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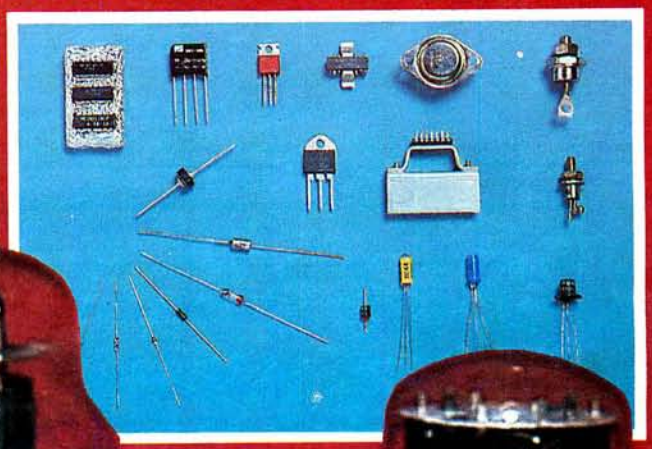

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TRIO

		£	c&p
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R600	Gen. Cov. Receiver	263.12	(—)
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FOR THE Radio ENTHUSIAST ...

APRIL 1984 VOL. 60 NO. 4 ISSUE 925

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in glasgow,

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in darlington,

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Lowe Electronics in the North East of England, set in the delightful market town of Darlington, the shop displays the full range of amateur products sold by the company. Our address in the town is 56 North Road, that is the A167 Durham road out of Darlington. Open Tuesday to Friday from 9am till 5.30pm, Saturday from 9am till 5pm (closed for lunch 12.30 to 1.30). A huge free car park across the road, a large supermarket, bistro restaurant and banking facilities combine to make a visit to this delightful market town a pleasure for the whole family.

in london,

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Lowe Electronics in London, our shop in the Capital City, easily found on the lower sales floor of the Hepworths' shop on Pentonville Road, within 3 minutes walk of Kings Cross railway station. Open all day Monday to Saturday, six days a week, from 9.30am to 5.30pm during the week and from 9.30am to 5pm on Saturday, a warm and courteous welcome, together with sound advice awaits those who enter. The entire range of amateur products is on display, backed by a considerable amount of stock. When in the City, visit Lowe Electronics.

We cannot seem to keep the TR9130 in an "in stock" situation. No sooner has a shipment arrived than we are "out of stock". I must say that even I am surprised by its popularity. Based on the renowned TR9000, the TR9130 has additional features that make it the most popular multimode on today's market. We are still getting requests for second-hand TR9000's and even they are a rarity on our second-hand shelf. Having a clear green readout, reverse repeater, the ability to tune whilst transmitting, 25 watts output, 6 memories and of course memory scan: TRIO's two metre multimode, the TR9130.


TR9130

TR9130 **£442.52 inc. VAT.** carriage £6.00

There are two schools of thought regarding two metre mobile FM equipment. One group are of the opinion that the simpler the rig the better and refer to the TRIO TR7500 as the ultimate mobile transceiver ever made. There are others who require their mobile rig to have memory channels and all associated facilities in order to gain operational flexibility. TRIO cater for both.

The TM201A and the TM401A are simple rigs, designed to fit into the smallest of today's cars and provide the simple functions that make mobile operation a pleasure. Repeater shift and lockable reverse repeater are included as well as superb receive performance. 25 watts from the 2 metre TM201A and 12.5 watts from its 70 centimetre cousin, the TM401A, ensures a strong transmitted signal. A separate 77 mm (3 inch) speakers in a solid enclosure gives high quality receive audio even whilst mobile.


TM201A

TM201A ..... **£269.00 inc VAT.** *carriage* £6.00
TM401A ..... **£299.00 inc VAT.** carriage £6.00

A remote controller with a green backlit LCD frequency readout is also available as an optional accessory. The FC10 simply plugs into the side of the transceiver and comes complete with mounting bracket and velcro pads to ease fixing without drilling holes in the car's dashboard.


TW4000A

FC10 .... **£41.20 inc VAT.** carriage £6.00

For a mobile transceiver having more operating features the TR7930 is the model to choose. The TR7930 is TRIO's logical progression from the very popular and reliable TR7800. The design of the TR7930 takes into account the minor and justifiable criticisms levelled against the TR7800. You will now find the frequency readout is a green backlit liquid crystal display that can be read in the brightest of sunlight. The memory allocation has been increased to a total of 21 channels and the rig can be instructed to hold on the received signal for either a timed period or until the signal disappears. Programmable band scan is also available between user defined limits. To make mobile operation safer the transceiver is pre-programmed so that if you select for example, 145.450 then the rig will adopt the simplex mode, if you select 145.650 then, automatically, you will get repeater mode. Of course TRIO have made it easy to over-ride this feature as you would naturally expect. I can say no more about the TR7930, a comprehensive rig for the mobile enthusiast.

TR7930 ..... **£312.00 inc VAT.** *carriage* £6.00

To improve mobile operation there is the TRIO MC55 boom microphone. Not jut an electret condenser microphone but having a transmission timer, up/down frequency shift switch, adjustable microphone gain and fitted with either a 6 or 8 pin microphone plug. To monitor the swr/output power of your mobile installation TRIO have produced the SWR100A/B. (model A: 1.8 to 150 MHz and model B: 140 to 450 MHz) Compact and easily fixed to your dashboard, be the first to know something is wrong with your mobile station.

MC55 ..... **£38.64 inc VAT.** carriage £2.00
SW100A/B ..... **£37.26 inc VAT.** carriage £2.50

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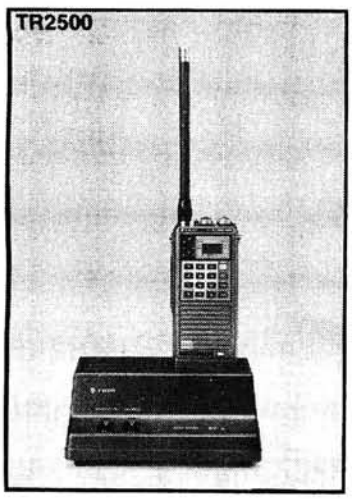
For the real VHF/UHF enthusiast there is only one FM mobile rig that in one compact unit has both 2 metres and 70 centimetres. The TRIO TW4000A. Not a cheap piece of equipment, the TW4000A has to be seen to be appreciated. Having many features to assist mobile operation the TW4000A also speaks. Unless you have actually operated the rig with the optional VS1 voice synthesizer fitted, then you cannot really make a considered judgement. It is easy to say that such a feature is a gimmick but I, on my journeys up and down the country, have found that having the frequency, memory number etc announced in clear distinct voice is much better than stealing a glance at the display. A recent review in AMATEUR RADIO magazine (December 1983) tells more.

TW4000A ..... **£469.00 inc VAT.** carriage £6.00
VS1 ..... **£24.50 inc VAT.** carriage £0.75

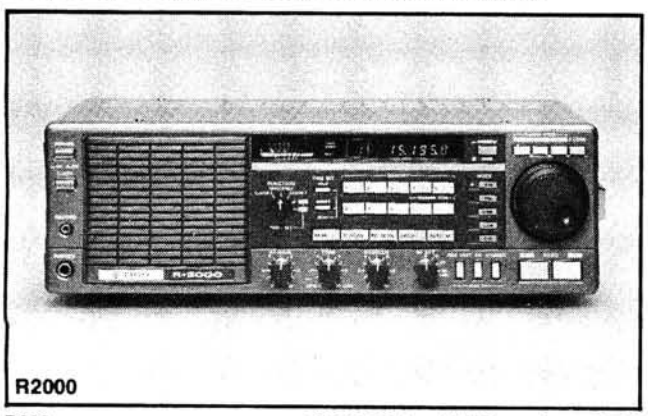
(in fact the VS1 is not a voice synthesizer, it is the digitally recorded voice of a Japanese girl programmed into a dedicated chip, her Japanese diction can be had as an alternative by moving an internal switch on the VS1 board from position EN to JA.)

Don't let us forget the two handhelds from TRIO, the 2 metre TR2500 and the 70 centimetre TR3500. Both very popular pieces of equipment. Reliable and functional. Each having ten memories, memory scan, programmable scan, repeater and reverse repeater shift and a comprehensive range of accessories compatible to both models.


TR2500

TR2500 ..... **£237.82 inc VAT.** carriage £6.00
TR3500 ..... **£256.45 inc VAT.** carriage £6.00

Two general coverage receivers are available from TRIO, the R600 and the R2000. The R600 is the basic model and covers continuously frequencies from 150 KHz to 30 MHz having AM, CW and SSB modes. The R2000 is more sophisticated having the same coverage but FM in addition to the usual modes found on a high quality general coverage receiver. Ten memories, memory scan, programmable band scan between user defined limits all add to the enjoyment to be had from a TRIO R2000. To create the perfect receiver an optional VHF converter covering again continuously 118 to 174 MHz and fitting inside the receiver is available. The nice thing about the VHF converter is that the frequency readout of the R2000 is also corrected so that if you are tuned to 145.600 then that is what the readout displays.


R2000

R600 ..... **£263.00 inc VAT.** carriage £6.00
R2000 ..... **£421.20 inc VAT.** carriage £6.00
VC10 ..... **£113.00 inc VAT.** carriage £6.00

HF equipment from TRIO provides you with a choice, solid state or valve. The NEW TS530SP from TRIO is the choice for those who require a rig that will give them world wide communication without frills. The TS830S has a receiver with variable band width and a transmitter having an RF speech processor. Both the TS530SP and the TS830S use a pair of the well known 6146B valves. There are also the four solid state rigs. The TS130 V and S amateur bands only, 25 watts and 200 watts PEP respectively, the TS430S covering the amateur bands and also being a general coverage receiver and the "FLAGSHIP" of the range, the incomparable TS930S, a piece of equipment whose specification and performance are well known.


TS430S

TS530SP ..... **£638.00 inc VAT.** carriage £6.00
TS830S ..... **£731.40 inc VAT.** carriage £6.00
TS130S ..... **£555.45 inc VAT.** carriage £6.00
TS430S ..... **£752.10 inc VAT.** carriage £6.00
TS930S ..... **£1150.00 inc VAT.** carriage £6.00


TS530SP

So that a full amateur radio station can be set up, TRIO have a comprehensive range of microphones, headphones, separate VFO's, aerial tuning units, for the TS430S and TS930S, the ATU's can be automatic, etc.
The items are too numerous to list, full details and prices can be obtained from any LOWE ELECTRONICS shop.

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★ The **LOWE TX40 CB transceiver** is now well known on ★
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Push-button Perfection

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Some of these features include: scanning, 10 memories, duplex offset storage in memory & odd offsets also stored in memory. Internal Lithium battery backup and repeater tone are of course 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 easy to read custom LCD readout indicating frequency, memory channel, signal strength, transmitter output and scanning functions.

A battery lock, frequency lock and lamp on/off switch are also featured, as is an aluminium case-back, providing superior heat sinking.

A variety of batteries will be available for the IC-02E, including new long-life 8.4 volt and 13.2 volt packs. Top panel connector for 13.8 volts which will power transceiver operation.

The IC-2E continues to be available, and its complete range of accessories work with the new IC-02E.

The IC-02E comes with the BP3 Nicad battery pack, BC25E wall charger, flexible antenna, wrist strap and belt clip as standard equipment. A truly excellent product destined to a great future.

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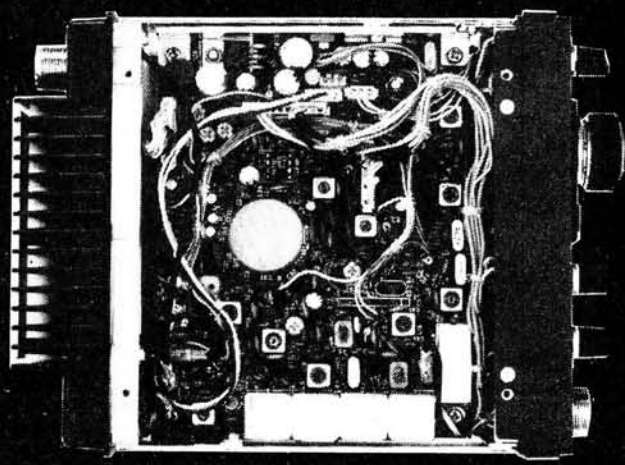

IC-745, Latest HF Transceiver

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The IC745 has a terrific combination of features found on no other transceiver, at such a low price. The IC745 is the only transceiver today that has so many standard features, options and accessories.

The IC745 is another superlative set in the ICOM range, see it in our retail shop at 95 Mortimer Street Herne Bay Kent, or contact our Reculver Road address for more information. Your own local ICOM dealer will be able to help you too.

IC-27E, Latest and smallest FM Mobile

Interest-free credit available Securikor or post despatch free, same day if possible.

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And we thought that the IC25E was small! ICOM have now produced a new and even smaller 25W FM 2 meter mobile – the IC27E.

We have little information on the IC27E at the moment, but by the time you read this they should be available.

Briefly, the IC27E offers two VFO's, 9 memories, priority channel and scanning. The easy to read LCD displays frequency, memory channel, power, S-meter and functions. All this is packed into a case W140×H38×D177mm. and weighing only 1.2 Kgs.

The price has not yet been announced but give us a call for this and other information.

Agent Please telephone first, anytime between 0900 – 2200 hrs.
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Fitted 2 metres with 70cm, 6 metres or HF options. Satellite unit available provides complete satellite operation with full Duplex.

Access

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- NC-8 - Standard/quick charger/DC Power supply
- NC-9C - Compact charger (220-234V)
- PA-3 - Car adapter
- YM-24A - Speaker/microphone
- FL-2010 - 10 watt power amplifier for FT-208R
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Size	155x88x31mm

RANGES **£35.00** each
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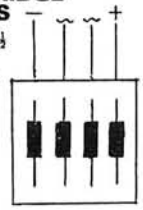

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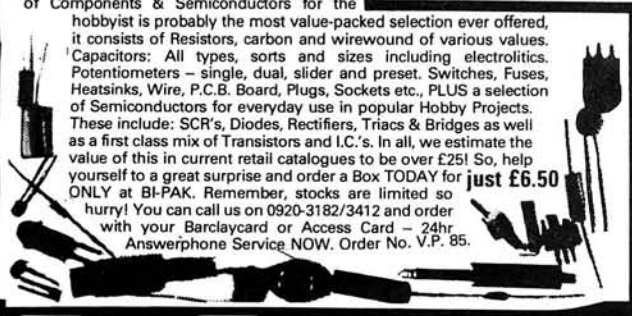

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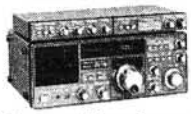
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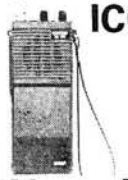
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AC141K	0.34	BC172	0.10	AD162	0.39	BC238	0.09	BF259	0.28
AC176	0.22	BC173B	0.10	AD142	0.79	BC212L	0.09	BF336	0.34
AC176K	0.31	BC182	0.10	AD149	0.70	BC213	0.09	BFX29	0.30
AC187	0.25	BC183	0.10	AF124	0.34	BC307	0.09	BFX84	0.26
AC187K	0.28	BC184LA	0.09	AF125	0.35	BC327	0.10	BFX85	0.32
AC188	0.25	BC212	0.09	AF126	0.32	BC461	0.35	BFX86	0.30
AC141K	0.34	BC172	0.10	AF127	0.32	BC478	0.20	BFX88	0.25
AC176	0.22	BC173B	0.10	AF139	0.40	BC547	0.10	BFY50	0.21
AC176K	0.31	BC182	0.10	AF239	0.42	BC548	0.10	BFY51	0.21
AC187	0.25	BC183	0.10	AU106	2.00	BC549A	0.08	BFY52	0.25
AC187K	0.28	BC184LA	0.09	AU107	1.75	BC557	0.08	BFY90	0.77
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AD149	0.70	BC213	0.09	BC107	0.10	BD132	0.35	BT116	1.20
AD161	0.39	BC213L	0.09	BC108	0.10	BD133	0.40	BU105	1.22
AD161/2	0.90	BC237	0.10	BC109B	0.12	BD135	0.30	BU108	1.69
AD162	0.39	BC238	0.09	BC139	0.20	BD136	0.30	BU124	1.00
AF124	0.34	BC307	0.09	BC140	0.31	BD137	0.32	BU126	1.60
AF125	0.35	BC327	0.10	BC141	0.25	BD138	0.30	BU205	1.30
AF126	0.32	BC461	0.35	BC142	0.21	BD139	0.32	BU208	1.39
AF127	0.32	BC478	0.20	BC143	0.24	BD140	0.30	BU208A	1.52
AF139	0.40	BC547	0.10	BC147	0.09	BF179	0.34	BU326A	1.42
AF239	0.42	BC548	0.10	BC148	0.09	BF180	0.29	MRF450	12.50
AU106	2.00	BC549A	0.08	BC149	0.09	BF183	0.29	MRF450A	
AU107	1.75	BC557	0.08	BC157	0.12	BF194	0.11		12.50
AU110	2.00	BC558	0.10	BC158	0.09	BF196	0.11	MRF453	17.50
AU113	2.95	BD131	0.32	BC159	0.09	BF197	0.11	MRF454	23.50
BC107	0.10	BD132	0.35	BC160	0.28	BF198	0.16	MRF475	2.50
BC108	0.10	BD133	0.40					MRF477	10.00
BC109B	0.12	BD135	0.30					OC71	0.40
BC139	0.20	BD136	0.30					R2008B	1.70
BC140	0.31	BD137	0.32					R2010B	1.70
BC141	0.25	BD138	0.30					R2540	2.48
BC142	0.21	BD139	0.32					TIP29	0.40
BC143	0.24	BD140	0.30					TIP29C	0.42
BC147	0.09	BF179	0.34					TIP30C	0.43
BC148	0.09	BF180	0.29					TIP31C	0.42
BC149	0.09	BF183	0.29						
BC157	0.12	BF194	0.11						
BC158	0.09	BF196	0.11						
BC159	0.09	BF197	0.11						
BC160	0.28	BF198	0.16						

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WHAT INFLATION

Cast your mind back seven or eight years to the introduction of the Yaesu FT 101E, it proved A WINNER FOR YAESU and a DELIGHT TO OWNERS. At £579 it was considered to be GOOD VALUE THEN. Reflect on this! and ask these questions: Did it have GENERAL COVERAGE . . . IF SHIFT/WIDTH CONTROL . . . TWO VFO'S . . . MEMORIES . . . A KEYER . . . FM . . . UNRESTRICTED RIT . . . AN RF PREAMP . . . FULL BREAK IN . . . SWITCHABLE AGC . . . SCAN FACILITY? Both you and we know it didn't. Yet despite the passing of the years, and MASSIVE INFLATION affecting other markets Yaesu can still offer you a transceiver with all these facilities AT VIRTUALLY THE SAME PRICE AS THE FT 101E WAS ALL THAT TIME AGO. Amateur radio expensive? Answer that one yourself. Oh! By the way the transceiver we are talking about is the FT 757GX.

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HIRSCHMANN 250. . . . There is no better buy on the market than this. . . . A lightweight Rotor suitable for most VHF antennas. . . . It's yours for £45 . . . Carr and ins. £1:50.

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Includes the world's finest traps – REYCO, which are guaranteed for five years no condenser used – no blow up possible. Precision moulded coil forms with stainless hardware – aluminium irridite finish – fully waterproofed and suitable for wire, vertical and beam antennas, rated at 2.5Kw and weigh only 4oz per trap – available for 7Mhz (KW40), 14Mhz (KW20), 21Mhz (KW15) and 28Mhz (KW10). £18.99 including VAT and carriage.
The BALUN – The Unadilla W2AU is famous because it's the best, same rating as the traps and has a built-in lightning arrestor – available 1:1 and 4:1 – get it right first time with W2AU Balun – guaranteed for five years. £18.99 including VAT and carriage.
THE KITS – AMCOMM 40 – 1 pair KW40 traps, 1 PL259, 1 W2AU Balun, 1 pair insulators and of course 120ft soft drawn copper wire – coverage 80-10 metres (including 10Mhz). Full instructions included. £43.50 including VAT and carriage.
AMCOMM 20 – 1 pair KW20 Traps, 1 W2AU Balun, 1 PL259, 1 pair insulators and 65ft soft drawn copper wire – coverage 40-10 metres, full instructions included. £41.50 including VAT and carriage.
AMCOMM 3B – 1 pair KW10 traps, 1 pair KW15 traps, 1 PL259, 1 W2AU Balun, 1 pair insulators and 30ft soft drawn copper wire – coverage 20m, 15m and 10m. Full instructions included. £47.50 including VAT and carriage.
NEW WARC TRAPS – KW12, KW17 and KW30 now available from stock. £18.99 including VAT and carriage.

YAESU FT980 GENERAL COVERAGE TRANSCEIVER

Yaesu said the FT1 was an adventure in electronics and we agreed. The FT980 is something quite different . . . IT'S AN ACCOMPLISHMENT IN ELECTRONICS providing the operator with a brilliantly designed transceiver with a wealth of features. Every feature has been carefully designed in to ensure the operator has MAXIMUM BENEFIT without gimmicks while allowing INCREDIBLE EASE OF OPERATION. We'd need more than this page to do justice to the FT980 so we suggest you call in and try it for yourself or call 01-422 9585 for a beautifully illustrated leaflet with a full description. . . . Yes it is expensive . . . the best usually is unless a way can be found to ease the pain . . . AMCOMM ARE EXPERTS AT THAT . . . TRY US.

THE HANDHELDS

As we said last month "It's been a great year for the handhelds, especially the Yaesu FT208R, they are all extremely versatile BUT THE 208 HAS THE EDGE. Did you see the reviews? They certainly told you a lot . . . WHAT THEY DID'NT TELL YOU WAS HOW TO OPERATE YOUR HF RIG FROM THE 208, from the garden, from the car, even the bath if your are willing to chance it. Whichever handheld you're interested in – Marine P.M.R. or Amateur: call us and we'll tell you, we'll even send you the information. Call 01-422 9585.

YAESU FT726R 2m/70cms/SAT

If you've been enjoying your annual winter break in ULAN BATOR you've probably missed the VOLUMES OF SUPERLATIVES being liberally dispersed about the YAESU 726R . . . They're coming from all sources . . . THE REVIEWERS . . . LUCKY OWNERS . . . FRIENDS OF LUCKY OWNERS . . . even from the VERY UNLUCKY DREAMERS . . . LITTLE WONDER! . . . ALL OF 2 MTS . . . ALL OF 70cms . . . and a large portion of the HF SPECTRUM . . . MORE . . . if rumours coming from JA prove correct it won't be too long before we have a 1296 FACILITY . . . add the SATELLITE DUPLEXER to that lot and you really have yourself a DREAM OF A RIG . . . Performance figures? Like the rest of it TOP NOTCH . . . but don't take our word for it, call AMCOMM ON 01-422 9585

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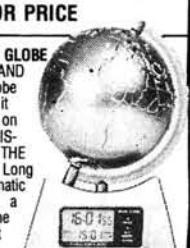

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I Wonder Why

THE REVISED UK CB RADIO LICENCE, which comes into effect on 5 March 1984, is mainly a "tidying-up" job in the light of the experience of the first two years of the service. The prohibition on transmitting music, or re-transmitting radio and TV broadcast material, is clearly spelled out now. The only signals permitted are speech, selective calling or digital identification signals, plus K-tone or pip-tone signals to indicate the end of a transmission. Repeater stations are ruled out, though they may later be authorised in the 934MHz service. Use of a CB on board ship requires the consent of the ship's Master.

The restrictions on the form of antenna permitted for 27MHz installations have been relaxed somewhat. The loading coil may now be placed anywhere in the antenna, instead of just at the base, but the length of the antenna is now limited to 1·65m and its diameter to 55mm, in both cases including the loading coil but excluding any ground-plane elements.

The requirement for transmitter power to be reduced when the CB rig is used with an antenna more than a certain height above ground has been totally revised, so that the power limit is stated in watts, rather than in dB relative to full power as previously.

Two changes have been made to the limitations on who may operate a CB set under a particular licence. The first allows any person to operate the apparatus under the direct supervision of the licensee—a reasonable relaxing of the rules. The second change prevents anyone under the age of 14 holding a CB licence. In future a child under 14 can operate only under the direct supervision of the licensee, or of another member of the licensee's household appointed to do so.

I was not aware that there had been any particular problems from young CBers, and I wonder why this rule has been made. After all, we have a minimum age limit of 14 for the Amateur Licence, but we still get plenty of "children" of all ages who abuse their licences and spoil other people's enjoyment of the hobby in the process.

Another "I wonder why" topic is the choice by British Telecom of the name Teletex for its new telephone data service. Surely, when the name Teletext is already in widespread use for the quite unrelated broadcast data services on TV (Ceefax and Oracle in the UK), it would have been wiser to select a name that didn't sound virtually identical when spoken. It's already caused confusion, for one national TV rental chain had a whole lot of display material printed for its shops proclaiming that several of their sets incorporated Teletex facilities. They didn't—they were Teletext sets!

Geoff Arnold

QUERIES

While we will always try to assist readers in difficulties with a *Practical Wireless* project, we cannot offer advice on modifications to our designs, nor on commercial radio, TV or electronic equipment. Please address your letters to the **Editor, "Practical Wireless", Westover House, West Quay Road, Poole, Dorset BH15 1JG,** giving a clear description of the problem and enclosing a stamped self-addressed envelope. Only one project per letter please.

Components for our projects are usually available from advertisers. For more difficult items, a source will be suggested in the "Buying Guide" box included in each constructional article.

PROJECT COST

The approximate cost quoted in each constructional article includes the box or case used for the prototype. For some projects the type of case may be critical; if so this will be mentioned in the Buying Guide.

INSURANCE

Turn to the following page for details of the PW Radio Users Insurance Scheme, exclusive to our readers.

CONSTRUCTION RATING

Each constructional project will in future be given a rating, to guide readers as to its complexity:

Beginner

A project that can be tackled by a beginner who is able to identify components and handle a soldering iron fairly competently. Generally this category will be used for simple projects, but sometimes for more complicated ones of wide appeal. In this case, construction and wiring will be dealt with in some detail.

Intermediate

A project likely to appeal to a wide range of constructors, and requiring only basic test equipment to complete any tests and adjustments. A fair degree of experience in building electronic or radio projects is assumed.

Advanced

A project likely to appeal to an experienced constructor, and often requiring access to workshop facilities and test equipment for construction, testing and alignment. Constructional information will generally be limited to the more critical aspects of the project. Definitely not recommended for a beginner to tackle on his own.

SUBSCRIPTIONS

Subscriptions are available at £13 per annum to UK addresses and £14 overseas, from **"Practical Wireless" Subscription Department, Room 2816, King's Reach Tower, Stamford Street, London SE1 9LS.** Airmail rates for overseas subscriptions can be quoted on request.

BACK NUMBERS AND BINDERS

Limited stocks of some recent issues of *PW* are available at £1 each, including post and packing to addresses at home and overseas.

Binders are available (Price £5.50 to UK addresses, £5.75 overseas, including post and packing) each accommodating one volume of *PW*. Please state the year and volume number for which the binder is required.

Send your orders to **Post Sales Department, IPC Magazines Ltd., Lavington House, 25 Lavington Street, London SE1 0PF.** All prices include VAT where appropriate.

Please make cheques, postal orders, etc., payable to IPC Magazines Limited.

Be Prepared

Following *PW's* most successful first venture into organising an open 144MHz contest last year, we will be repeating the event this year.

The *"PW QRP 144MHz Contest 1984"* will take place on Sunday 17 June between 0900 and 1700GMT (10am to 6pm local time).

Look out for further details nearer the date.

Tapes Catalogue for SWLs

The Handicapped Aid Programme—UK and the Canadian Handicapped Aid Program can supply twelve professionally produced tape recordings devoted to various aspects of the hobby of DXing, designed specifically for shortwave listeners everywhere.

Their publication entitled *Tapes Catalogue* contains descriptions of the subjects covered by the twelve tapes, order form and prices.

To obtain a free copy of the *Tapes Catalogue,* apply, enclosing return postage, to either: *HAP-UK, PO Box 4, St Ives, Huntingdon, Cambs. PE17 4ST, or CHAP, 6 Coolbreeze Avenue, Pt Claire, Quebec, Canada H9S 5G4.*

The Handicapped Aid Programme is an international organisation that promotes s.w. radio amongst handicapped people and offers them practical assistance. All profits from sales of the tapes are ploughed back into the organisation.

Royal Television Society

It will soon be 50 years since the termination of the contract between the Baird Company and the BBC, whereby the 30-line television service was broadcast on frequencies in the medium waveband, and received mainly in the homes of enthusiastic amateurs and experimenters.

The Midland Centre of the Royal Television Society plans to mark this anniversary with an event to be held towards the end of March and initially wishes to identify as many of those pioneer viewers as possible.

The Society, therefore, invites any of the original Baird viewers to contact their *Honorary Secretary, John Grantham, BBC Network Production Centre, Pebble Mill Road, Birmingham B5 7QQ.*

The 1983 Girl Technician Engineer of the Year

Mrs Frances Dagg, age 23, a Software Development Engineer from Coundon, Coventry, is the 1983 Girl Technician Engineer of the Year. At a ceremony in London on 19 January 1984, Baroness Platt of Writtle, Chairman of the Equal Opportunities Commission, presented her with a prize of £250 and an inscribed rose bowl. A special award of £100 was made to the runner-up, Mrs Lynne Holt, 29, also a Software Development Engineer from Coventry. Employed by GEC Telecommunications in Coventry, Frances work involves all aspects of computer programming, however, she is primarily concerned with writing CAD (computer-aided design) programs for electronic design purposes and assisting hardware engineers in their use. Her responsibilities also include training graduate engineers in the use of the Circuit Design System.

Seeing her software in action, providing increased efficiency in hardware design for a wide variety of applications, proves to be particularly rewarding for Frances. Her main leisure interests include, inevitably, her home computer, plus the works bridge club which she organises.

This Award, which is sponsored by The Caroline Haslett Memorial Trust and The Institution of Electrical and Electronics Incorporated Engineers, aims to focus attention on electrical and electronic engineering as a worthwhile professional career for women.

For details of the Award and how to nominate candidates for the 1984 award, contact: *The Institution of Electrical and Electronics Incorporated Engineers, 2 Savoy Hill, London WC2R 0BS. Tel: 01-836 3357.*

Rallies and Events

The RSGB National VHF Convention will be held at Sandown Park Racecourse, Esher, Surrey, on Saturday 24 March 1984.

This one day event will include an exhibition by the trade, specialist groups and an equipment test facility will be operated by Don Hamilton G8DON. Also, a full lecture programme on v.h.f., u.h.f. and microwave subjects will run through the afternoon.

The Convention starts at 10.30am until 6.00pm, with the address and presentation of trophies by RSGB President, Bob Barrett GW8HEZ, at 1.45pm.

Refreshments and a licensed bar will be available throughout the day and admission will be £1.00 for adults, £0.50 for under 18 year olds and free for those under 14 years.

Buxton Mobile Rally, organised by the Buxton Amateur Radio Rally Group, will be held at The Transport Museum, Buxton, Derbyshire, on Sunday 8 April 1984.

Doors open at 11a.m. (10.30a.m. for RAIBC) and admission will be 50p, with under 14 year olds admitted free, provided they are accompanied by an adult.

There will be numerous trade stands, refreshments, talk-in on 144MHz and 430MHz, plus ample car parking is available.

For details, contact: *Dave Cooper G6MIF, tel: Buxton (0298) 6174.*

The White Rose Amateur Radio Society will be holding their 17th annual rally, for the third year running, at the University of Leeds, on Sunday 1 April 1984.

Starting at 11a.m. there will be approximately 50 stands offering new and used amateur radio gear, components, computer products, surplus equipment, books, etc., plus repeater groups and BYLARA will be represented.

Talk-in will be available on 144MHz and 430MHz, and a demonstration station, GB2WRR, will be in operation. Car parking is free, but an entrance fee of 50p will be charged (children and OAPs free).

Further details from: *The Rally Manager, Alan Bramley G4NDU, tel: Leeds (0532) 689880.*

Insurance

Readers who are interested in applying to the *PW Radio Users Insurance Scheme* are advised to use the coupon published on page 18 of last month's issue.

News

Special Event Station

A special event station, GB2RBL, will be run on behalf of the Royal British Legion Branch, London N12, starting at 1100GMT on 31 March 1984 until 8 April 1984—a total of nine days.

Dependent on operators being available and propagation conditions permitting, GB2RBL will be active on 144MHz v.h.f. and the 14, 7 and 3·5MHz bands on h.f. For overseas DX, the station will be working 14·185MHz. Special event QSL cards will be available to all confirmed contacts, via the RSGB Bureau.

Further details from: *Terry F. Owen G4PSH, 5 Station Close, Holden Road, London N12 7EG. Tel: 01-446 0266.*

For Your Diaries

Amateur radio rallies and exhibitions during 1984 we've had dates for so far are:

NARSA Amateur Radio Weekend, Saturday/Sunday April 7/8 at Pontins Holiday Village, Southport, Lancs.

RSGB National Amateur Radio Exhibition, Saturday/Sunday April 28/29 at NEC, Birmingham.

27th Northern Mobile Rally, Sunday May 13 at the Great Yorkshire Showground, Harrogate, N. Yorkshire.

RNARS Mobile Rally, Sunday June 17 at HMS Mercury, Leydene, near Petersfield, Hants.

Longleat Amateur Radio Rally, Sunday June 24 at Longleat Park, Warminster, Wilts.

RSGB Woburn National Mobile Rally, Sunday August 5 at Woburn Abbey, Beds.

RAIBC/FRARS Hamfest '84, Sunday August 19 at Flight Refuelling Sports Ground, Merley, Wimborne, Dorset.

Scottish Amateur Radio Convention, Saturday September 8 at Cardonald College, Mosspark, Glasgow.

Welsh Amateur Radio Convention, Sunday September 30 at Oakdale Community College, Blackwood, Gwent.

Practical Wireless will be at all these events with recent copies of the magazine plus reprints and computer program cassettes, and *PW* parabolic dishes. We hope we'll see you there.

50MHz Licences to be Increased

The Department of Trade and Industry has asked the RSGB to make recommendations to them with regard to 60 additional stations taking part in 50MHz experimental work. Originally, 40 special research permits for Class A licensees were issued.

Those amateurs who have already submitted a full questionnaire to the Society's VHF Manager, need only confirm, in writing, that they wish to be reconsidered.

Questionnaires from new applicants must be with the Society by 31 March 1984. They are obtainable from RSGB Headquarters, marking the envelope "The Secretary—50MHz".

Completed questionnaires must then be sent to: *The VHF Manager, Keith Fisher G3WSN, RSGB, Alma House, Cranborne Road, Potters Bar, Hertfordshire EN6 3JW. Tel: (0707) 59015.*

Lowes Grows

Lowe Electronics, the Matlock based Trio main agents, are at it again, that is opening yet another branch, this time in the university town of Cambridge.

The new shop is located at *162 High Street, Chesterton, Cambridge, tel: (0223) 311230,* and will be opening at the beginning of April.

On Sunday 18 March, Lowes have booked the Trinity Suite in the Cambridge Post House Hotel at Lakeview, Bridge Road, Impington, Cambridge, between 2.00 and 4.30pm. The purpose of this will be to introduce both themselves and the Trio range of equipment to the local amateur population and any other interested parties—all are welcome.

The manager of the new shop, Tony Collet G4NBS, a lad who rises from that neck of the woods, will be there to welcome everyone and early arrivals will receive a glass of vino and the odd peanut. Additionally, Lowes will be running a station at the Post House using the callsign G8LOW and talk-in will be available on S22.

For further information, contact: *Lowe Electronics Ltd., Chesterfield Road, Matlock, Derbyshire DE4 5LE. Tel: (0629) 2817/2430/4057 and 4995.*

On the Move

Would readers please note that one of the suppliers of p.c.b.s for *Practical Wireless* projects has moved.

C. Bowes Electronics Ltd. is the company, and their new premises are at: *Unit 7, Kenwood Road, Reddish, Stockport, Cheshire SK5 6PH. Tel: 061-432 9434.*

Repeater Management Group—Open Meeting in Poole

Would all licensed amateurs, short-wave listeners or anyone who is interested in the UK repeater network, please note that *Practical Wireless* are sponsoring an Open Meeting with members of the RSGB Repeater Management Group (RMG), to be held in Poole.

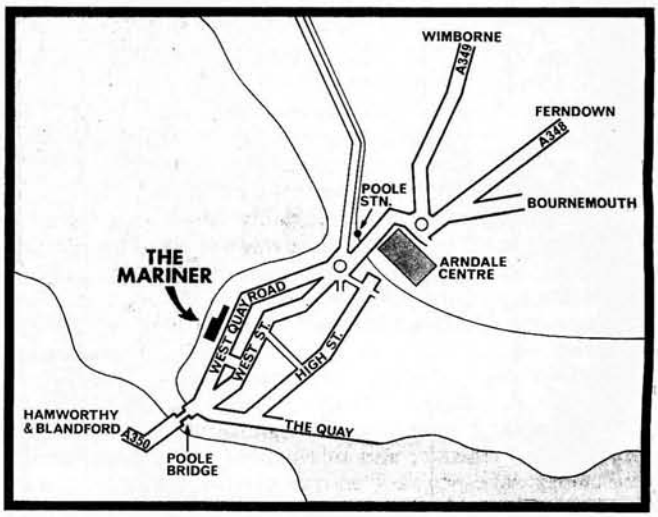
All who are able to get to Poole on a Saturday afternoon, are very welcome to attend the meeting, which will be held at *The Mariner, West Quay Road, Poole, Dorset* on Saturday 10 March, between 1.30 and 5.00pm.

At the meeting, interested parties will learn of the very latest state in the development of UK repeaters, join in discussions and put questions to RMG officers.

PW staff will be running a talk-in station and listening for initial contacts through the Bournemouth located 144MHz repeater GB3SC on channel R1.

The Mariner has excellent luncheon facilities and a large comfortable licensed lounge bar, plus ample car parking space is available.

We look forward to meeting all who are able to attend, but would ask you to bear in mind that the conference room must be vacated at 5.00pm, so the meeting will start promptly at 1.30pm.



The walk from the Station to the Mariner will take approximately 10 minutes

GaAs-f.e.t. PRE-AMP FOR 430MHz

by Sam Jewell G4DDK

The author's favourite band is undoubtedly 430MHz. This is reflected in the wide range of home constructed equipment he has produced since gaining an amateur radio licence, always with the constant objective of improving the performance of the home station. It was realised early in this process that a masthead pre-amplifier could give a marked improvement in receive sensitivity.

One problem was what device to use? An early attempt at a masthead pre-amplifier used a wideband design by DJ7VY which appeared in the German publication *VHF Communications*. This performed well at first but its great advantage of broadband operation soon became a disadvantage. A newly licensed G6+3 moved in just 50m away and began operating on 144MHz. The "DJ7VY" provides 17dB of broadband gain covering both 144 and 430MHz—the results when G6 . . . began operating were disastrous! Several attempts were made to add selectivity ahead of the pre-amplifier but the loss of the various filters tried just degraded the noise performance to the point where no advantage was gained in having a masthead pre-amplifier.

The answer lay in using a Gallium Arsenide f.e.t. with high *Q*, low loss input matching to give a degree of inherent selectivity. Conventional microwave GaAs-f.e.t. devices are relatively expensive and rather fragile and, since the author has an aversion to paying good money for something likely to be destroyed in an instant, they were avoided. Fortunately an alternative exists, the consumer dual-gate GaAs-f.e.t.

These devices were developed by the semiconductor industry as a low-cost solution to the problem of reducing the noise figure of TV tuners. Dual-gate GaAs-f.e.t.s are designed for operation up to approximately 900MHz. Because they operate at lower frequencies than their microwave counterparts they are able to use lower tolerance dimensions. This has resulted in low cost and less fragility—just what the author was looking for. The device chosen from those available was the Toshiba 3SK112 which is readily obtainable.

Pre-amplifier Design

The design of a pre-amplifier is largely dictated by its operating conditions. Unfortunately the data sheets for dual-gate GaAs-f.e.t.s do not usually give the optimum operating conditions for low-noise performance at 430MHz. Therefore it was necessary to extrapolate values from the available data and then confirm these values once the pre-amplifier was built. Table 1 gives the d.c. operating conditions for optimum low-noise performance of a 3SK112 at 430MHz.

Details of the input and output impedances are similarly not readily available, and this caused the greatest design difficulties. The problem was resolved by adopting wide-range matching circuitry from a conventional GaAs-f.e.t. amplifier and empirically determining the correct values for the 3SK112. The final circuit is shown in Fig. 1.

Circuit Description

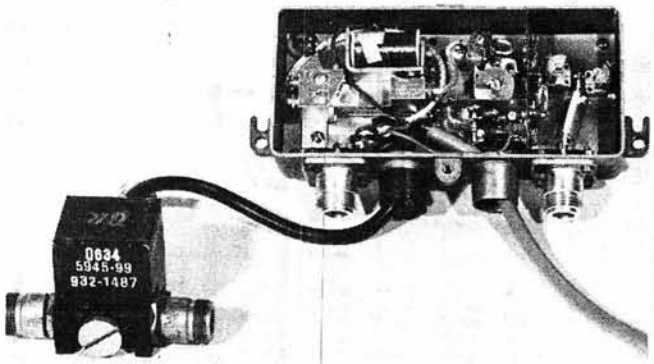
The gate 1 bias voltage V_{G1S} is developed automatically by placing resistor R1 in the source circuit. This form of auto-bias will be familiar to anyone who has designed and built valve equipment. The value of R1 is derived as follows:

$$R1 = \frac{V_{G1S}}{I_d} = \frac{1{\cdot}75}{10^{-2}} = 175\Omega$$

In practice the nearest preferred value of 180Ω is used.

Gate 2-to-source voltage is set at zero by coupling the connections together through a 15kΩ resistor, R2.

The source and gate 2 leads must be thoroughly bypassed to ground at 430MHz and this is achieved by soldering the leads directly onto the leadless disc capacitors, C3 and C4. The actual value of capacitance of these two components is not too important, as long as it is



BUYING GUIDE

Air spaced trimmers C1/2, 5/6 (Type SC8/18/A3) can be obtained from Oxley Developments, Priory Park, Ulverston, Cumbria (Tel: 0229 52621). The approximate cost shown below is for the pre-amplifier only without relays and enclosure.

Approximate Cost £27

Construction Rating ADVANCED

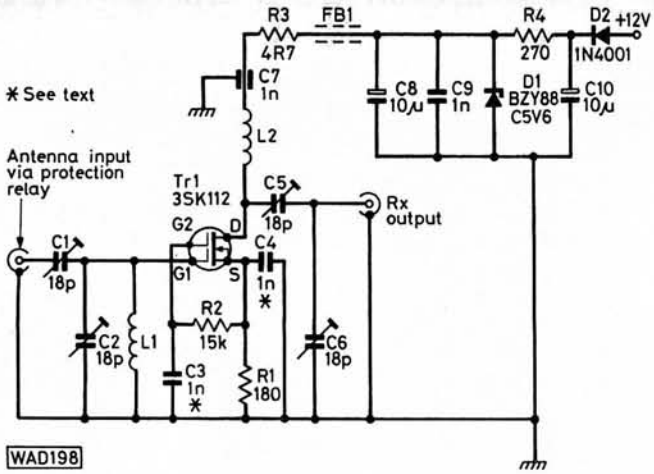
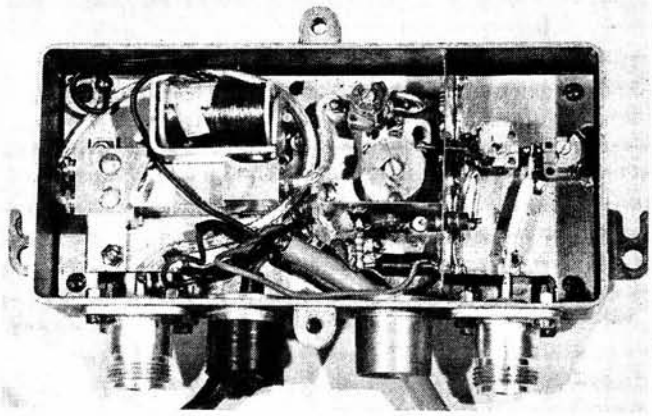
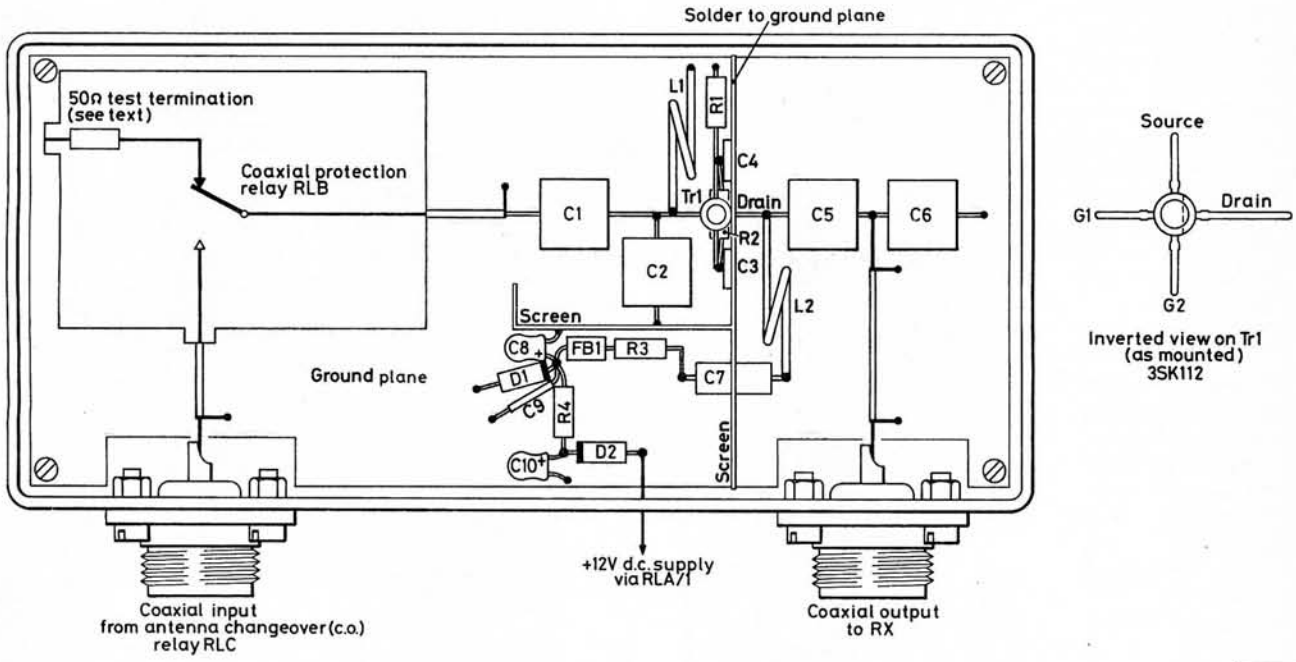


Fig. 1: Circuit diagram of the 430MHz GaAs-f.e.t. pre-amplifier



An internal view of the author's prototype pre-amplifier

Fig. 2: The final constructional arrangement of the pre-amplifier. Most components are mounted on or above the earthed ground plane. The drain of the GaAs-f.e.t. device, Tr1, passes to the output circuit through a 6 × 4mm rectangular hole cut through the vertical screen between the leadless disc capacitors C3/4. Resistor R2 is positioned under Tr1, across C3/4



within the range 220 to 1000pF. Of greater importance is their size, which means using slightly higher voltage components. Leadless disc capacitors are notorious for exploding when heated during soldering. The use of higher voltage devices will lessen the likelihood of this happening.

Very high *Q* (low loss) components must be used in the input matching circuit if lowest noise performance is required. Air-spaced, silver-plated trimmers and silver-plated copper wire **must** be used. Output matching is not so critical, but a silver-plated coil and capacitors were again used to ensure the lowest loss and highest gain.

Protection Relay

A protection relay is used to give extra isolation between the transmitter and pre-amplifier. If a good quality relay is available for the antenna changeover then the protection relay may not be necessary. Most relays measured by the author gave less than 40dB crosstalk isolation between the transmitter and receiver. This means that with 100 watts output power more than 10mW would appear at the pre-amplifier input. At this level of input the GaAs-f.e.t. would be driven into compression and could over dissipate, with a consequent risk of self-destruction. A protection relay can provide over 20dB of extra isolation and virtually eliminate the problem.

A 50Ω non-inductive resistor may be connected to the receive port so that when transmitting the pre-amplifier input is correctly terminated, since this reduces the chances of self-oscillation. This resistor can also be useful as a built-in test if the protection is arranged such that it can be controlled separately from the main relay. By connecting the resistor to the input of the pre-amplifier, in place of the "cold" antenna, an increase in receiver noise output should be apparent. The difference in level will depend on what the antenna is "seeing" within its beam pattern.

If the antenna can see only "cold" sky an increase in the noise level of several dB can be expected when the pre-amplifier is connected to the resistor. A relay which shorts the receive port to ground whilst transmitting is obviously not suitable for this purpose, although it may be possible to remove the shorting contact by "tweaking" the receive lever spring of the relay. Great care should be exercised if this is to be attempted however.

Construction

No attempt has been made to produce a printed circuit board for the pre-amplifier as the design is better suited to the form of construction shown in Fig. 2.

Construction starts by cutting thin brass or copper sheet to form the screens. Suitably-sized holes are drilled in the screens to fit the GaAs-f.e.t. Tr1 and the feed-through capacitor C7 in the positions shown. Once the holes are drilled the leadless disc capacitors C3 and C4 should be soldered into place, as shown in Fig. 2. These capacitors must be located on the input side of the screen if complete stability is to be assured. The leadless discs are best fitted by tinning the part of the screen where they are to be located and then sliding the disc into place. Finally solder the disc into place by heating the screen from the reverse side. Wet tissue paper can be used to prevent the first disc from moving whilst the second one is being soldered into place.

Once the leadless discs are in position it is advisable to fit resistor R2 between them, as shown in Fig. 2; resistor R1 may also be fitted at this stage.

Next the screens should be soldered together and also soldered to the base plate. The base plate can be made of brass or copper sheet, or of copper-clad p.c.b. material. Its size will depend upon the box used to house the pre-amplifier. The author used a salvaged Belling Lee TV distribution amplifier box. This type of box has a rubber sealing gasket around the lid and two very convenient mounting lugs. Unfortunately no regular source of this type of box has been discovered, so it may be necessary to use an alternative, such as that sold by RS Components.

When the screens and base plate are assembled it is possible to solder into place the remaining components. The input trimmer capacitor, C1, is supported at one end by the junction of C2 and L1. The other end of C1 is left floating and will eventually connect to the protection relay. The GaAs-f.e.t. should be mounted last and the correct orientation of the leads strictly observed.

When soldering any static-discharge-prone device such as the GaAs-f.e.t., certain precautions should be taken. It is wise to ensure that the soldering iron is at all times properly earthed and the author usually switches off the power to the iron whilst actually soldering the device into place. These types of GaAs-f.e.t.s are reasonably rugged, but there is no need to prove it!

A short length of ptfe coaxial line is used to connect the output trimmer to the output socket. The braid of this line should be connected to ground at both ends.

Power Supply and Control Unit

This unit would normally be situated in the shack in a convenient position, where the l.e.d.s can easily be seen. It contains a power supply for the pre-amplifier and a separate supply for the switching relays. A schematic diagram is shown in Fig. 3.

Desirable characteristics for any regulator used to power a masthead pre-amplifier are that it should produce a low noise output and be completely stable when connected to long supply leads. It is also desirable to have adjustable output volts to allow for voltage drop along the supply leads. Finally the regulator should be short-circuit proof, as it is all too easy to short the supply leads together when commissioning the new pre-amplifier. An LM317M adjustable regulator was chosen for the power supply and has given many months of reliable service without any problems.

Supervision of the control unit is provided by two l.e.d.s. Normally these are arranged to both be ON when receiving and OFF when transmitting. The l.e.d.s are connected across the supplies to the two changeover relays. A single switch on the control unit is used to release the protection relay in order to terminate the pre-amplifier input in 50Ω as discussed earlier. A press to talk (p.t.t.) connection needs to be made to the control unit from the

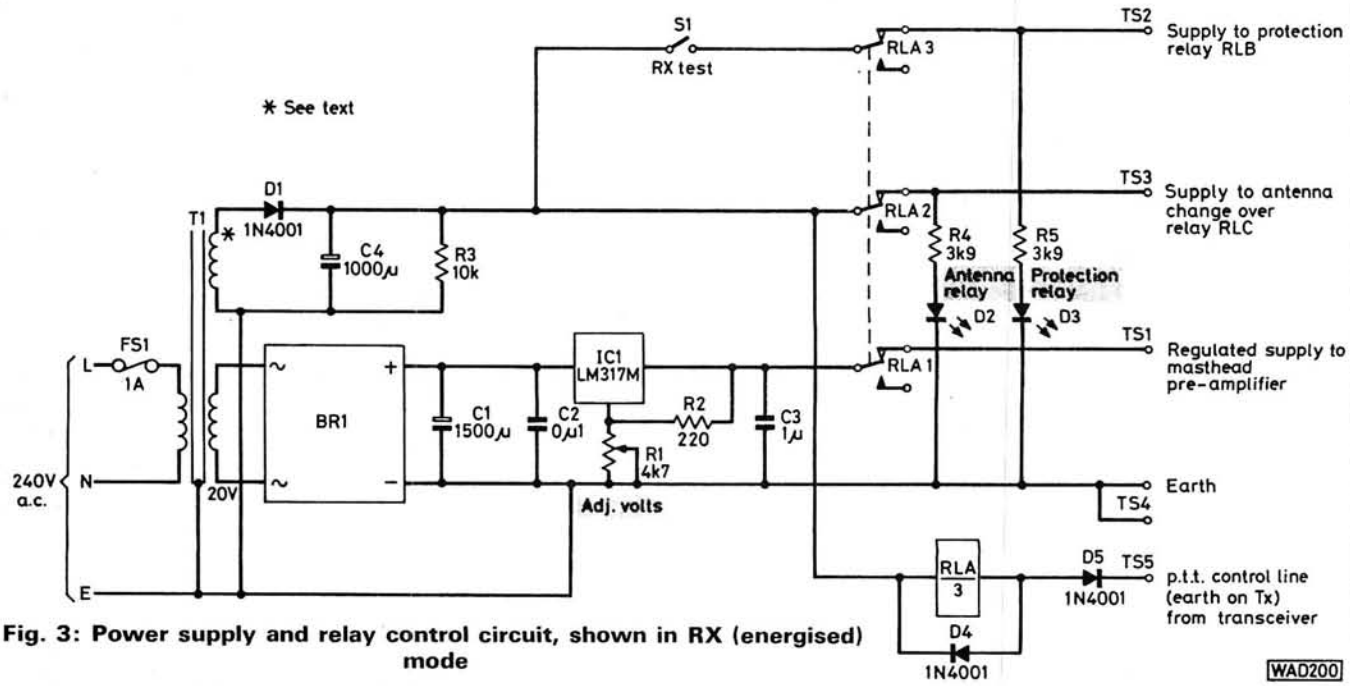


Fig. 3: Power supply and relay control circuit, shown in RX (energised) mode

★ components

PRE-AMPLIFIER

Resistors

High stability carbon film ¼W 5%

4·7Ω	1	R3
180Ω	1	R1
270Ω	1	R4
15kΩ	1	R2

Capacitors

Silver plated air-spaced trimmer

18pF	4	C1,2,5,6 (see buying guide)

Leadless ceramic disc

1nF	2	C3,4

Ceramic feedthrough

1nF	1	C7

Tantalum bead

10µF 16V	2	C8,10

Ceramic plate

1nF	1	C9

Semiconductors

Diodes

1N4001	1	D2
BZY88 C5V6	1	D1

Transistors

3SK112	1	Tr1

Miscellaneous

Silver plated copper wire 1·6mm diameter; Ferrite bead FX1115 (1); Weatherproof enclosure (see text); N type chassis sockets (2)

POWER SUPPLY/CONTROL UNIT

Resistors

Carbon film ¼W 5%

220Ω	1	R2
3·9kΩ	2	R4,5
10kΩ	1	R3

Potentiometers

Min. horizontal preset

4·7kΩ	1	R1

Capacitors

Tantalum bead

0·1µF 35V	1	C2
1µF 35V	1	C3

Electrolytic (axial)

1000µF 35V	1	C4
1500µF 35V	1	C1

Semiconductors

Diodes

1N4001	3	D1,4,5
1A 50V p.i.v. bridge	1	BR1
Red l.e.d.	2	D2,3

Integrated circuits

LM317M	1	IC1

Miscellaneous

Mains transformer (see text); 20mm fuse holder with 1A anti-surge fuse; s.p. switch, S1; 4 pole c.o. relay (Continental series or equiv.) RLA; Coaxial c.o. relay (RS349–686 or equiv.) RLB; Coaxial c.o. relay (CX520D or equiv.) RLC; Mounting box.

transceiver. This "hard wired" connection controls relay changeover.

It should be noted that the masthead relays are both arranged to be operated (energised) whilst on receive. Should the pre-amplifier fail this does allow the transmit feeder to be used for normal operation until the fault can be dealt with.

The power unit supplies the operate voltages for these relays and the choice of transformer will be dictated by the types of relays that the constructor is able to obtain. Most surplus relays seem to have 24–28 volt d.c. operate coils. Details of interconnections between the control unit and the masthead unit are shown in Fig. 4.

Control Unit Construction

The power supply and control unit is built into a vinyl-clad steel enclosure approximately 75mm square by 150mm deep. Again no p.c.b. is used as the majority of the components are large, and therefore better mounted directly to the box itself.

No mains ON/OFF switch is provided, therefore the unit is ON as soon as it is plugged into a mains socket outlet. A 1 amp anti-surge fuse is fitted for protection.

Alignment

Pre-amplifiers are always difficult to align properly unless an automatic noise-figure meter is available. Assuming such equipment is not to hand, the most popular method of tuning is to listen to a distant signal of reasonably constant strength, such as that from a beacon. The output circuit is first tuned for maximum signal strength followed by the input circuit for the largest signal to noise ratio.

Using this method it can be very difficult to convince yourself that an improvement in signal to noise ratio has actually been made. The adjustments are not made any easier by the vagaries of propagation.

For those enthusiasts who build more than the occasional pre-amplifier the answer is to build an alignment aid, such as the excellent device described by G4COM in the January 1976 issue of *Radio Communication*. The alignment aid is a simplified noise figure meter and although it does not indicate absolute noise figures, it does indicate any improvement in signal to noise ratio. If alignment of the pre-amplifier is carried out carefully, and everything is working as it should, then the pre-amplifier will not be far off optimum and even a professional noise-figure meter would not enable you to improve the results.

Fitting the Masthead Unit

Probably the biggest deterrent to fitting a masthead pre-amplifier is the problem of weatherproofing. If the pre-amplifier is housed in a properly sealed box, such as the previously mentioned RS Components box, and care is taken to ensure all leads and sockets connected to the box are properly sealed, then few problems should be encountered.

The arrangement used by the author for mounting the prototype system is shown in Fig. 5. A separate box is used to enclose the antenna changeover relay and this may seem unnecessary, but there is good reason for this. If a single larger box was used to house the pre-amplifier and

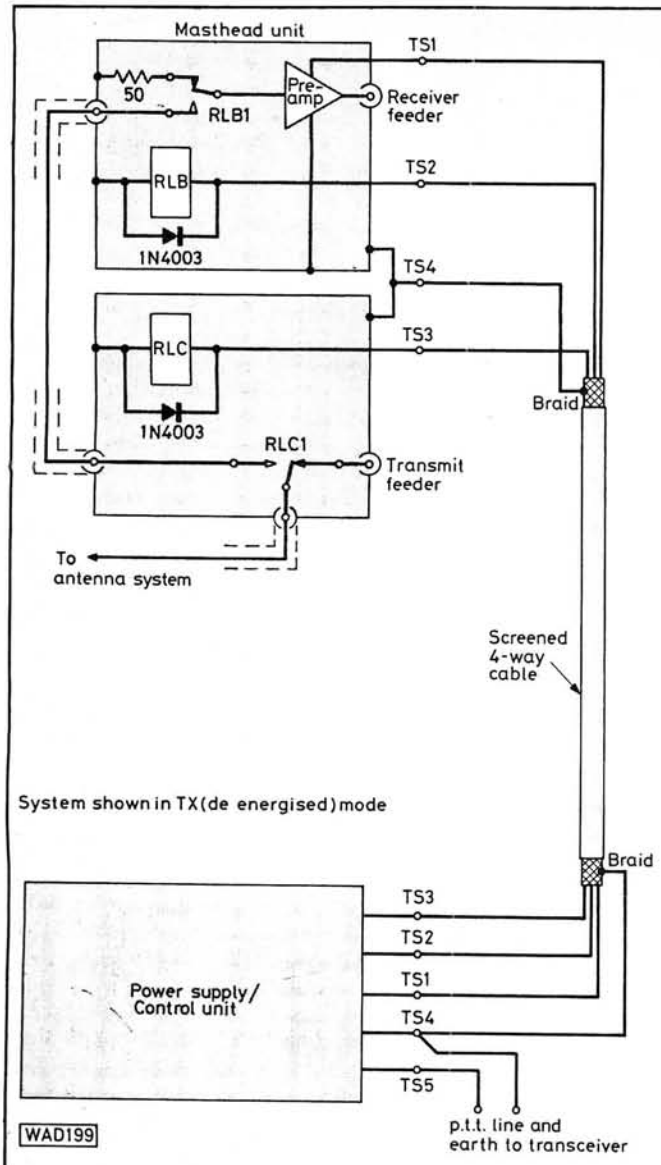


Fig. 4: System interconnections and relay control arrangements of the masthead pre-amplifier

both relays then the ultimate isolation between the antenna and pre-amplifier during transmit conditions would not be realised, due to crosstalk between the two relays. For low transmit power levels it may not be too important, but should be seriously considered if you are contemplating using high power.

Four-way screened lead is used to connect the masthead unit to the power supply and control box. The braid of this cable should be earthed at both ends of the run to maintain screen integrity. Using screened cable helps to prevent unwanted pick-up of noise and r.f. if the cable run happens to be close to other antennas.

Table 1

Parameter	Value
Drain Source Voltage V_{DS}	5V
Gate 1 Source Volts V_{G1S}	−1·75V
Gate 2 Source Volts V_{G2S}	0V
Drain Current I_D	10mA
Operating Parameters for 3SK112 at 430MHz	

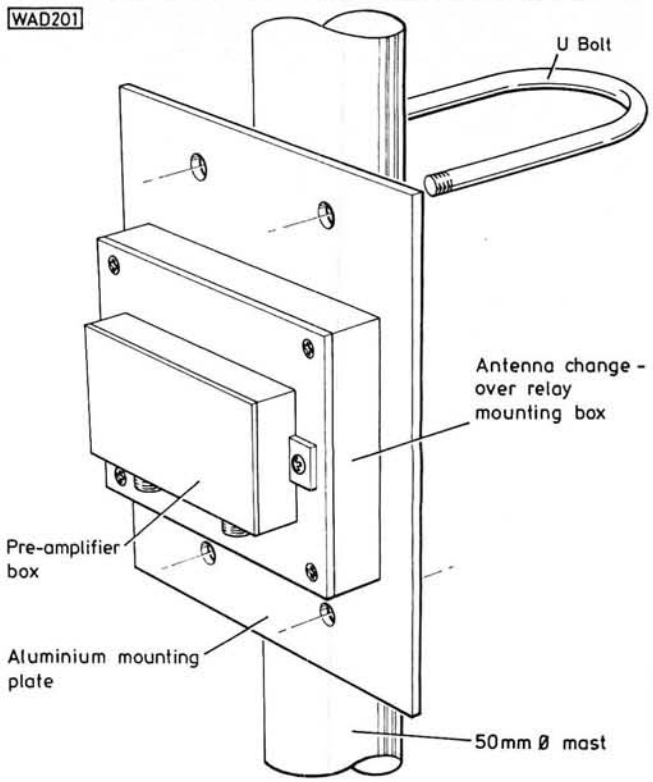


Fig. 5: Masthead mounting arrangements adopted by the author. For increased isolation on TX the antenna C/O relay RLC is fitted inside a separate weatherproof enclosure

Results

Within days of installation of the prototype masthead pre-amplifier system a widespread tropospheric opening occurred. During the opening much DX was worked from the author's Midlands QTH. What was unusual was that many of the stations worked were running only 5 or 10 watts output and were received at signal strengths of only a few dB above noise. It is certain that they would have been inaudible without the extra performance of the GaAs-f.e.t.

Solar noise runs consistently at 3dB over "cold" sky using two 4·2λ long Yagis. When the transmit feeder is used to connect directly into the receive converter no solar noise is detectable at all.

The pre-amplifier has survived severe icing, one of the wettest Springs on record, and several weeks of British Summer heat-wave! ●

Swap Spot

Have UK101 computer with manuals, value £80, signal generator a.m./f.m., 350kHz–20MHz in 5 bands with wobbulator output, TCS12 receiver, B41 v.l.f. receiver. Would exchange for 144MHz gear, HRO coilpacks, Heathkit Mohican info w.h.y. Jim G6ETV. Tel: Kidderminster 3674. *U514*

Have Trio 2200GX mobile/portable 144MHz TX/RX, NiCads, charger, rubber duck, mobile bracket, carry-case. Would exchange for Sony ICF2001. Keith. Tel: 0543 376366 (West Midlands) at weekends. *U515*

Have brand new 25 watt W & D linear and mobile mount for FT-290, gutter mount 7/8 Oscar. Would exchange for working 430MHz 3 or 4-channel set, i.e. Palm IV. R. Goodge, 29 Adamson Court, Broadfield, Crawley, West Sussex. Tel: 0293 25032. *U520*

Have 500pF four-gang variable capacitor. Would exchange for reel-to-reel tape recorder in working order. Chris Aubrey. Tel: 01-370 3992. *U522*

Have an IC $\frac{1}{8}$ scale model stock car, never races, with a Futaba radio system. Would exchange for TR-2500 or similar 144MHz portable hand held or w.h.y. Tel: 0223 862666 (Cambridge). *U528*

Have CB radios, 1 JWR and 1 Tandy hand held TCR 1001. Recent RAE. Struggling with Morse (have Datong will travel). W.h.y? Reg. Tel: 0943 609551 (Ilkley). *U529*

Have Video Genie 1 16K computer. Would exchange for FRG-7000 or FRG-7. W. E. Gates, 16 High Mill Drive, Scarborough. Tel: 0723 365093. *U532*

Have Realistic 140kHz to 30MHz DX 100 L receiver plus Binatone 12 channel hand held CB. Both as new. Would exchange for small dual beam oscilloscope. T. Nolan. Tel: Chester 313857. *U533*

Have Transcom GBX4000 CB radio complete with many accessories. Would exchange for ZX Spectrum 48K or similar computer. Or 144MHz hand held (prefer IC-2E). Peter. Tel: Romford 46538. *U535*

Have MMT144/432R transverter 1·6 shift, 10W out. Standard attenuator plus 7dB attenuator. Would exchange for 144MHz portable or something interesting. Tel: 01-446 4932 (evenings). *U543*

Have Eddystone 730 communications receiver, value £120. Would exchange for good oscilloscope. Can deliver Lancashire or Cheshire area. W. E. Moore, 18 Brunswick Terrace, Stacksteads, Bacup. Tel: Bacup 874928 (7 p.m.) *U563*

Have a 144MHz f.m. full range hand held 1 and 5 watt transceiver including charger. Would exchange for 48K Spectrum Mark III or dual beam oscilloscope. M. Ellis, 13 Dilworth Close, Summit, Heywood. *U566*

Have Racal diversity unit, CB Persuader speech processor, medals, large collection military models 1/96 scale die cast, two h.d. 12V 125Ahr batteries (new). Would exchange for EX W.D. receivers working or not. Can collect. Tel: 0908 314095 (3 p.m.) (Milton Keynes). *U573*

Have Sony ICF 6800W general coverage receiver f.m.—m.w., 29 s.w. bands, s.s.b. s.w. frequency counter, digital readout in good working order. Value approximately £225. Would exchange for VHS video recorder. Mr. Gordon, 24 Stanley Road, Poole, Tel: Poole 686521. *U579*

Have Seagull Sentry 40+ outboard motor. Has had only four hours use from new. Would exchange for IC-2E plus accessories or consider other hand helds. G6XJB. Tel: Waterlooville (Hants.) 4587 (evenings). *U583*

Have AR 88D receiver in perfect working order. Would exchange for good three row button key accordion. R. MacMaster, Shielbridge, Acharacle, Argyll. *U584*

Have parts for H.F. valve linear; valves (813, 805, T100, TZ40) and bases, capacitors (fixed/variable), coils, switches, meters, transformers, and chokes. Would exchange for HRO, Heathkit/USA transceiver, good or faulty, or w.h.y. G4KWL. Tel: 0734 871330 (Reading). *U585*

Have Kodak Carousel S–AV slide projector, good condition with case. Would exchange for 144MHz rig. Full details to Peter G6UMG, 252 Wilson Ave., Rochester, Kent. *U586*

Have Krokus 35 photographic enlarger with lens and trays. Would exchange for 8–10dB 144MHz Yagi beam with mast fittings. C. Gurney. Tel: Rochdale 41462 (evenings). *U587*

Have LCL 40 channel f.m. CB transceiver, s.w.r./power meter, whip antenna, antenna matcher, no p.s.u. Would exchange for ZX81 plus 16K RAM and etc., or amateur gear. W.h.y. Mr. McConnell, 415 Charter Ave., Coventry. *U588*

Have Icom IC-451E 432MHz multimode base station in very good condition. Original packing, all leads etc. Would exchange for Icom R70 or Trio R2000 receiver. Ian. Tel: 0509 502989 after 6 p.m. (Shepshed, Leics.) *U599*

Have TR9000 144MHz multimode, power supply adjustable to 30 volts, microwave modules MML 144/100–5 10 watt in 100 watt out 144MHz linear. Would exchange for FT-221 in very good condition. W.h.y? Tim. Tel: 0795 75093 evenings and weekends (Sittingbourne). *U600*

Have Sony TC-651 reel to reel stereo tape recorder. Logic control, auto reverse, echo, dubbing and mixing facilities. In immaculate condition and including tapes and accessories. Would exchange for modern h.f. transceiver or separates. D. Andrews G4NNP. Tel: 0271 65522 (North Devon). *U601*

Have professional 32K add-on memory for Pet computer. Would exchange for anything 430MHz or TV related. P. Saul. Tel: Towcester 0327-51716. *U614*

Have Nikon EM Camera f1.8 as new. Would exchange for modern communications receiver or scanning monitor. Also have pair Goodmans twinaxioms and monitor audio micromonitor loudspeakers. W.h.y? Mr. Michaels. Tel: Watford 33034 (Room U). *U615*

PW "SWAP SPOT"

Got a camera, want a receiver? Got a v.h.f. rig, want some h.f. gear to go with your new G4? In fact, have you got anything to trade radio-wise?

If so, why not advertise it FREE in our new feature SWAP SPOT. Send details, including what equipment you're looking for, to "SWAP SPOT", *Practical Wireless,* Westover House, West Quay Road, Poole, Dorset BH15 1JG, for inclusion in the first available issue of the magazine.

A FEW SIMPLE RULES: Your ad. should follow the format of those appearing above; it must be typed or written in block letters; it must be not more than 40 words long including name and address/telephone number. Swaps only—no items for sale—and one of the items MUST be radio related. Adverts for ILLEGAL CB equipment will not be accepted.

Midlands VHF Convention

This year's Midlands VHF Convention was held on Saturday, October 15 at the British Telecom Training College, Stone. The change from the previous venue at Wolverhampton Polytechnic was generally welcomed, particularly in view of the ample free on-site parking. The organisers had hoped that visitors might have set up demonstrations in the car park, unfortunately typical v.h.f. contest weather (horizontal rain) sent everyone scurrying for the warmth and comfort of the tea lounge.

A convention is very different from a rally with emphasis being placed on comfortable surroundings, really good catering and the social and technical aspects of the hobby to the virtual exclusion of the frantic commercial flavour of most amateur gatherings.

Throughout the afternoon the measurements area was busy measuring the special characteristics of numerous transceivers up to 10GHz, a considerable quantity of test equipment having been made available by the British Telecom Training College. By far the most popular measurement was sensitivity of 144 and 430MHz handheld f.m. equipment.

Two microwave enthusiasts tested out their 10GHz narrowband systems and were able to see their output spectrum. Several wideband 10GHz systems were also tested and a problem of stability was observed. One intrepid builder brought along a 133MHz v.f.o., for use with a homebrew 144MHz rig, to be aligned and measured.

After the interest shown in the f.m. sensitivity tests it would appear possible to stage a contest for "best on the day" f.m. receiver sensitivity. This would give far less trouble than the previously attempted noise figure contest.

As well as a few select trade stands there was a well stocked bookstall and a busy bring and buy stall. The large and comfortable social area included an exhibition of maps, charts, and other matters of radio interest. After the afternoon lecture session, the evening was rounded off with a buffet and evening bar accompanied by musical entertainment from the South Manchester Radio Club.

The afternoon lecture session was opened by Keith Fisher G3WSN, the RSGB's VHF Manager. He also reported hopes for extended 50MHz operation in the near future including the involvement of Class B licence holders in cross-band operations and the use of c.w. by Class B licence holders in the context of normal telephony QSOs.

He noted the vast quantity of information and reports received about the use of 50MHz. He also said that the 144·875MHz frequency in the beacon sub-band should have been vacated by RAYNET by January 1984, the traffic on this frequency moving to 144·775MHz. RAYNET use of 144·850MHz would continue for the time being. He was less happy about the future of the 430MHz band, the secondary status of the band in the UK and the Syledis problem were particularly worrying. There were various proposals to be discussed at the IARU Region 1 1984 conference to reorganise the 430–435MHz band plan including putting the high-power DX stations near 435MHz. He felt that the implementation of this proposal in the UK could result in us losing 432–433MHz, and reported that the RSGB, in conjunction with the Danish society, EDR, were preparing a paper on the problems of 430MHz. All comments and suggestions would be welcomed and should be forwarded via G3ZNU, the VHF Committee chairman.

The first speaker was Brian Bower G3COJ, who described his experience of 50MHz operation and the history of the band in the UK. He started by recounting the details of a few pre-war transatlantic 5m loggings.

The 1947 WARC found most European societies defunct so the 50MHz allocation was lost in Region 1. However, there was some activity during the 1947 sunspot maximum, permits being generally available. Much of it featured MD5KW (Egypt) who, as G5KW, was sitting in the front row. The first UK transatlantic QSO was recorded in November 1947. By the 1956 sunspot maximum

Keith Fisher G3WSN, introduces Tony Whittaker G3RKL

Testing microwave gear in the Measurement Area

The Bring and Buy stand was popular throughout the day

Band I TV was very well established and only one UK station had a 50MHz permit. There was much cross-band working and American stations worked all continents.

Brian noted the considerable variety of anomalous propagation modes likely to be encountered on 50MHz. These include conventional v.h.f./u.h.f. troposcatter, meteor scatter, aurora and ionospheric modes including F-layer reflection and single and multi-hop sporadic E-layer reflection.

In 1977 it became clear that Band I TV was declining and hope was raised that some permits might be obtained for the forthcoming (cycle 21) sunspot maximum. After some administrative hiccups, near disasters and false starts 40 permits for operation outside TV hours were issued in response to 200 applications for use from 1 February, 1983.

Brian explained how to get started on 50MHz. All that is necessary is a dipole, a converter and some form of talk-back. The most popular time seems to be 0700 to 0830 and there is an active UK 50MHz group with G4JCC, QTHR, as Secretary. It was reported that the final close down of Band I TV was scheduled for 2 January, 1985.

After a brief interval allowing everybody to stretch their legs and get a cup of tea, Tony Whittaker G3RKL, took the stand to describe the GB3SF experimental pilot s.s.b. repeater project. Tony explained that he was not professionally involved in radio and went to some trouble to correct the common misapprehension that GB3SF was to be a linear repeater when it was actually intended to be a single-channel voice repeater. Tony reported that GB3SF was now licensed but unlikely to be operational for some time since it was being built as a student project.

Tony had gone to considerable effort to analyse the channel usage and geographical spacing of existing v.h.f. and u.h.f. repeaters finding 62 144MHz f.m. repeaters equally distributed among eight 25kHz channels and 104 u.h.f. repeaters on nine channels with comparatively low occupancy of the recently designated odd numbered channels. There is considerable geographical overlap on some channels, the average separation between co-channel repeaters on 144MHz being about 150km and on 430MHz about 95km. An "average" 144MHz repeater had its antennas at 250m above sea level which gives a line of sight range of about 55km to a station at sea level and 75km to a station at an altitude of 30m. Tony suggested that an idealised network would have co-channel repeaters every 150km so the 30m a.s.l. station would experience considerable areas of overlap. Tony produced many more charts and statistics to underline his contention that there is a significant need for more repeater channels.

The obvious solution, Tony explained, seems to be to use s.s.b. and an easily realisable 5kHz channel spacing; this would give 40 channels rather than eight in a 400kHz sub-band allowing v.h.f. repeaters to be much more closely spaced without overlap problems. Using this system the country could be covered with a network having only 2 or 3 repeaters per channel.

Tony then outlined the design principles of GB3SF which will have an input frequency of 145·185MHz and an output frequency of 145·785MHz.

After a detailed discussion of the GB3SF frequency plan Tony went on to describe the construction of the 100dB isolation tuned coaxial cavity filters needed for the repeater, showing photographs of these. They provide an attenuation notch of almost 120dB with an insertion loss of some 2–3dB.

Peter Chadwick G3RZP, made a welcome return to give the third lecture on the subject of amplifiers. Peter is well known for his forthright exposition of the home truths associated with many aspects of radio. The purpose of amplifiers, he said, was to make things bigger. An amplifier consisted of a supply, a load and an input control, but even this simple model must run into linearity problems and saturated at some power level.

Peter illustrated his lecture with several fascinating slides, some of which showed actual amplifiers.

The final formal part of the convention was a v.h.f. forum with a panel comprising Jack Hum G5UM, Tom Douglas G3BA, Brian Bower G3COJ, and Keith Fisher G3WSN. This was an opportunity for all those present to raise any v.h.f. topic of interest and get the panel's reactions and thoughts. It was also a useful opportunity for the panel members to discover what topics were of particular concern to the v.h.f. community.

It was clear that the use of the 430MHz band was a very sensitive topic. In spite of this there was much informal encouragement of the use of the 430MHz band both from the panel and from the floor. The possibility of IARU societies agreeing to trade some of the width of some of the u.h.f. and microwave bands for protected, primary status, narrower bands was commented on by panel members, as was IARU concern about the increasing incompatibility of national u.h.f. and microwave allocations.

Much discussion centred around band planning and novice licences. A suggestion that 20kHz f.m. channel spacing be adopted instead of the current 25kHz spacing received very little support. RTTY calling arrangements centred around 145·3MHz were discussed and it seemed that most of the problems arose from the channelised mentality of operators in that part of the 144MHz band.

There seemed to be little real support for the perennially discussed novice licence, the American style novice licence involving limited c.w. only with access to small parts of the h.f. bands would be welcome but a novice licence allowing use of commercial v.h.f. phone equipment would not get much support. The panel expressed hopes that a regular UK 50MHz allocation for Class A and Class B licence holders would be forthcoming by 1986.

Some concern was expressed about the abuse of the UK band plan, particularly by newly licensed operators on the 144MHz band. Several panellists expressed the opinion that, whilst some of the abuse was deliberate, most of it was due to ignorance. It was felt that the incorporation of the band plans into the licence would be a bad thing; however, suggestions to provide information sheets to new licence holders were being actively pursued and a suggestion that band planning be incorporated in the RAE was welcomed and noted for further investigation.

The panel outlined the background to the extraordinary situation which had overtaken their Belgian colleagues, many aspects of this only serving to underline the importance of a strong national amateur radio society enjoying the support of the majority of the country's licensed amateurs and a good working relationship with the licence issuing authority. ●

Kindly Note

PW Dart, November 1983

Diode D2 in the circuit diagram, Fig. 1, should be an 8·2V Zener diode BZY88. Also capacitor C3, 1nF, should be inserted into the line joining the top ends of C2 and C4.

UPGRADING THE DX160

by Charles Molloy

The Realistic DX160 communications receiver was for several years available from Tandy in the UK and Radio Shack in the United States. There are still quite a few in use according to a recent survey reported in *DX Party Line* from HCJB (Voice of the Andes) and they can be picked up secondhand for quite a modest sum. This set has five bands. One from 150kHz to 400kHz includes long-wave broadcasting and navigation beacons while four others give continuous coverage from 535kHz to 30MHz. In addition to features one would expect, such as bandspread, antenna trimmer, r.f. gain control, noise limiter, S-meter, and product detector, there are also facilities one would normally find only in a more expensive set. There is amplified a.g.c., a front panel a.g.c. time constant switch with fast and slow action, a socket and plug for standby operation and the "front end" uses f.e.t.s.

The DX160 is a rather interesting, well-made set, attractive in appearance, easy to use and probably underrated performance wise. It operates either from the mains or 12 volts d.c., the latter feature attracting it to the writer who was looking for a receiver for use in a caravan and boat. Rather than leave it idle during the winter it was decided to try to hot it up so that it could be used as a second receiver for DXing. The only constraint was that it should be easy to restore it to its original state. This was imposed, not so much to maintain any resale value as to ensure that the set was still fit for mobile use the following season. Drilling holes or making changes to the printed circuit wiring, was out.

Digital Readout

Once you have used digital readout you cannot do without it. Tuning round the bands is so easy. As an Honest Frequency Meter model FC5M was in use with another receiver, a coaxial socket was fitted to the rear of the DX160 so that the FC5M could be plugged into this set as well.

In principle it should be easy to connect up an external digital readout. All you have to do is to tap onto the receiver's local oscillator. Provided the frequency meter has the correct offset, i.e. it will subtract the value of the i.f., the correct frequency will be displayed. The problem is how to do it without upsetting the local oscillator. A small amplifier acting as a buffer would certainly solve the problem but it is possible to manage without one. Tap a fixed capacitor onto the junction of C12, R32 and the drain of Q8, a convenient soldering point being at C12 (Fig. 1). C12 is located on the main p.c.b. which is on the left hand side of the set as viewed above from the front. It is signwritten on the top side of the board. The other end of the new capacitor goes to a coaxial socket fitted in place of the EXT STD BY socket at the rear. The wires from the latter are tied back and insulated from each other so that the external standby facility can be restored in future. The type of coaxial socket that stands proud will fit into the space available, even the holes for the self tappers line up.

The Realistic DX160

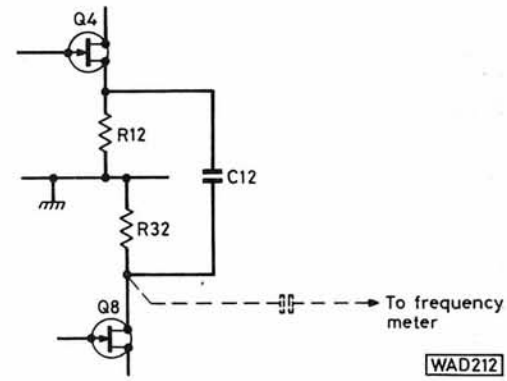


Fig. 1: DX160 digital readout

A 10pF fixed capacitor was used but the value may have to be found by trial and error if another frequency meter is used. It is a compromise between providing sufficient voltage at the lowest frequency and causing the least disturbance at the highest. A value of 33pF gave a good steady reading with the set tuned to 150kHz but detuned it by 7kHz and weakened the signal slightly on the 26MHz band, 4·7pF gave an unstable reading on the long waves.

Band E

On this band (13MHz to 30MHz) the frequency displayed was 910kHz lower than it should have been. This value is double the i.f. (455kHz) and occurs because the local oscillator is adjusted to a frequency lower than the signal. On the other four bands the oscillator is higher than the incoming signal. This is not such a disaster as might at

first appear. Subtract 90kHz and the last three digits of the display will be correct. If you want to set up on a particular channel there is always the pocket calculator to fall back on.

An examination of the circuit showed that while padders (C37, C39, C40, C41) were in use for bands A to D, there was none for band E so the oscillator could just as easily be set above as below the signal frequency. It turned out to be a simple job to make the changeover. Since the tracking points were unknown it was assumed they would be 14MHz and 28MHz. Set the pointer to 28MHz and make a note of the actual reading on the digital display (not what it should be). Add 910kHz and call this f1. Now set the pointer to 14MHz, add 910 to the figure displayed and call this f2. Adjust the reading on the display to f2 using a non-magnetic trimming tool on the core of T15. Now set the pointer to 28MHz and adjust trimmer CT10 until f1 is displayed. Go back to 14MHz and readjust T15 and come back to 28MHz for a final touch on CT10. A 10pF capacitor bridged across CT10 will extend its range if necessary, the most convenient place to fit one being on the oscillator section of the wavechange switch, from the tag with the black wire to chassis.

If the mod is done this way there should be no need to re-align the r.f. circuits. If a signal generator is available then check the alignment and while you are at it check bands A to D as well.

Selectivity

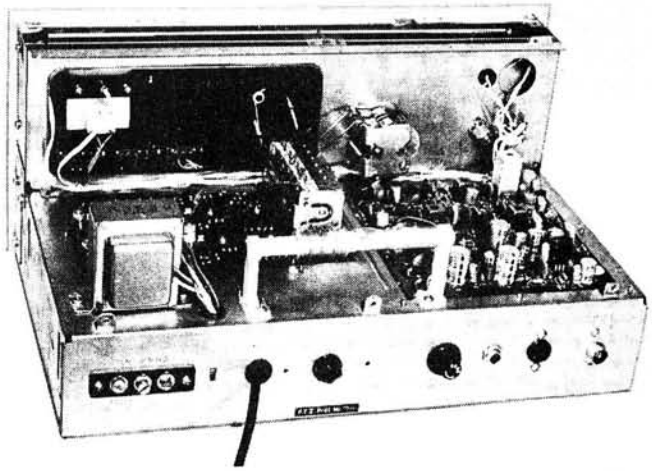
According to the users' handbook the bandwidth of the DX160 is 4kHz at the 6dB points and 18kHz at 40dB. Not bad for short wave programme listening but not so good for DXing. Selectivity is obtained from a ceramic filter and three adjustable single tuned i.f. transformers T16, T17 and T18. The ceramic filter is housed in the same can as T16. The DX160 is an inexpensive set which is likely to have been "aligned" on the assembly line. Some may never have been really spot-on, a conclusion reached as a result of the widely different accounts given of this set's performance.

It is not difficult to check if T16, T17 and T18 are peaked onto the ceramic filter. They are located in a row, parallel to the front panel on the top of the left hand printed circuit board as viewed from the front of the set. They are clearly signwritten, each slug being a different colour. T16 is red, T17 is white, T18 is black. You will need a trimming tool and preferably a signal generator though you can get away with tuning the set to a weakish signal giving a peak around 4 on the lower scale of the S-meter. The medium or long-waves in daylight should deliver a suitable signal. Mark the position of the slug's screwdriver slot in pencil on the can so that you can go back to it if necessary. Adjust the core slowly in either direction for a peak on the S-meter. Do one at a time and check if the receiver is functioning properly before moving to the next.

Sharpening the I.F. Responses

If you are adept enough to work on a p.c.b. with a small soldering iron then you can sharpen up selectivity. Simply replace the emitter bypass capacitors C16 and C19 with ceramic resonators. These capacitors are used to prevent negative feedback with consequent drop in receiver gain. Remove one and the output drops dramatically. Replace with a 455kHz resonator and the gain is restored but only close to 455kHz. The result is an improvement in selectivity.

Start with C16 which is the easier of the two. It is found between T16 and T17 close to Q5, all being signwritten on the component side of the board. The emitter, base and



collector of Q5 are labelled e, b, c on the lower side of the board, which helps in locating the solder points of C16. Using a small size soldering iron and a desoldering aid such as solder braid or a suction device, remove C16. The hole spacing on the board corresponds to the pin spacing of the resonator so the latter pushes in easily in place of C16. Solder below the board, check T16, T17 and T18 and try out the set.

If a further increase in selectivity is required, repeat the operation with C19 which lies between T17 and T18 and close to Q6. This time there is a problem as the hole spacing is wider but it is possible to spread out the flat pins of the resonator so that the tips partially enter the holes left by C19, from below the board, where they are soldered in place.

The ceramic resonators used are available from Ambit—ask for CFE455, 455kHz series type, stock number 16–45575. The dimensions are approx. 9 × 8 × 3mm with 5mm pin spacing and they are, if anything, slightly smaller than C16 and C19 which they replace.

Wide/Narrow Selectivity

A receiver with fixed selectivity must be a compromise. If the selectivity is narrow, sideband cutting will occur. If it is wide, better quality audio will be paid for by an inability to winkle out DX. After C16 and C19 were replaced with resonators, sideband cutting was evident and detuning had to be resorted to for programme listening. The capacitor C19 value 40nF, which was now spare, was tapped across the resonator fitted in its place. This brought an immediate improvement to audio quality. One wire from this capacitor was now soldered onto the live side of the resonator (farthest from front panel) and a lead from the other wire led off to a switch and chassis. The front panel standby switch and its wiring, which comes to the main board, were used. The two wires from the switch, red and mauve, were cut at the board and leaving behind a couple of millimetres with insulation so that the solder points could be found again in the future. The red wire was soldered to chassis and the mauve wire to the "free" end of the 40nF capacitor (ex-C19).

In order to prevent the receiver being permanently on standby, go back to the two wires removed earlier from the standby socket and solder them together. If the standby socket was not removed, then insert a shorting plug in it. The standby switch now offers wide selectivity when in the REC position and narrow when moved to STD BY.

Using a Medium Wave Loop

Although there is a version of the DX160 that has a screened antenna tuning inductor (T2), the model in the possession of the writer has a ferrite rod antenna. It is mounted above the chassis close to the hardboard back and replaces T2 and also T3, the latter being the longwire coil. This ferrite rod performs a dual function being a tuning inductor as well as antenna. If it is removed then the receiver will not work on the medium waves or long waves.

Although there is a coupling winding on the ferrite rod which goes to the A1 and A2 terminals so that a loop antenna can be connected up, the loop is virtually useless. It cannot null out a signal picked up by the ferrite rod so its directional properties are masked. Since the cabinet is made of metal it is only through the hardboard back that signal pickup is possible. Replace the back with a metal one and the ferrite rod should be screened and the loop will be effective. As an experiment, the hardboard back was covered in kitchen foil. When refitted, the medium wave band, without antenna connected, was quiet except for a few strong local stations which now were barely audible. The loop performed very well and even when a few ventilation holes were cleared through the foil, near the sides, it continued to do so.

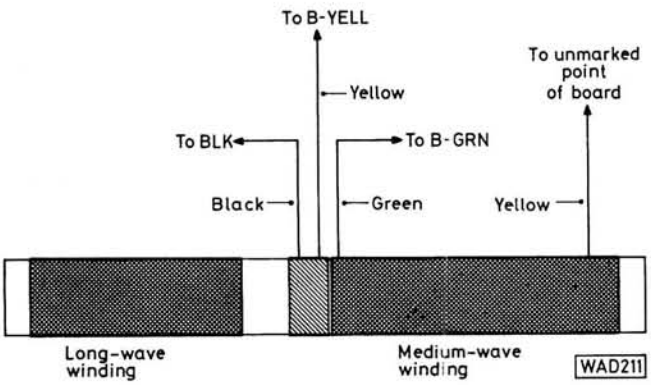


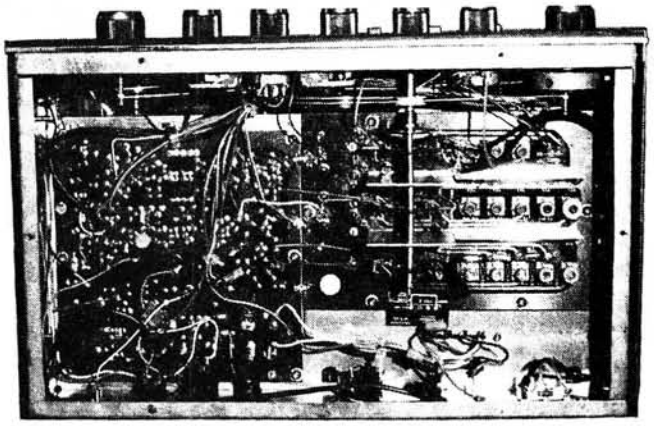
Fig. 2: Ferrite rod antenna, viewed from rear

Sensitivity on Medium Waves

Poor sensitivity on the medium waves is a complaint often made about the DX160 and one that is justified by the receiver specification. This quotes 50μV for band A, 100μV for band B (medium wave) and either 3μV or 4μV for bands C to E, all for a signal-to-noise ratio of 10dB, measured as (S+N)/N. It seems likely that the DX160 has been deliberately downgraded on the medium waves to ensure freedom from overloading on a band normally used for picking up local entertainment.

A modern screened r.f. transformer as a replacement for the ferrite rod antenna ought to provide a remedy and such a component, RW06A6408, stock number 35-64080, was obtained from Ambit. The base connections are shown in Fig. 3 and the ferrite rod antenna as viewed from the rear, is shown in Fig. 2.

There are four wires coming from points on the p.c.b. to the medium wave winding on the ferrite rod. These should be cut near the winding and taken to the new r.f. transformer instead. Start with the yellow wire on its own on the right (Fig. 2). It is cut near the winding and the free end soldered to pin 1 (Fig. 3). Move now to the three wires on the left hand side of the winding. The green one which comes from a point marked B-GRN is now terminated on



pin 6, the black one from BLK goes to pin 3 and the remaining yellow wire coming from B-YELL is soldered to pin 4. The new r.f. transformer is soldered to a small bracket which is attached to the rear of the main tuning capacitor using the small screw that holds on a wiring clip. The four short ends of the wires left on the medium wave winding on the ferrite rod are tied onto the rod so that they are available in the future.

All that remains is to peak up at the l.f. end of the band using the slug on the new transformer, making sure that the antenna trimmer on the front panel is operative at the h.f. end. If not, then re-adjust the slug. There is no need to replace the hardboard back with a metal one as the ferrite rod antenna is now inoperative.

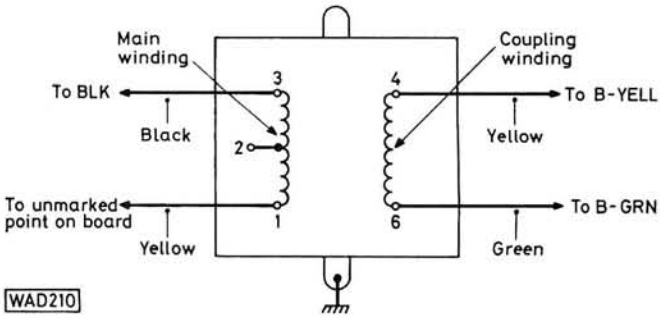


Fig. 3: Medium wave r.f. transformer connections

General Information

A copy of the DX160 circuit diagram, along with some notes, is available from the European DX Council, PO Box 4, St Ives, Huntingdon, PE17 4FE. Send 50p or three IRCs if abroad, and ask for the DX160 Receiver File. The circuit is of the version that does not have a ferrite rod antenna and the common end of the r.f. coupling windings instead of going to A2 are shown connected to chassis. This is probably an error in the drawing otherwise there would be no balanced antenna input.

The power socket at the rear of the DX160 allows 12V d.c. to be connected in place of the mains supply. There is no switching but there is a diode to protect against reverse polarity. The pilot lamps are run from their own winding on the mains transformer and do not light up when the set is run from batteries. As a result the power consumed is only 37mA with the volume at minimum which makes it

continued on page 78▶▶▶

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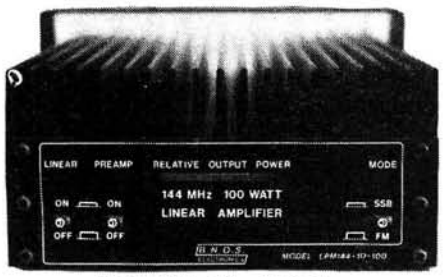

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Top-Band Dir

by Chris Plummer G8APB

In the second part of this article the author's receiver is described with sufficient detail to enable you to build one for yourself.

The receiver was developed by Bill North G3TRY and the author and is constructed on a single printed circuit board.

The Circuit

The basic set is designed around the now elderly TAD100 integrated circuit, but the newer TAD110 can be used as a direct substitute. The oscillator, mixer, detector, and audio pre-amp. stages are in the i.c. and a separate f.e.t. r.f. amplifier and a bipolar audio amplifier and beat frequency oscillator are also provided. The TAD100 has, unfortunately for our purposes, internal a.g.c. but this can be disabled by putting a preset d.c. bias voltage on pin 1 via the mixer coil.

Looking at each of the stages separately and noting their particular features you will see that all r.f. signals enter the set via a tuned frame or ferrite rod antenna if the case screening is effective. The construction of a frame or loop is relatively simple, the size can be adjusted to suit the case chosen for the set and can form the carrying handle for the unit. Construction can be of wood bound with sticky insulation tape and the wire let into a groove, or a metal frame screen such as a trough of aluminium, with the wire inside the trough. Make sure, however, that the aluminium trough does not act as a shorting loop to the antenna or you won't hear much. The gap in the trough can be bridged with wood or a plastic material. A ferrite rod antenna is fairly simple to make by winding the coil on the centre of the rod and fitting it either in an insulating tube mount, or a metal tube with a slot (Fig. 2.3). As with the frame antenna the rod mounting can be used as the carrying handle. One thing to remember is that the bearing is taken along the axis of the coil, i.e. at right angles to a frame antenna and along the axis of a ferrite rod.

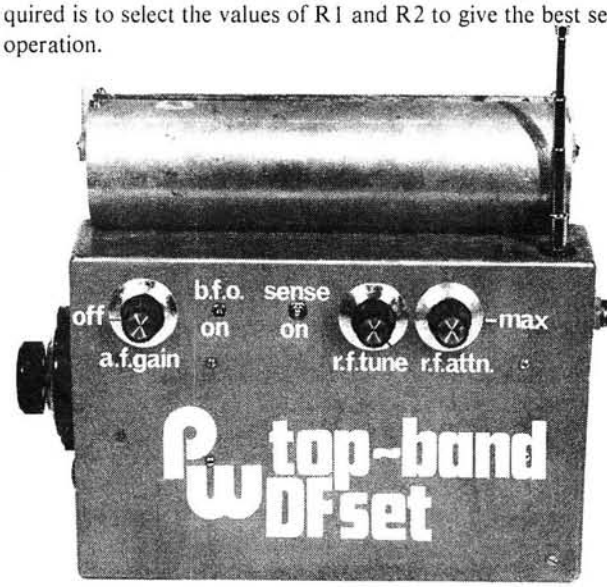
The r.f. stage is a fairly common arrangement, but here screening is important as leakage from the antenna across the r.f. stage can cause errors and confusion when close in to the transmitter. Attenuation of the incoming signal is by a variable resistor in the base of the 2N3819 f.e.t.

The TAD100 forms most of the circuitry with the exception of the tuned circuits. The oscillator is fairly standard and tends to be relatively easy to get going, the tuning range is (1·81–2·0+i.f.)MHz, i.e. 2·275–2·465MHz plus a small amount at both ends to allow for calibration. The local oscillator is deliberately set on the high side of the received signal to avoid i.f. image interference from medium wave signals.

The audio stage is self explanatory and needs no alignment. It will drive any commonly available high-impedance headphones. Headphones are used, of course, to keep your information to yourself and also help concentration, as well as being lighter, both in weight and battery consumption, than a more powerful amplifier and a loudspeaker.

The b.f.o. is a transformer feedback oscillator and only requires that the feedback winding is connected the right way round followed by a quick tune and adjustment of the injection to maintain oscillation and correct operation.

The final stage to consider is the sense amplifier. This is an untuned stage that amplifies the signal from the separate telescopic whip antenna and combines it with the signal from the main antenna at the correct level and phase relationship. This enables the operator to determine the correct direction from the main antenna, as previously described. The only adjustment required is to select the values of R1 and R2 to give the best sense operation.



BUYING GUIDE

Most of the components used are readily obtainable from advertisers in *PW*. The TAD100 can be obtained from Watford Electronics. The p.c.b. is available from the usual suppliers or from the author QTHR. Toko coils and formers can be obtained from Ambit International. A suitable "vernier slow-motion drive" is available from Maplin Electronics as RX40T vernier dial medium. Electrovalue stock Jackson variable capacitors.

Approximate Cost £34

Construction Rating INTERMEDIATE

ection Finding

Part 2

The set has been built by some 150 people either for use as a good simple Top Band receiver or as a d.f. set and very few problems have arisen. The p.c.b. design, which is a single-sided board approximately 150 × 50mm, is set out with plenty of room to use "junk box" components. Toko coil formers are recommended for the local oscillator and mixer coils, but unfortunately no prewound coils are available and to use these coil formers you need 42 s.w.g. enamelled wire or finer to be able to get all the turns required on the bobbin. It is of course possible to use other formers without problems but the turns will probably have to be adjusted. The filter is a standard Toko CFT455C, similarly the b.f.o. coil is a standard prewound unit. Three forward-biased 1N914 silicon diodes have been used to produce a reference voltage of about 1·4V as it was the cheapest way, but a 1·5 to 2V Zener could be used.

The complete receiver is built into a die-cast box. The author's prototype used a box 222 × 146 × 55mm in size. Remember that in use the receiver will probably be subjected to rain, mud, floods and other extremes of climate and temperature so make sure that there are no unnecessary holes in the case. The two-gang capacitor (C21,22) could be a Jackson C808 or other split-stator type according to price and availability.

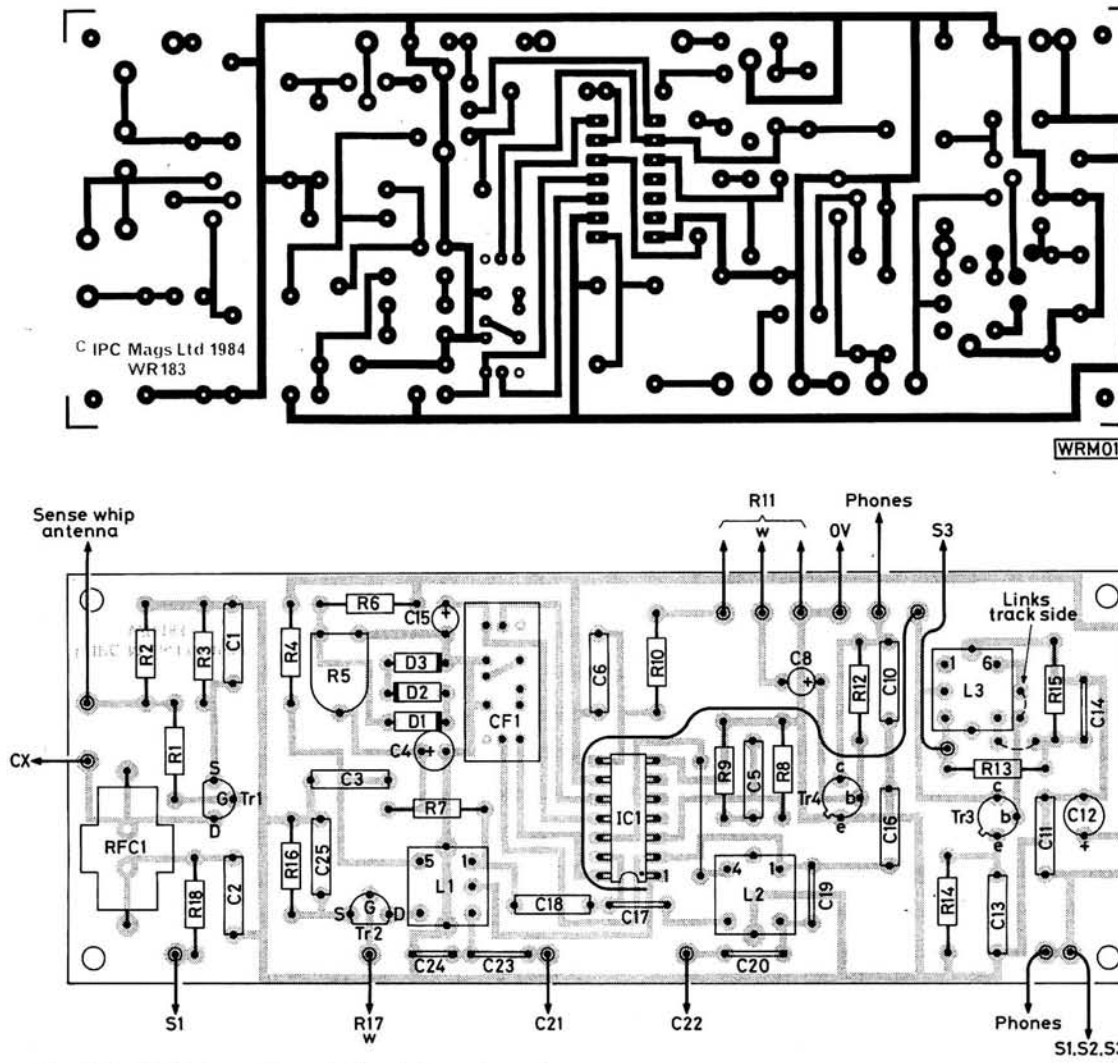
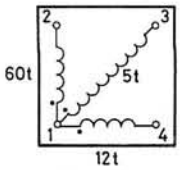
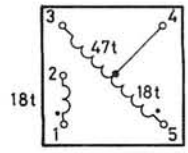


Fig. 2.1: Full size printed circuit board track pattern and component placement drawing. Note the insulated lead coupling the b.f.o. output to the general area around IC1 pin 1. Its route is not critical but care must be taken to ensure that it does not short to any other component

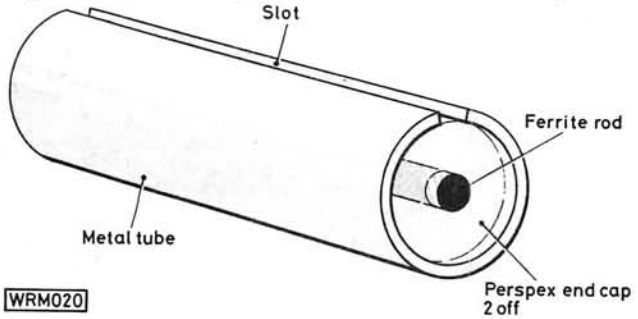




WRM018

Viewed from top

Fig. 2.2: Coil winding details for (left) L2 and (right) L1



WRM020

WRM021

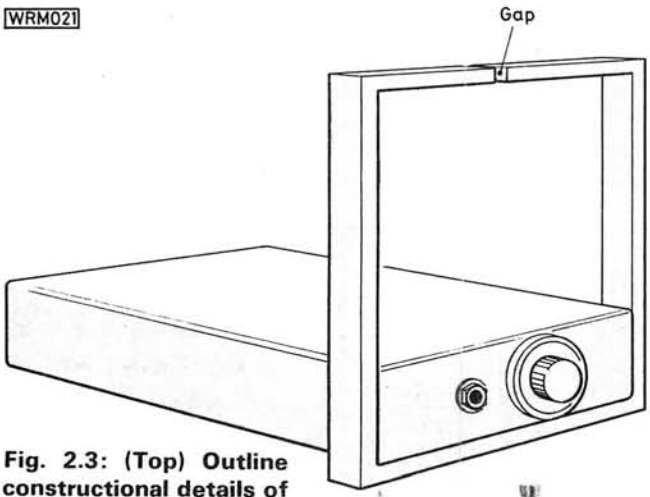
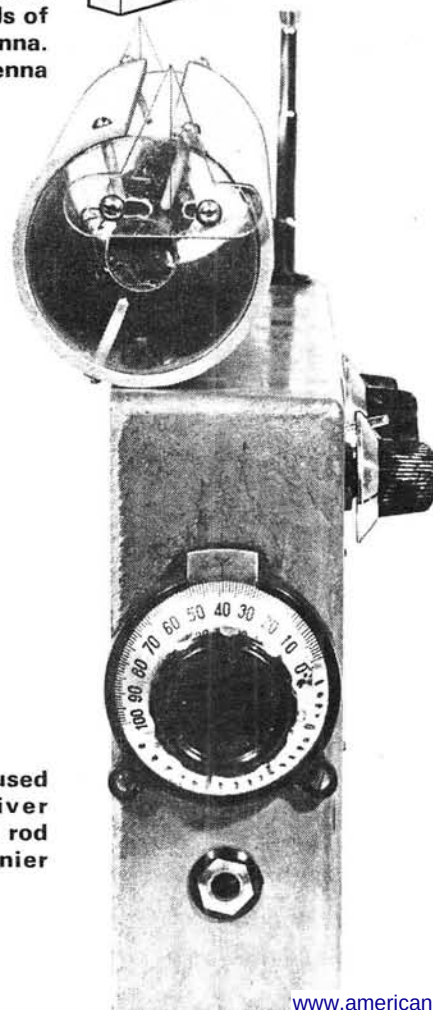


Fig. 2.3: (Top) Outline constructional details of the ferrite rod antenna. (Above) Frame antenna details



The author's much used prototype receiver showing the ferrite rod antenna and vernier tuning dial

★components

Resistors

Carbon Film ¼W 5%

150Ω	1	R18
180Ω	1	R9
220Ω	2	R4,16
470Ω	1	R10
820Ω	1	R8
1kΩ	1	R14
3·3kΩ	1	R6
4·7kΩ	1	R3
5·6kΩ	1	R7
10kΩ	1	R15
47kΩ	1	R2
68kΩ	1	R13
470kΩ	1	R12

Potentiometers

Min. Horizontal Preset

5kΩ	1	R5

Midget Carbon Track

5kΩ (Log)	1	R11 (with switch)
100kΩ (Lin)	1	R17

Capacitors

Polyester

10nF	9	C1,2,3,7,9,10,11,13,25
47nF	3	C5,6,18
100nF	1	C16

Ceramic Plate

100pF	2	C19,24
220pF	2	C20,23
1nF	1	C14
2·2nF	1	C17

Tantalum Bead

0·33µF	2	C8,15
4·7µF	1	C4

Electrolytic

22µF	1	C12

Air-spaced Variable

50pF	1	C26 (Jackson C804)
50+50pF	1	C21,22 (Jackson C808)

Semiconductors

Diodes

1N914	3	D1,2,3

Transistors

BC108	2	Tr3,4
2N3819	2	Tr1,2

Integrated Circuits

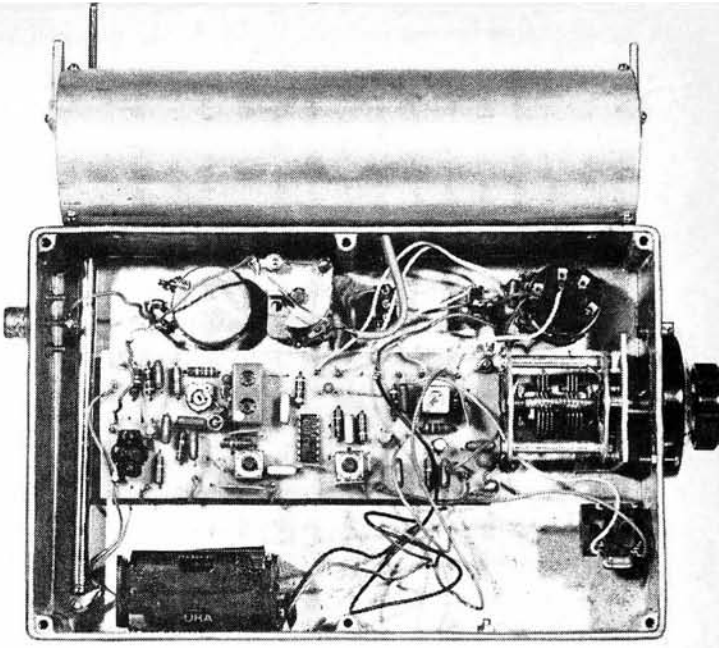
TAD100	1	IC1

Miscellaneous

Ceramic filter (CF1) Toko CFT455C; Coil (L3) Toko YRCS12374ACS; Coil formers Toko 10K (2); Min. toggle switches s.p.d.t. (2); Slow motion dial; Jack socket ¼inch; Battery holder; Diecast box; Telescopic antenna; Ferrite rod (see text); Knobs (3); Choke (RFC1) 2·5mH; Material for ferrite rod or frame antenna (see text).

Alignment Notes

1) Beat frequency injection is achieved by taking an insulated wire from the collector of the b.f.o. transistor to somewhere near the TAD100. No direct connection will be required.
2) Set the i.f. gain control preset for maximum signal.
3) Depending on the local oscillator and mixer coil windings select those capacitors marked * (Fig. 1.4) to achieve correct bandspread and tracking.
4) The main antenna frame (200 × 250mm) can be made of hardwood or metal (remembering the break if metal is used), with windings to suit tuning, say about 13 turns. A 200mm long ferrite rod 10 or 12·5mm diameter with about 25 turns wound on it mounted in a plastics or split metal tube could also be used.
5) Select resistors R1, R2, R3 and R4 to give best operation. Typical values would be R1 = 7·5kΩ, R2 = 620Ω, R3 = 220Ω, R4 = 230Ω. Use a 10kΩ preset in place of R1 for setting up. Set R1 to about 7·5kΩ and select R2 to give a drain current of about 3mA. To select R1 to give best sense operation use the following method. Set up a friend with a transmitter and travel about 5km away into open countryside. Adjust R1 to give the best sense circuit operation, i.e. greatest front to back ratio. Measure the value of the preset and replace with the nearest preferred value resistor.
6) Capacitor Cx is approximately 2pF and is made from a twisted pair of insulated wires 30mm long.
7) Set the local oscillator range on high side of 1·81–2·0MHz and then peak the mixer coil at midband.



Acknowledgements

My thanks must go to Bill North for the initial design work and trials, to Eric Mollart for the urge to write it down and Roy Powers G8CKN for being the "Devil's Advocate."

Good luck and good d.f.ing de Chris G8APB.

Further Developments

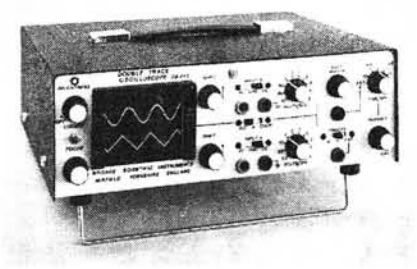
The receiver described is obviously of a specialised nature but can form the basis of a Top-Band monitor receiver and this will be described in another article. ●

Products

New British Oscilloscope

A new general-purpose, dual trace oscilloscope announced by Bridage Scientific Instruments Ltd. of Skipton, costs only £195 (excluding VAT) and is British built. Designated the Bridage DB242, the instrument has been specially developed to take into account the needs of educational and industrial laboratories, test bays and service departments. Compact and highly portable, the new oscilloscope is also suitable for radio and TV maintenance, electronics enthusiasts and radio amateurs.

Speed and simplicity of use are two important parameters that have been applied in producing this instrument, which is both easy to understand yet highly versatile. This is immediately apparent in the display, in which a medium persistence phosphor gives



good trace readability on the 60 × 50mm display screen on which a calibrated graticule is superimposed. Considerable time savings in use may be achieved, utilising the trace location button which returns overscanned traces to the screen regardless of the setting of other operating controls and the auto brightline triggering system.

Simple, reliable, advanced circuit techniques are employed to provide a worthwhile specification. Sensitivity can be varied from 50mV/cm in independent switched sequences for each channel. Sweep speeds can be varied between 1µs/cm and 0·2s/cm using calibrated switch positions.

Designed and manufatured in Britain, the Bridage DB242 oscilloscope uses safety approved components that comply with British and EEC standards. An even more economically priced single trace version, the Bridage DB121, possesses a similar general specification, but without the twin channel facilities, and costs only £175 (excluding VAT).

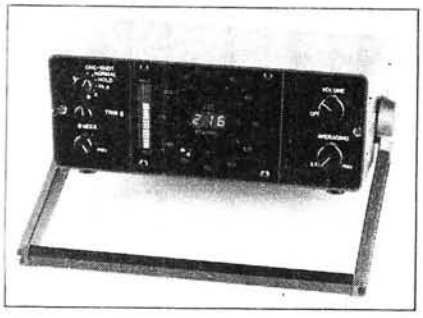
For further details contact the manufacturers: *Bridage Scientific Instruments Ltd., 63–65 High Street, Skipton, North Yorkshire BD23 1EF. Tel: (0756) 69511.*

New DF System

The latest radio direction finding system from Datong Electronics Ltd. is the Model DF2. which utilises a proprietary error-cancelling version of the Doppler principle and is intended for general professional applications from h.f. to u.h.f., both in mobile and base station situations. It can handle signals carrying most types of modulation including f.m., a.m. and s.s.b.

Being microprocessor-based, the system offers a high degree of operational flexibility plus special signal processing techniques which reduce bearing jitter under multipath conditions or heavy signal modulation. This is achieved by real-time digital averaging of the incoming data. The averaging period is panel selectable from 0·065 to 6 seconds yet the special software always ensures that the response time to new signals remains constant at 260ms.

Bearings are immediately presented in both polar and digital form. The polar display gives five degree resolution on a circle of 36 l.e.d.s, while the 3-digit display in the centre of the circle gives one degree resolution. A separate 20-



l.e.d. bar array indicates signal strength (when connected to the receiver's a.g.c. line).

Other advanced features of Model DF2 include: storage and display of last received bearing without errors caused by "squelch tail"; remote display option; "sample-and-hold" mode; regular autozeroing for non-digital circuits; single coaxial cable link to head unit; cancellation of errors due to receiver phase-shifts.

For further details, apply to: *Datong Electronics Ltd., Spence Mills, Mill Lane, Bramley, Leeds LS13 3HE. Tel: (0532) 552461.*

More on page 59

Benny

SPECIAL PULL-OUT FEATURE

PW RADIO DATA

part 2 - Valve & Semiconductor Codes + Trademarks

Every valve and semiconductor carries a type number. Some can tell you a lot about the characteristics of the device—others are not much better than a serial number. This month we list some of the more useful codes, both past and present; some of them are "House Codes" used by just one manufacturer, others are more widely used, like the European Pro-Electron code. Knowing these codes can help you find your way through unfamiliar circuits.

When you want to find out more about a particular component, knowing who made it can be a great help. Often the identification is just a trademark; no room for the company's name. The last three pages of our Radio Data feature this month show the trademarks of 75 radio/electronics manufacturers.

MULLARD House Code
Semiconductors e.g. O A _ 9 0 _

IDENTITY	CLASS		SERIAL NUMBER
The letter O indicates a semiconductor device	A	Diode or Rectifier	Has no significance except:
	AP	Photodiode	DIODES
	AZ	Voltage Regulator Diode (Zener)	Germanium–2 figure serial numbers
			Silicon–3 figure serial numbers
	C	Transistor	TRANSISTORS
	CP	Phototransistor	Germanium–serial numbers up to 199
	RP	Photoconductive cell	Silicon–serial numbers 200 and over

PRO-ELECTRON
Semiconductors e.g. B C 1 0 7 – _ _ _ _

MATERIAL	CONSTRUCTION	SERIAL NUMBER	RANGE NUMBER
A Germanium	A Signal diode	Devices for domestic use—3 figures	Additional information covering a range of variants of a basic type
B Silicon	B Variable capacitance diode	Devices for industrial use—one letter (Z,Y,X, etc) followed by 2 figures	Rectifier Diodes & Thyristors: The group of figures indicates the p.i.v. rating
C Compound materials such as gallium arsenide	C Small AF transistor		The final letter R denotes a reverse polarity (stud anode) version. (n.b. Thyristors, by convention, are normally stud anode, and therefore end in R)
R Compound materials such as cadmium sulphide	D AF power transistor		Voltage Regulator Diodes: The first letter gives the voltage tolerance: A = 1% D = 10% B = 2% E = 20% C = 5% The group of figures indicates the working voltage, the letter V being used to denote the decimal point. The final letter R denotes a reverse polarity (stud anode) version
	E Tunnel diode		
	F Small RF transistor		
	G Multiple device		
	L RF power transistor		
	N Photo-coupler		
	P Radiation sensitive device (Photodiode etc.)		
	Q Radiation generating device (l.e.d.)		
	R Small thyristor		
	S Small switching transistor		
	T Power thyristor		
	U Power switching transistor		
	X Multiple diode (e.g. Varactor or step recovery diode)		
	Y Rectifying, boost or efficiency diode		
	Z Voltage regulator diode		

SEMICONDUCTORS

JEDEC Code (USA)
- 1N – – – Diode
- 2N – – – Transistor
- 3N – – – 3-junction device (e.g. dual-gate f.e.t.)
- 4N – – – 4-junction device (e.g. opto-isolator)
- 6N – – – 6-junction device (e.g. Darlington opto-isolator)

GEC/Mullard House Code
- GEX – – – Germanium Diode
- GET – – – Germanium Transistor

HUGHES (EMIHUS) House Code
- HG – – – Germanium Diodes
- HS – – – Silicon Diodes

LUCAS House Code
- DD – – – Diode
- DT – – – Transistor

TEXAS House Code
e.g. 2 S 1 0 4

DEVICE	MATERIAL	SERIAL NUMBER
1 Diode 2 Transistor	G Germanium S Silicon	

NEWMARKET House Code
Semiconductors
Silicon

e.g. NKT 3 5 2 1 9

FABRICATION	FREQUENCY (f_T)	GAIN (h_{FE})	V_{CBO}	SERIAL NUMBER
1 Epitaxial *npn* 2 Epitaxial *pnp* 3 Diffused *npn* 4 Diffused *pnp* 8 FET	0 Less than 100MHz 1 100MHz minimum 2 200MHz minimum 3 300MHz minimum etc. up to 9 900MHz minimum	0 Less than 10 1 10 min. 2 20 min. 3 40 min. 4 80 min. 5 160 min. 6 320 min. 7 640 min. etc.	0 Less than 15V 1 15V min. 2 30V min. 3 45V min. 4 60V min. 5 90V min. 6 120V min.	

MAZDA
Receiving Valves
(Signal)

e.g. 10 F D 12

	FILAMENT OR HEATER RATING	CONSTRUCTION	SERIAL NUMBER
P/S 1 1·4V P/S 6 6·3V S 10 0·1A S 20 0·2A S 30 0·3A		C Frequency changer with special oscillator section D Signal diode(s) F Voltage amplifier tetrode or pentode K Small gas triode or tetrode L Voltage amplifier triode or double-triode including oscillator triode M Tuning indicator P Power amplifier, tetrode or pentode	
Parallel or Series operation		NOTE—2 letters may be used for multiple valves	

PRO-ELECTRON
Integrated Circuits

e.g. T B A 5 7 0 A Q

SOLITARY CIRCUITS	S Digital T Analogue U Mixed	H Hybrid otherwise no special significance	A Not specified B 0 to +70°C C −55 to +125°C D −25 to +70°C E −25 to +85°C F −40 to +85°C G −55 to +85°C	A 4-digit number or A Serial Number (combination of figures and letters)	C Cylindrical D Ceramic d.i.l. F Flat pack P Plastics d.i.l. Q Quad-in-line U Uncased chip Z Customised	ONE-LETTER SUFFIX
DIGITAL FAMILY CCTS	TWO FAMILY IDENTITY LETTERS				SHAPE –C Cylindrical –D Dual-in-line –E Power d.i.l. –F Flat (leads on 2 sides) –G Flat (leads on 4 sides) –K Diamond (TO-3 family) –M Multiple-in-line (more than 4 rows) –Q Quad-in-line –R Power q.i.l. –S Single-in-line –T Triple-in-line	MATERIAL C Metal-ceramic G Glass-ceramic (cerdip) M Metal P Plastics	TWO-LETTER SUFFIX
MICROPROCESSORS	TYPE LETTERS MA Microcomputer or Central Processing Unit MB Slice Processor MD Correlated Memories ME Other correlated circuits (interface, clock, peripheral controller, etc.)					
*Except for Z, the meanings given are recommended only						

MAZDA
Power Rectifier Valves (High Vacuum)

CONSTRUCTION	SERIAL NUMBER
U Half Wave UU Full Wave	

NEWMARKET House Code
Semiconductors
Germanium

e.g. NKT 6 1 3

TYPE	SERIAL NUMBER
1 RF *pnp* 2 AF *pnp* 3 Intermediate Power *pnp* 4 Power *pnp* 6 VHF *pnp* 7 AF *npn*	

M.O./G.E.C./OSRAM Receiving Valves

e.g. **X 6 1 M**

CONSTRUCTION	SERIAL NUMBER
A Valve for specialised industrial application B Double triode D Diode or double diode GU Gas-filled rectifier GT Gas-filled triode (thyratron) H High-impedance triode KT Kinkless tetrode (beam tetrode) L Low-impedance triode N Output pentode U Rectifier W Variable-mu screened pentode X Frequency changer Y Tuning indicator Z Sharp cut-off screened pentode	NOTE The suffix "M" indicates external metallising

MULLARD Transmitting & Industrial Valves CURRENT SYSTEM

e.g. **Y L 1 0 2 0**

CLASS	CONSTRUCTION	SERIAL NUMBER
X Photosensitive tube Y Vacuum } * Z Gas-filled } * valve or tube (not photodevice)	A Diode C Trigger tube D Triode or double-triode G Miscellaneous H Travelling-wave tube J Magnetron K Klystron L Tetrode, pentode, double-tetrode or double-pentode M Cold-cathode indicator or counter tube P Photomultiplier or radiation counter tube Q Camera tube T Thyratron X Ignitron, image intensifier or image converter Y Rectifier Z Voltage stabiliser	A group of four figures. The last figure is 0 for basic types; variants of the basic type are indicated by the figures 1–9

MULLARD Transmitting Valves OLD SYSTEM

e.g. **Q Q V 0 6 – 4 0 A**

FUNCTIONAL CLASS	STRUCTURAL PROPERTY	RATING (I)	RATING (II)	SUFFIX
B Backward-wave tube J Magnetron K Klystron L Travelling-wave tube M LF amplifying or modulator triode P RF power pentode Q RF power tetrode R Power rectifier T RF power triode X Large thyratron NOTE 2 letters may be used for multiple valves	A Output up to 1W } (backward & travelling wave tubes) B Output 1W or over } D Disc seal construction G Mercury vapour-filled H Hydrogen-filled N External magnet reqd. } Magnetrons P Packaged construction } R Inert-gas filled S Reflex construction } Klystrons T Multi-resonator } V Indirectly-heated oxide-coated cathode X Directly-heated tungsten filament Y Directly-heated thoriated-tungsten filament Z Directly-heated oxide-coated filament	(a) Approx V_a in kV for transmitting valves & rectifiers (peak voltage in the case of pulse valves)* (b) Approx p.i.v. in kV for thyratrons* (c) Approx operating frequency in GHz for microwave devices *Below 1kV, zero followed by a figure indicating tenths of a kV. e.g. 06=600V.	(a) Approx P_a in W for transmitting valves (total for multiple valves) (b) Max I_{pk} in A for pulse transmitting valves (prefixed by P) (c) For backward & travelling-wave tubes ouput power in mW or W (d) Pulse output power in kW for magnetrons (e) Ouput power in mW for klystrons (f) Output current in mA for rectifiers (g) Max $I_{A\,MEAN}$ in mA for thyratrons	When used, usually a serial letter indicating a particular design or development

VOLTAGE STABILISERS

British Systems

1. The type number consists of QS followed by two groups of figures separated by an oblique stroke.
   e.g. QS75/20
The first group is the nominal running voltage, the second the nominal maximum tube current.
2. The type number consists of QS followed by a four-figure serial number which has no numerical significance.
3. The type number consists of a group of figures, a letter, and a final figure.
   e.g. 150C4
The initial figures indicate the nominal running voltage. The remainder of the type number has no significance.

USA System

The RMA Valve system is used. The first figure is always 0 (no heater) and the final figure is generally 2 (for 2 useful electrodes). The primer or link are not counted as useful electrodes.

PRO-ELECTRON Receiving Valves

e.g. E C H 8 1

	FILAMENT OR HEATER RATING	CONSTRUCTION	BASE TYPE	SERIAL NUMBER
P	A 4	A Diode (excluding rectifier)	1 Miscellaneous	(a) One figure for early valves
S	B 0·18A	B Double diode, common cathode (excluding rectifier)	2 B10B (Min 10-pin) [a]	(b) Two figures for recent entertainment valves
S	C 0·2A	C Triode (excluding power output)	3 International Octal	
S/P	D 1·4V	D Power output triode	4 B8A	NOTE: In some type numbers with three figures, if the first figure is 1 then the second indicates the type of base, e.g. EF183-B9A base.
S/P	E 6·3V	E Tetrode (excluding power output)	5 B9D (Magnoval) & Noval [b]	
P	F 12·6V	F Pentode (excluding power output)	6 } Various subminiature	(c) Three figures for recent professional valves
P	G 5V*	H Hexode or heptode (hexode type)	7 } or wired-in	
S	H 0·15A	K Octode or heptode (octode type)	8 B9A (Noval)	
P	K 2V	L Power output tetrode or pentode	9 B7G (Min 7-pin)	
S	P 0·3A	M Tuning indicator		
S	U 0·1A	Y Half-wave rectifier	NOTES	
S	V 50mA	Z Full-wave rectifier	(a) 2 was previously used for B8B/B8G (Loctal)	
S	X 0·6A	NOTE—2 or 3 letters may be used for multiple valves	(b) 5 was previously used for B9G	
S	Y 0·45A			

NOTES
G is now used for miscellaneous ratings

Parallel or Series Operation

TYPE NUMBER

USA RMA Receiving Valves

e.g. 6 S N 7 G T

FILAMENT OR HEATER RATING	SERIAL & CODE LETTERS	NUMBER OF "USEFUL ELEMENTS" BROUGHT OUT	SUFFIX LETTERS
0 Cold cathode 1 1·6V 5 4·5-5·6V 6 5·6-6·6V 7 5·6-6·6V with Loctal base above this, figures represent nominal working voltage NOTE For tapped filaments or heaters figure indicates rating of both sections in series	Allotted in sequence commencing with A (omitting I and O). (Rectifiers follow the sequence backwards from Z). When all the single letters are exhausted, the sequence commences again with two letters commencing from AB (combinations of identical letters are not normally used). The initial letter S indicates a single-ended valve, when the second letter may be that of the nearest equivalent in the double-ended range. The initial letter L indicates a Loctal base valve in the battery range	(a) Metal valve envelopes, lock-in metal bases & internal shields having separate & exclusive terminals are counted as useful elements (b) A filament or heater counts as one, except as two when there are unequally-rated tapped sections (c) In octal based glass valves add 1 for pin No. 1 whether it has an element connected or not (d) Combinations of elements connected to the same terminal or terminals count as 1	(a) A,B,C,D,E & F indicate a later & modified version which **can** be substituted for a previous one but **not** vice-versa (b) X & Y indicate low- & medium-loss bases respectively (c) W indicates a military type (d) In Octal valves G Large glass bulb GT Smaller glass tube M Metal envelope

SPECIAL QUALITY VALVES

These are made by a number of manufacturers for applications where high reliability is required under adverse operating conditions. They are electrically similar to a number of standard types, but use improved mechanical construction to give greater freedom from microphony and vibration failures. They are also more carefully controlled in manufacture and testing than their standard counterparts.

NUMBERING SYSTEMS FOR SPECIAL QUALITY VALVES

MULLARD

System 1

This is based on the Pro-Electron code but the Base Type and Serial Numbers are placed between the first and subsequent letters.

e.g.	Standard	Special
	ECC88	E88CC

System 2

The initial letter is "M" followed by a four-figure serial number beginning with 8.

MARCONI–OSRAM

The prefix "Q" is added to the standard type number

e.g.	Standard	Special
	Z77	QZ77
	B309	QB309

AMERICAN

System 1

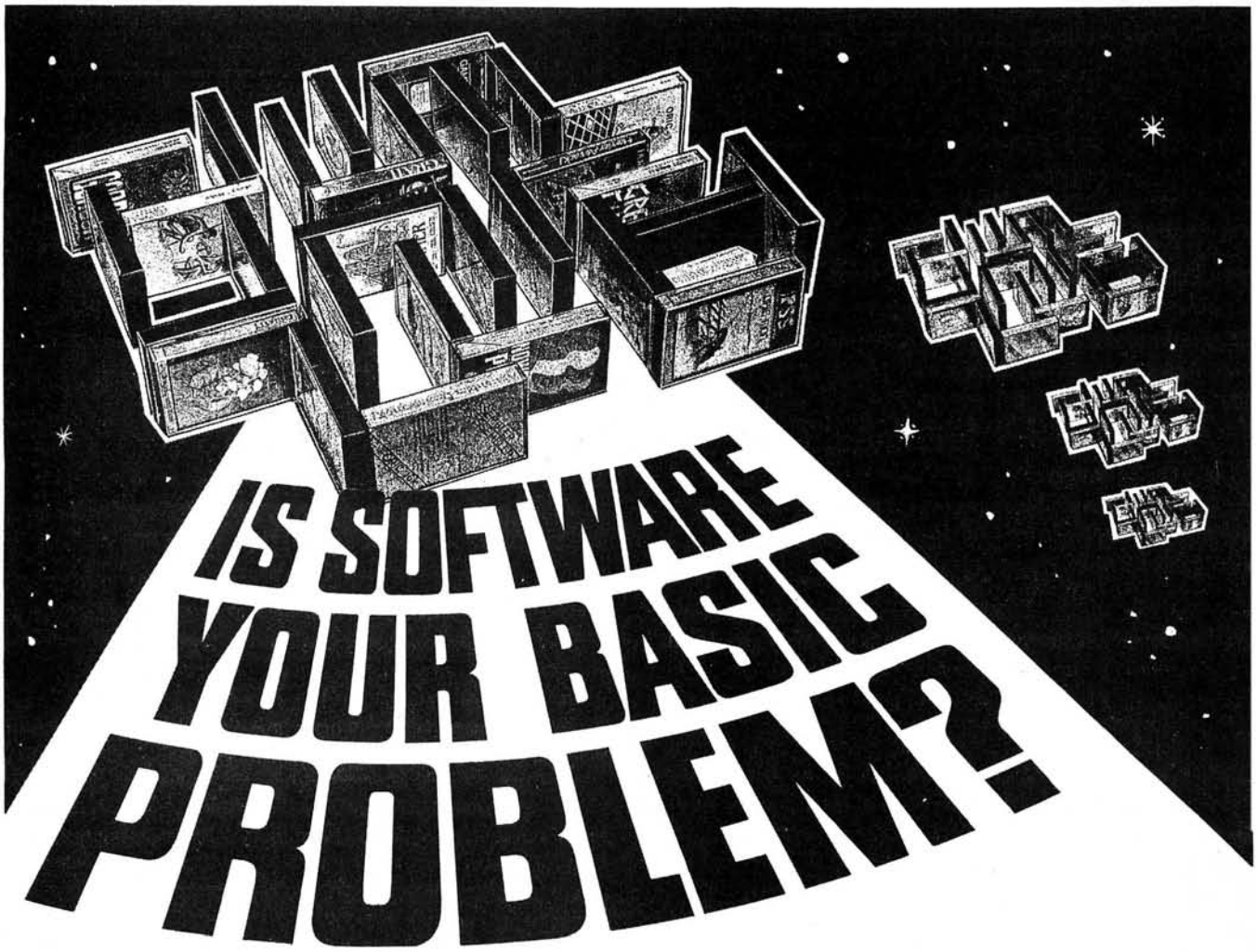
A four-figure reference number.

System 2

The RMA System, followed by the suffix "W" for a Military type, and often a further suffix "A" for a modified type.

MILITARY VALVES AND SEMICONDUCTORS

Selected, close-tolerance, versions of both Standard and Special Quality valves meeting government specifications are marketed by a number of manufacturers. In the United Kingdom, identification numbers commence with the letters "CV" (Common Valve) followed by a three- or four-figure serial number. Special Quality Valves mostly have numbers in the CV4000 group. In the USA normal type numbers are generally used, prefixed by USA (army), USN (navy) or JAN (joint army navy).



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YAESU

0010	FT1	Gen Cov HF t'ceiver	PHONE
0020	Key T901	Curtis keyer for above	28.75
0030	DCT1	DC power cable	10.35
0040	RAMT1	Non-volatile mem board	13.80
0050	FMUT1	FM unit	42.85
0060	XF8.9KCN	300Hz CW filter	18.40
0070	XF8.9KC	600Hz CW filter	18.40
0080	XF8.9KA	6kHz AM filter	18.40
0090	XF10.7KC	CW filter	16.65
0100	FT980	Gen cov HF t'ceiver	PHONE
0110	SP980	Matching speaker	58.65
0130	FT102	9 band HF transceiver	PHONE
0140	FC102	9 band matching atu	179.00
0150	FV102DM	Remote vfo for above	230.00
0160	SP102	External speaker	52.50
0240	FM AM	Unit for above	46.75
1341	MH1B8	Scanning hand mic.	14.95
0390	FT77	8 band 100 watt t'ceiver	PHONE
0450	Marker unit		10.35
0460	FM Unit		27.20
0410	FP700	PSU for FT77	125.00
0420	FC700	ATU for FT77	98.90
1459	FL2100Z	160-10m linear amp	459.00
0810	FT290R	2m Multimode portable	269.00
0840	FT790R	70cm Multimode Portable	269.00
0860	NC11C	FT290/790 AC charger	9.95
0880	CSC1A	FT290/790 carrying case	4.20
0870	MMB11	FT290/790 Mob mount	26.85
0900	FL2010	290R Linear amplifier	63.25
0700	FT208R	2m FM handheld 2½W	198.00
0710	FT708R	70cm FM handheld 1W	175.00
0750	NC9C	Slow charger	8.80
0720	FWB2	Spare Ni-cad battery pack	21.45
0740	FBA3	Charging sleeve	5.65
0760	NC7C	Base master charger	32.95
0770	NC8C	Base master quick charger	54.05
0780	PA3	Charger 12v DC	15.35
0800	MMB10	Mobile mounting bracket	8.05
1000	FT230R	2m 25W FM mob t'ceiver	PHONE
1010	FT730R	70cms 10W FM mob t'ceiver	239.00
1020	FT726R	3 band all mode base station	PHONE
1030	430T726	70cms module	250.00
1050	50T726	6 metre module	185.00
1051	HFT726R	HF module	200.00
1060	SAT726	Full duplex x/band unit	95.00
1090	FRG7700	0.2-30mHz gen cov rec	PHONE
1100	FRG7700M	7700 with memory unit	PHONE
1110	MEMGR7700	Memory module	69.00
1120	DCRG7700	DC modification kit	1.38
1130	FRT7700	Antenna tuner unit	46.00
1201	FRA7700	Active Antenna	41.80
1140	FF5	Low pass filter	10.75
1150	FRV7700A	118-130, 130-140, 140-150mHz	86.25
1160	FRV7700B	118-130, 140-150, 50-59mHz	90.85
1170	FRV7700C	140-150, 150-160, 160-170mHz	80.50
1180	FRV7700D	118-130, 140-150, 70-80mHz	87.40
1190	FRV7700E	118-130, 140-150, 150-160mHz	89.70
1200	FRV7700F	118-130, 150-160, 170-180mHz	89.70
0490	FT757GX	Multi Mode Gen Cov.	PHONE

ICOM

2005	IC751	* NEW * 100W H.F.	PHONE
2021	IC745	* NEW * 100W H.F.	PHONE
2008	RC10	Keyboard Freq. cont.	PHONE
2006	PSU(Int.)	230v AC power supply	149.00
2030	FM(EX242)	FM module for above	32.50
2040	KEYER(EX243)	Keyer module for above	39.00
2100	IC730	100w HF trans 12v DC	659.00
2120	FL30	SSB pass band filter	29.00
2190	IC720A	100w HF trans plus gen. cov.	949.00
2200	PS15	230v p.s.u. for HF t'ceivers	119.00
2210	PS20	230v chopper type unit	155.00
2060	FL45	500Hz filter for 740/730	39.00
2130	FL44	2.4kHz SSB filter	79.00
2220	FL32	CW narrow filter for 720	39.00
2230	FL34	AM filter for 720	29.00
2150	EX202	LDA unit for 730	13.50
2050	EX203	CW audio filter for 730	14.50
2170	EX205	TRV unit for 730	14.00
2240	B10	Memory back up for 720	5.95
2290	IC2KL+PSU	500W solid state linear	1303.33
2310	AT100	100 watt HF Auto ATU	269.00
2320	AT500	500 watt HF Auto ATU	369.00
2340	CF1	Cooling fan	24.00
2970	SP3	Matching ext speaker	45.00
2360	HP1	Communication phones	34.50
2960	SM5	Base microphone	34.50
2250	IC-R70	Comms rec 230v AC	549.00
2260	FM unit	Plug in module	30.00
2270	FL63	CW narrow filter	39.00
2130	FL44	Xtal filter	79.00
2410	IC290H	Multimode 2m 12v DC	469.00
2430	BU1	Back up supply	24.50
2440	IC471	Multimode 70cm	699.00

ICOM CONT.

2450	IC490	Multimode 70cm 12v DC	495.00
2480	IC2E	2m synth h'held 1.5w Special	169.00
2490	IC4E	70cm synth h'held 1.5w	218.00
2475	IC02E	144MHz h'held with k/b+LCD	229.00
2476	IC04E	432MHz h'held with k/b+LCD	T.B.A.
2810	MMB3	Mobile mounting bracket	12.50
2840	MMB12	Mobile mounting bracket	12.50
2870	HM7	8 pin hand mic.	14.95
2890	HM9	L/S mic for IC2E/4E	16.50
2900	HM10	Up/down scan mic.	29.00
2950	SM2	4 pin desk mic.	34.50
2960	SM5	8 pin desk mic.	34.50
2962	SM6	Desk mic (745/751/271/471)	34.50
2970	SP3	External loudspeaker	45.00
2520	LC3	Cases for IC2E/4E	5.00
2570	BC25	Standard mains charger	6.69
2590	BC30	Base hod type charger	56.35
2610	BP2	Low voltage pack	38.00
2620	BP3	Standard pack	25.00
2630	BP4	Empty battery box (AA cells)	7.95
2640	BP5	High power battery pack	48.00
2650	CP1	Charger lead for 12V supply	4.95
2660	DC1	12v Regulator pack	9.75

TRIO/KENWOOD

1450	TS930S	160-10m t'ceiver with gen cov	1095.00
1460	AT930	Automatic ATU 80-10m	141.75
1470	SP930	External speaker unit	59.00
1490	YK88A-1	6kHz AM filter	33.25
1500	YK88C-1	500Hz CW filter	33.25
1510	YG455C-1	500Hz CW filter	77.50
1520	YG455CN-1	270Hz CW filter	91.75
1530	TS430S	160-10m with gen cov rec	736.00
1540	PS430	Mains PSU for TS430S	112.75
1550	SP430	Speaker for TS430S	29.50
1570	FM430	FM option unit TS430S	34.50
1580	YK88C	500Hz CW filter	31.75
1590	YK88CN	270Hz CW filter	37.25
1600	YK88SN	1.8kHz SSB filter	32.50
1850	TL922	160-10m 2kw linear	724.50
1870	MC60 N4	Desk microphone	51.50
1880	MC60 S6	Desk mic with up/down	53.50
1890	MC60A	Desk mic with pre-amp	55.25
1900	MC35S	Fist mic 50K imp	14.75
1910	MC30S	Fist microphone 500ohm imp	14.75
1920	MC40S	Up/down mic for TR9000/7800	14.75
1930	MC42S	Up/down mic (TS930S)	15.25
1940	LF30A	LF low pass filter	21.25
1950	TS711E	2m/70cm all mode t'ceiver	785.00
1980	TR9130	2m multi mode mobile	433.50
1934	TW4000	FM transceiver 2m/70cm	425.00
1680	TR2500	2m FM synth handheld	219.00
1700	ST2	Base stand and charger	51.75
1710	SC4	Soft case and belt hook	13.75
1720	MS1	Mob stand and power unit	31.75
1730	SM220	Speaker/microphone	16.00
1750	LH2	Deluxe leather case	24.00
1770	DC25	Power supply from 12V	16.00
1780	TR3500	70cm handheld trans.	225.00
1790	TR5500	70cm multimode mob	395.00
1800	R600	Gen cov rec 150kHz-30MHz	239.00
1820	R2000	Gen cov rec	389.00
1821	HC10	World time clock	62.00

DATONG

3880	PC1	Gen cov convertor	137.40
3870	VLF	Very low frequency convertor	29.90
3670	ANF	Freq agile audio filter	67.85
3660	FL2	Multi-mode audio filter	89.70
3650	FL3	Auto filter for receivers	129.00
3700	ASP/B	r.f. speech clipper for Trio	82.80
3700	ASP/A	r.f. speech clipper for Yaesu	82.80
3710	D75	Manual RF speech clipper	56.35
3740	D70	Morse Tutor	56.35
3750	MK	Keyboard morse sender	137.40
3910	RFA	RF switched pre-amp	33.90
3800	AD270	Active dipole indoor	47.15
3820	AD370	Active dipole outdoor	64.40
3810	AD270-MPU	As above with mains p.s.u.	51.75
3830	AD370-MPU	As above with mains p.s.u.	69.00
3980	MPU	Mains power unit	6.90
3730	RFC/M	RF speech clipper module	29.90
3920	PTS1	Tone squelch unit	46.00
3640	SFB2	Auto Woodpecker blanker	86.25

MICROWAVE MODULES RANGE

3130	MML28/100-S	10m 100W lin/preamp	129.95
3140	MML70/50	4m 50 watt lin/preamp	85.00
3150	MML70/100-S	4m 100W lin/preamp	139.95
3160	MML144/30LS	2m 30W linear amp	69.95
3170	MML144/50S	2m 50W lin/preamp	85.00
3180	MML144/100-S	2m 100W lin/preamp	139.95
3190	MML144/100LS	2m 100W (1 or 3W i/p)	159.95
3200	MML432/30L	70cm 30W lin/preamp	99.00
3210	MML432/50	70cm 50W lin/preamp	109.95
3220	MML432/100	70cm 100 watt linear	228.65
3250	MMC435/51	70cm ATV con, VHF out	37.90
3260	MMC435/600	70cm ATV con, UHF out	27.90
3270	MTV435	70cm ATV 20W t'mitter	149.00
3290	MM1000KB	Converter with keyboard	99.95
3300	MM2001	RTTY to TV converter	189.00
3320	MM4001KB	RTTY term with keyboard	299.00
3330	MMS1	The MORSETALKER	115.00
3340	MMS2	Advanced morse trainer	169.00
3350	MMT28/144	10m linear transverter	109.95
3360	MMT70/28	4m linear transverter	119.95
3370	MMT70/144	4m linear transverter	119.95
3380	MMT144/28	2m linear transverter	109.95
3390	MMT432/28-S	70cm linear transverter	159.95
3400	MMT432/144-R	70 cm linear transverter	184.00
3410	MMT1296/144	23cm linear transverter	184.00
3425	MMC27/MW	27MHz to med wave conv	19.95
3430	MMC28/144	10m to 2m up conv	29.90
3440	MMC50/28	6m to 10m down conv	29.90
3450	MMC70/28	4m to 10m down conv	29.90
3460	MMC70/28LO	4m to 10m down conv	32.90
3470	MMC144/28	2m to 10m down conv	29.90
3480	MMC144/28LO	2m to 10m down conv	32.90
3490	MMC432/28-S	70cm to 10m down conv	37.90
3500	MMC432/144-S	70cm to 2m down conv	37.90
3510	MMC1296/28	23cm to 10m down conv	34.90
3520	MMK1296/144	23cm to 2m down conv	69.95
3530	MMK1691/137.5	1691mHz Meteosat conv	129.95
3540	MMA28	10m low noise preamp	16.95
3550	MMA144V	2m RF switched preamp	34.90
3560	MMA1296	23cm low noise preamp	34.90
3570	MMd050/500	500MHz digital freq meter	75.00
3580	MMd600P	600mHz-10 prescaler	29.90
3590	MMDP1	Freq counter amp/probe	14.90
3620	MMS384	384mHz freq source	29.90
3630	MMR15/10	15dB, 10W attenuator	11.90

AZDEN

4060	PCS4000	2mFM transceiver 25W	229.00
4130	MEX55	Mobile boom safety mic	28.50

FDK

5779	M.750XX	2m FM/SSB/CW 10W t'ceiver	315.00
5782	EXP.430	M.750 70cm transverter	249.00
5772	KP100	AC/DC Electronic Keyer	69.00
5780	ATC720	Synth air monitor 110-138MHz	159.00
5781	RX40	Synth FM mon 140-180MHz	149.00

MUTEK LTD

5850	SLNA 50s	50MHz low noise switched preamplifier using BF981	37.10
5860	SLNA 70s	70MHz low noise switched preamplifier using BF981	37.10
5870	SLNA 70u	70MHz low noise unswitched preamplifier using BF981	22.40
5880	SLNA 70ub	Unboxed version of SLNA 70u	13.70
5890	SLNA 144s	144MHz low noise switched preamplifier using BF981 (0.9dB noise figure)	37.10
5900	SLNA 144u	144MHz low noise unswitched preamplifier using BF981	22.40
5910	SLNA 144ub	Unboxed version of SLNA 144u	13.70
5920	SLNA 145sb	Transceiver optimised preamplifier with antenna c/o switching using BF981. Intended for the FT290R, but has many other applications!	27.40
5930	GFBA 144e	Ultra-high performance environmentally housed switched gasfet preamplifier using advanced negative feedback circuitry for superb dynamic performance. Supplied with ATCS 144s controller	129.90
5940	TLNA 432s	Very high performance bipolar transistor switched preamplifier for 430-440MHz using BFQ69 for 1.4dBnf and 0dBm input intercept performance	74.90
5950	TLNA 432u	Unswitched boxed variant of TLNA 432s	29.00
5960	TLNA 432ub	Unboxed TLNA 432u	20.40
5970	GLNA 432u	Series 432 MHz gasfet unswitched preamplifiers	PHONE
5980	BLNA 432ub	Sub-miniature 1.3dBnf BFQ69 preamplifier	13.70

MUTEK LTD CONT.

5990	BLNA 1296ub	Noise matched N Ina
6000	RPCB 144ub	Complete replace for the FT221 and
6010	RPCB 251ub	Complete replace for the IC211 and
6020	HDRA 95u-1	1.5dBnf/8.5dB ga range 88-108MHz
6030	HDRA 95u-2	11.5dB gain varia
6040	BBBA 500u	20-500MHz broad dynamic range p
6050	BBBA 860u	250-860MHz broa amplifier
6060	XBPF 700ub	Microstripline bar
6070	PPSU 012	12V (nominal) ma HDRA95 & BBBA
6080	CISA 001	'UHF'(f) to BNC(m
6090	ATCS 144s	Transmit receive sequence and co

WRAASE ELECTRONICS

SLOW SCAN H.F. EQUIPMEN

4720	SC140	SSTV receive x
4730	SC160	SSTV tranceive
4740	SC442A	SSTV TX/RX
4775	SC-1	SSTV + FAX
4750	FG422A	Light pen
4760	KB422A	Keyboard
4780	Prince	12" green displ

SCANNING RECEIVERS

5573	Sony ICF7600D	Digital receiver
5574	Power supply	mains, for above
5580	Bearcat BC100	synthesised h/he
5610	Bearcat BC2020FB	AM/FM VHF
5650	Jil SX200N	AM/FM VHF/UHF
5651	Jil SX400	26-510MHz AM/FM
5659	Gemscan	Synthesised VHF/UHF
5641	AOR2001	Synth. 26-520 AM/FM
5770	Fairmate AS32320	AM/FM VHF airband
5760	Corona CD6000	AM airband rec
5781	FDK RX40	pocket synthesised 180MHz
5780	FDK ATC720	pocket synthesised receiver

VHF/UHF AMPLIFIERS

TONO PRODUCTS

5340	2M-50W	40W linear for
5350	2M-100W	90W linear for
5360	MR-150W	140W linear 2
5370	MR-250W	210W linear for
5380	MR28	100W linear for
5390	4M60	50W linear for

TOKYO HY-POWER LABS INC

5670	HC-150	3.5MHz to 30M
5680	HC2000	1.8MHz to 30M
5690	HL-82V	2M linear amp includes Mosfe
5700	HL-160V	2M linear amp includes J.Fet p I/P
5709	HL-45U	70cm linear am 50W O/P
5711	HL90U	70cm linear am O/P *NEW*

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5720	ELH230E	2M linear min P small
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See full range of BNOS and Microw

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4670	VHF/W	Wavemeter 12C
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4710	24APSU	24 amp 13.8V p
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32.90
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mplifier 29.00
and low noise
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2 metres 325.00
10 metres 65.00
cms 159.00

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in 80W O/P
preamp 144.50
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eamp 3 or 10W
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prot. 30.75
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u prot. 105.00
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MORSE KEYS

HI-MOUND KEYS

5430	HK702	Up/down on marble	26.94
5440	HK704	Up/down super deluxe	17.65
5450	HK705	Up/down deluxe	13.80
5460	HK706	Up/down economy	14.60
5461	HK707	Up/down popular	13.75
5470	HK708	Basic unit up/down	13.26
5480	MK704	Squeeze keyer manipulator	12.65
5490	MK705	As 0548 with metal base	21.28
5501		Ex-ministry No. 8 key, original packing	4.95

Bencher Products

5220	BY1	Keyer paddle (black base)	37.95
5230	BY2	Keyer paddle (chome base)	48.30
5240	BY3	Keyer paddle (gold plated)	92.00
5250	ZA1A	Balun 3.5-30MHz for dipoles	15.00
5260	ZA2A	Balun 14-30MHz for beam antennas	17.25

RTTY/CW READERS

Tasco Products

5400	CWR685E	Tele reader – RTTY/CW/ASCII	769.00
5410	CWR670	Tele reader – as above, RX only	349.00
5420	CWR610E	Tele reader – as above, basic unit	159.00

Tono Products

5270	9000E	CW/RTTY/ASCII/Editor/lite pen, term L	669.00
5280	550E	CW/RTTY/ASCII/Terminal RX	299.00
5290	350	CW/RTTY/ASCII/Terminal RX only	259.00
5300	CRT120G	VDU 12 inch green screen – mains power	125.00
5310	CRT1200G	VDU 12 inch for 80 columns	136.00
5320	HC800	Line printer centronics	449.00
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ICS Electronics

4900	AMT-1	Amtor RX/TX	265.00

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5800	12/6A	Power supply 13.8V 6 amp, fully protected	48.30
5810	12/12A	Power supply 13.8V 12 amp, fully protected	86.40
5820	12/24A	Power supply 13.8V 25 amp, fully protected	125.45
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5831	L144/1/100	1 watt input linear	138.00
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5834	LPM144/1/100	1 watt input linear/preamp	172.50
5835	LPM144/3/100	3 watt input linear/preamp	172.50
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		L(M)	W(kg)	
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	144MHz			
6103	4 element	0.87	0.5	14.95
6110	9 ele fixed	3.3	1.9	17.71
6120	9 ele portable	3.3	1.7	20.00
6130	9 ele crossed	3.5	2.0	32.43
6140	13 ele portable	4.5	2.5	31.05
6150	17 ele fixed	6.60	4.5	37.66
	435MHz			
6190	19 element	3.2	1.1	20.70
6189	19 ele crossed	3.3	1.8	34.27
6200	21 element	4.6	2.6	29.62
6210	21 element ATV	4.6	2.6	29.67
	144/435HMz			
	Oscar Special			
6160	9 & 19 element	3.3	2.0	34.27
	1,250MHz or 1,296MHz			
6213	23 element	1.8	0.9	25.90
6214	4 × 23 ele antennas – power splitter – stacking frame			149.00

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5060	SP350	1.8-500MHz PWR/SWR	59.95
5080	AC38	3.5-30MHz ATU 400w PEP	65.00
5160	TP05X	50-500MHz 0-5W meter	13.95
5131	CA35A	Static protector	10.75
5132	CA23N	Static protector	12.60
5090	CT15A	15/50W dummy load PL259	7.95
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5110	CT150	150/400W dummy load	35.50
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MULLARD Cathode-ray Tubes OLD SYSTEM

e.g. A W 4 7 – 9 1

CONSTRUCTION		PHOSPHOR COLOUR	SCREEN SIZE	SERIAL NUMBER
FOCUS	DEFLECT			
A ES	Mag	A, B } Blue	The diameter or diagonal of the luminescent screen in cm	
D ES	ES	C Purplish Blue		
M Mag	Mag	D, E, F } Orange		
		G Yellow-Green		
		H Green		
		J Blue		
		K Green		
		L Orange		
		M Purplish Blue		
		N Yellow-Green		
		P Purplish Blue		
		U Blue		
		V Purplish Blue		
		W White		
		X Tricolour Screen		
		Y Yellow-Orange		

MULLARD Cold Cathode Tubes OLD SYSTEM

e.g. Z 8 0 3 U

	BASE TYPE	SERIAL NUMBER	FUNCTION
Z indicating a cold cathode gas-filled tube	As in Pro-Electron receiving valve code		A Amplifier tube (continuous operation) B Binary counter or switching tube C Multi-stage counter tube E Electrometer trigger or amplifier tube G Gating tube M Indicator (metering) tube S Multi-stage switching tube T, U, V } Trigger Tubes: 3-electrode, 4-electrode, 5-electrode

PRO-ELECTRON Cathode-ray Tubes

e.g. A 6 3 – 2 0 0 X

PRIMARY APPLICATION	SCREEN SIZE	SERIAL NUMBER	SCREEN PROPERTIES COLOUR GROUP	SCREEN PROPERTIES SERIAL LETTER
A Domestic TV D Single-trace oscilloscope E Multiple-trace oscilloscope F Direct-viewing radar L Display storage M Professional TV (direct-viewing) P Professional TV (projection) Q Flying-spot scanner	The diameter or diagonal of the luminescent screen in cm	Two or three figures	A Purple B Blue D Blue-green G Green K Yellow-green L Orange R Red W White X Tricolour screen Y Yellow	Indicating colour shade/persistence, etc.

MAZDA Cathode-ray Tubes for television

e.g. C M E 2 0 1 3

CONSTRUCTION	SCREEN SIZE	SERIAL NUMBER	SUFFIX LETTER
MONOCHROME TUBES FOCUS DEFLECT CME | E/S | Mag CRM | Mag | Mag COLOUR TUBES CTA	The overall diameter or diagonal of the screen in inches		Indicates some modified feature

MULLARD Photocells

e.g. 9 0 C V

BASE TYPE	SERIAL NUMBER	PHOTOCATHODE SURFACE	CLASS OF PHOTOCELL
As in Pro-Electron receiving valve code		A Caesium-antimony C Caesium on oxidised silver	G Gas-filled V High-vacuum


Advanced Micro Devices


American Microsystems Inc.


Analog Devices


Avel-Lindberg Ltd.


AVO Ltd.


Belling Lee


Burr Brown International


Cherry


Corin Tech Ltd.


Datel Systems


Eimac


Emihus Microcomponents Ltd.


EMM/Semi. Div. of Electronic Memories and Magnetics


English Electric Valve Company Ltd.


Eurotechnique


Exar Integrated Systems


Fairchild Semiconductor Systems


Ferranti Semiconductors


The General Electric Co. PLC


General Instrument


General Radio Company *Now* GenRad


Gould Electronic Components Division


Harris Semiconductor


Hewlett Packard


Hitachi

Hybrid Systems

International General Electric of New York

International Rectifier

Intel

Intersil Incorporated

ITT Semiconductors

Jackson Bros.

Lambda Electronics Co.

Lansdale Transistor & Electronics Inc.

Lucas Electrical Co. Ltd.

Mallory Distributor Products

Matsushita Electronics Corp.

Merrimac Industries Inc.

Micro Electronics Ltd.

Microwave Associates Inc.

Microwave Semiconductor Corp.

Mitsubishi Electric Co.

Motorola Semiconductor Products

Mullard

National Semiconductor

New Jersey Semiconductor Products Co. Inc.

Nippon Electric Co. Ltd.

North American Semiconductor

Philco Radio Television Ltd.

Philips

Pioneer

The Plessey Company

Rendar Components

Rank Electronic Tubes

Raytheon

RCA

Remo Components

Rockwell International

RS Components Ltd.

Sanken

SGS-ATES Group of Companies

Siemens

Signetics

Siliconix Ltd.

Silicon General

Solid State Scientific Ltd.

Standard Microsystems Corp.

Standard Telephones & Cables

Sylvania Radio Tubes

Texas Instruments

Thompson-CSF

Toshiba

Transistor AG (TAG)

Wandel & Goltermann

Welwyn Electric Ltd.

PW REVIEW

ICOM IC-R70 Communications Receiver

Icom's first h.f. receiver, the IC-R70 uses microprocessor technology to provide the alternatives of a general coverage receiver with 1MHz bands or an amateur bands receiver with rapid band selection.

The use of a microprocessor to control all the mode switching as well as band selection offers versatility although, of course, the front panel is now covered with a multitude of push-buttons rather than knobs.

The set, or rather the two sets tried, were fitted with the optional f.m. module. Two sets were tried as the first one had a pre-amplifier that was lacking in gain and not working at all at the lower frequencies. The second set met specification throughout.

Description

The receiver uses a quadruple conversion system using the third and fourth conversions to give a continuous bandwidth control. The first i.f. is at 70·451MHz and the second is 9·0115MHz. This is then mixed with the output of a variable crystal oscillator to give the third i.f. of 455kHz. This signal is then passed through the appropriate 455kHz crystal filter and mixed again with the output of the v.x.o. to restore the signal back to 9·0115MHz. This allows the pass-band to be varied to reduce interference from signals that are close in frequency to the desired signal.

The R70 uses two digital v.f.o.s which can be used independently on any desired band. The triple phase locked loops are controlled by the microprocessor system and frequency can be changed in either 10Hz, 100Hz or 1kHz steps at the press of the appropriate button.

At the front-end, band-pass filters d.c. switched under the control of the MPU, are provided for each band. The signal then passes either through the attenuator or pre-amplifier, or neither, as decided by the front panel switching. After mixing twice in two double balanced mixers the second i.f. signal passes through the appropriate band-pass filter, again selected by the MPU system, before being mixed down to the third i.f. for pass-band tuning. A noise blanker operates on the second i.f. ahead of the band-pass filters. If the f.m. option is fitted the signal, at third i.f., is once again filtered before passing to the limiters and discriminator. On a.m. or s.s.b. the third i.f. passes through the appropriate crystal filter before remixing with the v.x.o. output to produce the fourth i.f., which is the same as the second i.f. This is then passed through the variable notch filter before being demodulated. The squelch switching operates on all modes, the switch following the detectors.

The use of separate filters for each band together with the MPU control means that band changing is simply a matter of button pushing. When changing bands the MPU system automatically selects a frequency 1MHz up or down when set for GENERAL COVERAGE but selects a reference frequency 100kHz above the bottom band edge when in the HAM mode. The frequency "rolls over" at the band edges and for the amateur bands these are set to give coverage of all the variations worldwide.

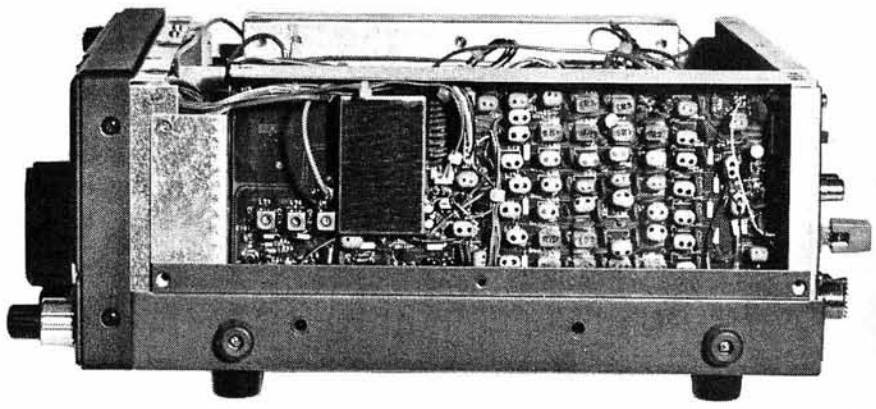
Controls

The display is of the green luminescent type and shows the frequency tuned on the right with the mode and v.f.o. selected on the left.

An analogue S-meter is fitted alongside the frequency display. The main tuning knob, which has an adjustable brake, is comfortable to use, and in fact all the controls are easy to operate and grouped reasonably well. The exceptions to this being the dual concentric controls for AF GAIN/RF GAIN and SQUELCH/TONE. Both of these had the legends on the panel printed underneath the knobs which made it impossible to read when viewed normally. The control system automatically switches from u.s.b. to l.s.b. below 10MHz. Hence above 10MHz SSB-N refers to u.s.b. while below 10MHz it refers to l.s.b.

Memory

Either of the two v.f.o.s can be selected and when changing v.f.o.s the frequency of the initial v.f.o. is stored in the memory enabling it to be used again. Re-selecting the first v.f.o. stores the frequency of the second v.f.o. in the same manner. The frequencies of both v.f.o.s can be equalised, either setting VFO A to the same frequency as VFO B or vice versa.



★ test measurements

Sensitivity:

Freq. (MHz)	Input e.m.f. (μV) for 10dB (S + N)/N		Input e.m.f. (μV) for S9 (s.s.b.)	Pre-amp gain (dB)
	c.w.*/s.s.b.	a.m.		
1·81	0·34	2·3	248	6·5
3·51	0·36	2·2	254	7·1
7·01	0·27	2·0	219	8·4
10·11	0·27	1·9	215	8·9
14·01	0·26	1·9	237	7·3
18·11	0·30	2·2	265	5·9
21·01	0·34	1·9	231	7·1
24·91	0·28	2·1	271	5·7
28·01	0·26	2·1	231	7·1
29·01	0·26	2·0	226	7·3
29·01	0·67μV e.m.f. for 12dB SINAD on f.m. (3kHz dev. at 1kHz)			

* The CW–N position improves sensitivity by 3dB

Squelch threshold: 0·4μV min.
1·2μV max.

S-Meter calibration: (At 14·01MHz u.s.b.)

Reading	Input required	
	μV e.m.f.	dBμV
S1	6·0	16
S2	8·2	19
S3	11·7	22
S4	17·7	25
S5	28·0	29
S6	45·0	33
S7	76·0	38
S8	134·0	43
S9	237·0	48
+20dB	1·3mV	63
+40dB	15mV	84

Image rejection: Better than 79dB

I.F. rejection:

Receiver tuned to (MHz)	Input signal (MHz)	I.F. rejection (dB)
29·01	70·4515	76

Selectivity:
WIDTH control at maximum, I.F. SHIFT centred

Mode (B/W)	−6dB	−60dB
SSB	2·1kHz	3·4kHz
CW (N)	550Hz	1·4kHz
AM	5·5kHz	11kHz
FM	14kHz	21kHz

RIT: ±1kHz

AGC: Output change for 110dB input change, relative to 9μV threshold: 0·5dB

RF attenuator: 20dB

Notch filter: 30dB approx. at 1kHz
Tunable 250Hz–2·1kHz

Audio output: 1·2W into 8Ω with 0·6% t.h.d. on 1kHz, for 100μV input at 14MHz.

Adjacent channel rejection:
a.m. 60dB at 950kHz (9kHz channel spacing)
f.m. 80dB at 29·6MHz (25kHz channel spacing)

★ specification

Frequency coverage:

Amateur Bands:	1·8– 2MHz (160m)
	3·5– 4·1MHz (80m)
	6·9– 7·5MHz (40m)
	9·9–10·5MHz (30m)
	13·9–14·5MHz (20m)
	17·9–18·5MHz (17m)
	20·9–21·5MHz (15m)
	24·5–25·1MHz (12m)
	28·0–30·0MHz (10m)
General coverage:	0·1–30·0MHz in 30 1MHz segments
Tuning steps:	1kHz, 100Hz or 10Hz
Frequency readout:	6-digit, 100Hz resolution

Sensitivity (min) with pre-amp ON:

Mode	Input for 10dB (S+N)/N	
	<1·6MHz	>1·6MHz
SSB/CW/RTTY	1μV	0·15μV
AM	3μV	0·5μV
FM	—	0·3μV for 12dB SINAD

RF Attenuator: 20dB

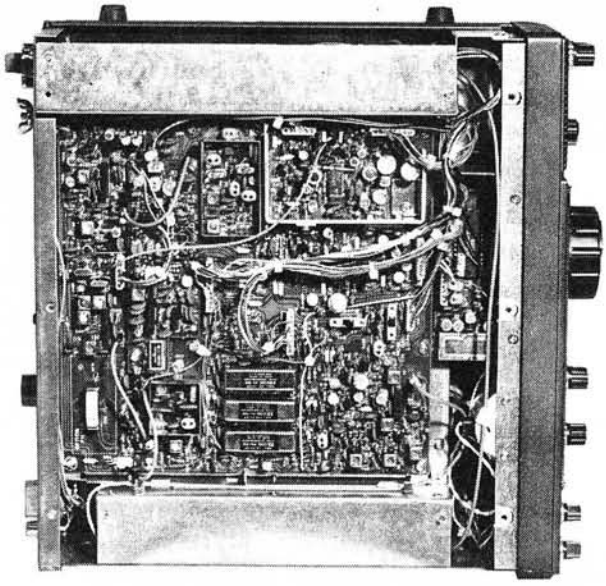
Frequency stability: Less than 250Hz from 1 min. to 60 min. after switch-on
Less than 50Hz thereafter
Less than 500Hz from −10° to +60°C

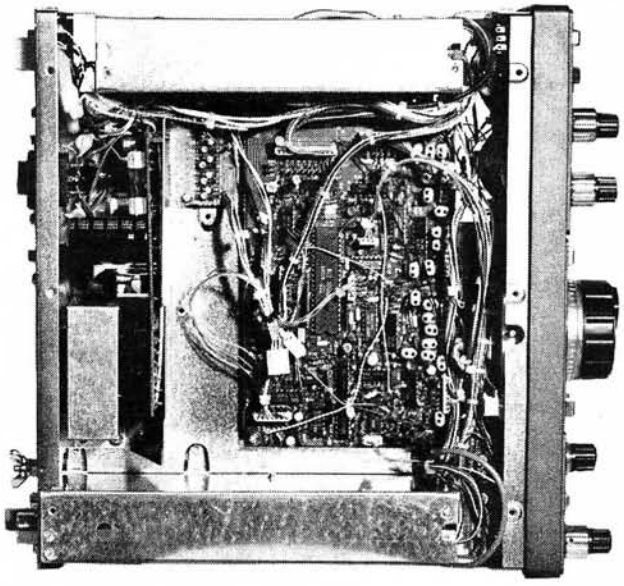
Selectivity: WIDTH control at maximum

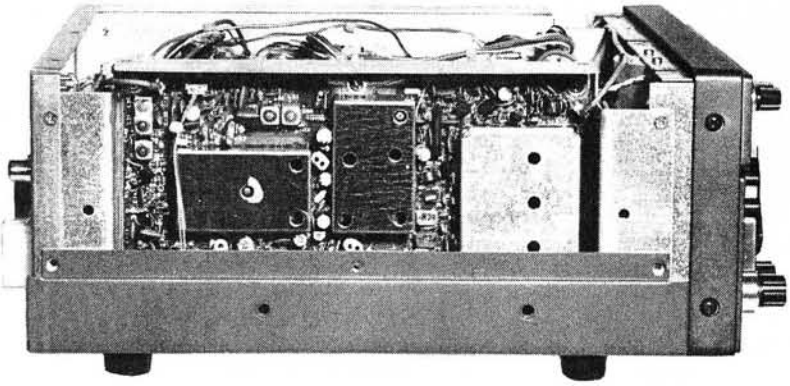
Mode	−6dB	−60dB
SSB/CW/RTTY	2·3kHz	4·2kHz
CW (N)/RTTY (N)	500Hz	1·5kHz
AM	6kHz	18kHz
FM*	15kHz	25kHz

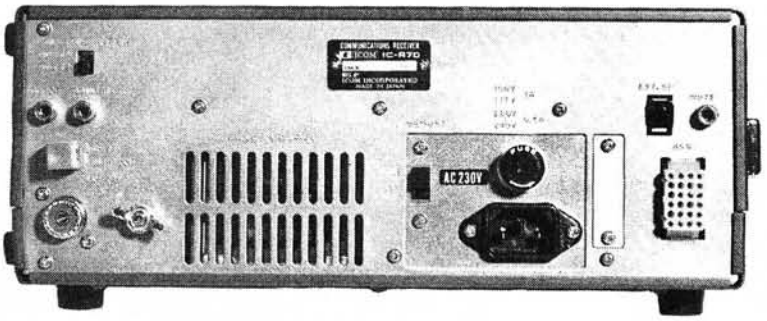
* Option

Spurious response rejection ratio: More than 60dB
Audio output: More than 2W in 8Ω
Antenna impedance: 50Ω unbalanced (or single wire below 1·6MHz)
Power requirements: 117V or 235V ±10%, 50/60Hz, 30VA (110/200/220V by internal modification)
Dimensions: 111 x 286 x 276mm
Weight: 7·4kg









The squelch threshold is controlled by the inner knob of a dual-concentric knob, the outer being TONE, and the squelch is operative on all modes. If you are not aware of this initially then you could be caught out and think that the set was faulty—we were!

The back panel carries the antenna sockets on one side and the external speaker jack, mute terminal and accessory socket on the other. The mute terminal is for use with a transmitter, grounding it mutes the set and monitors the transmitter. The 24-way accessory socket provides access to various parts of the control system as well as supply rails and signals.

Handbook

The handbook follows the usual Icom layout explaining the operation of the various controls together with a circuit description and block diagrams. A full circuit diagram and printed circuit board layout drawings are also provided. Full instructions are given in the handbook for the installation of the various options and this is followed by a troubleshooting table to enable you to find out just what controls you have not set correctly!

Price

The IC-R70 costs £499 incl. VAT. The sets tested were loaned by **Thanet Electronics, 143 Reculver Road, Herne Bay, Kent. Tel: 02273 63859** to whom we extend our thanks.

Dick Ganderton

Building an HF Linear Amplifier and ATU

Part 1
by I. Buffham
BSc CEng MIEE G3TMA

In these days of increasingly complex equipment packed with dozens of integrated circuits and microprocessors it is becoming more and more difficult for the average amateur to build transmitters or receivers to compare favourably with the latest Japanese black boxes.

Fortunately two areas remain where the resourceful amateur can still beat the commercial manufacturers at their own game and save a great deal of money in the bargain! These two areas are h.f. linear amplifiers and antenna tuning units and examples can be seen in the photographs which show the author's station consisting of a Drake "C" line driving a home-made linear amplifier and a.t.u.

The purpose of this article is to serve as a guide to the production of similar equipment. It is not intended that the equipment described should be built exactly as described because of the difficulty of finding suitable identical components in sufficiently large quantities.

Outline Specification

It probably goes without saying that the aim of most constructors in building an h.f. linear will be to achieve a p.e.p. output of at least 400 watts at the highest frequency of interest.

However, the one factor which has the greatest influence on the design of the amplifier is not the required power output but the available driving power from the station transmitter.

Some transceivers only have an r.f. output of 10 watts and so the linear preamplifier will be required to have a high power gain. This is only achievable by the operation of a valve in class AB1 or AB2 with the attendant complications of having to provide a stable screen grid supply, negative bias supply, neutralisation, and input tuning of the amplifier.

Fortunately most transceivers have a power output of around 100 watts p.e.p. permitting the construction of a class B grounded-grid amplifier with low power gain. Class B amplifiers are relatively easy to construct since they do not require screen grid or negative bias supplies or neutralisation. Also, in some amplifiers input tuning may be dispensed with.

The amplifier constructed by the author is a class B design and the front view is shown in the photographs.

Choice of Valve

After choosing the class of operation of the amplifier the next most important decision is the choice of the valve to be used. Many power triodes are available which are suitable for use in grounded-grid amplifiers and most of them may be rejected on the grounds of cost. Another consideration is the h.t. voltage required. In general the lower the h.t. voltage the simpler the construction of the amplifier. High h.t. voltages present problems with pi network component ratings and power supply construction.

The input impedance of the valve is also of interest. For grounded-grid amplifiers the input impedance, Z_{in}, is given by:—

$$Z_{in} = \frac{(\text{Peak r.f. driving voltage})^2}{2 \times \text{driving power}}$$

Provided Z is in the range 40–100 ohms then input tuning of the amplifier can be avoided.

A further consideration is the maximum frequency at which the valve may be used at full ratings, especially if the full 400 watts p.e.p. output is required on 28MHz!

Finally, in the interests of constructional simplicity, it is worth trying to

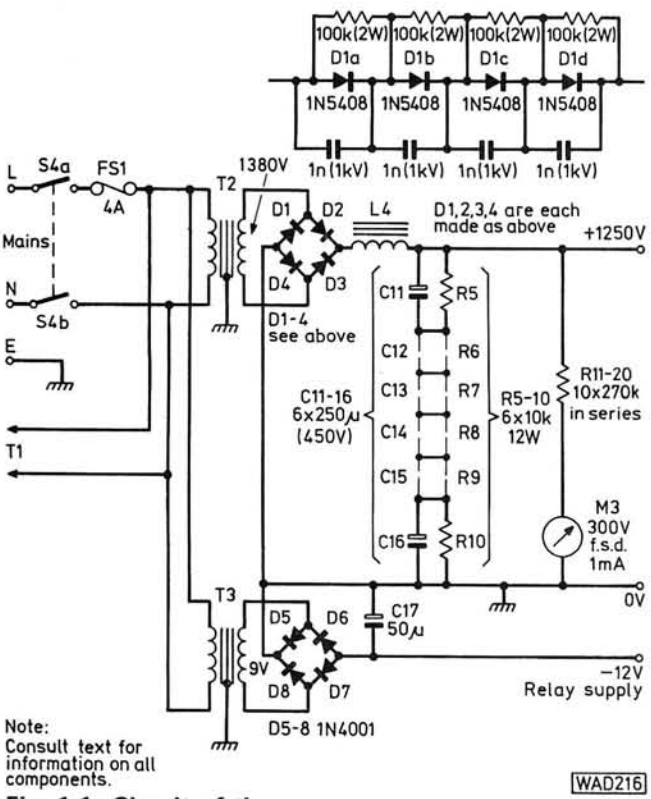


Fig. 1.1: Circuit of the power supplies for the linear amplifier

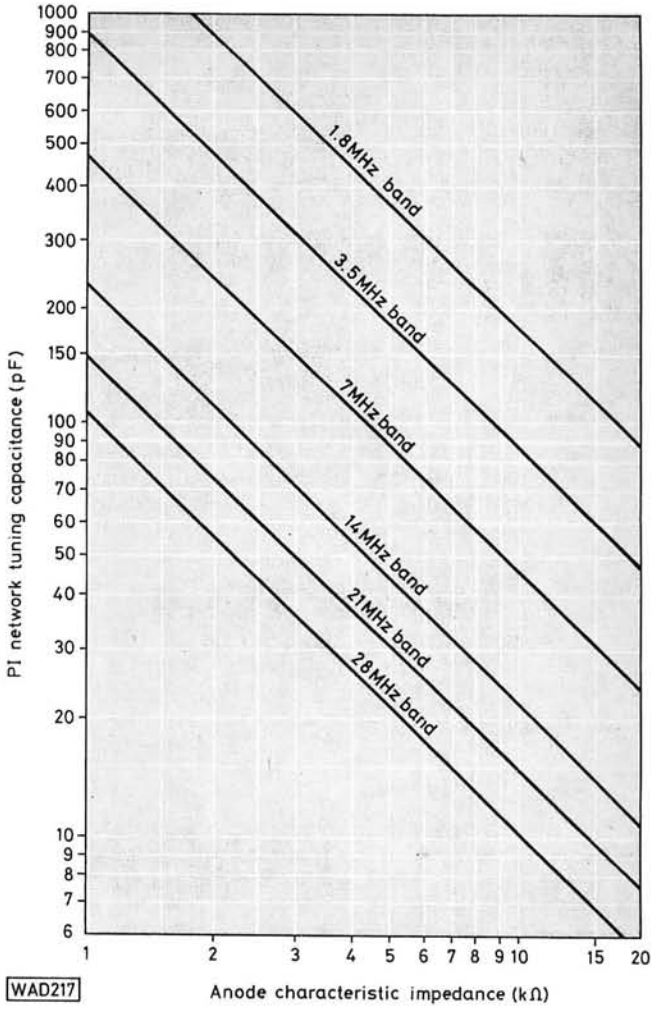
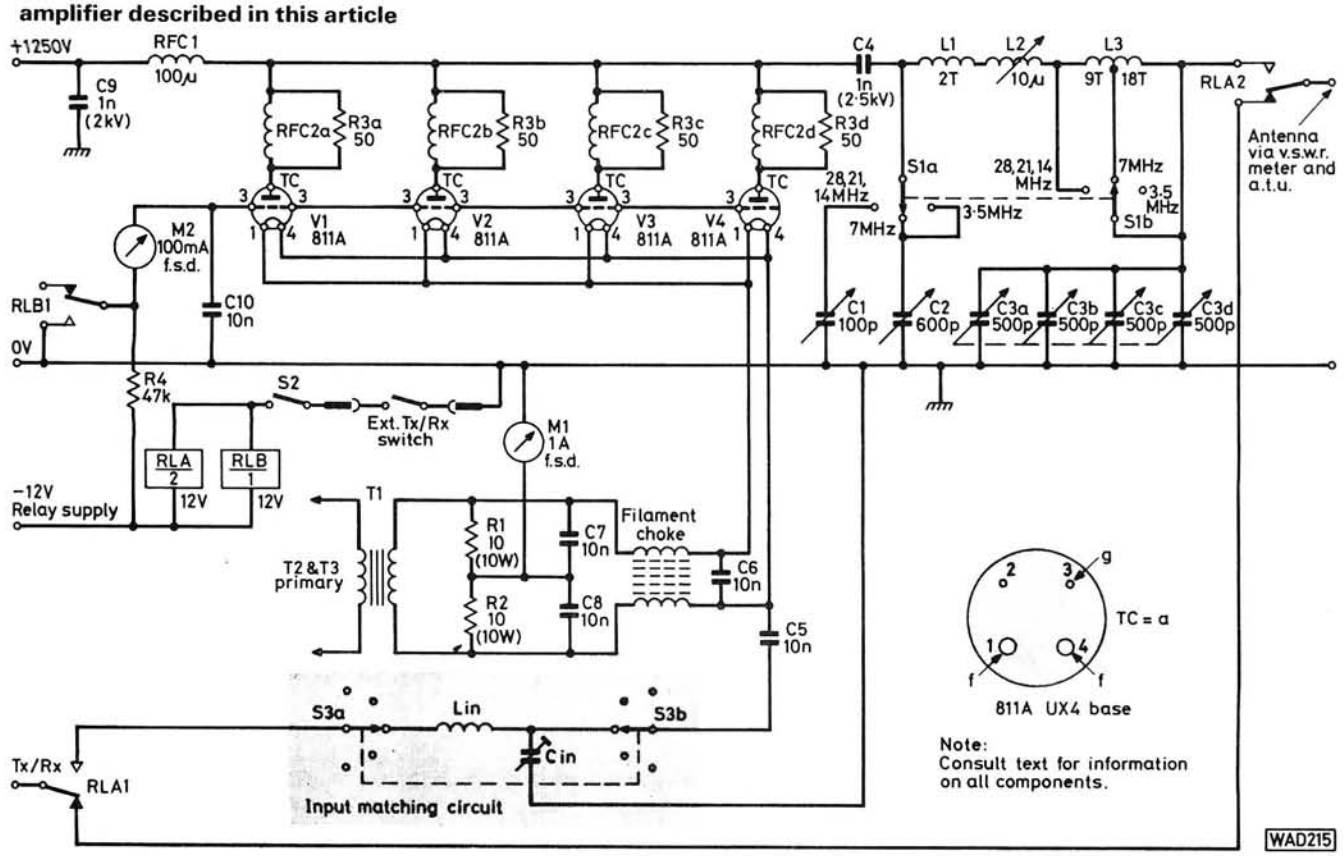


Fig. 1.2: Graph for determining the pi network tuning capacitance for the different amateur bands

(Courtesy of ARRL Radio Amateurs Handbook, 1966)

Fig. 1.3: Circuit of the h.f. linear amplifier described in this article



choose a valve which does not need any forced air cooling.

The characteristics of some common valves are listed in Table 1.

After much deliberation it was decided to construct the amplifier based on four 811A valves in parallel. The input impedance of such an arrangement will be 322/4 ohms i.e. 80 ohms so input tuning can be avoided. Also, as the 811A only requires an h.t. rail of 1·25kV the voltage ratings required for the pi network components are modest. One further advantage of the 811A is that despite being a pre-1939 design it has instant-heat filaments and so is ready for use immediately on switch on—just like a transistor!

The possibility of building a transistor amplifier was briefly considered but discarded on grounds of cost and technical difficulty. No doubt in the future home-built 400W solid-state amplifiers will become commonplace but valves are a much better bet for the time being.

Circuit Design

Having selected a valve for the amplifier it is then possible to proceed with the circuit design. A suitable circuit is shown in Fig. 1.3.

Filament Circuit: It can be seen from Fig. 1.3 that a bifilar wound r.f. choke is included in the filament circuit. This is to enable the filaments to be kept above r.f. ground. Such a choke can be simply constructed by making a bifilar winding of 1·5 mm² pvc insulated copper wire along the entire length of a ferrite rod 150mm long. Voltage drop across the choke should be very small but it is important to measure the filament volts **at the valve pins.** If necessary the primary taps of T1 should be adjusted to ensure the correct voltage at the valve pins (6·3V at 4A per valve). T1 should be mounted close to the valves to minimise lead lengths and voltage drops.

Ideally the secondary of T1 (7·5V r.m.s. at 16A) should have a centre tap to provide the h.t. ground return, but if such a transformer cannot be found a centre tap can be artificially provided by means of two resistors (R1,2) as shown in Fig. 1.3.

Input Circuit: A generalised input circuit is shown in Fig. 1.3. As explained earlier, with the correct choice of valve no input tuning will be necessary. If input tuning is required then this can be provided by a separate "L" network (Lin/Cin) for each band. The "L" network can be set up by connecting a v.s.w.r. bridge between the transmitter and amplifier and adjusting the trimmer capacitor (Cin) for 1:1 v.s.w.r.

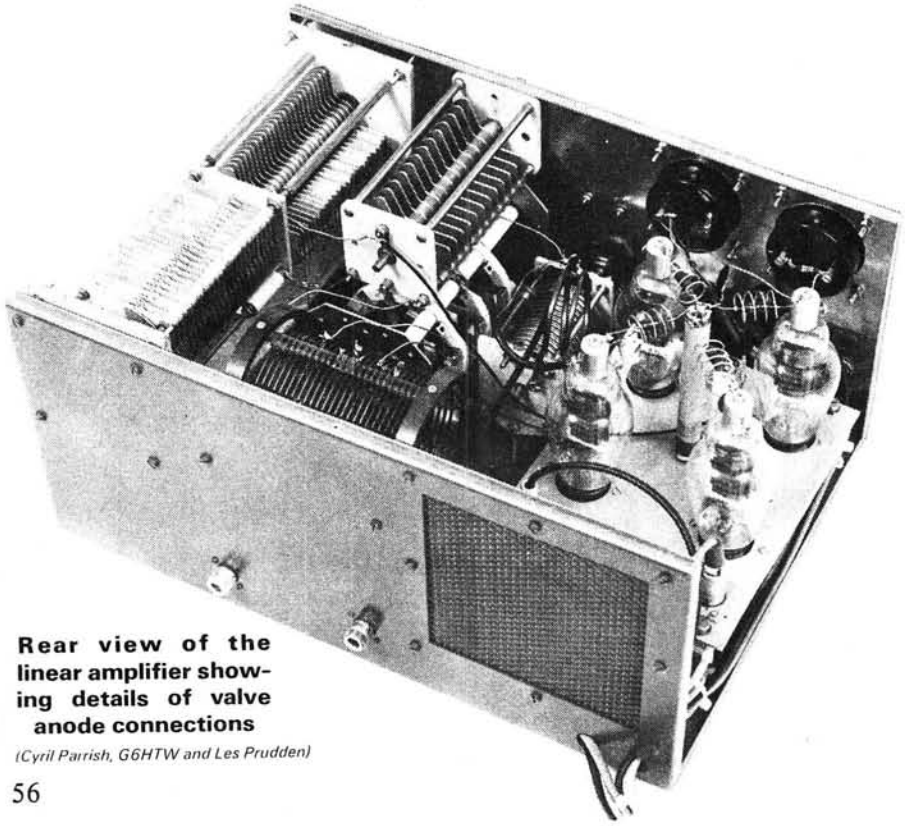
Anode Circuit: The principal component in the anode circuit is the r.f. choke, RFC1. This is designed to isolate the h.t. supply from the anode circuitry and so must have a sufficiently high reactance at the lowest frequency of interest. A value of inductance of 100μH will usually suffice. (i.e. a reactance of 2200 ohms at 3·5MHz.) The choke must be capable of handling voltages of up to twice the h.t. voltage and it must be capable of handling the anode current. Also, the choke must have no resonances within the amateur bands. If there are any such resonances the choke will absorb large quantities of r.f. energy and emit smoke. This problem may be overcome by adding or removing a few turns from the choke and checking all bands again. A suitable choke can be made by winding 24 s.w.g. enamel wire to a length of approximately 87mm on a 20mm diameter ceramic former.

Also in the anode circuit are the antiparasitic chokes RFC2/R3. Identical chokes are fitted in each valve anode and they consist of four turns of 14 s.w.g. wire, 15mm in diameter wound over a 50 ohm 2W solid carbon resistor. The object of fitting these chokes is to suppress any possible v.h.f. parasitic *oscillations* in the amplifier.

The final component to be considered in the anode circuit is the capacitor C4. The task of C4 is to block the h.t. from the pi network whilst allowing the r.f. power through. The d.c. rating of the capacitor must be at least twice the h.t. voltage and a suitable value would be 1nF.

Table 1. Parameters of some common valves

Valve	Supply (kV)	Max. Frequency (MHz)	Input Impedance (Ω)	Power Output (W)	Notes
811A	1·25	60	322	165	
813	2·5	30	376	219	Grid and screen joined
572B	2·5	30	275	400	
3–500Z	3·5	110	80	750	Needs chimney and blower



Rear view of the linear amplifier showing details of valve anode connections

(Cyril Parrish, G6HTW and Les Prudden)

PI Network Design

The purpose of the pi network is to efficiently transfer energy from the high output impedance valves into the 50 ohm load presented by the antenna. In Fig. 1.3 the components in the pi network are C1, C2, C3, L1, L2 and L3. The transfer of energy can be accomplished by more than

Most of the components used in this project will have to be painstakingly gathered together from amateur radio rallies. Only attempt this design if you have the ability to modify the construction and design to suit the components available. Please do not ask *Practical Wireless* or the author for information on how and where to obtain the components.

one set of values of L and C at one particular frequency. However, by varying the L/C ratio the Q of the pi network changes. If the Q is too high then there will be very high circulating currents in the pi coil causing losses. If the Q is too low then the network will provide reduced harmonic suppression. An optimum value of Q is around 10 and Fig. 1.2 provides a means of determining the value of pi tuning capacitance on various amateur bands. For four 811As in parallel the ratio of anode voltage to anode current (anode characteristic impedance) is 1250V/400mA or about 3·1kΩ.

Hence the value of tuning capacitance required for 3·5MHz is 300pF. The value of tuning capacitance required for 28MHz is 35pF. However, the output capacitance of the four valves in parallel is 22·4pF and so the pi tuning capacitor is only required to have a value of 12·6pF. It is difficult to find 300pF tuning capacitors which have a minimum capacitance of 12pF and so it was decided to fit two tuning capacitors in the amplifier. C1 is a 100pF capacitor with a minimum capacitance of 8pF and is switched in on the bands 14–28MHz. C2 is a 600pF and is switched in for the 3·5 and 7MHz bands. C3 is the loading capacitor and consists of four ganged 500pF broadcast capacitors.

The pi tank coil consists of L1, L2 and L3. L1, the 28MHz coil, is two turns of 10 s.w.g. copper wire, 45mm diameter and 32mm long. (L2 is set to minimum for 28MHz.) L2 is the pi coil for 21 and 14MHz and consists of a small "roller coaster" of approximately 10μH inductance. This coil will also be suitable for the 18 and 24MHz bands as they become available and the use of a "roller coaster" obviates the need for a 7 position bandswitch.

The pi coil for 3·5 and 7MHz (L3) consists of 27 turns of 12 s.w.g. wire 100mm diameter and 124mm long with 9 turns used for 7MHz and 27 turns for 3·5MHz. When initially tuning the amplifier on each band it is worth comparing the value of pi tuning capacitance actually used with the value obtained from Fig. 1.2. If necessary the pi inductor value should be changed so that the correct value of tuning capacitance is used. This will ensure operation of the pi network at the correct value of Q.

Metering and Tx/Rx Switching

Meters are included in the amplifier for measuring anode current and grid current. The anode current meter M1 is included in the negative lead of the h.t. supply to ensure that the meter is not at a high potential above ground. The grid current meter is M2. It is important to monitor grid current since this will give an indication of the tuning state of the amplifier.

If the correct pi network values are used and the amplifier is connected to a 50 ohm load the grid current will rise linearly with anode current as r.f. drive is applied. However, if incorrect pi network values are used or if the antenna has a high v.s.w.r. then grid current will rise rapidly as r.f. drive is applied with no corresponding increase in anode current.

Two heavy duty relays, RLA and RLB, are used to control the amplifier's transmit/receive switching. In the receive position the amplifier is by-passed enabling the antenna to be connected directly to the transmitter/receiver. Switch S2 is a front panel switch enabling the amplifier to be switched in and out of circuit as required.

Power Supply

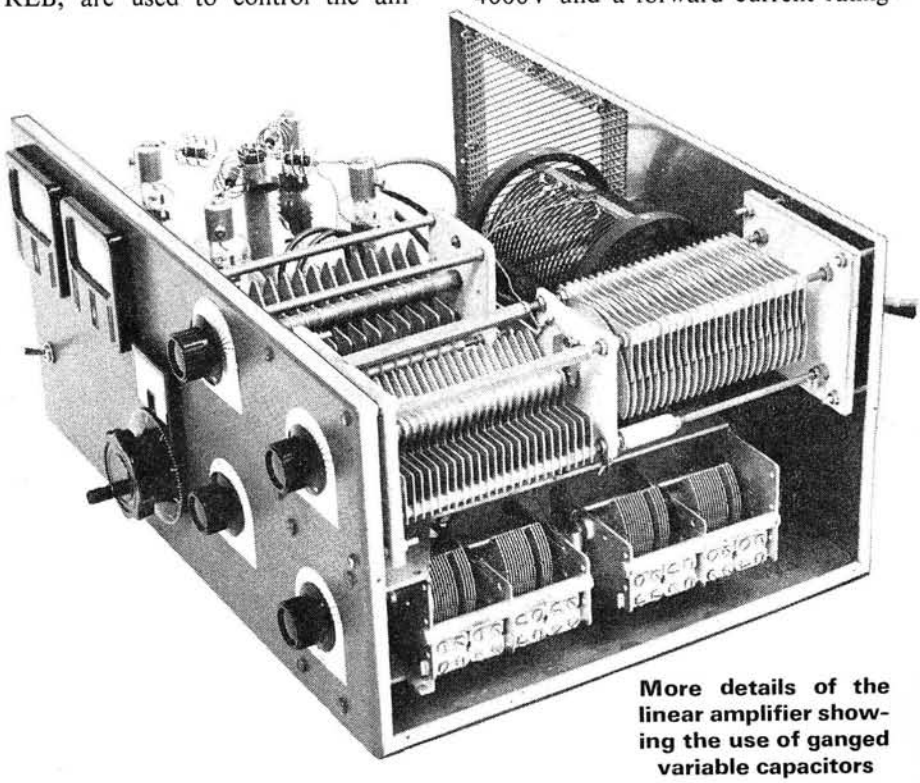
In the receive condition it is necessary to apply a small negative voltage to the valve grids in order to cut them off. This is achieved by RLB. A 12V negative supply is used for the relay coils and this supply is also used to cut-off the valves.

The power supply for the amplifier is shown in Fig. 1.1.

An h.t. supply rail of 1250V is required and this can be achieved in a number of ways depending on the components to hand. I was able to track down an h.t. transformer having a 1380V secondary. This will give the required 1250V d.c. with a choke input filter (d.c. voltage is 0·9 × a.c. voltage). However, an h.t. transformer with a secondary of 884V will give 1250V d.c. when used with a capacitor input filter (d.c. voltage is 1·414 × a.c. voltage).

The capacitor input filter approach is the preferable one but the final choice of circuit depends on the h.t. transformer which can be obtained.

Each of the diodes D1–D4 consists of four 1N5408 diodes in series to give a total peak inverse rating of 4000V and a forward current rating



More details of the linear amplifier showing the use of ganged variable capacitors

(Cyril Parrish, G6HTW and Les Prudden)

of 3A. Each diode is shunted by a 1nF 1kV disc ceramic capacitor to give protection from mains spikes and a 100kΩ 2W resistor to equalise reverse voltages across the diodes. The theoretical reverse voltage rating for D1–D4 is 1·4 × transformer secondary voltage i.e. 1·4 × 1380V, 1932V, but it is good practice to have a substantial safety margin.

A disadvantage of the choke input filter is its poor regulation at low currents. At low currents the filter behaves as a capacitor input filter and the output voltage will rise to 1380 × 1·414V i.e. 1952V. However, once a critical value of current is taken from the supply the output voltage will drop to the correct level of 0·9 × secondary voltage. This critical level of current is determined by the size of the choke L4 and can be determined from:

$$L4 = \frac{\text{Required Supply Voltage}}{\text{Supply Current (mA)}} \text{ (H)}$$

The standing current taken by four 811As in parallel is 100mA, hence a choke with an inductance equal to or greater than 1250/100, i.e. 12·5H, is required. So the h.t. supply will give an output voltage of 1952V off load but will immediately drop to the required value of 1250V when the amplifier is switched to transmit.

The smoothing capacitor bank C11–16 consists of six 250µF, 450V capacitors in series to give a total capacitance of 41µF at a working

WARNING

The h.t. voltage used in this project is dangerous. Treat all parts of the circuit with respect. Play safe and keep one hand in your pocket.

voltage of 2700V. The resistor chain R5–10 is fitted to equalise the voltage across the capacitors and also to discharge them on switching off. Each resistor is rated at 10kΩ, 12 watts, giving a total resistance rating of 60kΩ at 72 watts. A resistance of 60kΩ connected across a 1952V supply will give a current flow of 32mA. This is not sufficient to cause the voltage to drop to its final stable voltage of 1250V but it is sufficient to drop the voltage to some intermediate value. In the case of the author's supply the resistor chain drops the off-load voltage to approximately 1450V.

The voltmeter (M3) used was a 300V d.c. 1mA f.s.d. meter with 10 resistors, each 270kΩ, in series to give a 0–3kV meter.

A −12V supply is also required for the relays and to cut-off the valves during receive periods. This is simply provided by the transformer T3 with a bridge rectifier and capacitor input filter. The diodes D5–D8 are rated at 100V p.i.v., 1A and the capacitor (C17) is 50µF, 25V working.

Component Collection

Once the design of the amplifier has been established the most difficult and time consuming part of the exercise can begin. This is the collection of suitable tuning capacitors, coils, valves, transformers, chokes etc. The nature of the components is such that it is not economic to try and buy brand new ones from manufacturers. However, six months of *determined* visits to mobile rallies, junk sales, exhibitions and local amateurs should be long enough to assemble a formidable collection of heavy duty components!

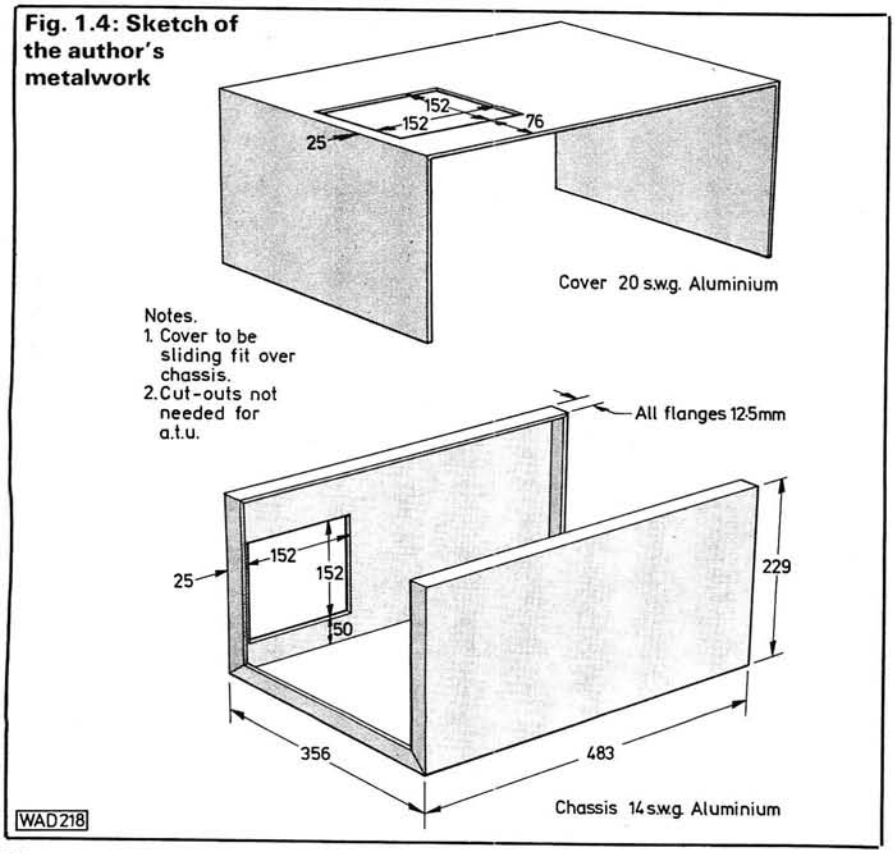
Metalwork

Having collected the major components it is then necessary to consider how they should be housed. There may be a great temptation to use a cabinet which is already to hand but Murphy's Law generally dictates that such a cabinet will be either slightly too small or the wrong shape. The only way to achieve a reasonable finished product is to design and build a cabinet specially to house the components which have been collected. The first step is to determine the physical layout of the major components and the only precaution to take is to ensure that the valves, the h.f. pi coil and the h.f. tuning capacitor are kept as close together as possible in order to minimise lead lengths. A sketch can then be made of a cabinet of ideal size to house the components. The sketch made for the author's amplifier is shown in Fig. 1.4. The cabinet consists of two parts. A heavy duty chassis of 14 s.w.g. aluminium and a wrap-over cover of 20 s.w.g. aluminium. Two 150mm square cutouts are provided for ventilation of the valves. Some lucky amateurs may have sufficient workshop facilities to be able to build the cabinet themselves but most of us will have to resort to getting the names of local sheet metal workers from Yellow Pages. Three or four local sheet metal companies should be sent a copy of the sketch with a request for a quotation. In these difficult times of recession it should be possible to get quite reasonable quotations!

Once the cabinet has been constructed then follows the relatively easy task of mounting and wiring all the components. In the case of the author's amplifier the valves are mounted on a small subchassis plate. A separate cabinet is used to house the power supply unit. Any large, sturdy metal box can be used.

Part 2 of this article will cover the design and construction of a suitable v.s.w.r. meter and a.t.u. for use with the linear amplifier.

Fig. 1.4: Sketch of the author's metalwork



VOX Option Handie

South Midlands Communications Ltd. have supplied me with information on the very latest Yaesu 144MHz f.m. handheld transceiver, entitled the FT-203R.

The FT-203R follows the trend for smaller and smaller units and is housed in a high-impact plastics case that measures only 153 x 65 x 34mm, weighs 450g yet delivers 2·5W r.f. output power into 50Ω using the standard 10·8V power pack.

Frequency range is 144 to 146MHz in 5kHz steps, selected via a three-digit thumbwheel switch and a push button for 0 or 5kHz. Simplex or repeater shift operation is selected by a switch on the rear panel, whilst the p.t.t. and tone burst switches are located on the side of the unit.

The top control panel has, in addition to, volume, on/off, squelch, frequency and power select, earpiece and microphone sockets, and a signal/power out meter, which allows the transceiver to be used for general direction finding and "foxhunting" when a directional beam antenna is employed.

A very useful feature is the VOX system in the FT-203R, that when

used in conjunction with the optional YH-2 headset, provides voice-actuated transmit/receive switching, allowing the operator to have both hands free during QSOs.

Supplied as standard is a 10·8V—425mAh NiCad pack, soft case and helical rubber antenna. Optional accessories include a 12V—500mAh NiCad pack (which will increase the r.f. power out), battery case for six AA size dry cells, d.c. car adaptor/trickle charger, mains charger, speaker microphone and, of course, the YH-2 headset which costs £13.80 inclusive of VAT and carriage.

The FT-203R costs £169, which includes VAT and carriage, and is available from: *South Midlands Communications Ltd., S. M. House, Rumbridge Street, Totton, Southampton SO4 4DP. Tel: (0703) 867333.*

Top-band Mobile/Base Transceiver

Latest information from Northampton Communications describes a dedicated top-band transceiver that has been designed and built in Northampton, and is suitable to fulfil the much needed requirement of mobile operation on the band.

The 1·8MHz enthusiast will know that obtaining equipment for this band usually means either buying high-priced, imported, multiband rigs, or build your own.

This rig, entitled the Lencom LC160, is suitable as a base station, whilst being compact enough for mobile operation. Of modular, solid state, construction which permits easy access for servicing or owner modification, the LC160 is tuned via a central control knob, linked to a 12:1 reduction drive and readout is via a 150mm long analogue dial. Frequency coverage is, of course, between 1·8 and 2·0MHz.

Switchable modes are s.s.b. and a.m., with c.w. being automatically obtained on insertion of the key jack, carrier and side tone being electronically switched.

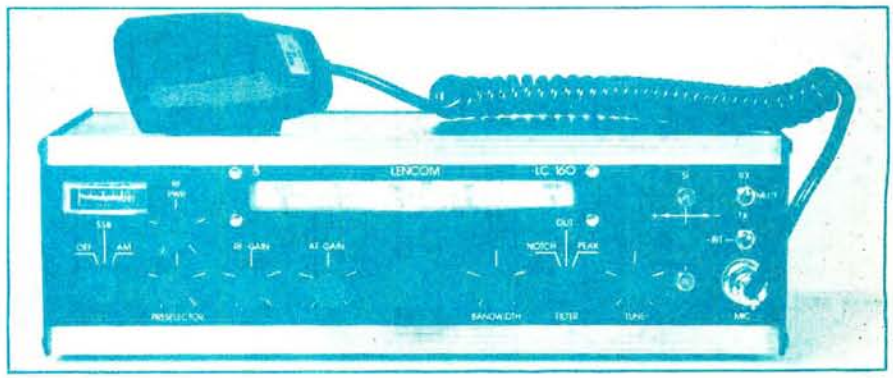
Excellent i.f. selectivity is obtained with a 2·1kHz mechanical filter at 455kHz; further selectivity is effected with the integral audio filter, which can provide a tuned notch or peak function. The bandwidth of notch and peak are variable.

The rugged p.a. delivers an r.f. power output of over 30W p.e.p., into 40–70Ω, and is fully controllable from the front panel. Audio output is 2W into 3Ω, by way of an external speaker (available separately), and with the microphone supplied, audio clipping is set at a 12dB level, the microphone gain being fixed.

For ease of mobile operating the audio output can be muted by a front panel control and an indicator light will be activated should any signals be present. Also transmit/receive may be switched either from the front panel or the p.t.t. on the microphone.

Other specifications include: stability of the v.f.o. less than 100Hz/hr, c.i.o. less than 50Hz/hr; bandwidth on s.s.b. 2·1kHz, a.m. 8·0kHz; carrier suppression is better than 40dB and the transceiver requires a 12 to 14V d.c. power source with current consumption at 1·2A on receive and 4A on transmit.

The LC160 top-band transceiver is housed in a case measuring 300 x 165 x 90mm, is priced at £199 which includes VAT and is available exclusively from: *Northampton Communications Ltd., Communications House, 76 Earl Street, Northampton NN1 3AX. Tel: (0604) 33936 or 38202.*



VFM? Value For Money

by G8YDK

A colleague had persuaded me to "have a quick look at it". The complaint was that when switched on the radio would work for just a few minutes and then stop. I suggested he buy a new battery, but he assured me that he kept buying new batteries, and had already spent more on batteries than he had on the radio!

The little red radio was still in its cardboard box with a price label clearly marked £2.50, so whatever I did could not be cost effective. When tested it was completely dead, the 6-F22 (PP3) battery was flat, measuring 2·2 volts, but then the switch was ON when I took the radio out of its box, so the battery would be flat wouldn't it? With a 9 volt supply applied to the battery clip the little radio worked reasonably well, but if the supply was reduced to lower than 8 volts it stopped.

Now, there are many technical procedures to establish if the local oscillator has stopped oscillating, but the "subject" didn't seem worthy of any of them. Anyhow, I *knew* that the oscillator stopped whenever the supply went below 8 volts.

With the two small retaining screws removed the 50mm square p.c.b. came out easily enough, but the leads to the speaker were a bit short. It wasn't too difficult to work out the details of the "front end" circuitry, and this is shown for reference in Fig. 1. I applaud the designer of this miniature superheterodyne receiver with its minimum of components.

With the supply set to 9 volts the first checks were made on the frequency changer transistor, Tr1: collector 5·9V, emitter 0·6V, base 1·1V. Emitter volts, 0·6, divided by R3 at 3·3kΩ, using good old Ohm's Law, gave 182 microamps emitter current—low, even for a frequency changer stage. Collector volts also seemed to be low for the 9V input and it was found that 3 volts were being dropped across R8. The 3 volt drop divided by R8 at 330Ω indicated a current of 9mA—well it certainly wasn't going to Tr1.

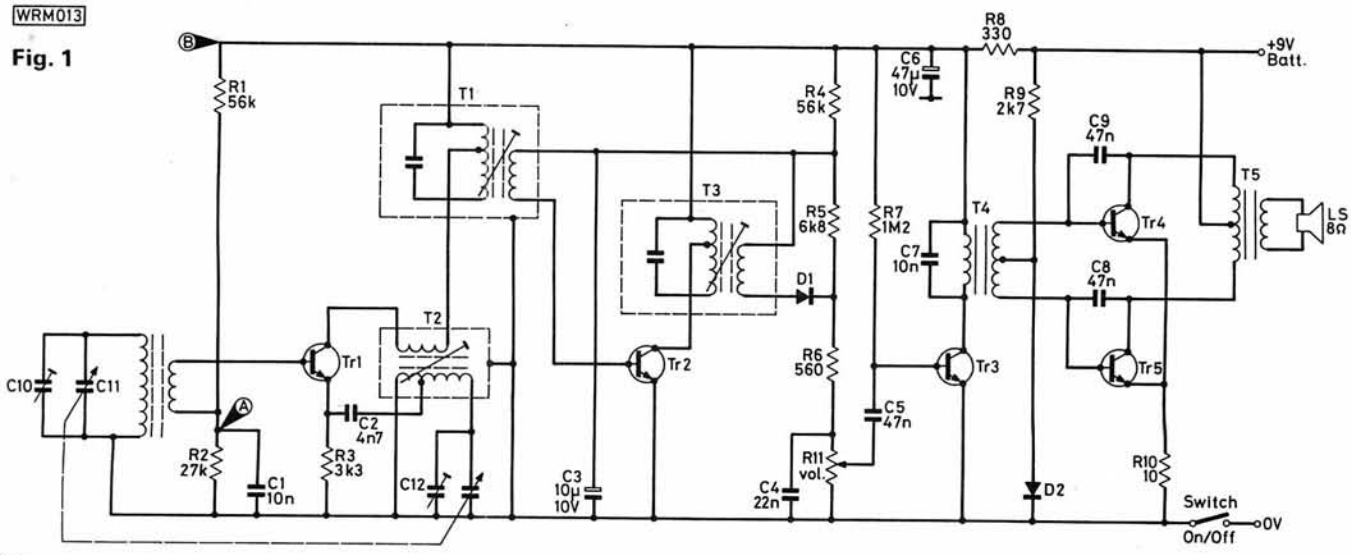
Back to Tr1; ignoring what should be the very low base current of Tr1, the potential at point A can be calculated to be the 6 volts measured at point B, divided by R1 + R2, multiplied by R2. This calculation worked out to be 1·95 volts, but point A measured 1·1 volts. So was R1 or R2 of incorrect value, or was capacitor C1 leaky? It was possible to unsolder the lead to the base coupling winding on the ferrite rod antenna at point A, and with Tr1 base isolated, resistance checks were made between points A and B and from point A to the 0V supply rail. The readings obtained were 56kΩ and 27kΩ respectively, showing both R1 and R2 to be correct, and suggesting that C1 was also OK. A voltage check at point A now gave a reading of almost 2 volts, so it *was* Tr1 upsetting the potential.

By juggling with the figures it could be seen that Tr1 was requiring 47 microamps of base current, which was ridiculous considering the calculated 182 microamp emitter current—no wonder it was affecting the base potential divider network which would normally be designed to draw ten times the expected base current. Current in R1 and R2 from the 6 volts available is 72 microamps.

Still, I was only "having a quick look at it", so the line

WRM013

Fig. 1



of least resistance . . . changing R1 from 56kΩ to 39kΩ allowed the oscillator to function until the supply fell to 7·1 volts. I put the set back together at this stage, and it *did* work, but my conscience eventually got the better of me! I convinced myself that there were too many "birdies" as I tuned across the band. Where were the 9 milliamps through R8? And I really wasn't happy about changing the value of R1.

The Second Session

I first put back the original R1, and became an honest man again. Now, where were the 9 milliamps going? I already knew it wasn't to Tr1. A screwdriver blade shorting the base/emitter junctions of Tr2 and Tr3 gave the clue; by switching off Tr3 the current through R8 (calculated each time by the measured voltage drop across it) reduced by approximately 1·5mA. No substantial difference could be noticed when attempting to switch off Tr2, although the voltage across R8 did fluctuate. Even if the current was leaking through some other route, I was expecting to see a reduction proportional to the current in Tr2, but I didn't.

I next removed Tr2 and my May 1975 *Television* transistor tester showed it to have an infinite hFE—obviously leaky. Now, what to replace it with? None of the transistors had any markings on them, although those long Japanese numbers don't mean much to me anyway—each piece of oriental equipment seems to have its own range of transistor numbers. Right! Silicon, *npn,* r.f., what did I have? I didn't really want to use something I had paid good money for. What was in that 50p "goodies" pack I couldn't resist at the Electronics Hobbies Fair? A 2N2369A, used for fast switching and v.h.f. multiplier stages, was located—should work OK at 455kHz. This was rapidly fitted into the Tr2 position, making sure that the collector "can" didn't touch the adjacent i.f. transformer.

With the supply set to 9 volts the current through R8 was now 4·5 milliamps, much better! However, even with the higher voltage this gave at point B, the oscillator still stopped when the supply was reduced much below 8 volts. I had already proved that Tr1 was unhappy, so in went yet another 2N2369A. This transformed the frequency changer stage, giving the expected d.c. conditions; i.e. with point B at 7·5 volts, emitter 1·8 volts, base 2·4 volts and emitter current therefore 545 microamps. The set would now continue to work with the supply as low as 5 volts.

The p.c.b. was again refitted, with necessary repairs to the fraying speaker leads. The radio was now re-aligned, naughtily using the "known transmitter" method, which was in fact perfectly adequate for the dial calibration used. The radio was now considered to be giving a very respectable performance, for its simple pedigree, but in keeping with my usual pessimism I decided to "live with it" for a while and soon became aware of the background audio hiss, even with the volume control at minimum!

The Third Session

That hiss must be generated after the volume control and a screwdriver blade across the base/emitter junction of Tr3 stopped it dead. In went the third 2N2369A—all now beautifully noise free and radio still working just as well.

Final reassembly, and triumphant return to owner—"Thanks very much, I'll buy you a pint at Christmas". Still, I did know that I was only doing it in pursuance of my *hobby,* and there's only one thing I enjoy more than my radio hobby—it's not a pint at Christmas! ●

INTERMEDIATE FREQUENCY

The second topic highlighted for attention in the report on the May 1983 RAE results is the choice of the intermediate frequency in a superhet receiver.

Selectivity

What are we looking for in a radio receiver? The most important thing is an ability to receive just one signal at a time, without interference from other stations. This ability to select one station and reject the rest is called, appropriately enough, the **selectivity** of the receiver. It's achieved by having tuned circuits—coils and capacitors—which are arranged to resonate at the frequency of the wanted signal.

Unfortunately, you can't make a tuned circuit resonate at one frequency only, or even just across the narrow band of frequencies carrying the signal from a single station. It will still have some response at frequencies above and below the wanted station (Fig. 1), and you'll hear signals on those frequencies too. The sharpness of a tuned circuit is called its ***Q* factor** (or just *Q* for short). The sharper the circuit the higher the *Q*.

There are several formulas for calculating *Q*, but the one of most use to us in our present discussion is

$$Q = \frac{f_o}{B}$$

where f_o is the resonant frequency of the tuned circuit and *B* is its **bandwidth**—the difference between the frequencies above and below f_o at which the output voltage from the tuned circuit is reduced to 0·707 times that at resonance (Fig. 2). If the output voltage has fallen to 0·707, the output power will be $0{\cdot}707^2$ or roughly 0·5 (remember, power is proportional to voltage squared). Those frequencies are therefore called the half-power points, or (for those of you into such things) the −3dB points.

Putting that formula into words, the *Q* factor is the ratio of the centre frequency to the bandwidth. Say you had a tuned circuit with a *Q* of 100. If its resonant frequency was 800kHz in the medium-wave broadcast band, then its bandwidth would be 800 ÷ 100 = 8kHz (because the formula can be turned round to say $B = f_o \div Q$). On the other hand, if the resonant frequency was 14MHz (14 000kHz) at the bottom of the 20m amateur band, its bandwidth would be 14 000 ÷ 100 = 140kHz. You can get an awful lot of stations into 140kHz, so that wouldn't be much use to us, would it?

If you cascade several tuned circuits one after the other, in a suitable way, you can achieve a much sharper response than each circuit produces on its own, but they must be very carefuly adjusted if you are to get a good response. If you have a receiver that is intended to receive on only one frequency there is no great problem, but if you want to tune to several stations, even just across the medium-wave broadcast band, for example, it means you've got to arrange to alter the resonant frequency of all the tuned circuits at the same time, keeping them in step with each other, a process called **tracking**. If each circuit has a reasonable *Q* factor, that's going to be very difficult, if not impossible. So, what's the solution?

The Superhet

The solution is the superhet receiver, or the supersonic heterodyne to give it its full name. The idea is that you convert the incoming wanted signal, whatever its frequency may be, to another frequency which is constant. This new frequency is called the **intermediate frequency (or i.f.)**, so called because it is an in-between stage in converting the incoming radio-frequency signal to an audio-frequency one to feed the loudspeaker or headphones. All the selectivity needed to get rid of interfering signals on channels adjacent to the wanted station is put into the i.f. amplifier.

What should the intermediate frequency be? Well, we've already found out that it's easier to achieve narrow bandwidths at low frequencies than at high ones. So, let's go for a low frequency. Problem solved? No, because there's another snag we've not talked about yet, and it comes about just because we've converted the incoming signal to the *i.f.*

How is that conversion done? By taking an output from an oscillator in the receiver, called the **local oscillator (l.o.)** and mixing or heterodyning it with the incoming signal, to produce an output at the intermediate frequency (Fig. 3). If we wanted to receive that station transmitting on 800kHz, and we chose a nice low i.f. of 100kHz, our local oscillator could run at 900kHz so that the "difference" frequency coming out of the mixer was 900 − 800 = 100kHz. There would be a "sum" frequency output too, at 900 + 800 = 1700kHz,

Fig 1

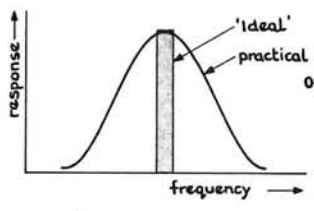


Fig 2

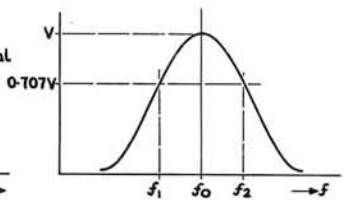
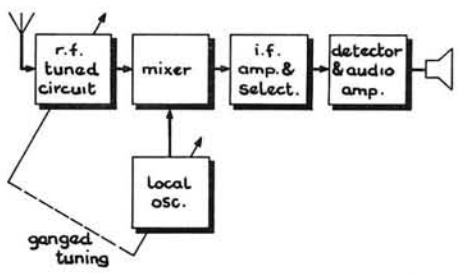


Fig 3



but that would be rejected by the i.f. amplifier tuned circuits, so no problem there.

Second Channel

But say there was another station, transmitting on 1000kHz, and his signal arrived at the input to our mixer too. With our local oscillator at 900kHz, this will produce a "difference" frequency of 1000 – 900 = 100kHz too. We can put a tuned circuit between the antenna and the mixer, tuned to 800kHz, and that will cut down the response to the 1000kHz signal, but it won't suppress it entirely (Fig. 4). If that r.f. tuned circuit had a *Q* of 100, it would reduce the interfering signal at 1000kHz by around 33dB. But that interfering signal might be 33dB stronger than the wanted one, maybe even stronger than that, so obviously we need a lot more selectivity ahead of the mixer. Adding another tuned circuit would help, but we're back to the problem of tracking the adjustment of all the tuned circuits.

It's therefore better if we use a higher intermediate frequency, because somehow we've got to achieve much better rejection of interference from stations on frequencies 2 × i.f. away from the wanted signal. This sort of interference is called **second-channel,** because of the fact that there are two signal-frequency channels that can mix with the local oscillator to give an output at the i.f., or **image,** because if you imagine the oscillator frequency to be a mirror, the unwanted signal is like the reflection of the wanted signal.

For simple receivers covering the long- and medium-wave broadcast bands an i.f. around 450-470kHz is chosen as giving a good compromise between the demands of adjacent-channel and second-channel rejection. With a single tuned circuit (*Q* = 100) ahead of the mixer, the lowest second-channel rejection figure (achieved when tuned to 1500kHz) would be a useful 40dB. If you tried to use that same i.f. on short waves, then at 21·5MHz in the 13m band you'd get no more than 20dB of second-channel rejection, and you'd certainly need to add at least one more tuned circuit ahead of the mixer.

Using a still higher i.f. will improve second-channel rejection, and frequencies of 9MHz or 10·7MHz are often used. You've still got to find some way of getting back a reasonable adjacent-channel selectivity, but I'll look at that later.

Fig 4

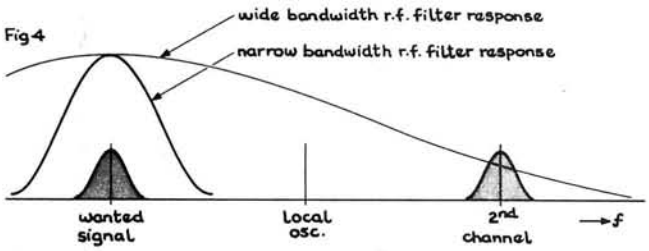
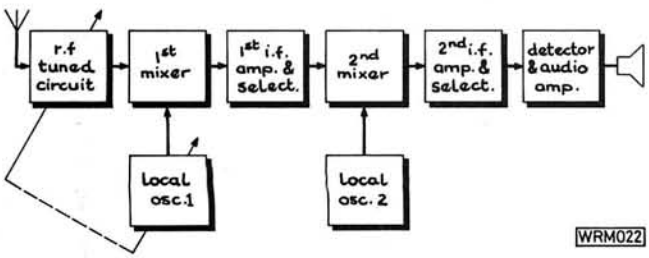


Fig 5



General Coverage

Intermediate frequencies of 9MHz or 10·7MHz are alright providing your receiver covers only amateur bands (or broadcast bands) because they fall between bands. If you want a general-coverage receiver to listen to any frequency from, say 1·6 to 30MHz, you've got a new problem, because you can't tune past the intermediate frequency without all sorts of nasty things happening!

There are two ways round this one. The first is to have a choice of two i.f.s, controlled by the receiver band-selector switch, so that the i.f. in use is always outside the frequency band selected. This method is used sometimes, but it means two lots of i.f. tuned circuits are needed, and the tracking between the local oscillator tuning and the signal frequency tuning is complicated. The other way is to have an i.f. which is higher than the highest frequency covered by the receiver. For a receiver covering up to 30MHz, i.f.s of around 47MHz or between 60 and 75MHz have been used.

The advantage of this method is that, regardless of what frequency the receiver is tuned to, the second-channel is always above the highest frequency covered. For example, when tuned to 150kHz, the second-channel frequency for a receiver with a 47MHz i.f. is 94·15MHz. So instead of having to tune the signal-frequency circuits and keep them all tracking together, we can have a fixed low-pass filter ahead of the mixer which passes all frequencies below 30MHz and rejects all frequencies above that point. This system is ideal for synthesised receivers, because there is no need to tune the front-end amplifiers.

So, we've got round the problem of second-channel or image interference, but that high i.f. means that adjacent channel selectivity will be very poor indeed. The solution is the double superhet circuit (Fig. 5). The idea here is that the first i.f. signal is fed to a second mixer stage where it's converted to a second i.f., at a lower frequency where adequate adjacent channel selectivity is easy to achieve. There's no problem with second-channel interference at the second mixer, because there should be no signals at the image frequency of the first i.f.

Summing Up

To summarise—because the bandwidth of a tuned circuit is proportional to its tuned frequency (for a given *Q* factor), you get smaller bandwidths at lower frequencies. We can achieve a constant bandwidth by using the superhet principle, converting all incoming signals to a fixed frequency, called the i.f., where we concentrate our adjacent channel selectivity.

The mixer in the superhet brings with it the problem of second-channel (image) interference. To get rid of the image we need a high i.f., but to give good adjacent channel selectivity we need a low i.f. We can get both by the double superhet. The first i.f. is high, for good image rejection, the second is low, for adjacent channel rejection.

For a domestic long/medium wave broadcast receiver, a double superhet would be too expensive. Instead, a compromise i.f. of around 460kHz is chosen. ●

on the air

AMATEUR BANDS by Eric Dowdeswell G4AR

Reports to: Eric Dowdeswell G4AR, 57 The Kingsway, Ewell Village, Epsom, Surrey, KT17 1NA.
Logs by bands in alphabetical order.

In view of the excellent DX reports that I get from my regular listeners it is not perhaps surprising if other readers sometimes express an element of doubt as to whether these stations have really been heard. After all, it is very easy to just sit on one of the DX nets that abound these days and copy the calls being worked by the net control station without bothering to copy the DX stations themselves.

However, after a while one gets to know pretty quickly whether a log is genuine or not and it is not hard to spot the spoofer! Given two somewhat similar station set-ups it is up to the operator as to what DX is heard and logged and I've come to the conclusion that a lot of DX is lost by the incorrect use of the r.f. gain control on the receiver. On most sets, according to the set's manual, the S-meter reading is correct only when the r.f. gain control is at maximum so there is a tendency to leave it there all the time in order to compare S-meter readings between stations, and that is just about the worst possible practice when looking for DX.

The r.f. gain control should never be advanced more than is neccessary and to hell with the S-meter! It is one of the biggest menaces on the average communications receiver yet its alleged virtues are taken for gospel by the user. It does not indicate actual signal strength since the set's sensitivity varies greatly from one end of a band to the other and more so between bands, and all it can ever tell you is that one signal is weaker or stronger than another. On the l.f. bands in particular using maximum r.f. gain will bring all kinds of problems, principally cross-modulation or overloading so that any signal strength indication is meaningless. CW signals that are really quite clean can sound awful with clicks and thumps if the front end is being overloaded. Turn back the r.f. gain and the signal sounds as it should do. Unfortunately many stations get adverse reports of their signal quality both on s.s.b. and c.w. when in fact the distortion is being generated in the receiver itself.

The golden rule is to turn up the audio to somewhere near maximum and then the r.f. gain as far as is necessary to copy the signal cleanly. The reduction in general noise level is quite remarkable and that is when the DX can be copied quite easily. I find it possible to copy DX stations that are perfectly readable yet make no movement on the S-meter at all and a genuine report would be something like 51 or 52 but turn the r.f. gain to maximum and they disappear in the attendant noise. According to the report in *PW* (July 1982) on the receiver side of my TS530S transceiver it is possible to copy a c.w. signal of 0·035 microvolt on the 21MHz band and I can well believe it.

Listeners to the amateur bands often hear operators referring to transmitter power as "100 watts p.e.p.", or whatever, which does not convey very much if one doesn't know the meaning of p.e.p. (peak envelope power) so a few words of explanation might be useful.

In a simple c.w. transmitter the maximum power output is realised when the key is down and is zero when the key is up. A few Morse characters are shown in Fig. 1(a) as they would appear on the screen of a suitably adjusted oscilloscope. Such a sharp turn-on of the output would produce heavy key clicks and thumps and would create a lot of interference in nearby radios. In practice suitable resistor/capacitance networks round off the keying waveform as in Fig. 1(b). The power input is simply output stage voltage times output stage current.

Next take an amplitude modulated transmitter as we are accustomed to listening to on the medium, long and s.w. broadcast bands. Here we have a constant carrier of the same amplitude as the c.w. case. The speech or music is impressed (modulated) on to the carrier and for the condition of 100 per cent modulation the carrier level either doubles in value or is reduced to zero, Fig. 1(c). If the modulating signal is excessive the positive excursion is more than double but the negative excursion cuts the carrier off, causing distortion and creating interference generally.

Since, with full modulation, the carrier level is doubled the input current to the output stage is also doubled, and derived from Ohm's Law, doubling the current in a constant resistance quadruples the power ($W = I^2R$), theoretically anyway! If a sine wave is used to modulate the transmitter then the carrier envelope is as shown in Fig. 1(c). It should be remarked that the carrier is being radiated continuously even in the absence of modulation, a very inefficient state of affairs. The act of modulation mainly produces two similar sidebands. The carrier is needed at the distant receiver in order to demodulate the signal and produce an audio signal at the headphones or speaker.

If the wanted carrier can be reproduced in the receiver at exactly the same frequency (and preferably in the same phase) then the carrier can be suppressed as well as one of the unwanted sidebands resulting in the well-known s.s.b. signal. Without going into technicalities it is generally reckoned that for a given power supply to a transmitter the effective peak power output on s.s.b. can be up to eight times that of an a.m. signal.

The waveform in Fig. 2 shows a typical s.s.b. signal with the upper and lower limits of the envelope similar to the 100 per cent a.m. condition. With the

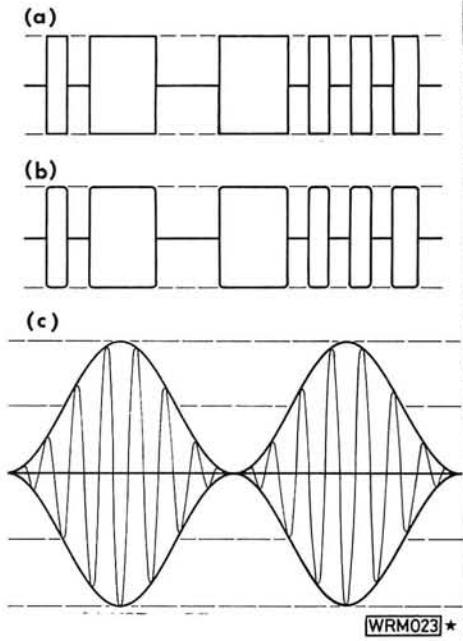


Fig. 1: (a) Typical c.w. or Morse code characters where the power output is either maximum or zero. The sharp rise time would create a series of undesirable harmonics which are suppressed in the transmitter to produce a rounded waveform as in (b). In (c) a sinewave modulates the carrier to give twice the amplitude of the c.w. carrier

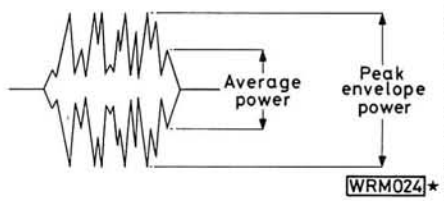


Fig. 2: Showing a typical speech waveform of an s.s.b. signal with average and peak envelope power indicated

human voice this only occurs for about 30 to 50 per cent of the time due to the peaks and troughs of the voice so that in order to keep this duty cycle as high as possible on s.s.b. it is now the fashion to incorporate or add speech processors to an s.s.b. transmitter to raise the value of the duty cycle. When done properly this can be very effective, especially when DXing but, as usual, this procedure has been abused on the amateur bands with severe speech clipping causing audio distortion and resulting interference to other stations, rather like over-modulation on a.m.

If you look at the S-meter on a receiver while copying s.s.b. without speech processing the signal level will rise and fall corresponding with the contours of the speech. With full speech processing the needle will stay virtually at the maximum level of the signal all the time the operator is speaking and the signal will have a great deal more punch and readability. What amazes me is the selfishness of operators who do not switch the speech processor off when working comparatively local stations but continue to inflict horribly distorted speech on our ears! Every intake of breath sounds like a hurricane!

General Notes

Paul Drinkwater up in Sutton Coldfield has been copying a few amateurs on s.s.b. the hard way using a m.w./l.w. pocket set and a Binatone clock radio with the local oscillator of one providing the necessary injection voltage for copying s.s.b. but it all sounds a bit haphazard and unrepeatable. Still, it is a start. From his report he seems to have copied a DL or two on the 3·5MHz band.

We G's have a habit of carping at and criticising our liberal AR regs but perhaps we should consider ourselves lucky compared to, of all countries, Sweden. In a QSO with an SM on 3·5MHz recently I was very surprised to learn that it is an offence for an amateur to possess any radio transmitter that will work outside the amateur bands. In this case my SM friend quoted an SM1 who bought a secondhand v.h.f. transceiver covering the maritime bands intending to modify it for the 144MHz band, something fairly commonplace over here. However the SM1 was arrested and the offending transceiver confiscated plus all his amateur bands gear! Eventually the case came to court and he was acquitted and his gear returned only for the matter to go to a higher court when his gear was confiscated again! The outcome is awaited with interest by the SM amateurs.

Incidentally, the Top Band allocation for SM is only 1·83 to 1·845MHz and 10W p.e.p. input and I was surprised to learn that the new WARC bands have not yet been released in SM-land.

One reader, **Arthur Ryall** in Stafford, is thinking of putting up a G5RV antenna for his JR310 receiver but wonders why flat twin feeder is frequently recommended over coaxial cable. Twin feeder is a balanced system to earth and any local electrical noise or TV timebase interference will have a better chance of being reduced or eliminated than with coaxial cable which is inherently unbalanced making cancellation of the interference less likely. Coaxial cable should not be connected to what is essentially a balanced antenna system, such as a simple dipole, unless a balun (balanced-to-unbalanced transformer) is fitted between the feeder and the antenna. One other factor mitigating against coaxial feeder is its great weight compared to flat twin feeder thus dragging down the centre of an antenna unless a support such as a mast is provided. This may account in part for the great popularity of the inverted-V antenna.

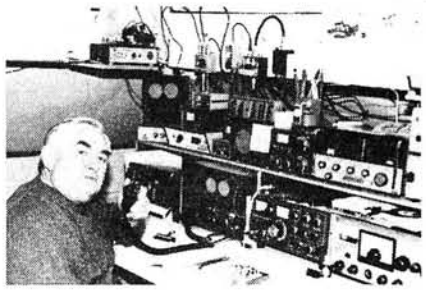
Round the Bands

As this is being written the l.f. bands, particularly the 3·5MHz and 1·8MHz bands, are really producing the DX once dusk falls and on for an hour or so after sunrise. It is very important to ensure that the antenna is the best that one can get up for these bands with as much of the wire as possible in the vertical plane and either a resonant length, if you have enough garden, or brought to resonance by means of an antenna tuning unit.

If you can lay down some radial wires underneath the antenna so much the better and now is the time to do it before the grass starts growing again. A slot for the wire, a couple of inches below the surface, can be made with the edge of a spade and the wires can be as long as is practicable and need not be related to the wavelength in use. The inner ends of the wires should be soldered together and a heavy copper wire taken back to the station earth. Triple ("twin-and-earth") pvc-covered wire as used for domestic electrical wiring is eminently suitable for this.

On to **Marcus Walden** of Harrogate and his Realistic DX302 and a 20m-long wire in the attic and an a.t.u. being constructed. Good lad! Around 3·8MHz he logged A71AD (QSL Box 4747 Doha, Qatar), A92HH (QSL W8LU), FM7WE, J88BC on St Vincent, OH0JN, OY8R, PJ2FR, VK3DWJ, VK6LK, VK2AVA, 5N2ARY, 6Y5IC and 7X5AB all on s.s.b. Due to the general QRM on 7MHz only HZ1AB, YC4FW and 6V0DY were worth logging but on 14MHz he caught HV3SJ (QSL I0DUD), J6LLO Box 800 St Lucia, plus ZF1GC. Finally on 21MHz it was FM7BX (QSL Box 152 Martinique), HH7BV, J28DN, J37AE on Grenada, TA2WCY, TL8DX, V2AS on Antigua with cards to OE3ALW, VP2MSS, VQ9BC (QSL WB6WUH), 3X4EX, and 5T23RD for an odd one.

From Plymouth a very long log from **Bob Stone** from which the following are culled. On 3·8MHz or thereabouts EA9JV, CT3CM, HK3DD, J88BC, VU2GI on the Laccadive Islands, N0XA, N7NG, T77V in San Marino,



Neat station set-up of Eric Fielding G4IHF in Rochdale covering the v.h.f. and h.f. bands. Eric is very active with the Bury RS, running a code class, and is a past treasurer of the club

YV5ANF, FM7CD, HH2MC, J3HSA on Grenada, and 5B4LP. Bob queries a special event station in Santa Maria, Brazil, with the call he swears was PY/KWS31M/A and being worked by all and sundry. Bob forgot to give any info on his receiving set-up but should be rectified by the next time around.

In Wellington, Somerset, **Dave Price** has been covering the bands from 28MHz to 3·5MHz although on the former the only item of note was VK6AEK, but more on 21MHz and YV5EUX, C53BI, VK6AJW, ZS1AAQ, A82LC in Monrovia, Liberia and FY7CM. 14MHz gave up YA1BGD, OY2A, VU7WCY, T77V, and so on to 7MHz with TA8GM, 6V0Y in Senegal and cards to VE4SK, and T77B. Dave's 40m loop antenna came into its own on 3·8MHz with large numbers of US stations, A92P, VU2GI, with K0CS of note among the Americans. Dave's receiver is a Yaesu FRG-7.

Dave Shapiro ARS53844 has also been making the most of his receiver, a Realistic DX-200, plus a 20m-long wire, a practice with which I heartly concur. It does seem a bit daft to spend a lot of money on a set only to listen to the easy stuff on 14MHz s.s.b. when there are several other interesting bands available at the turn of a switch. Anyway, starting on the 1·8MHz band Dave found a very good one in 5N8ARY and then 4X4DX. On to more goodies on 3·8MHz and DF3NZ/ST2, JF1IST, HI8HLB, J37AH, J88BC, TA2BNK, TI5BPF, VP2MSS, VL6LK, YB0WR and 8R1RBF. More mouth-watering stuff on 7MHz like HP3FL, J6LCV, KX6OH, TU2LE, VU7WCY, ZL4BO, 3X4EX and 6W1DY. Dave notes the continued use of the WCY suffix although the WCY is now officially over. All of note on 14MHz were XT2BM, TZ6WFP and KV4AD with just 5R8AL and 8P6OV on 28MHz.

In Shepherd's Bush, London, the set-up of **Denis Norton** comprises an FRDX-500, Datong FL2 audio filter, SST6 a.t.u. all fed from a 20m-long antenna, a half-wave vertical for 28MHz and a five-eighths wavelength vertical for 144MHz. How did that thing creep in?? Good

enough to find VE1YX on 1·8MHz and then CT2EF, FC2XN, 3A2GL and familiar 4U1ITU. Up to 14MHz and mainly JAs and ZLs during morning sessions, plus ZS6AOO and 7X2LS. Last band is 21MHz for HP1XEK, SV1OL/SV5, VK3WCY, VP9DL and 5N9MBT.

Reports from readers are always most welcome and should consist of a selection of around a dozen of the best DX heard on the bands from 1·8 to 28MHz and especially the new WARC bands on 10, 18 and 24MHz. Don't forget the c.w. stuff at the low end of each band. Time of day is rather important on the l.f. bands so that others can make an effort to hear the DX. With everyone using a v.f.o. these days actual precise frequency is not important unless a station is consistently heard on a particular frequency. Rarity of the DX station is the main consideration rather than distance. Don't forget, reports direct to me by the 15th of the month.

Club Time

Club magazine *Q5* of the North Bristol ARC rightly points out that many members regard the AGM as a bit of a "yawn", a date NOT to be noted in the diary, which is patently unfair when they are prepared to turn up and use the facilities of the club for the other 51 meetings during the year, arranged and provided by others of course. What makes AR an interesting hobby is seen from a different angle by every individual and the NBARC has been pressing its members to elect a committee that reflects these various interests and age groups.

Apart from that excellent precept, if every member voted at the AGM the club would get the committee it deserves and there would be no room for the all-too-frequent gripes and groans that come from those that shun AGMs.

Acton, Brentford & Chiswick ARC G3IIU Tuesday March 20 will have G3XPC giving his postponed chat on his further experiences in DXing in foreign countries. That is at 7.30pm in the Chiswick Town Hall, High Road, Chiswick, London W4. Visitors and potential members always most welcome, according to W. G. Dyer G3GEH, 188 Gunnersbury Avenue, London W3, the hon sec.

Axe Vale ARC 7.30pm on the first Friday of the month at the Cavalier Inn, Axminster, according to sec Bob Newland G3VW available on Lyme Regis 5282 or try the publicity officer Roger Jones G3YMK on Uppottery 468.

Bangor & District RS Where the sec is Stewart Mackay GI4OCK of 11 Dellmount Park, Bangor, Co Down, NI, or you can meet him and the gang in the Sands Hotel, Bangor, at 7.45 onwards on the first Friday of the month with visitors assured of finding something to suit their interests. Advance notice now of the club's summer mobile rally in June with details later.

Biggin Hill ARC Third Tuesdays in St Marks Church Hall, Church Road, Biggin Hill, Kent, according to sec Ian Mitchell G4NSD, 37b The Grove, Biggin Hill, Westerham, Kent.

Bromsgrove ARS G4TUI Coming up to its first anniversary the club has been doing very well with lectures, demos, outside visits and generally promoting AR in the area. Second Tuesdays at Rigby Lane School, Bromsgrove at 8pm with Alan Kelly G4LVK, 8 Green Slade Crescent, Bromsgrove, Worcs available on 021-445 2088 with details of future club happenings.

Bury RS G3BRS Latest issue of club's comprehensive magazine *Feedback* lists over 100 members which can't be bad and attributable to the standards maintained by the club in the way of lectures, outings and its many other activities including the Bury Ham-fest which I have been assured was a great success as usual. Every Tuesday at 8, in the club room at Mosses Centre, Cecil Street, Bury with the principal meeting on the second Tuesday but for details of the March highlight you'll have to chat with Brian Tyldesley G4TBT, 4 Colne Road, Burnley, otherwise Burnley 24254.

Cheshunt & District ARC G4ECT G6CRC From the newly-named club mag *Hamster* (!) I see the club holds meetings every Wednesday at 8 in the Church Room, Church Lane, Wormsley, near Cheshunt, Herts, with a junk sale slated for March 7 under the auspices of G4TQG and the 14th a natter-nite. The GB3PI repeater group has the floor on the 21st, with another natter period on the 28th. Filling in the details is sec Roger Frisby G4OAA, 2 Westfield Road, Hoddesdon, Herts, otherwise H'don 464795.

Chichester & District ARC Tuesday March 6 has John Outram discoursing on signal processing in microwave radar systems, in the Long Room of the Fernleigh Centre, 40 North Street, C'chester, at 7.30pm, with a regular meeting in the Green Room on the 15th. All of which makes it the first Tuesday and the third Thursday of the month. Meetings are complemented by a club net on the 144MHz band (S11) every Wednesday at 7pm. Make a note now of the AGM which is on Tuesday April 3 in the Long Room of the Centre. Club sec G4ETU has resigned so in the meantime I suggest you write to the club's chairman G4EHG, Marmanet, Salthill Road, Fishbourne, Chichester, Sx or have a chat on C'chester 789587.

Colchester RC Second and fourth Thursdays it seems, at the Colchester Institute, Sheepen Road, Colchester, at 7.30 with March 8 devoted to a talk by an RSGB rep on the AR repeater network and its administration while the 22nd will be Part 2 of a talk on Marconi and his work "Mainly Arcs and Sparks" by Stanley Wood. Note now the constructors' competition slated for April 5. Your sec is G3FIJ, 29 Kingswood Road, Colchester, otherwise (0206) 851189.

College of Technology, Belfast GI2BX RTTY with the ZX81 forms the main part of the evening's action on Wednesday March 28, by Ray Bowring GI8RKC, at 7pm sharp, Room B10, which is the lecture theatre at the College to which the public is also invited seemingly. Your contact at the College is Jim Barr GI1CET on Belfast 227244 ext 243 during any working day except Thursdays.

Coulsdon ATS You won't believe it but the club call of the CATS mob is G4FUR and that just can't be accidental! Anyway they meet on the second Monday at 7.45 for an 8pm start at St Swithun's Church Hall, Grovelands Road, Purley, Surrey, with the subject of d.f.ing on both 1·8 and 144MHz being given a thorough airing by G3NPF on March 12. CATS Publicity Officer Richard Goring G6VYT can be contacted at 54 The Glade, Old Coulsdon, Sy, or Downland 54319.

Darlington & District ARS Nearing its first anniversary the club meets in the Hurworth Community Centre just south of the town on Fridays at 7.30. Activities run to Morse code and RAE classes by G3UTI and G3GUV and periods on the air with the club station. Sec C. Webb G4NYJ will be glad to hear from anyone interested in joining the club, at 34 Cleveland Terrace, Darlington, or ring him on D'ton 467271.

Dartford Heath DF Club This club is devoted it seems to the art of d.f.ing but there is precious little useful information on its activities in the club newsletter. Seems hunts start at NGR 525730 on Dartford Heath and are run by "Pete" G8DYF he is on Greenhithe 844467. Next hunt starts at the Horse & Groom on Tuesday March 6 with another the following Sunday. Mag editor is Rosie Keeling G8YDB, QTHR I suppose.

Derwentside ARC (Consett) G4PFQ The RAFA HQ is the spot every Monday at 7.30 in Sherburn Terrace, Consett, Co. Durham, where activities include code classes, Raynet participation and on-the-air sessions with the club's h.f. and v.h.f. gear. Potential members should get info from June Wallis G1AAJ, 10 Middlewood Road, Lanchester, Durham (0207) 520477.

Dudley ARC G4DAR The lecture by Joe Jacobs on "TV OBs 1950 to the 80's" was postponed and will now take place on Tuesday March 13. Meetings are on the second and fourth Tuesdays at 7.45 at the Central Library in Dudley. Interesting item for the 27th is a chat by G3ZPF on DXing from impossible situations, applicable to many amateurs I suspect! Cheryl Wilding G4SQP, 92 Ravenhill Drive, Codsall, Wolverhampton is also available on Codsall 5636 for information on the activities of the club.

East Kent RS G3LTY G6EKR The Cabin, Kings Road, Herne Bay, Kent, on the first and third Thursdays with visitors and others particularly welcome says sec Stuart Alexander G6LZG, 66 Downs Road, Canterbury, Kent who will be glad to tell you of the club's forthcoming events.

Exeter ARS G4ARE "Static and chips" by G3RSJ ought to be interesting on March 12, with advance notice of a visit to Radio Devon on April 9 and a strict limit to the number of places available for this outing. Main meetings at the Community Centre, St Davids Hill, Exeter, on the second Monday while on other Mondays it's informal gatherings at the Scout Hut, Emmanuel Hall, Okehampton Road, Exeter, which houses the club station for on-the-air activity plus code classes but R. R. Tipper G4KXR, 11 Chancel Court, Pinhoe, Exeter,

will be glad to bring you up to date on club happenings, or buzz Exeter 68065.

Fylde ARS The Kite Club, Blackpool Airport, first and third Tuesdays at 7.45 with a full house expected for the airport's senior air traffic controller on March 6 when he will describe how electronics have affected air navigation and air traffic control. G3AEP and G8GG will tackle something entirely different on the 20th with the construction of Top Band d.f. equipment the main topic. Next month's issue will be too late to tell you of the RTTY evening on April 3rd headed by G4RSA. Try H. Fenton, 5 Cromer Road, St Annes for an update on the club's programme, that is St Annes 723457.

Great Yarmouth RC G3YRC Every other Thursday which makes it March 15, 29 and so on, at the STC Sports & Social Club, Beevor Road, South Denes, G. Yarmouth, with old, new and potential members most welcome. PRO for the club is John Noy G8VPE, 14 Poplar Drive, Filby, G. Yarmouth, Norfolk or ring (049377) 673, who will be glad to give details of current events at the club.

Horndean & District ARC G4FBS Limitations of the club premises has forced a restriction to the membership of around 70. So with some 66 already on the books you'd better get along there pretty soon! Club facilities include a quarterly newsletter, computerised printout of membership list, special club QSL cards and a local award. Meetings at 7.30 at Merchistoun Hall, London Road, Horndean, Portsmouth, Hants, usually with club business followed by a talk, discussion or demo. On March 5 G4RLE will deal with the techniques of operating special event stations, and on to April 2 when G4BEQ talks on "A Year of Radio". Club Publicity Officer is R. E. Tribe G4SAQ, 32 Sutton Road, Cowplain, Portsmouth.

Leighton Linslade RC Gets together on the first and third Mondays in room A64 of the Vandyke Community College, Vandyke Road, Leighton Buzzard at 7pm usually running on to around 10pm. More details from club sec Peter Brazier G6JFN, Kingsway Farm, Miletree Road, Leighton Buzzard, Beds, otherwise Heath and Reach 270.

Maesteg ARC Still quite new the club gets together at the 7777 Club, Llangwynyd, Maesteg, on the first and third Tuesday evenings and, needless to say, new members will be very welcome as will be visitors. Try M. R. Carey GW6ZIH, 47 Heol Ty-Gwyn, Maesteg, Mid-Glam, for an update on club events.

Norfolk ARC G4ARN A new headquarters is the good news from the club, situated at the Valley Drive Community Centre, Plumstead Road, Norwich, with meetings every Wednesday evening at 7.45. A permanent station should be on the air by the time this appears in print and a new programme of events and fixtures is promised for the near future. Up-to-date info from sec Peter Forster G3VWQ, 12 Thor Road, Thorpe-St-Andrew, Norwich, or Norwich 37709.

North Bristol ARC G4GCT Future event for the diary is the RSGB film show on Friday March 30 which includes *The Secret Listeners,* a graphic account of how many amateurs used their talents to intercept enemy radio communications during the last war. Club meetings every Friday at the Self-Help Enterprise, 7 Braemar Crescent, Northville, Bristol, with Ted Bidmead G4EUV, 4 Pine Grove, Northville, B'tol anxious to answer your every query.

Radio Club of Thanet G2IC Second and fourth Tuesdays at 8pm, the Grosvenor Club, Grosvenor Place, Margate, Kent, with an expose of the mysteries of Air Traffic Control being revealed by G6HXR on March 13. Ian Gain G4NEF, 17 Penshurst Road, Ramsgate, Kent, will tell you about the "do" on March 27 or anything else to do with the club, alternatively (0873) 54154.

Rhyl & District ARC GW4ARC GW1ARC The venue is the 1st Rhyl Scouts' Hut, Tynewydd Road, Rhyl, on the first and third Mondays so be there at 7.30. Latest info on club happenings from sec John McCann GW4PFC, 67 Ashley Court, St Asaph, Clwyd or try (0745) 583467.

Ripon & District ARS The usual format at 7pm every Thursday is RAE and c.w. code classes, a coffee break and on to a talk, lecture or demonstration around 8pm. All this at the St John Ambulance Hall, Ripon, but more info from Peter Fautley G6CUG, Parkside, Thornton-le-Street, Thirsk or buzz Thirsk 24945.

Salop ARS G3SRT Weekly on Thursdays at the Albert Hotel, Smithfield Road, Shrewsbury, with March 8 a natter-nite and the first of four d.f. fox hunts on the 15th and another natter session on the 22nd. Don't forget to enter the construction contest due to be judged on April 12. More from Diane Parslow G6UDB, 1 Willington Close, Little Harlescott Lane, Shrewsbury, Salop (0743) 62737.

South Bristol ARC Every Wednesday at the Whitchurch Folk House, East Dundry Road, Whitchurch, the March 7 meeting featuring talks by G4KUQ and G4MCQ on AMTOR and ARQ respectively with the 14th a club project constructional evening. March 21 is for s.w.l.s, with computer addicts catered for on the 28th. Data communications on April 4 will be covered by G4MCQ. Active promotion of AR in the area has included visits by journalists from the Bristol *Journal* resulting in interesting write-ups and photographs of members' shacks and equipment. As can be seen club interests run from QRP operation to AMTOR technology. Right, contact sec Len Baker G4RZY, 62 Court Farm Road, Whitchurch, Bristol which also houses (0272) 834282.

South East Kent (YMCA) ARC G3YMD G8YMD At the Dover YMCA, Godwynehurst, Leybourne Road, Dover, Kent, with main meetings on Wednesdays, RAE coaching and operating practice on Monday evenings, plus code classes by G3VSU on Tuesdays. Further details from sec Alan Moore G3VSU, 42 Nursery Lane, Whitfield, Dover or Dover 822738.

Southend & District RS Liaison Officer John Weston G6XBM lives at 67 Victoria Road, Rayleigh, Essex (Rayleigh 742128) will update you on club fixtures, meetings taking place on Fridays at 7.30 at the Council Offices in Rayleigh, right opposite the church, where visitors are likely to be given a warm welcome.

Stevenage & District ARS On March 6 G4ISO will talk on the workings of the WAB award programme while the 28th is devoted to the club's AGM which all members are expected to attend. That makes it the first and third Tuesdays at TS Andromeda, Fairlands Valley Park, Shephall View, Stevenage, Herts, at 8, but before that there are code practice classes from 7.15pm. Then there is the club net on Sundays at 7pm on 145·250MHz for the very latest news of club activities, or contact Cliff Barber G4BGP, 13 The Sycamores, Baldock, Herts, or more cheaply (0462) 893736.

Stourbridge & District ARS G6OI G6SRS New gathering spot is the Robin Woods Centre (used to be the Beauty Bank School), School Street, which is off Enville Street. S'bridge. Thoughtfully, an excellent map is now part of the re-vitalised *STARS Newsletter.* Meetings on first and third Mondays at 8 promptly, the informal one on March 5 covering constructional work, Morse code practice session and on-the-air activity, with the club's AGM down for the 19th. Interested? Then the contact is sec Malcolm Davies G8JTL, 25 Walker Avenue, Quarry Bank, Brierley Hill, also known under Lye 4019.

Street & District ARS G6XYI Thanks to the efforts of W. Scriven G4EGO this club has been formed at the Strode College for the benefit of both students interested in AR and local enthusiasts. He has also been running an RAE course that has proven very successful. Meetings of the club are held in the electronics lab on the first Tuesday of the month at 7pm with a collection of equipment for both h.f. and the 144MHz band. Already a rally in November is on the cards with trader support being sought. So those of you in the Street area should make every effort to support EGO after the great start he has given the club and he can be found at the College, Church Road, Street, Somerset or try Street 42277.

Sutton & Cheam RS Meetings either at the Sutton College of Liberal Arts or the Downs Tennis Club, Holland Avenue, Cheam, Surrey, that on March 16 being at the Downs Club where the winner of the club's constructional contest will be adjudged. The 35th annual dinner will be held at the Woodstock where a good time for all is promised. Club activity is maintained via three nets, Mondays at 8pm on 144·390MHz s.s.b., Tuesdays at 10.30am on 3·770MHz s.s.b. and Sundays at 10.30am on 144·5MHz f.m. Jack Korndorffer G2DMR, 19 Park Road, Banstead, Sy, will be pleased to supply the latest on club events and membership facilities.

Swansea ARS GW4CC Advance notice of a rally on Sunday April 8 at the Patti Pavilion, Swansea, next to the St Helens Cricket Ground which is on the A4067 Swansea to Mumbles coast road, from 10.30am to 5pm. Usual delights of trade stands, RSGB bookstall, local repeater groups, bring and buy sale, licensed bar and light refreshments plus talk-in on S22 and good parking facilities. What more could one want! If there is more to tell you, you can get it from Roger Williams GW4HSH, 114 West Cross Lane, Swansea, or (0792) 404422, who is the club sec if you want details of club membership.

Todmorden & District ARS Secretary Janet Gamble G6MDB of 283 Halifax Road, Todmorden, Lancs, tells me that the local lads and lassies have got together to form this new club, so let us all wish them well in this venture. It's first Mondays at the Queen Hotel,

Todmorden, with that on March 5 having a lecture asking "Satellites—How do they stay up?" and you'd better know now that April 2 is homebrew night. The 40-odd members already recruited will welcome even more potential members and visitors.

Vale of the White Horse ARS First and third Tuesday of the month at the Lansdown Club, Milton Trading Estate, at 7.30 for an 8pm start. Lucky lads on March 6 when Petra Suckling G4KGC will reveal all on the subject of operating in v.h.f. contests. Club nets are held on Thursdays at 7.30pm on 28·750MHz and on Sundays at 8pm on 145·2MHz. Ian White G3SEK, 52 Abingdon Road, Drayton, Abingdon is the sec also to be raised on (0235) 31559.

Wirral ARS G3NWR Be at the Guide Hut, Westbourne Road, West Kirby, on the first and third Wednesdays at 7.45 if you want to join in the fun, like on March 7 when G3LEQ deals with h.f. propagation matters or on the 21st with G3EGX describing lessons learned about antenna masts, hopefully not the hard way! Must tell you now of the surplus equipment sale evening on April 4 while another worthwhile event will be the video show of Dud Charman's *Aerial Circus* lecture on the 18th. Your club sec is Cedric Cawthorne G4KPY, 40 Westbourne Road, West Kirby (051-625 7311).

Photographs of club activities are very welcome for publication in this feature and should be black and white and well-focused. Do remove any beer glasses and sandwiches from the immediate area before taking a picture! Some otherwise excellent pics have had to be rejected because no effort had been made to set the scene.

MEDIUM WAVE BROADCAST BAND DX

by Charles Molloy G8BUS

Reports to: Charles Molloy G8BUS, 132 Segars Lane, Southport PR8 3JG.

The part of the medium waves above 1550kHz is a fruitful source of DX both for the newcomer and the experienced DXer. Start off by locating Nice (France) on 1557kHz and Sarnan (Switzerland) on 1566kHz. The latter broadcasts in German and Romanisch.

Nice signs off for the night at 2300, clearing the channel for the English programme from Radio Mediterranean in Malta. This programme started at 2230 when it could be heard as a background to Nice but it is not practicable to separate the two with a loop as the bearings are too close together. The English programme from Malta which usually comes in well in the UK, lasts until 2330. The station does QSL and reports should be sent to PO Box 2, Valetta, Malta.

Now move up to 1562kHz and listen for the 1kW outlet at Covilhã in Portugal. This broadcaster is on the air 24 hours a day and isn't too difficult to hear in the UK as it operates 4kHz away from the nearest Geneva channel. Move now to 1566. Sarnan will have closed down for the night by now leaving the channel for Sfax in Tunisia, La Corruna in Spain and Leningrad in the USSR to fight it out between them. This is a frequency worth monitoring as you never know what may pop up.

Top End DX

Those who feel like staying up late will find the top end of the band can be rewarding. At this time of year it will be after midnight before Region 2 DX appears, two regulars from North America being WQXR on 1560kHz and CKLM on 1570kHz. WQXR is located in New York City so a loop will null out any QRM from Portugal on 1562kHz. WQXR is quite different from the majority of broadcasters in the United States. It is a serious music station owned by the *New York Times* and comes in well in the UK though it does fade to inaudibility at times. Write to WQXR Radio, 229 West 43rd Street, New York, NY 10036, USA, for a QSL.

CKLM is located at Laval in Quebec which is part of greater Montreal. This station is unusual in that the programming is in Quebec-style French, which may create problems when gathering material for a reception report. The address of the station is CKLM Radio, 1600 Est Boulevard St Martin, Laval, PQ, Canada.

There are three interesting and contrasting stations in the Caribbean that are heard frequently at the top end. Listen after 0030 on 1555kHz for Radio Cayman. Situated on a group of islands to the south of Cuba, Radio Cayman is sometimes quite a good signal in the UK. The time zone is GMT minus five hours, programming is in English and the address is PO Box 1110, Georgetown, Grand Cayman, British West Indies.

As a contrast listen on out-of-band 1610kHz for the religious Caribbean Beacon located on Anguilla, the most northerly of the Leeward Islands and then tune to 1580kHz for the Voice of America relay in Antigua which is also in the Leeward group. QRM can be a problem on 1580 but it does ease off considerably as sunrise approaches.

RSI

These letters stand for Radio Sweden International which is, as the name suggests, the external service of that country. Normally one would expect to find it on the short waves but owing to the proximity of Sweden to the UK, propagation is often better on the medium waves, especially after dark.

The daily programme, which lasts just half an hour, is varied, features such as *Panorama, Saturday in Sweden, Mailbag,* covering current affairs as well as different aspects of life in Sweden. Tuesday is the day for *Sweden Calling DXers* which has been on the air since 1948. It correctly styles itself as the longest running DX programme, appearing in five different language editions each week.

You can hear RSI on 1179kHz (254m) daily at 1830, 2100 and 2300 hrs UTC plus the s.w. channels 9·63MHz at 1100 and 6·065MHz at 1600 and 1830. The address, if you want to comment on the programme, ask for a schedule or send a contribution to *Sweden Calling DXers,* is RSI, S-105-10, Stockholm, Sweden.

Receivers for MW DXing

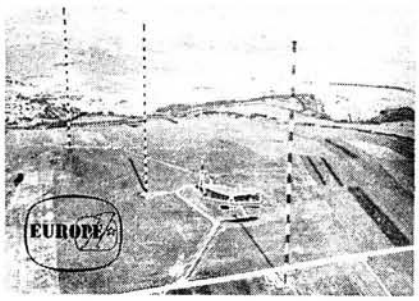
Last month we had a look at car radios and the possibility of adapting one for DXing. There is another specialised receiver almost tailor made for the DXer—a domestic style portable designed for taking radio bearings at sea.

I have such a set, the Hitachi "WH-1160 11 transistor 4 band radio." At first sight it looks like an ordinary portable, somewhat smaller in size than the Vega 204. There is a scale marked in degrees fixed to the top of the set, above which is a rotatable plastics box measuring 210 × 30 × 28mm which has a pointer that moves over the scale. The box contains the medium and longwave ferrite rod antenna. To use the set ashore just line the case onto true north, rotate the antenna box for a null and read off the bearing, or its reciprocal, from the scale. If you are not interested in d.f. then place the set in a convenient spot and rotate the antenna as required for optimum reception.

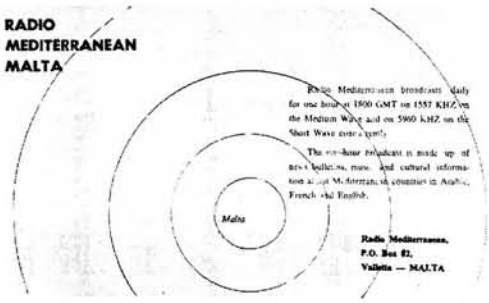
The circuitry of the WH-1160 is interesting. There is an r.f. stage for increased sensitivity and a b.f.o. selected by a switch at the rear. A front panel RADIO/DF switch, when in the DF position, helps one obtain a deep null by switching off the a.g.c. and switching in a level control in its place. The latter is a manually operated i.f. gain control. This arrangement really works well. It's a pity that the facility to switch off the a.g.c. is so rarely available on modern sets, even with quite expensive communications receivers.

The remaining two bands cover 1·6MHz to 12MHz using an internal ferrite rod antenna which has some directional properties. There is no provision for connecting an external antenna but a retractable whip is available to supplement the s.w. ferrite rod antenna.

This type of receiver is ideal for local radio DXing. It is very easy to use, is more sensitive on the medium waves than the average portable and it is possible to null-out TV buzz at my QTH with the rotatable antenna. The set performs well on the longwaves bringing in Sweden on 191kHz, Leningrad on 200, Morocco on 209, Oslo on 218, USSR on 236 and



QSL from Europe No. 1



QSL from Radio Mediterranean, Malta

Schedule from Radio Sweden International

Algeria on 254. The Hitachi WH-1160, which uses discrete components rather than i.c.s., is probably no longer available new but sets of this type are occasionally to be found on offer in radio shops though more often in small boat chandlers or in the advert columns of magazines such as the *Practical Boat Owner*. It would be interesting to hear from anyone who uses such a set for DX-ing.

Readers' Letters

Twelve year old **Paul McCarthy** who lives at Linwood in Scotland has been DXing for about a year using a Realistic DX200 receiver and a 25m long random wire antenna. Recent DX heard on the medium waves with this set-up includes Dubai on 1481kHz, Omdurman on 1295kHz which causes a heterodyne with the BBC on 1296kHz, Senegal on 765kHz, CJYQ St John's on 930kHz, WMRE in Boston on 1510kHz, WNEW New York on 930, Radio Globo in Rio de Janeiro on 1220. Paul asks for the address of Europe No. 1 (185kHz), which according to their QSL card, is Europe No. 1, PO Box 209, D663 Saarbrucken, West Germany.

Reader **John Ratcliffe** has been modifying the internal ferrite rod antenna of two early transistor receivers—a National and an AWR Radiola. The first "mod" was to rewind the main m.w. winding using Litz wire, which sharpened up the tuning considerably. Then John fitted an additional 7 turn coupling winding on the rod, which was brought out for connection to an external antenna or a loop. This winding was moved along the rod to find the best position and then fixed with adhesive. "There are no birdies, whistles, images or what have you. If any reader is interested in modifying receivers this way then I would be pleased to hear from him and will pass on any information". John's address is I/37 Whiting Street, Southport 4215, Queensland, Australia.

My note about the Greek station on 981kHz in the February issue brought an interesting response from reader **Antony Vaughan** of Southampton. The station on 981kHz now carries the ERT2 programme of the Government owned network. A lettergram from ERT (Hellenic Radio) to Antony stated that ERT1 and ERT2 are to be merged and the address will be Messogion 102, Attiki, Greece.

SHORT WAVE BROADCAST BANDS

by Charles Molloy G8BUS

Reports: as for Medium Wave DX, but please keep separate.

Telling the time is normally not a problem for most of us, except perhaps on the two occasions each year when the clocks go forward, or back, an hour. The s.w.l. though will find that life is not so simple. Listening to other parts of the world brings us in contact with different time zones. If we monitor the Pacific Service of Radio Australia on 6·035MHz in the 49m band, which comes in well in the UK in the evening, we will hear programmes intended for a breakfast audience on the far side of the world! The DXer has his own problems. He must decide whether to keep his log in GMT, which is standard practice, even though it may be summertime. What time and date shall be quoted in a reception report? What do the letters UTC stand for?

What Time Is It?

Early last century it was agreed internationally that Greenwich Mean Time (GMT), centred on the Greenwich meridian, would be regarded as universal time. All other time zones are related to GMT, 15 degrees of longitude corresponding to a one hour time difference. The east coast of USA for example, which is approx Long 75° West, has the time zone GMT minus five hours. This is called Eastern Standard Time (EST). Similarly, Sydney Australia, which is approx 150° E, is ten hours ahead of GMT.

Again by international agreement, it was decided quite recently that Co-ordinated Universal Time, denoted by the letters UTC, would be the new universal time for radio purposes. There is a slight difference between UTC and GMT but the two are brought into line either on June 30 or December 31 each year by what is known as a leap second. For practical purposes GMT and UTC are the same.

Unfortunately, UTC is not yet in general use, as a period of a few years was allowed for the changeover, so the listener at the moment will come across both GMT and UTC. There is an alternative method of denoting GMT and that is by the small letter z. This practice occurs in navigation and occasionally creeps into radio literature. There is no problem really as 1100GMT = 1100UTC = 1100z. The 24 hour clock is always used, there being no place for am and pm in international broadcasting.

Reception Reports—Date and Time

The golden rule when writing to international broadcasters is to use UTC (GMT), even although summertime may be in operation. Quote what is known as the Greenwich Date. To go back to Radio Australia. If we are listening at 8pm on March 26 this corresponds to 6am local time on the 27th in Australia. Write out the reception report in the form 2000 hours UTC (GMT) on March 26. Ignore summertime, as it will certainly lead to confusion. There is no common changeoever date and summer in the northern hemisphere corresponds to winter in the southern and vice versa.

It is tempting, when writing to domestic broadcasters on the tropical bands or on the medium waves, to use the station's local time just in case GMT or UTC is not understood or there is a mis-

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60	9.49	1.80
100	11.08	2.00
200	15.69	2.25
250	18.97	2.64
350	23.47	2.70
500	29.23	2.95
750	41.28	3.70
1000	53.00	4.00
1500	68.37	4.70
2000	82.27	5.10
3000	115.35	OA
6000	203.65	OA

*115 or 240V Pri 240V

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to 200/240V C.T.

VA	Price	P&P
60	9.50	1.80
100	11.08	2.00
200	15.68	2.25
250	18.97	2.40
350	23.47	2.70
500	29.23	2.95
1000	52.98	4.00
2000	82.27	5.00
3000	115.37	OA
6000	228.75	OA

12/24V or 12-0-12V
2×12V Secs. Pri. 240V

12V	24V	Price	P&P
0.3	.15	2.41	.90
1	.5	3.19	1.20
2	1	4.25	1.20
4 A	2	4.91	1.60
6	3	7.69	1.60
8 M	4	8.98	1.60
10 P	5	9.82	1.80
12	6	10.89	1.90
16 S	8	12.97	2.12
20	10	17.46	2.44
30	15	21.69	2.64
60	30	44.45	OA
83	41	51.20	4.50

96/48V. Pri. 2×120V Secs. 2×36/48V

72/96	36/48	Price	P&P
.5	1	5.37	1.20
2 A	4	14.69	2.20
3 M	6	17.79	2.40
5 P	10	32.23	3.20
6 S	12	40.36	3.50
8	16	44.03	3.75

50/25V or 25-0-25V
2×25V tapped secs. Volts Sec V 5, 7, 8, 10, 13, 15, 17, 20, 25, 30, 33, 40, 20-0-20 or 25-0-25V

50V	25V	Price	P&P
0.5	1	4.13	1.40
2 A	4	8.69	1.84
3	6	10.36	1.90
4 M	8	14.10	2.12
6 P	12	18.01	2.20
8	16	24.52	2.70
10 S	20	30.23	3.00
12	24	36.18	3.20

60/30V or 30-0-30V
Pri. 2×120V. 2×30V Tap Secs. Volts out 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60, 24-0-24 or 30-0-30V.

60V	30V	Price	P&P
.5	1	4.70	1.50
1	2	7.15	1.50
2 A	4	9.20	1.90
3	6	13.31	2.00
4 M	8	15.15	2.20
5 P	10	19.16	2.20
6	12	21.86	2.65
8 S	16	30.72	3.00
10	20	35.76	3.30
12	24	41.22	3.50

MINIATURES (SCR)

Sec V	A	Pri	P&P
3-0-3	.2A	3.11	.90
6×2	1A×2	3.45	1.20
9-0-9	.1	2.59	.90
9×2	.33×2	2.41	.90
8,9×2	.5×2	3.36	1.20
8,9×2	1A×2	4.27	1.40
15×2	.2A×2	2.41	.90
12-0-12	.05	3.11	.90
20×2	.3×2	3.39	1.20
20,12,0			
12,20	.9	4.13	1.20
15,20-2	1A×2	5.60	1.60
15,27×2	.5×2	4.83	1.40
15,27×2	1A×2	7.30	1.60

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30/15V or 15-0-15V
2×15V Tap Sec. Volts 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20, 24, 30 or 15-0-15V

30V	15V	Price	P&P
.5	1	3.19	1.20
1	2	4.32	1.40
2 A	4	6.99	1.60
3	6	8.10	1.85
4 M	8	9.67	1.90
5	10	11.95	2.00
6 P	12	13.52	2.00
8 S	16	18.10	2.26
10	20	20.88	2.26
12	24	23.20	2.50
15	30	26.60	3.00
20	40	35.64	4.83

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500	13.30	2.24
1000	22.70	2.80
1500	28.17	3.20
2000	42.14	4.00
3000	71.64	4.80
5000	108.30	OA

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VA	Price	P&P
20	7.21	1.50
80	9.35	1.60
150	12.10	1.90
250	14.73	2.00
500	22.14	2.20
1000	33.74	2.80
2000	60.47	4.50

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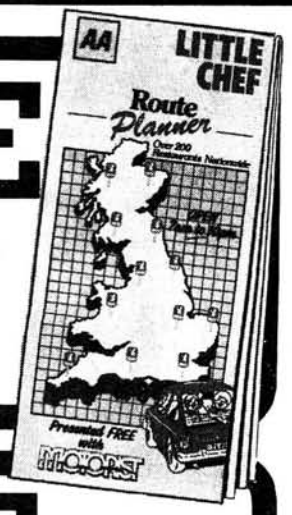

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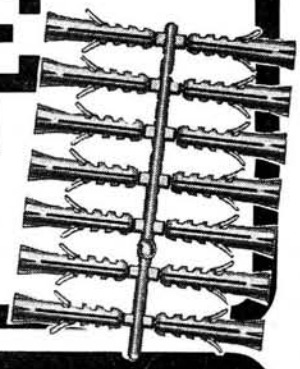

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MARCH 10th ISSUE

SPECIAL FEATURES:

AIDS TO BETTER GARDENING—

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home plus

EXTRA, EXTRA, Home Plus colour magazine, is also carried in these three issues. Feature Articles include Raising the Readies, Gadgets for the home and winter ravages repaired.

DON'T MISS OUT THIS SPRING

QSL card from Argentina sent in by Andrew Hill

QSL card from Red Cross sent in by Glen Hocking

QSL card from Voice of Nigeria sent in by Kevin Lewis

QSL card from Voice of Vietnam sent in by Glen Hocking

understanding over the date. It is better not to do this unless you are absolutely sure of local time, say as the result of a time check over the air. Use the local date on your report if you use local time and to be safe, give UTC and the Greenwich date as well.

Logs

Reader **Simon Griggs** complains that "the short wave section has very little if any lists of what stations have been heard" while **D. Prince** (Llandyssul) likes reading about "other bods' logs". Stations heard by other DXers are of considerable interest and form the backbone of DX club bulletins, where there is space for lengthy lists that are able to include the easy as well as the DX type loggings. Anyone with more than a passing interest in the hobby should join a DX club. A copy of the EDXC club list referred to in the February issue will give the prospective member a chance to obtain a specimen copy of several club bulletins, before deciding which one suits him. Clubs, like people, vary a lot.

Logs for this column should supplement rather than compete with DX club bulletins. New stations, rarities, unusual loggings, even everyday ones if made by newcomers using simple equipment. Readers will want to know the gear in use, the antenna, the time of day, the frequency, as it will help them when they try to pick up the same broadcasts themselves. Contributors to club bulletins follow this practice. Users of simple receivers will not be able to provide the exact frequency but even "the h.f. end of the 15MHz band" would help others who might be tempted to try themselves.

Interval Signals

In order to assist listeners to home-in on a station before the start of the programme it has long since been the practice to transmit a distinctive interval signal. There is an infinite variety of them ranging from a few bars of electronic music (AWR) to a recording of farmyard animals (Botswana). Perhaps the most famous and certainly the best known was the letter "V" in Morse used by the BBC during the last war to identify its transmission to occupied Europe.

The need for an interval signal will disappear as receivers with digital readout become the norm though one hopes they will remain as the station's signature tune. Interval signals are of great value to the DXer as an aid to station identification, that is if one can remember them. The *WRTH* tries to help with some stations by printing a few bars, if the signal is a musical one. Not everyone can read music though. *DX Party Line* from HCJB which is on the air on Mondays and Saturdays at 2130 UTC on 15·295MHz and 17·79MHz features the "interval signal of the week". This is played several times before the identity of the broadcaster is revealed, which does help to imprint it on the memory.

Tape recordings of interval signals have been compiled from time to time, one currently being available from the Handicapped Aid Programme. The list which accompanies the tape classifies signals according to type, which does help a lot. Further information on this and other tapes of interest to DXers, is available by sending a SAE to HAP(UK), c/o EDXC, PO Box 4, St Ives, Huntingdon, Cambs, PE17 4FE.

Readers' Letters

"A sample copy of *Contact*, the publication of the World DX CLub, 17 Motspur Drive, Northampton NN2 6LY is available for 50p or 2 IRCs (3 IRCs airmail). The bulletin is directed towards m.w. and s.w. broadcast band enthusiasts and contains no amateur radio news" writes Arthur Ward who is the producer of *Contact*. He goes on to say that the WDXC has never gone over the 500 membership mark, always seeing that a quarter of the total reside overseas.

"I recently had a bargain of a lifetime" writes **John L. Hopkins** of Oxford who paid a "fiver" for a Codar CR70A with PR30 preselector and Joymatch antenna. John would like to know where he can purchase a manual for the CR70A as Codar are no longer in the radio business. Can anyone help?

"I now use a Tandy Realistic DX60 receiver" writes **Adrian Childs** of Dorchester who is full of praise for his latest acquisition which covers the medium waves, short waves: 3MHz to 26MHz in three bands, v.h.f. 88 to 108MHz and CB. Using the receiver's whip, Adrian heard Radio Bagdad in English on 9·61MHz at 2130. When used with a roof-top v.h.f. two-element antenna the DX60 pulled in All India Radio on 9·665MHz at 2015, the Voice of Nigeria on 15·12 at 1800, Radio Hanoi on 10·04 at 1800, all with programming in English. A v.h.f. or TV antenna often makes a good short wave antenna.

"A good catch I recently had was Radio Impacto, a new station in San Jose, Costa Rica—around 0500 on 6·15MHz" writes **Shoyab Patel** of Dewsbury who was using a Panasonic R50B receiver along with an 8 metre long external antenna. Our reader also mentions the Voice of Peace which is now on 6·24MHz with a power of 400 watts to be raised to 10kW. Reader **J.R. Sadler** of Bishop's Stortford picked up Radio Argentina on 15·345MHz with his Astrad 6010, time of reception not mentioned, while **S.R. Smith** of Crewe heard Radio Kuwait on 11·675MHz, no details of receiver or antenna quoted.

VHF BANDS by Ron Ham BRS15744

Reports to: Ron Ham BRS15744, Faraday, Greyfriars, Storrington, West Sussex RH20 4HE.

Reports from continental readers, 144MHz QSOs in the Middle East, awards for BARTG members, a new solar magazine and the end-of-year tropospheric opening are among the goodies under discussion this time.

Solar

Readers interested in solar astronomy can find out more about the work of the London Solar Committee and their journal, *Solar News*, by writing to Bert Chapman, 15 Homersham Road, Kingston-Upon-Thames, Surrey, KT1 3PL. Bert tells me that they have members in London, Northern Ireland and Scotland with radio telescopes and others keen to learn more about the subject. *Solar News* is very well presented and full of gen and I see that the first edition for 1984 includes articles entitled, A Beginner's Guide to the Sun, 1983 Solar Report, Solar Radio Astronomy plus sunspot and other useful observational data.

Cmdr Henry Hatfield, Sevenoaks, using his spectrohelioscope, saw a few filaments on the sun's disc on December 30, one double spot, 11 filaments and a few prominences on January 4 and a similar situation on the 7th. It is possible that the double spot, then on the east limb, was responsible for the radio noise storm that Henry and I recorded, on 136 and 143MHz respectively, on January 12, 15 and 16. A few small bursts were also recorded on the 11th and 14th. **Ted Waring,** Bristol, counted 9 sunspots on December 17 and 7 on January 11.

The 28MHz Band

"It's surprising what crops up out of a completely dead band", writes **Dave Coggins,** Knutsford, who concentrates much of his efforts on studying the propagation of signals in the 28MHz band. Dave normally uses a 2-element quad antenna but is currently building a vertical to work in conjunction with it. In his 28MHz log for December, Dave reports hearing signals from the Canary Islands on the 4th, Ukraine on the 8th and 10th, Australia on the 10th, 28th and 29th, Canada on the 15th and plenty of activity from Europe and Scandinavia on the 11th, 18th, 28th and 30th.

Peter Lincoln found a few ZS stations during the month prior to January 10 and a near neighbour of mine, Fred Pallant G3RNM, heard signals from DK, EA, OE, ZS3, 4 and 5 on the 2nd and 3rd, and at 1531 on the 2nd a W4, "was the only W on the band" said Fred, which emphasises just how patchy 28MHz has been.

28MHz Beacons

Congratulations to **Norman Hyde** G2AIH, one of my regular beacon observers from Epsom Downs, on being awarded a special badge by the RSGB to mark his 50 years of membership, 1934/1984. His log, along with those from Dave Coggins, **John Coulter,** Henry Hatfield, **Bill Kelly, Ted Owen,** Ted Waring, **Freddy De Witte** and me provided the information to compile the monthly list of beacons heard seen in Fig. 1.

One of our Netherlands readers, Freddy De Witte NL7357, Fig. 2, is a keen radio and television DXer and over the period 1981 and 1982, he and a friend, Carlo NL5736 logged more than 1250 stations on the 50MHz band and are the only two listener members of SMIRK, a six metre club. Among the beacons in Freddy's log are the South African ZS5VHF which he heard on December 19 and from the UK, GB3SX on the 20th.

Dave Coggins logged the beacons in Germany on the 18th, 22nd, 23rd, 29th and 31st and Norway on the 18th and 23rd via brief periods of sporadic-E. John Coulter, Winchester, heard W3VD every day between the 12th and 16th, Ted Owen, Maldon, reports hearing the Australian beacon VK6RTW on the 10th, also Henry Hatfield commented about the very strong signal he received from DL0IGI at 1530 on January 12th.

While on the subject of beacons, Dave Coggins heard signals from the UK 50MHz beacon GB3SIX, at 1342 on January 8.

Like John Coulter, Ted Waring heard signals from W3VD in December as well as KA1YE on the 11th and 14th.

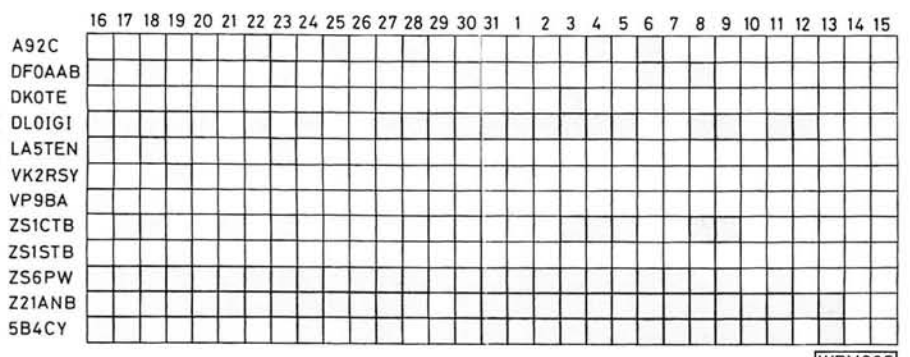

Fig. 1: Distribution of beacon signals

Satellites

On December 4, while Belgian and French stations were pounding in on 144MHz due to a prevailing tropospheric opening, the icing on the cake for **Alan Taylor** in Coventry was hearing the voice of Owen Garriott W5LFL, the first radio amateur in space operating from the American Space Shuttle, *Columbia*. At 1520 on the 4th, Bill Kelly, Belfast, heard W5LFL calling stations in Europe. At the same time, **Fraser Lees** G6JIO, Ringmer, was staying in Italy with IW2BNA and with the Italian's FT-221 and 18-element Tonna antenna they heard a report from the space craft that they were "just going over Austria".

In Western Germany, **Allan Sancto** DD5FM (G6BWH), hopes to receive OSCAR signals by the spring when the weather is better for him to install a 22-element crossed-Yagi antenna on the roof to feed an FT-290R. On December 29, in Winchester, John Coulter logged, "W5EM SO ASTXA USPEHOW W NOVOM GODU HAPPY NEW YEAR", which continued for several days on 29·331 MHz from RS3A as well as sundry signals from Canadian, European and Icelandic stations working through the satellites. Another catch for John came on January 12 when he heard Arthur Gee G2UK, Chairman of AMSAT-UK, in contact with a UK3 via satellite.

Tropospheric

The atmospheric pressure, measured at my QTH with a Short and Mason barograph, at midday on December 16 was low, 29·5in (998mb) and by 1600 on the 19th it was very low at 28·9 (978) and with the associated wind and rain, conditions were definitely not good for v.h.f. communications. However, a gradual rise followed and by 2200 on the 26th, the pressure was high at 30·5 (1032) where it stayed until noon on the 29th when a fall set in and, true to form, a tropospheric opening took place. After a slight recovery the pressure then dropped sharply from 30·4 (1029) at 1000 on the 31st to 29·5 (998) at 0400 on January 3 and by 1400 on the 4th, it was back above 30·0 (1015) where it hovered until mid-

Fig. 2

Fig. 3

Fig. 4

day on the 11th, only to fall again to average around 29·5 as gales swept across the country for several days.

Looking back to the opening on December 1 and 2, Simon Hamer, New Radnor, heard signals through the 144MHz repeaters in Buxton GB3HH R4, Horsham GB3BP R6, Lincoln GB3LN and Martlesham Heath GB3PO R3 and Dutch stations on one of the repeaters on R0. As I have said before, it is sometimes very difficult to identify a particular repeater during an opening because of the large number that use the same channel. On December 4, George Grzebieniak G6GGE, London, using his new antenna system, worked 4 OZs and a PA on 432MHz. During the opening on the 29th, he exchanged good reports with 3 stations in France, 1 in Guernsey and 2 in Germany on 432MHz and DK8SG on both 432MHz and 1296MHz. In his station, Fig. 3, George has an FRG-7 receiver fed by a 20m long wire antenna, a Plustron TVR5D for DXTV, an IC-211E for 144MHz and transverters for 430MHz and 1296MHz.

During the mornings of the 3rd and 4th, **Fred Southwell** G6ZRU, worked stations in France, Denmark and Holland and during the evenings of the 28th and 29th he worked into Belgium, France and Germany on 144MHz. At his home in Henfield, Sussex, Fred uses a FT-101ZD, FTV-901R transverter and 8-element quad antenna for 144MHz. Around 1730 on the 28th, I heard a Sussex G2 station, working through a repeater on R6 say "conditions are exceptional" and that he had heard French, Belgian and German stations on 144MHz as well as several continental repeaters. Alan Taylor heard many 144MHz repeaters on the 29th and a very strong signal from DJ2HH.

Band II

That early December tropo produced strong signals for Simon Hamer from stations in Belgium BRT II, Egem, France TDF Cultur from Abbeville, Boulogne, Caen, Lille, Rennes and Vannes, Inter from Caen, Musique from Lille, Niort and Rennes, Holland NOS-1 from Goes and Smilde. In addition there were BBC Radios Devon, Kent, Sussex and York and ILR Orwell, Trent and Southern Sound. A similar report for the period, with the addition of the ILR stations BRMB, Capital Radio, Chiltern and 2CR, came from 14-year-old **Damien Read** using an Amstrad TS35 and a Philips 901 music centre at his home in Newport.

Albert Moulder, Rainham, tells me that he has received confirmation from David Cox, Engineer in Charge of BBC Radio Sussex, for his reception report and says that following the World Administrative Radio Conference in 1979 many more broadcast stations will appear in the 102/104MHz region of Band II.

By the end of 1983, **Brendan McNamee,** Loughborough, using an Akai AJ500FL with its own telescopic antenna, added BBC Radios Cambridge and London, ILR Capital and Wiltshire and a French station to his DX score during the opening on December 29. Brendan has now received QSL cards from BBC Radios Sheffield and Sussex, ILR Chiltern and stickers from LBC and is looking forward to future openings when he can put his homebrew antenna preamplifier to the test. "On December 29 the Dutch, French and Germans were rocketing in", said Damien Read, who logged French stations on about 20 spots in Band II, heard Belgium for the first time and hopes that one day there will be a tropo big enough to receive stations from the USA. Don't we all Damien!

French stations were predominant in the logs of Harold Brodribb, St Leonards-on-Sea, who counted 23 in the band on the 28th and 15 on the 29th. Ian Kelly, Reading, added detailed accounts of the stations he also received from Belgium, Germany and Holland between the 28th and 30th. "On the 29th, ILR Signal Radio was strong and the DJ Erika Hughes couldn't believe she was receiving phone calls from listeners in places such as Essex, Farnborough, Luton and Oxford", writes Ian, who also identified the station SWF-2 from Hornisgrinde on 96·2MHz and heard other German stations in Band II on January 1.

In Belfast, Bill Kelly, using a Panasonic DR2800, heard French stations at 0515 on the 26th, French and German between 0500 and 0600 on the 29th and a German at 0420 on January 3. At times during December, Bill, with a Grundig Satellit 3000, received signals from BBC Radios Barrow in Furness, Cleveland, Clyde, Cumbria, Leeds, Scotland and Wales and ILR stations Ayr, BRMB, Manx and Red Rose.

Late on the 29th, Simon Hamer received signals from BRT-2 West Glanders, the German stations NDR–1 and 2 from Aurich and Harz, WDR–1, 2 and 3 from Teutoburger Wald and at 0040 on the 30th he listened to *Rainy Days on Mondays* by Paul Williams, on the BFBS station at Langenberg.

RTTY

Congratulations to Ted Double G8CDW on being made an honorary life member of the British Amateur Radio Teleprinter Group for his long service as contest manager and to their retiring chairman "Smudge" Lundegard G3GJW on his unanimous appointment as BARTG's President at their AGM. Congratulations also to Eric Yeomanson G3IIR, one of the founder members of BARTG, on becoming honorary vice president of the Radio Society of Great Britain and to Tony Oakley G4HYD, former BARTG newsletter editor, on receiving the Norman Keith Adams Prize, awarded by the RSGB for his article in *RadComm* on a simple tuning indicator for AMTOR and RTTY signals.

Readers wishing to join BARTG, who celebrate their Silver Jubilee during 1984, should send an s.a.e. to John Beedie G6MOK, 161 Tudor Road, Hayes, Middx. The current membership fee is £5 per annum and their quarterly newsletter, free to members, is packed full of information on such subjects as AMTOR, Computers, FAX, Mechanical Hardware, RTTY, satellites and telemetry.

During the month prior to January 10, Peter Lincoln BRS42979, Aldershot, found RTTY signals on 14MHz coming mainly from Europe and a few from Asia in the daytime and occasionally from north-America during the late afternoons. On those days that the band remained open well into the evenings, Peter logged fairly strong signals from south-America. Although 21MHz was generally quiet throughout the period, Peter did log some stations from the USA during the afternoons.

Peter's RTTY equipment, MM2001 and Tono Theta 550 terminal units and Panasonic TC800G monitor, can be seen along with his Icom IC-R70 and Realistic DX300 receivers at his operating desk in Fig. 4.

At 1030 on December 25, I watched a station print a screen-filling Christmas tree made up of the letters "O" and "X" with the words MERRY CHRISTMAS

arranged in the middle. At 1102 on January 1, a Spanish station printed a large "73", taking up several lines on the screen, as he signed off with an IT9.

Although Norman found RTTY activity generally quiet during the month preceding January 14, he is very pleased with the signals he did receive on 14 and 21MHz from stations in DU, FG7, JA, OX, VK2, 3 and 6, XE, ZS6, 5N3 and from FB8WK on Crozet Island. At 1700 on December 18 he copied a Belgian station on 14·078MHz using 75 baud. Despite my limited operating between December 16 and January 15, I did copy RTTY signals from 11 prefixes, DL, EA, F, G, I, IT9, OE, OH, ON, SM and YU on 14MHz around 14·090MHz and 11 call areas, G, UW, VE, Ws 1, 2, 3, 4, 8, 9 and 0 and 9K on 21MHz around 21·090MHz.

Tailpiece

Last September, Simon Poysden ZR6AGN (G1BND), Hillbrow, Republic of South Africa, spent four weeks in Cyprus and using the callsign ZR6AGN/5B4 from Limassol found propagation excellent and had no trouble accessing 144MHz repeaters in Israel. During his trip, Simon worked stations in Cyprus 5B4 and ZC4, Israel 4X4 and 4X6, Lebanon OD5 and Island of Rhodes SV5 and among his interesting QSOs was one with KJ1L/MM, sailing past the south coast of Turkey, via the Haifa repeater in Israel. Throughout the tour Simon used a Yaesu FT-480R and Araki 5/8 colinear antenna and says that amateurs in both Cyprus and Israel are busy building repeaters for 430MHz. Simon also managed a bit of h.f. working back to ZS from the station of 5B4BS.

"73s to all in UK" writes Edward Baker, Benidorm, Spain, who, with a Panasonic RF-3100 receiver and telescopic antenna, can hear stations in Alicante, Castellor and Valencia. He adds, "If one counts the RNE 2 and 3 outlets there are 32 f.m. stations audible so DXing is hard due to this many filling the band."

TELEVISION by Ron Ham BRS15744

Reports: as for VHF Bands, but please keep separate.

Once again the main cause of the DX under review this time, is tropospheric. **Roger Wallis,** Solihull, has sent two weather pictures that he received from Anglia TV last September and RTBF Belgium in November, Figs. 1 and 2. They provide a quick source of information about the progress of the high-pressure systems that are mainly responsible for the long-distance television pictures we all look for.

Amateur Television

The annual pram race for charity, which took place at Pagham, Sussex, on Boxing Day, attracted some 60 competitors and the event was recorded for posterity by **Ted Brodie** G6HTB, **Richard Butterworth** G6FDU, **Brian Dubbins** G8OCN and **Robin George** G6AII. Ted's home-brew transmitters feeding MBM48 antennas were installed at two points on the 3km route, the Lamb Inn, Fig. 3 and the Kings Beach Hotel, so that live pictures, including graphics and titles by **Caroline Butterworth** with a Commodore 64 computer, were seen at both places. **Charles Nightingale** G3IDX and wheelchair mobile **Alf Maynard** G3UPQ organised the 144MHz talkback and progress reports of the race. The group wish to thank messrs Jaysound Audio of Bognor Regis for the loan of a JVC GX-78E camera used by G6AII at the Lamb Inn (Fig. 4), and **Andy Hearny** G3UEQ for his technical assistance. Andy received the 150mW pictures from the event at his QTH in Chichester 10km away and a P2 reception report came from **Henry Kaminski** G5NBX who received the signals off the side of the beam. The edited tapes will be shown to the contestants and at local homes for the handicapped and hospitals. Congratulations to all concerned, I heard that at least 500 man hours went into organising and planning the filming of the race.

During the December openings **Steve Green,** Malvern received an ATV test card and picture, Figs. 5 and 6, from G6CUQ in Redditch and Ted Brodie, Pagham, received ATV pictures from stations in Belgium and Germany with his 430MHz up-converter into a Ferguson TX receiver and MBM48 antenna. Ted also has a Sony HVC20000P camera which he used at the Kings Beach Hotel during the pram race.

SSTV

During 1983, **Richard Thurlow** G3WW, March, made 204 SSTV QSOs mainly on 14MHz with a few on 144MHz, spread over 29 countries. Of this number, 106 were first-timers bringing Richard's worked-first-time score, since November 1972, to 1956. Two-way colour pictures, including the new 24 seconds single-frame colour, were exchanged with more than 25 stations world-wide. "G4NJI has received the "print out" board from the SC-1 from Volker Wrasse, believed to be the first in the UK." writes Richard and adds, "G4DYB and G4NJI can be found, almost nightly, on 144·5MHz f.m. or 144·23MHz s.s.b. with G3CCH around 2100GMT". Thanks for the gen Richard, no doubt **Peter Lincoln**, well-known for his SSTV viewing with a Volker Wrasse SC-140, will look out for them. "Among the rarer signals was HB0AWQ calling CQ with no reply and stations from DJ, I, LA, YO and YU were seen quite often" writes Peter in his report for the month ending on January 10.

Over in Germany, **Allan Sancto** DD5FM/G6BWH is building the SSTV analogue-to-digital converter described in the RSGB journal *Radio Communication* by Brian Smith G3WCY. Two of Allan's colleagues are also building the device and Allan thanks one of his local radio club experts, Udo Elstner DF4MO, for his technical assistance. I look forward to hearing more from all of you Allan.

Band I

On December 17, **Ian Davidson,** Carmarthen, using a Vega 402DE receiver and pre-amplifier noted short bursts of test card from Poland and an analogue clock showing 3 hours ahead of GMT on Ch. R1 49·75MHz. Between 1700 and 1900 on the 18th, he watched a puppet show from Switzerland on Chs. E2 48·25MHz and E3 55·25MHz, a caption Artwelt on E2, and the news from Poland was fighting for predominance on Ch. R1 with Swiss television on Ch. E2. Ian was surprised at these results, especially as he was using a Band II Yagi at the time, however, Ian has plans for a wideband antenna for Band I and is looking forward to the 1984 sporadic-E season. Between 1400 and 1700 on January 11, Ian received a cartoon film and a sort of quiz programme from RAI Italy on their Ch. B 62·25MHz.

During a sporadic-E opening on December 23, **Philip Heaney** received pictures from Poland with the dt caption behind the newsreader on Ch. R1, as did **Fraser Lees,** Ringmer. He also identified Russian pictures on both Chs. R1 and R2. At midday on the 21st, **Steve Green** received a test card from TV1 Sweden on Ch. E2, YLE TV1 Finland on Ch. E3 and during a similar event on January 7, he logged pictures, possibly from the USSR, on Ch. R1. It looks as though the upset hung about because early the following morning, I received pictures of some form of wrestling, followed by news with a YL presenter on Chs. R1 and R2. Both Steve and I logged bursts of activity on Chs. E2 or R1 with glimpses of test card from Sweden on Ch. E2 and Poland on Ch. R1.

The majority of Band I enthusiasts have seen Russian words appear on their screens, especially during the sporadic-E season. Thanks to **Cyril Fairchild** G3YY, Brighton, who sent the following translations for the benefit of TVDXers. BPEMR = Time(S), NEWS; CNOPT = Sport; HOBOCTb = News; NPORPAMMA = Programme; TACC = TASS News Agency; CCCP = S.S.S.R. (USSR); TB or MB = TV; COObWAET = Report or Information; YTPEHHNN-NOYTA = Morning-Post-

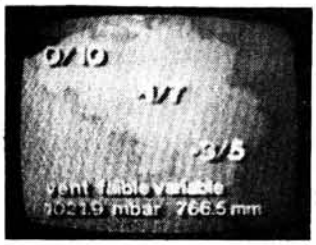

Fig. 1

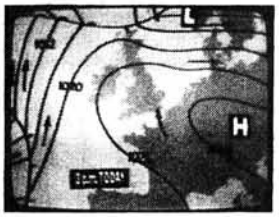

Fig. 2

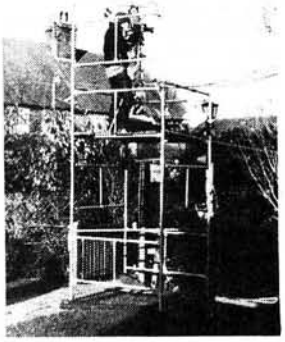

Fig. 3

Fig. 4

Fig. 5

Fig. 6

Fig. 7

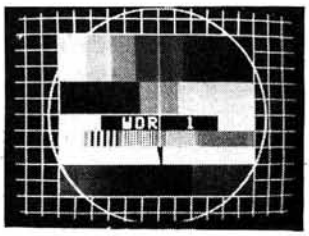

Fig. 8

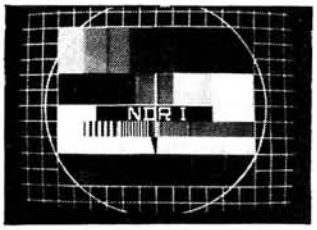

Fig. 9

Fig. 10

Fig. 11

Fig. 12

Fig. 13

Fig. 14

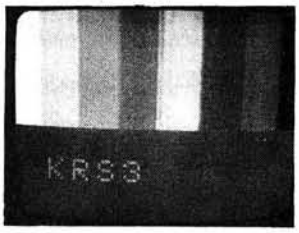

Fig. 15

Fig. 16

Programme; MOCKBA = Moscow; NPABAA = Pravda.

Readers, please remember, we cannot print some of the Cyrillic capitals correctly but our interpretation of the precise form sent by Cyril should suffice.

Tropospheric

Like many of us **George Grzebieniak** found Band III wide open when he received pictures from Belgium on Chs. E8, 10 and 11 and Holland on E5, 10 and 11 during the tropospheric openings on December 4 and 5 and 28 and 29. He also logged DR Denmark on Ch. E7 and the 3rd and WDR Germany on E11 on the 29th. Among the pictures George showed me was a clock caption, Fig. 7, that he received from Denmark on Ch. E10 during a similar event on August 29.

Like George, Philip Heaney, Norwich, received the test card from Denmark on the 3rd and 4th as well as seeing such captions as BRT-1, DR, FR3, PTT-NED 1 and 2, Sverige TV2, TDF and ZDF, plus a card showing a coat of arms with the words Niebull Canal and another saying Schleswig Canal 45, on the v.h.f. and u.h.f. bands.

On December 1, **Simon Hamer,** New Radnor, received pictures from France on 8 spots between Chs. 21 and 63 and on the 2nd he watched a documentary about the German occupation of Brussels in 1940, as excellent pictures from BRT TV1 and TV2 pounded into Wales from Egem on Chs. E43 and 46. Between 1800 and midnight on the 29th, Simon saw a clock and *Journal Televise* from RTBF-1, *Nos Journaal* from Holland, a programme *Orwell auf Jura* from Germany on ZDF and the captions Ard Hessischer Rundfunk-3 and ARD/WDR-1 spread between Bands III, IV and V.

"A really fine opening" said **Alan Taylor,** Coventry, whose report about Band III was similar to the others. He writes, "The u.h.f. band, Chs. 21 to 69, was so good that I received London ITV at a better strength than my local Central TV! and there were many Dutch and German stations on at incredible strengths".

In December, **Roger Wallis,** Solihull, was given a 19in Hitachi colour set and on the 29th he used a Belgian PM5544 test card to adjust it correctly. On the 3rd, Roger received pictures from Denmark, Germany and Holland. Like myself on the 29th he watched the afternoon programmes from Belgium on Ch. E8 and logged a test card on E10. Roger also watched colour Teletext information from RTBF on Ch. 41 and Anderlues test card on Ch. 61. At 1715 I watched an episode of *Chopper Squad*, with subtitles, in colour from Belgium on Ch. E10 and saw the captions Beste Wensen 1984 SPD above a news reader on Ch. E9 and BRT Journaal on E10.

"All together a very good trop" writes **Tony Palfreyman** about those first few days in December after he logged most of the continentals that were about. These included German regionals like NDR-1, Fig. 8, WDR-1, Fig. 9, WDR III, Fig. 10 and his best catch of all was DDR-2 from East-Germany on Ch. 34. Tony's pictures of the German newscaster, Fig. 11, and Teletext, Fig. 12, will give some idea of the strength of the DXTV pictures received during the December openings.

"On December 2, I tuned to ZDF

West Germany, they were transmitting an experimental stereophonic broadcast programme with various items with stereo sound including Henry Mancini and speech in stereo", writes **David Girdlestone,** Norwich, who photographed one of their captions Fig. 13.

Last November, **O.J. Jones,** Stoke-on-Trent, received bursts of signals between Chs. 6 and 8 in Band III and will no doubt be interested in the fluctuating conditions observed by Tony Palfreyman in Stannington during the late December tropo. "It started in the afternoon of the 29th, with snowy pictures from Holland on Chs. 39 and 45 and as the evening drew on these pictures became very strong. Checking the channels, I found Belgian stations on Chs. 42, 43, 46 and 62. The pictures received at this time were suffering from co-channel interference and for about 10 minutes hardly anything was identifiable, even local pictures were rolling. Then German stations were seen on the channels where there had been Belgian and Dutch", writes Tony. He added "On our local IBA Channel 4 from Belmont on Ch. 32, a WDR III test card could be clearly seen in the background and as the German stations went off the air a lot of British stations came up. This was certainly a hard trop to work with the constant changing in selectivity of countries, but it was a very interesting event". I am sure Tony that many newcomers to TVDXing will appreciate your description of this event and know now, that one can expect anything to happen when the atmospheric pressure is high and the troposphere is disturbed.

"TVDX on the 29th was remarkable", writes **Harold Brodribb,** who received a test card from RTL Luxembourg, Ch. E7, the film *Jack of Diamonds* and adverts for road safety and a building society on Ch. E5 and like the rest of us, some very strong continental pictures in Band III. He also saw a notice "RTE 1 regrets poor reception in some areas" on Ireland's Ch. D (175·25MHz, same frequency as Ch. E5). "I have never seen Eire before", said Harold.

Station Reports

My thanks to Filip Rogister, Overijse, for the information that BRT is the abbreviation for Belgian Radio and Television—Flemish section and BRT-TV1 and TV2 on the test cards are the first and second networks. RTBF is the French network in Belgium. Filip also tells me that the TV pictures, Figs. 5, 7 and 8 in our January issue are in fact Dutch and not German as I said (sorry about that) and that the NCRV in Fig. 7 is a Dutch programme company name as is Vara, Tros and Ikon. We often see these names and enjoy the programmes when conditions are right Filip.

Thanks as well to Jan Van Der Horst, Arnhem, who also told me about the Dutch programme makers and adds the names Avro and Veronica and writes, "the programme company has broadcast time, NOS is the super-structure that coordinates everything, cameras, studios, etc, and the PTT provides the links between studios and the different transmitters."

While in Germany on Christmas Day 1982, Steve Green received a Merry Christmas caption from PTT-NL Holland, Fig. 14 at 200km and among the DX signals he logged in the UK last December was a set of colour bars inscribed KRS3, Fig. 15, any ideas readers?

I mentioned a test card with a digital clock and the name Wendelstein on it in a recent column and from Germany, **Allan Sancto** writes, "This could have been Germany 1 ARD, Wendelstein refers to the mountain on which the antennas are located, as the enclosed post-card, Fig. 16, shows. It's 1840m high and from the peak one can see through to Austria and Italy. Also located just below the antennas is a solar observatory". Allan tells me that his QTH is about 13km from Wendelstein and he has a superb view of the range from his shack window.

UPGRADING THE DX160

▶▶▶*continued from page 32*

feasible to run the set from dry batteries as an alternative to a car battery. The socket connections are shown in Fig. 4. If the plug is missing then a Tandy 274-1210 plug can be made to fit by removing one of its pins.

DX150

This receiver, with either the suffix A or B, pre-dates the DX160 but superficially it looks the same. The DX150 has only four bands, the long waves being omitted. It has an internal loudspeaker, the external loudspeaker sockets for the DX160 at the rear being replaced by a switch for changeover from mains to 12 volt working.

Internally there is quite a difference between the two receivers though the circuitry appears to be the same. The main p.c.b. of the DX150 is not silkscreened though T16, T17 and T18 are easily located but it is more difficult to identify C16 and C19 below the board. The components associated with the "front end" are on a separate small board mounted at right angles to the chassis beside the wavechange switch. Capacitor C16 can be found without difficulty as it is the large component adjacent to the oscillator section of the switch. Tapping on a fixed capacitor provided digital readout as before though this time 22pF was needed. The highest frequency band (D) has the oscillator on the l.f. side of the incoming signal. Un-screened coils are used in the r.f. and oscillator circuits but a space with hole is conveniently left for an r.f. coil for medium-wave use. ●

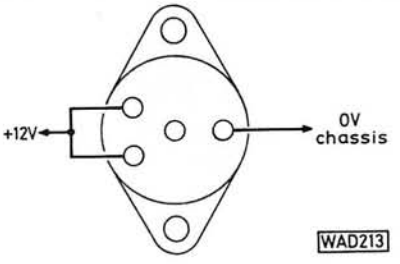

Fig. 4: Power socket connections

Mike is in hospital with appendix: He never did miss an opening!

. . . heard by John Tye G4BYV

I'm sorry about my transmission this evening, old chum, but my daughter has gone to bed in the next room and as I don't want to disturb her I've switched to low power.

. . . heard on 144MHz by M. Minns G4MIN

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. . . heard on GB3SC by G6JYN

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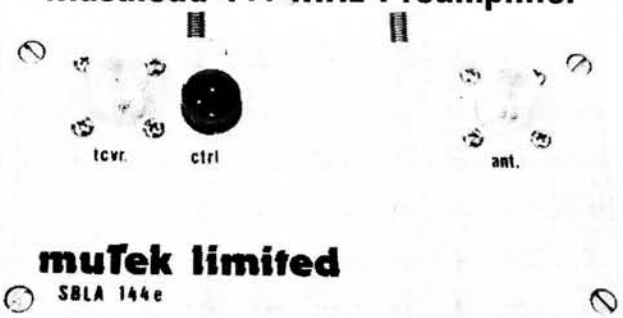

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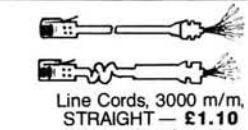

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Northern Amateur Radio Societies Association

The Association is holding its 22nd Annual Radio/Electronics Exhibition at Pontins Holiday Village, Ainsdale, Southport on Saturday 7th April and Sunday 8th April 1984 opening at 11.00am each day. It will include inter club quiz, construction contest, grand raffle, R.S.G.B. book stall, amateur computers, N.A.R.S.A. stands and trophy, a demonstration station and trade stands featuring all types of radio/electronic equipment. Bring and Buy Sale.

Admission will be £1 per day but lots of 20 or more tickets may be booked in advance from Mike Bainbridge G4GSY, 7 Rothbury Close, Bury BL8 2TT at a 20% discount by sending the appropriate cash and s.a.e.

Chalets may be booked direct from Pontins 0704 77165 and range from £11 + V.A.T. (2 persons) to £31 + V.A.T. (6 persons).

Bar and restaurant facilities will be available during the day while the restaurant will be open for breakfasts and from 1700 to 1900 on the Saturday evening. There will be evening entertainment limited by the capacity of the entertainment hall. Children's play areas will be available during the days.

Car parking will be available at a small charge but please follow all instructions of attendants to avoid congestion.

Talk in will be available on S22 or other available simplex channels.

Come along and enjoy yourself at this family weekend exhibition and make it a great success.

INDEX TO ADVERTISERS

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An even more exciting step is the new Brass Racer EK-1, an electronic keyer built into the base of our new Brass Racer Iambic paddle. Using the Curtis 8044 chip, this self-contained keyer and paddle is fully Iambic with dot/dash insertion and adjustable speed control. Use on either tube or solid state rigs. The perfect unit for mobile, DXpedition, or just plain fun.

Standard or deluxe models available

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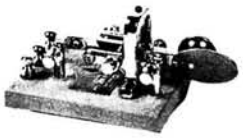

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All of our keys are available in Standard and Deluxe models. The Original and the Iambic are also available in the Presentation models.

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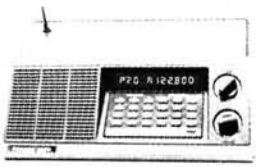

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