest Awards, intended to encourage SWL activity during the organisation's annual jam boree, will charge an entry fee of two IRCs in the UK and 4 IRCs overseas. All IRCs in excess of those used to send contest certificates to the contestants will be donated to the Live Aid appeal.

Any clubs or individuals who can offer assistance of any kind with the running of this scheme should contact Trevor at the address below.

Full details of the contest rules are available from: *Trevor Morgan, 1 Jersey Street, Hafod, Swansea SA1 2HF.*

Welsh convention

This year's Welsh Amateur Radio Convention will be held at the usual venue – Oakdale Community College, Blackwood, Gwent on Sunday 6 October 1985. Doors will be open at 10.00am and the official opening will be at 11.00am by Mrs J Heathershaw G4CHH, President of the RSGB.

The programme will include lectures entitled, 'The 5th Generation of Transverters' by Chris Bartram G4DGU of muTek, 'Oscar 10 Video' by Werner Hass DJ5KQ, and also an HF DX feature and a film for newcomers. Morse test facilities will also be available. Applicants should contact Mr G Williams, BTI Radio Station, Worston Lane, Highbridge, Somerset TA9 3JY.

There will be £300 in cash raffle prizes, the usual trade stands, a bring-and-buy and an RSGB stand. Admission is £1.50 at the door.

Further details can be obtained from: *R B Davies GW3KYA, 16 Vancouver Drive, Penmaen, Blackwood, Gwent NP2 0UQ. Tel: (0495) 225825.*

Civil Service special

The Civil Service Amateur Radio Society (CSARS) intends to operate two special event stations this month, under the callsign GB0CSR.

The first, on 7 September from 9.00am to 8.00pm, will take place on the occasion of the society's annual open and sports day. The venue will be the Central Ordnance Depot, 38 Base Workshops REME, Chilwell, Notts.

The second special event station will operate on 8 September from 9.00am to 8.00pm, at the Civil Service regional annual sports day. The event takes place at the Civil Service Sports Ground, Wilford Lane, Notts.

Operation in both instances will be on HF 80-10m and possibly 2m.

More information is available from: *K R Hawkins G4OFL, 37 Darley Avenue, Toton, Notts.*

Insurance shock

We recently had a letter from Mr R Robinson, of West Yorkshire, who has spotted an item in his local paper, *The Yorkshire Post*, which he thinks might be of interest to readers of *Amateur Radio*.

The item recounts how a motorist's insurance policy became invalid after he installed a CB radio in his car, due to a clause in his policy specifically excluding the use of a vehicle with a two-way radio. This led to the motorist being prosecuted and fined £80 for driving without insurance!

According to the man's solicitor, he believed he was adequately insured, having been advised by the insurance broker that the exclusion clause referred only to taxi radios.

This unfortunate incident has brought to light a situation which mobile operators should be wary of. Check that your insurance policy has no similar exclusion clauses.

New computer club

A new Amateur Radio and Computer Club (AMRAC) has recently been formed in South Hampshire. The club aims to promote the use of computers in amateur radio and to encourage the use of digital communication techniques.

The members are active on the data frequency 144.675MHz using ASCII and both the AX25 and Cambridge Packet systems.

Meetings are held every fourth Friday at 8pm in the Crown Public House in Bishop's Waltham. The next meetings are scheduled for 6 September and 4 October.

Further details are available from: *The Secretary, Trevor Tugwell, 50 Mayridge, Fareham, Hants. Tel: (0485) 81032.*

Radio lectures

The Maidstone Amateur Radio Society recently held its AGM and the new committee has arranged two special events for September.

On 13 September there will be a lecture entitled 'Fault Diagnosis of 27-30MHz Rigs' and a lecture on aerials is to take place on 27 September.

The lectures start at 8.30pm at the YMCA Sportscentre in Melrose Close, Maidstone, and the club meets every Friday at the same location at 7.30pm.

North Devon Radio Rally

The fifth North Devon Radio Rally is to be held in Bradworthy Memorial Hall, near Holsworthy on 2 November at 10.30am until 5.00pm. There will be a bring-and-buy stand and talk-in is on 2 metres (S22).

Raleigh celebration

Exmouth Amateur Radio Club will be operating a special event station from Hayes Barton, East Budleigh, Devon using the callsign GB4HB during the 28 days from 5 September until 2 October on the HF bands, 144MHz, 432MHz, Oscar 10 and RS satellites.

Hayes Barton is the birthplace of Sir Walter Raleigh, who was born in 1554. He later went on to establish a colony in North Carolina in 1585 and it is hoped to contact the Raleigh Amateur Radio Society in the City of Raleigh as part of their 400 year celebrations. It is also hoped to contact the Operation Raleigh ship, the 'Sir Walter Raleigh', GB0SWR/MM, on her round the world mission.

A special QSL card featuring the Elizabethan farm house where Raleigh was born will be issued to all contacts.

New clubrooms

The members of the West of Scotland Amateur Radio

Society have been very busy lately converting a former curtain factory in the centre of Glasgow into new clubrooms.

The curtain goes up on this project (groan! – Ed) on 20 September at 8pm, when the new club will be formally opened by the President of the RSGB, Mrs Joan Heathershaw G4CHH.

The new clubrooms have a sizeable meeting hall, a shack equipped for HF and VHF operation, a lounge, kitchen and cloakrooms, and a room for Morse classes and construction work.

The club meets at 7.30pm every Friday and has a fortnightly lecture programme starting in September.

Further information can be obtained from: *Ian McGarvie GM4JDU, 3 Kelso Avenue, Paisley PA2 9JE. Tel: (050) 581 2708.*

South Manchester RC

The South Manchester Radio Club has sent us details of events planned for September. On 13 September an HF activity night will take place followed on the 20th by a junk sale.

On the 27th the club will have a visit by the RSGB General Manager, John Nelson G4FRX.

For further details contact the club secretary, Dave Holland, on (061) 973 1837.

Edgware news

The Edgware and District Radio Society has announced a lecture on 12 September, entitled 'Pre-War Transmitters'. It will be given by Eric Godfrey G3GC.

The club will meet at 8pm in the Watling Community Centre in Orange Hill Road, Edgware.

For further information on the club and their other activities contact: *John Cobley G4RMD, 4 Briars Close, Hatfield, Herts.*

WACRAL news

The World Association of Christian Radio Amateurs and Listeners (WACRAL) has sent us information regarding its 1985 conference weekend.

The venue for the conference is Cliff College, Calver, Sheffield on 4-6 October. The cost per member is £22.50.

The conference programme is partially planned and talks have been arranged. The WACRAL HQ would like to hear from volunteers to give talks and help with the organisation of the conference.

Cliff College can accommodate 68 people and there is also a caravan and camp site nearby.

For further information contact: *WACRAL HQ, Micasa, 13 Ferry Road, Wawne, Hull HU7 5XU. Tel: (0482) 822276.*

RRD fact sheet

The DTI are currently producing a five page fact sheet on how the RRD functions.

It will also go into some detail on the future of amateur radio and how the Post Office at Chesterfield issues licences.

Copies will be available some time in the next few months from the RRD at Waterloo Bridge House, Waterloo Bridge Road, London. Tel: 01-275 3263/3323.

The document was inspired by some pertinent questions raised by Ian Abel of Yorkshire.

The RSGB are not involved in this project.

Bury news

Amateurs in the Bury area will be interested to hear about events planned by the Bury Radio Society.

On Tuesday 10 September G3LEQ's subject will be propagation, and on 8 October the Club Construction Contest will be judged by the Rev George Dobbs G3RJV, who is a regular contributor to *Amateur Radio* and editor of the journal of the G-QRP Club, *SPRAT*. He will also give a talk on QRP operation.

Main meetings are held on the second Tuesday of each month at the Mosses Centre, Cecil Street, Bury. Newcomers should contact: *Brian Tyldesley G4TBT, 4 Colne Rd, Burnley.*

Morse of course

Morse testing will take place at the following locations this month:

3 September – Three Counties Radio Club, Liphook, Hampshire.

8 September – Telford Mobile Rally.

22 September – Harlow Mobile Rally.

29 September – RSGB HF Convention, Belfry Hotel, Oxford.

Enquiries and bookings should go to: *Gavin Williams G3YCP, BTI Radio Station, Worston Lane, Highbridge, Somerset TA9 3JY.*

Radio rummage

The South Bristol Amateur Radio Club (G4WAW) are holding their first 'radio rummage' on Sunday 27 October. As the name suggests, the emphasis will be on bring and buy, surplus user equipment, surplus equipment and parts.

There will also be radio displays (SBARC radio shack), a Raynet stand, film shows, a Wild West 'shoot-out' and various refreshments. Talk-in will be on S22 and SU8 and the entrance fee will be 50p.

Enquiries for this event should be made to: *Mike Ward G1LDJ (Organiser). Tel: (0272) 667179.*

The club meets at 7.30pm every Wednesday at: *The Whitchurch Folk House, East Dundry, Whitchurch, Bristol, Avon BS14 0LN.*

COURSE GUIDE

Course title	Enrolment date	Additional information
RAE	9/10 Sept	Derby CFE. Weekly 2 hr session for 30 wks. Tutor = G4MLL. College also runs an Advanced RAE course. Tel: Derby 73012
RAE + CW courses	10 Sept	Bradford and Ilkley Community College, Gt Horton Rd, W Yorks BD7 1AY
Construction for the Radio Amateur	10 Sept	As above
RAE + CW practice	17 Sept	The Nautical College, Fleetwood, Lancs. Thursday evenings for 25 wks. Tel: (03917) 79123
Microelectronics + RAE course	Sept	Hendon College, N London. Head of Technology = Chris Holford. Tel: 01-202 3811
RAE + CW courses	Sept	Wigan College of Technology. Tel: (0942) 494911
Hobby Electronics	Sept	As above
RAE	9/10 Sept	De Havilland College, Borehamwood, Herts. Every Tuesday. Tutor = G L Benbow G3HB (Editor of *How to Pass the Radio Amateurs' Examination*). Tel: (953) 6024. The college also runs this course on Thursdays at its Applecraft Centre in Welwyn Garden City. Tel: WGC 26318
RAE + CW courses	16/17/19 Sept	Reddish Vale Evening Centre, Stockport, Cheshire. The RAE course is on Monday evenings and the CW course on Thursday evenings. Tel: (061) 477 3544
RAE	9/10/11 Sept	Paddington College, London. Tutors = G4KKM and G6MFR. Use of Electrical Engineering Dept's facilities to conduct practical experiments. College operates club station, G4UWU. Special rates for students, pensioners, unemployed. Pass rate nearly 90%
RAE	Sept	Adult Education Centre, Tonbridge, Kent. Practical demonstrations + theory. Tutor = G8PWO. 86% pass rate. Tel: Tonbridge 354313
RAE	9-14 Sept	Islington Institute, 86 Agar Ave, Camden Town, London NW1. Tutor = G3ZKE. Tel: 01- 485 7065
Morse + Theory and Regulations	Sept	Dept of Elec Engineering, Loughborough Technical College, Leics. Tuesday eves, 6.00pm-7.00pm – Morse, 7.00pm-9.00pm – Theory and Regulations. Tutor = G3FLS. Tel: (0509) 215831
RAE	9 Sept onwards	Fareham Adult Education Centre, Wickham Rd, PO16 7DA. Tutor = G3CCB. Tel: (0329) 288139
Theory + Morse + Practical RAE	9/10 Sept	Brunel Technical College, Bristol, Dept Aerospace and Radiocommunications. Tutor = G3ZJH. Last year 94% pass rate for theory, 100% for CW. Tel: (0272) 4142, ext 64

L·E·T·T·E·R·S

SWR DEBATE

May I be permitted to make one or two points regarding Bill Mantovani's 'Back to Basics' feature in the May issue of *Amateur Radio*. However, before doing so let me admit that it is easier to criticise than to produce the original article!

Regarding the statement that 'the SWR is constant along the whole length of the feeder' – top right-hand corner, page 47 – this is untrue. Consider the case where the line is sufficiently lossy for only 50% of the feed voltage to appear at the antenna end; also that the latter produces a total mismatch.

In this case the whole of the voltage is reflected and is again halved during its journey back to the feed end. Thus, whilst the SWR at the end is infinite, at the feed end it will be circa 1.5:1.

In reality the losses are far less and the differences in SWR as measured at the two ends of the feeders are similarly less.

This brings me to my second point: feeder losses and the effect of SWR. These are far less significant, certainly at HF, than is generally imagined. One hundred feet of decent co-ax will have a 'level line' loss of circa 1dB at 28MHz; to double the loss would require an SWR circa 6:1. For the more typical feeder, say 50ft with a 3:1 maximum SWR, the loss may be ignored.

Certainly high powers and SWR can produce flash-over, it's a case of horses for courses. However, Bill has avoided the usual excuses of blaming high SWRs on feeders for blown output stages, the latter being almost solely due to incorrect operating conditions or component ratings.

Finally, it was gratifying to read on page 35 that my speculations regarding the Hateley Dipole of Delight (*Letters, Amateur Radio*, February) were not far off.

J W Barker G3WAL, Rugby

The topic of SWR is a very thorny one because of a number of misunderstandings that have spread through our hobby in recent years, primarily due to the now accepted use of the SWR meter for checking the match between transmitter and antenna system. It is rarely possible to mention the word SWR without invoking a contradiction of opinions, which is totally uncalled for and would not occur if people understood SWR in the first place. I have personally spent many an hour both on and off the air discussing SWR related facts (and in some cases fallacies), but I don't think that a feature aimed at someone just starting in amateur radio is a good place to launch into such discussion – there is plenty of time for that when the newly licensed amateur gets down to looking at the performance of his antenna system for himself!

In reply to the first of Mr Barker's comments, the answer is quite simply that we are both right. In his letter, Mr Barker considers the situation where a lossy transmission line is being used, but this is really going outside the scope of the RAE syllabus and the objective of my 'Back to Basics' feature, which is to cover only elementary principles. Therefore, it is sufficient for the RAE to consider only the behaviour of standing waves on a loss-free transmission line, in which case it is indeed true that the SWR is constant along the whole length of the feeder because there is no power loss.

Mr Barker is quite correct on his second point, that too great a significance is placed on feeder losses and low SWR than need be, which brings me back to my opening statement of misunderstandings over SWR. The SWR and any line losses need to be pretty high when operating at HF frequencies before there is a pronounced effect on the transmitted signal, especially as the ionosphere, under favourable propagation conditions, does a great job of ensuring that even the poorest signal travels long distances. However, using a lossy transmission line or operating with a high SWR could lead to TVI problems, amongst others, so a certain amount of common sense is obviously called for, especially when you bear in mind that any attempts to reduce the SWR on a co-ax line down to below about 2:1 can be regarded as wasted effort from the point of increasing the radiation from the antenna.

As Mr Barker states, at frequencies below about 30MHz, losses incurred by typical feeder lengths may be ignored and a high SWR is not always a bad thing to be avoided at all costs.

This is not the prime cause of a blown PA stage, as is often believed. Not everyone will agree with my or Mr Barker's comments, but these are the facts – it's the fallacies which cause the arguments, but it does make the airwaves interesting!

Bill Mantovani G4ZVB

WAS GOD A RADIO AMATEUR?

As a long time SWL and also a CB operator I would like to reply to certain people who write to your magazine under the guise of being 'radio amateurs', namely G4XIV, G4KCC, G4GJN (***AR***, July).

Erich Von Daniken wrote a book called *Was God an Astronaut?*, I think it should have been called *Was God a Radio Amateur?* I get sick and tired of amateurs knocking hell out of everyone who has anything to do with CB. We are not all idiots, just as amateurs are not all gods, excluding you three of course.

My wife and I are both disabled and we have CB in our car in case of emergencies. We certainly do not contribute to the 'chaos' on 27MHz, just as you three are not part of the 'undisciplined rabble' on 2 metres. We are members of the RAIBC and they have kindly loaned us a receiver which gives us a lot of enjoyment. We would also like to study for the RAE, but because of health reasons my wife is unable to attend classes to gain the necessary knowledge, and offers of home tuition do not seem readily available. So we will carry on in our own way, and in due course we will pass the RAE despite people like you.

You are entitled to your opinions, but do us all a favour before you carry on slamming CB operators. Try to get to know some of us; you never know, you might even realise there are some CBers who really want to become amateurs.

By the way, our transceiver and aerial conform to the legal requirements, and we do have a licence. With people around with your attitude, it's a wonder that anyone bothers to become a radio amateur. Still, I suppose there must be some of them who are interested in helping others to learn rather than in just putting them down.

J B Hackett, Cornwall

SNOBS

After reading the letters of G4GJN, G4XIV and G4KCC, I feel that I must reply. Why do these people, who I can only describe as 'snobs', perpetually 'slag off' CBers? Just because we cannot afford the money to buy HF, VHF or UHF equipment are we inferior?

True, on 27MHz FM there are a few who do abuse the band, but many others use it seriously and properly. True radio amateurs are those who struggle to make do with what they can afford, not those who can walk into a shop and pay cash for a black box that can get them around the world without any skill needed.

I myself am studying for the RAE and hope to sit at Christmas. I also intend to take the Morse test so that I may obtain a class A licence. If and when I pass the exam I will depend upon other radio users to lend me some equipment – those users, that is, who are not so stuck up and still use CB regularly. However, not even a drastic change in my financial status will see me discard my rig and refuse to speak to that 'undisciplined rabble'.

David Rule (Iron Man), London

L·E·T·T·E·R·S

RAE CONFUSION

The letters penned by L G Slater and B J Marsh in the May and July issues respectively caused me some confusion. On the one hand Mr Slater seems to be raising a relevant point about the status of the RAE when he describes his repeated failures to pass it, despite having a technical background and many previous exam successes in presumably related subjects. Mr Marsh, on the other hand, makes another quite justifiable point; studying for and sitting an examination carries no in-built guarantee that one will pass. Try again, he advises.

My confusion arises through agreeing with what I believe lies behind Mr Slater's lack of confidence with the RAE, agreeing with Mr Marsh's comments, and learning today that I have scored a double credit pass in it. Why not take the certificate and run, I ask myself!

Never having been a good runner I propose to ignore my own advice and take a closer look at the RAE.

Paper 1 seems generally to be a free gift, and it shouldn't be. Assuming, and it is only an assumption, a 40% pass level then 14 correct answers scores a pass.

Since 23 questions deal with licence conditions it is possible to gain a pass in Paper 1 without knowing anything about transmitter interference (12 questions).

I should have thought more emphasis on this extremely important branch of our hobby would go far to silence the perennial complaints in the amateur media about interference, not all of which comes from the whipping boys of the CB fraternity and radio pirates.

More central to Mr Slater's complaint is the state of Paper 2. At the same pass rate correct answers required are 24 out of its total of 60. It is this paper which is responsible, I believe, for the bulk of the failure rate. Because the examining board calls in the question papers immediately after the exam it is not easy to analyse their content over a period of time. From my own experience, however, I am quite certain that at least ten of the questions put to me had no obvious relation to the syllabus.

I have marked papers at university level and have been an internal examiner for CSE, setting and marking papers for a number of years. In consequence I feel I can recognise a question on a subject I know next to nothing about, and I recognised ten such in the RAE.

Trevor MacDiarmid, Essex

LEARNER'S POINT OF VIEW

In the July '85 issue of *Amateur Radio* under the headings of 'Progressive Licence' and 'No Novice Licence', Mr Holmden and Mr Skaife both express views which, as a newcomer to the subject, I heartily endorse.

At present I am awaiting the results of the RAE, which I attempted in May (and if I've failed I intend to persevere), however for a while I was a CBer.

The rig was used for my convenience (savings on local 'phone calls, road reports and directions etc) rather than the 'enjoyment' of talking to some 'one-nine-for-a-copy' wally who was proud of his Silver Rod, 100 watt boots etc.

I enrolled with the local school's evening classes in September '84 rather lightheartedly, originally only to accompany one of my husband's friends who wanted some moral support.

At that time I wasn't bothered if I learned anything or not, but within a few classes the amateur radio bug bit me really hard. If I have failed the RAE, it won't be for the lack of first class expert tuition as our class was taught by none other than Ray Petri G8CCJ (why not plug the author as well as his book) who really gave far more than Kent County Council could expect for the meagre pittance that is paid to their tutors. When I get my ticket I intend to use CB only to talk to my parents, who have neither the inclination nor (possibly) the ability to pass the RAE.

As regards the letter from Mr Shannon headed 'Drivel', I'm afraid I believe that he's talking drivel himself. As far as I'm concerned, any ex-CBer who has the determination to study for and pass the RAE is probably genuinely interested to discover if the callsign she/he is working is known to her/him under an alias or 'handle'.

As for compulsory CW, why? Surely the system proposed by Mr Holmden is by far the better. Also, my level of technical knowledge is probably sadly lacking according to Mr Shannon's standards, but with 13 'O' levels (I was studying for 5 'A' levels but got fed up with the lack of cash) and the fact that I am a member of MENSA, I am sure that even Mr Shannon will agree that I am far from ignorant. Yet I do not wish to venture into CW and his precious HF bands, at least not for a while.

Any comments appreciated – I'm used to criticism, if only because I'm not male.

Rosemary Pearce, Kent

Subsequent to us receiving this letter, Rosemary rang in to tell us she had passed the RAE with credits for both papers. She is now waiting for her new callsign, G1RGP, to be issued. Congratulations Rosemary.

PRACTICAL KNOW-HOW

I refer to Dino Bragoli's letter, 'A Humble G6', in the April issue of your excellent magazine.

It occurs to me, an ancient G3, that part of the problem of how to make or even acquire an antenna matching unit (an AMU, not ATU; nothing 'tunes' an antenna except when it is reworked mechanically) is the lack of practical training prior to the technical examination for our licences.

In the days prior to circa 1960, we, the transmitting amateur, were also the teachers of our hobby. When the local G2 or G3 stood up in front of the RAE class and explained what an AMU was he would naturally bring with him his own piece of 'home-brew' to illustrate the beast. No doubt it cost him £2-10-4½d to build, but it did the job. Pupils found items mostly at the local DIY shop or 'Fred's emporium' and went home with their own ideas on how to construct their home-brew.

Anyway, to put my money where my mouth is, and having 35 years of professional experience trying to match Txs and Rxs to odd lengths of wire and long lengths of coaxial, I am willing to make a date and time this year for an AMU constructional evening and teach-in where there is the greatest response to the suggestion.

The idea would be a practical demonstration of all types of AMU using all items out of the local stores or junk box in a flash case or on a piece of plywood. I would not only invite newcomers to the hobby, but ask some old timers to show up with prime examples of their own work.

Anybody interested in this idea should contact: *Ron Broadbent G3AAJ, 94 Herongate Road, Wanstead Park, London E125EQ.*

ONLY A HOBBY

I took the RAE in May 1984 and went straight on to the hard task of learning CW. During that period I held a class B licence and found local amateurs very helpful. In January 1985 I took the Morse test and am now the proud holder of the callsign G0AOJ.

I was (dare I say it) a CBer for about 2 years and have been a listener on the amateur bands for 3 years. It seems to me that many people take amateur radio too seriously and hold very strong views on such matters. Take Mr Shannon G4GJN, for example. He says that black box operating should be stamped out; if we all thought like that people would still be going to work on a horse and cart.

Come along fellow amateurs, let's get rid of all this back biting. After all, it's only a hobby, so let's enjoy it.

F Fenwick G0AOJ, Humberside

PCB KIT £5.95
4 pieces copper clad, circuit etchant, 2 pens, 5 different sheets transfers, plastic tray & instructions.
Book 'How to Design & Make Your Own PCB's' **£1.95**

AA NiCad CHARGER KIT £3.50
12-0-12 Transformer on PCB with diodes ex-unused equip series resistor, battery clips & holder, mains lead & purpose designed plastic housing box & full instructions.

MINI-DRILL KIT & SPEED CONTROLLER **£11.95**
High Torque Motor, 12V to 18V, 40W 1000 rpm per volt. 5 pole rotor, carbon brushes 50x2mm dis. Chuck & Set of Collets. 3 HSS Bits 1mm 0.8mm & 0.6mm & 3m flex. Speed controller kit & transformer. Instructions.
Or items may be purchased separately: Speed Control £4.50. Transformer £2.90. Motor £2.90. Chuck & 3 collets £2. HSS Drill bits with shanks 1mm 5 bits £1.50. 0.8 or 0.6mm – 5 bits £2.50 (bits not recommended for glass fibre).

UNIVERSAL NI-CAD CHARGER with battery test facility and LED indicators. For PP3, AA, C & D cells **£5.99.**

NI-CAD RECHARGABLE CELLS AA/HP7 500 mA Hr Pack of 4 £1.50 or 4 pks for only £5. (Ex-equip, tested & guaranteed).

PRECISION THERMISTORS low current, v fast response, nominal resistance at 20 degs C 5MO, 1MO, 300K, 100K & 1K any mix for £2 or 10 **£3.50.**

BLEEPERS & BUZZERS

MINI-BLEEPTONE 2-tone, 5-30V DC, 5-15mA £2.50 ea 3 for £6 or 10 for £18 (advertised elsewhere for **£5.05 ea!)**

MINI-PANEL MNTG with 100mm wire leads (22x15x15mm) 400Hz, 70dB at 30cm. 20mA Type MB6 6V. Type MB9 9V. Type MB12 12V £1.60 ea 3 for **£4**

MINI-PCB MNTG – 3 types as above but PCB mounting – same price.

HIGH POWER PANEL MNTG 100mm leads (25mm diax17mm) 50mA 400Hz 8dB at 30cm. Type LB6 6V. type LB9 9V. Type LB12 12V £1.70 ea or 3 for **£4.50.**

D C RELAYS

B1A. 14-PIN DIL, 1-pole n/o 1A contact. Coil 5V-12V, 1200R. 75p ea 5 for £3 or 10 for **£5**

PCB mntg. Reed 5V Coil

E1MO 1-pole n/o 2A. 175R 90p ea or 5 for **£2.50**

E1MC 1-pole N-C 2A 140R 90p ea or 5 for **£2.50**

E2M 2-pole 1 n/o, 1 n/c, 2A 100R. £1.10 ea or 5 **£4.25**

62L 1-pole c/o 10A contact. Coil 4V-8V 70R 26x10mm footprint, 25mm tall £1.90 ea or 3 **£4.70**

G2V 2-pole c/o 1A contacts. Coil 4V-8V 60R PCB Mntg **£2 ea**

KH11 4-pole c/o 3A contacts. Coil 12V, 150R. Solder tags **£2 ea or 3 for £5.50.**

K52 2-pole c/o 6A. Coil 9V-18V, 180R. PCB mntg **£2 ea or 3 for £5.50**

K13 as above but 12-20V, 430R – same price

K3W 3-pole c/o 6A contacts. Coil 6V, 38R, PCB mntg **£2.50 ea**

K6W 2-pole c/o 6A contacts. Coil 6V, 30R. Solder tags **£2 ea**

SPECIALS – ex-equip, good, 2-pole c/o contacts. 1-2A Continental plug-in, 12V coil, 700R 70p ea. 5 for £3 or 10 for £5

D C MOTORS

HIGH TORQUE 40W Reversible. 1000rpv 3V-18V, 2A max working, dia 28x50mm + shaft (15x2.3mm dia) Torque at 2A = 0.54 lbs inch approx **£2.90**

CHUCK and collets to fit above motor to use as drill. Takes up to 2.5mm drills – SEE MINI DRILL KITABOVE

TINY virtually inertia-less motor ie no iron in rotor. 1.5-3V 15mm diax30mm + shaft 6x1.6mm. With governor – can be bypassed **£1.50**

NOMINAL 12V motor works down to 1V ex-unused equip. VCR transport mech. 33mm dia. 30mm o/a + shaft 12x2m a bargain at **75p ea or 3 for £1.75**

MINI TOY motors 1-3V 19x18x9mm **50p ea or 5 for £2**

PORTABLE POWER SUPPLY

CARRY 240V AC WITH YOU!
Light-weight, compact & robust – silent operation from 12V car battery.
150W model **£89**
300W model **£129**
400W model **£189**

Please send sae for further details & technical spec
Please add 80p P&P to total order
Goods sent by return post

CROYDON DISCOUNT ELECTRONICS
40 Lower Addiscombe Rd Croydon CR0 6AA
01-688-2950

You can depend on

ELECTROVALUE

to supply the fine range of test & measurement gear by

thandar

Made in U.K.

FREE 44 PAGE PRICED AND ILLUSTRATED CATALOGUE ON REQUEST

● Over 9000 items stocked

- counters
- multimeters
- scopes
- signal generators etc.

ELECTROVALUE LTD 28 St. Jude's Road, Englefield Green, Egham, Surrey TW20 0HB Phone Egham (0784) 33603. Telex 264475
North Branch, 680 Burnage Lane. Manchester M19 1NA
Telephone 061 432 4945
Please mention this publication when replying

BRITAINS FOREMOST QUALITY COMPONENT SUPPLIERS

CIRCUIT ANALYSIS

on CBM/PET or COMMODORE 64

An all machine code program for the most rapid analysis of the performance of linear electronic circuits. This package evaluates voltage gain, current gain, input impedance and output impedance in magnitude, phase angle form.

Program features:
Capacity 30 nodes, 100 passive components, 20 active sources.
Simulates LCR transistors, FET, Op-amp, transformer and transmission lines in any circuit configuration.
Simulates real or complex sources and loads,
Simple, rapid, component value or parameter changes.
Hardcopy of all results, including conventional graphs
Graph axes may be LIN/LOG/db as appropriate with automatic scaling.
Evaluates maximum or minimum value of all circuit functions.
Evaluates unity gain bandwidth and slope of voltage gain characteristic at this frequency.
Evaluates bandwidth at 'x' db down on the repsonse at any frequency.
Hardcopy of component list and performance summary.
Filing of circuit details and last used parameter values, enabling a rapid loading of previously saved circuit.
Comprehensive instructions with many examples.
State model and disk drive number. Cassette to order.

Written by a Design Engineer for other engineers.
Many satisfied users. In use two years.

S.J. BRANSON
111 Park Road
Peterborough PE1 2TR
Tel: (0733) 67604

PRICE **£60** INCLUSIVE NO V.A.T.

DX DIARY

News for HF operators compiled by Don Field G3XTT

The onset of summer (if you can call it that) heralded some improved conditions on ten metres, at least in a north-south direction, and US amateurs were quick to make transatlantic contacts on 24MHz after its release for their use. This latter band should prove very interesting in time, particularly once higher powers are permitted to UK amateurs.

The force is with us

Having said all this, we can be in no doubt that the sunspot minimum is now well and truly with us, and many amateurs will be looking for something other than distant DX to keep them amused. Many years ago my daytime recreation on the LF bands used to be chasing squares for the Worked All Britain Award, and I am delighted that this award programme is still going strong, despite the death some years ago of its founder G3ABG.

Worked All Britain

WAB started in April 1969 under the sponsorship of the Cannock Chase Amateur Radio Society. The initial award was available in Basic, Bronze, Silver and Gold classes, the Gold Award requiring the applicant to have worked (or heard, in the case of an SWL) 1500 out of a possible total of 3980 Ordnance Survey squares.

These squares derive from the grid pattern of squares (100 kilometres per side) into which Great Britain is divided by the Ordnance Survey. Each square has a two letter reference (TL, TM, etc) and is further sub-divided on a north/south and east/west basis into 100 smaller squares (with 10km sides). These squares are numbered 0 to 9 both vertically and horizontally from the bottom left-hand corner (thus going from 00 to 99). The WAB awards are based on these squares, plus a distinction by county. Thus some squares only count once, but others, if divided by a county boundary, will count more than once.

A WAB record book, listing all areas, counties and offshore islands (a specified number of each are required for the Gold Award) became available for seven shillings and sixpence. By July 1969 six hundred books had been sold and a further award (the WAB Century Award) was introduced for working 100 book-holders.

WAB contests

The WAB contests were introduced in 1970. There were six twelve-hour events for LF, HF and VHF (both phone and CW in each case).

Originally, all contacts from 1/1/46 counted for WAB awards and QSL cards had to be submitted with claims. However, this placed an undue burden on the QSL bureau and on mobile operators travelling from square to square for the benefit of others.

For contacts made after 1/1/72, therefore, QSLs were only required where reports were not exchanged at the time of the contact. In January 1972 a new series of (updated) books was issued, at a cost of 65p.

Diamond Award

It was at this time that the Diamond Award was introduced. By now the number of possible areas had grown to 4200, and Diamond Award claimants had to have worked 3000 of them, together with a specified number of book-holders, islands, and numbers of areas on particular bands.

It was around 1971/73 that WAB became independent of the Cannock Chase ARS and the first AGM and election of officers took place on 15 April 1973. This, and each succeeding AGM, was held at Drayton Manor Park.

The first committee consisted of G3VIT (President), G3ULH (Manager/Treasurer), G3ABG, GW3UXS, G3VLL, GM3OGJ, G3RDC and Bob Treacher. Later that year the new committee introduced the Large Squares Award.

New counties

It was in 1972 that Parliament intervened, by way of the Local Government Act, which made considerable changes to county boundaries, much to the chagrin of those who were close to qualifying for various awards. However, the opportunity was taken to have a thorough re-organisation of the books and the existing awards, as well as introducing two new awards (the WAB Counties and WAB Districts awards).

Since that time (1 April 1974,when the act came into effect) WAB has continued with over 5000 books now having been sold. In 1979 the Decade Award was introduced to celebrate 10 years of WAB.

At the 1982 AGM a formal constitution was adopted, ensuring voting rights to book-holders and paving the way for affiliation to the RSGB.

The future

WAB continues to grow and is by no means confined to HF,with an increasing number of class B devotees. In his report to the 1985 AGM on 12 May, the awards manager reported that no less than 670 awards had been issued in the previous year, and the treasurer reported donations of £250 to RAIBC and £100 to QTI.

It is worth noting that no individual receives payment for services to WAB and profit from the sale of books and fees for awards is donated to organisations catering for the less fortunate amateur.

So there you have it, an interesting awards programme which at the same time puts something back into our hobby. My thanks to Adrian Keeble G4HPU for the above background to WAB. If you want to take part why not send £5 for a book to Brian Morris G4KSQ at 22 Burdell Ave, Sandhills Estate, Headington, Oxford OX3 8ED, or send him a stamped, self-addressed envelope for more information. Alternatively, see the WAB stand at the HF Convention.

Lundy Island

As part of their tenth birthday celebrations, members of the Newport Amateur Radio Society (GW4EZW) will oper-

ate from Lundy Island from 21 to 28 September. This may be the last major DXpedition to Lundy as the helicopter service to the island will be discontinued on 30 September. Operation will be on all HF bands (160-10) as well as VHF. Although not counting towards the Islands on the Air programme, Lundy does count towards the WAB Awards (see above) and five of the operators will be WAB members.

The callsign to be used is GB4LIE and a considerable array of gear will be taken in addition to a 60ft tower (which, needless to say, is not going by helicopter!) for the HF beams. Skeds can be arranged beforehand by writing to PO Box 33, Newport, Gwent, or phoning (02912) 6867. Special QSLs will be available through the bureau or via the above box number.

Cyprus

Now that the British Sovereign bases count as separate countries, there is interest in which ZC4 amateurs are active on the bands. There are currently some twenty-five ZC4 licences in force, including the two club stations, ZC4EPI in the Western Base and ZC4ESB in the Eastern Base. Of the remainder, only about ten are active and only about half of these could be described as very active. CW operation from ZC4 is particularly scarce. ZC4CZ offers skeds (especially CW) to anyone interested and can be contacted via JSB, BFPO 53. His QSL manager is G4MGQ/G8MWS.

Rodrigues Island

For much of last winter 3B9CD was regularly to be heard on the low frequency bands operating from Rodrigues Island, a dependency of Mauritius. Rodrigues, which is linked to Mauritius by a regular boat service, is a lush volcanic tropical island, about forty square miles in area with a population of about 33,000.

The island was first sighted by the Portuguese in 1507 and at that time was uninhabited. Later, however, it was colonised by the French who used slaves to cultivate sugar plantations. Britain acquired the island and the slaves from the French at the end of the Napoleonic wars and most of the present islanders are direct descendants of those slaves, although there have been some Chinese and Indo-Mauritian immigrants. The main export is labour to work in Mauritius itself.

In amateur radio terms, Rodrigues acquired the 3B9 prefix on independence in 1968, having previously used the VQ9 prefix (assigned to several British islands in the Indian Ocean and still used from the Chagos Archipelago). Many Mauritian amateurs have operated from there over the years and several visiting amateurs from elsewhere (Mauritius has a major international airport, and Rodrigues can be reached by boat or light aircraft). My own collection of QSLs includes cards from 3B8AE/3B9, K1BJ/3B9, 3B8FK/3B9 and DL9EAJ/3B9 as well as 3B9CD mentioned earlier.

Somewhat more inaccessible are the other Mauritian dependencies of Agalega Island (3B6) and the St Brandon Rocks (3B7, also known as the Cargados Carajos Shoals). These two count as a single country for DXCC but separately for the Islands on the Air awards.

Agalega Island actually consists of two islands (North and South islands), twenty-seven square miles in total, lying about 600 miles north of Mauritius. With a population of only 350 life is very much at the subsistence level,although there is a small export of copra and coconut oil.

The St Brandon Rocks lie 250 miles NE of Mauritius and consist of twenty-two islets, uninhabited except for a fishing station on the largest.

I have two QSL cards from Anand 3B6CD (the same operator as 3B9CD) dating from 1979/80 and a further card for a contact in 1981 when he operated briefly as 3B8CD/3B7.

However, in recent years there has been little or no amateur operation from Agalega or St Brandon. Readers will recall the saga of SM0AGD's attempt to travel there earlier this year (see June *DX Diary*), which was thwarted by officialdom. In any case these islands are sufficiently remote to discourage the would-be tourist.

All in all, then, we may have to wait some time for another operation unless the Mauritian operators themselves can put something together.

News

Despite what I said last month about Mount Athos, a short operation by G4VGO (ex-KF10 and SV0BV) was announced in late July, and there are rumours of a possible operation in September. Sometimes it is hard to know just what to believe. One thing is for sure, an unauthorised operation in late June by DL7FT, supposedly from Mount Athos, did nothing to help the amateur radio cause in that part of the world.

New Zealand amateurs will be allowed to use the ZM prefix in place of the more usual ZL from 1 October until the end of the year. This is to mark the 6th conference of IARU (International Amateur Radio Union) Region III which will be held in Auckland from 13-17 November.

A very special station to look out for during this period will be ZL8OY, scheduled to arrive on Kermadec Island in late September. Chris is currently active as ZL7OY from Chatham Island,and will be very popular with the masses if his new posting comes about as planned (from Chatham, and previously from Auckland Island, Chris was mainly to be found on 40, 20 and 15 metres SSB).

The Guernsey Amateur Radio Society are planning a training course for young (under 18) RSGB members, to coincide with the CQWW SSB contest in late October. The aim is to train newly licensed (class A or B) amateurs in DX and contest techniques, focussed around a major international contest.

Further information can be obtained from Andrew Haymon GU4WTN, c/o GARS, PO Box 100, Guernsey (or 'phone (0481) 65633). Andrew himself is probably the youngest ever (at 16) UK recipient of the DXCC award.

Contests

On the contest scene, September brings the German organised Worked All Europe SSB event on 14/15th and the Scandinavian Activity Contests (CW event for 27 hours starting at 1500GMT on 21st and SSB event, similar, but a week later).

And there we have it for another month. I always welcome comments on, and contributions to, this column. Ideally these should reach me about one month before publication date. See you at the HF Convention?

G4LJF's 100ft tower with KT34XA and KLM yagi for 40m

ANGUS McKENZIE TESTS

ICOM IC735 MOBILE HF TRANSCEIVER

The IC735 is Icom's latest addition to their range of HF transceivers which can all be run off 13V for mobile operation, and some of which can be provided with an internal mains power supply. This rig is smaller than the other Icoms and is thus very compact indeed. It is primarily intended for mobile operation, although it could be very suitable for use as a base station using an external 13V PSU. It has general coverage reception from 0.1MHz to 30MHz, and transmits on all amateur bands from 160 to 10m.

SSB, CW, AM and FM modes are included and interconnections allow the use of AFSK for RTTY purposes. The front panel tuning knob runs very freely but there is a small access hole underneath the front panel to allow for increased tuning tension if required. Frequency is indicated digitally with 100Hz resolution, the display also giving very comprehensive status indications including VFO A or B, memory channel, mode, Tx/Rx, etc. The LCD has a green background with black lettering, which is very easy to read from all angles.

Front panel

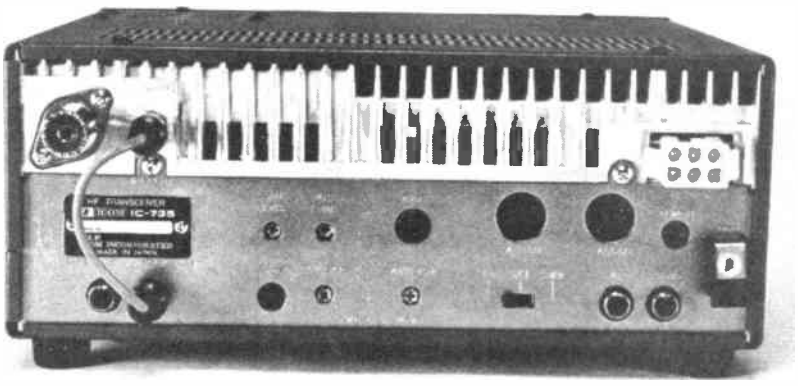
The main controls on the front panel include push-buttons for supply on/off, MOX Tx/Rx, four mode buttons (SSB button cycles between normal and reverse SSB modes), noise blanker on/off, 20dB antenna attenuator, 10dB gain pre-amp on/off, AGC fast/slow and processor on/off.

To the left of the tuning knob is a bug hutch cover which pulls forward and down revealing some miniature up/down faders with a very short throw for adjusting noise blanker level, RF gain, RF output power, VOX gain and delay and mic gain.

Below these are more push-buttons selecting normal AM or narrow AM (ie, SSB filter!), CW normal or narrow, meter ALC or power output, VOX on/off, semi or full break-in keying, and electronic or manual keying.

I am slightly concerned about this hinged cover as it is rather flimsy and, I feel, could be easily broken in a mobile installation. Furthermore, I wonder just how long the miniature faders will last before rot sets in!

To the right of the tuning knob are four large buttons to control the VFO mode, the first of these giving 10Hz/1kHz synthesiser steps, and in the 10Hz position the tuning rate is approximately 2kHz per revolution, rising to 8kHz per revolution when tuned fairly fast. If it is tuned very fast the synthesiser loses lock, so you don't QSY as far as you think you ought to! In the 1kHz step position the tuning rate is approximately 100kHz per revolution.



The second button selects MHz steps and the third button, when pressed in, allows the VFO to tune from one amateur band to the next in jumps. By the side of this button is a memory button associated with which are push-buttons for going up and down the twelve memories which store mode and frequency.

A scan button has two functions. When the rig is in the VFO mode and the scan button is pressed, the rig searches slowly between the frequencies stored in memories 11 and 12. The normal searching rate is just under two minutes for 100kHz, with 10Hz steps selected, and eleven seconds per 100kHz, with 1kHz step rates chosen. The searching speed can be made faster by removing an internal jumper connector.

Squelch control

If the squelch control is used searching stops when a signal breaks the squelch, searching continuing ten seconds after the signal disappears. An internal switch can select a fixed stop when a signal has been found.

When in the memory mode the scan button scans over all the memories in rotation, the same scan stop and continue functions being applicable.

Two VFOs are incorporated, and one can switch between them, equalise them or split between Tx or Rx. Rotary controls include passband tuning, which is centre indented, and tunable notch (switched). An RIT control can be switched in to offset Rx by ±800Hz. Two more buttons select memory write and memory to VFO functions. To the left of the tuning knob is a dial lock button, to prevent accidental QSY, which is very useful if you are mobile.

Good sound quality

Finally, a dual concentric rotary control includes Rx audio gain and behind this is a squelch control, which is active on all modes. On the front panel is a ¼in mono headphone jack and an 8-pin standard Icom mic socket, the mic supplied being an ICHM12 which is an electret fitted with up/down buttons and a PTT lever and gives quite good sound quality.

A bail stand is provided under the front which can lift the rig around 2.5cm. The loudspeaker is built into the top panel. On the left side cheek is an adjustment hole to allow the LCD brightness to be varied, other holes under the bottom panel providing access to CW side-tone volume and Rx audio tonal balance adjustment.

On the rear panel are very many interfacing sockets. The antenna connection is an SO239, and two phone sockets are provided to give breakpoints with a jumper immediately after the Tx/Rx antenna relay in the receive path. A transverter Tx drive socket gives around 30mV at 28MHz which is a ridiculously low level, although most modern transverters should just about be sensitive enough. I suggest that it is about time that Japanese manufacturers standardised on a much higher level than this at say +10dBm, which would make life easier for everybody.

Sockets

The 13V dc input socket allows the connector to lock onto it and the heavy duty lead supplied is fused in positive and negative lines, its length being just over 3m!

A spring-loaded earth tag is fitted below this socket. Two more phono sockets are for ALC input and Tx relay (short on Tx). A three-position switch enables the meter to read power output, set SWR and SWR read.

A stereo jack is provided for keying, and a 3.5mm jack for external speaker. The PA heatsink includes a cooling fan mounted internally. Preset adjustments are provided for AF compression level, mic tone adjustment, AM carrier insertion level and anti-VOX level.

A sub-miniature coaxial connector labelled remote is provided for computer interface using serial data. Two multi-pin accessory sockets are fitted with various connections. Accessory one, an 8-pin DIN, providing ground, send (Tx ground), mod (input to Tx modulator for AFSK), AF output (fixed level from just before Rx gain control), squelch, 13.8V dc and ALC input.

Accessory two, a 7-pin DIN includes 8V dc, ground, send, band data, ALC input and transverter control and 13.8V. When the 8V pin is connected externally to the transverter enable pin the PA shuts off and the transverter RF drive socket is enabled.

Although this socket is not the normal Icom oblong type previously used, the importers inform me that the interconnections are standardised, including the band data for interfacing with external Icom equipment, although no lead is available at present.

Two additional switches are provided internally, a 25kHz marker and a power reduction switch to 50W max. Options include a narrow CW filter and an electronic keyer board.

Laboratory tests

We checked the RF sensitivity on SSB at 28.55MHz and it proved to be very good for a mobile rig, although it fell short by just 1dB or 2 from the best Icom alternatives.

It should certainly be sensitive enough, even on the 10m band, for normal QSOs, even when the band is quiet, although there is not too much sensitivity to spare. The reciprocal mixing performance measured superbly well for spacings beyond 20kHz, the measurements for spacings above 100kHz being fantastic.

At a few spot frequencies the off-channel input signal gave a beat with off-channel local oscillator spurii to degrade the odd measurement, but these oscillator 'birdies' were all very weak indeed. The 5kHz measurement sat right on top of one of these, the ratio here being −74dB, but it improved to −86dB when the rig was moved just 1kHz further away, this figure being up to the average good Icom synthesiser performance.

John Thorpe method

The intermodulation performance was checked in several ways and the figures quoted are from the John Thorpe method. These measurements show that the IC735 has a spectacularly good dynamic range, and who can possibly quibble about a +20dBm intercept point on a rig with a good sensitivity!

We checked the blocking performance, which has been rather poor on some earlier Icom rigs, and found that this one shows a very marked improvement over the IC745 for example. The intercept point at 5/10kHz spacing was around −25.5dBm rather than the horrendous figures noted on the 745. This results in a much cleaner reception on the LF bands, which will allow you to winkle out weak DX stations much more easily. The FM sensitivity measured fairly well but I would have liked to have seen it a few dB better.

The SSB selectivity shows the top of the curve to be a little bit on the narrow side with the −60dB points showing 3.8kHz bandwidth, which is just about right. The skirt opened out a bit below this, though, particularly as the generator hit a small sprog at around 5kHz off-channel. The FM selectivity was, as usual, rather on the wide side and it was not possible to reject 10kHz off-channel stations adequately for 10m FM.

We noted just 24dB difference between S1 and S9 on SSB, but readings above S9 were surprisingly realistic. We checked the FM received response inserting 750μS pre-emphasis in the signal generator and noted an amazingly flat response from just below 500Hz to 4kHz, the bass end rolling off sharply below 200Hz.

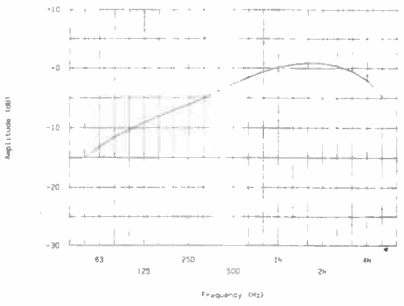
Insufficient attenuation

At 5kHz the response was still only 5dB down and this is in my opinion showed insufficient attenuation of frequencies above 3kHz, thus contributing to the slightly poorer than average FM sensitivity reading. Although the SSB response was slightly on the narrow side this was virtually entirely due to the filter, for the response after the product detector was quite flat to 2.5kHz.

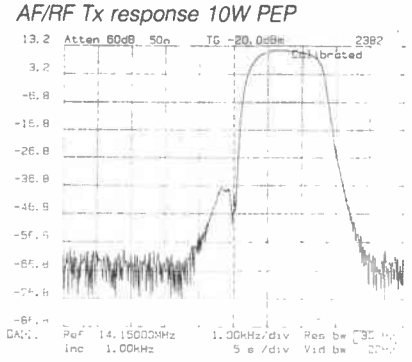
Product detector distortion measured fairly well, up to Icom's normal standard which is quite acceptable.

The FM discriminator distortion was also quite reasonable at 1.7% for 2.5kHz deviation. The maximum audio output power was 2.8W for 10% THD, but this increased to a healthy 4.6W into a 4 ohm load, which should be ample for mobile use and a lot better than much of its competition.

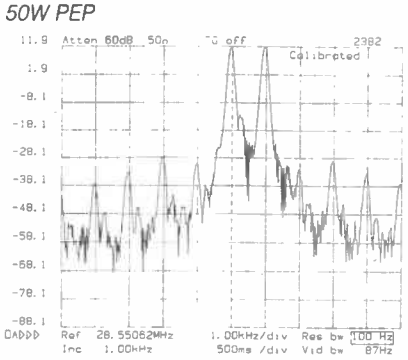
Received audio response (750μS pre-emphasis)



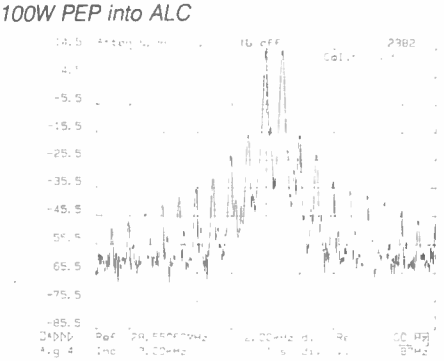
AF/RF Tx response 10W PEP



50W PEP



100W PEP into ALC



FM limiting action was excellent but we did note that the quieting at very low input levels measured far better than the sinad sensitivity, thus showing increased distortion on low level signals, which is a little curious. This could again have been caused by the over wide response.

Excellent

We checked the frequency stability and tuning accuracy and these were both excellent. The digital read-out was well within 100Hz of the true received carrier frequency on SSB, although we noticed an offset of around 1kHz on CW. This particular point is highly debatable but one very useful improvement by Icom is that they have at last changed their philosophy concerning sideband switching. On the IC735 the carrier point remains the same, as does the digital read-out when switching sidebands.

We checked this by tuning in a strong AM station on AM and then switching to SSB. When the carrier beat was 0 and the speech pitch was correct, there was hardly any detectable pitch or quality change when changing sidebands, thus allowing you to check on another station's sideband rejection.

If you look at the two-tone plots taken on 28.55MHz you will see that at 100W PEP output (into ALC) the lower order products are quite acceptable, but higher orders do not decrease fast enough. An example of this is that the products do not reach −60dB until the 15th order. At the 50W PEP level you can see that the third order products are actually lower than 5th order, and this shows slight distortion cancellation in the PA and its driver. However, note also that 9th order is no better than it was at 100W.

Plots taken at 14.15MHz show a very similar story at 50 to 100W PEP levels. The AF/RF plot taken from mic input to RF output at a maximum output power of around 10W, using my newly developed technique, shows the transmitted passband to be rather on the narrow side. Not only are the skirts extremely steep below 500Hz and above 2.5kHz, but there is some added LF roll off below 700Hz which would make transmissions a little bit on the thin side.

Superb

Carrier rejection is superb, however, being better than −60dB rev full carrier, and sideband rejection is also excellent. Returning to the two-tone plots you will also be able to see that some audio distortion developed, eg F1-F2 being −28dB.

The average for all the plots here shows around 3% second order audio intermodulation distortion. This seems to be a characteristic of many Icom rigs and, whilst it is not bad, I would like to see it cleaner.

Power output on CW, SSB and FM is generally at 100W or slightly higher on all amateur bands. Transmitted frequency accuracy was within 50Hz and maximum FM deviation was set at 5kHz; rather high for 10m FM. We had a look for harmonic and spurious outputs from all bands and in general harmonics were between −63dB and −75dB or even lower, whilst the odd spurii were always below −60dB. Only on one band did we note harmonics at just a slightly significant level, 10.125MHz at full power producing a second harmonic of −54dB and a third of −55dB. The rig draws up to 18A at full power output.

Subjective trials

I tried the rig on all modes for reception from medium wave up to 29.6MHz. CW reception was excellent even though the review sample was not fitted with a narrow CW filter. SSB was always received cleanly and tuning across LF and HF bands showed up less crackly rubbish in between stations than usual, thus verifying the excellence of the synthesiser and of the front end performance. The passband tuning was spectacularly useful, for a very high frequency interfering carrier could be removed so easily with a slight adjustment of PBT.

I was not impressed with the notch filter, however, as it did not seem to give a good enough notch and was over wide. There seemed to be plenty of sensitivity on all bands and I did not need to use the pre-amp (which gives around 10dB gain) below 21MHz under normal conditions. The 20dB antenna attenuator was useful for LF but was not as necessary as usual, again because of the superb front end performance. On 10m the receiver seemed very lively in a sporadic-E opening and there seemed to be plenty of IF gain.

IC735 Laboratory Results

Receiver Results	
All measurements with RF pre-amp on	
Sensitivity SSB for 12dB sinad	
28.55MHz	−122dBm (0.18 μV)
Sensitivity FM for 12dB sinad	
29.55MHz	−118dBm (0.28μV)
Selectivity, SSB bandwidth	
−3dB	1.7kHz
−6dB	2kHz
−40dB	2.9kHz
−60dB	3.8kHz
−70dB	5.1kHz
Reciprocal mixing ratios	
5kHz	81dB
6kHz	86dB
8kHz	91dB
11kHz	94dB
22kHz	104dB
52kHz	113dB
102kHz	120dB
Calculated intercept point (Thorpe method)	
5/10kHz	−25.5dBm
10/20kHz	−19dBm
20/40kHz	+2dBm
55/110kHz	+19dBm
105/210kHz	+20dBm
S-meter SSB	
S1	−100dBm
S3	−95dBm
S5	−91dBm
S7	−85dBm
S9	−76dBm
S9+20	−56dBm
S9+40	−40dBm
S9+60	−20dBm
SSB product detector distortion	1.1% THD
FM discriminator distortion (2.5kHz deviation of 1kHz)	1.7%
Maximum audio output power (10% THD)	
8 ohms	2.9W
4 ohms	4.6W
Size	241 (W) x 94 (H) x 239 (D) mm
Weight	5kg
Transmitter Tests	
Frequency accuracy	within 100Hz
FM max deviation	5kHz
Max power SSB/CW	>100W output
SSB carrier rejection	−60dB
SSB alternate sideband rejection	below −48dB
Maximum current	18A

Fast AGC was just about fast enough, whilst slow AGC was a compromise between being fast enough to cope with a net and slow enough to retain a moderate dynamic range on a strong SSB signal. However, I would personally have preferred it to be slightly slower. The filter bandwidth was rather narrow, which is excellent for DX reception, but too narrow in my opinion for a long relaxed QSO with a strong station.

Fewer problems

I noted fewer problems than usual when receiving 160m from my trapped half-wave dipole, although there was slight intermodulation from medium wave signals until I switched in the ATU. AM reception was quite good, distortion seeming better than usual although still not good enough, peak modulation sounding just slightly rough.

Incidentally, measurements showed that when the rig was tuned right onto an AM station centrally, the distortion was slightly higher than when tuned slightly off it, which is a bit odd. AM selectivity was not particularly good but the quality of stronger stations was above average. FM reception on 10m confirmed the selectivity to be too wide, although quality was excellent.

I tried all the various facilities offered on the front panel and, despite their complexity, the rig was very easy to use as the various buttons and knobs are very well laid out. I liked the feel of the tuning knob which makes this rig so much easier to tune than, say, the Yaesu FT757. In the context of mobile operation it would perform very well indeed, but I also liked the rig for home station use.

The loudspeaker quality is quite adequate, although there was a slight tendency for it to rattle very occasionally when driven at a high power level. Back panel facilities are very extensive, allowing for many different interfacing possibilities. I feel that this rig has been better designed both technically and ergonomically than earlier Icom rigs. The instruction manual is well up to the usual high Icom standard and gives helpful explanations of all the facilities, although it was just a little vague about transverter interfacing.

Conclusions

This rig is clearly in direct competition to the Yaesu FT757 and the Trio TS430S. Whilst I appreciate that many readers will have their personal loyalties for one brand or another, I feel that the IC735 is a clear winner over its competition within a fairly similar price bracket. The Yaesu and Trio prices have just been reduced somewhat, making the Icom comparatively more expensive. Not only is the Icom's overall performance excellent in all areas, except for my criticism of the rather high two-tone intermodulation levels of high orders, but ergonomics are splendid and far superior to the competition.

Flag waver

I would not be surprised to see Icom discontinue the IC745, for I much prefer this new model. It seems to be an excellent flag waver for Icom and it is fascinating that not only is the intercept point dramatically better, but Icom have also improved the IF blocking performance which was so poor in the IC745.

Modulation quality was regarded as being quite adequate from a communication point of view, FM being excellent, and the considerable LF cut on SSB would actually be an asset when the rig is used as a mobile. I have no doubt that this rig will sell extremely well and I highly recommend purchase.

The rig should be compatible with Amtor as the change-over is very rapid and the AGC attack very fast, but note that you cannot turn the AGC off.

I would like to give my usual thanks to Thanet Electronics for loaning the review sample, and to Jonathan G1LMS, Nigel G1LSA and Mark G4RCD who all helped with measurements.

At the time of writing the rig is priced at £849, the accessory PSU costing £169 and the CW narrow filter option £46, all including VAT.

YAESU
FT709R
70cm FM
HANDY-TALKY

In the November 1984 edition of this magazine I gave a very warm recommendation for the Yaesu FT209R and its higher power version, the RH model. A few months ago the Yaesu FT709R arrived and I have been assessing it for a while, both with its own supplied 5/8 wave flexy whip and with a Walters & Stanton double 5/8 collinear, made for them by Diamond. Let me say here and now that FT709R is easily the best portable 70cm FM rig that I have yet tried as it offers excellent performance with superb ergonomics and facilities which far outclass those of the Icom IC04E.

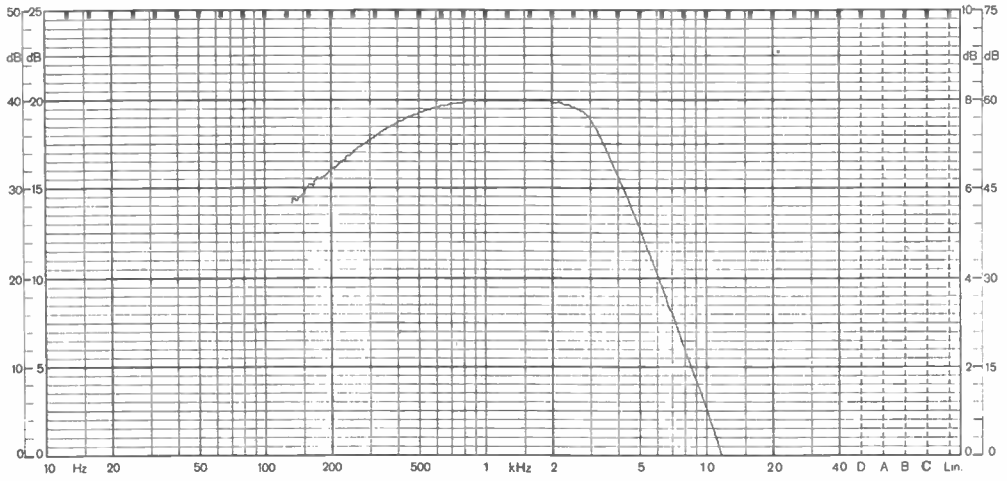
Virtually identical

The facilities are virtually identical to those of the 209R, which were discussed in great detail in the previous review of the 209R. As a short recap the following basic facilities are mentioned. In the centre of the front panel there is a 5x4 push-button matrix which gives access to frequency from 430-440MHz. Stepping buttons can be selected to give 25 or 50kHz channelling. There is immediate access to plus or minus repeater shifts, reverse repeater and any of ten memories which can hold frequency and repeater offset information. Various types of scanning are provided, and both priority channel scanning and direct access to a pre-determined calling channel are available, the latter being stored in memory 0. You can scan up and down the memories by selecting any memory and using the up and down stepping buttons.

The FT709 also includes battery saving circuits which allow the rig to monitor a channel for 300mS and then fall asleep for 300mS to 3S as programmed, thus saving the current drain when on squelch to not more than a few mA. Three miniature slide switches select the meter to indicate power output/S-meter or battery check, scanning clear/manual/busy channels and key pad lock on/off. Three battery packs are available which slide on sideways underneath the rig; the FNB3 delivering 10.8V at 425mA/hours, FNB4 12V at 500mA/hours and the FBA5 which can hold 6 AA size dry cells. The review sample being supplied with the FNB3.

When you slide the battery pack off, a small adjustment hole is exposed through which a mini screwdriver can reach the 25/50kHz channelling switch.

The LCD indicates frequency and all important status functions. It is easy to see, especially in the dark if you press an illumination button on the right side cheek which also includes a hand strap



FT709R FM transceiver audio response. 3kHz deviation 750μS de-emphasis

attachment. The PTT lever and toneburst button are on the left cheek whilst the mic and loudspeaker are mounted on the top of the front panel. On the back of the rig is a substantial belt clip. On the top there is a BNC socket for antenna connection and sockets for external mic/speaker. An accessory speaker mic (type MH12 costing £18.80) is available which can be used with VOX controls on the top panel, one selecting VOX on/off and the other low or high sensitivity.

The volume control incorporates the on/off switch and by the side is the squelch control, both of these being very easy to use. A low/high power switch is also provided here. Underneath the battery pack are the charging connections and a socket for driving the rig from an external dc voltage (6-15V).

Of the many important accessories available, mentioned in the FT209R review, I would like to remind readers about the fast charger, type NC15 costing £65.95. The charger for the FNB3 battery pack, type NC9C and the charger for the FNB4 battery pack, type NC18C both cost £9.60. The basic price for the FT709R is £289 including VAT, the FNB3 battery pack, whip, case, carrier strap and small earpiece. With the FNB4 pack the price becomes £299.

Yaesu FT709R Laboratory Results

Receiver Results

Sensitivity	
FM, for 12dB sinad	
432.025MHz	−122dBm
433.4MHz	−122dBm
435.975MHz	−122dBm
439.975MHz	−121dBm
Selectivity	
off channel blank carriers	
±25kHz spacing	65/64dB
±50kHz	70/69.5dB
off channel 3kHz modulation/3kHz deviation	
±12.5kHz spacing	7/12dB
±25kHz	65/65dB
±50kHz	71/72dB
RM, FM ratio	
+100kHz spacing	107dB
+50kHz	90dB
+25kHz	84dB
S-Meter assuming that the numbers on the meter are 'S' units	
S1	−111dBm
S9	−91dBm
S10 (fsd)	−88dBm
FM audio distortion at 3kHz deviation	1.4%
Maximum audio output power (10% THD at 5kHz deviation)	
4 ohms	1W
8 ohms	0.7W
Capture ratio	4dB
Quieting	12dB
Calculated intercept point	
12dB sinad method	
+100/+200kHz spacing	−16dBm
Size 65 (W) x 168 (H) x 34 (D) mm	
Weight 570g	

Transmitter Results

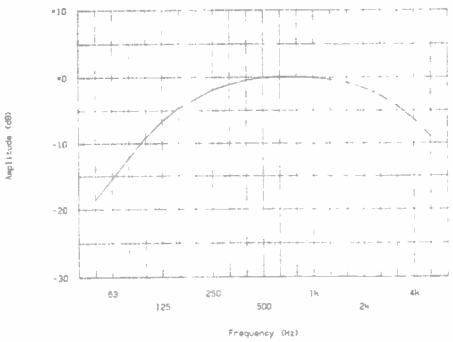
Maximum output power (high/low)	Int Battery	Ext 13.8Vdc
433.5MHz	4/0.35W	5/0.35W
Deviations (toneburst/normal speech/provoked speech)		3.6/4.2/5.3kHz
Repeater shift accuracy		within 10Hz
Toneburst frequency accuracy		1752Hz
Tx accuracy		+300Hz
Current drawn at 13.8Vdc (Tx high/Tx low/Rx squelch)		940/335/37mA

Laboratory tests

The input sensitivity varied from 0.18-0.2μV across the band and, whilst the sensitivity is quite good, I have measured somewhat better in one or two other rigs. The input intercept point is – 16dBm, and this shows a significant improvement over much of the competition. The reciprocal mixing performance measured quite well at close spacings and very well further out, so there should be no trouble in this area. The IF selectivity measured extremely well at 25 and 50kHz spacings, but 12.5kHz off-channel signals showed the close in selectivity to be only fair. Although amateurs do not normally use this close spacing on the band, there are, unfortunately, some other band users who do use 12.5kHz offsets.

FM discriminator distortion is at quite an acceptable level, and a maximum

Received audio response (750μS pre-emphasis)



audio power output of 0.7W is higher than that of many other handhelds into 8 ohms, and rising to a full watt into 4 ohms, which is almost high enough for mobile use. The received audio response does not roll off at LF until you get down to around 200Hz, below which it rolls off fairly gently.

Slightly down

The HF end is only slightly down at 3kHz, and even at 5kHz the response degrades the measured sinad sensitivity which therefore sounds better than it measures. I quite liked the extended response on this band with the wider channelling, but I would have preferred a steeper bass cut. Received frequency accuracy was excellent. We checked the current consumption on Rx normal squelch which was just 37mA at 13.8V.

The transmit section had a frequency error of only 300Hz, the repeater shifts being accurate. The toneburst was only 2Hz high, and its deviation was just right. Normal speech deviation was set quite accurately for the band. The transmitted response from the mic input jack to the carrier output with 750μS de-emphasis showed LF cut below around 250Hz, which was not particularly steep, the HF extending almost flat to 3kHz and 5kHz being only 7.5dB down. This is a wider response than usual, but again, perfectly reasonable for UHF.

The output power available from the Nicad pack (10.8V) was around 4W on high power and an average of 350mW on low power. Using an external 13.8V supply, maximum power rose to 5W. This is a lot of power for a UHF portable and thus makes it far easier to get contacts. Current drain on high power averaged at 940mA from an external 13.8V supply, reducing to 335mA on low power.

Subjective trials

The performance of this rig with just its own flexy whip was way above average, but what I found particularly astonishing was its potential with the double 5/8 whip.

From my garden it was possible to access at least five repeaters, lower powered rigs on their normal antennas managing only one with luck! I have used the rig at other locations and found it to be superb, both the transmitted and received quality being above average. The ergonomics really are superb, and Icom should have a look at these, for this rig is so much better than the IC04E.

The ease of access to repeaters and then back to simplex is particularly marked, and I have no grumbles at all! The battery saving circuit could allow you to leave the rig squelched all day long, and still leave you plenty in the battery; a facility which should not be underestimated in its importance. Some two years ago I reviewed this rigs' predecessor, the FT708, very favourably in this magazine, but the FT709R is significantly in advance of it.

Conclusions

I consider the most important competitor to be the Trio TH41E, which I reviewed very recently. The Trio rig is stunningly small and is also a good performer, but it has only a very low power output and its whip is so small that it provides only a very low ERP.

The FT709R, although much heavier, is for the amateur who wants to have the higher power and super facilities, which also make the rig suitable as a low power mobile rig. A BNOS linear with an appropriate power sensitivity when combined with this rig could provide you with a very good mobile installation, but I do not see why you shouldn't have a lot of fun with this rig as a base station.

Very satisfied

I most strongly recommend this new Yaesu product which may well greatly assist in further popularising the band. Some of my friends have already bought them and have been very satisfied. Very many thanks to Amcomm for the loan of the review sample which I finally decided to purchase, and to G1LMS and G4RCD for assisting me to prepare the review.

INTEGRATED CIRCUITS

AN124	2.50	MC1350P	0.95	STK439	7.95	TBA720A	2.45	TDA2581	2.95
AN214Q	2.50	MC1351P	1.50	STK461	11.50	TBA750Q	2.65	TDA2582	2.95
AN239	2.50	MC1357	2.35	TA706IAP	1.50	TBA800	0.89	TDA2593	2.95
AN240P	2.80	MC1358	1.58	TA7108P	1.50	TBA810AS	1.65	TDA2600	6.50
AN264	2.50	MC14518CP	7.50	TA7120P	1.65	TBA810P	1.65	TDA2610	2.50
AN612	2.15	MC1495	3.00	TA7129P	2.50	TBA820M	0.75	TDA2611A	1.95
AN362L	2.50	MC1496	1.25	TA7130P	1.50	TBA820Q	1.45	TDA2640	3.50
AN7140	3.50	MC145106P	7.95	TA7137P	1.00	TBA890	2.50	TDA2680A	2.75
AN7145	3.50	MC1723	0.50	TA7176AP	2.95	TBA920	1.65	TDA2690	2.45
AN7145M	3.95	MC3357	2.75	TA7193P	3.95	TBA950/2X	2.35	TDA3310	2.95
AN7150	2.95	MC3401L	2.50	TA7203	2.95	TBA990	1.49	TDA4600	2.50
BA521	3.35	ML231B	1.75	TA7204P	2.15	TBA990Q	1.49	TDA9503	3.15
CA1352E	1.75	ML232B	2.50	TA7205AP	1.15	TCA270	1.50	TDA3560	3.95
CA3086	0.46	MSM5807	8.75	TA7222AP	1.80	TCA270SQ	1.50	TEA1009	1.35
CA3123E	1.95	PLL02A	5.75	TA7227P	4.25	TCA650	2.50	UPC566H	2.95
CA314OT	1.15	SAA500A	3.50	TA7310P	1.80	TCA800	2.95	UPC575C2	2.75
ETT6016	2.50	SAA1025	7.25	TA7313AP	2.95	TCA830S	1.95	UPC1025H	1.95
HA1339A	2.95	SAS560S	1.75	TA7314P	2.95	TCA900	2.50	UPC1028H	1.95
HA1366W	2.75	SAS570S	1.75	TA7137P	1.00	TCA940	1.65	UPC1032H	1.50
HA1377	3.50	SAS580	2.85	TA7314P	2.95	TCA440	2.20	UPC1156H	2.75
HA1156W	1.50	SA/SB/T/U	1.00	TA7321P	2.25	TDA1001	1.95	UPC1158H	0.75
HA1551	2.95	SA500A	3.50	TA7609P	3.95	TDA1002A	1.95	UPC1167C2	1.95
LA1230	1.95	SL901B	7.95	TA7611AP	2.95	TDA1003A	3.95	UPC1181H	1.25
LA4102	2.95	SL917B	6.65	TAA310A	1.95	TDA1004A	6.95	UPC1182H	2.95
LA4140	2.95	SL1310	1.80	TAA320A	1.95	TDA1006A	2.50	UPC1185H	3.95
LA4031P	1.95	SL1327	1.10	TAA350A	1.95	TDA1010	2.15	UPC1191V	1.50
LA4420	1.95	SL1327Q	1.10	TAA550	0.25	TDA1035	2.50	UPC1350C	2.95
LA4430	2.50	SN76003N	3.95	TAA570	1.95	TDA1037	1.95	UPC1353C	2.45
LA4400	4.15	SN76013N	3.95	TAA661B	1.95	TDA1044	2.15	UPC1365C	3.95
LA4422	2.50	SN76023N	3.95	TAA700	1.70	TDA1054	1.95	UPC2002H	1.95
LA4461	3.95	SN76033N	3.95	TBA120AS/B/C	1.00	TDA1190	2.15	555	0.35
LC7120	3.25	SN76110N	0.89	TBA395	1.50	TDA1270Q	3.95	556	0.60
LC7130	3.50	SN76113N	1.25	TBA396	0.75	TDA1327	1.70	723	0.50
LC7131	5.50	SN76131N	1.30	TBA440N	2.55	TDA2002	1.95	741	0.35
LC7137	5.50	SN76226DN	2.95	TBA480Q	1.25	TDA2003	2.95	747	0.50
LM1011	3.15			TBA510	2.50	TDA2010	1.95	748	0.35
LM324N	0.45	SN76227N	1.05	TBA510Q	2.50	TDA2020	2.95	7808	0.60
LM380N8	1.50	SN76533N	1.65	TBA520	1.10	TDA2030	2.80	7805	0.65
LM360N8	1.75	SN76544N	2.65	TBA520Q	1.10	TDA2140	3.95	7812	0.65
LM383T	2.95	SN76570N	1.00	TBA530	1.10	TDA2151	1.95	7815	0.65
LM390N	3.50	SN76650N	1.15	TBA530Q	1.10	TDA2160	2.50		
M51513L	2.30	SN76660N	0.90	TBA540	1.25	TDA2190	3.95		
M5155L	2.95	STK014	7.95	TBA540Q	1.35	TDA2521	3.25		
M51521L	1.50	STK015	5.95	TBA550Q	1.95	TDA2522	1.95		
MB3712	2.00	STK043	9.50	TBA560C	1.45	TDA2523	2.95		
MB3756	2.50	STK415	7.95	TBA560Q	1.45	TDA2524	1.95		
MC1307P	1.00	STK433	5.95	TBA570	1.00	TDA2530	1.95		
MC1310P	1.95	STK435	7.95	TBA641A12	3.50	TDA2532	1.95		
MC1327	0.95	STK437	7.95	TBA651R	2.50	TDA2540	1.95		
MC1327Q	0.95					TDA2541	2.15		
MC1349P	1.20					TDA2560	2.15		
						TDA2571	2.95		

NEW BRANDED CATHODE RAY TUBES – Please allow additional £3 per tube for carriage

A1865/20	65.00	D14-173GR	65.00	M19-103W	55.00	M50-120GV	65.00		
AW36.11	25.00	D14-181GH/98	65.00	M23-110GH	55.00	M50-120LC	65.00		
CME822W	19.00	D14-181GJ	55.00	M23-112GM	55.00	M61-120W	75.00		
CME822GH	25.00	D14-181GM	53.00	M23-112GV	55.00	S6AB	45.00		
CME1428GH	45.00	D14-181GM50	59.00	M23-112GW	55.00	SE4/D-P7	45.00		
CME1428W	39.00	D14-182GH	59.00	M23-112KA	55.00	SE42BP31AL	55.00		
CME1523W	39.00	D14-200BE	69.00	M23-112LD	55.00	SE42BP31	65.00		
CME1431GH	39.00	D14-200GA/50	85.00	M24-120GM	59.00	SE52AP31AL	55.00		
CME1431W	39.00	D14-200GM	75.00	M24-120LC	59.00	SE5Fp31	55.00		
CME202GH	45.00	D14-210GH	75.00	M24-120WAR	59.00	T937	65.00		
CME2024W	45.00	D14-270GH/50	75.00	M24-121GH	55.00	T948N	65.00		
CME2325W	45.00	D14-310W	110.00	M28-12GH	55.00	T948H	65.00		
CME3128W	45.00	D14-320GH/82	85.00	M28-13LC	49.00	V4150LC	65.00		
CME3132GH	45.00	D14-340GH/KM	85.00	M28-13LG	49.00	V5004GR	59.00		
CME3155W	45.00	D14-340KA	45.00	M28-13GR	49.00	V5004LD	59.00		
CRE1400	25.00	D16-100GH	65.00	M28-131GR	55.00	V6001GH	65.00		
CV429	89.00	D16-100GH/65	69.00	M28-133GH	55.00	V6007DP31	59.00		
CV1450	35.00	D16-100GH/67	65.00	M31-101GH	55.00	V6008GH	59.00		
CV1526	19.00	D16-100GH/79	69.00	M31-182GR	55.00	V6034WA	59.00		
CV2185	15.00	D16-100GH97	65.00	M31-182GV	53.00	V604CLA	59.00		
CV2191	19.00	D16-160GH	69.00	M31-184W	65.00	V6048J	49.00		
CV2193	15.00	D21-10GH	65.00	M31-184GH	65.00	V6052GR	65.00		
CV5119	85.00	DB7.36	35.00	M31-184P31	65.00	V6064BP31	55.00		
CVS320	85.00	DB7.36	55.00	M31-186W	59.00	V6064CLA	55.00		
CVX389	55.00	DG7.5	55.00	M31-190GH	55.00	V6069GH	55.00		
D9-110GH	39.50	DG7.32	45.00	M31-190GR	55.00	V6070P31	49.00		
D10-210GH	45.00	DH3.91	55.00	M31-190LA	55.00	V7016A	65.00		
D10-210GH68B	65.00	DH7.91	45.00	M31-191GV	55.00	V7030	59.00		
D10-230GH	35.00	DP7.5	35.00	M31-220W	59.00	V7031GH	59.00		
D10-230GM	35.00	DP7.6	35.00	M31-270GY	65.00	V7031/67A	59.00		
D10/293GY/90	65.00	DN13.78	35.00	M31-271P31	65.00	V7035A	49.00		
D13-30GH	49.50	F16-101GM	75.00	M31-271GW	65.00	V7037GH	45.00		
D13-33GM	49.00	F16-101LD	75.00	M31-271W	65.00	V8004GR	65.00		
D13-47GH/26	69.00	F21-130GR	75.00	M36-141W	75.00	V8006GH	65.00		
D13-47GH	55.00	F21-130LC	75.00	M36-170LG	75.00	V8010A	65.00		
D13-51GL/26	85.00	F31-10GM	75.00	M38-103GR	65.00	VCR139A	11.50		
D13-51GM/26	85.00	F31-10GR	75.00	M38-120W	65.00	2BP1	9.00		
D13-450GH/01	55.00	F31-10LC	75.00	M38-120WA	65.00	3BP1	11.50		
D13-471GH/26	55.00	F31-10LD	75.00	M38-121GHR	65.00	3DP1	11.50		
D13-600GH	59.00	F31-12LC	75.00	M38-121LA	65.00	4EP1	30.00		
D13-610GH	59.00	F31-12LD	75.00	M38-122GW	65.00	3H/OBM	55.00		
D13-611GH	59.00	F31-13GR	75.00	M38-140LA	65.00	3WP1	18.50		
D13-611GM	59.00	F31-13LD	75.00	M38-142LA	65.00	5BP1	9.00		
D13-630GH	59.00	F31-13LG	75.00	M38-341P31	65.00	5BHP1	30.00		
D14-150GH	75.00	F41-123LC	185.00	M38-344P39	65.00	5BHP1FF	30.00		
D14-150GM	75.00	F41-141LG	185.00	M40-120W	59.00	5BHP31	30.00		
D14-172GH/84	59.00	F41-142LC	185.00	M43-12LG/01	65.00	5CP1	10.00		
D14-172GR	55.00	M7-120W	19.00	M44-120LC	65.00	6EP7/S	39.00		
D14-172GV	55.00	M14-100GM	45.00	M44-120GR	65.00	13BP1	13.50		
D14-173GH	55.00	M14.100LC	45.00	M50-120GH	65.00	13BP4	17.50		
D14-173GM	53.00	M17-151GVR	175.00	M50-120GR	65.00	17DWP4	25.00		
		M17-151GR	175.00			32J/1085	69.00		
						88D/88B/89D/89L	15.00		
						1273	39.00		
						1564	39.00		
						1844	45.00		
						55451GM	75.00		
						9442E1	80.00		
						95447GM	75.00		
						95449	75.00		
						7709631	79.50		

SEMICONDUCTORS

AAY12	0.25	BC182	0.10	BD238	0.40	BFX88	0.25	TIP32C	0.42
AC126	0.45	BC182LB	0.10	BD242	0.65	BFY50	0.21	TIP33C	0.95
AC127	0.20	BC183	0.10	BD246	0.75	BFY51	0.21	TIP34B	0.95
AC128	0.28	BC183L	0.09	BD376	0.32	BFY52	0.25	TIP41A	0.45
AC128K	0.32	BC184LB	0.09	BD410	0.65	BFY90	0.77	TIP41C	0.45
AC141	0.28	BC204	0.10	BD434	0.65	BLY48	1.75	TIP42C	0.47
AC141K	0.34	BC207B	0.13	BD437	0.75	BR100	0.26	TIP47	0.65
AC142K	0.30	BC208B	0.13	BD438	0.75	BR101	0.49	TIP120	0.60
AC176	0.22	BC212	0.09	BD520	0.65	BR103	0.55	TIP125	0.65
AC176K	0.31	BC212L	0.09	BD538	0.65	BR303	0.95	TIP142	1.75
AC187	0.25	BC212LA	0.09	BD597	0.95	BRC4443	1.15	TIP146	2.75
AC187K	0.28	BC213	0.09	BD701	1.25	BRY39	0.48	TIP161	2.95
AC188	0.25	BC213L	0.09	BD702	1.25	BT100A/02	0.85	TIP2955	0.80
AC188K	0.37	BC214	0.09	BD707	0.90	BT106	1.49	TIP3055	0.55
AD142	0.79	BC214C	0.09	BDX32	1.50	BT116	1.20	TIS91	0.20
AD143	0.82	BC214L	0.09	BF115	0.35	BT119	3.15	TV106/2	1.50
AD149	0.70	BC237B	0.09	BF119	0.65	BT120	1.65	ZRF0112	18.50
AD161	0.39	BC238	0.09	BF127	0.39	BU105	1.95	2N1100	5.50
AD162	0.39	BC239	0.12	BF154	0.20	BU108	1.59	2N1308	1.35
AD161/2	0.90	BC251A	0.12	BF158	0.22	BU124	1.25	2N1711	0.30
AF106	0.50	BC252A	0.15	BF160	0.27	BU125	1.25	2N2219	0.28
AF114	1.95	BC258	0.25	BF167	0.27	BU126	1.60	2N2905	0.40
AF121	0.60	BC258A	0.39	BF173	0.22	BU204	1.55	2N3053	0.40
AF124	0.65	BC284	0.30	BF177	0.38	BU205	1.30	2N3054	0.59
AF125	0.35	BC300	0.30	BF178	0.25	BU208	1.39	2N3055	0.52
AF126	0.32	BC301	0.30	BF179	0.34	BU208A	1.52	2N3702	0.12
AF127	0.65	BC303	0.25	BF180	0.29	BU208D	1.85	2N3703	0.12
AF139	0.40	BC307B	0.09	BF181	0.29	BU326	1.20	2N3704	0.12
AF150	0.60	BC327	0.10	BF182	0.29	BU326S	1.50	2N3705	0.20
AF178	1.95	BC328	0.10	BF183	0.29	BU407	1.24	2N3706	0.12
AF239	0.42	BC337	0.10	BF184	0.28	BU500	2.25	2N3708	0.12
AU106	4.50	BC338	0.09	BF185	0.28	BU508A	1.95	2N3733	9.50
AU107	3.50	BC347A	0.13	BF194	0.11	BU526	1.90	2N3773	2.75
AU110	3.50	BC461	0.35	BF195	0.11	BU807	2.25	2N3792	1.35
AY102	2.95	BC478	0.20	BF196	0.11	BUY20	2.15	2N4280	3.50
BC107A	0.11	BC527	0.20	BF197	0.11	BUY69B	1.70	2N4427	1.95
BC107B	0.11	BC547	0.10	BF198	0.15	MJ3000	1.98	2N4444	1.15
BC108	0.10	BC548	0.10	BF199	0.14	MJE340	0.40	2N5294	0.42
BC108A	0.11	BC549A	0.10	BF200	0.40	MJE350	0.46	2N5296	0.48
BC108B	0.12	BC550	0.14	BF241	0.15	MJE520	0.46	2N5298	0.60
BC109	0.10	BC557	0.08	BF245	0.30	MJE2955	0.45	2N5485	0.45
BC109B	0.12	BC557B	0.08	BF257	0.28	MPSA13	0.29	2N5496	0.95
BC109C	0.12	BC558	0.10	BF258	0.25	MPSA92	0.30	2SA329	0.95
BC114A	0.09	BC639/10	0.30	BF259	0.28	MRF237	4.95	2SA715	0.60
BC116A	0.15	BCY33A	1.60	BF271	0.25	MRF450A	13.95	2SC495	0.80
BC117	0.19	BD115	0.30	BF273	0.18	MRF453	17.50	2SC496	0.80
BC119	0.24	BD124P	0.59	BF336	0.34	MRF454	25.50	2SC931D	0.95
BC125	0.25	BD131	0.42	BF337	0.29	MRF455	17.50	2SC1096	0.80
BC139	0.20	BD132	0.42	BF338	0.32	MRF475	2.50	2SC1106	2.50
BC140	0.31	BD133	0.40	BF355	0.37	MRF477	10.00	2SC1172Y	2.20
BC141	0.25	BD135	0.30	BF362	0.38	OC16W	1.95	2SC1173	1.15
BC142	0.21	BD136	0.30	BF363	0.65	OC23	1.50	2SC1306	1.00
BC143	0.24	BD137	0.32	BF371	0.25	OC29	2.25	2SC1307	1.50
BC147A	0.12	BD138	0.30	BF394	0.19	OC36	2.25	2SC1364	0.50
BC147B	0.12	BD139	0.32	BF422	0.32	OC42	0.75	2SC1449	0.50
BC148A	0.09	BD140	0.30	BF423	0.25	OC44	0.75	2SC1678	1.25
BC148B	0.09	BD144	1.10	BF457	0.32	OC45	0.55	2SC1909	1.45
BC149	0.09	BD150C	0.29	BF458	0.36	OC70	0.45	2SC1945	2.65
BC153	0.30	BD159	0.65	BF467	0.68	OC71	0.55	2SC1953	0.95
BC157	0.12	BD160	1.50	BF595	0.23	OC75	0.95	2SC1957	0.80
BC158	0.09	BD166	0.55	BF597	0.25	OC81	0.50	2SC1969	1.95
BC159	0.09	BD179	0.72	BFR39	0.23	OC16W	2.50	2SC2028	1.15
BC161	0.28	BD182	0.70	BFR40	0.23	R2006B	1.45	2SC2029	1.95
BC170B	0.15	BD201	0.83	BFR81	0.25	R2010B	1.45	2SC2078	1.45
BC171	0.09	BD202	0.65	BFR88	0.30	R2322	0.58	2SC2091	0.85
BC171A	0.10	BD203	0.78	BFR90	1.50	R2323	0.66	2SC2098	2.95
BC171B	0.10	BD204	0.70	BFR91	1.75	R2540	2.48	2SC2166	1.95
BC172	0.10	BD222	0.46	BFT42	0.35	RCA16334	0.90	2SC2314	0.80
BC172B	0.10	BD223	0.59	BFT43	0.35	RCA16335	0.80	2SC2371	0.36
BC172C	0.10	BD225	0.48	BFW61	0.60	S2060D	0.98	2SC931D	0.95
BC173B	0.10	BD232	0.35	BFW92	0.85	SKE5F	1.45	1SD234	0.80
BC174	0.09	BD233	0.35	BFX29	0.30	TIP29	0.40	2SD325E	1.65
BC174A	0.09	BD234	0.35	BFX84	0.26	TIP29C	0.42	3N211	1.95
BC177	0.15	BD236	0.49	BFX85	0.32	TIP30C	0.43	3SK88	0.95
BC178	0.15	BD237	0.40	BFX86	0.30	TIP31C	0.55		

NEW VIDEO SPARES

HEADS

Suitable for Ferguson 3V00, 3V01, 3V06, 3V16, 3V22, 3V23, 3V24, 3V29, 3V30, 3V31, 8903 and many JVC, Akai, Nordmende, Telefunken.

Suitable for National Panasonic NV333 340, 2000, 3000, 7000, 7200, 7500, 8170, 8400, 8600, 8610F, 8620, Blaupunkt RTV 100E, 200, 202, 211, 222, 322, RTX100, 200, 224.

Suitable for Sony C5, C6, C7, 8000, 8080 Toshiba V5470, V8600, V8700.

3HSS £25.50

4HSS £34.50

PS3B £40.50

★ Video head cleaning tape (VHS Auto Wet/Dry) £6.50

★ Video Head Aerosol Cleaner £0.85

★ Video Copying lead and connector kit 'ZV' £7.95

VIDEO BELT KITS

Akai VS 9300/9500/9800	£3.75
Ferguson 3V16	£4.50
JVC HR 3330/3600	£4.50
JVC HR 3360/3660	£4.50
Panasonic NV 300	£4.00
Panasonic NV 2000B	£3.75
Panasonic NV 3000B	£3.75
Panasonic NV 7000	£3.50
Panasonic NV 8600B/8610B/V011	£3.75
Sanyo VTC 5500	£3.75
Sanyo VTC 9300	£3.75
Sanyo VTL 9300P	£3.90
Sharp VC 6300	£3.75
Sharp VC 7300	£3.75
Sharp VC 8300	£3.75
Sharp VC 9300	£3.75
Sony SL 3000B	£3.75
Sony SL 8000/8080	£4.50
Sony SL C7/J7	£4.00
Toshiba V7540	£4.50

TAPE HEADS

Mono Head	1.50
Auto Reverse	3.50
Stereo Head	2.95

ELECTRO-OPTICAL

9677M	22.00
P4231BAM	19.00
XP1002	29.00
XP1117M	24.00
XP42040	35.00
9524H	28.00

DIODES

AA119	0.08	BY210-800	0.33	1N23B	2.95
BA115	0.13	BY223	0.90	1N23C	2.95
BA145	0.16	BY298-400	0.22	1N23ER	2.95
BA148	0.17	BY299-800	0.22	1N23WE	2.95
BA154	0.06	BYX10	0.20	IN4001	0.04
BA156	0.15	BYX36-150R	0.20	IN4003	0.04
BA157	0.30	BYX38-600R	0.60	IN4004	0.05
BAX13	0.04	BYX55-600	0.30	IN4005	0.05
BAX16	0.06	BYX71-600	1.10	IN4007	0.06
BB105B	0.30	BZX61	0.15	IN4148	0.02
BT151	0.79	BZY88	0.10	IN4448	0.10
BY126	0.10	BZY95C30	0.35	IN5401	0.12
BY127	0.11	CS4B	4.50	IN5402	0.14
BY133	0.15	CS10B	8.45	IN5403	0.12
BY164	0.45	OA47	0.09	IN5406	0.13
BY176	1.20	OA90	0.05	IN5407	0.16
BY179	0.63	OA91	0.06	IN5408	0.16
BY182	0.55	OA202	0.10	ITT44	0.04
BY184	0.35	OA95	0.06	ITT923	0.15
BY199	0.40	1N21DR	2.95	ITT2002	0.10
BY206	0.14				
BY208-800	0.33				

BASES

B5D	5.50
B7G	0.25
B7G SKTD	0.25
B8G	0.35
B8H	0.70
B9A	1.50
B9ASKTD	0.40
B9G	0.75
B10B	0.20
B13B	0.50
B14A	3.00
12 Pin CRT	0.95
Nuvistor	0.95
Octal	0.35
SK610	35.00
UX5	1.75
UX7	1.75
Valve Can	0.30
8 Pin Dil	0.14
14 Pin Dil	0.15
16 Pin Dil	0.17
18 Pin Dil	0.18

WIREWOUND RESISTORS

4 Watt 2R4-10K	0.20
7 Watt R47-22K	0.20
11 Watt 1R5-15K	0.25
17 Watt 1R-15K	0.30

ZENER DIODES BZX61 0.15

6V2 7V5 8V2 9V1 10V 11V 12V 13V 15V 16V 18V 20V 22V 24V 27V 30V 33V 36V 39V 47V 51V 56V 68V 75V

BZY88 0.07

2V7 3V 3V3 3V6 3V9 4V3 4V7 5V1 5V6 6V2 6V8 7V5 6V2 9V1 10V 11V 12V 13V 15V 18V 20V 24V 27V 30V

THERMISTORS

VA1040	0.23
VA1056S	0.23
VA1104	0.70
VAT8650	0.46
VA1097	0.25

BATTERIES

7V Power Mike batteries TR175 £2.25 ea other prices on request

LINE OUTPUT TRANSFORMERS

DECCA 100	7.95
DECCA 1700 MONO	9.95
DECCA 1730	8.95
DECCA 2230	8.25
GEC 2040	8.95
GRUNDIG 1500	15.45
GRUNDIG 5010-6010 2222, 5011-6011	13.45
ITT CVC20	8.20
ITT CVC30	8.25
PHILIPS G8	8.50
PHILIPS C9	8.99
PHILIPS G11	13.39
PYE 725	10.95
RBM T20A	12.40
TANDBERG 90	11.15
TELEFUNKEN 711A	11.15
THORN 1590	9.50
THORN 8000	9.20
THORN 9000	9.95
THORN 9800	22.40
THORN MAINS TRANSFORMER 3000/3500	9.70

SOLDERING EQUIPMENT

25W Antex Iron	4.59
Weller Instant Heat Gun	11.30
240V Weller Marsman	4.74
½ Kilo Solder 60/40	6.95

EHT MULTIPLIERS

ITT CVC20	6.35
ITT CVC30	6.35
PHILIPS G8 550	6.96
RANK T20A	6.91
THORN 3000/3500	7.57
THORN 8500	5.50
THORN 9000	8.00
UNIVERSAL TRIPLER	5.45

REPLACEMENT ELECTROLYTIC CAPACITORS

DECCA 30 (400-400/350V)	2.85
DECCA 80/100 (400/350V)	2.99
DECCA 1700 (200-200-400-350V)	3.55
GEC 2110 (600/300V)	2.25
ITT CVC20 (220/400V)	1.80
PHILIPS G8 (600/300V)	2.25
PHILIPS G9 (2200/63V)	1.19
PHILIPS G11 (470/250V)	2.35

POTENTIOMETERS

STANDARD VERTICAL POTS	0.12
MIN VERTICAL POTS	0.12
STANDARD HORIZONTAL POTS	0.12
MIN HORIZONTAL POTS	0.12
CONVERGENCE PRE-SETS	0.30
SLIDERS LOG	0.48
SLIDER LINEAR	0.48

SPARES & AIDS

HEAT SINK COMPOUND	1.00
FREEZE IT	0.95
SOLDA MOP	0.64
SWITCH CLEANER	0.85
WD40	1.25
PUSH PUSH MAINS SWITCH (DECCA, GEC, RANK, THORN ETC)	1.02
PYE I F GAIN MODULE	6.99
ANODE CAP (27KV)	0.69

PUSH BUTTON UNITS

DECCA ITT CVC20 6 WAY	7.95
ITT CVC5 7 WAY	10.19
PHILIPS G8 (550) 6 WAY	14.49

VARICAP TUNERS

ELC1043/05 MULLARD	8.65
ELC1043/06 MULLARD	8.65
U321	8.25
U322	8.25

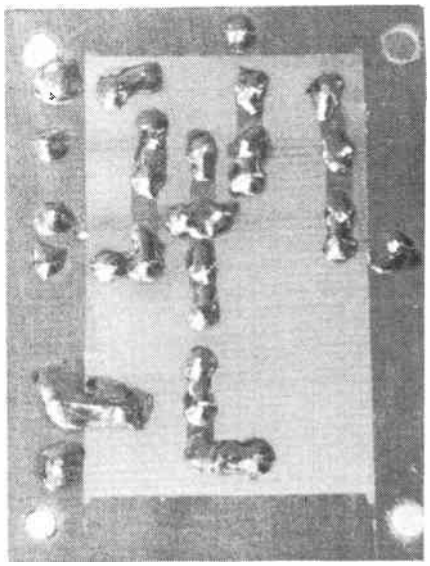
20MM ANTI SURGE FUSES

100MA-800MA	15p each
1A-5AMP	12p each

20MM QUICK BLOW FUSES

100MA	8p each
200MA-5AMP	5p each

BEGINNERS' WORKSHOP



A series for the would-be constructor

PART FIVE: PRINTED CIRCUIT BOARD CONSTRUCTION

Rev George Dobbs G3RJV

Home-built amateur radio projects vary from the rough and ready to the ultra sophisticated 'let's beat the manufacturers at their own game' approach. Amateur radio, in spite of what some think, is a hobby and just as much pleasure can be derived from a rat's nest of components that does the intended job as from a semi-professional 'joy to behold' piece of equipment.

Do your best

No one need be ashamed of what they build, after all most radio amateurs build little or none of their own equipment. Whatever the level of skill or the available facilities, the constructor likes to make the best job possible of each project.

Most commercial equipment uses printed circuit boards to form the basis of the actual electronic circuitry contained within the alluring box. Since the printed circuit form of construction came into popular use in the 1950s it has become the normal method of electronic construction. It is neat, the components are easy to mount into place, the method is durable and above all it is reproducable. The reproductability of the method makes it ideal for commercial use.

Professional finish

Amateur constructors like the neatness and the professional finish of the technique, but amateurs rarely wish to make more than one of any particular circuit board.

This calls into question the viability of using printed circuit techniques for making one-off circuit boards. Certainly they are neat and the finished job looks good, but there are a whole variety of techniques which give reliable and pleasing results, some of which were discussed in the last part of this series. Is it worth all the fuss of etching and drilling a board for a one-off project?

Well, noble constructor, the choice is yours. Over the years I have found that it takes little extra effort to make up an etched circuit board but I also use other techniques, a favourite being the 'cut board' method described in Part Four of this series to build my equipment. However, do not be put off by the thought that making a printed circuit board is difficult or hazardous.

The average amateur building equipment on his kitchen table can easily produce and use an etched board for any of his projects. This little article will attempt to show that the printed circuit board method of construction is just another option that the home constructor can take up and use when he feels it necessary.

The PCB VFO

The simplest way to describe the making of a printed circuit board is to show the building of an actual project. In the last part of this series the practical project was a little audio amplifier module which was built on circuit board using 'cut board' techniques. Although the amplifier could be a little project in its own right, I mentioned that it would form the audio stages of a simple amateur band receiver.

To illustrate the making of a printed circuit board, I will describe another section of that receiver, the variable frequency oscillator (VFO). The receiver is to be a direct conversion receiver for the 80 metre (3.5–3.8 MHz) amateur band, so the VFO is required to cover the actual frequency of the band.

A variable frequency oscillator at radio frequencies is not a project to be tackled lightly; of all the projects that a radio amateur may wish to build, making a stable VFO can be amongst the more difficult. Getting the circuit to oscillate should not be difficult but obtaining a stable variable signal source at radio frequencies can be a problem.

No problem

The circuit chosen for this VFO is simple and reliable but usually the actual choice of circuit is not the problem. Good stability seems to rely more upon how the circuit is built than the choice of circuit.

A radio frequency variable oscillator must be built like a battleship, as the usual problems of drift can often be related to poor physical mounting of components, overcrowding or poor layout and lack of good screening.

In this project, if the constructor follows both the method of making the

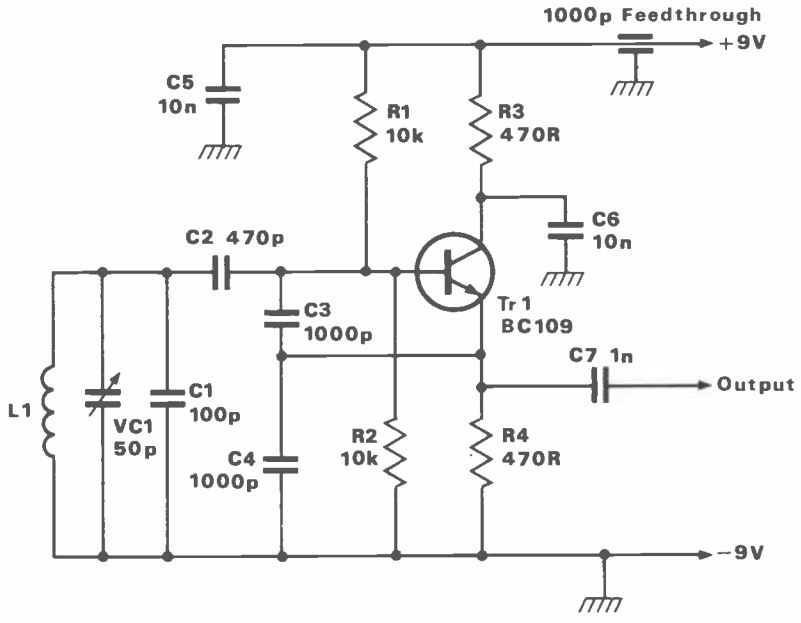


Fig 1 *VFO circuit diagram*

circuit board and the method of mounting the board there should be few problems. The circuit is shown in *Figure 1* and most good RAE candidates or graduates should recognise it as a parallel tuned Clapp oscillator.

The feedback to maintain oscillation comes from the emitter of Tr1 via C3/C4. The oscillator is tuned by an inductor (L1) with C1 and VC1, the latter providing the tuning control. The output is taken from the emitter. A simple little circuit but capable of good results in this application, although in this form not suitable for driving a transmitter.

Making the board

The first task is to translate the circuit diagram to a drawing of the layout for the printed circuit board. I begin with a layout sketch viewed from the top of what will be the completed board. *Figure 2* shows the sketch I made for this board. I like to work out the layout from the top,although this does mean that I have to transfer the interconnecting lines, which will be the printed circuit copper sections, onto the reverse side of the layout sketch.

There are those, more clever than I who can think 'in reverse image' and design the layout from what will be the copper side of the board. At least begin by doing it my way because it is simple to transfer the image through a bit of paper.

I begin with a sheet of 0.1 inch grid graph paper, not all that common in these metric days. Your friendly local stationery shop assistants may say, 'We don't stock that sir, it's all metric these days.' Just tell them that the whole American nation and the electronics industry worldwide all use inches and that the calculator and electronic till on the counter are all designed on a 0.1inch grid spacing.

Because most stationery outlets seem to concentrate on the school market, which is hooked on metric units, it is not a bad idea to buy in a few sheets when you locate the stuff. I found some excellent 0.1inch grid paper some years ago that is translucent, so I can see the design from both sides. Sadly my stocks are running low . . . any reader know where I can get some more?

The method of laying out the board follows the directions I gave in the last part of this series. Simply follow the circuit and have the actual components to be used at hand to measure the spaces required between the mounting holes. The audio amplifier described last time used a 'minimum etch technique' board where as much copper as possible is left on the board. This board is the reverse in that most of the copper is to be removed. All that is required is for the lines of copper to join the components and a groundplane around the edges of the board.

This is the better technique for a VFO because an excessive amount of copper connected to ground on the board can give rise to capacitive effects which influence the operation of the circuit. The dots 'in limbo' in *Figure 2* are the connections to the groundplane that runs around the edge of the board.

The pattern of connecting tracks and holes now has to be transferred to the underside of the paper to show the actual layout of the copper side of the board. This can be done on a lightbox or by holding the paper up to a window and tracing through the required dots and lines. Cut out the paper to the size of the required board and cut out a piece of printed circuit board to fit.

The design uses single sided printed circuit board which is advisable for VFO construction. I also recommend the use of good quality fibre glass board. A piece the size of this board can be easily had from those offcuts sold cheaply at amateur radio events.

Fasten the paper copper side up with Blu-tack, or if the children have stolen it all I use a little piece of masking tape at each corner. The next job is to mark the position of all the holes. I prefer to drill the actual holes at this stage, through the paper and into the board. Other constructors mark the position of the holes with a centre punch and drill the holes after the etching process is completed. Either way make sure all the holes are marked, as I have had problems later from missing out the odd hole at this stage.

Fig 2 *PCB copper side*

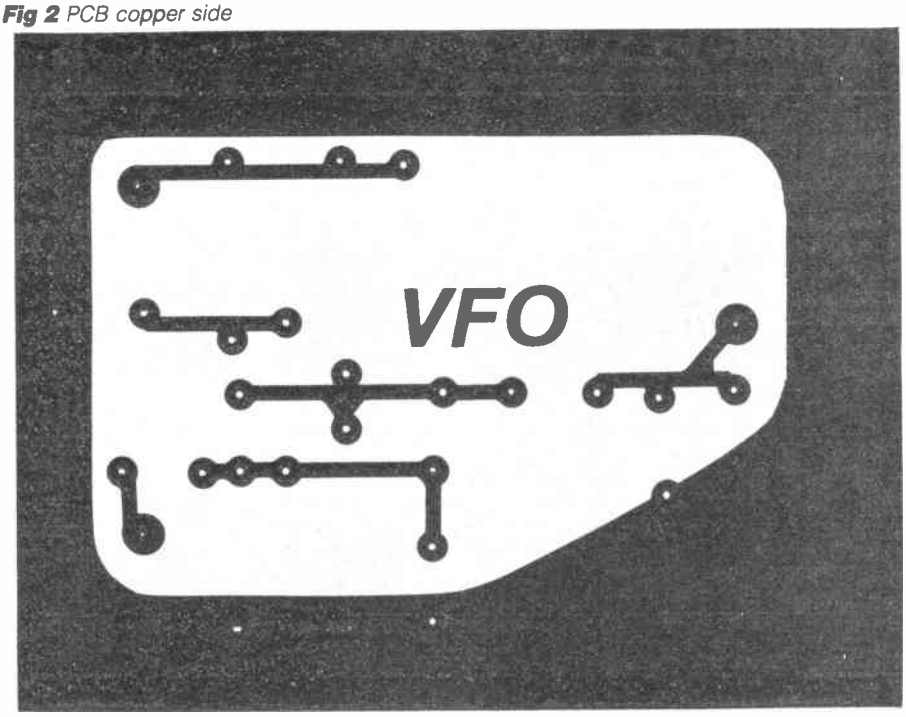
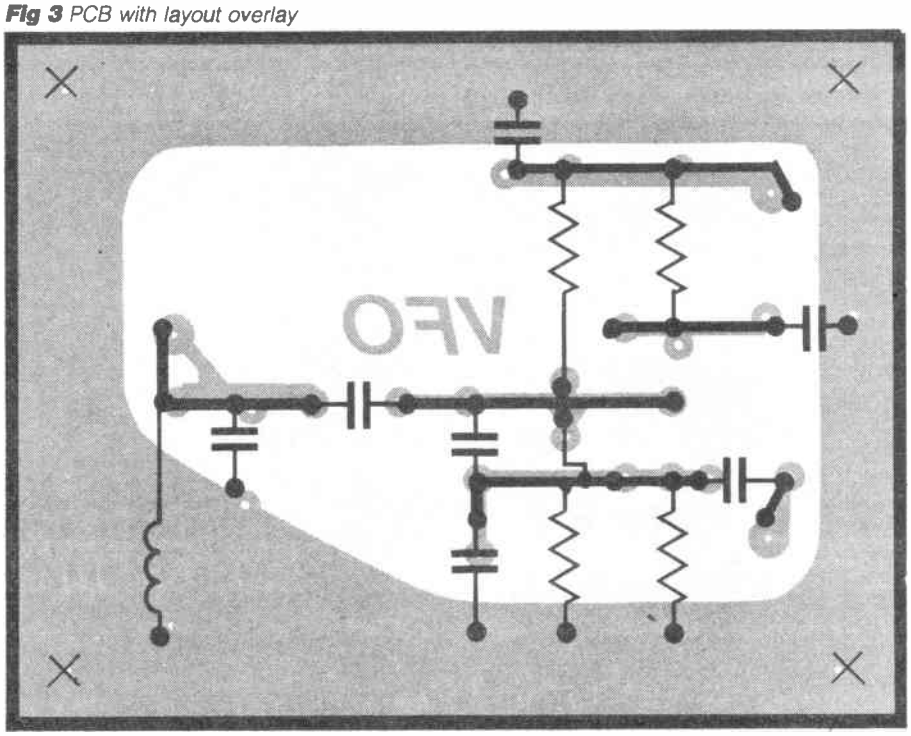


Fig 3 *PCB with layout overlay*



The paper is now removed from the board, checking that the holes or dots are all there. The next stage is a careful cleaning of the copper side of the board. This is important because any dirt or grease on the board will resist the etchant and leave unwanted copper on the board. If the holes have already been drilled it pays to clean the board first with emery paper to ensure that there are no burrs around the edges of the holes.

Cleansing agent

The best simple cleansing agent I know is household scouring powder – Vim or any other similar product. Clean the *whole* board right into every corner. Then rinse the board in hot water and dry it well with a clean cloth.

Next add the etchant resist, the stuff that will prevent some parts of the copper dissolving and leave the required connecting tracks. Amateurs use all sorts of etch resistants: nail varnish; modelling paint; bits of PVC tape cut to shape and I know someone who swears by typewriter stencil correcting fluid. Most constructors however seem to opt for etch resist pens. These are small felt tipped pens which draw the pattern directly onto the copper. These pens are expensive and I think the tips are too fine for many of the applications in amateur radio etching. Very thin etch resist lines are prone to being lost in the etching process.

I use felt pens, but these are just the common types sold by most stationery chain stores. Most *spirit* felt pens act very well as etchant resist pens, often described as 'marker pens', and the range of tip size is useful in the choice they afford of thickness of line. Thin lines may look very neat but I usually opt to have my copper track quite thick, especially if no integrated circuit pins come into the circuit layout. My best PCB pen is a 'Bullet Tipped' Pentel marking pen. It produces reasonable lines and good 'blobs', at the points where the board is to be drilled.

I begin by making these 'blobs'. When marking the holes (or the centre punch points), I make a reasonable sized blob at each of these locations. This gives the matrix from which I can identify the layout of the board and add the interconnecting lines. Two simple rules: push down on the pen to release plenty of fluid, remember it has to do battle against the etchant chemical, and try to keep your finger off the clean sections of the copper as much as possible. It can help to put a little triangle of masking tape across each corner of the board to provide holding points.

Just follow the layout sketch for the copper side and take care to hit the right holes with the right lines. A clumsy move or shaky hand might mean that adjacent lines or blobs may touch. This is not the end of the world, or that board. After etching, the lines can be separated by scratching away the copper.

Etching the board

'Come in and see my etchings!' is a classic joke. As a matter of fact, just as I had completed etching the board for this project my lady organist called to see me. I tried the phrase on her. I think she was amused . . . back to the process.

The usual etchant, and I believe the safest, used by amateurs is Ferric Chloride. It is not bad stuff but there are some warnings. The main problem is that it stains . . . my word. It can ruin towels, teacloths, clothes, nice sinks and can give fingers the appearance of a heavy smoker. Keep it away from children and all other things that your wife holds dear.

The best place to etch boards is in a garage or garden shed; I use a cellar room. Ferric chloride can be bought in crystal form or in concentrated solution; the crystals are cheapest, the solution is easiest to handle.

Make up the solution to the directions on the bottle. Likewise the crystals, but if there are no directions just make up a strong solution. Text books seem to advise about 1 part crystals to 2 parts water, but I just add it and stir until its good and strong.

I prefer a rather rapid etching action so that I can monitor the process and pull out the board when the etching is just complete. Slow, overnight etching is prone to one of the common faults in amateur production of printed circuit boards: over etching. Once the etchant has removed the copper to the edges of the resist lines, it begins to etch under the etch resistant material and can produce ragged lines at best and broken lines at worst.

Vessels

The vessels used for the etching process should be of plastic or glass. Some people use the plastic trays designed for photographic darkroom work, some use plastic containers which once contained margarine or ice-cream but I almost always use jam jars or coffee jars. My reason for this is that I like to etch vertically. Most people seem to etch with the board lying flat, copper side up, in the solution. The problem here is that the waste from the process lies on the top of the board and hinders the etching process, requiring constant agitation to get a good result.

I hang my boards vertically into a jar with a neck wide enough to take the board width, and hold the board in place with a washing peg and wire rod. The photograph shows how its done. I usually put a bit of PVC tape around the edge of the board, naturally over a section along the edge where copper is to remain, and this gives better grip.

The board is suspended in the solution and from time to time during the process I give the board a quick twist around to clear waste. Held in this manner, it is very easy to lift the board from time to time to check the progress of the etching. It beats poking about in a tray with plastic tweezers to find the board and lift it out.

Checking

By checking the process at regular intervals (my usual etch time is about an hour) I can remove the board at exactly the time when the last unwanted copper disappears.

This leaves a circuit board with nice clean edges around the tracks. Lift out the board, allowing the etchant to drain away over the solution before waving it about. Then rinse the surplus chemical off the board. The really wary can do this in the garden with a watering can. Give it a good wash in soapy water and then clean off the etch resist with household scouring powder and water. With any luck you should have a fine piece of etched circuit board.

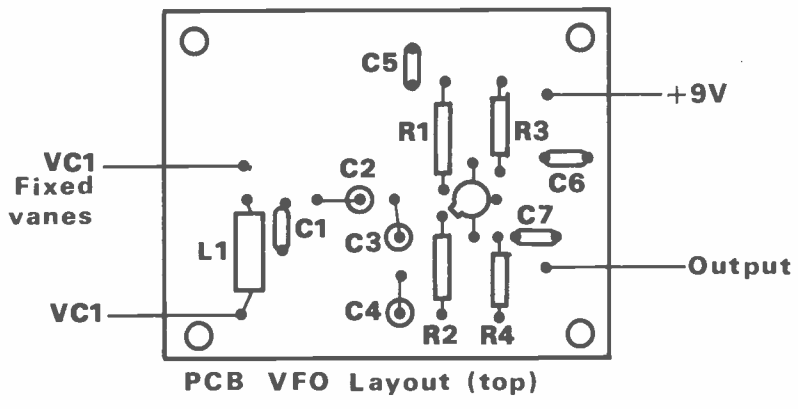
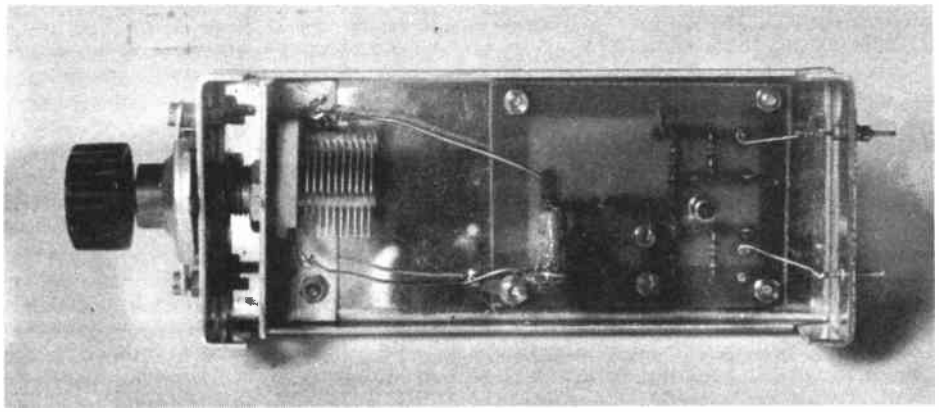


Fig 4 *Component layout*



Building the VFO

The layout for the completed VFO printed circuit board is shown in *Figure 4*. The components are simply placed into the board as shown and soldered into place. Some of the components are horizontally mounted, for example R1, 2, 3, 4, and others are vertically mounted, such as C2, 3, 4. The most critical components are those associated with the tuned circuit. The frequency determining capacitors should be of a type suitable for RF applications. I prefer the use of polystyrene capacitors in such circuits although others prefer silver mica capacitors. The capacitors in question are C1, C2, C3 and C4.

The inductor (coil) L1 is wound onto a 3/16inch diameter former with a core. These are common items and can be obtained from a variety of sources, including many surplus items of equipment. I chose to mount the inductor horizontally along the board with stiff copper wire, forming binding posts at either end for the ends of the windings. The whole coil is smothered in polystyrene cement of the sort used in model making, to give extra rigidity.

The actual coil is wound using 32swg enamelled copper wire, laying down the turns side by side to give a close wound coil. Begin at the ground end by securing the end of the coil wire, removing the enamelling by scraping with a knife and tinning the revealed copper to the ground wire. Solder it onto that wire which is twisted once around the former and then twist the two ends together for a tight fit. Count out the number of turns and then secure the other end to a piece of wire in the same way. The polystyrene cement acts to hold the turns in place as well as helping to secure the coil to the board.

The VFO requires a screened box and a slow motion drive to add the tuning rate. The box is an aluminium box type A10 from Minfford Engineering. The tuning capacitor, VC1, should be a good quality airspaced 50pF tuning capacitor. These can cost a small fortune and are items to be sought at radio rallies. A Jackson type C804 variable capacitor can be obtained from Cirkit but these are rather expensive.

The slow motion drive is a 6:1 epicyclic in-line drive of the type often used in home-made amateur radio equipment. The drive is mounted on to the front of the box shown in *Figure 5*. The variable capacitor is mounted on an aluminium plate set behind the front of the box. The photograph shows the method of mounting.

Take care to drill the hole for the drive and the mounting plate hole for the capacitor in line, to ensure a smooth action when rotating the knob.

The board is mounted into the box with four holes in each corner. These holes take 6 BA nuts and bolts. A stand-off pillar is required under each bolt to hold the board off the bottom of the box. If stand-off pillars are not available extra nuts can be used to space the underside of the board away from the box. The output can be taken out of the box by passing a wire through a hole but I used a feedthrough connector. However, this must not be a capacitor type feedthrough. A feedthrough capacitor is, however, used to take the supply line into the box.

If a feedthrough capacitor is not available then just feed an insulated wire into the box through a small hole, in which case it might be a good idea to add a small 1,000pF mica capacitor between the input lead and ground on the underside of the board.

Testing the VFO

If the constructor has a frequency counter the testing is easy. Connect the counter to the output and power up the VFO. Even without a counter the testing is not difficult. It is a matter of using a receiver tuned to the 3.5 to 3.8MHz amateur band to listen for the signal. Some adjustment of the core will be necessary to bring the VFO into the correct frequency range. Set the core so that when the capacitor VC1 is fully meshed the output is on 3.5kHz.

As an item on its own the VFO is not very useful. I suppose you could swish it up and down the band and listen to it on a receiver. The next part of this series will take the VFO and the audio amplifier described last time and use them to make up a simple receiver for the 80 metre band.

Suppliers

Aluminium box type A10: *Minfford Engineering, Sun Street, Ffestiniog LL41 4NE. Tel: (076676) 2572.*

VC1 Jackson C804 type: *Cirkit Holdings PLC, Park Lane, Broxbourne, Herts EN10 7NQ. Tel: (0992) 444111.*

Coil former 3/16 inch (4.8mm) type 722/2 plus core: *Maplin Electrical Supplies Ltd, PO Box 3, Rayleigh, Essex. Tel: (0702) 552911.*(Maplin also supply Jackson C804 capacitors).

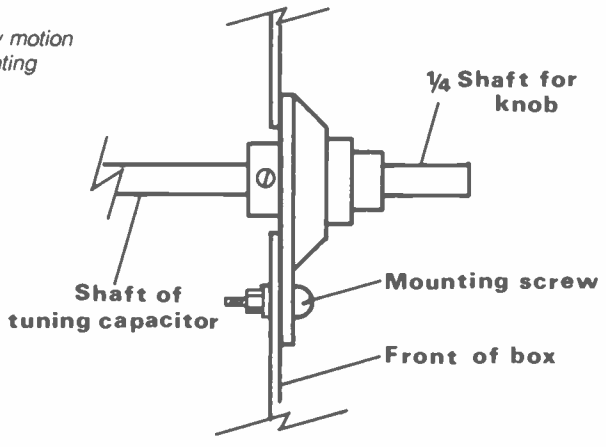


Fig 5 *slow motion drive mounting*

COMPONENTS	
R1	10K
R2	10K
R3	470
R4	470
C1	100pF (silver mica)
C2	470pF (polystyrene)
C3	1000pF (polystyrene)
C4	1000pF (polystyrene)
C5/6	0.01μF (min plate ceramic)
C7	1nF (min plate ceramic)
TR1	BC109
L1	25 turns 32 swg enamelled copper wire on 3/16 inch former + core
VC1	50pF variable capacitor airspaced.

934MHz

Some recommended equipment

by Angus McKenzie G3OSS

When CB was first opened up in the UK some years ago there was not only an allocation on 27MHz but also 20 channels between 934 and 935MHz, although no sets were available for some months after the band was released.

I looked at a couple of early Revtek sets and carried out a few home-base to mobile trials, but found the band to be a disaster area as the range was so short and the modulation quality so bad as to preclude any serious use. The original allocation was 934.025MHz for channel 1, the other 19 channels being at 50kHz spacings above this frequency.

About a year ago the DTI changed the frequency allocations down by 12.5kHz, channel 1 becoming 934.0125MHz, again with 50kHz channelling. This meant that all the sets in use at the time had to be modified for the new channels. Various other sets were introduced but most of them were also rather unsatisfactory. Unfortunately, for the first two years only a relatively small group of keen enthusiasts used the band, putting up with rather inferior quality.

Then, in early 1985, a company based in Portsmouth, Telecommunications Ltd, introduced a Japanese made transceiver known as the Cybernet Delta 1. Many accessories were included, and the performance was so much better that the potential of the band became almost completely realised in performance terms, and these units have already nearly doubled the band occupancy in four months.

The band and its users

Let me say here and now that the users of 934MHz are largely a group of enthusiasts who bear no resemblance at all to 27MHz operators. They are all very keen indeed for the band to be kept clean and for everyone to be very helpful and polite. I have been quite active on the band since March and have never heard any rudeness whatsoever, let alone vulgarities.

There is much talk about equipment, aerials and who has talked to whom, in much the same way as 433MHz FM users discuss equipment, but the average 934MHz user is not all technical, although he or she likes to learn a lot about those technicalities which are important for improved band operation. The dreaded 27MHz-style echo mics are somewhat rare on 934MHz, thank goodness. If one does pop up, the reverberant user is soon very politely told that his intelligibility is suffering and that echo mics are not particularly welcome.

At the moment there are about 2,000 band users spread around the UK, but somewhat surprisingly there are fewer of them around the London area than I might have expected. Even so, a call on channel 20, the calling channel, will almost always produce a contact, after which it is generally appreciated that the contact should continue on another channel (in the same way as we QSY from 2m and 70cm calling channels).

Quite a few radio amateurs are on 934MHz, often using the band for talk-back purposes whilst carrying out experiments on amateur bands. This has encouraged quite a few 934MHz band users to investigate amateur radio and many have passed the RAE as a result.

A typical station would be a Delta 1 with 13V PSU interconnected with a high gain collinear antenna, such as the Nevada with Pope H100 cable, and usually a masthead pre-amp which dramatically improves Rx performance. The average user will probably have his antenna at 10m above ground level and will enjoy contacts of up to 30km distance under normal conditions and up to 80km in their best directions, provided the station at the other end also has a good take-off.

Working mobile

Many people also like to work mobile, and again a mobile external Rx pre-amp gives a very useful improvement to sensitivity. My wife and I have enjoyed many mobile contacts, and I can remember one particular example which shows the band up in a good light. We wanted to travel from my home in Finchley to Harefield in Middlesex. Unfortunately, on this particular day there was a very important football match at Wembley, so we decided to divert around Watford in the hope of taking a long loop to avoid the immense traffic near Wembley.

I have to admit that we got hopelessly lost because of diversions, but 934MHz enthusiasts came on channel to help us out of our problem. We were in a very hilly area and some stations on the other side of a hill were often difficult to copy, whereas several more distant ones came in very clearly, including one in South London. It is thus difficult to give a typical range, but I suppose the minimum would be around 5km and the maximum perhaps 100km if you are at a very high spot.

Considerable increase

My findings are that average activity on the band is somewhat higher than on 433MHz simplex in the Greater London area, and the band's occupancy is now beginning to increase quite considerably. When tropospheric ducting occurs contacts of up to 200km have been noted by me, and at weekends very many stations around the south of England have been going to high points to increase their range.

There are quite a few retailers stocking 934MHz equipment. Whilst some of them seriously lack technical knowledge, many take a lot of trouble to satisfy their customers and have quite good test equipment.

If you spend an evening with a 934MHz band user who has a good system, I think you will be impressed with the standards of operating and you will most certainly find everyone very friendly. You will notice some very bad quality transmissions, many of them being off-channel, but I think you will find that those stations using the Delta 1 stand out as having extremely good modulation quality.

Unimpressed

I have heard many Revteks on the band, and I continue to be very unimpressed with their sound quality; noting drifting, distortion and sometimes a very high and bubbly background noise. Although I am being critical of Revtek here, it has to be said that it was this company that was responsible for getting the band going in the first place, thus establishing a significant group of enthusiasts. Unfortunately Revtek ceased trading late in 1984, but a new company has now been set up to service Revtek equipment, Crestbyte, their agents being Selectronics of Canvey Island.

The cost of equipment is appreciably higher than that of amateur radio FM gear, for the simple reason that it sells in much smaller quantities. You can easily spend £600 establishing a new station from scratch if you include a rig, antenna and cable, and masthead pre-amp. It is the relatively high cost of equipment that has kept a lot of 27MHz operators off the band, but I leave you to draw your own conclusions concerning what would happen if equipment became very much cheaper.

Band usage

Although in the London area I have only very rarely heard the band used for private and semi-business contacts, there are quite a few serious users in rural areas, where farmers want to keep in contact with each other, and when shops want to contact their delivery vans.

By far the highest percentage of users just like to chat to one another, enjoying the companionship. Quite a few users have abandoned 27MHz, as they have found that band to be fairly putrid in built-up areas. It seems that once someone has come onto 934MHz he or she is likely to stay on the band with enthusiasm. There is a 934MHz club at present with just under 1,000 members, which holds regular meetings around the country and which produces a very useful magazine for a membership fee of only £5 per annum. The club address is:

The 934MHz Club UK, PO Box 323, Althorne, Chelmsford, Essex CM3 6UR.

Many readers would obviously want to compare the value for money aspect of 934MHz for business purposes as against cellular radio. A single mobile installation on cellular radio would cost about the same as a base station with two mobiles on 934MHz, allowing local contacts in a family or business situation which would be very effective for a very small annual licence fee.

On the other hand, cellular radio is very effective indeed for mobiles, but the cost of calls rules it totally out of court for the majority of potential users. I have a feeling that a saturation point might well be reached rather sooner than many people think, unless the cost of calls can be significantly reduced when more people use cellular radio. Obviously I am not comparing the chatty aspect of the two modes, but I do see that there are tremendous potentials for 934MHz in business use.

The potential could be significantly increased if a good quality 934MHz handy-talky became available. Many have tried to use 27MHz for local use, but bad manners, continual break-ins and foul language have wrecked that band, except in some rural areas.

I suggest that if you hear someone making business use of 934MHz, then leave them alone unless they obviously want to chat and do not mind break-ins. You may feel that business use should be discouraged, but there is a double-edged sword here, for prices could come down if there was a large expansion of band use, and the DTI have reserved an additional 20 channels which may be allocated one day when there is a higher demand.

Some problems with the band

In the last few months, since Racal Vodafone cellular radio became established using base station frequencies only just above 934MHz, there have been serious intermodulation problems produced in the poorer 934MHz installations, and even in some good ones if the station is extremely close to a cellular radio transmitting site. The primary reason for this is that the cellular radio channels are offset by the same amount as the new 934MHz frequencies, allowing intermodulation products developed within the receiver to fall onto 934MHz channels.

The problem is exaggerated if there is also a very strong 934MHz local transmission on the band, for the latter signal would cause the receiver front end to be far more susceptible to intermodulation from out of band signals. One transverter enabling 27MHz rigs to be used on 934MHz is particularly prone to the problem.

Whilst most users find the situation extremely annoying, it has been reported that a few rather enjoy it because they can contravene the Wireless Telegraphy Act by listening into 'phone calls! There are strong rumours that the DTI have been requested by both the 934MHz users and by some cellular radio companies to allocate a new band of frequencies further away from the 934MHz band in order to clear the problem. The signal strength of the Racal and British Telecom installations is sometimes extremely high in order to provide saturation coverage, whilst the front end intermodulation performance of some of the 934MHz equipment can only be said to be abysmal.

I have investigated the problem at length, and I intentionally introduced a situation which made the problem very obvious at my own location. Pope H100 cable is not particularly easy to solder up with N plugs, and a poor joint can seriously degrade the system RFIM performance. Even with the masthead pre-amp switched off the band became almost unusable with a badly soldered plug connected to the antenna, but after making it up in the correct manner the problem virtually disappeared, even with the masthead pre-amp switched on.

The problem can also be significantly decreased by the use of a beam antenna, provided you avoid pointing it at your local cellular base station. The higher the gain of the antenna the greater will be the rejection of interference in most directions, but the DTI will also allow a maximum of 25W ERP, which unfortunately discourages the use of higher gain antennas.

Dramatic

Although one is allowed 8W at the antenna many of the rigs only give 5W output, and in an average installation perhaps only 2W would be getting to the antenna. An overall average system noise figure of 12dB or so is typical, and so the improvement to a system figure of 2dB when fitting a good masthead pre-amp is very dramatic indeed. I am surprised that as yet no manufacturer has been able to offer a masthead power amplifier which could give a fixed 8W output from 2W drive; this would obviously make an amazing difference to the transmitted signal strength. Bearing in mind cable losses, I suggest an external power amplifier would be more important than trying to design a rig to give the full 8W for base station use, although a true 8W rig would of course be most helpful in a mobile set-up.

In looking at some coaxial switches and masthead units I am a little concerned that prices are very high. The quality of relays used is in general not particularly good, thus introducing both transmitted and received power losses through the devices. Surely a good British manufacturer such as muTek Ltd could make a greatly superior masthead if they wanted to, and show up some of the Japanese imported products!

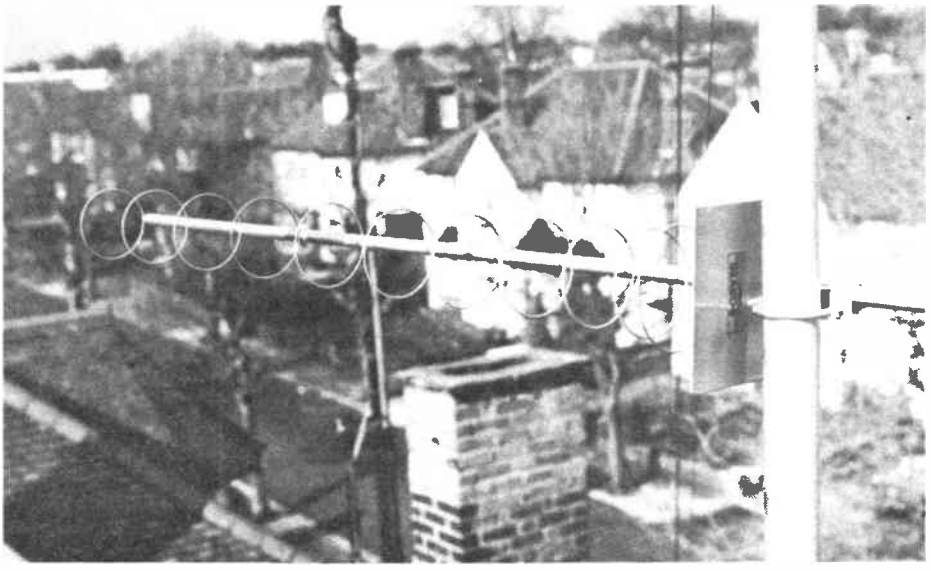
Appalling hum

I have heard a few signals on the band with appalling hum in the background, created by the use of very grotty 27MHz CB power supplies. It is worthwhile getting a better supply with a good ripple performance in order to avoid constant polite criticism every time you go on the air!

Some people have purchased second-hand Revteks, only to find out that they have not been modified to the new channel spacing and that the audio modulator is faulty. They might end up paying quite a lot for maintenance costs, and would have been better off buying a new rig in the first place.

Some stations have used inappropriate co-ax, which is so lossy that they can hardly hear anybody! Even UR M67 is not really recommended for the band unless you only need a very short run. Some users have positioned their antennas much too close to TV aerials with their attendant steel supporting poles. Not only is the antenna mistuned, but the directivity pattern can be significantly affected.

I remember hearing a remarkable story on the band of one user who found that his collinear antenna was highly directional. He advised some of his pals to buy the same antenna and put it on a rotator! On investigation he eventually told me that his collinear was above a



beam antenna, and of course reflections from the directors and reflector of the beam were indeed making his collinear fairly directional!

Some enthusiasts have put up beams, only to find that many stations at an intermediate distance are no better on the beam than on the collinear. An omni-directional aerial picks up all the paths from another station, whereas a beam selects only the main direct path, so you might be disappointed with a beam's performance in some directions in which there are many hills, etc. You will notice the beam's superiority though in a tropoduct, but if you are to remain legal a collinear with plenty of gain should give a very good performance.

The Cybernet Delta 1

Although primarily intended and designed as a mobile rig, this unit is used by the majority of 934MHz users as a home-base station, requiring 13V dc powering. Two rotary controls adjust Rx audio volume and squelch whilst a row of microprocessor control buttons select up and down chanelling, various memories, scanning, auto/manual searching, and clear.

The mic socket has four pins for audio with earth and PTT with earth. Unfortunately there is no provision for up and down stepping from the microphone. A push-button turns the rig on and off, and frequency stability is reached after a few seconds warm-up. 16 memories are available with scanning and another 20 channels can be enabled with a small modification internally, when the DTI allocates them.

The display gives channel number and basic status indications. The antenna socket is a 50 ohm N type on the end of a short flying co-ax. A dc interconnection is on another flying lead, with a fairly unusual connector to a very long extension which is fused. Two miniature jack sockets are provided for feeding an external speaker and a remote S-meter. There is an adequate heatsink across the back and the rig is completely encased in metal, a mobile mount being supplied.

Two samples were checked and these gave power outputs of 5.25-5.5W across the band. Rx sensitivity averaged 0.25μV (−119dBm) and the RF input intercept point was typically at −4.5dBm, which is a lot better than almost all 70cm FM units!

Selectivity was excellent and I never heard any interference from a strong adjacent channel signal. Received audio quality from another Delta 1 was excellent, with clean crisp HF, higher than average audio power available, and some 4.4W for 10% distortion being noted into an external 4 ohm load. The S-meter seemed to be reasonable, although there was not enough range between minimum and maximum indications.

I checked the frequency accuracy over a period of many months and after warm-up it was never more than 1kHz off-channel, which is a lot more than one can say about the Revteks! No frequency drift problems occurred and transmitted quality was considered very good indeed. The speech deviation normally peaked at ±5kHz, and even when extremely provoked it was only marginally above this.

A transmitted dynamic range of around 56dB was given if I was totally quiet, as compared with full modulation, and this is actually a lot better than many amateur FM mobile rigs. I am full of praise for this unit, which is very well made and supplied with a good technical back-up from the importers.

Mobile pre-amp type HRA 900M

This unit is fitted with a PL259 connector to screw onto a magmount and an SO239 onto which you can screw the mobile collinear aerial. The pre-amp had too much gain at 20dB and the system sensitivity became 0.14μV for 12dB sinad, the aerial cable loss being virtually eliminated. I noted a 1dB power loss on Tx, however, which is a pity. I feel this must be partly due to the inappropriate use of PL259s rather than N types.

A masthead model type HRA900 is fitted with N type sockets and has a slightly lower through loss, the Rx pre-amp having slightly better performance, although it also has a very high gain. Both pre-amps are RF sensed and require only a 13V dc feed, the earth return being via the co-ax screen.

HAS-1 remote coaxial switch

This little unit has one N input socket and two outputs and is energised with 13V dc, then selecting a second antenna. It has about 0.5dB loss and switches very effectively, although it is not rated at more than 8W throughput on 934MHz. I do not recommend switching with the power on. It might well be of considerable use on lower frequencies, and it would probably take much more power on these. It is well weather-proofed and is recommended.

Antennas

Both the Nevada collinear antenna fitted with an N type socket and the mobile collinear fitted with a PL259 are recommended, the latter being available with a mag-mount. The length of cable supplied with the latter is far too long at around 5m and I suggest you cut it down as much as you can to reduce the loss.

I would have preferred a higher quality co-ax used for it; its typical loss would be around 2.1dB plus the loss of any connectors. Both the aerials give a good SWR, incidently.

Conclusions

Not only am I delighted wih the 934MHz band itself, but the performance of the equipment is surprisingly good for the frequency involved. My wife has enjoyed many mobile contacts when she has been on long journeys, and liked the informality and courtesy shown to her by all the band users.

If you want to get your XYL or OM interested in the hobby, you might try inveigling them with 934MHz first and they will soon become very good operators. The band is extremely useful for TV talk-back and many other purposes, but I have to be frank and suggest that there is far more potential than is being realised at the moment. An effective walky-talky with just a few channels could do a lot to get more people interested.

Don't confuse this band with 27MHz CB as it is utterly different, even the average age group being much higher, quite a few retired folk also being on the band.

Propagation is far more influenced by local terrain than is 433MHz, and the reliability of mobile to fixed station contacts is therefore rather variable. I highly recommend you to look at the band for yourself by contacting a band enthusiast. The 934MHz club will be pleased to put you into contact with one.

Incidently, I should mention that most users refer to the 934MHz band as 'personal radio' to discriminate it from CB.

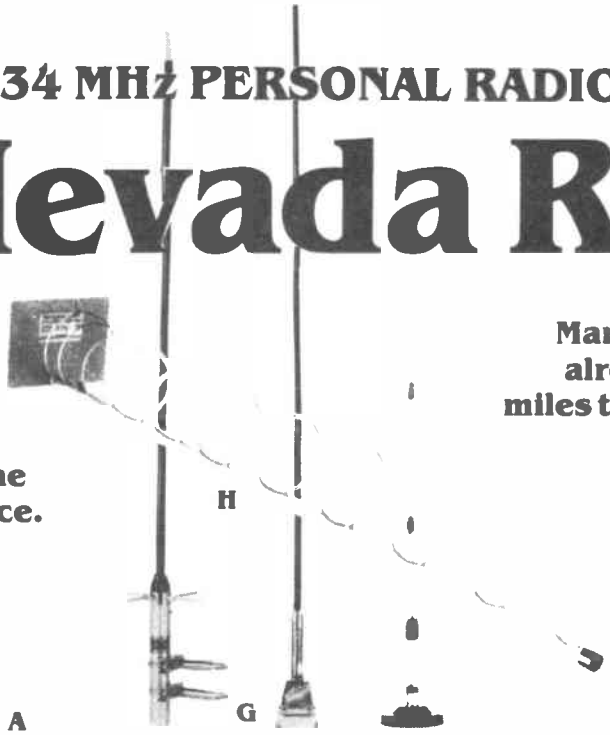
I would like to acknowledge the assistance of Telecomms Ltd and Selectronics, as well as that of many band users in assisting me with so much information for this article.

934 MHz PERSONAL RADIO

The Nevada Range

Join the growing number of people discovering this exciting radio band.
Available to anyone for the cost of a current CB licence.

Many two way contacts have already been made from 10 miles to 250 miles according to location and weather conditions.



A. THE CYBERNET DELTA 1 934 MHz TRANSCEIVER
Has been engineered specifically for the UK market using latest "state of the art" technology. With a sensitive receiver and many additional facilities these sets have achieved contacts of over 200 miles range, under certain conditions.
- Sensitive RX (0.25 µV for 12 db SINAD).
- 16 memories available.
- Auto/Manual scan and search facility.
- External 'S' meter socket.

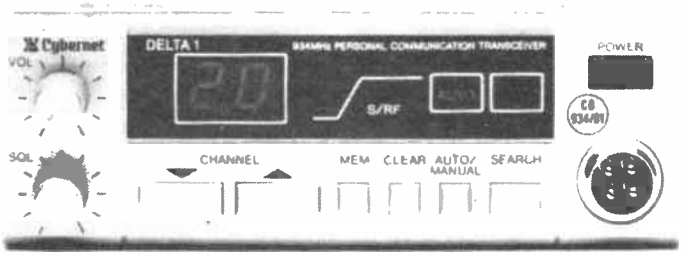
+ £5 SPECIAL DELIVERY **£355**
Ask for a demonstration of this superb set from one of the Nevada "MAIN" dealers below.

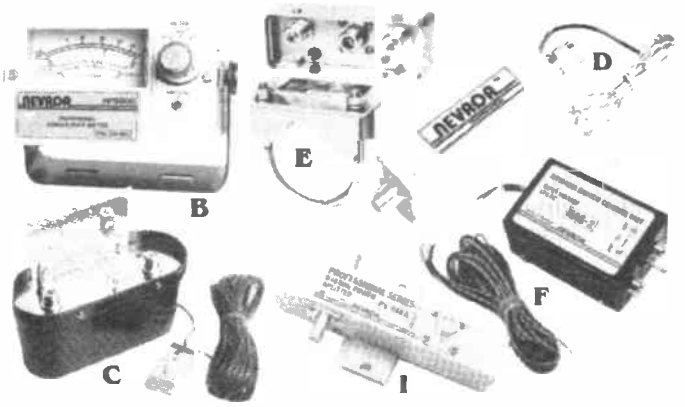
B. SWR/POWER METER
This precise and extremely accurate meter features an illuminated scale, low loss 'N' type connectors and twin meters for both power and SWR measurement. Power 0-50 watts in two ranges. **£89.95**

C. HRA 900 MASTHEAD PRE-AMPLIFIER
Super low noise GaAs FET pre-amplifier that mounts at the masthead. Low insertion loss and noise (typically 0.8 dB) coupled with 15dB gain enable this unit to double the received range of many sets. **£139.95**

D. HRA 934 L IN-LINE GaAs FET PRE-AMP
A super new ultra-low noise pre-amp which fits in line on any base or mobile installation. Guaranteed to give a staggering increase in received range. Extremely low noise 0.7 DB NF. 20 DB gain. **£125**

E. REMOTE ANT. SWITCH
High quality weatherproof mast head mounting switch. For switching 2 antennas with one cable feed. i.e. Beam/Colinear ('N' type sockets). **£59.95**





F. HAS-2
Remote DC switch for E. **£6.00**

G. ANTENNAS
Manufactured to the highest possible specification.

PA7-E BASE COLINEAR
- our top of the range base antenna supplied with mounting brackets, weatherproof tape, and 'N' connector. Gain 7.14 dBi stacked ⅝ array. incl. p&p **£66**

P7-ME High gain mobile magnetic mount antenna with unique ¼ wave matching system 7.14 dBi gain. incl. p&p **£44**

P7-RE High gain gutter mount mobile antenna fully adjustable 7.14 dBi gain. incl. p&p **£44**

H. Tc 12L MKII NEW 12 ELEMENT BEAM
A new aluminium version of our succesful 12 element loop quad - This beam is now better than ever.
- We guarantee this antenna has more gain than any similar 12 element Yagi array.
- Designed by Mike Walters one of the UK's leading microwave antenna engineers.
- Built in low noise feed system to a high quality 'N' socket.

SPECIFICATIONS:
Gain: 18 dBi. Front-Back ratio 25 dB.
Weight: 0.7 Kg Length: 53.5 ins. **£49**

I. POWER SPLITTER
Enables the co-phasing of any two 934 MHz antennas to give an additional 3 DB gain. **£24.50**

NEVADA 934 MHz MAIN DEALERS

"Agrimotors" Merton CB Radio Centre
Merton, Okehampton, Devon EX20 3DZ
Tel: (08053) 200

Bens Television & CB
219 St Pauls Road, Peterborough, Lincs.
Tel: (0733) 54979

Bennetts Ltd.
24 Norwich Street, Dereham, Norfolk NR19 1DG
Tel: (0362) 2488

Catswhiskers
25 Chatham Street, Reading, Berks.
Tel: (0734) 589193

CB City
64 Waterloo Road, Stoke On Trent, Staffs.
Tel: (0782) 814952

CB Trading Company
40-44 Old Church Road, Clevedon, Avon.
Tel: (0272) 874192

Globemaster
8a Cherwell Close, Langley, nr Slough, Bucks.
Tel: (0753) 41191

Green Electronics
6 Short Street, Lowestoft, Suffolk.
Tel: (0502) 513960

Guildford Communications
34 Aldershot Road, Guildford, Surrey.
Tel: (0483) 574434

G.W.M. Radio
40-42 Portland Road, Worthing, West Sussex.
Tel: (0903) 34897

Henry's
404-406 Edgware Road, Paddington, London W2 1ED
Tel: (01-724) 0323

Horsetrader
1424 Leeds Road, Thornbury, Bradford, Yorks.
Tel: (0274) 663928

H & R Watson
24-26 Forest Hall Road, Newcastle On Tyne NE12 9AL
Tel: (091268) 4609

Imagefree Limited
1-3 Station Road, Rainham, Kent.
Tel: (0634) 373874

Jameson CB
44 High Street, Forres, Morrayshire.
Tel: (0309) 72133

Marshion Electronics
366 Spring Road, Ipswich, Suffolk IP4 5NG
Tel: (0473) 75476

Mitier Telecommunications
The Parade, Cherry Willingham, Lincoln.
Tel: (0522) 754279

Modulations Communications
62 Wootton Road, Abingdon, Oxon.
Tel: (0235) 21400

Rafcom
18 Bridge Street, Swinton, S Yorks.
Tel: (0709) 873874

Selectronics
203 High Street, Canvey Island, Essex.
Tel: (0268) 691481

South Coast Electronics
6 Monks Avenue, Lancing, West Sussex.
Tel: (0903) 753754

Square Wheels
82b Edgewood Road, Birmingham 45, West Midlands.
Tel: (021460) 1581

S & S Communications
Unit 9, Clifton Parade, Bristol Avenue, Farington, Leyland, Lancs. *Tel: (0772) 422239*

Stadium Accessories
67 Bowman Street, Darlington, Co Durham.
Tel: (0325) 59929

Tandy Electronics
125 Langwith Road, Hillstown, nr Chesterfield, Derbyshire. *Tel: (0246) 826578*

Telecomms
189 London Road, North End, Portsmouth Hants PO2 9AE *Tel: (0705) 662145*

Tower Communications
11 High Street, Haddenham, Cambs.
Tel: (0353) 740306

Wall & Son
4 Tetbury Street, Minchinhampton, Glos.
Tel: (0453) 882089

NEVADA 934 *Professional Series*

WORLDWIDE DISTRIBUTORS: TELECOMMS, 189 LONDON ROAD, PORTSMOUTH PO2 9AE
TELEPHONE: 0705 662145 TELEX: 869107 TELCOM G

SHORT WAVE LISTENER

TREVOR MORGAN GW4OXB

It doesn't seem like two years since I started writing this section of our magazine, but time flies! Over that period I have received literally hundreds of letters. Some have made suggestions of items you, the readers, would like to see in the column, some have been praising or criticising articles and others have just been very interesting letters giving personal details or stories of your own experiences in the hobby.

One such letter forms part of this month's column and I hope you find it as interesting as I did.

To the mailbag

Once again the mailbag has been full and we start off with a letter from Philip Davies in Shropshire who voices the plea that 'special event' stations should give the information about their stations more often.

Although I can see your point, Philip, when you've got a pile-up going it's very easy to skip the details and get the reports over to the callers. However, I can't see any reason why the operator can't give out the gen, say, after five or so contacts, unlike a few of the Russian stations recently who gave absolutely no details unless specifically asked for them!

Also mentioned by Philip was the ever changing Oblast list and the best way to keep up with this is to obtain the *Geoff Watts Oblast Update* available from: *62 Belmore Rd, Norwich NR7 0PU* for the princely sum of 35p.

A newcomer to the mailbox this month is Colin Blunn in Leicestershire who uses a Trio R600 and a 60ft endfed. Colin is on the prefix trail and obviously enjoys the hobby.

Another new member of our readership is Peter Hunter from Norwich who is reading hard for the RAE but getting his apprenticeship in listening meanwhile. His shack boasts a Drake 2B and a Realistic DX100 fed from a 40 metre dipole. Welcome to the bands, lads!

Michael Hudson in Kent includes a question on listeners' contests in his informative letter. Many of the national and international amateur contests have listener sections and details of these are regularly published by the RSGB in *'Radcom.* Often these are also included in 'Listeners' Club' sections of broadcast stations such as Radio Sweden, Radio Finland, Radio Nederland and many others, including many of the Eastern bloc countries such as Radio Berlin International (DDR). DDR not only has a regular DX programme but issues a newsletter to regular listeners. This is where the general coverage receiver comes in handy.

Mike only lives 100 yards from the sea at Folkestone which must give him excellent groundwave reception of DX. His Trio 9R59DS and loft mounted wire do sterling service on all bands. He compliments *Amateur Radio* on the *Prefix Awards* and looks forward to gaining his Gold award in due course.

A nice letter from our friend in Caithness, namely Don Robertson, who informs me that he is still in the chase for the first Gold award for working all 1000 on CW. His latest count was over the 900 mark so I expect his list to pop through the letterbox any day now!

Contagious

Keith Forward in Sussex did his leg a mischief recently (must be catching, Keith) but it's an ill wind, etc, and he's using his spare time to dig into the pile-ups for some more prefixes. Keith mentions the dreaded 'woodpecker' and reminds me of a tale going the rounds of an amateur in QSO with a Soviet station who threatened that unless the woodpecker got off the frequency, he'd turn his linear up and scorch the blighter's tail feathers (or words to that effect!).

So to this month's *Prefix Awards*, and I must mention that these awards are available to licensed amateurs as well as listeners. HF claims to me please and VHF/UHF to G8MWR.

Eric Franks RS52095 opens his account this month with a Bronze claim heard using his Trio R600 and an endfed wire antenna. Eric offers A4X, AP6, HH7, PY5, PZ1, 5B4 and 6WI for starters, with an interesting mixed bag.

Philip Davies offered A71, D44, FY7, J28, J5, JW0, KP4, P29, S83, SV5, TJ1, YB4, 6 and 8 (Indonesian Islands), ZD8, 5T5, 9J2 and 9X5 as part of his Silver award claim. Details of the stations included on his sheets made interesting reading too. Well done Philip.

Colin Blunn sent photostats of his log sheets for his Bronze claim which included J37, CE3, ZD7, J87, 9Y4, 5N8 and VP9 among the catches. Colin's log showed that hooking on to pile-ups paid dividends on occasions, but the best of his catches featured in individual QSOs.

Key-bashers

Two key-bashers have come to the fore in John Fogden G4WSX, in Chichester, who claimed his Bronze for two way QSOs, and Eric Collins G4ZME, who resides in Canterbury, working his key on QRP at times to get in on the action with his Bronze claim.

Alex Pyne G4UNH preferred the mike to catch 295 prefixes, including 7X5, CZ3, J87, VP2, VQ9 and sundry others to make his Bronze claim.

Somehow I forgot to mention Reg Keeley-Osgood last month, so apologies, Reg. This was a nicely presented claim for Bronze with 275 prefixes logged including A92, HH2, HW4, T12, VY3, and a nice batch for the score. I loved the comments in the 'remarks' columns, Reg, like: 'If you want to play with your teleprinter do it in twenty minutes!' . . . lovely stuff!

Last month I gave a run down on the Howes DCRX receiver kit and at that time I had not completed the kit due to a severe lack of time and also due to me cooking the IM380 chip by over enthusiastic handling of a hot soldering iron! However, thanks to Howes' excellent trouble-shooting service the problem was soon solved, but I would recommend the use of IC sockets just in case you do have a dodgy chip or a heavy hand!

Pleasantly surprised

Having had reports from Martin Moss and others I was keen to get the DCRX fired up so I hooked up the G5RV and listened around 80 metres.

To be honest, I was very pleasantly surprised (not least with the fact that my first receiver effort actually had sounds coming from it!) to find stations being received from the whole of Europe, North America, Canada and even a stray ZL in the limited time I had. I'm not going to dwell on the receiver for fear of sounding biased, save to remark that it works extremely well and I got a hell of a kick out of having put it together myself. By the way, the transmitter worked too!

As I mentioned earlier, I have had a lot of interesting letters from readers and think some of them deserve reproduction, so starting this month we are going to introduce some of the listening fraternity to you. If you would like to be one of our featured listeners, please write in to me with details of your station and, if possible, a picture of yourself or your shack.

Featured listener

This month's featured short wave listener is *Elmer Liddicoat.*

Elmer lives near St Austell in Cornwall. Having spent some of his earlier years as a wireless operator in Lancaster bombers, he has many memories of the old 1154/55 equipment and similar receivers of that era. Probably influenced by those memories, Elmer's shack still boasts a fine Eddystone 1830/1 receiver.

The position of an old

industrial tip at the bottom of his garden has some influence on the fact that his 330 foot long wire has a slope from 120 odd feet at the top end to 30 feet at the business end in his lounge.

Elmer uses the Global 1000 ATU to couple the antenna to his 1830 and also to his second rig, a Lloytron Pathfinder, which although originally used on HF is now only used for two metres, marine and aircraft bands.

A Sigma 2A airband receiver completes the set-up in a neat shack which gives the appearance of cool efficiency without being cluttered.

Elmer's interests are varied with the simple premise of enjoying the hobby, and with RAF St Mawgan nearby, the upper RED 8 airway overhead and the London Control Aerials at nearby Davidson Moor, his VHF receivers get more than their fair share of use.

In the future he hopes to complement his VHF facilities with a scanning receiver as the GB3NC repeater is only a stone's throw away and is pretty lively, especially during the summer months with the tourists chatting up the locals.

Cheeky

One cheeky correspondent asked if there was an award for logging GW4OXB! Well, I know I'm not on the air all that much . . . but really! Kidding aside, during the annual Jamboree-on-the-air I operate a station on behalf of the White Fang Fellowship (an ex-scout association) and usually use the call GB2WFF.

As an encouragement to short wave listeners and for the promotion of the Jamboree, I am offering an award for listeners logging the JOTA stations over the weekend of the event.

Entries must include callsign, frequency and time as usual, and also the name of the scout troop or organisation operating the station, or on whose behalf the station is being operated. Score 1 point for each station in your own country and 2 points for all others, with a penalty of 5 points for duplicates in the same band.

The entry fee for the contest is 2 IRCs or 50p for UK listeners and 4 IRCs or £1 for overseas listeners. There will be engraved plaques for the top two entries and *all* entrants will receive a commemorative certificate. Just to gild the lily, if you log GB2WFF you'll get my card too!

JOTA weekend

The JOTA weekend is usually 19/20 October, but *check the press* for confirmation nearer the time.

I imagine most if not all of you have used long wires and dipoles in one shape or form and want to get a bit more adventurous with aerials without paying the earth for a beam and rotator.

Years ago it was the 'in thing' to cadge bamboo poles from a local carpet warehouse to use as supports for a variety of beams. These poles are not so common nowadays and cardboard rolls don't stand up to the weather so well.

Out of fashion

Something that goes out of fashion in one hobby has the habit of becoming useful in another, and to this end the angling fraternity is being helpful to the amateur radio fans by casting off their old split cane fishing rods and roach poles in favour of more modern fibre glass or carbon fibre rods.

Split built cane rods are extremely strong and can withstand very strong winds, which makes them ideal for quad spiders or other wire formations. They can often be obtained from secondhand dealers or church bazaars at very reasonable prices. As these rods are available in sizes from 7 to 16 feet quite large beams can be constructed.

One of the many published plans I tried early on in my 'serious' listening days was the design by VK2ABQ for a tribander beam using bamboo poles and copper wire. This was an up-grade from the 20m 'Bow tie Monobander' which gave good results for about six months or so, a long time for any one aerial to be in place.

Easier construction

After I made my VK2, G3FRB (Phil Horwood) came up with modifications that made construction easier. Phil had excellent results using this design, but although I made plans to rebuild mine I never got round to doing so.

For those interested in experimenting, I'm reproducing the design here (see diagram) which could be neatly made using old fishing rods. The centre 'spider' can be made up from aluminium or galvanised steel tubing of the required size.

Simple dipoles are also a reasonable project if you wish to rotate them, and verticals become a viable proposition in awkward 'visual' areas as fishing rods are almost invisible if sprayed a dull grey.

One thing about being a listener is that you don't have to worry about the SWR, and the use of a reasonable antenna tuner will give good results even if the measurements are a little bit astray.

'Kontest korner'

From time to time, as space permits, I'll try reviewing a few awards and contests that are of interest to listeners. Although it's a good thing, in my opinion, to be a member of the RSGB, some readers cannot afford the fees and don't get to see the *Radcom* updates.

The People's Republic of Bulgaria offers a number of awards for listeners including the following:

PRBA, for valid reports for five LZ1 and five LZ2 stations on each of 3.5 and 7MHz;

Five Bands LZ, for one LZ1 and one LZ2 on each of 3.5, 7, 14, 21 and 28MHz;

W 100LZ Award, for 100 LZ contacts in one calendar year;

W 28Z ITU Award, for reports from stations in zone 28, ie, DL, DL (West Berlin), FC/TK, HA, HB9, HB0, HV, I, IS, LZ, T7, OE, OK, SP, SV, SV5, SV, SY, YO, Y, ZA, 9H, 4U1ITU;

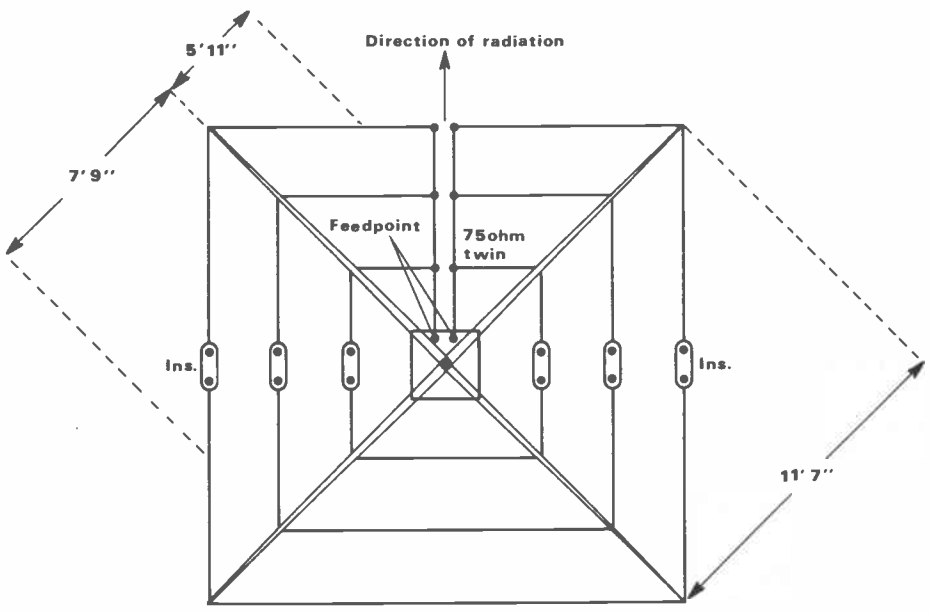
Class one award, for 28 QSLs from stations in 20 countries;

Class two award, for 28 QSLs in 16 countries;

Class three award, for 28 QSLs in 10 countries;

QSLs from five different LZ stations are obligatory in all cases.

Anyway, I hope the weather keeps clear for your experiments and wish you all the best of DX for another month.

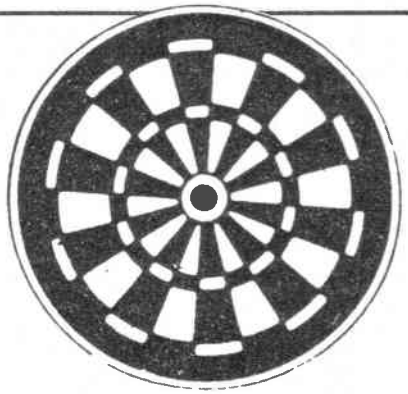


VK2 tribander beam with modifications

RAINBOW COMMUNICATIONS

HOME

G5RVs
½ size £9.50
F/S £12.50
½ wave verticals for 10m £11.90.
Centre loaded mobile whips from £8.95
25 watt linears from £20
Repairs and Service



TEL: 01-640-1904
ASK FOR HOWARD
(G4VWR) OR WIN XXXXX

AWAY

MET
AKD
SUN
ALTRON
JAYBEAM
LCL + DNT

CBs with 10FM conversion kits or ready converted

OPEN TILL 8pm MON-SAT
MAIL ORDER WELCOME
68 Gorringe Park Ave,
Mitcham, Surrey
SOUTH LONDON'S BUSIEST EMPORIUM

VISA Access

Amateur Radio smart blue binders, each holding up to 12 issues keeping them in prime condition.

BINDERS!

Only
£4.25
inc p&p

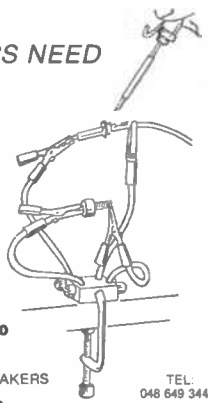
Overseas readers please add 30p
Please allow 14 days for delivery

Send your orders to:
Edwardschild Ltd, 28 Shenfield Cres.
Brentwood, Essex CM15 8BN

GRIPMATE

ELECTRONIC ENGINEERS NEED

'EXTRA HANDS' FOR SOLDERING, GLUEING AND ASSEMBLING



This essential compact tool comes complete with 4 croc-clip flexi-arms to hold components positively and rapidly with infinite positioning. . .
ONLY
£4.85

USEFUL ACCESSORIES. . .
48mm 2.5x MAGNIFIER FLEXI-ARM £2.50
MAGNET FLEXI-ARM £1.50
ALL PRICES INCLUDE VAT – POST – PKG
SEND NOW! CHQ/PO OR SAE DETAILS DIRECT FROM THE MAKERS

TEL: 048 649 344

***KEMPLANT LTD* (DEPT 2)**
DURFOLD WOOD, PLAISTOW, BILLINGHSHURST, WEST SUSSEX RH14 0PN

G6 YHB
G6 YHC
G1 NBA

SELECTRONIC

G4 UVJ
G1 MAM

Radio Communication – Equipment Sales & Service
THE U.K. LEADING SUPPLIER OF 934MHz PERSONAL RADIO EQUIPMENT

APPOINTED 'NEVADA' SERVICE DEALER

COMMTEL NPR 934	£365.00
NEV 934 DELTA ONE	£355.00
SECOND HAND EQUIPMENT FROM	£150.00

BASE ANTENNAE

YAG 934 4 ELEMENT YAGI 5dB	£9.90
BCH 934 OMNI FOLDED DIPOLE	£15.53
BPC 934 7.5dB COLINEAR	£59.95
PA7E 7.14dBi COLINEAR	£66.00
LY 934 12 ELEMENT LOOP YAGI	£49.00

MOBILE ANTENNAE

MMC 934 3dB MAG MOUNT	£26.45
AMC 934 3dB ROOF MOUNT	£20.70
P7ME 7.14dBi MAG MOUNT	£44.00
P7E 7.14dBi GUTTER MOUNT	£44.00
P714 7.14dBi GUTTER MOUNT	£44.00

PRE AMPS

HRA9 934 MAST HEAD PRE AMP	£159.95
NEV 021 MOBILE PRE AMP	£135.00
AP 104 MOBILE PRE AMP	£79.95
SEL PA 2 INPUT PRE AMP plus 8 watt PA Module	T.B.A.

SWITCHES

SEL 934/CS N to 2×N	£23.95
SEL 934/MHCS MAST HEAD N	£49.00
HAS 1 MAST HEAD N	£59.95

PLUGS AND CONNECTORS

LNC 934 LARGE CABLE BNC PLUG	£6.90
BNC 934 BNC PLUG FOR RG 58	£1.84
NCL 934 N TYPE UR 67/H 100	£3.08
NCS 934 N TYPE RG 58	£2.93
NJL 934 N JACK UR 67/H 100	£2.95
SEL 934B N BARREL CONNECTOR	£3.08
SEL 934M N MALE TO MALE	£3.20
SEL 934F N to BNC ADAPTOR	£3.60
SEL 934AM BNC to N ADAPTOR	£3.60
MCP 934 4 PIN MIC. PLUG	£1.30
MBS 934 6 PIN MIC. PLUG	£1.50
DCP 934 REFTEC POWER PLUG	£2.20

CABLES

H 100 LOW LOSS COAX	£0.80
RG 213 LOW LOSS COAX	£0.86
RG 58M MOBILE LOW LOSS COAX	£0.46

934MHz to 144MHz CONVERTOR
Converts 934 radio and cellular radio to 144-146MHz for use with scanners or VHF receivers etc. £79.95

METRES

SEL 934/S SIGNAL/POWER METER	£17.75
SEL 934/SM SWR/POWER METER	£49.50
HPS9 934 SWR/POWER METER	£89.95

ACCESSORIES

SEL 934/PL TUNED PATCH LEAD	£6.50
SEL/APS ANTENNA POWER SPLITTER	£24.95
ROT/934 LIGHTWEIGHT ROTATOR	£59.95
AMG 303GM ADONIS BASE MICROPHONE (Modified for C.B. use)	£45.50
PROTEL 103 BASE MICROPHONE	£39.95
SEL 934/MM MOBILE SAFETY MIC.	£39.95
ELS 934 EXTENSION SPEAKER	£11.50
NCS 934 SUPRESSION KIT	£8.90

Tandy® AUTHORISED DEALER

CREDIT TERMS & MAIL ORDER AVAILABLE
Full service facilities for all products we sell by experienced qualified engineers.
ACCESS AND BARCLAYCARD/VISA WELCOME

203, HIGH STREET, CANVEY ISLAND, ESSEX
Telephone: Canvey Island **(0268) 691481**

BARCLAYCARD VISA

A HAM'S LIFE IN PAPUA NEW GUINEA

by Jim Smith P29JS

My first arrival in Papua New Guinea (PNG) was in early 1975 after a lengthy trip from the United Kingdom. It so happened that this year was particularly important, since on 17 September PNG became an independent country.

Until then, in terms of amateur radio and DXCC, two separate countries existed – Papua and New Guinea. No real distinction was ever made in callsign allocation, both areas being VK9. In addition, to confuse the issue further, this same prefix was used in several territories of Australia. It was always good fun working a VK9 and then keeping fingers crossed, hoping it was one you needed. It is also true to say that long-term residents of these various areas needed no special calls. Ray Hoare VK9RH was Norfolk Island, Bob Sutherland VK9BS was Papua, and so on.

Prior to independence, the Post and Telegraph Department had been gradually taking over more and more of the radio licensing structure from Australia. As an indication of this the prefix P2 was introduced in order that identities be preserved. VK9BS became P29BS, VK9DJ became P29DJ, etc. These changes came into force on 1 January 1975.

Diverse country

To say that PNG is a diverse country would have to be the understatement of the year. A large island in itself (shared by West Irian to the north-west), it consists of hundreds of islands, many of them quite large. The country has many different cultures and ethnic groups. It is said that there are over 700 different languages in addition to Pidgin – a sort of common language.

A central rib of mountains divides the mainland mass. Peaks reach in excess of 15,000 feet and this forms the main division between what was Papua and New Guinea. As a result, one tribal group in one valley can be effectively cut off from another in a neighbouring valley. Each group is almost unaware of each other's existence and has developed quite differently.

Some nine years later, as an independent country, PNG continues to move forward out of the stone age mentality, out of inter-tribal fighting, out of tribal control, towards the future. The transition has not been easy and problems exist, particularly in the movement of a reasonably simple and primitive people towards the bright lights of the cities. Hundreds of people in houses which do not exist, looking for work that isn't there.

Radio licensing is vested in the Post and Telecommunications Corporation. Whilst PNG does not have reciprocal licensing with every country, it is nevertheless true to say that many licences are recognised. Frequency allocations are excellent and in many cases quite different from Australia.

Probably the most significant event in recent years was the introduction of the Novice Licence. This licence has limited HF allocation, an easier theory paper and a Morse code requirement of 5wpm. The first Novice Licence was issued to Ron Pain P29NRP, in March 1977. Ron has long since upgraded to a full call.

The result of the Novice Licence was that many people made a start in amateur radio, and this may not have been possible for them previously. Most take the novice status seriously and work towards full call privileges, battling with additional theory and Morse requirements.

In addition, 'Z' calls are also issued. These have full theory examination qualifications but lack the Morse code. Many remain as 'Z' calls from choice. They have no HF privileges, but prefer the challenge of VHF, UHF, etc. Content with 6 metre openings, satellite working and VHF/UHF studies, Rick Warnett P29ZFS is very well-known in these areas.

PNG has quite a large amateur radio population but, like amateurs everywhere else, many are not active. Three 'nationals' have full calls: P29SK, P29LL, P29KP, and many are studying for novice and full calls. The PNGARS is built on strong foundations. It has some problems, the main one being a reasonably migrant expatriate population which keeps the society in a state of flux. However, this is understood as people are on contracts, etc. An active QSL bureau and regular meetings help to keep things together. However, many never get to attend a monthly meeting in the 'Big Smoke', since many are 'up country'.

In terms of radio locations, PNG has many variations. From coastal areas such as Lae, Madang, Port Moresby, Rabaul, etc to two major centres – Goroka and Mount Hagen, which are both in the temperate highlands at altitudes of over 4,000 feet. Some sites have to be seen to be believed, with their majestic scenery of breathtaking beauty.

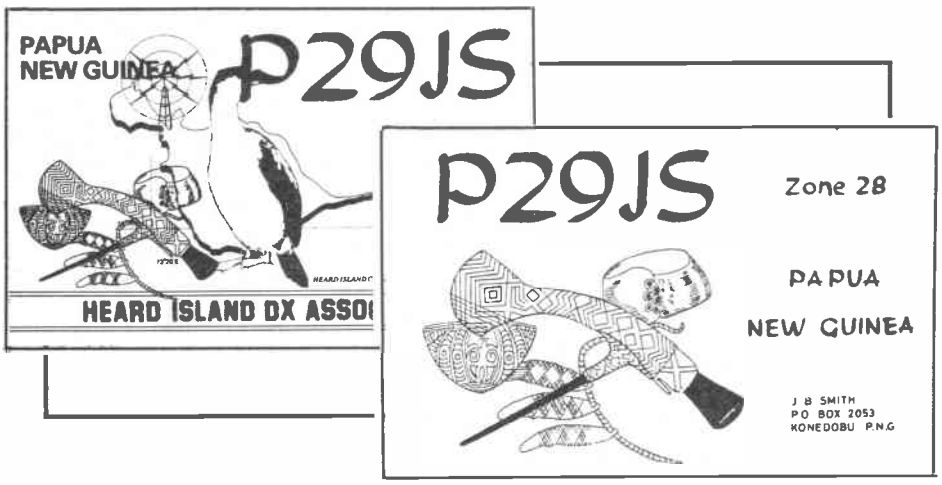
Propagation from here can be quite unique – a near equatorial spot, a reasonable station, not forgetting a bit of decent sunspot activity, and one can be in business. Put a few dBs on for the P29 callsign and I suppose one could say we have it made. Most of the Asian countries are easily worked – AP, BY, VS6, XU, YB, 9V, all within the proverbial 'spitting distance'. Long-path openings round the equator have to be heard to be believed.

70,000 QSOs

As P29JS some years ago I was very active, in excess of 70,000 QSOs, and the 220 net kept me pretty busy. In addition, several exotic DXpeditions were undertaken, thus proving that PNG is not a remote backwater. Port Moresby has an excellent international airport and a long and memorable history, as Jacksons' Airport was famous in WWII.

Regular daily flights to Australia and other areas can get one into the main traffic steam fairly easily. In fact, both Papua and New Guinea were deeply involved with pioneer flying in the early days. It is not a forgiving country for the flyer. Often, conditions can become marginal in minutes, especially for the smaller aircraft. Accidents happen and the edge can be very small between safety and disaster.

I am back in PNG (with Civil Aviation) for a short time and have been lucky to retain my PNG identity, so will be looking for a QSO with you – perhaps on the 14220 net. 73, Jim Smith, P29JS.



BACK TO BASICS

Bill Mantovani G4ZVB concentrates on the knowledge of operating procedures required for the RAE with a look at LICENSING CONDITIONS

Licensing conditions

Knowing the terms and conditions of the amateur radio licence is perhaps the most important aspect of the whole RAE syllabus. Of the 35 questions which make up the first one hour paper of the RAE exam about two thirds of those questions will be on the licensing conditions. The other third is on transmitter interference, which we have already covered, and it is quite surprising to note how many examination candidates have actually failed the first paper because they did not pay sufficient attention to fully learning the licensing conditions. It's like having to answer questions on the Highway Code for a driving test; after spending so much time learning to drive the car the swatting up on the code is then often left till the last minute, where it is all crammed in at once.

The RAE exam is very different to the driving test though in that it places far more emphasis on the rules and regulations than the latter. It is therefore in your own interests to go into the exam with a good sound knowledge of the licence conditions.

RAE syllabus

Towards the back of the RAE Manual you will find extracts from the Amateur Licence A, and this chapter should be *very carefully* read and understood along with the notes to be given here covering the more popular question areas. If there have been any recent relevant changes then these will be pointed out as we go along.

By now you really should have your copy of *How to become a radio amateur* as this gives you all that you need to know about obtaining a licence, details of the amateur Morse test, the conditions of the licence itself, together with any relevant notes, plus a schedule of the frequency bands, classes of emission, power etc. This publication is available free of charge from the Radio Amateur Licensing Unit at the address given at the end of this month's article.

Table 1 shows a list of books which are recommended reading for the prospective amateur.

Types of licence

There are two types of amateur transmitting licence currently available in this country, referred to as the A and B licences. The Amateur Licence B does *not*, at the time of preparing this article, authorise the use of frequencies below 144MHz but otherwise its conditions are broadly the same as those of the Amateur Licence A. You do not, however, need to have passed the amateur Morse test, only the RAE exam, in order to be granted a B licence.

The Amateur Licence A is the principal type of amateur transmitting licence and to apply for this one you must first have passed both the RAE examination and the amateur Morse test, the latter having been taken no later than 12 months immediately preceding the date of the licence application, otherwise you will have to resit and pass the Morse test again. The two licence types are more commonly known as the class A and the class B licence, and to be granted either type the applicant must be over 14 years of age.

There is sometimes confusion over the terms Amateur Radio Licence and Amateur Radio Certificate, so let me explain the difference. The former refers to the A and B licences we have just been looking at, and the latter is a certificate issued by the Post Office Amateur Radio Licensing Unit, without charge, to anyone who has successfully passed both the RAE exam *and* the Morse test. You are usually sent this certificate by the licensing unit when they receive your A licence application, but you can also apply for it if you, for some reason, do not wish to take out a class A licence immediately.

This may be the case, for example, if you already had a class B licence, then passed the Morse test but decided to wait until the class B expired before applying for the class A. As before, provided the holder of the certificate made his application for the class A licence before the end of one year from the date on which the Morse test was passed, then no further retaking of any exam is necessary, but if the 12 months are allowed to lapse then the Morse test must be sat again.

The Amateur Radio Certificate does actually permit the holder, under certain conditions, to operate an amateur radio station but only in the presence of, and under the direct supervision of, the licensee of that station. It *does not* allow the holder to set up and operate his own station but it does mean that he or she could possibly operate, say, a club station.

The minimum age for holding an Amateur Radio Certificate has just been lowered by the Department of Trade and Industry to 10 years of age, a move which could entice some very young members into our ranks.

Callsigns

Every amateur station is identified by its callsign, and in the United Kingdom the prefix G is used. The full prefixes for England, Scotland, Wales etc are given in *Table 2* and you are strongly advised to learn these (they are after all very easy to remember) as there is nearly always a question on prefixes in the exam. It would read something like: The callsign for the Isle of Man is a) GM, b) GD, c) GI or d) GW. The suffix of the callsign usually consists of a number plus three letters (unless it is for a special events station or the like), and for class A the latest series is G0--- or GW0--- etc, whilst for the class B licences, the series is currently G1---, GW1--- etc.

The fee for both types of licence is at present £12.00 and the renewal fee,

Table 1

Recommended reading

How to become a radio amateur – DTI (Radio Amateur Licensing Unit)

The Radio Amateurs' Examination Manual – G L Benbow G3HB (RSGB)

How to Pass the Radio Amateurs' Examination – G L Benbow G3HB (RSGB)

The Radio Amateurs' Q & A Reference Manual – R E G Petri G8CCJ (WP Publications)

Amateur Radio Operating Manual – R J Eckersley G4FTJ (RSGB)

A Guide to Amateur Radio – P Hawker G3VA (RSGB)

Radio Communication Handbook – RSGB

Amateur Radio magazine

Amateur callsign prefixes for the UK	
Prefix	**Country**
G	England
GD	Isle of Man
GI	Northern Ireland
GJ	Jersey
GM	Scotland
GU	Guernsey
GW	Wales
GB	– used for special event stations, repeaters, beacons etc

Table 2

which is also £12.00, is payable in advance each year on or before the anniversary of the issue of the licence. That may seem like a longwinded way of saying that the amateur licence costs £12.00 per year but my advice to you is to learn it the way the book says it.

It is unfortunate, but sometimes there are questions on the RAE paper when of the four choices of answer given, all four look correct at first glance but only *one* of them will be the correct one as per the book. The City and Guilds maintain that they do not do it to trick anyone, but the fact remains that if you don't read the licensing conditions *and* the exam paper carefully you could all too easily end up ticking off the wrong answer.

Temporary or alternative

Looking at the actual conditions now, both the RAE Manual and *How to become a radio amateur* contain the conditions of the Amateur Licence A. It is not necessary therefore to reprint them all here as they are all quite straightforward, but do make sure that all of the conditions are fully understood for the reasons cited earlier. There are, however, some points arising from previous examinations that call for some clarification.

Candidates often confuse the terms temporary premises and alternative premises. The amateur station may be established at a number of places, at the address on the licence, in any vehicle or vessel (but not on the sea or within any estuary, dock or harbour) and as a pedestrian. It can also be established at two other locations referred to by the licence as the temporary and the alternative premises, with the RAE question tending to centre around what is temporary and what is alternative. Sometimes another quite correct sounding term is thrown in for good measure and then the candidate suddenly becomes confused because of not having understood the conditions sufficiently beforehand.

It's easy if you remember that *temporary* is for separate periods, none of which exceed four consecutive weeks, and *alternative* is where prior notice (in writing and at least seven days before the station is established) of the address of the alternative premises has been given to the manager of the Radio Investigation Service district in which this alternative premises is situated, or to the controller of the Telecommunications Board of the appropriate Bailiwick in the case of the Channel Islands. So, if you are going on holiday, say, for a period of less than a month or just wish to set up the station at the local school to demonstrate amateur radio, then that is called temporary.

Are you with me so far? For periods that would exceed four consecutive weeks it would then be termed as alternative premises and written notice, as explained, would be required plus further notification to the appropriate manager or controller of when the station is no longer established, the latter again in writing. A couple of things make the above sound a little more confusing though. The first is that the term temporary location is also used and this has a slightly different meaning to temporary premises, and the second is that the suffix, which must be added to the end of the callsign when operating from temporary premises, is '/A', the 'A' standing for the word 'alternative'! At first all of this does indeed sound very confusing, but if you read it through carefully then it isn't too difficult to grasp.

Callsign and notification of location

Dwelling for a moment on the subject of location, you can see from the above that the callsign is used to indicate if the station is being operated from somewhere other than the main address. Whenever the station is used the callsign given on the licence must be transmitted, but the prefix and/or suffix can alter depending on where the station is being operated from. If it is from a vehicle or vessel the suffix '/M' is added to the end of the callsign, while if operating as a pedestrian or portable from the top of a hill, say, then the suffix '/P' is used. Operation from temporary premises, as we have just seen, is '/A'.

The prefix of the callsign alters if the station is operated from another country within the United Kingdom in accordance with the prefixes in *Table 2*, ie G0ZZZ gives his call as GM0ZZZ/M if he (or she) goes to Scotland for a holiday and decides to do some operating from the car whilst he is there. This is possible because the Licensing Unit issues callsigns on a suffix basis so that there will only ever be one -0ZZZ issued in the UK, be it prefixed by G, GM, GW or whatever.

Sending a callsign

There is a limit to how fast (in Morse) and how often the call is sent during a transmission. It must be sent for identification purposes at the beginning and at the end of each period of sending, be it in telephony or Morse telegraphy, and also whenever the frequency of transmission is changed. If the period of use exceeds 15 minutes then the callsign has to be repeated at the beginning of each succeeding 15 minute period. Where the transmission is in Morse, the callsign must not be sent at a speed in excess of 20 words per minute, and when the station is used from the temporary premises or location then the address of those premises or location also has to be sent at the beginning and end of establishing contact with each separate amateur station, again at intervals no longer than 15 minutes.

Onto another favourite question now. The licence states: 'when telephony is used, the letters of the callsign may be confirmed by the pronouncement of well-known words of which the initial letters are the same as those in the callsign; but words used in this manner shall not be of a facetious or objectionable character.' This means for instance that the word 'Mike' could be used to indicate the letter 'M' in conditions where the person you are talking to might think you said 'N'. Any suitable words can be used provided that they comply with the licence condition, but to maintain some degree of uniformity it is recommended that the phonetic alphabet given in *Table 3* be used. This is not a difficult thing to memorise and it is certainly recommended that you do so.

Another often referred to condition is that the licensee becomes licensed to use the station for the purpose of sending to, and receiving from, other licensed amateur stations as part of the self-training of the licensee. This is done in communication by wireless by means which include visual images, facsimile

Table 3

Recommended phonetic alphabet					
A	Alpha	J	Juliett	S	Sierra
B	Bravo	K	Kilo	T	Tango
C	Charlie	L	Lima	U	Uniform
D	Delta	M	Mike	V	Victor
E	Echo	N	November	W	Whiskey
F	Foxtrot	O	Oscar	X	X-Ray
G	Golf	P	Papa	Y	Yankee
H	Hotel	Q	Quebec	Z	Zulu
I	India	R	Romeo		

Amateur Band allocation (UK)	
Band	**Frequency limits**
160m	1,810 2,000MHz
80m	3,500 3,800MHz
40m	7,000 7,100MHz
30m	10,100 10,150MHz
20m	14,000 14,350MHz
17m	18,068 18,168MHz
15m	21,000 21,450MHz
12m	24,890 24,990MHz
10m	28,000 29,700MHz
4m	70,025 70,500MHz
2m	144,000 146,000MHz
20cm	430,000 440,000MHz
	(There are also a number of microwave bands available above 1,000MHz)

Table 4

signals, radio teleprinter signals, plain language messages, which are remarks about matters of a personal nature directly concerning you the licensee and the person with whom you are in communication and, finally, signals that are not in secret code or cypher, but which relate to or form part of the transmission of the above images, signals or messages.

The station can also be used during disaster relief operations, as may be carried out by an organisation such as the British Red Cross Society and as directed in the licence conditions and, of course, for the purpose of receiving transmissions in the Standard Frequency Service.

Limitations

The amateur licence is subject to a number of limitations, all of which are quite straightforward even though these may not appear so because of the wording. The station, for example, may not be used on a bus, train or other public transport vehicle, nor in an aircraft. Also, the licence only allows you to transmit within certain frequency bands, using only certain types of emission, as listed, and with a limited maximum power. All of these are specified in something called the Schedule, which you will also find in both the *RAE Manual* and in Appendix F of *How to become a radio amateur.*

The Schedule

From the Schedule you will notice that the amateur is allocated a number of bands over a very wide range of the frequency spectrum. The HF, VHF and UHF amateur bands are listed in *Table 4* and you should make good note of the frequency coverage of these bands. Remember also that the amateur bands are not necessarily used exclusively by amateurs and that we have to share them with other services. 160m for instance, or Top Band as it has become known, is only available to amateurs on a basis of non-interference to other services, as are the 17m, 12m and 4m bands.

You can expect to be questioned on the Schedule as it is a very important aspect of the licence conditions; it is therefore worth spending some time reading it carefully and getting to know what you can or can't do on the various bands. Some bands, for example, allow for only a fraction of the 400 watts PEP (26dBW) maximum power level mentioned last month. The maximum PEP allowed on 160m is 15dBW (approx 30W) with a corresponding carrier power maximum of 9dBW (approx 8W). At present only CW is allowed on the 17m and 12m bands with a maximum carrier power of 10dBW (10W).

Possible restrictions

Except for the two bands just stated, most other modes of emission are allowed on the other bands (with possible restrictions) and the band plan is usually such that CW occupies the lower end of the band, CW and telephony the upper end and RTTY (radio teletype) a small segment in between these two. This is by no means a complete guide because some bands may have spot frequencies or a band of frequencies set aside for beacons, amateur satellite working, slow scan television (SSTV), etc. Also, despite the fact that it says for the 30m band (10.1-10.15MHz) that the permitted types of transmissions are the same as those for some of the other HF bands there is a voluntary agreement within the International Amateur Radio Union (IARU) Region 1, which covers the UK and the rest of Europe, Africa, the USSR and Turkey, to restrict operation in this very small band to Morse and RTTY only. This sometimes confuses candidates as they often think that this band is subject to the same restrictions as the other 'new' bands, 17m and 12m, but this is not so and the agreement is purely voluntary.

You will also notice on the Schedule that the *status* of the amateur service is listed as primary or secondary on certain bands, and again this has been a favourite question area in the past. Holders of the Amateur Radio Licence B only are not permitted to use the frequencies below 144MHz, nor may they transmit in Morse except where the following exceptions apply. If the class B licensee also holds a valid Amateur Radio Certificate then he can indeed operate someone else's station on the HF bands provided the necessary supervision is present as explained earlier.

The other exception is that as a result of discussions between the Department of Trade and Industry and the Radio Society of Great Britain, class B licence holders have been allowed to use Morse code in their contacts for an experimental one year period that commenced on the first of April this year. All that the licensee has to do is apply to the RSGB for a Notice of Variation to the Class B licence. You should not be required to know about the latter for the exam and this has been mentioned for information only.

Emission designation

Something that is often forgotten is that the licence requires that the class of emission be recorded in the log book, not simply the type of mode of operation. We shall look at the requirements for the log book next month, but it is worth covering this point now. It is not correct to enter in the log that your mode of transmission is SSB, CW, FM or whatever. The proper way is to use the emission designators. These are symbols used to designate the various classes of emission and which have

Table 5

Designators for the more common modes of emission		
Type of emission	**Description**	**Designator**
Morse	on-off keying of a carrier (CW)	A1A
	frequency shift keying	F1A
	audio frequency shift keying	F2A
Telephony	amplitude modulation (AM)	A3E
	frequency modulation (FM)	F3E
	double sideband (DSB)	A3E
	single sideband, suppressed carrier (SSB)	J3E
RTTY	frequency shift keying	F1B
	AF shift keying using an FM carrier	F2B
Facsimile	frequency or AF shift keying	F3C
Television	fast scan TV using AM double sideband	A3F
	fast scan TV using FM	F3F
	slow scan TV	F3C

meanings assigned to them in the radio regulations of the ITU (International Telecommunications Union). At one time the Schedule actually quoted these designators for you but now you have to work them out for yourself from the notes at the back of the licence.

The designator is made up of three symbols, the first denoting the type of modulation of the main carrier, the second the nature of the modulating signal or signals and the third the nature of the information to be transmitted. However, as this has only been a recent change questions on how to work out the emission designator will probably not be included in the December exam, but should be expected from 1986 onwards when the new syllabus applies. You are required, though, to know what the designators are for the more common types of transmissions and these are listed in *Table 5* for you to learn and remember.

Take note

Speaking of transmissions, take note of the fact that other than the initial CQ or general call, the licence does not allow you to broadcast in general and the station can only be used for establishing direct contact with another amateur station. Contacts may be conducted with a group of amateur stations provided that you first establish communication with each station separately. This also means that the holder of an amateur licence A or B may not establish contact with any station other than another amateur station except in the case of a genuine emergency as specifically stated elsewhere in the licence. If, therefore, you one day came across an operator on the amateur bands who wasn't licensed to be there (and there are a few!) and you established contact with that station, even if only to point out the error of his ways, you would in fact be breaking the licence conditions.

The licence also does not allow for the transmission of any message which is grossly offensive or of an indecent or obscene character, nor does it authorise the use of the station for business, advertising or propaganda purposes, or (unless it is specifically provided for in the licence) for the sending or receiving of news or messages on behalf of, or for the benefit or information of, any social, political, religious or commercial organisation, or anyone other than the licensee or anyone with whom he is in communication.

This may all sound very long-winded but one of the things that this means is that amateurs in this country are not permitted to convey third party messages, unlike amateurs in some other countries. A letter of variation is available from the RSGB permitting stations to use a GB callsign, operate simultaneously and pass third party type greetings to *any other UK station* but other than this the basic ruling is that you cannot pass on or receive messages, or set up a contact, for a third party.

Recorded messages

Still on the subject of messages, the licence also sets out conditions by which recorded messages can be transmitted. If you are in contact with another amateur station and you record his transmission, you can retransmit that recording back to the originating station for his (or her) intended reception, *provided* that the callsign of that originating station is not included in the retransmission. You are not allowed, however, to transmit for any purpose tape or gramaphone recordings of the type intended for entertainment purposes, as amongst other things you would probably be breaking some form of copyright.

We have now covered quite a lot of the licence conditions, so the rules for keeping a log book, non-interference, frequency control, etc will be left until next month. However, there are still one or two points that need looking at before closing. So far most of the conditions have related to the transmitting equipment, its operator and operation, but there are also clauses in the licence about the receiver and what the licensee is allowed to receive or do with the messages he might receive.

Quote – unquote

Firstly, the receiver. It is required that the station '...shall be equipped for the reception of messages sent on the frequency or frequencies, and by means of the class or classes of emission, which are in current use at the station for the purpose of sending'. This is all quite straightforward but in the notes there is quite an important clause about the receipt of unauthorised messages. Once you have your licence, if you receive a message for some reason, the receipt of which isn't authorised to you, then you are not supposed to disclose anything about the contents of that message, its origin, destination or even the fact that you heard the message in the first place to anyone other than '...a duly authorised officer of Her Majesty's Government, a person acting under the authority of the Secretary of State, or a competent legal tribunal...'.

The above has been quoted directly from the licence because you are often asked in the RAE exam to whom you are allowed to disclose such a message, so please learn and remember what is reproduced here.

That's not all of it though. You should not retain any copy of that message nor make any use of it or allow anyone else to do likewise. If there was another person operating the station at the time the message was received then he too is bound by the same conditions. Most of you will probably already know that it is an offence anyway to deliberately receive certain messages for which you are unauthorised, whether you are a licensed radio amateur or otherwise. This refers to such activities as tuning in to frequencies used by the Police, for instance. So, if one day you happen to suddenly pick up a transmission that you shouldn't, the best thing to do is to pretend it never happened!

That's about all for another month except to repeat once again what was said earlier. The licence conditions are a very important part of the RAE exam so please do make sure that you read them through and understand them thoroughly. You will only kick yourself afterwards when you open the exam paper and you haven't done so.

You will no doubt have noticed that I have used a number of extracts directly from the licence conditions as set out in *How to become a radio amateur*. This has been necessary because it would have been incorrect to state things otherwise and will hopefully avoid ambiguity. This point of view is also shared by the DTI and full acknowledgement is given to them for the permission to do so.

I hope that all of you who are intending to sit the RAE in December are by now having a go at Ray Petri's *Questions and Answers*, which usually follow at the end of each month's session.

Final note

One final note, a new RAE syllabus was published by the City and Guilds of London Institute earlier this year and this will come into effect from May 1986, making no difference to anyone taking the exam this year. The new syllabus places a greater emphasis on the practical side of amateur radio than before with a doubling in the number of questions on operating procedures and a reduction in the content of the electrical theory section. Copies of the new 1986/88 syllabus (765 Radio Amateurs' Examination) can be obtained by sending £1.50 to: *The City and Guilds of London Institute, 76 Portland Place, London W1N 4AA*, and you will also receive a set of sample questions from past papers. I trust that you noticed in last month's issue of *Amateur Radio* that the next exam dates are Monday 2 December 1985 and Monday 12 May 1986 and not as I stated in the June and July issues. I certainly hope this did not inconvenience anyone, it must have been due to a breakdown in communication – HI! 73s 'till next month.

Acknowledgements and references

Radio Amateurs' Examination Manual – G L Benbow G3HB (RSGB)
Department of Trade and Industry/Radio Amateur Licensing Unit
City and Guilds of London Institute

Useful addresses

The City and Guilds of London Institute, Electrical and Telecommunications Branch, 76 Portland Place, London W1.
Radio Amateur Licensing Unit, Post Office Headquarters, Chetwynd House, Chesterfield, Derbyshire S49 1PF
Radio Society of Great Britain, Lambda House, Cranborne Road, Potters Bar, Herts EN6 3JW
WP Publications, 11 Wayville Road, Dartford, Kent DA1 1RL

QUESTIONS & ANSWERS

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

1. Transmitter interference is generated:
   a) in practically any stage of a transmitter
   b) in overdriven power amplifier stages only
   c) in class C driver stages
   d) in the multiplier stages only

2. When a transmitted telephony signal occupies a bandwidth greater than that necessary for the transmission of intelligible speech, it is likely to:
   a) cause adjacent channel interference
   b) cause severe key clicks to local TV
   c) cause image channel interference to local hi-fi equipment
   d) pass through the ionosphere into space

3. An AM telephony transmitter operating on the HF bands causes interference to the reception of transmissions in other frequency bands which are well separated from it. It is likely that this interference is due to:
   a) mains hum on the transmission
   b) an inefficient ground plane at the transmitting station
   c) an inefficient ground plane at the receiving site
   d) harmonics and spurious emissions from the transmitter

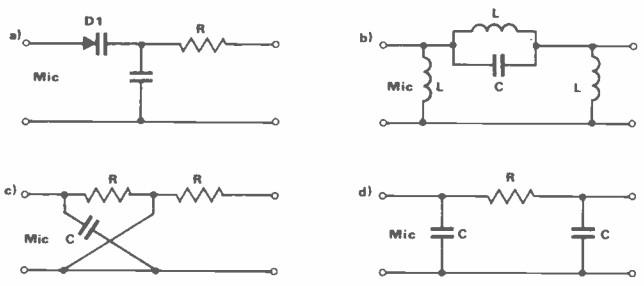
4. Poor frequency stability of a transmitter will usually be attributed to the:
   a) multiplier stages
   b) power amplifier stage
   c) carrier frequency oscillator
   d) items in a) and b) above

5. To reduce the possibility of frequency drift and to eliminate 'chirp':
   a) the antenna must be 50 ohm resistive
   b) the PA stage must be tuned to the upper sideband of the transmission
   c) the carrier oscillator must have a stabilised dc power supply
   d) a narrow-band, bandpass filter must not be fitted at the transmitter output

6. Regarding amateur telephony transmissions. Adjacent channel interference is likely to be caused when:
   a) the third harmonic is 40dB below the carrier
   b) the second harmonic is 60dB below the carrier
   c) audio modulating frequencies exceed 3kHz
   d) audio modulating frequencies do not exceed 1kHz

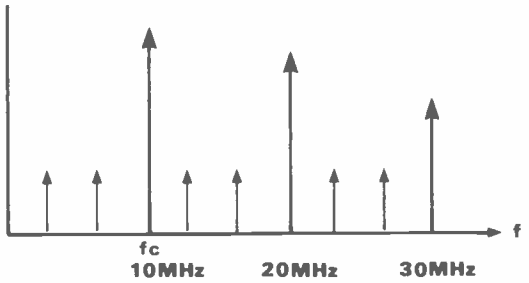
7. Referring to question 6, having received complaints that you are causing adjacent channel interference, the first thing you might do is to:
   a) ensure that your third harmonic is better than 60dB below the carrier
   b) increase the level of second harmonic to 10dB below the carrier
   c) ensure that you have an audio low pass filter in the audio/microphone amplifier circuit of the transmitter, with a cut-off frequency of 2.6-3kHz
   d) fit a band-stop filter in the transmitter output circuit

8. Which of the circuit diagrams below will match your choice of answer to question 7 above?



9. *Figure 1* shows the possible frequency spectrum of a transmitter operating at a frequency of 10MHz. The signals at 20 and 30MHz are respectively referred to as the:
   a) second and third harmonics
   b) first and second harmonics
   c) fundamental and first harmonic
   d) sidebands

Fig 1



10. Referring to *Figure 1*, between the carrier frequency f_C and the two harmonics shown other emissions are spotted. These are generally referred to as:
    a) harmonics
    b) sub-harmonics
    c) spurious emissions
    d) extra-radiating emissions

11. Referring to *Figure 1*, an effective reduction in the level of unwanted frequencies higher than the carrier frequency can be achieved by fitting:
    a) a suitable low-pass filter in the transmitter output
    b) a suitable high-pass filter in the transmitter output
    c) a band-stop filter centred on the transmitter output frequency
    d) a balun to the mains supply lead

12. *Figure 1* might give the impression that harmonics above the third do not exist. What do you think?
    a) Japanese receivers are not capable of generating harmonics above the third
    b) harmonics of higher order than the third radiate insufficient energy to worry about
    c) the filtering action of the antenna removes all harmonics higher than the third
    d) the 'x' axis of the diagram has been reduced for simplicity. Harmonics of much higher order are often present and are quite capable of causing interference

13. Which is the cheapest and simplest instrument for detecting the presence of harmonics?
    a) SWR meter
    b) Digital frequency meter (frequency counter)
    c) Moving coil meter in series with a diode
    d) Absorption wavemeter

14. A more accurate method of detecting and measuring the frequency of harmonics present at the output of a transmitter is to use a:
    a) frequency counter (not selective)
    b) suitable communication receiver (beware spurious receiver responses)
    c) thermocouple ammeter (beware of overload)
    d) bolometer (read instruction book first)

15. What is the most likely cause of harmonics at the output of a transmitter?
    a) Overdriven and non-linear RF amplifier stages
    b) High impedance ac mains supplies
    c) Antenna tuner units which are not earthed
    d) Incorrect coatings on the cathode of the PA valve

Q & A

16. For maximum efficiency the RF stages of an amateur FM transmitter are operated in class C. Class C operation of RF amplifier stages:
a) produces an output signal free of all harmonics
b) produces an output signal nearly free of all harmonics
c) is likely to produce more harmonic content than classes A and B
d) will produce less harmonic content in the output signal than class A stages

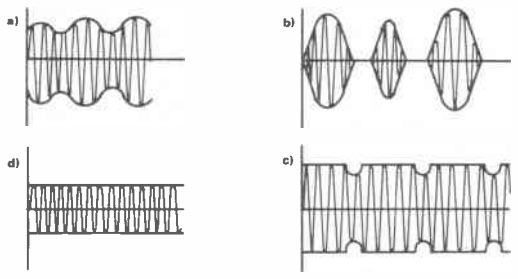
17. A through-line power meter, terminated in a 50 ohm dummy load is connected to the output of a transmitter, and indicates a power of 40 watts when there is no RF drive to the PA stage. What do you suspect is wrong?
a) Close coupling from a nearby transmitter
b) Static due to a charged cloud passing overhead
c) Parametric oscillation in the power meter circuit
d) Parasitic oscillation in the PA stage

18. The output signal of a transmitter contains excessive harmonics. A possible cure might be to:
a) reduce the level of drive to the PA stage
b) increase the level of drive to the PA stage
c) reduce the effective regulation of the carrier oscillator
d) increase the supply voltage to the carrier oscillator

19. OK then, your efforts in the above question have not had the effect hoped for. You remember that you removed something from the system yesterday, simply because it did not seem to do anything except reduce the power to your antenna from 30 to 27 watts; in other words it seemed to lose 3 watts. Anyway, your friendly local interference investigation officer is walking down the drive with a formidable looking detector in his hands. In frenzied panic you dip into the dustbin and find and replace that certain vital 'something' which reduces your harmonics and saves your bacon. What did you replace?
a) The antenna terminals
b) The calibrated short circuit (csc)
c) The low-pass filter
d) The high-pass filter

20. The S-meter calibration of a typical communication receiver may be about 6dB per S-point. What will be the difference in S-meter readings before and after the filter is fitted in question 19?
a) Practically no difference, because the filter has an insertion loss of only about 0.5dB
b) The S-meter reading will halve as there is about 6dB insertion loss
c) The S-meter reading will increase by 2.5 S-points
d) The S-meter reading will increase by 30 S-points

21. The modulating signal to an AM transmitter is too high and causes overmodulation. Which one of the following waveforms will be observed on an oscilloscope?

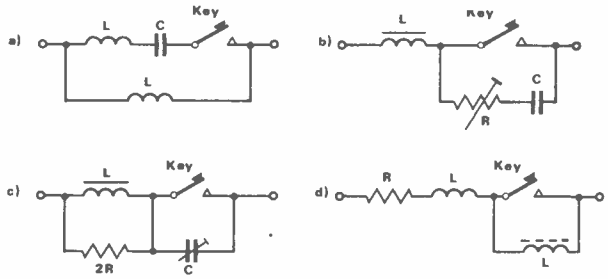


22. Overmodulation of the carrier wave will cause harmonics of the modulating signal to be radiated as unwanted sidebands. This causes a type of interference known as:
a) sideband natter
b) sideband splatter
c) sonic sidebands
d) sub-audio interference

23. The maximum deviation of the carrier wave in an amateur narrow band frequency modulation (nbfm) system will be about:
a) ±75kHz
b) ±2.5kHz
c) ±10kHz
d) the same as a single sideband transmission

24. Which one of the following transmissions is least likely to cause interference?
a) F3E FM telephony
b) A3E AM telephony
c) J3E SSB suppressed carrier
d) A1A AM telegraphy

25. When telegraphy (as distinct from telephony) is being used, arrangements shall be made to ensure that the risk of interference, due to key clicks being caused to other wireless telegraphy, is eliminated. Which one of the circuit arrangements below is suitable for use as a key click filter in a telegraphy transmitter?

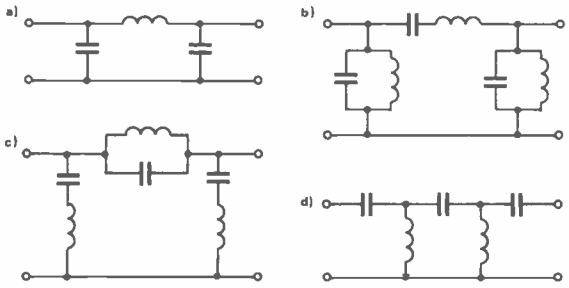


26. Refer to the key click filter that you selected as your answer to the previous question. It causes the keyed waveform to rise and fall slowly when the key is operated and released (See diagram below). Which component or components of the filter are responsible for the slow rise of the leading edge of the waveform when the key contact is closed?
a) L
b) R, L and C
c) C and L
d) R and C

27. Referring to questions 25 and 26, which component or components of the key click filter are mainly responsible for the slow decay of the keyed waveform when the key contact is opened?
a) L
b) R, L and C
c) C and L
d) R and C

28. A UHF television receiver is overloaded by a nearby VHF 145MHz amateur transmission. A possible cure is to:
a) fit a bandpass filter in the transmitter output
b) fit a high pass filter at the TV antenna socket and a braid-breaking choke between the TV and the antenna downlead
c) rectify the mains supply to the TV receiver
d) rectify the mains supply to the transmitter

29. Shown below is a selection of filters. Which one matches part of your answer to the previous question?



Q & A

30. The second harmonic of a transmitter operating on 18MHz is interfering with a nearby TV receiver. It has been decided to fit a harmonic trap in the form of a λ4 open circuit coaxial stub across the output socket of the transmitter. Assuming the co-ax has a velocity factor of 0.67, what is the approximate length of the stub?
    a) 5.6m
    b) 2.8m
    c) 1.4m
    d) 0.67m

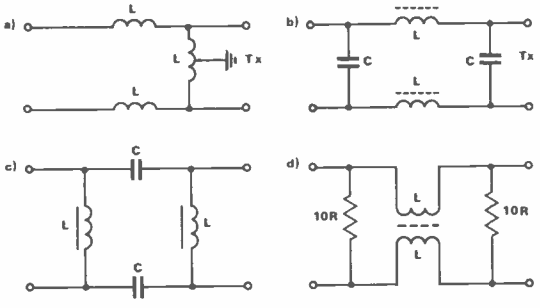
31. A VHF CW transmitter is initially set to operate on a frequency of 144.100MHz. In the first three hours of operation it drifts 2kHz towards the lower band edge before it becomes stable. Under normal circumstances is it likely to cause interference in the adjacent frequency band, and what will be the carrier frequency when the transmitter has stabilised?
    a) Yes/143.890MHz
    b) Yes/144.009MHz
    c) No/144.980MHz
    d) No/144.098MHz

32. A perfect transmitter, emitting no harmonic or spurious emissions:
    a) could still cause overloading to nearby TV receivers and hi-fi equipment
    b) will never cause overloading to nearby TV receivers
    c) will only cause second harmonic interference
    d) will still require a low-pass filter in the output

33. When testing an amateur transmitter for TVI one of the best indicating devices to use is:
    a) an absorption wavemeter
    b) a valve voltmeter
    c) the TV suffering interference
    d) the nearest DTI monitoring station

34. Your SSB transmission breaks through on a neighbour's imported hi-fi system. The best course of action, after checking your station, might be to:
    a) fit speaker lead chokes and mains filters to the hi-fi
    b) bypass the hi-fi's audio input leads with 470pF capacitors
    c) screen the hi-fi's printed circuit boards with silver paper
    d) leave the hi-fi alone and advise the owner to consult his dealer.

35. It is advisable to filter the mains supply where it enters the cabinet of a transmitter. Which one of the filter arrangements below looks the most suitable for this purpose?



To make reading the answers as difficult as answering the questions we've printed them back to front. However, all becomes clear when you gaze into the looking glass. . . .

ANSWERS

1-a; 2-a; 3-d; 4-c; 5-c; 6-c; 7-c; 8-d; 9-a; 10-c; 11-a; 12-d; 13-d; 14-b; 15-a; 16-c; 17-d; 18-a; 19-c; 20-a; 21-d; 22-b; 23-d; 24-a; 25-b; 26-a; 27-d; 28-b; 29-d; 30-c; 31-d; 32-a; 33-c; 34-d; 35-b.

OK then, no more questions this month. Transmitter interference is the antisocial aspect of the hobby. You are tested on your knowledge of this subject in the first paper; for the 1985 exam there will be 12 questions on the subject and for the 1986-88 examinations there will be 15.

For obvious reasons it is essential that every operator has an in-depth understanding of the causes and possible cures for interference. I say possible cures simply because text book solutions are not always the answer and even a person with plenty of experience can start to run short of ideas and cash when trying to solve a difficult case.

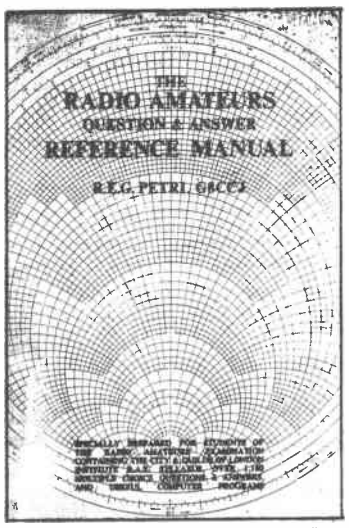
Transmitter interference is more likely than anything else to bring you a visit from your friendly local interference investigation officer. If you should receive a visit ask to see his credentials and co-operate as fully as possible. Ask his advice; he is only too willing to help, but remember he has solved many cases before yours so offer *your* advice sparingly. You wouldn't dream of advising a great big red faced police sergeant that he ought to get the double yellow lines shifted, when he is simply trying to get the traffic flowing and your 'MOT failed' banger is causing the obstruction, would you?

The causes of interference will be discussed as appropriate throughout a course of instruction, but the lecture you must not miss is the one specifically on interference. It should preferably come in the last couple of weeks of the course so that it is fresh in the mind; it accounts for about half the questions in the first paper.

If you sat the May examination you will have received the results by now, about a month earlier than usual – well done C&G.

For the majority of you I hope that congratulations are in order, especially to the students who attended my course at Rede School in Strood, and worked like slaves, with no tea breaks and not one nervous breakdown.

Don't despair if you didn't pull it off this time, have a chat with your tutor – he really wants you to pass. Get his opinion of where your weaknesses lie and work harder on this area next time round.



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:

WP Publications,
11 Wayville Rd,
Dartford, Kent DA1 1RL.

HATELY ANTENNA TECHNOLOGY

1 KENFIELD PLACE, ABERDEEN, AB1 7UW, SCOTLAND, UK
Proprietor:- Maurice C Hately, M Sc, MIEE, Chartered Electrical Engineer

DIPOLE of DELIGHT
OUR ANTENNAS HAVE PASSED CRITICAL EVALUATIONS WITH FLYING COLOURS
See 'AMATEUR RADIO MAGAZINE':-
DEC 1984 pages 49 & 49 author Trevor Morgan GW4OXB
MAY 1985 pages 34 & 35 Trevor Morgan GW4OXB
JULY 1985 pages 17 & 18 Don Field G3XTT

For TECHNICAL COMMENT see 'RADIO COMMUNICATION' magazine June 1985 p 453 author Pat Hawker G3VA

In May we were in France at the REF National Congress, to show antennas and to deliver a lecture on their operation and theory. In order to simplify the purchase of our antennas by French amateurs, we have set up an exclusive agency with M Yann Balcou, SEPIC, 88 bis Rue Grande, 36000 CHATEAUROUX, France; Tel (54) 27.89.88 who has antennas in stock.

Due to increases in materials etc, we will have to increase prices of some antennas on October 1st. However by that date it is planned to have an **inconspicuous light weight beam antenna available for the soon to be released 50 MHz band.**

For our present Range of Dipoles, Monoband and Multiband, see our advertisement inside the back cover of the May edition or send an SAE. Most antennas are ex-stock and are sent First Class Mail by return, for personal cheque.

We make an unconditional 1 month money back guarantee.

AMATEUR ELECTRONICS UK

G6XBH **R.A.S. (Nottingham)** G8UUS

Radio Amateur Supplies
Tel: 0602 280267

Visit your Local Emporium

Large Selection of New/Used Equipment on Show

AGENTS FOR:
F.D.K
AZDEN
ICOM
YAESU
FORTOP ATV

ACCESSORIES:
Welz Range
Microwave Modules
Adonis Mics
Mutek Pre-Amps
Barenco Mast Supports
DRAE PSU and
Wave Meters

AERIAL: Tonna, Halbar, New Diamond Range of Mobile Whips

PLUS OWN
'Special' Q.R.P. GW5 HF5 Band Beams
JUST GIVE US A RING

Monday: CLOSED Tuesday - Saturday: 10.00am to 5.00pm

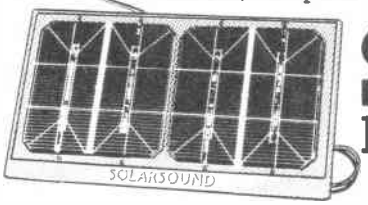
3 Farndon Green, Wollaton Park, Nottingham, Off Ring Road
Between A52 (Derby Road) & A609 (Ilkeston Road)

Power your radio, calculator, re-chargeable batteries, computerised robotic, model racing car, aircraft, CB and your next experiment...

...OUT OF THIN AIR!

Now you can stop buying batteries! SOLAR ELECTRONICS have harnessed the power of daylight so you can power anything requiring up to 6½ volts at .470 amps (open circuit). Think of the applications. Think of the convenience. The first truly portable solar panel that you can plug straight into. 230mm x 125mm x 7mm thick, complete with a 4-way adaptor plug; it works in good, normal daylight – or even electric light!

Telephone for a free leaflet and introductory offer.
Solar Electronics (Int.) Ltd., 284 Weyhill Road, Andover, Hampshire SP10 3RA. Tel: (0264) 58822.



SOLAR ELECTRONICS
Solar Electronics (Int) Ltd.

RF CONNECTORS & ADAPTORS

PL259 PLUGS to take 10.3mm coax..... 50p each
REDUCERS for 6mm (UR70) Coax..... 20p each
4 PIN MICROPHONE PLUGS..... 70p each
6 PIN MICROPHONE PLUGS.....£1 each
7 PIN MICROPHONE PLUGS.....£1.10 each
8 PIN MICROPHONE PLUGS.....£1.20 each
REDUCERS for 5mm Coax..... 15p each
PL259 PLUGS with built in 5mm reducers..... 50p ea
4 PIN MICROPHONE CHASSIS SOCKETS..... 90p ea
6 PIN MIC CHASSIS SOCKETS..... 90p ea
7 PIN MIC CHASSIS SOCKET..... £1 each
8 PIN MIC CHASSIS SOCKET..... £1.10 ea
COUPLER 2 x SO239 SKTS Back to back.....70p ea...DITTO but 2 x PL259 PLUGS, in line.....75p ea
ELBOW COUPLER PL259 to SO239, a plug and socket at right angles..... £1.00 each
SO239 CHASSIS SOCKET sq 4 hole fix.....50p ea ...SO239 Chassis socket but round hole...50p ea
GREENPAR SO239 Round Hole Chassis Socket with PTFE Insulation..... 60p each
ADAPTORS SO239 Socket with BNC PLUG on the other end..... £1.60 each
BNC socket to PL259 PLUG adaptor.....£1.60
Lightning Arrestors in line PL259..... £1.20

T CONNECTORS 3 x SO239 Outlets.....£1.20
T Connector with 2 x SO239 and 1 x PL259..... £1.30
T CONNECTORS BNC 3 Sockets.....£2.50...Ditto but 2 x Sockets and 1 Plug outlet..... £2.50
BNC COUPLER 2 Sockets Back to back..... £1.40
BNC COUPLER 2 Plugs back to back.... £1.95

JAPANESE N TYPES CHASSIS SOCKET Round Hole Chassis Fix..... £1.30
N COUPLER in line 2 N Sockets Back to Back. £2.50 each. Ditto but 2 Plug Back to Back...£2.50 ea
Japanese BNC Chassis Sockets open ended back..... 70p each

GREENPAR CONNECTORS PLUGS for 10.3mm Cable H100/UR67/RG213..... £2.50 each
PLUGS for 5mm Coax (UR76 etc).. £2.50 each
CHASSIS SOCKETS 4 hole fix.....£1.80 each
Line sockets for 10.3mm Coax.....£2.30 each
GREENPAR PL259s.....£1.15 each

GREENPAR BNC PLUGS for 5mm cable..... 98p each
BNC Chassis Socket Mini coax entry RG174U etc.... 65p each
BNC Chassis Socket 5mm cable entry..... 65p each
OTHER JAPANESE ADAPTORS all 50 ohm
N Type Male to BNC Socket (Female)....£2.50
N Type Male to SO239 Socket.....£2.50
BNC PLUG to N Socket (Female)..... £2.50
PL259 Plug to N Socket (Female)..... £2.50

ALSO IN STOCK SC AND 75 OHM BNC PLUGS AND ADAPTORS SAE For Fuller Lists.
Our Normal range of Cables also stocked H100/RG213U/UR67/UR57/UR43/UR76/RG58CU/UR70/RG174U/UR95/AERIAL WIRES and other Special cables. A SAE will bring full lists.

POSTAGE IS EXTRA @ ONLY 50p Per ORDER for any Quantity.

W H WESTLAKE,
WEST PARK,CLAWTON,
HOLSWORTHY, DEVON.
Phone 0409 253758

RITTY and CW TRANSCEIVE with NO TERMINAL UNIT

This fantastic program interfaces direct with your rig, slashing the cost of previous systems. Split screen, type ahead, auto CR/LF, accurately preset baud rates and shifts (normal or reverse), QSO review, tracks and sends any CW speed up to 250wpm. Tape and kit for the very simple interface, including PCB and User Port connector, for only £20. Ready-made interfaces available. For CBM64, BBC-B, VBIC20 (+ at least 8k). CW-only version for SPECTRUM (no interface needed, max speed 150wpm) £10.

And for CBM64, VIC20, BBC-B, SPECTRUM, ZX81-16k

Morse Tutor Britain's best. Learn fast in easy stages from absolute beginner to over 40wpm. Join the hundreds who have succeeded with this program. Tape and full learning guide £6.

RAE Maths All the practice and testing you need. Tape and comprehensive reference sheet detailing all you need to know £8. VC20 needs expansion (any).

Don't let maths make you fail. PASS with this program.

Superb locator, logbook and contest log programs also available.

All programs are very easy to use and come with full instructions.
Prices include p&p 1st Class by return. Add £1 per tape if outside UK or Ireland

technical software (AR)

U.K. ORDERS ADD 15% VAT. BUY IT NOW – price revision on 1st September
From, Upper Llandwrog, Caernarfon, Gwynedd LL54 7RF. Tel: 0286 881886

NEWSAGENT ORDER FORM

To (name of newsagent)

Amateur RADIO

.....

Please order a copy of ***Amateur Radio*** for me every month

NAME.....
ADDRESS.....
.....
.....

Newstrade distributors: Argus Press Sales & Distribution Ltd, 12-18 Paul Street, London EC2A 4JS. (Tel: 01-247-8233)

ELMASET INSTRUMENT CASE
300x133x217mm deep ..... **£10.00 ea (£1.50)**

REGULATORS
LM317T Plastic T0220 variable **£1.00**
LM317 Metal **£2.20**
7812 Metal 12v 1A **£1.00**
7805/12/15/24 plastic **50p**
7905/12/15/24 plastic **50p**
CA3085 T099 Variable regulator **£1.00**

COMPUTER ICS
27128-300nS **£5.50**
2764 INTEL/FUJITSU 300ns ..... **£3.50 used £2.50**
2732 EX EQPT **£2.50**
2114 EX EQPT 60p 4116 EX EQPT **70p**
6116 LP-2 (TC5517APL-2) **£2.50**
6116 -2 (TC5517AP-2) **£2.20**

POWER TRANSISTORS
TIP141, 142, 147 £1 ea, TIP112, 125, 42B ..... 2/**£1.00**
TIP35B £1.30 TIP35C **£1.50**
SE9302 100V 10A DARL SIM TIP121 ..... 2/**£1.00**
2N3055 Ex eqpt tested ..... 4/**£1.00**
Plastic 3055 or 2955 equiv 50p ..... 100/**£30.00**
2N3773 NPN 25A 160V £1.80 ..... 10/**£16.00**

DISPLAYS
Futaba 4 digit clock, fluorescent display 5-LT 16 **£1.50**
Futaba 8 digit calculator, fluorescent display 9CT-01-3L **£1.50**
LCD Clock display 0.7" digits **£3.00**
Large LCD Clock display 1" digits **£3.00**
7 seg 0.3" display comm cathode ..... 2/**£1.00**

QUARTZ HALOGEN LAMPS
A1/216 24v 150w **£2.25**
H1 12v 55w (car spot) **£1.25**

MISCELLANEOUS
4x4 MEMBRANE KEYBOARD **£1.50**
INDUCTOR 20µH 1.5A ..... 5/**£1.00**
10,000µF 100v SPRAQUE ..... **£4 (£1.25)**
15,000µF 40v **£3** (1.50)
NEW BRITISH TELECOM PLUG+LEAD **£1.50**
1.25" Panel Fuseholders ..... 5/**£1.00**
5.25" floppy discs Verbatim DSDD ..... 10/**£20** (£1)
MAINS ROCKER SWITCHES 6A SPST ..... 5/**£1**
STAINLESS STEEL HINGES 14.5" BY 1" OPEN £1.00 each ..... 10/**£7.00**

MAINS TRANSIENT SUPPRESSORS 245v .... 3/**£1.00**
TOK KEY SWITCH 2 POLE 3 KEYS – ideal for car/home alarms ..... £3 £100+ **£2.00**
12v 1.2w small wire ended lamps fit AUDI/VW TR7 VOLVO SAAB ..... 10/**£1.00**
Heat shrink sleeving pack **£1.00**
PTFE sleeving pack asstd colours **£1.00**
250 mixed res diodes, zeners **£1.00**
Mixed electrolytic caps ..... 100/**£2.00**
Stereo cass R/P head **£2.50**
Mono head £1, Erase head **50p**
Thermal cut-outs 50', 77', 85', 120'C **80p**
Thermal fuse 121'C 240v 15A ..... 5/**£1.00**
Vero pins fit 0.1" Vero ..... 200/**£1.00**
TO220 Micas + bushes 10/50p ..... 100/**£2.00**
TO3 Micas + bushes ..... 20/**£1**
RELAYS 240v AC coil PCB mounting 2 pole changeover £1 3 pole c/o **£1.00**
Fig. 8 mains cassette leads ..... 3/**£1.00**
KYNAR wire wrapping wire 2oz reel **£1.00**
PTFE min. screened cable ..... 10m/**£1.00**
TOKIN MAINS RFI FILTER 250v 15A **£3.00**
IEC Chassis plug/rfi filter 10A **£3.00**
Mercury tilt switch small **£1.00**
Min. rotary sw. 4p c/o 1/8" shaft ..... 2/**£1.00**
Thorn 9000 TV audio o/p stage ..... 2/**£1.00**
10m7 CERAMIC FILTER 50p ..... 100/**£20.00**
6m or 9m CERAMIC FITLER 50p ..... 100/**£25.00**

240v AC FAN 4.6" SQUARE NEW **£5.50** (£1.60)
240/115v AC FAN 4.6" SQ. NEW **£7.00** (£1.60)
BELLING-LEE 12-way block L1469 ..... 4/**£1.00**
POTENTIOMETERS short spindle
2k5 10k 25K 1M Lin ..... 5/**£1**
500k lin 500k log long spindle ..... 4/**£1**
40KHZ ULTRASONIC TRANSDUCERS EX-EQPT. NO DATA ..... PAIR/**£1.00**
STICK-ON CABINET FEET ..... 30/**£1.00**
T03 TRANSISTOR COVERS ..... 10/**£1.00**
TRANSISTOR MOUNTING PADS T05/T018 £3/1K
DIL REED RELAY 2 POLE N/O CONTACTS **£1.00**
ZETTLER 24V 2 POLE c/o relay 30x20x12mm sim RS 348-649 ..... **£1.50 100+£1**

RECTIFIERS
120v 35A stud **65p**
12FR400 12A 400v small stud ..... 4/**£1.50**
BY127 1200V 1.2A ..... 10/**£1.00**
BY254 800v 3A ..... 8/**£1.00**
BY255 1300v 3A ..... 6/**£1.00**
1A 800v bridge rectifier ..... 4/**£1.00**
6A 100v bridge **50p**
10A 600v bridge **£1.50**
15A 100v bridge **£1.50**
25A 200v bridge £2.00 ea ..... 10/**£18.00**
25A 400v bridge £2.50 ..... 10/**£22.00**

SCRs
MCR72-6 400v £1 BTX95 800V 15A **£1.50**
35A 600v stud **£2.00**
MCR106 equiv. 4A 400v **40p**
2N5061 800mA 60V T092 ..... 4/**£1.00**
TICV106D .8A 400v T092 3/£1 ..... 100/**£15.00**
MEU21 Prog. unijunction ..... 3/**£1.00**

TRIACS diacs 25p
TXAL225 8A 400V 5mA gate 2/£1.00 ..... 100/**£35.00**
25A 400v ex eqpt. tested **£1.50**

CONNECTORS (EX EQPT. price per pair)
'D' 9-way £1; 15-way £1.50; 25-way **£2.00**
37-way £2; 50-way £3.50; covers 50p ea

BULK SEMIS

QTY	ITEM	PRICE 500+
5K	BF245	25p
1K75	BPX25	£1.20
1K	7485	24p
8K	4556 SGS	30p
800	4077	15p
500	74HC30	18p
10K	TL084	45p
5K	CA3140E	38p
500	LM1808N	30p
1K3	UA3086PC	30p
100	74LS374	40p
1K	74S240	25p
70K	**BC337 5K+**	**£38/1000**
15K	**BC213L 5K+**	**£39/1000**
15K	**2N3904 5K+**	**£40/1000**
3K	**4070**	**£15/100**

MADE UP DISC DRIVE CABLES
34 IDC TO 34 WAY CARD EDGE
SINGLE DRIVE **£6** DOUBLE DRIVE **£8**

WIRE WOUND RESISTORS
W21 or sim 2.5W 10 OF ONE VALUE FOR **£1.00**
R47 1R0 2R0 2R7 3R9 5R0 10R 12R 15R 18R 20R 27R 33R 36R 47R 120R 180R 200R 330R 390R 470R 560R 680R 820R 910R
1K 1K15 1K2 1K3 1K5 1K8 2K4 2K7 3K3 10K
R05 (50milli-ohm) 1% 3W ..... 4 for **£1**
W22 or sim 6 watt 7 OF ONE VALUE for **£1.00**
1R5 9R1 10R 12R 20R 33R 51R 56R 62R 120R 180 270R 390R R47 560R 620R 1K 1K2 2K2 3K3 3K9 10K

W23 or sim 9 watt 6 OF ONE VALUE for **£1.00**

R22 1R0 3R0 6R8 56R 62R 100R 220R 270R 390R 680R 1K 1K8 10K
W24/ sim. 12 watt 4 OF ONE VALUE for **£1.00**
R50 2R0 10R 18R 47R 68R 75R 82R 150R 180R 200R 270R 400R 620R 820R 1K

PHOTO DEVICES
Slotted opto-switch OPCOA OPB815 ..... **£1.30**
2N5777 50p ..... 100/**£26.00**
TIL81 T018 Photo transistor **£1.00**
TIL38 Infra red LED 2/**50p**
OPI2252 Opto isolator **50p**
Photo diode 50p ..... 6/**£2.00**
MEL12 (Photo darlington base n/c) **50p**
RPY58A LDR 50p ORP12 LDR **85p**
LEDs RED 3mm or 5mm 12/£1 ..... 100/**£6.00**
GREEN or YELLOW 3 or 5mm 10/£1 ..... 100/**£6.50**
FLASHING RED 5mm 50p ..... 100/**£30.00**

DIODES
1N4148 ..... 100/**£1.50**
1S3740 Germanium ..... 100/**£2.00**
1N4004 or SD4 1A 300v ..... 100/**£3.00**
1N5401 3A 100V ..... 10/**£1.00**
BA157 1A 400V Fast recovery ..... 100/**£2.50**
BA159 1A 1000V Fast recovery ..... 100/**£4.00**

MULTI TURN PRESETS
10R 20R 100R 200R 500R **50p**
2K 5K 22K 50K 100K 200K

IC SOCKETS
6-pin 15/£1 8-pin 12/£1; 14-pin 10/£1.00; 18/20-pin 7/£1; 100/£12; 1k/£50; 22/28-pin 25p; 24-pin 25p; 100/£20; 1k/£100; 40-pin 30p; 16-pin 12/£1; 100/£6

TRIMMER CAPACITORS small
GREY 1.5-6.4pF GREEN 2-22pF ..... 5 for **50p**
GREY larger type 2-25pF ..... 5 for **50p**

SOLID STATE RELAYS NEW 10A 250v AC
Zero voltage switching
Control voltage 8-28v DC **£2.50**
VARIAC 0 to 130v 6A new uncased **£6.00** (£2)

POLYESTER/POLYCARB CAPS
1n/3n3/5n6/8n2/10n 1%63v 10mm 100/£6
10n/15n/22n/33/47n/68n 10mm rad ..... 100/**£3.00**
100N 250V radial 10mm 100/£3 .....
1u5 P/carb 15mm rad ..... 100/**£7.00** (£1)
2u2 160v rad 22mm ..... 100/**£10.00** (£1.50)
470n 250v AC X rated rad ..... 4/**£1.00**
33n/47n 250v AC X rated rad 15mm ..... 10/**£1.00**
10n 250v AC X rated rad 10mm ..... 10/**£1.00**
100n 600V SPRAGUE axial 10/£1 ..... 100/**£6.00** (£1)

BEAD THERMISTORS
GLASS BEAD NTC Res @ 20'c **80p**
250R 1K2 50K 220K 1M4
R53 THERMISTOR **£2.00**

BEAD TANTALUM CAPS
6u8 25V 47u 3V 6V 12/£1 ..... 100/**£6.00**
2u2 20V 8/£1 ..... 100/**£8.00**

MONOLOTHIC CERAMIC CAPS
10N 50v 100/£6 10N 50V ..... 100/**£3.00**
10N 50v dil package 0.3" rad. £4/100 ..... **£30**/1k

STEPPER MOTOR 4 PHASE 2 9v WINDINGS
£3.50 ..... 10/**£30.00**

KEYTRONICS
332 LEY STREET, ILFORD, ESSEX
Shop open Mon-Sat 10am-2pm
TELEPHONE: 01-553 1863

MIN CASH ORDER £3.00 OFFICIAL ORDERS WELCOME
UNIVERSITIES COLLEGES SCHOOLS GOVT DEPARTMENTS

P&P AS SHOWN IN BRACKETS (HEAVY ITEMS)
65p OTHERWISE (LIGHT ITEMS)

ADD 15% VAT TO TOTAL

ELECTRONIC COMPONENTS BOUGHT FOR CASH

News and comment from Glen Ross G8MWR

HF CROSSBAND

It has always been assumed that a class B operator cannot work crossband to one of the HF bands, but a letter issued from the DTI states clearly that this is not so. I quote: ***'. . . it is perfectly in order for a class B licensee to receive an HF transmission from another licensed amateur station and to respond by transmitting on frequencies for which he/she is licensed to transmit.'***

No reference is made to the Schedule, only the licence, so presumably it has always been legal to do so. More details as and when, etc . . .

Six metres

For the first time we are able to start with this band knowing that it is definitely ours! For a long time there has been speculation as to whether or not we would get it and this has now been laid to rest by the announcement of an amateur band between 50 and 50.5MHz.

From what can be gathered at the moment it seems that we will have this on the basis of an exclusive primary user which in itself will make a nice change from our usual position. Anything else that you may have heard, as of 1 August, is pure conjecture and there is plenty of that flying around on the bands.

Crystal ball operators, stargazers and soothsayers are all getting into the act and the 'authentic information, straight from the top' providers are legion. The RSGB are, rightly, not going to spoil negotiations by shouting things from the house-tops (some unrequired publicity held up the 50MHz permits for some time), but surely they could at least indicate the lines on which they are hoping to negotiate?

Policy

The big question of the day is 'will class B operators get the band?' and here at least we have some information to go on. It has been publicly stated and previously reported in this column without comment from them, that the policy of the RSGB is that they will only accept an allocation if it is available to all operators.

This statement was made by a senior member of the VHF committee at the 1983 Midlands VHF convention, and when asked to state categorically that the band would be refused if it would not be available to class B operators, he confirmed that this was the official policy.

What now?

I believe that the RSGB is negotiating with this result in view, but let us be rather more realistic about things. The great thing with any achievement is to get a foot in the door. Having got this you are then in a position to discuss things to try and get an improvement of existing terms.

Based on this argument the RSGB must know that it would be extremely foolish to refuse an allocation simply because preconceived objectives have not been met. If they did so then we would have no band to discuss and the PMR boys would probably get it instead. In the best interests of the hobby they *must* accept it on whatever terms can be obtained and then try to improve those arrangements as and when possible.

Options

One of the major obstacles to be overcome is the fact that there are still a lot of continental TV stations on the band, and under international treaty there has to be a 'degree of immunity to interference' built into any arrangements we may make. This could be done in several ways. The first and most obvious is that the band would only be available outside TV hours, as it is to the present permit holders. The second way would be to reduce the number of operators on the band.

This could be done by making it available to only one class, and as there are roughly the same number of class A and B licensees I suggested to an RSGB official that it could be made available to class B only and the same effect would be produced. This went down like a lead balloon for reasons I could not comprehend!

The idea can be substantiated by the fact that class B operators are at least conversant with different types of VHF propagation and therefore interference problems would be less likely than if class A operators, many of whom have *never* been on VHF, got the allocation... (They muttered something about dedication and Morse tests...).

More ideas

Power limits and aerial size and polarisation could play an important part in the negotiations as they would be an obvious way to reduce any problems. A power limit must be a strong contender and already exists on both Top Band and four metres, so is nothing new to the hobby. A restriction on the type and polarisation of aerials has not been part of our licence since the 1930s, as far as I am aware, and would not be a welcome step.

A self-imposed restriction on the size of the aerial will probably happen anyway once most people realise how large a six metre beam is (roughly three times the width and length of the same beam on two metres). The last idea would be a geographical one with a power limit on all stations south of a line, say, Gloucester to the Wash. We have a power limit on parts of 430MHz for stations in the south of the country so, again, this would not be breaking new ground, but it would lead to a lot of ill feeling.

Predictions

'All very interesting', you might say, 'but what are we going to get?' No one knows, but having consulted 'Old 8MWR's almanac', let's make an educated guess. The band will be opened late this year to class A operators (and, just possibly, class B) with a *radiated* power restriction during the hours of TV; full power being available at all other times. If class B operators do not get the band initially it is likely that it will be released to them one year later when the effects of interference from amateur operators has been seen to be virtually non-existent.

Partisan?

I sometimes get comments to the effect that I seem to be for class B and anti class A operators. Nothing could be further from the truth. Both classes have made up their minds about what they want to do and are getting on with it. What I do object to is the tendency to think that class A people are somehow more the 'true amateurs' because they have taken a Morse test. True, amateur spirit is in experimentation and investigation of new techniques and there is as much, or more, of this going on on the bands above 30MHz as there is

below that magic frequency. Another thing that annoys me is that so often there seems to be one law for the rich and another for the poor.

Crossband

An example of this is the fact that class B operators are not allowed to work crossband from, say, two metres to 50MHz whilst the illegal crossband activities of class A people are actually publicised. I have commented before that this is not on; you are only allowed to operate crossband to frequencies that are on your licence schedule and 50MHz does not appear on an A class licence any more than it does on a B.

The mole

The only other country to have a 50MHz permit is Norway and several of them have now been worked. The mole has reported that there is a possibility of the LAs getting the go ahead to operate on 70MHz also, although no details are yet available. If this does happen it will certainly gladden the hearts of our 70MHz operators as it will widen their horizons considerably.

47GHz world record

There is life up here and we congratulate HB9MIN and HB9AMH for setting a new world record on 13 January this year. The new distance is 53kms. The gear at HB9MIN ran 2 milliwatts to a 0.6 metre dish and HB9AMH was using 10 milliwatts and a 0.4 metre dish. The contracts were made using wide band FM and signal reports were around 5 and 3 both ways. The fact that the temperature at the time was minus 11 degrees centigrade helped propagation but would certainly have put me off trying!

Resolution

At the start of the year I suggested that you try a new band or mode and, feeling that I ought to follow my own advice, I am now up and running on 24GHz. It is early days yet but five contacts have been made so far; initial tests were done with G4IAG and G4ISM over distances of a few km. The best result so far was getting 5 and 9+ reports at a distance of 23kms from G3FYX. All this running just 5 milliwatts of wideband FM to a 20dB horn; the equipment, *including* the horn, being inside a 5 by 7 by 2 inch die-cast box – a 24GHz handheld? What did you do?

Certificates

The first one this month goes to G6CSY (Orpington) who claims a Bronze 144 award which was gained in a day's operating as GW6CSY in the low power contest. He ran 3 watts to a long yagi! Not being content with that he then claimed the same award for his home station where he has 5 watts to a 9 ele beam. That one took a bit longer to get though.

G4WJR of Skelmersdale also collects a 144 Bronze award using 10 watts to a 9 ele beam at 45 feet. The interesting point about this one is that the distance requirement was met with a sporadic-E contact with YU3ES at a distance of 1481kms which is over the requirement for a Gold award. A 144 Bronze goes to Mike G1HGD (Kenilworth), who started out with a FT290 and an HB9CV aerial which was handheld and, as he says, came with built in arm-ache. The aerial has now gone up into the loft and a 100 watt linear is in circuit, dramatically improving the results.

Silver upgrades go to Ian GW6OFI and Mic G1IPA. Ian says he could not stand the sleepless nights and so took the stacked 10 ele array down and replaced it with a single 16 ele yagi. High winds and large aerials do bring on the frighteners, especially if you are in an exposed location.

Close down

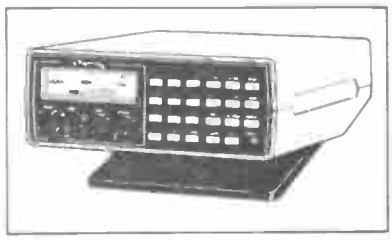
That brings us to the end of this month's column. It is nice to get comments from so many of you. You may not get an individual mention but the comments I use are based very much on what I hear from you. Letters please to: 81 Ringwood Highway, Coventry, or you can try Prestel on 203616941. Have fun.

dressler
(UK) LTD

191 FRANCIS RD
LEYTON E10.
Tel: 01-558-0854
01-556-1415

EAST LONDON'S HAM STORE

FRG-9600



MX 4000

AR 2001

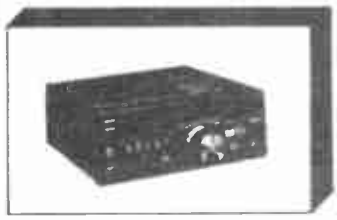
HF
LF

SUMMERTIME ANTENNA SPECIALS

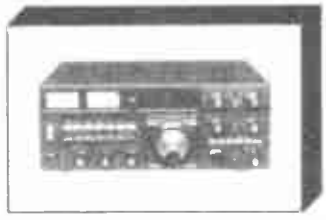
VHF
UHF

MET — TONNA — ETC

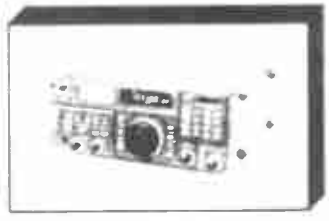
Rotators from £49.00 — £350.00. Poles & lashing kits.
Bearings, Cables, Towers, Preamps, Connectors etc.
Erection service available!!!
And when you've got all that up. What about a new rig?



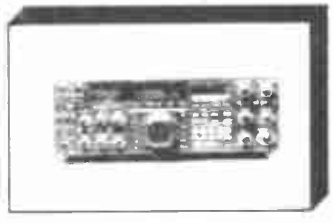
FT757GX



FT726R



ICR71



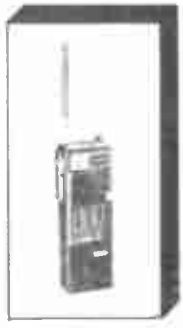
TS-940S

Full range of accessories for all makes

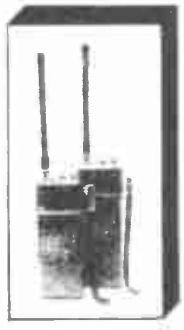
HOW ABOUT A HANDHELD?

IC02E IC04E

TH41 TH21



MT-20



FT-209R FT-709R

IC-2E

HP FACILITIES AVAILABLE

PROMPT MAIL ORDER

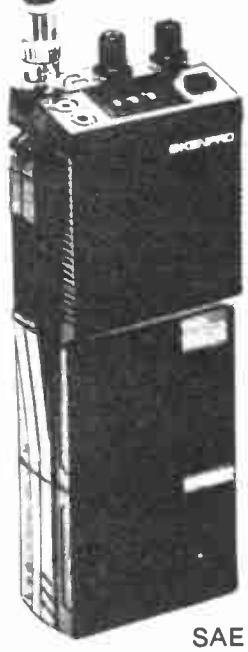
OPEN: MON - SAT
9AM - 5.30PM

HI~TEC WORLDWIDE

Specialist Communications Distributors

ARE YOU PAYING TOO MUCH?

KENPRO



IF YOUR LOOKING FOR A HAND HELD CHANCES ARE YOU WILL WANT TO BE SURE THAT YOU ARE BUYING QUALITY. FOR LONG RELIABLE SERVICE, YOU WILL PROBABLY HAVE DOUBTS ABOUT 'CHEAPY'S' AND RIGHTLY SO. BUT THE REGULAR MAKES ARE SO EXPENSIVE. **WELL AT LAST** THERE IS A HIGH QUALITY ALTERNATIVE. **THE KENPRO KT2000EE/KT400 EE** KENPRO'S UNCOMPROMISING QUALITY IS ALREADY WELL KNOWN IN THE UK, AND NOW WE ARE THE APPOINTED DISTRIBUTORS FOR KENPRO TRANSCEIVERS WITH FULL SERVICE BACK UP REINFORCED BY DIRECT CONTACT WITH THE FACTORY SO IF YOU DO NOT WANT TO RISK QUALITY KENPRO HAS THE ANSWER AND FOR A LIMITED PERIOD ONLY IT IS ON OFFER FOR A SPECIAL INTRODUCTION PRICE AND WITH **FREE CHARGER.** Price + P+P and Ins

KT 200 EE VHF TRCVR ..... £169 – £5
KT 400 EE UHF TRCVR ..... £189 – £5

STANDARD ACCESSORIES NICAD PACK, FLEXIBLE ANT, EAR PHONE, HAND STRAP, BELT SUSPENDER
FREQUENCY RANGE 140-150MKz/ 430-440MKz
FULL UK SPECIFICATION, TONE/ REPEATER SHIFT ETC OPTIONAL ACCESSORIES

KT SM1 SPEAKER MIC £19.50
KT BMC MOBILE CHARGER LEAD £4.50
KT LC LEATHERETTE CASE..... £5.50
KT BP (H) HI POWER NICAD PACK £33.00

SAE FOR FREE BROCHURE, INSTANT FINANCE AVAILABLE

TRADE ENQUIRIES WELCOME

HI-TEC WORLD WIDE LTD 584 HAGLEY ROAD WEST, OLDBURY WARLEY, B68 0BS TELEPHONE 021-421-6001

MMM A COOL 100

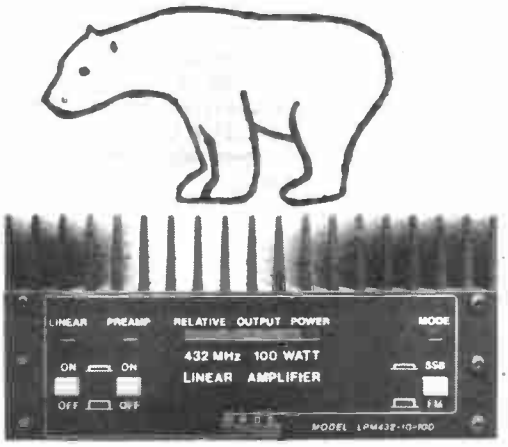
For some time now, a large number of satisfied BNOS customers have been asking for a Linear Amplifier that gives a true 100 Watts on 70 cms. 'Just like my two metre one' they say.

Now BNOS design engineers have developed a 100 Watt RMS Linear Amplifier that is more than worthy of its BNOS label.

The LPM432-10-100 and the L432-10-100 are now available in the form that has made their predecessors so popular. The LPM incorporates the usual BNOS Bargraph Powermeter, the switchable GaAsFET low-noise pre-amp and our unique overdrive protection circuit.

The pre-amplifier really pulls in the DX whilst the highly efficient final stage ensures that you are one of the biggest signals around – continuously.

In fact, the only thing it will not do is heat your shack!



L432-10-100	**£295.00**		
LPM432-10-100	**£335.00**		
L432-1-50	**£195.00**	**LPM432-1-50**	**£235.00**
L432-3-50	**£195.00**	**LPM432-3-50**	**£235.00**
L432-10-50	**£155.00**	**LPM432-10-50**	**£195.00**

FREQUENCY RANGE	**430 to 440 MHz**
OUTPUT POWER	**100W RMS ± 0.5dB**
INPUT POWER	**10W Recommended**
POWER REQUIREMENTS	**13.8V, 20A**
PRE-AMP GAIN	**Typically 12dB**
PRE-AMP NOISE FACTOR	**Better than 1DB**

B.N.O.S. ELECTRONICS

B.N.O.S. ELECTRONICS LTD. DEPT AR, BIGODS HALL, GREAT DUNMOW, ESSEX CM6 3BE. TEL (0371) 4677

SECONDHAND EQUIPMENT GUIDE

by Hugh Allison G3XSE

Thanks

A few months ago in this column I described a CR100 look-alike receiver that a reader had bought and wished to identify. I am grateful to Peter Bonson in Wokingham for writing in and informing me that it was an HR22. I am also grateful to those of you who wrote in pointing out that EC10s run on *nine* volts (positive earth) not twelve as I stated. Head hung in shame!

Two of the letters on EC10s mentioned drift on or around eighty metres, which is a new one to me. Has anyone successfully cured this one?

On the subject of letters, many thanks to those who do write in. All are read with interest. Those that deal with repairs that have been done are noted, and those that require help are answered. If several are received on the same subject or ask the same questions, I bring the subject up in the column. Typical of these are the several letters I have recently received on the differences and/or faults on the Trio 2200 series and a sudden spate of tuning problems on Mizuho SB2M SSB portables.

Trio 2200 series

These early two metre FM portables are all about the size of a book and are a bit big and heavy by today's standards. A lot of them are now coming onto the secondhand market, probably due to their original owner buying a newer, smaller rig, and are financially appealing to the newcomer to the hobby. Unfortunately they have not been advertised 'new' for a long time and thus the newcomer may not know what he is buying.

Before the specific model details, a few general points. Crystal controlled variants (2200, 2200G and 2200GX) all require two crystals per channel, one for the transmitter and one for the receiver. If the rig you are buying doesn't have the channels you want this could be bad news financially. Crystals normally cost about £2.50 each, thus £5 a channel. For twelve channels that could be an awe inspiring £60! Lowe Electronics have *some* crystals available for these rigs at £1 each. They also have a fair range of spares, so they are worth a try if you have problems.

Faults on all these rigs are uncommon; like most Trio equipment you can almost take an axe to them before they play up, but common 'owner induced' problems are either broken telescopic aerials or rotten batteries being left in the holder and eating it away. The battery carriers are non-standard but are (like the aerial) still available from Lowe.

On the subject of batteries, nicads produce about 1.2 volts and dry cells 1.5 volts. There are spaces for ten batteries (all models use pen-cells by the way). Since 10 x 1.2 = 12 volts, 10 x 1.5 = 15 volts, we can see why there should be two 'dummy' short circuit batteries provided with the rig. Use them with eight cells when using dry cells, and leave them out when using ten nicads. All variants are negative earth.

The handbooks supplied with the series are all from the (now thankfully past) era of Japanese English. 'The above specifications are subject to change without for improvement' is one of my all time favourites, but unfortunately there is one poor sentence in some of the handbooks that has led to much trouble, and I quote: 'minimum 13.8 volts, 0.8 amps'. What this actually means is that the rig should be run from an external supply of 13.8 volts *maximum*, with an 0.8 amp *minimum* current capability.

Don't connect it up to a 0-28 volt 5 amp power unit and turn the volts up full. Take my word for it, this produced a very unwell 2200GX and required lots of surgery to make it better again.

Beware the Kenwood branded variants by the way. Nothing wrong with them as such, just that they may appear a bit deaf and/or low on output power, due to having been shipped from the factory aligned for 146 to 148MHz use in America. Although nothing a quick tweak will not cure, the rig may also be full of useless channels.

One final general point. Secondhand prices given below are for guidance only. I don't know where there are any for sale at this moment at these prices, and you are obviously free to buy or sell at any price you choose. They are merely the average prices that they have sold at over the past year. Prices refer to standard, clean examples complete with all supplied accessories and with three to five channels fitted. For extra channels add a couple of quid per channel and for a good set of nicads add a fiver.

TR2200. Approximately available between 1970 and 1974. One watt output, 6 channel capability. It was fitted with three now useless channels (two in the SSB end, plus the teleprinter calling channel). The claimed receiver sensitivity was 1μV for S/N of 20dB. The price new was £69.50; guide price today about £30.

TR2200G. Available between February 1974 and May 1976. One watt output, 12 channel capability. 1μV still gives 20dB of quietning. The cost new was £86; value now about £45.

TR2200GX. Available between May 1976 and October 1978. Two watts output, 12 channel capability. 1μV gives 30dB quietning, quite an improvement; also quoted as 0.4μV for 20dB quietning. It was fitted with the lovely, but sadly short-lived, tuning fork repeater access tone. Normally supplied with three channels S20, 22 and R7. The price new was £130; today's value about £65.

TR2300. Available between October 1978 and November 1983. One watt output, eighty channel synthesizer (144 to 146). Receiver sensitivity as 2200GX. The price new was £175; today worth about £75, but too few seen for sale to be accurate.

Finally, it's worth mentioning the TR3200, which is really a 70cm version of the 2200GX. Very highly sought after on the secondhand market where they change hands for about £90.

Mizuho SB2M

This is a two metre SSB portable rig which produces about one watt output, CW or SSB. It is tunable via a novel variable Xtal oscillator (VXO) from 144.2 to 144.4MHz in four ranges. The frequency range is therefore not too handy for CW use, although the handbook gives details of use elsewhere in the band. Judging by both the letters received from readers, and the mountains of them in for repair recently, the variable capacitor used in the VXO, ie the tuning control on the front panel, is not up to the passing of the years. The problem seems to start, curiously, with a reduction in tuning range, typically down to only 25kHz per band, when the tuning becomes erratic and intermittent.

The repair is easy enough to do yourself, provided you have reasonable eyesight and a steady hand. This is not a repair to be attempted with a hangover. Neither the author or the magazine accept any responsibility for any damage done to a set while attempting the following repair. In addition to 'normal' tools, ie soldering iron, Philips screwdriver, small pliers, etc, you will need a scalpel, an empty egg box, a 'Q-tip' and a roll of Izal toilet paper!

Remove the case and undo the four screws holding the front to the side cheeks, the tuning knob (secured by a grub screw) and the two cross head screws under the knob that secure the variable capacitor to the front. Unsolder the two wires (one black, one orange)

going to the capacitor, and unsolder the earth wire coming from the mic socket and going to the board with the filter on it. Undo the four screws holding the board with the filter on and it should just be possible to remove the variable capacitor.

That's the easy bit. Now, with due regard to personal safety, cut round the bottom of the clear plastic cover on the capacitor and remove it. From here on always hold the capacitor with the spindle pointing downwards. Undo the four miniscule nuts and remove the trimmer plate. With the egg box closed you have two holes. Carefully lower the spindle into this hole and examine the upper end of the rotating shaft. It should have a tiny washer on it (only about one eighth of an inch diameter). If it's not there look on the underside of the trimmer plate, it sometimes sticks there. Remove the washer and rub it gently up and down the rough side of the Izal toilet paper with one finger. Clean both sides, then clean the end of the rotating shaft and the centre of the trimmer plate with the Q-tip.

Do not be tempted to use *anything* like WD40, Electrolube etc. Now re-assemble the capacitor, using the minimum amount of glue to stick the clear plastic cover back on, then refit it into the rig.

This should cure the problem, and it only remains to go out and celebrate. The above variable capacitor cleaning routine works well on 'Search 9' and NR56 receivers, as well as the tuning capacitors in portable radios. Variable capacitors without the washer described above normally rely on pressure from the earth plane of the trimmer plate onto the rotating shaft to provide the earth connection. By pushing a fine sewing needle between the plastic trimmer plate and the earth plane it is often possible to resurrect dodgy variable capacitors.

FREE CLASSIFIED ADS

FREE CLASSIFIED ADS CAN WORK FOR YOU

We are pleased to be able to offer you the opportunity to sell your unwanted equipment advertise your 'wants'.

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

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

DEADLINE AND CONDITIONS

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

FOR SALE

■ G3LLL clipper for FT101 Mk11/B, £10. G4DJC Tel: (0245) 262728.

■ TS711E 2m base multimode 2-30W output built-in processor, voice synthesiser, 40 members, mains or dc operated £675. FT480R 2m mobile multimode £275. Both in good condition. Tel: Reading (0734) 596485 after 9pm or weekends.

■ Azden PC5-4000 2m FM transceiver £110. SWR and power meter for 3.5-150MHz £12. Mobile antenna for 2m band £5. Buyers collect or pay carriage please. Tim Boorman GW1FBL, 109 Saunders Way, Sketty, Swansea SA2 8BH. Tel: Swansea (0792) 201565 evenings.

■ Reace UH-74 VSWR meter, range 50MHz, 144MHz, 430MHz, detachable head and 10 watt power meter, mint condition, boxed, surplus, cost £30 new, only £15 ono. Also Hammaster mike, model 4500, £10 ono. Both items £20. Tel: 01-247 6097 day time only.

■ Weltz ac 38m ATU, new £55. Gould 13.8V, 3.5A PSU overvoltage and current protection £12. HB9CV 2m antenna £5. Exchange all above for FC901 or FC092 ATU. Terry (G40XD) after 6pm (0462) 35248.

■ Shack clearance Lowe SRX30D, Tal RTTY interface, FTV 901R 2 and 70, Eddystone 940, Trio 7730, Icom IC271E, Icom IC240 IC3 PSU, Icom ICR70, FDK multi 2000, FRV7700, active antenna for FRG7700, 12 amp PSU, 2m beam, Sony air band Rx, Telco low pass filter, Trio 7930 2m FM. All in excellent condition and very reasonable price, dealers welcome, make an offer for the lot. Tel: 01-594 3495, 10am-4pm (work).

■ Panasonic RF-3100L 32 band receiver, hardly used freq FM87.5-108MHz MW520-1610KHz LW150-4.10KHz SW1.6-30MHz. Receiver controls for gain BFO pitch etc. Exc condition £145 ono. Mr T Aitken. Tel: (day) 01-381 0125, (eves) (0582) 456515.

■ G8AOD selling; new location requires mods. Marconi TF1041B V/voltmeter with UHF probe £30. GR wavemeter 1140A 250-1200MHz £5. Trio 9R59DS gen cov Rx, £40. Solartron dBIe beam.Scope CD1400 15MHz amplifiers,£50. Complete home-brew 70/23cM Tx (AM) VFO control (easily modified to FM) O/P 6W on 70cm O/P 9W. on 23cm from 2C39BA. Three BR ant relays. Low noise convertors NF = 1.9dB 23cm (NEC 6U535). Present IF 24-26MHz give away at £220 the lot. Buyer collects. Wadie, 2 Pottery Close, Brede, Rye, E Sussex TN31 6HE. Tel: (0424) 882224.

■ Trio TS120V QRP transceiver, 20 watts; input, digital frequency display etc. Boxed and in good clean condition, No mods, complete with mike, leads, and workshop manual, only £275. Also matching TL-120 100 watt linear amplifier, boxed, leads etc only £125. Both the above items are in first class working order. Graham G4VOE Tel: (061) 740 4126 anytime, QTHr.

■ Two new 4CX250B valves, one good, used 4x150A, two good used valve bases and chimneys, two new OHz and bases, Bosch 40μF 2.5KV cap. Yaesu Mn battery case, FBA-5 with nicads. Yaesu NC-9C bat charger. Offers to Graham G4VOE. Tel: (061) 740 4126 anytime. QTHr.

■ Panasonic 14 inch mono portable TV VHF/UHF 3 standards, CCIF, Europe, USA, switchable channels 14-83 USA, 21-69CCIR, UHF and 3-11 CCIR, 2-13* USA/Europe VHF solid-state £85 ono WHY. Tel: Truro 40711 or Truro 77736 (Steve). Buyer must arrange collection.

■ Exchange Plustron TVRC5D Sc Lafayette HE30 for high grade SSB quality receiver such as Collins 51-J 2-3 (75A-4), Eddystone 1590 (830/7) RCA-AR 8516L, National HRO 500, Hammarlund SPJX600. Also sell or swop Grundig Oceanboy 820, £50. Grundig Satellit 1400 SSB digital,£140 or exchange Satellit for Sony CRF 320 CRF1 or any 31 band 1MHz segment receiver. Tel: (061) 743 1570.

■ Mullard DG-7-5 CRT complete with protective sleeve and base. Ideal for small scope etc £30 ono or exchange for anything useful with cash adjustment either way. Please write to Mr Ken Brown, 44 Tenby Court, Monkton, Pembroke, Dyfed SA714JF.

■ VIC 20 computer, 19K with RAM pack. Joystick control, fifteen tapes with various games, one tape contains Morse tutor program, £85 or any reasonable offer considered. Instruction book included. GF Simlox G0ASD, 11 Tyrol Close, Wollaston, Stourbridge, West Mids. DY8 3NL. Tel: (0384) 372961.

■ Weirauch 80 .22 air rifle plus ASL scope. Tuned for maximum performance, new and unused. Sell or P/X for Yaesu FT290 or WHY Tel: Shrewsbury (0743) 67087, Mr. Element.

■ Burndept BF470 three channel hand-held, crystalled and tuned up on 70cm. RB14, complete with service sheets, good condition. Also homebrew charger and frame, £90 ono. QTHr Hughie GM1EMP. Great Opportunity for ex PMR rig. Tel: (041) 638 7513.

■ Brand new Trio R-600, £270. DX400 vgc £170. Very good reason for sale. Also Revcone aerial, unused with selection of plugs £20. Martin King. Tel: (0522) 721464, after 6pm till 8.15pm.

■ Icom R71E receiver, virtually brand new, approx 10 hours use. With unused 12V dc adaptor £570. Dressler active antenna, never yet used £60 or exchange best Zeiss 10 x 50 (west) binoculars. Balance in cash. Tel: (01) 281 2493 anytime.

■ Four element Yagi, Hidaka VS2440. Four band antenna. A rotary dipole on 40m. Neighbours object to overhang. Virtually brand new, beautifully constructed. £200. Contact Ian G4GWB. Tel: (0670) 790090 (Northumberland).

■ Outboard motor. Seagull 2½HP. Long shaft sale or exchange for reflector telescope. 3in refractor, or good 9.5mm projector. Sale 16mm Bellhowell sound projector or exchange 16mm films to value of £75. Debrie professional sound projector, 16mm, exchange SSB transceiver, or 70cm transceiver. G8BK, 290 Priory Road, St Denys, Southampton, SO2 1LS.

■ Bearcat 300. Top of line scanner, 50 memories, eleven preset memories covering police, fire, ambulance, marine, taxis etc. Full scan facility up to 512 clock priority channel, automatic scan every two sec, tape output ex. speaker output. 12 volt dc or 240Vac. Covers Ham bands including 2m and 70cm. Also satellite frequencies, price £250 ono. Also Stenwheiser profi-power microphone for sale. £80. Colin Grellis, 8 Dreadnought, Bridport, Dorset DT6 3PY.
Tel: (0308) 24340.

■ Ham Concorde II 240 channel USB, LSB, FM, AM, CW. Frequency counter tape CW plugs at rear. Has been converted to 10 metres. Covers 28.406 to 29.696. £75 ono good condition. K Wood, 43 Dordon Road, Dordon, Tamworth, Staffs B78 1QW. Tel: Tamworth 897837.

■ R1155 receiver in working order. Mains PSU and loudspeaker fitted in contemporary wood cabinet. Complete service instructions. Offers invited. D Makin, 4 High Grove, Hillcrest, Whitehaven, Cumbria CA28 6TA. Tel: Whitehaven 62724.

■ Icom IC271E 2m multimode. Only a few months use. Complete with original packing. £540. Buyer to collect or pay for postage. Tel: (0403) 710565.

■ Yaesu FT790R 70cm multimode. As new. £280 ono. Tel: Glasgow 641 7203. F Thomson, 40 Morven Road, Cambuslang, Glasgow.

■ FT101 plus FV101 looks and works like new, £350 ono plus HT transformer, 250V in output 4.600V, 3.500, 2300, 1700V at 1.75 KVA, £100. Tel: (0248) 354022 ask for Dave.

■ BBC model B computer with interface m/drive plus FT101 2D mark 3 complete with FC 707 ATU. All bands mint condition. £495 cash or exchange. Tel: (0279) 20192.

■ Yaesu FT207R plus battery charger, £95.Tel: Tisted 306 (after 6pm) ask for Darren.

■ TS7730 2 metre FM tcvr, scanning mic, memories, 25 watts, mobile mount, ¼ wave mag mount ant, £180. MC50 desk mic, £20. HK708 Hy-mound hand CW key, £10. Sinclair Spectrum 48K, mains adaptor, manual £60. G4KWA, QTHr. Tel: 01-777 9061.

■ Trio TH21E 2 metre handheld with battery charger and a spare battery pack, 3 months old £130. Reftec 934MHz colinear mag mount 20ft and 50ft of HR100 cable £50. Farnborough, Kent. Tel: 58825.

■ Ham International multimode II, 26.965 – 28.305MHz, AM, FM, USB, LSB, very good condition, only needs new crystals to enable use on 10 metre band, £60 ono. RAAM 5 digit 0-250MHz frequency counter with SWR power FS and modulation meters, in box £35 ono. CB handheld, 40 channels. FM, 2 watts, £20 ono CB pre-amp and home base aerials for sale.
Tel: (0843) 603252.

■ FRG7000 rec, digital display, CPU, digital clock & timer, 0.25M-29.9MHz, modes LSB, USB, CW, AM, AM/ANL, mint, £180 ono. Mr HR McAlroy, 75 Roundthorn Road, Baguley, Manchester M23 8ER. Tel: (061) 998 6674.

■ Yaesu FRG7700 receiver Yaesu FRV7700 VHF converter, Yaesu FRA7700 active antenna, Yaesu FRT7700 antenna tuner. All mint condition and all with manuals, £300. I would like coiled loaded mini beam and rotator plus cash. Dave, Liverpool. Tel: (051) 260 5799.

■ Trio TS711E 2 metre multi-mode Tx/Rx. still boxed and used only twice, good reason for sale, Slim Jim inclusive, can deliver within 50 miles of Selby, £795 ono. Fully guaranteed one year. Enrico Giancani, G1KSW, 28 Langdale Grove, Selby, North Yorks YO8 9BQ.

■ Yaesu FRG7 HF Rx with timestep DFC and FM detector. Handbook included. All in perfect working order. £80. G6WJZ, QTHR. Tel: (0527) 77963.

■ Yaesu FT790R UHF multimode. Including up/down mic, case, strap, ni-cads and helical whip. Mint condition, only a few weeks old. £265 ovno. Carriage at cost. Tel: Orpington 29230.

■ Sale or exchange FT707, as new, never used on transmit, about 1hr on receiver, in original packing, for FT101ZD or similar. Tel: Dave (0604) 36914.

■ Historic wartime type 3 II portable transmitting/receiving equipment 1-6m, PA grid 3-16, crystal 3-8, with power pack 90-250V or 6V battery, spares box and manual, in 2 watertight approx 13inx11inx6in containers – best offer circa £140. Tel: (087251) 221 (Cornwall).

■ Datong active antenna model AD270, approx twelve hours use, £32 or exchange for ATU 1000, must be mint. Tel: Plymouth 362334 after six.

■ AM/FM 10 channel mains powered VHF/UHF scanner, by SBE Japan, model SBE 12SM, plus operation manual. '19' Ex-AM rack mounted PSU for same audio-tronic headphones, model LSH 30. Dactron 12 volt 500mA regulated PSU, model PM103. Redifon R550A receiver SSB/LSB 200KHz 30MHz plus operation manual offered or exchange for Bolex cine equipment or Stuart Turner steam models fitting WHY. Tel: (0296) 622725, evenings (Bucks).

■ IC271E new £575, or take FT290R in part exchange, or mint LS102 26-30MHz. Yaesu dummy load wattmeter YP150Z damaged meter otherwise perfect £35, cost £99. FDX 700AX 2m 144 to 148 with mars band 5KHz, 10KHz, 100KHz steps £145. Postage extra. Mr Waters, 42 Tregundy Rd, Perranporth, Cornwall TR6 0EF.

■ Superstar 360FM, AM, FM, SSB + legal FM. No modifications, good condition, £100 ono. Tel: Gravesend (0474) 26036.

FREE CLASSIFIED ADS

■ BBC computer software including Morse tutor (send/receive), maths, chess, go, educational. All boxed original. Teacher clearing desk to buy pupils disc drive. SAE Artingstoll, 9 North Hill Green, Romford RM3 9AN.

■ CB transceiver Stalker 9 DX, American FM, legal FM, AM, LSB, USB, almost new £85 ono. Also Hammaster power mike £25. All still boxed. And Rotel CB DV27 anteline modulator antenna. Station closing down many things to go. Private sale. Mrs Walvish, 62 Roll Gdns, Gants Hill, Ilford, Essex IF2 6TW. Tel: 01-550 3262.

■ Tandy DX200 receiver, five band 150kHz-30MHz, handbook. Mint condition, £45 ono (carriage extra). Heathkit RA-1 amateur bands receiver 180m-10m, £20 ono (carriage extra). D Foster-Bazin, 31 Lockeridge Close, Blandford Forum, Dorset DT11 7TT. Tel: (0258) 53930.

■ Two Tandberg 7 inch reel/reel xfield decks series 3500X. £110 each including 18 7 inch tapes. Knight, 298 Watford Road, St Albans, Herts AL2 3DW. Tel: Saint Albans 52973.

■ AR88D 535kHz to 32MHz, working, very good condition. Instruction book, circuit diagram, RCA matching loudspeaker, spare set valves, joystick VFA de-luxe, Joymatch III ATU, Codar PR30RF pre-selector, whip aerial, measured fqncy aerial reels (ex wd). Assorted valves, Morse keys, misc related items. £85 ono, everything you can carry. W F Cooter, 3 Shelleycotes Road, Brixworth, Northampton NN6 9NE. Tel: (0604) 880037.

■ FT901D HF tcvr vgc USB, LSB, AM, FM. Spare PA and driver valves. Service manual. YD148 desk mic, £480. Welzac 38m ATU £55. Gould PSU 13.8V 3.5A overvolt and current protection £12. 2m HB9CV antenna, £5. Buyer arranges collection. Terry G4OXD. Tel: (0462) 35248.

■ Cobra 148 GTL DX, AM, FM, USB, LSB, CW with Zetagi B300PS variable power amplifier. 75 to 400 watts, runs off 12V, for sale or part exchange for HF VHF equipment WHY? Tel: Shrewsbury (0743) 67087.

■ Yaesu 101ZD MkIII 9 band transceiver, fitted fan and FM board. Mint condition, £450. Trio 2400 handheld speaker mike base charger boxed £135, Eddystone 770R £75. Bill G4EMG. Tel: (01) 534 3460 eves, (01) 553 7308 days.

■ Microdot CW RTTY terminal unit complete. Built in monitor, as new, 18 months old, cost £540. Bargain at £300. Buyer to collect. G4OOK. Tel: (0642) 211685 QTHr.

■ DX302 digital communications receiver, complete with instruction booklet. Telescopic aerial. Mains/battery operated. Mint condition £195.00 ono. Tel: (0202) 572877.

■ First class gen cov Rx in mint cond. Price today about £4,000. VLF to 32MHz. All modes, all solid state, made to mil spec. Sale due to change of interest. No time wasters please. SAE for full specs. DNT rig new. Good for 10m, £30. DX5 trapped vert for sale. No longer needed as now have beam HF linear, full power. Martyn Bolt G4SUZ, 112 Leeds Road, Mirfield, West Yorks WF14 0JE. Tel: (0924) 495916.

■ Liner Two VHF SSB rig, working £75. Pye 70MHz rig will convert £65. Old 45's and LP's. Ring for details. New DNT's for 10m boxed, only £30. Datong ASP good cond with PSU £70. Dx5V HF ant beam makes this surplus mil spec gen cov Rx solid state. Digital readout covers VLF to 32MHz. BT approved. Freedom 'phone, only 6 weeks old. Offers WHY? Martyn Bolt G4SUZ, 112 Leeds Rd, Mirfield, West Yorks WF14 0JE. Tel: (0924) 495916.

■ LAR antenna noise bridge, 500kHz to 200MHz, £12.00 + £1 P&P or exchange for 2 variable capacitors (wide spaced), 200 to 350pF for ATU. J Van Walwyk, 11 Valette Court, 75 St James Lane, London N10 3RA.

■ KW ezee match ATU £35. LAR HF omni match ATU, all bands incl warc £50. SEM Ezitune ant tuning bridge £25. Half size G5RV £7.50. Mains PSU 12 volt 5 amp metered £15. All items as brand new. John Randall G3OAZ, 243 Paddock Road, Basingstoke, Hants. Tel: 465126.

■ AR2000 and discone aerial, £300. No offers buyer collects. WJJ Van Winkelen, 51 Pound Lane, Norwich NR7 0UN.

■ Ham-master HM2025, 144-148MHz FM mobile transceiver, repeater shift, toneburst, 1 or 25 watts, scan, memory, as new in box £125. Trio 2200, 12 channel FM 144MHz portable, Ni-cads, charger, case, duck, box, £85. Super-star AM/FM/SSB/CW converted 28-30MHz (5x40) channels £125, pre-amp 27-30MHz £5. I E Day G0BHQ, 54 Gresley, Glascote, Tamworth, Staffs. Tel: Tamworth 250038.

■ Icom ICR70 receiver £375. Yaesu FRT7700 antenna tuner £25. NAD5120 stereo turntable with A&RC77 cartridge, hardly used £80. All in very good condition, and original packing with instruction manuals. Mr S J Wilkinson, 257 Foredyke Avenue, Hull HU8 0DY. Tel: (0482) 837049.

■ Magenta open top sports car. Swap for 144MHz 430MHz dual band transceiver and aerial or ATU or power pack or WHY for VHF UHF multimode. Tel: Anderson, (037387) 483 Faulkland (Somerset) evenings.

■ *Radio-Elecs* (USA) Mar-Dec ex Sep-Oct. *Elecs + Wireless World* Jan, Apr, July, Aug-Nov both 1983. *Radio + Elecs World* Oct 1982-Apr 1985 ex Jan, Feb 1983. *Ham Radio Today* Feb-Aug 1983, ex Apr, May, Aug 1984, Apr 1985. *Television* Apr 1983-1985, ex May 1983. Offers by title. All offers replied to. W M, PO Box 23, Brentford, Middlesex UB6 9BZ.

■ Panasonic and Technics complete range of service manuals. Sold as set or one off's at £1.50 for B&W televisions, radio's and small items. £3.00 for colour televisions, video's and electronic organs. SAE, E S Zych, 9 Edinburgh Drive, St Ives, Cambs PE17 6DA.

■ Ham International Concorde 2.27MHz. AM, FM, USB, LSR, CW easily converted to 10 metres. Offers around £100. Buyer collects. Details contact David Spiers, 41 Manor Road, Middle Littleton, Evesham, Worcs WR11 5LL. No phone.

■ Trio TH21E FM handheld Tx, three months old including EB2 battery pack, £160. Also amp. Puma BIT02, matches TH21E or any h/held 144MHz Tx, including power pack, £40. John GM6YJS, Netherlorn, Bridge of Awe, Taynvilt, Argyll PA35 1HT. Tel: (08662) 243.

■ Hewlett Packard transistors, low noise (2.8dB), 4GHz type HXTR6101 (2N6617), ideal for satellite Rx, qty limited, £35 – each. Tel: Taylor (01) 969 3192, evn.

■ Trio 144MHz FM transceiver TH-21E with spare battery pack and charger, £150.00. Also 934MHz colinear and mag mount, £35.00. R Tomlinson, 9 Stalisfield Place, Mill Lane, Downe, Kent. Tel: Farnborough 58825.

■ Lowe SRX30 communication receiver. 0.5MHz to 30MHz. AM, CW, SSB amateur and broadcast bands, complete with manual. Excellent condition £85 ono, buyer collects and inspects. Tel: Leeds (0532) 686362.

■ Ham International Concorde 3 AM FM CW. USB LSB 27MHz radio. 10kHz shift, plus many extras, too many to list. Unwanted gift never used, still boxed. Beautiful example. £190.00 ovno. Tel: Dronfield (0246) 410409 between 9am and 5pm any weekday.

■ Trio R2000 with VHF convert £360 preselect inc Belcom LS102L 26-30MHz multimode + mic £160 ono. KDK 2mtr mobile, 25 watt, 144-148MHz, FM only £100. Mr Peter Baines, c/o 53 Maple Road, Penge SE20.

■ Yaybeam crossed yagi 5XY2m new unused £24. Two 24 inch stand, new unused £12. Pole 10ft x 2in new £12. Buyer must collect. Tel: (0727) 36057.

■ Tandy CB handheld model TRC1005, 40 channel 4 watt 4 months old, cost £130, £55 post paid. A F Sephton, 16 Bloemfontein Avenue, Shepherds Bush, London W12 7BL. Tel: (01) 749 1454.

■ Tono 550 RTTY/CW decoder £140.00. SR9 receiver £25.00. Amstrad 901 CB and SWR meter £25.00. Will exchange all three for Racal 117L or 117E receiver. P J Willars. Tel: (0604) 26275.

■ Exchange Grundig yacht boy 700 receiver 150kHz to 26.200MHz + 88 to 108MHz FM digital/analogue + clock, S-meter etc, immaculate SSB narrow/wide bandwidth. 5kHz filter, for telereader CWR610E decoder unit, must be in first class condition. Borthwick, 92 Linglie Road, Selkirk, Selkirkshire.

■ £300 plus your mint FRG7 buys my 1984 mint boxed Icom ICR70, currently £629. That makes your FRG7 worth £329. Well, almost! Reason for sale? Require urgently FT221R or FT225R in top condition. R70 in exchange. Cash adjustment either way. Also as new Olympus 35mm omin and accs for exchange. Tel: Brightlingsea (0206) 304544.

■ Trio 9R59D communications receiver and matching SP5DS speaker, good order, £60. GEC base station transceiver, 10 channel, 158.2MHz. Also some hand sets, same frequency. Offers, buyer to collect. G W Reed, 96 Wootton Road, King's Lynn, Norfolk PE30 4BT. Tel: (0553) 763428.

■ Commtron CB legal FM 27/81 plus AM 40 £35. 'Harry Moss' CB £25. CB handheld £35. Sony ICF2001 communications receiver portable £85, including power supply. Yaesu FT202/R handheld two metre transceiver, one watt £80. Xtalled R1 R2 R7 S20 S21 S22 Daiwa search nine, two metre receiver, xtalled R2 R7 R1 S10 S11 12 17 23 R8 R0. Jane Barton, 124 Dora Road, Wimbledon, London SW19.
Tel: (01) 946 2967.

■ Collins KWM2 M/PSU M/spkr SM-2, pencil desk mic, some spare valves, full hand book, good condx £400, buyer to collect. 65ft 3 section lattice tower HD winch 'no base plate', buyer to collect, £270. Tel: (0642) 45327 Eston Grange days only, Peter.

■ Teac 55E 200K SS/DD disk drive (cased), as new, £65. 13cms brass PA cavity (needs 2C39BA/7289, beautifully made £60. Tech 120kHz-500MHz 7 band signal generator (good) £27. Tel: Paul Crawley (0293) 515201.

■ Yaesu FT480R 2m multimode, boxed, absolutely perfect, £295. Microwave Modules MML100S linear with SEM 12A PSU, £140. Ham International Concorde, AM, FM, SSB, CW rig for CB or converts for 10m by plug-in crystal, £70. CP100W linear for 10m with pre-amp, £40. 8-10A PSU, £20. Hansen type VHF/HF SWR-power-mod meter, 200W, £20. All being sold sadly to finance HF rig! Paul Godolphin, 3 Knipe View, Bampton, Penrith, Cumbria. Tel: (09313) 359. Can arrange delivery.

■ Quantity surplus items, gear, books, photo equip, etc, sae list. 13 Tennyson Road, Daventry, Northants.

■ HRO Rx with BS and GC coils, spare tuning gang assembly, IFs other bits, original hand book mod. Details, any trial, must go, no room in shack. Swop or any offers. G3VXS QTHr. Tel: (0782) 625661.

■ FT101 2m converter, £285. Tel: (0283) 221870.

■ TI994/a home computer extended basic, terminal emulator and speech synthesiser. Many games plus video chess, joysticks, all manuals and B/W TV. Sell for £175 ono or swap for Trio R600 or similar. Must be in full working order. Also for sale Tristar 747 USB, LSB, AM, FM. Price £60 ono. Can go with above if wanted. Tel: Oakley (02302) 4740. Evenings between 6.00pm and 10.00pm please.

WANTED

■ Valves: 'R' type to KT88 any quantity, output triodes specially wanted, all interesting value wireless, communications, audio, equipment, early hi-fi. Valve amps with large output valves, speakers and units, turn-tables, pick-ups, tuners, pre-1950 radiograms etc, compact military receivers, transmitters, 'spy-sets', American midget radios, crystal sets, Ekco, Philips, Philco etc. Bakelite 'art-deco' radios and speakers. Anything value and interesting considered. Please write or tel: John Baker, 57 Birkenhead Street, London WC1H 8BB. Tel: (01) 833-3008.

■ FC700 ATU and FV-700DM VFO. Tel: Peter (0538) 702208, G4YYO QTHr.

■ VFO for Trio 2200GX or 7200G or 7200GII. Believe serial no of VFO is VFO30G but will consider any suitable VFO. Will consider transceiver and VFO as matched pair if necessary. Also wanted VFO for Trio 7010 SSB CW. Tel: Allan (0782) 612868.

■ Marconi oscillator, crystal type 1655C for TF995A/2 signal generator 333.3kHz in glass envelope with B7G base or non-working generator with this crystal. F Turner, 1 Birchwood Road, Malvern, Worcs WR14 1LD. Tel: Leigh Sinton 32453.

■ Two variable capacitors (wide spaced) 200 to 350pF for ATU. J Van Walwyk, 11 Valette Court, 75 St James Lane, London N10 3RA.

■ Swap as new 35mm Olympus OM10 + case + computer, flash, all boxed for mains valve 144 linear 100W out minimum for 3W drive. Tel: Gerry (890) 9733.

■ Any FR range Yaesu or Trio R1000. Cash paid for carriage if too far to collect. D J Howes, 149 Warren Wood Road, Rochester, Kent ME1 2XG. Tel: (0634) 404096.

FREE CLASSIFIED ADS

■ RAE base station, Morse key, type D, with or without cover. Your price paid. All letters answered. Dick Fixter, 18 Linley Drive, Boston, Lincs PE21 7EJ.

■ Yaesu FTV901R transverter in exchange for my FV901DM scanning VFO or will sell. G3VYP. Tel: (056) 885 296 (nr Ludlow).

■ Wanted by new class B holder: an FM/SSB 2 metre rig. Must have digital readout and be fairly cheap. Yaesu or Sommerkamp preferred, but any make considered. The condition of the rig is not important, as long as it is in perfect working order. Also want cheap Morse tutor. Robert, 12 The Grove, Farley Hill, Luton, Beds LU1 5PE. Tel: (0582) 454055.

■ Info required for gov surplus equip. Monitor CRO type 1000, payment for info. Mr D Evans, 29 Malton Road, Woolton, Liverpool L25 8QU.

■ PSU 30 watt stabilised, 13+V good condition. Also FRG7 receiver. Tel: 01-672 3372.

■ Dressler ARA30 active Rx antenna. Must be in good condx. Or HF vertical, also must be in good condx. Ricky.
Tel: (0392) 31941.

■ Belcom LS102L 26MHz to 30MHz. Also 707 Nato 2000. Tel: (0283) 221870.

■ Codar AT5 transmitter with ac power unit. Please send price and condition to Marris, 35 Kingswood House, Farnham Road, Slough, Berks SL2 1DA.

■ Yaesu FT101B, FT301, FT101ZD or similar, in good working condition. Willing to pay top prices for clean equipment. Also ATU required. Tel: (04536) 2385, evenings after 6.00pm or weekends.

■ Codar CR70. A MkII BFO unit needed. I'm willing to pay a reasonable amount for the unit. Also, will anyone who knows or has info on the Marconi CR200 receiver please drop me a line. Richard Riley, Ford Wembury, Devon PL9 0DZ. Tel: (0752) 862 403.

■ Codar PR30 preselector with power supply. G3JMO, 42 Runswick Avenue, Redcar TS10 5EL. Tel: (0642) 486155.

■ Exchange FT208R FM 2 metre hand-held, PA3 car adaptor, NC8C PWR/quick charger, YM24A speaker/mic and ¼λ whip, for FT290R in good condition. G6CJL QTHr. Tel: (0422) 54635.

■ BBC microcomputer, and gen coverage receiver. Urgently. Tel: (061) 682 5533, after 6pm, Tues only.

■ Heathkit or KW receiver. The following considered: SB300, 301, 303, 310; GR78; KW201; 202, 707. N Cameron, EI4DZ, 16 St Mary's Cres, Westport, Co Mayo, Eire.

■ Crystal shift unit for Storno Viscount CQM19 VHF transceiver. Also crystals 10.3657, 10.37107, 8.100, either HC6U or HC25U. A McGhie, 1 Boyach Crescent, Isle of Whithorn, Wigtownshire DG8 8LD. Tel: (09885) 443, evenings.

■ Vega 402 or Rigonda Fiesta 6 inch TV tube or complete set with good tube for spares. 8MHz and 44MHz crystals for AM Cambridge for simplex and repeater frequencies. Also wanted, small winch for tower and 70cm TV transmitter. Wood and Douglas preferred, but would consider any type. Mr Dimmock, 13 Stephenson Way, Bourne, Lincs PE10 9DA. Tel: (0778) 423433.

■ Burndept 470/471 h/h. Tel: (0705) 831641, Steve.

■ Transformer number 299086 to fit Hartley Electromotives/Solartron CT436 oscilloscope. Please write to Gordon Crowhurst, 41 Mill Dam Lane, Burscough, Ormskirk, Lancs L40 7TG. Tel: (0704) 894299.

■ Datong converter PC1 or UC1. Tony Leeming. Tel: (0608) 811102.

■ Exchange 48K Spectrum/Microdrive/Kempston interface, etc, for any HF, CW or CW/SSB HF rig, KW2000/Heathkits or WHY. Anything considered but must be good working order. Tel: (0632) 562908 evenings.

■ Wanted for heavy weight station: Racal MA79 transmit drive unit and/or TA99 with PSU. Have for exchange KW2000A with PSU, in good working condition, with several new valves, including 6146Bs. Also have Datong FL3 in perfect order with box and original leads. Terrific device this!! Cash adjustment considered to balance values. Also have other stuff, any deal done to mutual satisfaction, call me anytime. Eddie Green, 53 Holden Road, London N12 7DP. Tel: 01-445 0528, evenings if possible.

■ Icom ICR70 FM mode or ICR71E. Details, will collect if reasonable distance. Tel: Derby 662712.

■ One aerial for 20 and 40 metres. Must be outdoor with chimney use, only £30-£40. Also, one digital amateur bands radio. It must be in working order. £40-£50. Tel: Wood Clochan 378.

■ Heath CW filter for SB301. Collins 75S-3 CW and 3.1 SSB filters. T&R 1920's, 1930 and some 1940 and 1942. Many duplicate T&Rs, Bull, CQ, SWM, QST from 20's, to swap or sell. SAE enquiries: Baker, New Bungalow, Bontneywydd, Aberystwyth, Dyfed, Wales.

■ MEL Mullard miniaturised communications receiver, type L662. Also low frequency marine receiver (*Practical Wireless*, January 1975) or similar. J Ball. Tel: (01) 647 9502, or write 17 Heathdene Rd, Wallington, Surrey SM6 0TD.

■ President McKiney circuit diagram and handbook, buy or borrow for copy. Also front facia for same. Your price paid, must be good clean condition. All letters answered, all costs refunded. John Duffy, 146 Hugh Gardens, Newcastle-on-Tyne, Tyne and Wear NE4 8PQ.

■ Yaesu FTV901R, must be in mint condition with all leads, manual, two metre module. Top price paid. G3BRD. Tel: Seaford (0323) 897313.

■ Trio ham clock HC2. Tel: Weston-super-Mare (0934) 21248.

■ SX200N scanner, by disabled pensioner. Willing to pay up to £125 for same, as funds are limited. Tel: (0282) 59320, anytime.

■ Taylor valve tester, model 45C. Could anyone supply me with handbook for the above or photo copy, all costs paid. Chris Brown. Tel: Horringer 441.

■ Avanti AV190 Saturn 11m antenna in good condition, or does anyone know where I may buy one? Have Uniden 200. Good condition, in maker's box, for sale £40 ono, or swap for three element Yagi for 11m or light weight rotator. Tel: Luton (0582) 454055, ask for Bob.

FREE CLASSIFIED AD FORM

Form has been used

Amateur RADIO SMALL ADS

Form removed

USED AMATEUR EQUIPMENT? I Buy, Sell & Exchange!

SELLING? I pay the BEST POSSIBLE PRICES for your Clean Used Equipment!

BUYING? I have the BEST SELECTION of top Quality Used Equipment Available!

For the Deal You've been Looking for, Phone Dave, G4TNY

ANYTIME ON HORNCHURCH (04024) 57722 or Send SAE

G4TNY AMATEUR RADIO
132 Albany Road, Hornchurch, Essex RM12 4AQ

MORSE READER PROGRAMMES

SPECTRUM · BBC 'B' · DRAGON · CBM 64 · VIC 20 · ZX81 16K · ATARI 600/800XL · AMSTRAD 464

Sinclair computers need NO interface, others use simple one transistor (BC107 or similar) interface. Programmes self tracking 8/30 WPM. All connections to existing sockets. Cassette with full instructions and interface circuit where required £6.00 inc P&P. Interface built and tested £2.50 inc P&P.

RTTY

FOR YOUR 48K SPECTRUM

Menu driven, 10 programmable memories, split screen, morse ident, four baud rates, etc etc. NO TERMINAL UNIT, just a simple filter! Cassette with full instructions, circuit and filter layout £8.50 or SAE for full details. Filter unit built and tested £6.00.

JEP ELECTRONICS
NEW ROAD COMPLEX
NEW ROAD
KIDDERMINSTER DY10 1AL
TEL: 0562 753893

SERVICE MANUALS

For **ANY** Age, Make or Model of Electronic Equipment. Amateur Radio, Vintage Wireless, Test Equipment, Old Ministry Equipment, Audio, Televisions, Colour and Mono, Video Recorders, Radiograms etc..etc. Thousands stocked. SAE enquiries and quote BY RETURN

MAURITRON TECHNICAL SERVICES,
Dept AR, 8 Cherry Tree Road, Chinnor, Oxon, OX9 4QY.

XXX ADULT VIDEO CLUB

For the genuine adult films. Available only from ourselves. Ring

0924-471811 (24hrs)

For the intimate details or write
ADULT VIDEO CLUB
P.O. Box 12, Batley, W. Yorks.

MORSE TUTOR

£4.00 on cassette. **£6.00** on microdrive for Sinclaire Spectrum. 4 to 19 words per minute, variable spacing, variable groups of random letters, numbers or mixed; Random sentences, own message, single characters and variable pitch. Feedback on screen, printer, or speech (Currah Microspeech 48K only) and repeat facility. 16K and 48K versions on one cassette 48K only on microdrive.

WD SOFTWARE
Hilltop, St. Mary, Jersey, C.Islands
Telephone (0534) 81392

HEATHERLITE MOBILE MICS

Made to help you drive safely

Reasonably priced to suit your rig, head/neck band, electret mic, control box, variable mic gain, scanning buttons, plug fitted – superb quality. Priced from £20.50inc.

FULLY GUARANTEED

Ring for Details – Heather G8SAV (0401) 50921

NEXT ISSUE ON SALE

Amateur **RADIO**

Thursday 26th September

MORSE CODE PREPARATION

Cassette A: 1-12 wpm for amateur.
Cassette B: 12-25 wpm for professional examination preparation.
Each cassette is type C90.
Price of each cassette (including booklets) **£4.95.**
Morse key with separate battery (PP3) — driven solid-state oscillator and sound transducer produces clear tone for sending practice. Price of key with electronic unit **£9.95.**
Price includes postage etc. Europe only
MH ELECTRONICS (Dept AR)
12 Longshore Way, Milton, Portsmouth PO4 8LS

INTERGRATED CIRCUITS

TEXAS INSTRUMENTS TOP SPECIFICATION DEVICES AT A PRICE WELL BELOW ANY OTHER SUPPLIERS AVAILABLE AS FOLLOWS:- 7400, 7402, 7420, 7428, 7440, 7451, 7474, 7486, 7493. PRICE FOR PACK OF 10 (1 TYPE) £1.00 +50p P+P DON'T BE WITHOUT A COPY OF OUR 60 PAGE CATALOGUE CRAMMED WITH THOUSANDS OF ELECTRONIC AND MECHANICAL BARGAINS 75p (FREE WITH ORDER)

J A CREW + CO
SPINNEY LANE
ASPLEY GUISE
MILTON KEYNES
OR TELEPHONE:- 0908 583252

Counters 12v DC Resetable	£4.00
Single meters scaled 0-50	£2.00
Rectifiers F/W module 600 volt, 25 amp	£3.00
Valves MH4	2.00
FL32	£2.00
50 4G	£3.00
Amplifiers 10 watts cased 80hm	10.00

Maldon Transformers

134 London Road, Kingston-on-Thames
Tel: 01-546 7534

DRAGON/TRS80C. A wide range of high quality radio software, available on tape or ROM cartridge. RTTY Tape £12. Morse Tutor £6.50. CW Transceive £10.75. ROM Cartridge for RTTY, ASCII, CW and AMTOR £59.

CBM64 – RTTY – Tape £11 Disk £14
CBM64 – CW Tx/Rx Tape £10 Disk £12
VIC20 – RTTY – Tape £10
ATOM – RTTY – Utility ROM £16

All programs feature split-screen type-ahead operation.
State callsign (if any). SAE for details.

GROSVENOR SOFTWARE (AR)
2 Beacon Close, Seaford, Sussex, BN25 2JZ.
(0323) 893378

UNIDEN CR-2021 COMMUNICATIONS RECEIVER

150KHz-29999KHz. AM/SSB/CW 76-108MHz. FM 6 memory AM, 6 memory, FM, auto scan, digital tuning, LCD. Supplied with mains PSU.

£166.74 inc VAT and carriage
For full illustrated tech. spec. S.A.E.
E.M.A. ELECTRONICS, Orford, Woodbridge, Suffolk
Tel: 039-45-696 or 328

BATCH PRODUCTION

Wiring & assembly PCB, cable and cable forms, modules and chassis to sample or drawings

McDeane Electricals Ltd
19B Station Parade,
Ealing Common,
London W5

R & S RADIO

AMATEUR RADIO EQUIPMENT

Bought, Sold & Exchanged
Used equipment always available
SAE list on request

R & S RADIO
489 Radipole Lane,
Weymouth, Dorset
OR PHONE: (0305) 786930
(anytime)

Telephone the advertising department on: 0277 219876 for details

ADVERTISERS INDEX

Amateur RADIO

ADVERTISING RATES & INFORMATION

DISPLAY AD RATES

depth mm x width mm	ad space	series rates for consecutive insertions			
		1 issue	3 issues	6 issues	12 issues
61 x 90	1/8 page	£66.00	£62.00	£59.00	£53.00
128 x 90 or 61 x 186	1/4 page	£115.00	£110.00	£105.00	£92.00
128 x 186 or 263 x 90	1/2 page	£225.00	£210.00	£200.00	£180.00
263 x 186	1 page	£430.00	£405.00	£385.00	£345.00
263 x 394	double page	£830.00	£780.00	£740.00	£660.00

COLOUR AD RATES

depth mm x width mm	ad space	colour rates exclude cost of separations	series rates for consecutive insertions		
		1 issue	3 issues	6 issues	12 issues
128 x 186 or 263 x 90	1/2 page	£305.00	£290.00	£275.00	£245.00
263 x 186	1 page	£590.00	£550.00	£530.00	£470.00
263 x 394	double page	£1,130.00	£1,070.00	£1,010.00	£900.00

SPECIAL POSITIONS

Covers: Outside back cover 20% extra, inside covers 10% extra
Bleed: 10% extra [Bleed area = 307 x 220]
Facing Matter: 15% extra

DEADLINES

*Dates affected by public holidays

issue	colour & mono proof ad	mono no proof & small ad	mono artwork	on sale thurs
Oct 85	29 Aug 85	4 Sept 85	6 Sept 85	26 Sept 85
Nov 85	3 Oct 85	9 Oct 85	11 Oct 85	31 Oct 85
Dec 85	31 Oct 85	6 Nov 85	8 Nov 85	28 Nov 85
Jan 85	28 Nov 85	4 Dec 85	6 Dec 85	26 Dec 85

CONDITIONS & INFORMATION

SERIES RATES
Series rates also apply when larger or additional space to that initially booked is taken.
An ad of at least the minimum space must appear in consecutive issues to qualify for series rates.
Previous copy will automatically be repeated if no further copy is received.
A 'hold ad' is acceptable for maintaining your series rate contract. This will automatically be inserted if no further copy is received.
Display Ad and Small Ad series rate contracts are not interchangeable.

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

COPY
Except for County Guides copy may be changed monthly.
No additional charges for typesetting or illustrations (except for colour separations).
For illustrations just send photograph or artwork.
Colour Ad rates do not include the cost of separations.

Printed — web-offset.
PAYMENT
All single insertion ads are accepted on a pre-payment basis only, unless an account is held.
Accounts will be opened for series rate advertisers subject to satisfactory credit references.
Accounts are strictly net and must be settled by the publication date.
Overseas payments by International Money Order or credit card.
FOR FURTHER INFORMATION CONTACT
Amateur Radio, Sovereign House, Brentwood, Essex CM14 4SE.
(0277) 219876

Commission to approved advertising agencies is 10%.
CONDITIONS
10% discount if advertising in both Amateur Radio and Radio & Electronics World.
A voucher copy will be sent to Display and Colour advertisers only.
Ads accepted subject to our standard conditions, available on request.

MARCO TRADING

VIDEO PROJECTION UNIT

Brand New, complete and working, but no instruction manual.

Supplied complete with Projector, Tuner and Screen.

PRICE: Normally over £2,500
Our Price: £1,200

CHART RECORDERS

Brand new 3 channel pen recorders complete with charts spares kts. Full spec upon request – Once only bargain £40 + £10 p&p plus 15% VAT

EXPORT TV's AND VIDEO's

Attractive prices on 22", remote control, brand new, guarantee
Write for details

IC SOCKETS

D11 to D11		
8 pin	0.08	0.70/10
14 pin	0.10	0.95/10
16 pin	0.11	1.00/10
18 pin	0.14	1.60/10
22 pin	0.21	1.95/10
24 pin	0.25	2.25/10
28 pin	0.30	2.75/10
40 pin	0.34	3.10/10

EUROPEAN ADAPTORS

These very high quality British made two pin European adaptors are ideal for driving radios, cassette recorders, TV games, calculators etc. The adaptors fit in the UK shaver socket.

REF	DC Voltage	Current	1+	10+	100+
EOB1	4.5V	200m/a	50p	45p	32p
EM3	6V	200m/a	£1.00	80p	55p
EO9	6V	400m/a	£1.50	£1.25	85p

Postage & Packing: 45p per adaptor or £1.60 per 10. £4.50 per 100

NEW 1985 CATALOGUE AVAILABLE — Many prices reduced — range increased — 123 pages fully illustrated. Price 65p, per copy (free upon request with orders over £5) — includes 30p Credit Notes, special offer sheets, order form and pre-paid envelope. **SEND NOW FOR YOUR COPY.**

RESISTOR KITS

¼W pack 10 each value E12 – 10R-1M
Total: 610 resistors **ONLY 4.80**
¼W pack 5 each value E12 10R-1M
Total: 305 resistors **ONLY 2.75**
½W pack 10 each value E12 2R2-2M2
Total: 730 resistors **ONLY 5.25**
½W pack 5 each value E12 2R2-2M2
Total: 365 resistors **ONLY 3.50**
50V Ceramic Kit 5 ea value
125 per Kit **ONLY £3.50 ea.**

SOLDERING AIDS

Antex 15W iron	8.00
Antex 18W iron	8.00
Antex 25W iron	5.20
Antex elements	2.00
Antex bits	0.98
Antex stands	1.90
Desolder Tool	4.50
Spare nozzles	0.48
25W Kit-iron with 13A plug and stand	ONLY £7.20
18W Kit iron 13amp & stand	7.10

NI-CAD CHARGER

Universal charger to charge PP3, AA, C, D **PRICE £6.00**

NI CADS

PP3	£4.45,	4	16.00
AA	£0.95,	10	8.00
HPII	£2.30,	4	8.50
C	£2.35,	4	8.75

BATTERY HOLDERS SNAPS

EH73S/Take 2AA Cells	17p
A302/Take 4 AA Cells	21p
A304/Take 6 AA Cells	32p
EH80S/Take 8 AA Cells	40p
EH80T/Take 10 AA Cells	48p
CX2/Take 2 C Cells	29p
B203/Take 4 Cells	31p
DX2/Take 2 D Cells	29p
PP3 Battery Snap	7p, £6/100
PP9 Battery Snap	17p/pr £16/100

TELECOM EQUIP

BT Plug & 3M lead	1.25
BT Master Socket	2.85
BT Sec Skt	1.95
BT 4-core cable 1M	0.15
BT approved 100M	12.00

VEROBOARD

2½ x 3¾	0.85
2½ x 5	1.00
2½ x 17	3.07
3¾ x 17	1.05
3¾ x 5	1.15
3¾ x 17	4.10
4¾ x 17¾	4.95
Pkt of 100 pins	0.30
Spt face cutter	1.48
Pin insertion tool	1.85
Vero wiring pen & spool	4.50
Dip board	3.85
Vero Strip	1.25

ROTARY POTS

0.25W Carbon Log & Lin
1K-2M2 each 0.32
10 3.00 Any 100 28.00

BRIDGES

1½A 50V	0.27
100V	0.28
200V	0.32
400V	0.40
600V	0.67
800V	0.58
2A 100V	0.52
200V	0.55
400V	0.61
600V	0.67
800V	0.70
6A 100V	0.66
200V	0.68
400V	0.74
600V	0.80
800V	0.86
10A 50V	2.20
100V	2.24
200V	2.35
400V	2.50
600V	3.50

SWITCHES

Sub-Miniature Toggle
SPST 60p SPDT 63p
DPDT 66p
Miniature Toggle
SPDT 68p SPST 65p
DPDT 72p
DPDT Centre off 85p
Standard Toggle
SPST On/Off Plate 48p
DPDT On/Off Plate 58p
Miniature DPDT Slide 15p
Push-To-Make 28p
Push-To-Break 25p
Rotary Switch
1 pole 12 way, 2 pole 6 way, 3 pole 4 way, 4 pole 3 way 50p

PVC TAPE
6 colours available
£1.50 per 10

TERMINAL BLOCKS

2 amp 12 way	0.19
5 amp 12 way	0.20
10 amp 12 way	0.40
15 amp 12 way	0.46
32 amp 12 way	0.90

PRE SETS

Vert + Horiz
100R to 1M 10p
100 for £6.50

CERAMIC CAPACITORS

All 50V
1p to 10nf 4p each
100 for £2.75

COPPER WIRE

Tinned + Enamelled copper wire
2oz reels: 14 to 38 swg
per reel £1.00

EQUIPMENT WIRE

1/0.6 4 p/m	£2.75/100
7/0.25 p/m	£3.50/100
16/0.28 p/m	£5.35/100
24/0.2 10p/m	£7.50/100

FLEXIBLE MAINS CABLE

0.5mm 2 core (3A) round 12 p/m	£9.75/100
0.75mm 2 core (6A) round 17 p/m	£13.50/100
0.5mm 3 core (3A) round 18 p/m	£15.10/100

CURLEY LEADS

2 metre (extended) screened 3 core 75p each, 5/£3.50

SPECIAL OFFER

This complete set of three stripfix plastic signs, containing over two thousand words, transmitters, frequencies, dials, letters and symbols etc. Three for £3.75

ZENER DIODES

400 m/w 3v to 75v.
8p each
100 for £6.00
1 watt 3v3 to 200v:
15p each
100 for £12.50

VOLTAGE REGULATORS

78L05/12/15	0.30
7505/12/15	0.55
7905/12/15	0.65
LM317K	3.50

PLASTIC BOXES

3x2x1"	0.35
3x2½x2"	0.65
4x3 1½	0.70
4½x4x1½"	0.83
6x4x2½	1.15
8½x5x3¼"	2.15

Colour Black, all boxes with lids and screws

SPEAKERS

4" Round 4 ohm 1.6W £1.58, 8 ohm 85p, £1.50/2

DC MOTOR

6-12 volt 75p, 5 for £3

SPEED CONTROL MOTOR

Using UPC 1447H
Working voltage 12v-0-5v
£2.50 each 10 for £22.00

SANYO DYNAMIC MICROPHONE

C/W 1 metre of cable and plug, ON-OFF switch and stand.
1MP 500ohm MODEL NoHM95
PRICE ONLY £1.50

74LS

LS00	28p
LS01	28p
LS02	28p
LS03	28p
LS03	32p
LS08	28p
LS09	28p
LS10	28p
LS11	28p
LS12	25p
LS13	33p
LS14	58p
LS15	25p
LS20	28p
LS21	28p
LS22	28p
LS30	30p
LS32	28p
LS37	23p
LS74	38p
LS122	70p
LS138	45p
LS139	68p
LS151	75p
LS155	50p
LS157	45p
LS158	58p
LS160	60p
LS161	70p
LS162	72p
LS163	80p
LS166	1.95
LS170	1.75
LS244	1.00

BUZZERS

Solid State
6 volt 80p
12 volt 80p

LINEAR I.C.'s

CA3011	1.80
CA3012	1.75
CA3014	2.38
CA3018	1.10
CA3020	2.10
CA3028A	1.30
CA3035	2.55
CA3080E	1.80
CA3085	1.20
CA3086	0.68
CA3090AQ	5.00
CA3030E	1.40
CA3140E	0.60
HA1336W	3.15
LM324N	0.55
LM339	0.65
LM348	0.90
LM380	1.65
LM381N	1.45
LM382N	1.45
LM386	0.99
LM387	1.45
LM389N	1.20
LM3914N	2.55
LM3915N	2.60
MI232B	2.10
555	0.35
C-mos555	0.88
741	0.25
SAS560S	1.85
SA5570S	1.85
SL901B	5.20
SL917B	6.25
TA7205AP	1.50
TA7222P	2.12
TDA1004	2.90
TL072	0.98
TL081	0.68
TL084	1.28

SERVICE AIDS ALL SERVISOL PRODUCTS

Switch Cleaner	0.98
Circuit Freezer	1.14
Foam Cleanser	0.95
Aero Klene Silicone Grease (Aerosol)	1.22
Antistatic Spray	0.98
Plastic Seal	1.08
Excel Polish	0.92
Fire Extinguisher 640g	2.80
Video Head Cleaner	0.92
Solda Mop (Std)	0.74
Solda Mop (L/Gauge)	0.74

CLOCK RADIO VHF/LW/MW

Mains, bedtime, digital display alarm clock/radio. Full circuit. Alarm Control-/Wake to Music. Sleep Control – 10 min Snooze. £8.50 each (plus 75p addtl postage per set).

WALKMAN TYPE SPEAKERS

Powered Stereo. Complete with carrying strap. Built-in Pre-amp. Needs to be heard to be believed. Uses 4 x D size batteries – not supplied. £8.50 (plus addtl postage £1).

FUSES

QB 20mm 100 mA to 6.3A:
6p each 100 for **£3.50**
Slow Blow 20mm 100mA to 200mA:
20p, 100 for **£15.00**
Slow Blow 20mm 20mA to 800mA:
12p, 100 for **£7.50**
Slow Blow 20mm 1A to 6.3A:
10p 100 for **£5.00**

L.E.D.'s

RED: 3mm + 5mm **10p** each, 100 for **£6.00**
YELLOW: 3mm + 5mm **13p each** 100 for **£10.00**
GREEN: 3mm + 5mm **13p** each, 100 for **£10.00**

C-MOS

4000	0.24	4021	0.58	4036A	2.75
4001	0.24	4022	0.96	4038	0.75
4002	0.25	4023	0.35	4039A	2.80
4007	0.25	4024	0.50	4040	0.60
4011	0.24	4025	0.24	4042	0.50
4012	0.24	4027	0.45	4043	0.42
4013	0.56	4028	0.45	4044	0.50
4014	0.60	4029	0.75	4046	0.60
4015	0.60	4030	0.35	4049	0.38
4016	0.40	4031	1.30	4050	0.36
4017	0.60	4033	1.25	4051	0.70
4018	0.60	4034	1.46	4052	0.60
4020	0.85	4035	0.70	4053	0.60

DIODES

IN916	0.04	**AA119**	0.12
IN4001	0.05	**AA129**	0.18
IN4004	0.06	**AAY30**	0.16
IN4005	0.06	**BA100**	0.24
IN4007	0.07	**BY126**	0.12
IN4148	0.05	**BY127**	0.10
IN4149	0.06	**BY133**	0.16
IN5400	0.12	**BY184**	0.40
IN5401	0.15	**OA47**	0.10
IN5402	0.15	**OA90**	0.08
IN5404	0.16	**OA91**	0.09
IN5406	0.18	**OA95**	0.18
IN5408	0.20	**OA200**	0.06

TRANSFORMERS

British made transformers at very attractive prices.
Primary Secondary Current 1+ 10+ 100+
240v: 6-0-6v 400m/a **58p 52p 43p**
240v: 6-0-6v 500m/a **65p 60p 48p**
Carriage 45p per transformer. £1.60 per 10.

TRANSISTORS

Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)
AC127	0.30	BC107	0.10	BC238	0.12	BD233	0.60
AC128	0.30	A or B	0.12	BC239C	0.14	BD234	0.62
AC128K	0.34	BC108	0.10	BC251	0.12	BD235	0.63
AC132	0.55	A B or C	0.12	A B or C	0.14	BD236	0.63
AC141	0.26	BC113	0.14	BC301	0.30	BD237	0.65
AC141K	0.40	BC114	0.12	BC302	0.32	BD238	0.56
AC142	0.26	BC115	0.12	BC303	0.32	BD241	0.60
AC142K	0.48	BC116	0.15	BC307	0.10	BD243A	0.80
AC151	0.45	BC117	0.22	BC308A	0.10	BD244A	0.65
AC152	0.46	BC118	0.17	BC323	0.99	BD375	0.32
AC176	0.28	BC119	0.30	BC327	0.14	BD410	0.76
AC176K	0.46	BC125	0.12	BC328	0.14	BD434	0.68
AC187	0.42	BC140	0.28	BC337	0.12	BD436	0.68
AC187K	0.48	BC141	0.42	BC338	0.12	BD437	0.76
AC188	0.44	BC142	0.30	BC350	0.14	BD438	0.75
AC188K	0.50	BC143	0.30	BC440	0.30	BD439	0.68
ACY40	0.88	BC147	0.08	BC441	0.32	BD507	0.48
AD142	1.10	A or B	0.10	BC461	0.32	BD508	0.53
AD143	1.10	BC148	0.08	BC547	0.12	BD509	0.54
AD149	0.96	A or B	0.10	BC548	0.12	BD510	0.48
AD161	0.42	BC149	0.09	BC549	0.12	BD517	0.56
AD162	0.42	BC157	0.10	BC550	0.18	BD520	0.66
AD161/162	0.96	BC158	0.10	BC550C	0.18	BD699	1.25
AF106	0.48	BC159	0.10	BC557	0.12	BD707	0.88
AF114	2.10	BC160	0.30	BC558	0.12	BDX18	2.35
AF115	2.10	BC161	0.30	BCX34	0.27	BDX32	2.10
AF116	2.10	BC168B	0.12	BCY70	0.15	BF115	0.32
AF117	2.10	BC169C	0.10	BCY71	0.17	BF117	0.54
AF118	0.85	BC170	0.14	BCY72	0.18	BF119	0.82
AF121	0.62	BC170B	0.12	BCZ10	1.68	BF120	0.38
AF124	0.48	BC171	0.10	BCZ11	1.45	BF123	0.40
AF125	0.48	BC171	0.10	BD124P	0.80	BF125	0.42
AF126	0.48	A or B	0.08	BC130Y	0.68	BF127	0.38
AF127	0.48	BC172	0.08	BD131	0.34	BF152	0.16
AF139	0.68	A or B	0.12	BD132	0.34	BF154	0.23
AF178	0.68	BC177	0.20	BD131/132	0.95	BF157	0.40
AF239	0.68	BC178A	0.22	BD135	0.32	BF158	0.22
AF279S	0.75	BC182	0.09	BD136	0.36	BF159	0.24
AL100	2.50	A B or C	0.09	BD137	0.36	BF160	0.23
AL102	5.90	BC182L	0.09	BD138	0.38	BF167	0.30
AL113	2.20	A B or C	0.09	BD139	0.38	BF173	0.25
ASY80	1.75	BC183	0.09	BD140	0.38	BF177	0.42
AU110	1.40	A B or C	0.10	BD144	1.60	BF178	0.30
AY102	4.32	BC183L	0.08	BD145	1.82	BF179	0.32
BA102	0.34	A B or C	0.12	BD150A	0.51	BF180	0.35
BA110	0.67	BC184L	0.10	BD159	0.65	BF181	0.35
BA121	0.40	A B or C	0.10	BD160	1.65	BF182	0.32
BA129	0.38	BC207	0.15	BD165	0.45	BF183	0.32
BA148	0.16	BC208	0.16	BD175	0.60	BF184	0.32
BA154	0.08	BC212	0.09	BD182	1.00	BF185	0.32
BA155	0.10	A B or C	0.10	BD183	1.10	BF194	0.08
BA156	0.08	BC212L	0.08	BD184	1.20	BF195	0.10
BA157	0.28	A B or C	0.10	BD201	0.72	BF196	0.10
BA164	0.14	BC213	0.09	BD202	0.87	BF197	0.10
BB104B	0.52	A or B	0.10	BD204	0.80	BF198	0.14
BB105B	0.30	BC213L	0.10	BD222	0.80	BF199	0.16
BB105G	0.48	A or B	0.10	BD225	0.86	BF200	0.26
BB110B	0.42	BC237	0.11	BD232	0.45	BF222	0.48

Type	Price (£)	Type	Price (£)	Type	Price (£)	Type	Price (£)
BF224	0.20	BR100	0.20	BY179	0.66	OC36	1.75
BF224J	0.16	BR101	0.44	BY182	0.87	OC42	0.72
BF240	0.20	BR103	0.58	BY184	0.40	OC42K	1.40
BF241	0.20	BRC4443	1.76	BY187	0.72	OC44	0.72
BF244	0.26	BRY39	0.38	BY189	4.75	OC45	0.58
BF244A	0.28	BRY56	0.42	BY198	0.44	OC71	0.50
BF244C	0.24	BRY61	0.86	BY199	0.47	OC72	0.52
BF245A	0.28	BSS17	0.56	BY206	0.24	OC81	0.68
BF254	0.15	BSS27	0.92	BY207	0.24	OC200	2.46
BF256	0.40	BSX19	0.34	BY210/400	0.25	OC202	2.20
BF257	0.32	BSX20	0.34	BY210/600	0.26	ORP12	0.85
BF258	0.30	BSX59	0.62	BY210/800	0.30	R2008B	1.50
BF259	0.32	BSX76	0.29	BY233	1.20	R2010B	1.52
BF262	0.30	BT100A/02	0.94	BY227	0.26	SHG1 5	0.40
BF263	0.30	BT101/300	1.15	BY229	0.30	TAG1/100	1.40
BF270	0.30	BT101/500	1.25	BY238	0.68	TAG3/400	1.78
BF271	0.26	BT102/300	1.35	BYX10	0.24	TIC44	0.40
BF273	0.18	BT102/500	1.65	BYX36/150	0.22	TIC45	0.45
BF274	0.32	BT106	1.50	BYX36/600	0.28	TIC46	0.48
BF323	0.92	BT108	1.30	BYX48/300	0.72	TIC47	0.70
BF336	0.26	BT109	1.18	BYX49/300	0.47	TIC106A	0.70
BF337	0.26	BT116	1.25	BYX55/350	0.29	TIP30A	0.46
BF338	0.26	BT119	3.62	BYX55/600	0.33	TIP31C	0.54
BF355	0.42	BT120	3.60	BYX71/600	1.18	TIP32	0.40
BF363	0.82	BT121	3.02	BYZ12	0.42	TIP32C	0.60
BF367	0.24	BT138/600	1.30	C106D	0.80	TIP33A	0.63
BF371	0.27	BT151/560R	0.90	E1222	0.40	TIP34A	0.72
BF422	0.38	BT151/300R	1.15	E5024	0.30	TIP41C	0.46
BF450	0.38	BTY79/400R	2.80	GET872	0.48	TIP42A	0.52
BF457	0.33	BU100A	2.30	ITT44	0.04	TIP47	0.60
BF458	0.36	BU104	2.00	ITT2002	0.11	TIP110	0.88
BF459	0.44	BU105	1.20	ME0402	0.20	TIP2955	0.60
BF539	0.22	BU105/02	1.56	ME0404/2	0.24	TIP3055	0.60
BFR40	0.22	BU108	1.80	MEU21	0.60	TIS43	0.32
BFR41	0.22	BU124	1.75	MJ400	1.25	TIS88	0.40
BFR51	0.30	BU126	1.25	MJ2955	0.90	TIS90	0.25
BFR61	0.32	BU133	1.80	MJ3000	1.98	TIS91	0.28
BFR62	0.28	BU204	1.35	MJE240	0.60	ZTX108	0.12
BFR88	0.34	BU205	1.30	MJE340	0.54	ZTX109	0.12
BFR90	1.72	BU206	1.70	MJE370	0.88	ZTX212	0.28
BFT41	0.38	BU208	1.55	MJE520	0.48	IN4001	0.05
BFT43	0.38	BU208A	1.63	MJE2955	0.99	IN4003	0.05
BFW10	0.79	BU208/02	2.05	MJE3055	0.70	IN4004	0.06
BFW44	0.76	BU326S	1.75	MPSLO1	0.28	IN4006	0.07
BFX29	0.28	BU407	1.65	MRF475	2.50	IN4007	0.07
BFX30	0.30	BU407D	1.80	MRF479	5.20	IN4148	0.05
BFX80	3.56	BUX80	3.70	MRP	10.00	IN5400	0.12
BFX84	0.24	BUY20	1.75	OA47	0.10	IN5402	0.15
BFX85	0.26	BUY69A	2.60	OA90	0.08	IN5405	0.16
BFX86	0.26	BUY69B	1.98	OA91	0.09	IN5406	0.18
BFX87	0.26	BUY101	0.48	OA95	0.18	IN5408	0.20
BFX89	0.65	BY118	1.10	OA200	0.06	IS920	0.08
BFY50	0.21	BY122	0.68	OA202	0.15	2N697	0.55
BFY51	0.21	BY126	0.12	OC25	2.10	2N706A	0.33
BFY52	0.21	BY127	0.10	OC26	1.70	2N2904	0.28
BFY57	0.40	BY133	0.16	OC28	1.50	2N2906	0.24
BFY90	0.90	BY135	0.25	OC29	2.47	2N2926G	0.10
BFY90S	1.34	BY164	0.44	OC35	1.75	2N3053	0.22

Type	Price (£)
2N3054	0.56
2N3055	0.45
2N3702	0.10
2N3704	0.10
2N3708	0.10
2N3772	1.90
2N3773	2.70
2N3904	0.16
2N3906	0.16
2N5294	0.48
2N6107	0.71
2N6126	0.68
2N6127	0.68
2SB337	1.60
2SC495	0.65
2SC1172Y	2.90
2SC1173Y	0.82
2SC1302	1.40
2SC1226	0.84
2SC1279	0.50
2SC1306	0.92
2SC1307	1.40
2SC1413A	2.70
2SC1444	1.45
2AC1449	0.63
2SC1507	0.63
2SC1678	1.06
2SC1758	0.68
2SC1909	1.20
2SC1923	0.30
2SC1945	2.88
2SC1953	0.74
2SC1957	0.76
2SC1969	2.88
2SC2028	0.73
2SC2029	2.10
2SC2078	1.05
2SC2091	0.73
2SC2098	2.90
2SC2122A	3.20
2SC2166	1.20
2SC2314	0.80
2SC2335	1.50
2SC2371	0.90
2SC2749	2.70
2SC2752	0.60
2SD234	0.64
2SD348	3.30
2SD986	0.62
2SJ50	5.20
2SK134	3.80
2SK135	4.60
3N126	1.90
3N211	2.52
3SK45	0.76
3SK88	0.66
3SK135	5.20

DIODES

Type	Price (£)
BD233	0.60
BD234	0.62
BD235	0.63
BD236	0.63
BD237	0.65
BD238	0.56
BD241	0.60
BD243A	0.80
BD244A	0.65
BD375	0.32
BD410	0.76
BD434	0.68
BD436	0.68
BD437	0.76
BD438	0.75
BD439	0.68
BD507	0.48
BD508	0.53
BD509	0.54
BD510	0.48
BD517	0.56
BD520	0.66
BD699	1.25
BD707	0.88
BDX18	2.35
BDX32	2.10
BF115	0.32
BF117	0.54
BF119	0.82
BF120	0.38
BF123	0.40
BF125	0.42
BF127	0.38
BF152	0.16
BF154	0.23
BF157	0.40
BF158	0.22
BF159	0.24
BF160	0.23
BF167	0.30
BF173	0.25
BF177	0.42
BF178	0.30
BF179	0.32
BF180	0.35
BF181	0.35
BF182	0.32
BF183	0.32
BF184	0.32
BF185	0.32
BF194	0.08
BF195	0.10
BF196	0.10
BF197	0.10
BF198	0.14
BF199	0.16
BF200	0.26
BF222	0.48

MARCO TRADING (DEPT AR9)
The Maltings
High Street
Wem, Shropshire SY4 5EN
Tel: 0939 32763 Telex: 35565

ORDERING: All components are brand new and to full specifications. Please add 50p postage/packing (unless otherwise specified) to all orde4rs then add 15% VAT to the total. Either send cheque/cash/postal order or send/telephone your Access or Visa number. Official orders from schools, universities, colleges etc most welcome. (Do not forget to send for our 1985 catalogue - only 65p per copy. All orders despatched by return of mail.
NEW RETAIL 1000 sq.ft. shop now open Mon-Fri 9.00-5.00, Sat 9-12.00.

MARCO 85
Electronics Components Catalogue

Our latest 123 page catalogue over 4000 items fully illustrated. Send 65p now for you copy FREE with orders over £5.00.

DEWSBURY ELECTRONICS

G4CLX

IF IT'S TRIO IT MUST BE **DEWSBURY**

A FULL RANGE ALWAYS IN STOCK

FRG 8800 £559

APPROVED TRIO DEALER

TRIO R600 £299

TRIO R2000 £479

APPROVED TRIO DEALER

NRD 515 £965

IC – R 71E £699

WRASSE WEATHER FACSIMILE RECEIVERS NOW AVAILABLE – SOLE UK DISTRIBUTORS

NEW PRODUCT NEWS

IF YOU'RE THINKING ABOUT C/W YOU MUST READ THIS!

★ Iambic Keyer ★ Dash/Dot Memory
★ Keying Speed 1 – 55 wpm ★ Built in Side Tone Oscillator And Speaker
★ Headphone Socket ★ Variable Weight Control
★ Side Tone Volume and Pitch Control
★ Switchable Automatic/Semi Automatic Keying/Tune Control
★ Operation from Internal Batteries or 9 – 15v. External Supply ★ Low Current Drain
★ British Made
★ Selectable Positives or Negative Keying

5 YEAR GUARANTEE

Only £49.95 + £3.00 p&p to inclue External Power Leads and Plugs

POCOMOTOR AFR2000
RTTY ALL MODE DECODER

(Now with CW option) From £427

STAR MASTER – KEYER

Stockists of DAIWA — MET ANTENNAS — MUTEK — WOOD & DOUGLAS — TASCO TELEREADERS — MICROWAVE MODULES — ICs AMTOR — AEA PRODUCTS — DRAE

Dewsbury Electronics, 176 Lower High Street, Stourbridge, West Midlands.
Telephone: Stourbridge (0384) 390063/371228
Telex: 337675 TELPES G

BARCLAYCARD VISA

Instant finance available subject to status. Written details on request.

Access