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Practical Wireless

AUGUST 1982

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Practical Wireless

AUGUST 1982 VOL. 58 NO. 8 ISSUE 905

contents

OUR SPECIAL OFFER THIS MONTH
Master Check Probe
(see page 54)

CB RIG CHECK

Repeated from Practical Wireless July 1982.

CB is a mobile short-range telephone system. You require a licence to use it, £10 p.a. from Post Offices.

This month's CB Rig Check covers three mobile transceivers, two of which are very similar to each other and obviously come from the same factory. The third rig is one of the first from a recognised amateur source in the UK.

All three rigs gave clean r.f. outputs within the limitations of the measuring equipment used, as the respective spectrum analyser pictures show. However, in terms of power output the Lowe TX-40 was giving out almost 7W of r.f. power into 50Ω—some 175 per cent over the legal limit, although we were assured that the rig had passed the relevant checks and was below the legal 4W when measured. With the attenuator in it produced twice the legal limit!

The other two rigs, a Uniace 100 and a Realistic TRC-2001, both gave 4·8W at 13V d.c. supply level. Obviously, the manufacturers hope the test house supply will be lower.

The Realistic and Uniden rigs are good examples of 'badge engineering'. Apart from the front panels and some very minor differences in p.c.b. layout, they are the same rig—even the serial numbers show remarkable similarities. Both are made in Hong Kong and are good examples of that area's radio production. Over the test period they performed capably and both proved easy to handle. The Lowe model was also well made and was a creditable performer. It is unfortunate that it was way over the top on output power.

Receiver sensitivity of the Lowe was much better than the other two rigs when measured in the lab and an RF GAIN control allows better use of this extra sensitivity.

Channel indication on all three rigs is by bright red l.e.d. displays while a meter indicates "S" levels and r.f. power.

The Lowe TX-40 has the microphone socket on the front panel. Obviously Lowe's amateur experience has rubbed off on their CB rig as the mic socket is of the metal-bodied screwed-ring type as opposed to the more commonly fitted DIN types. The Uniace 100 also has a similar mic socket fitted but the Realistic is fitted with a latching type DIN socket. Both the latter rigs have the mic socket in the left side of the rig making the mic lead stretch a long way across the front of the rig. The Realistic's mic lead was rather on the short side to make matters worse.

In use, all three rigs gave reasonable results using a mag-mounted Avanti Moonraker antenna. Audio quality was good, both transmit and receive and the squelch controls worked well.

The handbooks supplied with each rig were adequate, Lowe's being the best, giving the operator information on installation and antenna fittings as well as full operating instructions. All three gave a full circuit diagram, useful in cases of repair being needed in the future.

HOW MUCH?

Lowe TX-40. This rig will cost you £55·00, and is available only from Lowe Electronics, Chesterfield Road, Matlock, Derbys. Tel: 0629 2817, to whom we extend our thanks for the loan of the review rig.

Realistic TRC-2001. Available from Tandy retail outlets throughout the UK, price £79·95. Our thanks to Tandy Corporation, Bilston Road, Wednesbury, W. Midlands WS10 7JM, for the loan of the review rig.

Uniden Uniace 100. Priced at £80.00, this rig is available from CQ Centre, 10 Merton Park Parade, Kingston Road, London SW19. Tel: 01-543 5150 who we thank for the loan of the review rig.

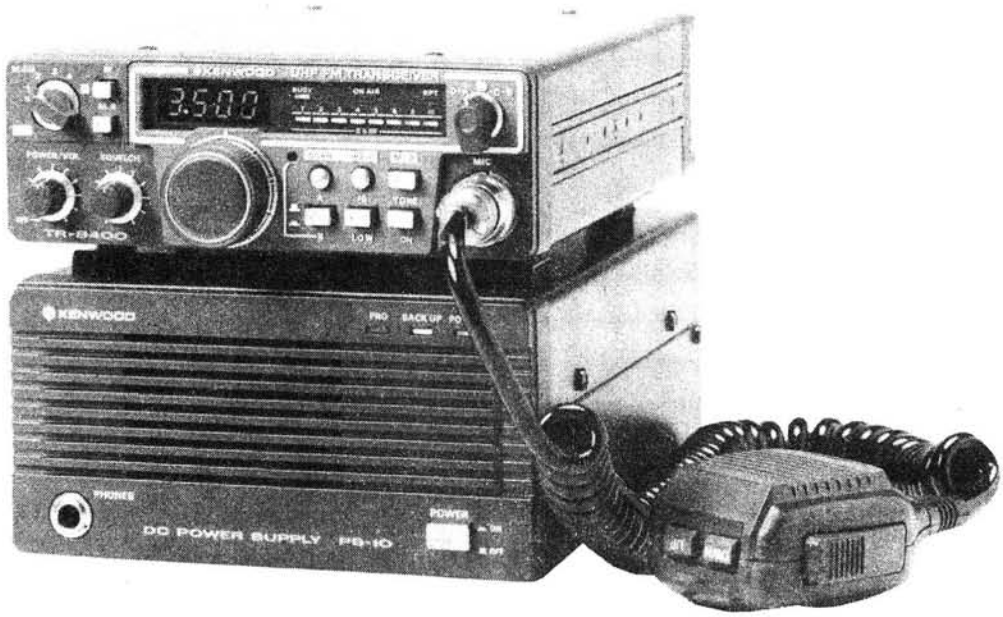
THE DIRECTORS AND STAFF

OF

LOWE ELECTRONICS

have pleasure in inviting you to their open day

SATURDAY 14th AUGUST 1982



with each new TR8400

a free PS10

I appreciate that not everyone has the wherewithall to buy a TS780 at £748.00, not everyone requires 70 cm and 2 metres in one rig.

However, 70 cm is a growing band and there are many easy to use repeaters up and down the country and, of course, SU8 and SU20 are popular Simplex channels: many more amateurs are finding out the pleasures to be had on the less crowded 70 cm band. To those of you who already own a 2 metre mobile rig which you don't want to trade in or part with, then why not consider a TR8400. At its new reduced price of £299.00 the TR8400 is, without a doubt, a good buy. Now, however, we are giving away, free of charge, with each new TR8400 bought, a matching power supply – the PS10. Not only a power supply but a high quality speaker also. The PS10 has the necessary connections for memory back up. Switch off the power supply and rig but leave AC power on to the PS10 and the backup indicating led remains lit and the memory frequencies are retained.

So for those mobile moments, or sat atop the free matching PS10 power supply in the comfort of your own shack, then, for 70 cm FM, the TR8400 is the rig for you.

TR8400 **£299.00 inc VAT**

Carriage £5.00

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NEW YAESU HF MULTIMODE TRANSCEIVER FT102.

Stop Press – FT102: – For the ultimate signal + Rx front end operates on 24V Dc and RF Stage (JFET) is bypassable extending the dynamic range over 100dB + Ultra Clean PLL system uses 6 narrow band VCO's + versatile IF shift/width system 2.7KHz→ 500Hz + wide variety of crystal filters for fixed bandwidths with parallel and cascade configurations + IF tunable notch filter + audio peak filter + new noise blanker with control of pulse width + microphone amp with tunable audio network adjustable to tailor response to individual voice characteristics before application to the superb internal RF speech processor + extra product detector allows AF monitoring of Tx IF signal + dual meters allows precise setting of processor and audio levels + peak hold ALC meter + three 6146B's in special configuration + DC fan whisper quiet + VFO uses custom IC module low component count within cast aluminium housing + external receiver provision + separate Rx antenna + AM/FM option module + full line of accessories + FC102 Antenna Tuner:– 1.2KW + single wire provisions, + 20-200-1,200W peak hold + separate SWR + Internal relays for push button selection + FRA-1-4 R waterproof 4 way switching box (inside FC102 or up tower) excellent isolation + FV102DM Synthesised scanning external VFO + 10Hz steps + fast slow scan + 12 channel memories + scanning external VFO + 10Hz steps + fast slow scan +/ 12 channel memories + readout to 10Hz!! + keypad, knob or microphone control + SP102 External speaker + large HiFi speaker + Selectable LPF and HPF for 12 possible response curves + stop.

£1295 inc. VAT @ 15% & Securicor

FOX TANGO ONE

The 'ONE' with the FM option

GENERAL COVERAGE, ALL SOLID STATE
The FT-ONE is a full-coverage all mode transceiver, equipped for reception between 150kHz and 29.99MHz, and transmission on all nine amateur bands. For commercial use the FT-ONE may be programmed to transmit throughout 1.8-29.99 MHz range.

KEYBOARD FREQUENCY ENTRY
Fully digitally synthesised, the FT-ONE uses a front panel keyboard for initial frequency entry. Frequency change is then accomplished via the main tuning dial or the pushbutton scanner, with tuning in either 10Hz or 100Hz steps. The FT-ONE permits extremely fine tuning and instant band changes.

DUAL VFO SYSTEM
Ten digital VFO's with memory are provided, in conjunction with an A-B selection scheme that allows instant recall of any transmit, receive, or transceiver frequency. For split-frequency operation, the operator may select TX on VFO-A and RX on VFO-B, automatically storing the calling and listening frequencies. For net operations, a non-volatile memory board is available as an option, (eliminates the possibility of dumping).

FULL CW BREAK-IN
Recent advances in solid-state technology have made full CW break-in reliable enough to be incorporated into the FT-ONE. You can select traditional semi-break-in (for use with amplifiers not equipped for full high-speed break-in.

'ELITE' CLASS PERFORMANCE
In addition to the full break-in and superb receiver filters, the FT-ONE is packed with subtle virtues that others might have overlooked. Rear panel jacks allow the use of both an external receiver and an independent receive antenna, when scanning automatic halting on a received signal may be programmed, an optional Curtis 8044 keyer board is available and there is even a microphone squelch (AMGC) to reduce background noise pickup between words and sentences!

GAIN/INTERCEPT OPTIMIZED RECEIVER
Utilizing up-conversion with a first IF of 73MHz, the FT-ONE RF amplifier stage uses push-pull power transistors configured to produce a typical output intercept of +40dBm. The first mixer utilizes a diode ring module followed by a low noise post amp, for optimum noise figure consistent with modern day intercept requirements. The result is a receiver with a typical two-tone dynamic range wall in excess of 95dB (14MHz, CW bandwidth). Additional gain tailoring is provided via PIN diode attenuator controlled from the front panel.

FILTER READY FOR COMPETITION
Three filter bandwidths are available for CW operation (two for FSKI), using optional 600Hz or 300Hz crystal filters. Filter insertion losses are equalised and an audio peak and notch filter is standard. Both IF Shift and Variable Bandwidth are provided, and two CW filters may be cascaded, for competition-grade selectivity. For SSB work, the Variable Bandwidth elliminates costly 1.5kHz or 1.8kHz filters.

EXPANDED OPERATING DISPLAYS
Digital displays for the VFO frequency, memory channel, and RIT offset are provided. The large front panel meter provides easy viewing of transceiver operating parameters, including finals collector current, input voltage, FM discriminator, processor compression, and forward/reflected relative power.

NON OPTIONS
Remember with your FT-ONE the noise blanker, speech processor and power supply are all built-in, not options

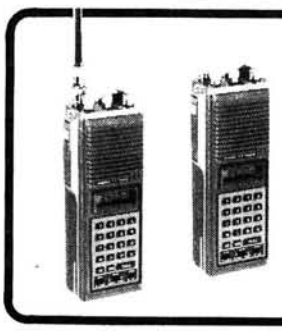
FTONE	Transceiver	1295.00
KEYT901	Curtis Keyer	23.00
DCT1	DC Power Cable	6.50
RAMT1	Non volatile memory	10.00
FMUT1	FM Unit	34.90
XF8.9KCN	300Hz CW filter	15.35
XF8.9KC	600Hz CW filter	15.35
XF8.9KA	6KHz AM filter	15.35
XF10.7KC	CW filter	13.80

FT207R

£169.00 buys you a 2.5 watt Yaesu FT207R or a 1.5 watt IC2F synthesised handheld transceiver. The FT207R steps in 12½ KHz (Not 10 KHz with added "5 up" switch) it scans for occupied or empty channels (no scanning) it has 4 channels of memory (none) and "auto revert" priority mode (none), programmable and ± 600 KHz splits (±600 KHz only), one could go on – but we would probably not have any FT207R's left by the time you read this!!

FT720

A unique modular VHF/UHF FM transceiver system at a remarkable price. Take a tiny FT720R control head for £115.00. Plug in a 720R' 2m ('V 10w £130.00, 'VH 25w £140.00) or 70cm ('U 10w £150.00) RF deck or operate it remotely with a 200cm or 400cm (E72S £15.00 or E72L £20.00) extension cable. Better still, buy a switching box (S72 £55.00) to enable control of a 2m and a 70cms deck from one control head, for the neatest installation around.



FT208R £209.00
2.5w, 2m
12.5/25 KHz
Synthesised

FT708R £219.00
1w, 70cms
25 KHz
Synthesised

FRG7700 £329

0.15-30 MHz General Coverage Receiver AM/SSB/CW/FM (Memory Version £409).

Matching; Antenna tuner, filters, six VHF convertors, active antenna!!!

★FT902D £800
★FT902DE £790

FT902DM £885

10-160m. SSB, CW, AM, FM, Deluxe digital, Keyer, fan, variable bandwidth etc.

902

FTV901R	Transverter Frame, 3 band	£195
FV901DM	Digital VFO. 40 mem. Scan	£260
YO901P	Monitor scope/Panadaptor	£330
FC902	Antenna tuner unit	£135
SP901	Speaker (Patch version £55)	£31

FT707 £569

10-80m. 100w PEP. SSB, AM, CW. Variable IF bandwidth. Digital (10w model £485).

707

FP707	Mains P.S.U. (20A)	£125
FC707	Antenna tuner	£85
FV707DM	Digital VFO 6 Mem	£203
FTV707R	Transvertor Frame.	£90

50TV 50MHz **£70,** 70TV 70MHz **£80.**
144TV 144MHz **£100,** 430TV 432MHz **£185.**

FT209R £249

2m, synthesised. 25 + 12½ KHz steps FM, 1 KHz + 100 Hz steps SSB. 2½W PEP.

Matching; Mobile bracket, 10W linear Amplifier, charger, carrying case available.

FT480R £379

2m Synthesised, 25 12½, 1 KHz steps FM. 1 KHz, 100, 10 Hz steps SSB. 10W PEP.

FT107M £725

10-160m. 100w PEP, SSB, AM, CW. Variable IF. Deluxe all solid state. (DMS version £799).

107

FP107E	Mains PSU External	£113
FP107	Mains PSU Internal	£102
FTV107	Transvertor frame 2 band	£119
FV107	External VFO	£98
FC107	Antenna Tuner	£112

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ICOM

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See revue in February Radd.Comm.

IC-720A
Possibly the best choice in HF.
£883.inc.

The main problem that the amateur of today has to deal with is deciding just which rig out of the many excellent products available he is going to choose. Technology is advancing at such a rapid rate and getting so sophisticated that many cannot hope to keep up. Some go too far!

Perhaps one way of dealing with the problem is to look at just what each model offers in its basic form without having to lay out even more hard earned cash on "extras". The IC-720A scores very highly when looked at in this light. How many of its competitors have two VFOs as standard or a memory which can be recalled, even when on a different band to the one in use, and result in instant retuning AND BANDCHANGING of the transceiver? How many include a really excellent general coverage receiver covering all the way from 100kHz to 30MHz (with provision to transmit there also if you have the correct licence)? How many need no tuning or loading whatsoever and take great care of your PA, should you have a rotten antenna, by cutting the power back to the safe level? How many have an automatic RIT which cancels itself when the main tuning dial is moved? How many will run full power out for long periods without getting hot enough to boil an egg? How many have band data output to automatically change bands on a solid state linear AND an automatic antenna tuner unit when you are able to add these to your station?

Well you will have to do quite a bit of hunting through the pages of this magazine to find anything to approach the IC-720A. It may be just a little more expensive than some of the others – but when you remember just how good it is, and of course the excellent reputation for keeping their secondhand value you will see why your choice will have to be an IC-720A!

IC-PS15 Mains PSU £99

ICOM

IC-2E £159.inc.
IC-4E £199.inc.
The World's most popular portables & now the marine version IC-M12

Nearly everybody has an IC2E – the most popular amateur transceiver in the world – now there is the 70 cm version which is every bit as good and takes the same accessories. Check the features.

Fully synthesized – Covering 144 – 145.995 in 400 5KHz steps. (430-439.999 4E)
Power output – 1.5W with the 9v. rechargeable battery pack as supplied – but lower or higher output available with the optional 6v or 12v packs. Rapid slide-on changing facility.
BNC antenna output socket – 50 ohms for connecting to another antenna or use the Rubber Duck supplied (flexible ¼ λ whip – 4E)
Send/battery indicator – Lights during transmit but when battery power falls below 6v it does not light, indicating the need for a recharge.
Frequency selection – by thumbwheel switches, indicating the frequency. 5KHz switch – adds 5KHz to the indicated frequency.
Duplex simplex Switch – gives simplex or plus 600KHz or minus 600KHz transmit (1·6MHz and listen input on 4E)
Hi-Low switch – reduces power output from 1.5W to 150mW reducing battery drain.
External microphone jack – if you do not wish to use the built-in electret condenser mic an optional microphone speaker with PTT control can be used. Useful for pocket operation.
External speaker jack – for speaker or earphone. This little beauty is supplied ready to go complete with nicad battery pack, charger, rubber duck.

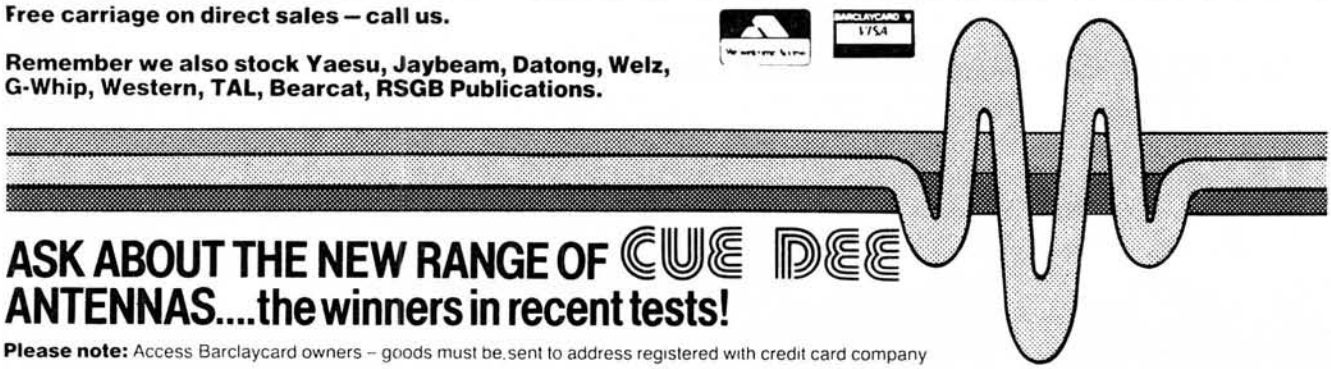
A full range of accessories in stock.		£ p
ICML1	10W mobile booster for IC2E	49 00
BP5	11 volt battery pack	30 00
BP4	Empty battery case for 6 x AA cells	5 80
BP3	Standard battery pack	17 70
BP2	6 volt pack	22 00
BC30	Base charger for above	39 00
BC25	Mains charger as supplied	4 25
DC1	12 volt adapter pack	8 40
HM9	Speaker microphone	12 00
CP1	Mobile charging lead	3 20
IC1 2 3	cases	each 3 60

All prices include VAT

The IC4E is going to revolutionise 70 CM!

Free carriage on direct sales – call us.

Remember we also stock Yaesu, Jaybeam, Datong, Welz, G-Whip, Western, TAL, Bearcat, RSGB Publications.



ASK ABOUT THE NEW RANGE OF CUE DEE ANTENNAS....the winners in recent tests!

Please note: Access Barclaycard owners – goods must be sent to address registered with credit card company

IOW RF ouput on SSB, CW and FM. Standard and non-standard repeater shifts. 5 memories and priority channel.

Memory scan and band scan, controlled at front panel or microphone. Two VFO's LED S-meter 25KHz and 1KHz on FM-1KHz and 100KHz tuning steps on SSB. Instant listen input for repeaters.

ICOM's answer to your HF mobile problems – the IC-730. This new 80m-10m, 8 band transceiver offers 100W output on SSB, AM and CW. Outstanding receiver performance is achieved by an up-conversion system using a high IF of 39MHz offering excellent image and IF interference rejection, high sensitivity and above all, wide dynamic range. Built in Pass Band Shift allows you to continuously adjust the centre frequency of the IF pass band virtually eliminating close channel interference. Dual VFO's with 10Hz and 1KHz steps allows effortless tuning and what's more a memory is provided for one channel per band. Further convenience circuits are provided such as Noise Blanker, Vox, CW Monitor, APC and SWR Detector to name a few. A built in Speech Processor boosts talk power on transmit and a switchable RF Pre-Amp is a boon on todays crowded bands. Full metering WWV reception and connections for transverter and linear control almost completes the IC-730's impressive facilities.

ICOM produce a perfect trio in the UHF base station range, ranging from 6 Meters through 2 Meters to 70 cms. Unfortunately you are not able to benefit from the 6m product in this country, but you CAN own the IC-251E for your 2 Meter station and the 451E for 70 cms.

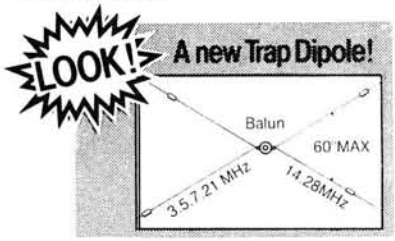
Both are really well designed and engineered multi-mode transceivers capable of being operated from either the mains or a 12 volt supply. Both contain such exciting features as scan facilities, automatic selection of the correct repeater shift for the band concerned, full normal and reverse repeater operation, tuning rate selection according to the mode in use. VOX on SSB continuous power adjustment capability on FM and 3 memory channels. Of course they are both fitted with a crystal controlled tone burst and have twin VFO's as have most of ICOM's fully synthesized transceivers.

The famous IC-240 has been improved, given a face lift and renamed the IC-24G. Many thousands of 240's are in use, and its popularity is due in part to simplicity of operation, high receiver sensitivity and superb audio on TX and RX. The new IC-24G has these and other features. Full 80 channels (at 25kHz spacing) are available and readout is by channel number – selected by easy to operate press button thumbwheel switches. This readout can clearly be seen in the brightest of sunlight. Duplex and reverse duplex is provided along with a 12½ KHz upshift, should the new channel spacing be necessary.

Amazingly small, yet very sensitive. Two VFO's, five memories, priority channel, full duplex and reverse. LED S-meter, 25KHz or 5KHz step tuning. Same multi-scanning functions as the 290 from mic or front panel. All in all the best 2M FM mobile ICOM have ever made.

The TONO range of communication computers take a lot of beating when it comes to trying to read RTTY and CW in the noise. Others don't always quite make it!

Check the many facilities offered before you buy – especially look at the 9000E which also throws in a Word Processor. Previous ads have told you quite a lot about these products – but why not call us for further information and a brochure?



The MT-240X Multi-band trap dipole antenna (80m – 10m) is a superbly constructed antenna with its own Balun incorporated in the centre insulator with an SO239 connector. Separate elements of multi-stranded heavy duty copper wire are used for 80-40-15 and 20-10 Metres. Really one up on its competitors. £49.50 inc. VAT

Thanet Electronics

143 Reculver Road Beltinge Herne Bay Kent Telephone (02273) 63859

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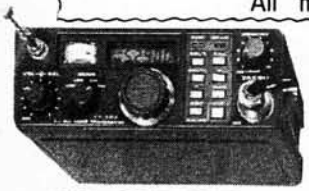

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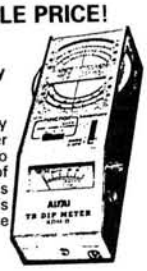

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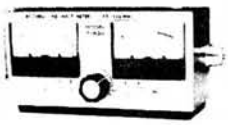

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Receiver pre amp not applicable.

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All linear amps have straight through facility.

All the above Models are designed for a nominal 12 volt supply. If AC mains operation is required, please see our Model SCL 144/PS as featured on page 26 of the February issue of Practical Wireless.

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The above specifications are a brief outline to our Product Range please send an S E A or telephone for further information.

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Kit – £19.60 **Assembled – £26.95**

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Kit – £5.30 **Assembled – £8.10**

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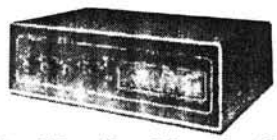

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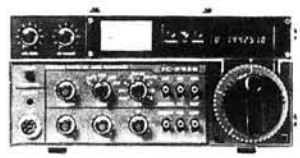

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comment...

First, the Bad News...

AS PART OF our 28MHz band "special" this month, we had hoped to publish details of how to convert 27MHz a.m./s.s.b. CB rigs for operation on the 28MHz Amateur band. However, we thought we'd better check out how you went about clearing the unpaid Import Duty and VAT on an illegally-imported rig, to make it all right and proper.

You may have seen mention of the arrangement whereby illegal a.m./s.s.b. CB sets that had been converted to meet Home Office CB Specification MPT 1320 could be "legitimised" by making a payment of £5 to the local Customs and Excise Office. We assumed that a similar arrangement would apply to sets converted for 28MHz, but apparently this is not so. The way the Customs legislation was framed refers only to sets converted to MPT 1320. The idea of sets being converted to Amateur bands use was not thought of, and our information is that it is not likely to be considered in the near future.

Whilst we are on the CB front, you will be interested to know that a series of seven Citizens' Band Radio Information Sheets were issued recently by the Home Office Radio Regulatory Department. These deal with Licensing, Frequencies, Modulation modes, Antennas, Illegal equipment (including conversion) and Interference problems.

Sheet No 5, on antennas, is particularly interesting as it lays down in more detail what is and is not considered permissible under the terms of the Specification and Licence: what form the base loading coil may take, what form the ground-plane may take for base-station antennas, why the antenna design has been limited in the way it has.

We plan to bring you details of the more important points from this information sheet in our next issue. Further details are available from the Home Office Radio Regulatory Department, Waterloo Bridge House, Waterloo Road, London SE1 8UA.

Geoff Arnold

services

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.

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 to both home and overseas addresses at £13.00 per annum, from **"Practical Wireless" Subscription Department, Room 2613, King's Reach Tower, Stamford Street, London SE1 9LS.** Airmail rates for overseas subscriptions can be quoted on request.

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Limited stocks of some recent issues of *PW* are available at 95p each, including post and packing to addresses at home and overseas.

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

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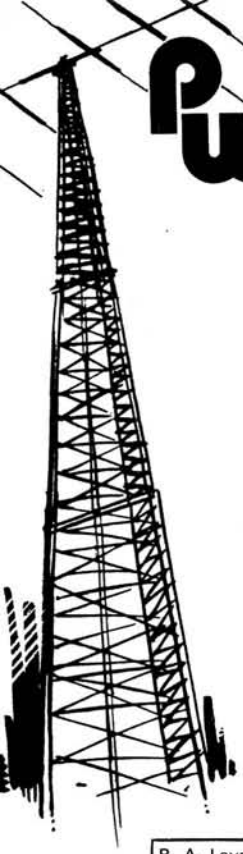

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2					
3					
4					
5	Antennas (Aerials), s.w.r. meters, etc.				

Please continue list of equipment on a separate sheet if necessary

TOTAL SUM TO INSURE £

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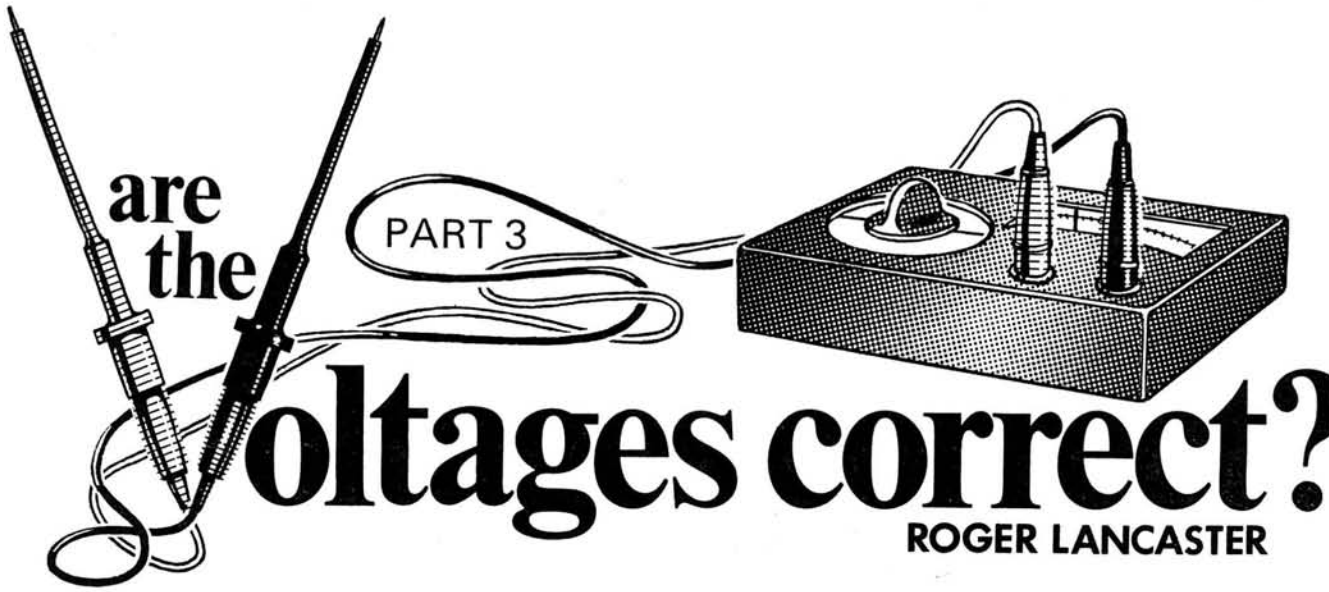


are the PART 3 voltages correct?

ROGER LANCASTER

Solution to last month's problem: The circuit is reproduced here in Fig. 3.1.

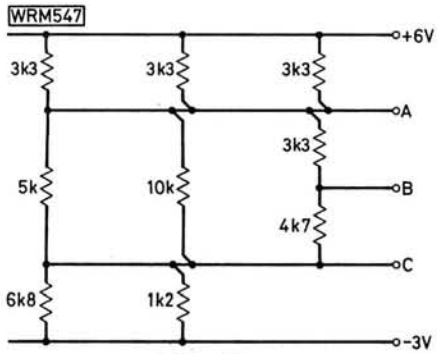


Fig. 3.1

You were asked to calculate the potentials of "A", "B" and "C" with respect to earth.

Point "B" is not a main junction of resistors, so we ignore that for the time being. The three 3·3kΩ resistors in parallel reduce to $\frac{3\cdot3}{3} = 1\cdot1\text{k}\ \Omega$. Between "A" and "C" we have three parallel paths: 5kΩ, 10kΩ and (3·3 + 4·7)kΩ. So

$$\frac{1}{R} = \frac{1}{5} + \frac{1}{10} + \frac{1}{8} = 0\cdot2 + 0\cdot1 + 0\cdot125 = 0\cdot425$$

Therefore, $R = \frac{1}{0\cdot425} = 2\cdot353\text{k}\Omega$

The remaining parallel pair reduce to $\frac{6\cdot8 \times 1\cdot2}{8} = 1\cdot02\text{k}\Omega$

The circuit can then be simplified to that shown in Fig. 3.2. Total resistance is

$1\cdot1 + 2\cdot353 + 1\cdot02 = 4\cdot473\text{k}\Omega$

Total applied voltage is 9V

$$V_{R1} = \frac{1\cdot1}{4\cdot473} \times 9 = 2\cdot213\text{V}$$

So, potential at "A" = +6–2·213 = **+3·787V**

$$V_{R3} = \frac{1\cdot02}{4\cdot473} \times 9 = 2\cdot052\text{V}$$

So, potential at "C" = −3 + 2·052 = **−0·948V**

The voltage across "AC" is the number of volts extending from +3·787V to −0·948V, that is the 3·787V above 0V **added to** the 0·948V below 0V. This is 3·787 + 0·948 = 4·735V.

The voltage across the 4·7kΩ resistor is

$$\frac{4\cdot7}{8} \times 4\cdot735 = 2\cdot782\text{V}$$

So, potential at "B" = −0·948 + 2·782 = **+1·834V**

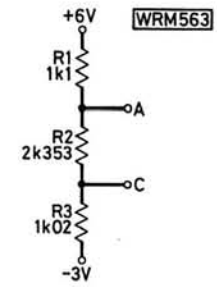
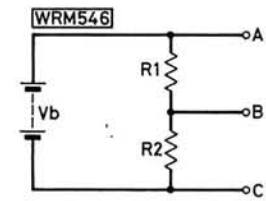


Fig. 3.2

Effects of Meter Resistance

Let us look again at the experiment I suggested you do in last month's issue. The circuit is reproduced in Fig. 3.3.

Fig. 3.3



You were asked to measure V_{R1}, then V_{R2}, then the voltage across "AC", then to check whether $V_{R1} + V_{R2} = V_b$.

If you used a moving-coil meter you will have found that $V_{R1} + V_{R2}$ did **not** equal V_b, thus apparently disproving Kirchhoff's Second Law. However, if you took your meter resistance into account you will have discovered the reason for this and restored your faith in Mr Kirchhoff and your meter.

If not, consider what would happen if I used a good quality 22 000Ω/V meter on its 10V range, two 220kΩ resistors and a 6V battery, as shown in Fig. 3.4.

$$V_{R1} = V_{R2} = \frac{220}{440} \times 6 = 3V$$

and $V_{R1} + V_{R2} = 6V$ (the battery voltage).

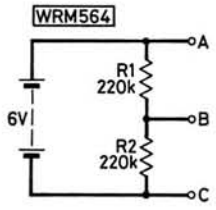


Fig. 3.4

When I measure the voltage across "AB" (V_{R1}), however, my meter (which on the 10V range has a resistance of Rm = 22 000 × 10 = 220kΩ) modifies the circuit to that of Fig. 3.5. Between "A" and "B" there is now a resistance of 110kΩ as long as I have the meter connected.

So, the voltage across "AB" $= \frac{110}{330} \times 6 = 2V$

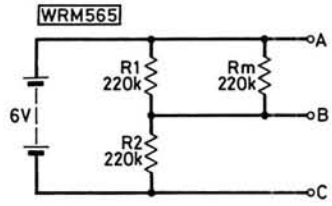


Fig. 3.5

That same 2V exists across the meter terminals, so this is what the meter will indicate.

Incidentally, **while** my meter is connected across "AB", the voltage across "BC" is $\frac{220}{330} \times 6 = 4V$, but this would not be immediately obvious to me unless I knew and believed in Kirchhoff's Second Law.

When I remove my meter from "AB" and connect it across "BC" I shall read 2V across "BC" and the "invisible" 4V will be across "AB". But when I connect the meter across "AC" I shall read exactly the 6V of the battery. This is because the 6V of the battery exists across "AC" no matter what resistance is connected between "A" and "C" (provided we neglect the internal resistance of the battery, which is negligible in this example).

If you try working out what the results would be using a cheap 2000Ω/V meter (again on its 10V range), you should find the readings will be 0·5V across each individual resistor yet 6V across the two in series.

Now we must not get angry with the meter. It is **not** inaccurate. In every case it is telling us faithfully the voltage across its terminals. It is up to us to take into account its resistance when necessary.

But when do we need to take meter resistance into account and when do we not? Not every time, surely? Fortunately no. Significant discrepancies only occur when measuring the voltage across a relatively large resistance which is part of a series chain. The golden rule is: ignore the meter resistance to begin with; estimate the voltage by calculation, then measure it; if there is a significant difference between estimated and measured voltages, then recalculate taking meter resistance into account before you suspect that a fault condition exists at this point.

Digital electronic voltmeters have a high resistance, usually of several megohms, which remains constant regardless of range, so these tend to provide instantly accurate voltage readings on more occasions than moving-coil types. However, many of them have disadvantages when compared with moving-coil meters in other respects, so don't torture yourself with agonies of remorse if you happen to have bought a moving-coil multimeter.

So far we have considered only resistive circuits. In these circuits, if our readings are not as expected, even after taking meter resistances into account, then either something must have happened to the value of one (or more) of the resistors, or to the supply voltage, or there is a wiring fault. By analysing the readings, we should be able to spot the likely fault before having to unsolder anything to be tested by ohmmeter. Resistors usually become high in value or open-circuit, although it is not unknown for resistors to become low in value.

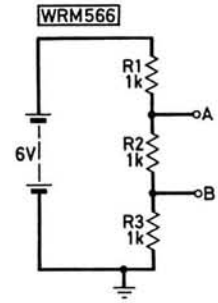


Fig. 3.6

For example, see Fig. 3.6. Suppose I measure the potentials at "A" and "B" and obtain readings of 1V and 0·5V respectively. The potentials should be 4V and 2V respectively. The first check would be to see whether the battery voltage is still 6V. If this is so, the most likely fault is that R1 has gone high in value, and we could confirm this by removing it from circuit (or at least unsoldering one end of it) and testing it on the ohms range of our meter. We will probably find it reads 10kΩ, since this value would give us the readings obtained. It is **possible** that **both** R2 and R3 have gone down in value to 100Ω each, but this would be extremely unlikely.

As we know, resistors obey Ohm's Law and this is why we are able to find faults in resistive circuits by making voltage measurements. Some other components obey Ohm's Law **under certain conditions only** and we have to treat circuits containing these components quite differently. However, we can still deal with the purely resistive **parts** of complex circuits by using the methods described so far, as long as we can first estimate the voltage across the resistive part.

Now we will turn our attention to the more common of these other components.

Capacitors

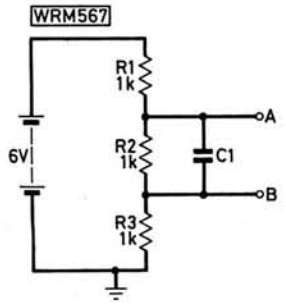
As far as alternating currents are concerned, the **reactances** of capacitors obey Ohm's Law, but in this series I am considering only the direct current aspects of circuits. There is a good reason for this; the vast majority of faults manifest themselves in the form of changes in the **d.c.** potentials of the circuit and since d.c. potentials are easy to measure without disturbing the circuit under test this is a sound basis on which to carry out fault-finding.

By the nature of their construction, good capacitors have virtually infinite resistance between their plates. While it is possible to measure some resistance with a good megohmmeter, it is of such a high order of megohms that we can consider good capacitors as being open circuit to d.c.

Capacitors, therefore, do not affect the d.c. conditions of the circuit and, for our purposes, can be treated as if

they do not exist. Take capacitor C1 in Fig. 3.7. No matter what its value, C1 does not alter the resistance between "A" and "B", which remains 1kΩ whether C1 is connected or not. Potentials at "A" and "B" are 4V and 2V

Fig. 3.7

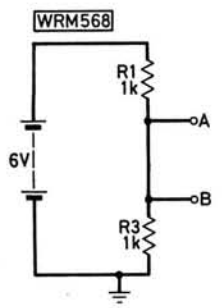


respectively, therefore. It is true that C1 would **oppose any tendency of p.d. between "A" and "B" to change** (for instance if the supply voltage changed) but this would be only temporary while the charge on C1 re-adjusted to the changed conditions. This will not normally bother us with our static d.c. measurements, except that we may find the voltages need a very short time (depending on the capacitance of C1) to "settle down" after the supply is initially connected.

Faulty capacitors can become open-circuit (connecting lead broken internally, resulting in drastically reduced capacitance), short-circuit (plates connected together due to dielectric breakdown) or "leaky" (deterioration of the dielectric allowing the resistance between the plates to fall).

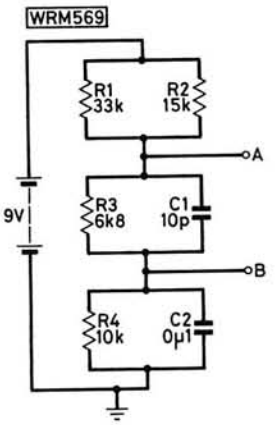
Referring again to Fig. 3.7, if C1 became open-circuit there would be no change in the d.c. potentials. The only easy way to prove C1 open-circuit is to connect another known good capacitor in parallel with C1 and check that the fault symptoms (whatever they were) then disappear. If C1 became short-circuit, the potentials at "A" and "B" would be equal, the equivalent circuit being that of Fig. 3.8. From this it can be seen that the common potential would be +3V. If C1 became leaky, the resistance between "A" and "B" would no longer be the 1kΩ of R2 but something less, since this resistor would be in parallel with the leakage resistance of C1, and the potentials at "A" and "B" would change accordingly.

Fig. 3.8



Now try your skill at the following problems, all based on the circuit of Fig. 3.9. A full solution will be given in next month's article.

Fig. 3.9

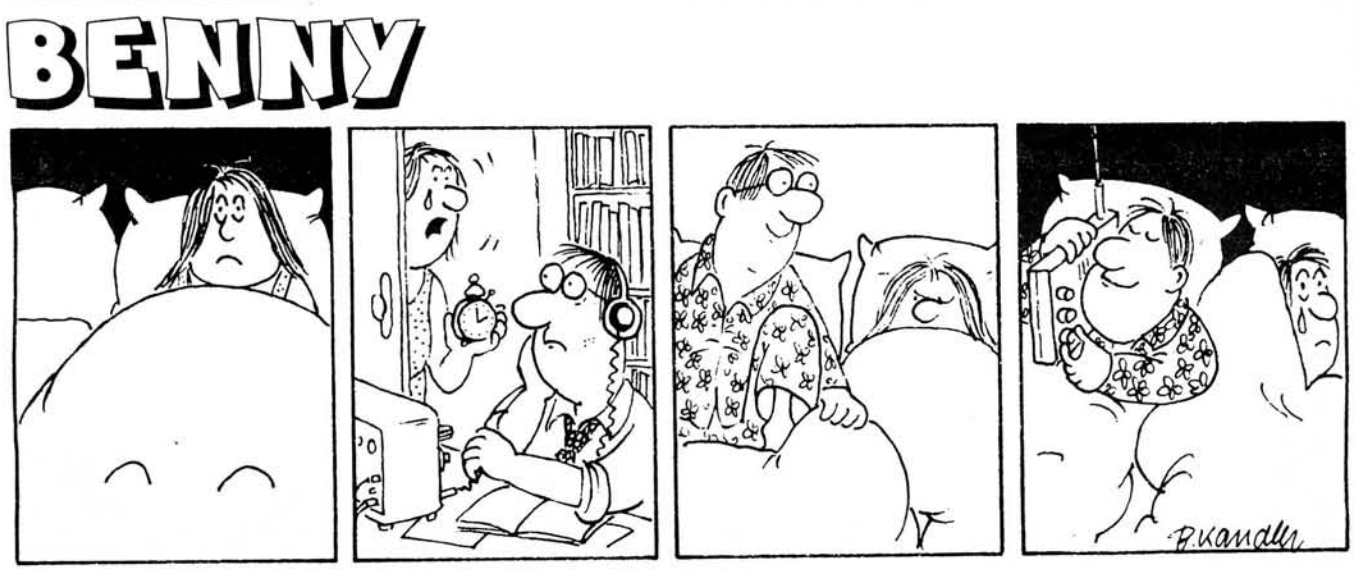


No. 1: Calculate the potentials at "A" and "B" with respect to earth.

No. 2: Determine the most likely **component** fault for each of the following sets of potential readings for "A" and "B".

(i) "A" = +9V "B" = +9V
(ii) "A" = +9V "B" = 0V
(iii) "A" = +4·43V "B" = +4·43V
(iv) "A" = +3·04V "B" = +1·8V

Next month we shall look at inductors and certain semiconductors and the effects they have on voltage readings.



FREQUENCY SYNTHESISER

Mirko VOZNJAK YU1AD

Frequency synthesis is a term that is widely encountered these days. Generally speaking, a frequency synthesiser is a device that can produce a spectrum of frequencies; i.e. a signal source with an output consisting of multiple well-defined frequency increments controlled by a stable and highly accurate reference.

Applications for frequency synthesisers may be divided into two principal groups:

(1) Signal sources for measurement and instrumentation purposes.
(2) Local oscillator sources for transmitters and receivers.

The synthesiser design that forms the basis of this constructional article falls within the first group, i.e. as a measuring instrument, and details of its capabilities are shown in the specification box.

Synthesiser Principles

In order to understand the basic principles behind the frequency synthesiser a block diagram of the system is shown in Fig. 1.

The central element comprises a phase comparator and voltage controlled oscillator (v.c.o.), contained within a single i.c. package in the practical circuit.

There are two inputs to the phase comparator, the first being a reference signal, in this case of 500Hz, obtained initially from a high stability 5MHz crystal oscillator. The second input to the phase comparator is provided by the v.c.o., having first been processed through a string of programmable divider elements.

When there is a difference in frequency between the reference and divider-processed signals arriving at the inputs to the phase comparator, an error signal will be present at the output. This output error signal is in the form of a d.c. voltage which is fed to the v.c.o. circuit to effect a change in its frequency until the difference between the two phase comparator inputs becomes zero. The system is now in a "locked" condition and the v.c.o. accuracy and stability becomes that of the reference source signal.

In this particular system, since the output from the programmable dividers is not a symmetrical square-wave, additional processing in the form of a divide-by-two flip-flop stage is provided to match the 500Hz reference frequency.

A Practical Example

For an understanding of the actual operation of the frequency synthesiser we will consider what happens if an output signal of 1000kHz is required.

The initial operation is the setting of the programmable dividers to read 1000, i.e. to obtain a divide-by-1000 situation. The v.c.o. may be initially above or below the required output frequency so a corresponding error signal will be introduced by the phase comparator to the v.c.o. circuit, forcing it onto 1000kHz which when divided by 1000 will provide a 1kHz output from the summing/combining gate. This 1kHz signal passes to the divide-by-two stage to provide 500Hz, which once again will match the reference signal from the local oscillator source. In this situation the v.c.o. will be locked; any tendency of the v.c.o. to change frequency will introduce an error signal from the phase comparator and force the v.c.o. back onto the programmed frequency. To confirm that the system is

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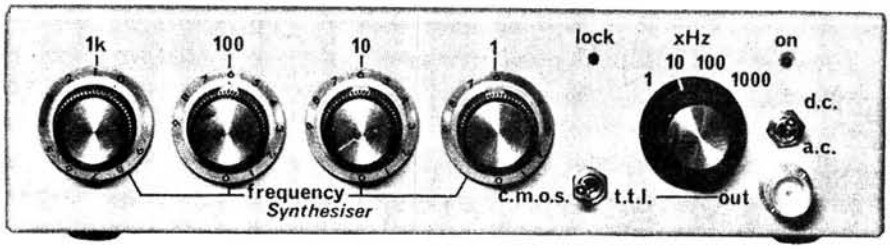


Front control panel layout of the prototype unit

★ specification

Frequency range and resolution:	1kHz–1·999MHz in 1kHz steps 100Hz–199·900kHz in 100Hz steps 10Hz–19·990kHz in 10Hz steps 1Hz–1·999kHz in 1Hz steps
Waveform and output level:	Symmetrical square wave with choice of c.m.o.s. (12V) or t.t.l. (5V) compatibility
Frequency stability:	In the order of a few parts per million dependent on crystal used. Socket provided for connection of high stability external reference.

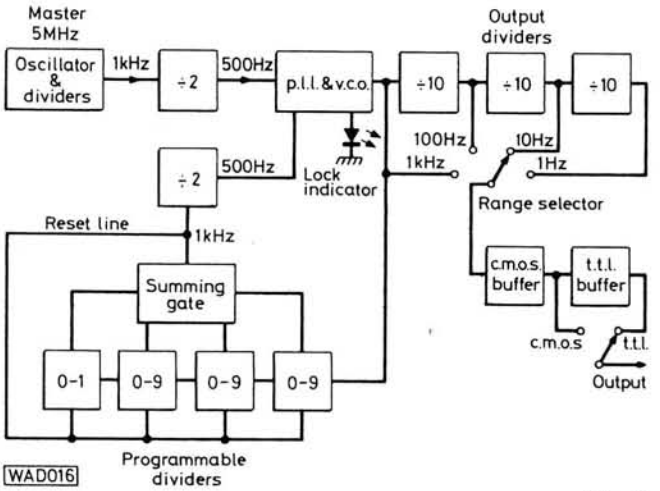


Fig. 1

stable an l.e.d. LOCK indicator is provided, which when illuminated indicates that an in lock situation exists. During correct operation the l.e.d. will be illuminated.

In its basic form the frequency synthesiser in this design will operate over the range 1kHz–1·999MHz in 1kHz increments; however, it is highly desirable to cover the missing a.f. portion of the range. Accordingly the output divider section is provided giving access to both lower frequency outputs and at the same time improving the resolution. In the lowest range selectable a coverage of between 1Hz–1·999kHz is obtained in 1Hz increments.

Finally, buffer stages are provided to allow output compatibility with c.m.o.s. or t.t.l. levels.

Circuit Description

To facilitate the construction of this instrument it has been divided into four basic modules.

(1) Main module, containing the reference signal level translator, both divide-by-two stages, summing gate, phase locked loop (p.l.l.) i.c., output dividers and buffer stages.

(2) Programmable divider chain.

(3) Reference crystal oscillator and divider stages to reduce the 5MHz signal to 1kHz.

(4) Power supply module.

Main Module

The circuit diagram of the main module, board 1, is shown in Fig. 2. Since the 1kHz signal provided by the reference source is of a 5V t.t.l. level, Tr1 is used as a level shifter to allow compatibility with the rest of the module which, with the exception of the t.t.l. output buffer, works at 12V c.m.o.s. levels.

Both signal inputs to the phase detector are divided by a 4013, dual divide-by-two flip-flop. Most of the hard work is performed by the 4046 p.l.l. This device contains two phase detectors and a *CR* type v.c.o.; only one of the phase detectors is used in this application. Pin 1 of the 4046 goes to a high state when the v.c.o. is locked, and is conveniently used in conjunction with non-inverting driver transistor Tr2 to power the LOCK l.e.d. In spite of the fact

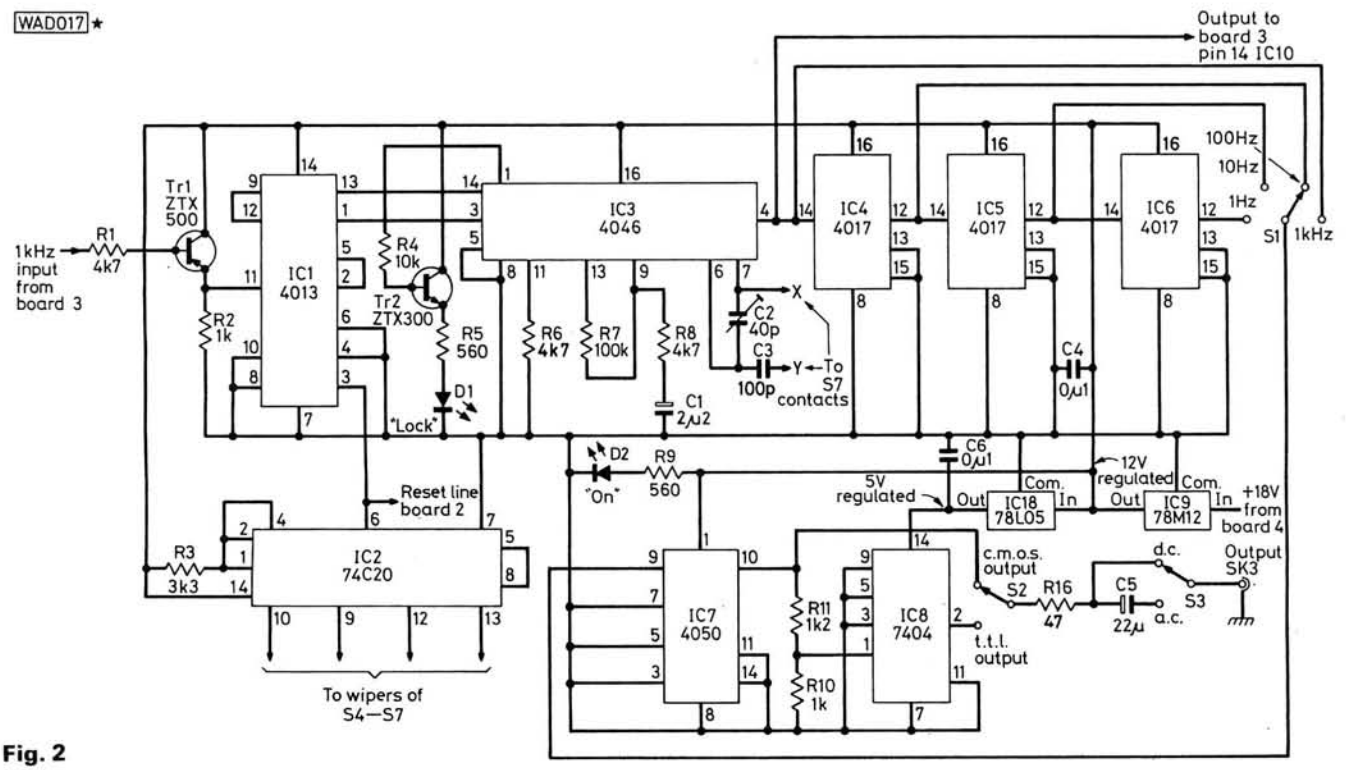
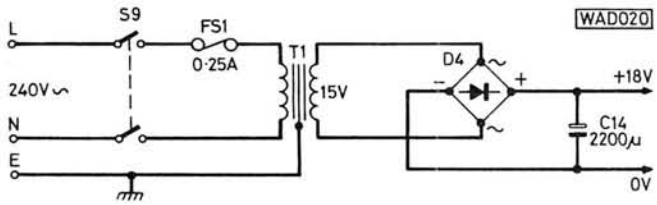


Fig. 2

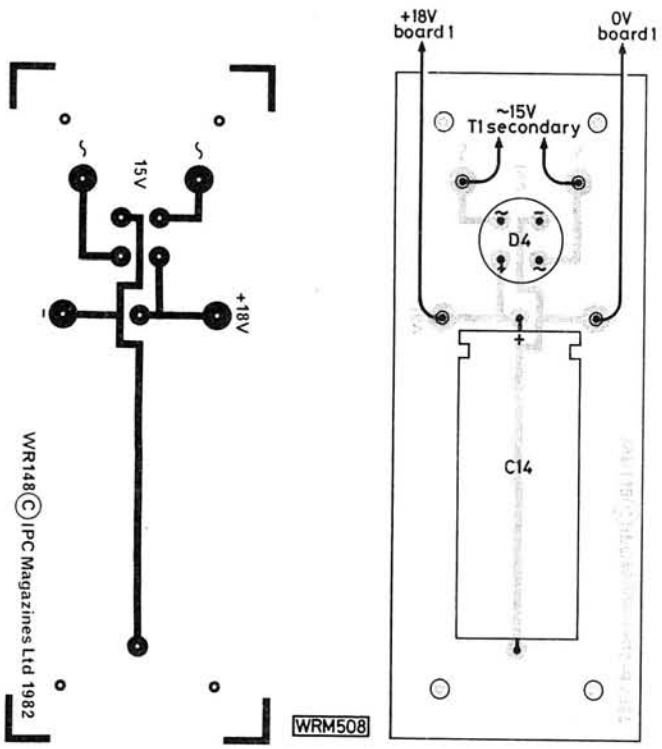
that the v.c.o. in the 4046 has an extremely wide range of control, asking it to have full control over the range 1kHz–1·999MHz, with a single value of capacitor, would be a bit too much. For this reason trimmer capacitor C2 is used for the range above 1MHz, whilst at lower frequencies a 100pF capacitor (C3) is switched in via a second set of contacts on the m.s.d. (most significant digit) switch (S7), when in the "0" position.

The summing/combining stage is formed from a 74C20, dual four-input NAND gate. The second half is used as an additional buffer prior to the divide-by-two stage using the second half of the 4013. The same signal is used to reset the programmable counters.



▲ **Fig. 3: Circuit diagram of the mains p.s.u. module**

▼ **Fig. 4: Track pattern and component layout shown full size**



With the selected values of R7, 8 and C1, forming a low-pass filter in the error signal path, locking occurs quickly allowing a very short "blink" of the LOCK indicator.

The three divide-by-ten stages used to extend the range of the synthesiser use 4017 c.m.o.s. devices. The required output signal, selected by S1, is fed into the non-inverting 4050 c.m.o.s. buffer, providing c.m.o.s. compatibility with a considerable current sinking capability. Output signals are routed via a resistive divider network R10, R11 to feed the t.t.l. level drive input of a 7404 buffer stage.

Switch S2 is used to select the required output format and as both outputs have a small d.c. component, which is sometimes undesirable, S3 is used to insert a tantalum electrolytic d.c. blocking capacitor which allows only the required a.c. component through to the output socket.

The main module is supplied from the p.s.u., board 4, with a nominal 18V unregulated d.c. voltage to feed the on-board 78M12 monolithic regulator, IC9. This device is also used to supply the crystal oscillator/divider and programmable divider modules. A 78L05 monolithic regulator is used to supply the 7404 t.t.l. buffer, IC8.

Programmable Dividers

The circuit of this module, shown in Fig. 5, is quite simple to construct and consists of four 4017 i.c.s and supply rail decoupling capacitor, C13. Selector switches S4, 5, 6 and 7 are mounted on the front panel of the synthesiser and must be of the non-shorting (break-before-make) type. The m.s.d. selector could be either a rotary type, limited to two positions, or a miniature d.p.d.t. toggle switch.

When wiring switches to the board it is very convenient to use wires of a different colour to avoid confusion. An ideal source for such wire is 10-way ribbon cable which comes with a full complement of standard colour-coded conductors. Using the standard resistor colour coding for the wires makes life much less complicated when wiring up; i.e. Black for 0, Brown for 1, etc.

Crystal Oscillators and Dividers

The circuit diagram for this module is shown in Fig. 7. The basic oscillator uses a 5MHz crystal which should be a clean "AT" cut type, providing very good stability in normal environmental conditions. To tune the crystal to the exact frequency, two trimmers are provided; C8 (5·5–65pF) for coarse adjustment and C9 (2–10pF) for precise alignment. To allow for final frequency adjustment when assembled the two trimmers are mounted in back-to-back fashion on the p.c.b. The component side of the board locates C8, whilst C9 is soldered on the track side of the p.c.b. with a 6mm hole provided in the rear of the cabinet to allow access for trimming C9. The oscillator

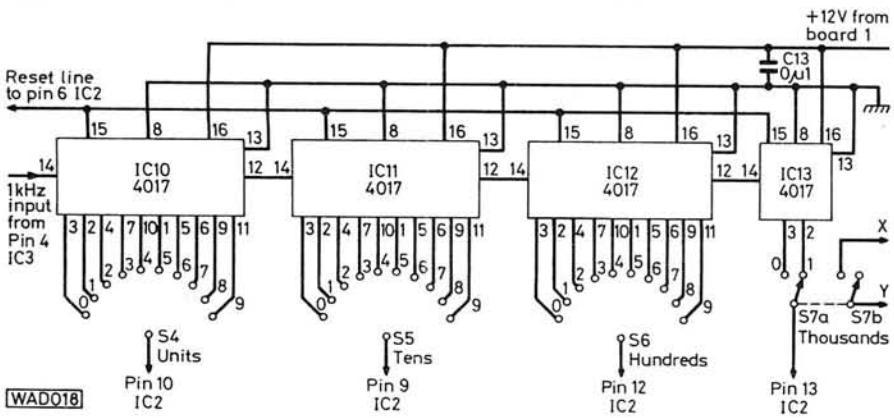


Fig. 5: Circuit diagram of the programmable divider module, board 2

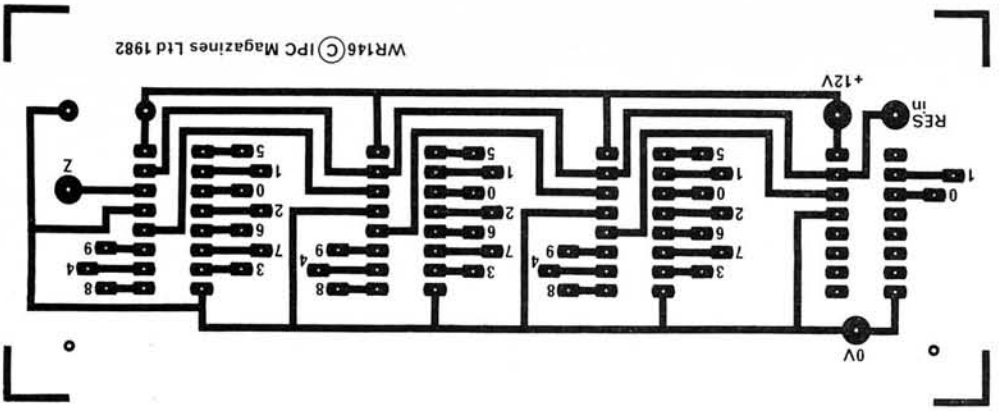
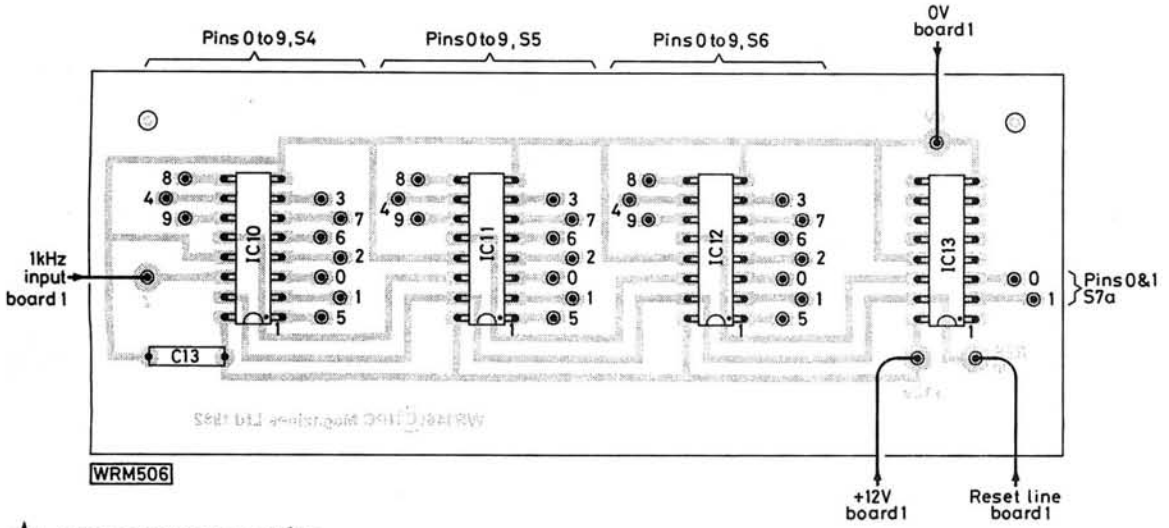


Fig. 6: Track pattern and component layout, board 2



★ components

Resistors

¼W 5% Carbon film

47Ω	1	R16
560Ω	2	R5,9
1kΩ	2	R2,10
1·2kΩ	1	R11
1·5kΩ	1	R15
3·3kΩ	1	R3
4·7kΩ	3	R1,6,8
5·6kΩ	1	R13
10kΩ	1	R4
56kΩ	1	R12
100kΩ	2	R7,14

Capacitors

Polystyrene

100pF	1	C3
1nF	1	C10

Silvered mica

100pF	2	C7,11

Polycarbonate

0·1µF	4	C4,6,12,13

Tantalum

2·2µF 35V	1	C1
22µF 25V	1	C5

Electrolytic 25V

220µF	1	C14

Variable trimmers

2–10pF	1	C9
5–40pF	1	C2
5–60pF	1	C8

Semiconductors

Diodes

5mm red l.e.d.	2	D1,2
1N914	1	D3
Bridge rectifier 1A	1	D4 (RS 262–141)

Transistors

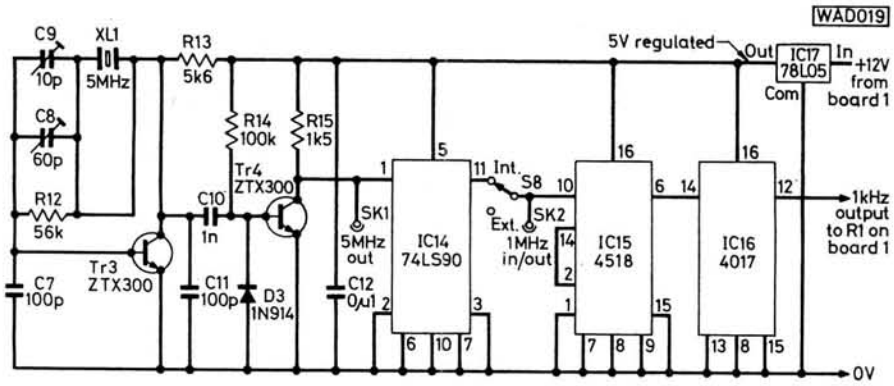
ZTX300	3	Tr2, 3, 4
ZTX500	1	Tr1

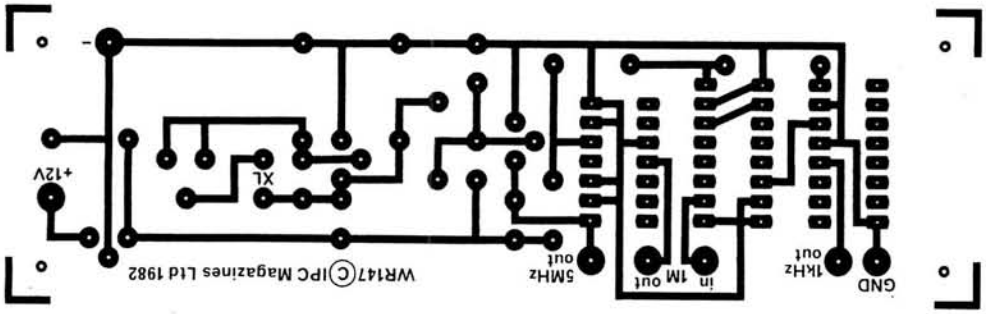
Integrated circuits

4013	1	IC1
4017	8	IC4,5,6,10,11,12,13,16
4046	1	IC3
4050	1	IC7
4518	1	IC15
7404	1	IC8
74C20	1	IC2 (Ambit International)
74LS90	1	IC14
78L05	2	IC17,18
78M12	1	IC9

Miscellaneous

Mains transformer T1, 15V 0·25A secondary. Fuse FS1, 0·25A 20mm with holder. 5MHz crystal, parallel resonance 30pF wire ended-HC18/U, XL1. Non-shorting, break-before-make rotary switches: s.p. 12-way S1, 4, 5, 6; d.p. 6-way S7; knobs: numbered skirt (1–10), Maplin type R82(4); plain skirt type R81 (1). Miniature toggle switches: s.p.d.t. S2, 3, 8; d.p.d.t. S9. BNC round sockets and earth tags SK2, 3. Phono socket SK1. Case 200 × 125 × 50mm.





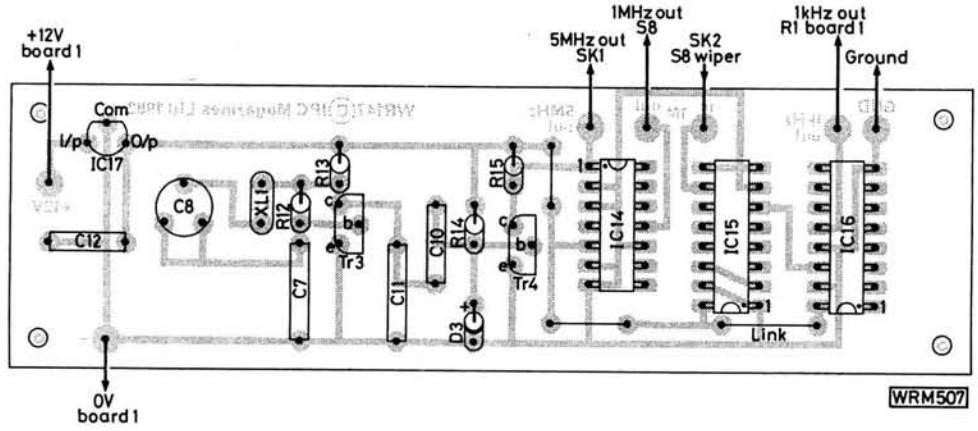


Fig. 7: Circuit diagram of the reference oscillator and divider stages

Fig. 8: Track pattern and component layout, board 3

board should be mounted on the rear wall of the cabinet using 12mm pillars.

The 5MHz signal is fed via buffer Tr4 to IC14, a 74LS90 which acts as a divide-by-five stage. The buffered 5MHz signal is also brought out to SK1 on the back panel for external use if required. The output from the divide-by-five stage is then connected to the next divider stage IC15 and also to SK2, a rear-panel mounted BNC socket. When S8 is closed 1MHz signals pass between the dividers or may be taken out via SK2. When S8 is open an external 1MHz high stability signal may be introduced into the unit via SK2. This input must be t.t.l. compatible.

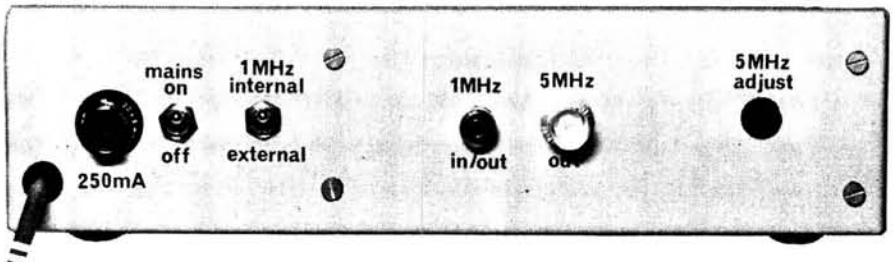
The 1MHz signal is divided to 1kHz by three divide by ten stages, two of which are formed from IC15, a 4518, and the third by IC16, a 4017. The complete module is supplied with 5V d.c. regulated by IC17, a 78L05 regulator.

Power Supply

The p.s.u. circuit, Fig. 3, is very simple, containing only the bridge rectifier, filtering capacitor and the mains transformer which should be secured to the earthed case.

Construction

Fully detailed p.c.b. layouts are given for all four modules. Diode D3 and all resistors are mounted ver-



Rear panel layout of the prototype unit

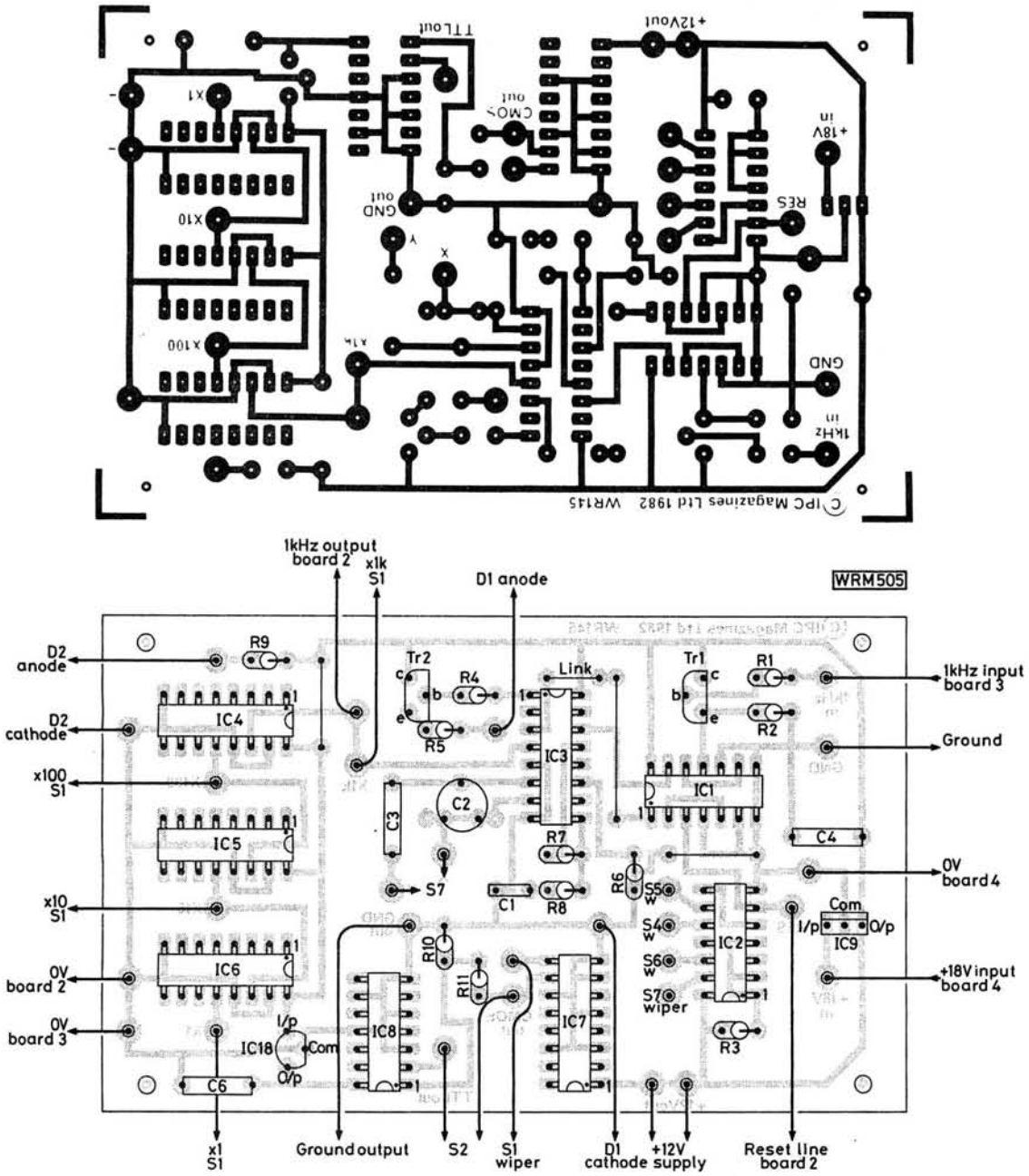


Fig. 9: Track pattern and component layout of the main module, board 1

tically. Off-board wiring links are connected to the board using double-sided Veropins. The output attenuator resistor R16 is mounted on the unused pins of S1, whilst capacitor C5 is mounted directly on S3. The accompanying photographs show the general layout of the prototype.

The programmable divider selector switches used in the prototype use small knobs with the 10 carefully removed by rubbing with fine emery cloth. In the case of the m.s.d. switch S7, all numbers with the exception of 0 and 1 are removed.

From the photograph of the prototype unit it can be seen that the mains switch S9, INTERNAL/EXTERNAL switch S8, 1MHz INPUT/OUTPUT BNC socket, 5MHz OUTPUT socket and 20mm mains fuseholder are all mounted on the back panel of the case.

Alignment

After completing the unit, a thorough visual inspection should be made before attempting to apply power. Providing that all is well the first step in alignment is to tune the 5MHz oscillator. This may be accomplished by use of an accurate frequency counter or by comparison with a known 5MHz standard.

The reference divider chain output is then checked to ensure that the output is at 1kHz and finally the entire unit

continued on page 31▶▶▶

STUDYING for the RAE

Arthur HARADA M.Ed, Dip. SP. Ed, ACP, G4INX

How many readers have heard the one about the aspiring amateur who, the night before taking the RAE, read for the first time a second-hand incomplete examination manual in two hours. The story goes on to tell how at the same time this candidate, refreshed by liberal amounts of alcohol, was also ear-wigging for VP8 on 80 metres and had an eye focused on the late night TV movie. When in due course the CGLI slip arrived showing credits in both parts, our friend was baffled not to receive at least one distinction! We lesser mortals must be content to pass the RAE by systematic and evenly paced study over months.

Of course there will always be exceptional people who have a flair for passing examinations after minimal work. If anything, the above fictitious tale emphasises the fact that individuals do differ in HOW and WHAT they learn from the same experience. Nevertheless, having made this comment, what follows sets out to increase the reader's chances at gaining the RAE. It is a guide to learning how to learn and, to some degree, provides widely accepted principles transferable to other subjects. However, scope is left for one to use study techniques well-proven by the candidate's past triumphs.

First Steps

Preparing for the RAE using just one reference book is risky. Bearing in mind that many books can be obtained on extended loan from the local library, there is no excuse for not consulting a wide variety of relevant texts. A copy of the RAE syllabus should be obtained, plus the highly to be recommended series *Passport to Amateur Radio* in *PW*, as well as this magazine's excellent publication *So you want to pass the RAE*, both most adequately cover the examination in sufficient detail. Another worthwhile purchase is the RSGB's *Radio Amateurs Examination Manual (9th Edition)*. Obviously rally bookstalls offer technical literature beyond the RAE pass level — more of this later.

RAE Classes

Enrolment and regular attendance at RAE classes is one major way of studying. Although sitting behind a desk once more may recall memories of childhood failure, remember participation now is a free decision and in your interest. Likely as not sitting next to you will be someone less than half your age, and who appears to know all the answers. So what?

Generally, RAE classes start circa 7p.m. and last for two hours. Try to avoid a heavy meal or inebriating liquids before, a distended tummy draws blood from the brain. The result is sleep and your paying for tuition meanwhile. If at all possible persuade the instructor to allow a short break after 40-45 minutes, since few people can offer 100 per cent concentration to new learning for much longer. During the interval be ready on occasions to swap with classmates problems associated with studying at night and weekends. Such an activity may help reduce any feelings of fatigue or incompetence as others are bound to feel the same at times. A good teacher will use the time partly to evaluate what the students have learnt by listening to their pertinent diplomatic remarks.

Joining a local amateur radio club is another must. Make no secret there, or to relatives and friends for that matter, your intention to obtain a callsign. Tell anyone who'll listen about your regular schedule of study, which should total at least $1\frac{1}{2}$ hours per day. In turn, their genuine concern and regular gentle enquiries as to your progress binds you to an undertaking difficult to default. Avoid anybody who walks up and asks point blank questions such as "What are the six types of frequency (or phase) modulation?" Either the question has a catch or they're demonstrating their superior ignorance.

Forming a study group with not more than 3-4 candidates and meeting in one another's homes is a popular aid to further study. Each member takes it in turn to read up and teach the rest a topic of mutual concern. By trying to teach others one can gain substantial benefits, more so if over-learning takes place by all participants. Here over-learning means knowing more than sufficient to obtain mere passes; the outcome is more accurate retention over a longer period of time. Hence the possible acquisition of the previously mentioned "difficult" books.

Note-taking and Memorising

Listening to the spoutings by the instructor followed by periods of re-reading the textbooks means the learner is not totally involved in the learning situation. Note-taking keeps you active and provides a written record for future revision so:

1. Store your notes together by topic and use your own wording, don't just copy down chunks of a textbook or speech.
2. Keep all notes in a looseleaf A4 size binder.
3. Notes should not be too lengthy but in skeleton outline, like these points.
4. Use logical and memorable layout on the page, e.g. a new page for each set of notes.
5. Label circuit diagrams clearly using different colours to stress key components.
6. Illustrate verbal statements e.g. the Station shall not be established or used in an aircraft or a public transport vehicle — could be followed by a series of drawings with a red cross through them.

Each stint of note-taking or study should have definite objectives. In practice, this means that at the start a state-

continued on page 31▶▶▶

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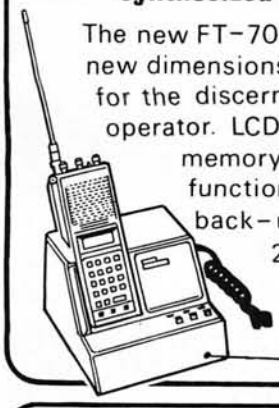

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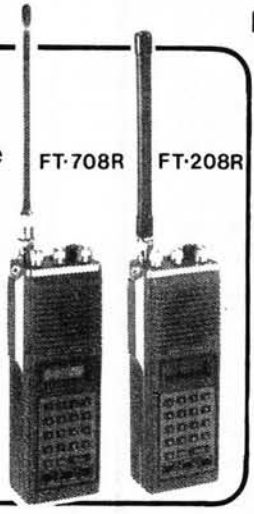

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STUDYING FOR THE RAE

▶▶▶continued from page 28

ment is made about what new things you will be able to do at its end. For example, "Given a block diagram of an h.f. transmitter I shall be able to label accurately all the parts". Failing to reach the objective(s) can be caused by sundry explanations, a common fault is trying to learn too much too hastily. Tackle smaller portions of material.

Committing information to memory can be achieved in many ways. Reading several pages of notes and then repeating into a tape recorder what has been read, with the binder closed, is one method. Sometimes used is re-writing the notes from memory — helpful if one has trained the mind's eye to visualise each page's particular design elements. Answering sample exam papers should be tried, even if they are Australian (obtainable for £1 from G2DYM at "Cobhamden", Beerdown, Uplowman, Tiverton, Devon EX16 7PH). But as there are infinite learning strategies peculiar to oneself, experiment.

Don't panic if, after amazing gains in new knowledge, additional facts take longer to sink in. It is likely this marks a plateau of learning, so it may be necessary to reorganise earlier learning into a new pattern or approach before further progress can occur. Change tactics. Incidentally, you won't be the first to consider jolting the grey matter with 3kV or to have woken up the household shouting "At resonance $f = 1/2\pi\sqrt{LC}$". Mentioning formulae brings me to suggest that all the many examples should be worked through stage by stage before seeking short-cuts in calculations. Analysis shows these calculations are poorly answered by the bulk of entrants.

Practical Work

Grasping the theory is greatly re-inforced by relating it to some construction project, however small. Propose that your club arranges competitions solely for unlicensed members. Secondly, the advertisers within these pages sell modestly priced kits for plenty of hands on learning by doing. Finished work can always be incorporated into the future station's facilities.

Motivation

To keep studying over months necessitates some form of reward. Study for the love of the subject is an ideal, more usually it is for other pleasures such as self-esteem, transmitting the club callsign or re-mortgaging the home for shack equipment. Rewards should be used even for short-term effort e.g. mastering a key area of the Licence conditions means an extra noggin (wide interpretation) at bedtime. Cutting down on study time or buying a two metre transceiver as an incentive is excessive at this stage and pre-judges the exam's outcome. So is being anxious without corresponding study as well.

Conclusion

Sufficient detail about the RAE's multiple-choice form and your chances of passing have been published in the past (*PW* January 1980, May 1981). There are fewer mistakes on the papers these days, hopefully the examiners are more alert (RSGB reps please note). Finally, it only remains to advise that hurriedly revising a few days beforehand or on the way to the centre heightens the chance of misunderstanding. Instead, aim to be at ease on the day itself, arrive in plenty of time so as to adjust to the vibes of the room and other people's nervous reactions. I look forward to meeting you on the air waves, 73. ●

FREQUENCY SYNTHESISER

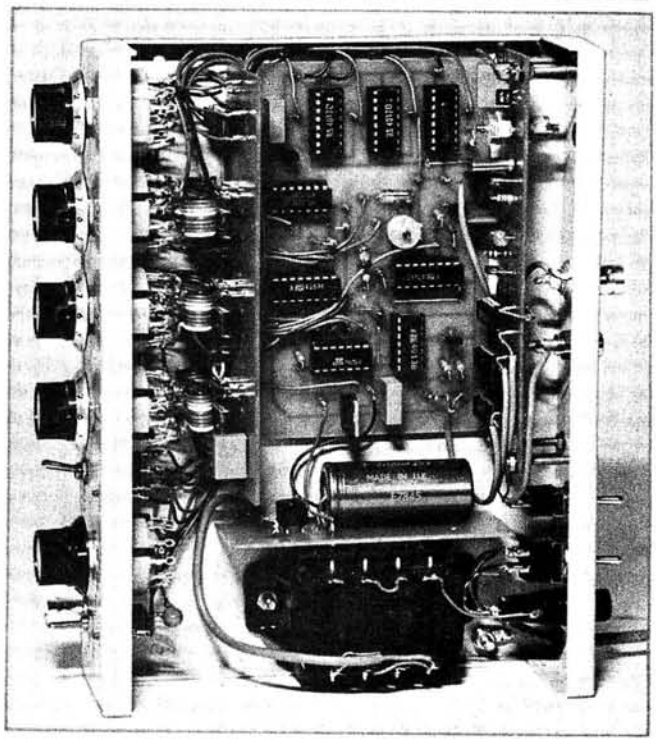
▶▶▶continued from page 27

should be checked by observing the output on an oscilloscope and/or checking with a frequency counter. The displayed waveform must be a symmetrical square wave with the indicated counter display coinciding with the programmed one.

The v.c.o. trimmer C2 should be set to the optimum value by using the following method. Set programming switches to 1·999, tune C2 slowly and observe the l.e.d. LOCK indicator. It should be possible to establish an area of tuning in which the l.e.d. remains on, indicating that the v.c.o. is locked. Trimmer C2 should be set to the centre of this area.

Applications

Some useful applications for this instrument are:
(1) As a calibration source for receivers covering not only the indicated range, but with care the entire s.w. bands utilising harmonics of the output.
(2) As a clock oscillator for any logic circuitry, either t.t.l. or c.m.o.s., requiring a clocking rate within the range of the instrument.
(3) The accurate calibration, in conjunction with an oscilloscope, of signal generators in the a.f. and r.f. range. By examining Lissajous figures, direct comparisons between the synthesiser output and the generator on test may be carried out, up to 2MHz. Using multiple figures (no more than five, so as to be recognisable) up to 10MHz may be covered. In basic terms this project can replace a frequency counter in this particular application. ●



An internal view of the prototype

MODS

IMPORTANT—The ideas presented here are suggestions only, and as they are untried by this magazine, we cannot accept responsibility for any resultant damage, however caused. Before alterations are attempted, care should be taken to ensure that any guarantee is not invalidated, and it should also be borne in mind that modifications usually have an adverse effect on resale prices. In cases where specialist skills or equipment are needed, most dealers will undertake the work for a reasonable fee.

Roger Hall G8TNT(Sam)

No. 16

Because the last three Mods columns have been very full and a change of residence has meant that I have not had time to produce a column for the last two months, I now have a very full "Wanted" folder. That's why this month's page is devoted to requests for help. If you know how to do any of the mods that have been asked for, please write in and tell me so that I can pass them on. Similarly, if you would like to know how to do a specific mod, send me the details and I will try to publish your request. If you are going to write to me, please do NOT include a stamped addressed envelope, a stamp, a postal order, a cheque or cash. *Practical Wireless* does not run this page as a profit-making venture and so we do not want you to send us money. Those of you who have sent in cheques will have noticed that they were not cashed. This page is meant to be a free information exchange. Unfortunately this means that I cannot enter into any correspondence and so it's no use including an s.a.e. It's not the cost of the stamps that stops me sending out personal replies, it's the time. I now have a large amount of information on file and if I were to send out individual replies to the requests that I receive, I would never have time to do anything else. When I publish a mod everyone has a chance to read it, not just the individual that asked for it. That's why all correspondence must take place through this page, a slower but better system.

I have received a surprising number of letters from readers who want to know why the name Sam appears in brackets after my name. Those of you who have spoken to me on the 144MHz band will know that I use my middle name when I'm on the air. To be called Roger when talking on the radio is most confusing and so I use Sam. I hope that solves the puzzle Jim, Dave and everyone else who wrote in.

In our March 1982 issue I published a mod that Liam sent in from Ireland. He showed us that the microprocessors inside Bearcat receivers can be tricked into covering parts of the band that they were not designed to. It would seem that a large percentage of our readers are scanner users because I have now been inundated with requests for similar mods for various other makes of scanner.

Mr R. J. Bird has a Regency Touch M-100 and he is wondering if anyone knows how to modify it.

Both Mr P. A. Roberts and Mr D. C. Wright would like information on extending the frequency range of the Realistic PRO-2008.

Mr J. E. Patterson is just one of the many people who have written in to ask about modifying the Sony ICF-2001. Again, frequency extension is the mod required.

Mr D. Nolan would like a service manual or a circuit diagram for the SX-200N, as well as any mods. Mr K. L. Phillips, Mr N. W. Meare and many others would also like to know some mods for this set.

Mr D. Pelligrini has written in with a clue that may help someone. He has found that switching the set off at the wall socket (without using the switch on the set) and then switching it back on again some 30 minutes later, will sometimes cause all of the memories to be dumped in favour of 685·625MHz. Unfortunately this is a random event and it may take several tries before the set can be made to do it. When this frequency does eventually appear, the set will then scan up to 999·995MHz when it will reset to 0MHz. It will then carry on scanning until it enters one of the normal bands of operation when it will revert to normal. The scanning process takes many hours and Mr Pelligrini wonders if anyone can come up with something a little more positive. Perhaps Mr J Hellinger is on the right track. He has written in with another clue. When he first bought his set it had an intermittent fault that made it scan up to 950MHz. This turned out to be caused by an unsoldered diode (D405) on the p.l.l. board. When the diode was resoldered, the fault disappeared and now Mr Hellinger would like to know if anyone has tried tinkering with diodes 405, 6, 7, 8, as they all appear to be in the same circuit and so they may hold the answer.

Mr H. C. Young G3HIA, tried the Bearcat mod but he found that the actual frequency of the signals that he was receiving did not match those on the digital display. I have heard of this happening before but I don't know why it does or how to cure it. If anyone can help Mr Young, please write and let me know.

Mr E. Howe sent in a request for help in curing a fault on his Bearcat receiver. From your description of the symptoms Mr Howe, the fault would appear to be inside your set and I would suggest that you take it to your local dealer who will repair it for you. As I said earlier, we do not want money for information and so your cheque will not be cashed.

Arne Brun OZ1CJG, would like to know how to make his IC-RM3 function like a real scanner and stop on signals when he is using it with his IC-211E.

Peter Twinn wants to know if it is possible to extend the coverage of his Amstrad 6010 receiver so that it will cover the 28MHz band. He also wonders if an "S" meter could be fitted to this set.

Does anyone have a circuit diagram and information on how to stop drifting on a Lafayette 600A? Doug Bundle wants to know. He also wants to know if it is possible to fit an n.b.f.m. demodulator to this set.

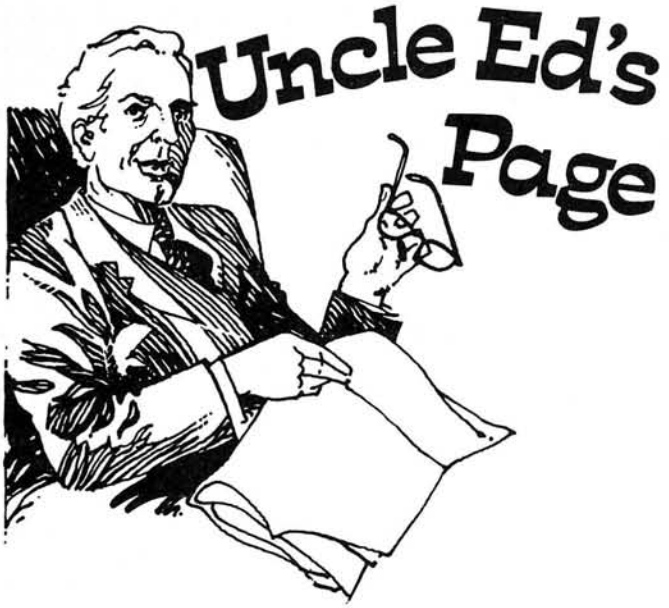
Mark A. Higgins has a Hallicrafter "Super Skyrider" Model SX-28A. He wants to know how to add on a digital frequency display. He would also like some information on this set, especially a circuit diagram, alignment procedures and servicing information.

Jack Chapman GI4LVC, wants to know if it is possible to modify his KDK-2016E for reverse repeater operation, perhaps using the +600 switch.

Indra YC0BQZ, has asked for information on the FT-227RA. He is in Indonesia and he would like to be able to use his set on the local v.h.f. commercial band that is just below the 144MHz band. I know that the FT-227 can be modified to cover almost 10MHz Indra, but I don't have the details. Hopefully someone will write in and enlighten us.

Tony Waller G3KBI, has an FR-100B that he would like some mods for, especially fitting f.m.

continued on page 40▶▶▶



A monthly look at some aspect of the radio/electronics hobby that seems to bug the beginner, or occasionally a more advanced topic seen from an unusual angle.

METERS—4

I was going to finish this series about meters with Part 3 in June *PW*. However, I was taken to task (quite rightly) in a letter from Mr S. Taylor of Exeter, about the way of measuring the resistance of a meter movement. He pointed out that shunting R3 across the meter would change the total circuit resistance, and more than 1mA would then flow in the example I gave. Since we had arranged that just 0·5mA flowed through the meter, more than 0·5mA must flow through R3, which means that its value must be less than the meter resistance. In fact, the value of R3 when checking a 1mA, 75Ω movement by that method would be only 71·34Ω, almost 4·5 per cent lower than it should be.

There are two obvious ways round the problem. You could use a "constant current" source instead of the 1·5V battery and resistors R1 and R2 shown in Fig. 7 (repeated here).

Fig 7

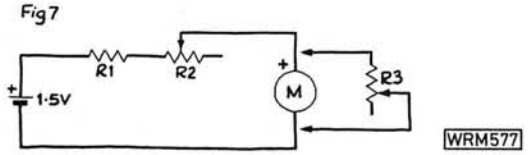


Fig 10

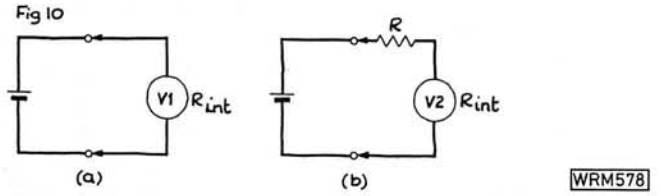
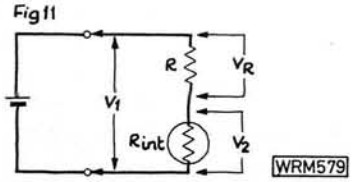


Fig 11



Having set the source to deliver 1mA, it will continue to do so regardless of any change in the circuit resistance. Mr Taylor suggested using a higher-voltage battery and higher values for R1 and R2, which would of course go some way towards turning the supply into a "constant current" source (see *Uncle Ed, PW* May and July 1981).

The second way would be to put a milliammeter in series with the battery, and adjust R2 to maintain exactly 1mA when R3 is shunted across the meter. Of course, adjustments of R2 and R3 will interact to some extent, so you'd have to go back and forth between them until you got the two meters to read exactly 1mA (the meter in series with the battery) and 0·5mA (the meter being measured).

I expect you will have realised that the two methods I've just described are really only automatic and manual versions of the same procedure. In the first, you have a circuit to keep the current constant for you. In the second, you have to "do-it-yourself".

The method of Fig. 7 is one commonly found in reference books. Another popular one, suitable only for voltmeters, is as follows. Connect the voltmeter across a normal supply and take the reading (Fig. 10(a)). Call this V_1. Next, connect it in series with a known resistor R across the same supply (Fig. 10(b)). Call the second reading V_2. The resistance of the voltmeter is given by $R_{int} = \frac{V_2 \times R}{V_1 - V_2}$

This is taken from Newnes *Radio and Television Engineers' Reference Book,* now sadly out of print.

For this method, it is essential to have a supply with a very low internal resistance (a "constant voltage" source), because any source resistance will be added to the resistance calculated for the voltmeter. There's just no way to separate them.

When I come across a formula like the one above, I feel very unhappy about it unless I can work out for myself just why it has that form, and what each part of it really means. To get anywhere, you need to be able to do simple algebra, at least up to the level where you know the rules for changing equations around. To understand our formula, I have redrawn Fig. 10(b) in a slightly different form in Fig. 11. Now, it looks more like a simple potential divider, and I'm sure you'll know (especially if you're following Roger Lancaster's excellent series) how to calculate the voltage across resistor R and the meter. The reading we got for V_1 is the supply voltage. V_2 is the voltage across the meter after adding R. $V_1 - V_2$ is the voltage across the resistor, which I'll call V_R. Substituting that into the formula, we get:

$$R_{int} = \frac{V_2 \times R}{V_R}$$

Taking R across to the left-hand side, this becomes

$$\frac{R_{int}}{R} = \frac{V_2}{V_R}$$

which tells us that the ratio of the meter resistance (R_{int}) to the added resistance (R) is the same as the ratio of the voltages across them. Since the same current is flowing through both of them, this must be so.

Incidentally, in our quest for accuracy, it is as well to remember that the multimeter you used to measure the value of R3 in Fig. 7 could be quite inaccurate on the resistance ranges. Even expensive instruments can often claim no better than ±5 per cent, though digital ones are usually much better. Read the handbook for your multimeter carefully—you could be in for quite a shock.

If you look at catalogues of meter movements, you will find that those intended for use as current meters (low coil resistance values) have their resistance very closely specified, typically ±1 per cent. Those intended for use as

continued on page 40▶▶▶

A 28MHz PRE-AMPLIFIER

J. HARRIS G3LWM

Over the years the members of 10-UK have noticed the falling-off in performance of many amateur receivers and transceivers on the 28MHz band. This simple f.e.t. pre-amplifier has been used with a wide variety of equipments and found very useful.

When used with a receiver it is possible to switch the pre-amp in or out of circuit with a simple switch but used in conjunction with a transceiver, a relay or solid-state

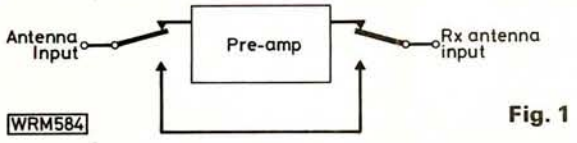


Fig. 1

switching will have to be used. In many modern amateur transceivers a switched output is readily available and the circuit shown has been used with a Trio TS-120V. No doubt a similar switched line can be located in other transceivers.

Construction

The construction of the pre-amp is simple, using v.h.f. techniques and keeping all leads as short as possible. Remember to ground the plain copper side of the printed circuit board. All the components are soldered directly to the copper pads, ensuring that the transistor is mounted correctly orientated. The coils are wound on suitable formers fitted with ferrite cores.

Two prototypes were built using different transistors and coil construction techniques. The two spectrum analyser plots show the differences in performance and the drawings of component placement (Fig. 3) show the version using a 3N201 f.e.t. and coils wound directly onto ferrite screw cores. Tuning is by moving the cores and also by adjusting the trimming capacitors. If the pre-amp decides to oscillate at u.h.f., ferrite beads on the leads of Tr1 should tame it, but this was not found necessary on either of the prototypes which showed no signs of instability up to 1200MHz.

The second prototype used Toko coil formers and cans with fixed capacitors of 68pF instead of the trimmers C1,5. Tuning in this case is by the adjustable ferrite cores. It can be seen that this version is very 'peaky' compared to the other version and will not cover the whole band without re-tuning. The coils have the same number of turns as the other version but, by necessity, of a much finer wire. The same p.c.b. is used for both versions.

Other f.e.t.s which are suitable for use in this circuit are BF961, BF900, and 3SK88. The first two are in a plastic "pill" package while the 3SK88, like the 3N201 is in a TO72 can.

If the gain is too great it is preferable to reduce the output by using a resistive attenuator rather than alter the resistor values shown in the circuit.

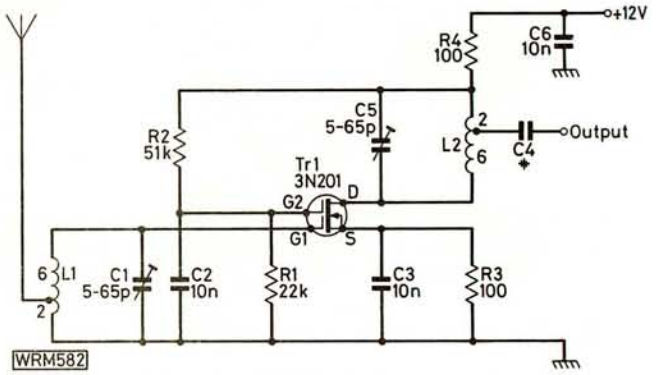
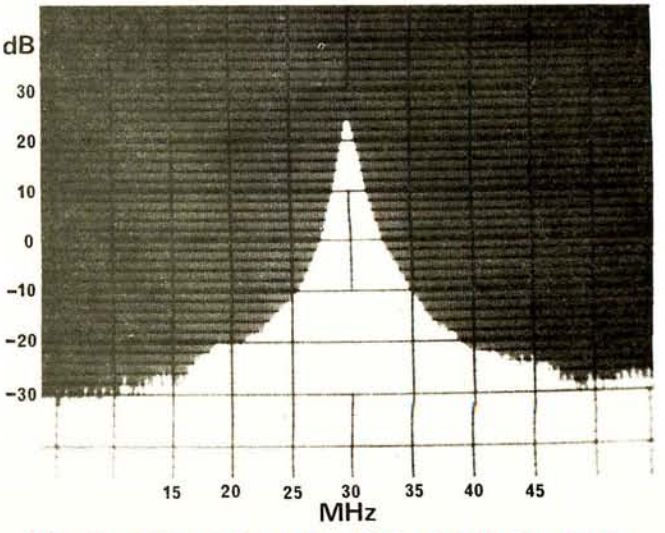


Fig. 2: Circuit diagram of the pre-amplifier. Capacitor C4 is not on the p.c.b. and its value is not critical. R4 can be ignored and C6 soldered directly onto the 12V pad on the board

The alternative pre-amp design using a BF961 transistor and Toko coil formers with fixed tuning capacitors



The spectrum analyser plot of the alternative design

The capacitor C4 shown on the circuit diagram is not mounted on the p.c.b. and its value is not critical. Resistor R4 and the supply decoupling capacitor C6 are also not on the board. The prototypes used a 0·1μF polyester capacitor for C6 mounted on the board with R4 replaced by a wire link.

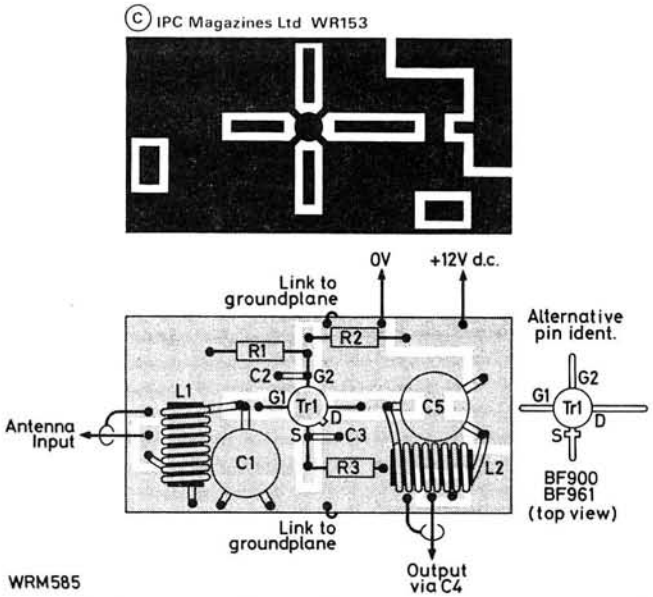
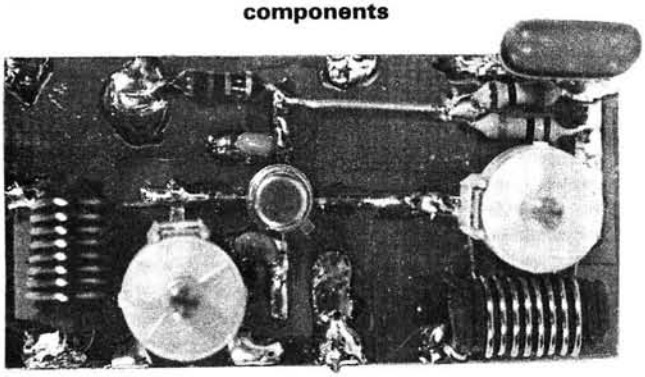
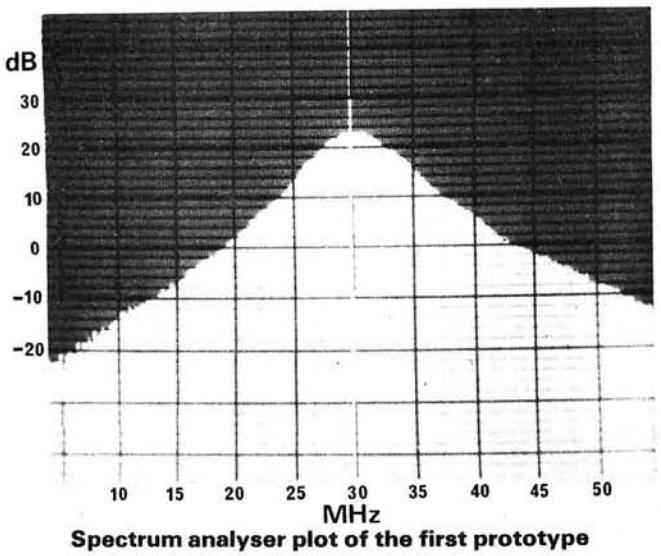


Fig. 3: Printed circuit board track pattern and component layout shown full size. Note that the p.c.b. is double-sided and the plain copper ground-plane is connected to the ground-plane on the component side by short wire links. There are no holes drilled for components



The first prototype showing the coil construction and the mounting of the metal canned transistor



Spectrum analyser plot of the first prototype

★ components

PRE-AMPLIFIER

Resistors

¼W Metal film

100Ω	2	R3,4
22kΩ	1	R1
51kΩ	1	R2

Capacitors

Monolithic ceramic

10nF	3	C2,3,6

Miniature trimmers

5–65pF	2	C1,5 (see text)

Semiconductors

Transistors

3N201	1	Tr1 (see text)

Miscellaneous

Ferrite cores 6mm dia x 1mm thread pitch (2); 24 s.w.g. enammelled copper wire; Printed circuit board; Alternative coils—Toko 7mm coil formers (2); 7P ferrite cores 10–20MHz (2); 7kN/kP cases (2) (see text).

TRANSCEIVER SWITCHING CIRCUIT

Semiconductors

Diodes

1N4001	1	D1
Red l.e.d.	1	D2 (with appropriate series resistor)

Miscellaneous

Relay 12V 3c.o. contacts; Min. toggle switch s.p.s.t.

Coil details

L1,L2 8T 24 s.w.g. on 6mm dia. x 1mm pitch ferrite screw core tapped at 2T (see text).

Transceiver Switching

For use with the Trio TS-120V or similar rig with an aux 12V d.c. supply available on transmit, the circuit shown in Fig. 4 is recommended.

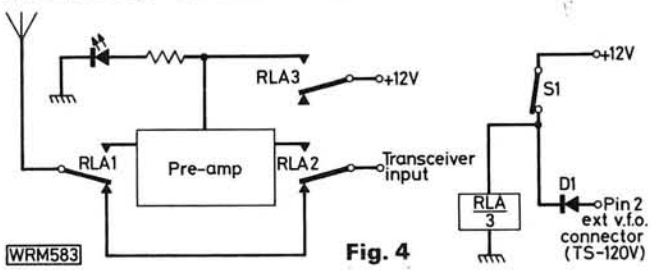


Fig. 4

With S1 closed the pre-amp is inoperative on both transmit and receive. This will allow the transceiver to be used on other bands as well as 28MHz without the pre-amp in circuit. Note that in this state the relay is operated and the l.e.d. is off. With S1 open the pre-amp is on during receive and the l.e.d. is also on. The pre-amp is switched out of circuit when the TX/RX is placed in the transmit condition. In the transmit mode the l.e.d. is off. Diode D1 is required as a blocking diode to prevent the 12V relay supply voltage getting back into the TX/RX. This circuit has been used in this instance but many other control circuits are possible to suit individual installations. ●

D.O.WHITE G3ZPA

28MHz THE LOW-POWER DX BAND

Once the winter season begins the 28MHz band will again open up for long distance radio reception. As the number of sunspots which keep this band alive is now declining, it is time to utilise this band before it reverts to its line of sight or v.h.f. propagation mode only. When this band is "on the boil" so to speak, it is safe to say that it can produce more easily worked DX with low power transmitters and simple antennas than all other bands put together. Indeed anyone who has witnessed the signal strengths received from some stations running 10 watts or so into simple vertical or dipole antennas cannot fail to be impressed.

During the main season, which runs from the beginning of October until the end of March, the main DX is usually around mid-day, but how long the band remains open depends on the sun's relative position over a given signal path. An example of this would be hearing stations in Japan, Australia and New Zealand in the morning, African stations around mid-day, East Coast American and Caribbean stations in the afternoon and the West Coast of America around dusk.

You may now be asking "How do I know when propagation for DX is likely to be good?" Most important is to know when to listen. One way to find out is to consult the propagation columns of the major amateur radio magazines, where information is published on a month-to-month basis so that you can get a very good idea of when this band should be open and to what parts of the world. For those unable to do so, the following charts have been prepared to enable one to see at a glance just what you should be hearing. They have been prepared from observations of sun spot cycles 20 and 21.

This is not a treatise on propagation, but simply a guide to when to listen for that particular choice DX. As you can see it is ostensibly a daylight band only, but can go on long into the night at times. Even during the summer doldrums it can suddenly burst into life when most unexpected.

For those fortunate individuals who are able to read Morse code, there are in the 28MHz band a whole conglomeration of Morse code beacons radiating from various sites all over the world, many as part of the International Beacon Project to study propagation of this band. These unmanned beacons are day and night sending out slow Morse code station identification letters and numbers. The Table shows an up-to-date list of beacons throughout the world with their associated operating frequencies and location. ●

28MHz Beacons

28·125MHz	VE2TEN	Chicoutimi, Canada
28·175MHz	VE3TEN	Ottawa, Canada
28·2025MHz	9J2B	Reserved
28·205MHz	DL0IGI	Mt. Predightstol, Germany
28·2075MHz	W4ESY	Florida, USA
28·210MHz	3B8MS	Mauritius
28·2125MHz	ZD9GI	Gough Island
28·215MHz	GB3SX	Crowborough, England
28·2175MHz	VE2TEN	Reserved
28·220MHz	5B4CY	Cyprus
28·225MHz	VE8AA	Lake Contwoyto, Canada
28·230MHz	ZL2MHF	Upper Hutt, New Zealand
28·235MHz	VP9BA	Bermuda
28·2375MHz	LA5TEN	Oslo, Norway
28·240MHz	OA4CK	Lima
28·2425MHz	A9XC	Hamala
28·2425MHz	ZS1CTB	Cape Town
28·2475MHz	EA2HB	San Sebastian, Spain
28·2525MHz	VE7TEN	Reserved
28·2575MHz	DK0TO	Konstanz, Germany
28·260MHz	VK5WI	Adelaide, Australia
28·265MHz	VK	Reserved
28·270MHz	ZS6PW	Pretoria, South Africa
28·2725MHz	TU2ABJ	Abidjan
28·275MHz	VE3TEN	Reserved
28·2775MHz	DF0AAB	Luetjenberg, Germany
28·280MHz	YV5AYV	Caracas, Venezuela
28·2825MHz	W9	Reserved
28·285MHz	VP8ADE	Adelaide Island
28·2975MHz	W8	Tuckasegee, USA
28·290MHz	VS6HK	Cape D'Aguilar
28·295MHz	VU2BCN	Bangalore
28·315MHz	ZS6DN	Johannesburg
28·335MHz	VK2WI	Sydney
28·888MHz	W6IRT	N. Hollywood, USA

February-March

	1	2	3	4	5	6	7	8	9	10	11	12
0600												
0700												
0800												
0900												
1000												
1100												
1200												
1300												
1400												
1500												
1600												
1700												
1800												
1900												
2000												

April-May

	1	2	3	4	5	6	7	8	9	10	11	12
0600												
0700												
0800												
0900												
1000												
1100												
1200												
1300												
1400												
1500												
1600												
1700												
1800												
1900												
2000												

June-August

	1	2	3	4	5	6	7	8	9	10	11	12
0600												
0700												
0800												
0900												
1000												
1100												
1200												
1300												
1400												
1500												
1600												
1700												
1800												
1900												
2000												

September-October

	1	2	3	4	5	6	7	8	9	10	11	12
0600												
0700												
0800												
0900												
1000												
1100												
1200												
1300												
1400												
1500												
1600												
1700												
1800												
1900												
2000												

November-January

	1	2	3	4	5	6	7	8	9	10	11	12
0600												
0700												
0800												
0900												
1000												
1100												
1200												
1300												
1400												
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1600												
1700												
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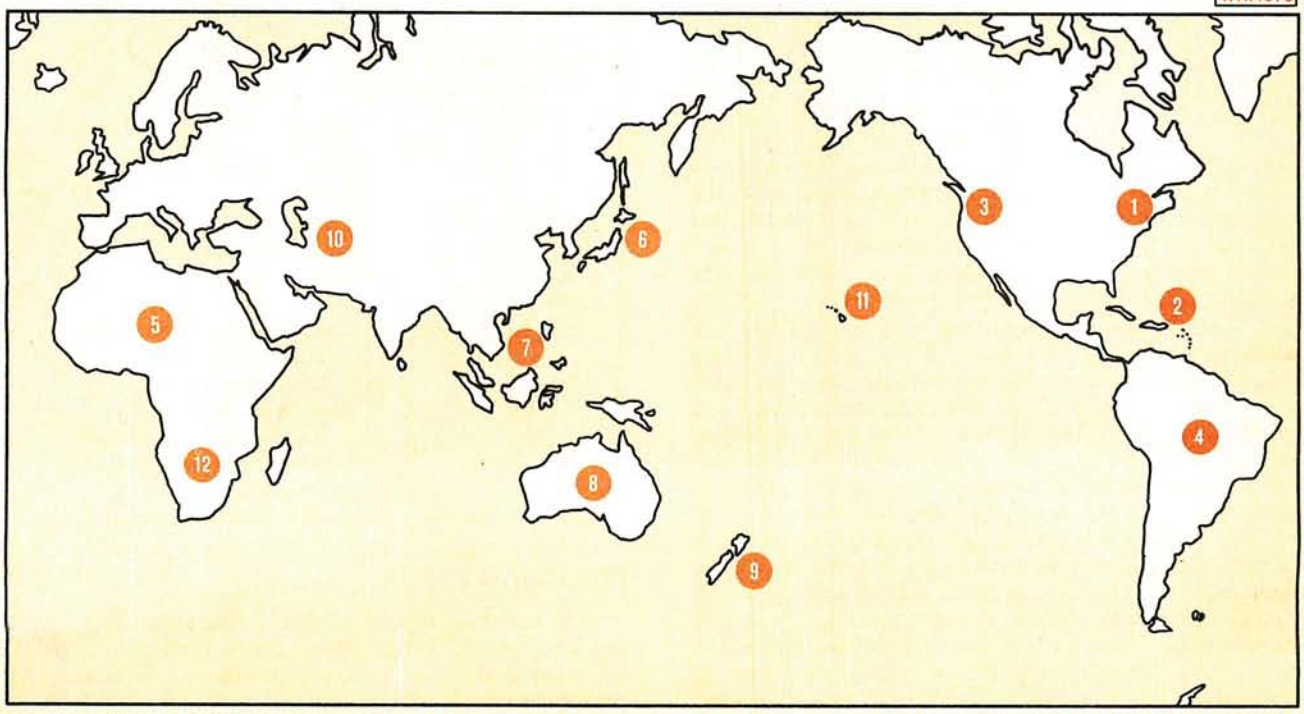
Using the Charts

Simply look up the time you wish to listen, and the numbers shown against that time are the areas on the accompanying map which are most likely to be heard.

WRM570



28MHz OPERATING

J. HARRIS G3LWM

A large number of radio amateurs tend to look upon the 28MHz band as one of the best DX bands and so treat it like the 14MHz and 21MHz bands.

Long distance propagation on 28MHz is related to the 11-year sun-spot cycle, with the best results for intercontinental communications being obtained during periods of high sun-spot count. The peak of conditions in the current cycle occurred during the winter of 1980, but conditions last year also proved to be excellent, with the band opening up in late August.

During the summer months (May–September) 28MHz Sporadic-E conditions exist and most European countries can be contacted on a regular basis.

Unlike the other h.f. bands low power operation on 28MHz can give very good results; using powers of 10W or less many radio amateurs have had world-wide contacts on both c.w. and s.s.b.

As with the other h.f. bands propagation tends to swing from the east in the morning, to the west in the afternoon, although paths from several parts of the world will often exist simultaneously. Many operators have achieved WAC (worked all continents awards) in times as short as five minutes!

Apart from DX working via the ionosphere the 28MHz band exhibits several observable v.h.f. characteristics. Propagation modes, apart from line of sight, are by refractive, tropospheric, Sporadic-E, meteor scatter and auroral means, with the ranges obtained also being comparable with the v.h.f. bands.

One of the main reasons why 28MHz is often discarded for "local" ground-wave communication is because the band is approached with h.f. instead of v.h.f. techniques. At v.h.f. the correct antenna and polarisation are essential for good results. However, many radio amateurs try 28MHz for local use using multi-band verticals, beams, wire dipoles or even the proverbial "bit of wet string". A 28MHz beam will work well but only if you are in contact with another station using a beam with the same polarisation as your own. At least a 20dB loss can be expected in a cross-polarised contact between a station using a vertical and the other a horizontal antenna. It should be noted that this polarisation loss only occurs on ground-wave contacts and when using other modes of propagation that do not involve the signal going through the ionosphere. Multiple refraction causes polarisation shifts and signals arriving at a distant station may well be polarised at any angle. As this polarisation shift occurs in a very random manner it matters little for DX working what type of polarisation is used. For the sake of mechanical rigidity, and ease of mounting, the vast majority of 28MHz beams are mounted horizontally.

Because of the unpredictable and rapid polarisation changes, very good results can be obtained on the 28MHz band, for both DX and local working, using simple vertical antennas. However, experience over many years has shown that the majority of commercial amateur receivers and transceivers lack sensitivity around 28MHz. So, for good local results on 28MHz under "flat" conditions, you must use a good dedicated vertical antenna and a sensitive receiver, otherwise results will be far from expectations and discouraged operators will tend to go back to the v.h.f. bands.

Band Usage

Over the years operating frequencies for various modes have evolved and these are listed in Table 1.

The availability of a world-wide network of beacons enable operators to easily check the prevailing propagation characteristics at any given time. The RSGB also publish, on a monthly basis, propagation predictions that form a very useful guide.

Table 1
IARU Region 1 28MHz Band Plan With UK Usage

Frequency (MHz)	Mode(s) and Uses
28·00–28·20	c.w.
28·10 ±50kHz	RTTY
28·105	Inter-UK c.w. working frequency
28·20–29·70	c.w./phone
28·20–28·30	Beacons (Region 1)
28·305	Inter UK s.s.b. calling frequency
28·68 ±5kHz	SSTV
29·4–29·55	Downlinks for Oscar series amateur satellites and their beacons
29·55	Alternative f.m. calling frequency
29·60	International f.m. calling frequency

Capabilities

It is not the purpose of this article to discuss in detail the ionospheric propagation properties of the 28MHz band, as this is well covered in most books dealing with amateur radio. We shall however look in some detail at the v.h.f. characteristics of the 28MHz band.

Let us take, for example, line of sight propagation, with a typical station consisting of a 100W s.s.b. transmitter and a 5/8λ ground-plane antenna 6m above ground level. You may expect a range of 80–110km when in contact with a similarly equipped station. Using f.m. the expected range would be between 56 and 80km, when no propagation enhancement is present. During "lift" conditions the ground-wave range may be greatly increased, with signals sometimes exhibiting slow fading characteristics. At such times the range may extend to 300km or more. Various scatter modes of propagation often occur with severe distortion of f.m. signals making these conditions mainly suitable for c.w. or s.s.b. contacts.

When Auroral propagation is present 28MHz signals are affected to a similar degree to the v.h.f. bands, with similar distances being worked. Meteor Scatter effects have also been observed at 28MHz, but very little work has been carried out in this area and as yet there appear to be no comparative studies between the 28MHz band and other v.h.f. bands.

28MHz Repeaters

The majority of the world's 28MHz repeaters are located in the USA, and Region 1 of the IARU does not at the moment encourage such devices. However, there is at least one 28MHz repeater operational in West Germany and one is planned for Sweden.

Repeaters in the 28MHz band have their own output frequencies on 29·62MHz, 29·64MHz, 29·66MHz and 29·88MHz with their associated input frequency 100kHz lower at 29·52MHz etc. The modulation used is f.m. and a number of the devices have a fairly narrow deviation requirement, typically of 1·5kHz.

As the transmitter and receiver sections are located on different sites, often separated by as much as 16km, it is difficult to know in advance if it is possible to work the repeater, even if you can hear the output in the UK. Nevertheless, with the right conditions these repeaters can be contacted.

In the USA many of the 28MHz repeaters have input facilities on other frequencies within the 50MHz, 144MHz and 432MHz bands. It is thus quite possible to work stations in the USA who are using low power v.h.f./u.h.f. equipment, mobile or even portable, to access the repeater.

Equipment for 28MHz

Apart from the wide range of multi-band h.f. amateur transceivers now available there are other possibilities.

(1) For amateurs who have a 144MHz band transceiver, Microwave Modules offer a 144/28MHz transverter (MMT28/144) that, when used in conjunction with a 144MHz transceiver, gives very good performance. This option would be of particular interest to the Class B licence holders who have just obtained the full Class A licence, but cannot afford the purchase of expensive multi-band h.f. equipment. Even if you only have 144MHz f.m. equipment 28MHz activity using this mode is growing in the UK and amongst many DX stations.

(2) The conversion of CB equipment is also possible though care should be taken as it is often only the older types of CB equipment that can be easily converted to cover 28MHz. *See this month's Editorial page for the latest legal information on conversions.*

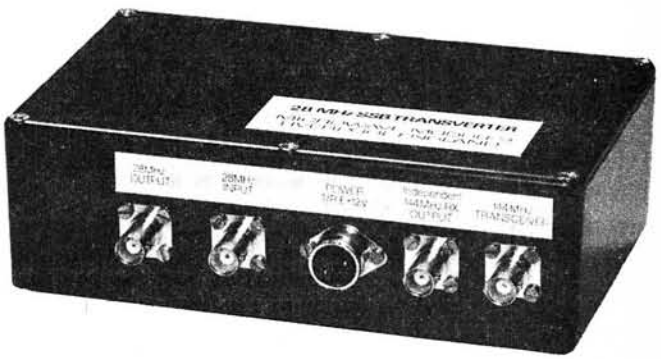
(3) Again for f.m. only the conversion of low band p.m.r. equipment should not prove too difficult. In the 1960s many BCC69 sets were converted for use on 28MHz a.m.

(4) The majority of CB antennas can be easily modified to operate on 28MHz and as readers are aware these are readily available.

(5) The 10-UK group also hopes to publish details of a home constructed 144/28MHz transverter.

Using a variety of equipment, from the most expensive FT-901 to a home constructed set based on modified CB p.c.b.s and home-made p.a. unit, an active f.m. net on 29·6MHz is operational in the Harlow/Bishop's Stortford area, with many other stations in the London, Royston, Newmarket and Bury St. Edmunds region participating. Under the right conditions many DX stations have been worked on this frequency including Japan, Australia and New Zealand.

During the summer months daily contacts are held with many European countries (Denmark, Germany, Sweden etc.). In every case for successful results in this net stations using dedicated 28MHz antennas and sensitive receivers have always scored over those using makeshift or multi-band antennas. Mobile to mobile results, over varied terrain, generally produce better results than the 144MHz band. On 28MHz little fast "flutter" is experienced when working mobile as is found on the v.h.f. bands.



The Microwave Modules MMT28/144 linear transverter, a popular means of access to 28MHz for 144MHz transceiver owners.

Antennas

As with all amateur operations the consideration of the antenna is most important, if good results are to be achieved.

One of the basic antennas for 28MHz is the λ/4 ground-plane, which is simple to construct and easy to match. However, the λ/4 vertical is still 1·8dB worse than a λ/2 dipole and it does not have adequate low angle radiation for ground-wave working, although it is quite acceptable for DX working. As the vertical element is increased in length the radiation angle is reduced but the feed impedance is increased.

A λ/2 vertical has a good low angle of radiation but a rather high feed impedance, making matching difficult as it is a voltage fed device. The λ/2 vertical does not need radials but sometimes the addition of short radials can aid matching and the radiation pattern.

As the length of the radiating element is increased the impedance drops once again, but the radiation angle remains low. The best all round vertical antenna for 28MHz is the 5λ/8 as this has good low angle radiation and is easy to match. A 3λ/4 has an ideal feed impedance of 50–60Ω, but the radiation pattern is inferior to the 5λ/8.

Matching the 5λ/8 has to be done with the addition of series inductance to bring down the base impedance. As a guide, antennas of up to λ/4 require series inductance; from λ/4 to λ/2 require series capacitance, except when approaching a λ/2. Radiating elements of from λ/2 to 3λ/4 require series inductance. Based on this information a 5λ/8 antenna needs a λ/8 inductive match to provide a 50Ω base impedance.

Although the radiation pattern from a 5λ/8 is slightly worse than that of a centre-fed vertical dipole, it has higher gain because the lobe is more concentrated. If you lengthen the vertical still further to 7λ/8, and introduce series capacitance, you will obtain two lobes, both in phase, and a gain of 1·2dB over the basic 5λ/8 system.

Wherever possible mount vertical antennas in the clear and remote from other antennas. For ground-wave use, of course, the higher you can mount the antenna the better.

Mobile Antennas

The λ/4 vertical, full size or loaded, can be used with reasonable success but will require a good ground-plane system. It is essential to mount such an antenna in the centre of the car roof; gutter or wing mounting of a λ/4 antenna can produce results as much as 20dB down. With a bumper mounted λ/4 antenna the loss is even worse!

The conventional 5λ/8 antenna is too large to be used whilst mobile, but helically wound versions have proved to be very good in use, even when gutter, wing or bumper mounted. The smallest helically constructed antenna should on no account be shorter than 1·4m. Within the bounds of mechanical stability and safety the rule is the longer the better.

Further Improvements

Having now obtained or modified some equipment to work within the 28MHz band do not use poor quality coaxial cable to feed your antenna.

The performance of many multi-band transceivers falls off at around 28MHz, and to make the most of the station a good low noise pre-amp may be needed. However, care must be exercised, too much gain will degrade the performance of the receiver and also affect the dynamic range. Use enough gain to overcome receiver noise; optimise the pre-amplifier for best noise figure, not gain, and follow it with a resistive attenuator to reduce the gain to something in the order of 6–15dB. Do not adjust bias voltages in order to reduce receiver gain as this will degrade the noise figure.

The 10-UK Group

There still remains a vast amount of research to be carried out on 28MHz propagation. Increased amateur activity on the band will assist in the compiling of further information.

In order to stimulate more activity on 28MHz a group called 10-UK has been formed and its members are only too willing to pass on any specific information to anyone who is interested enough in 28MHz to join.

The address to write to is, **10-UK c/o N. O'Brien G3ZEV, 88 The Maples, Harlow, Essex.**

At 1·7MHz, the 28MHz band has the widest bandwidth of any h.f. band and it is up to radio amateurs to make full use of this allocation, both during the DX period and also when the band is only usable for fairly local contacts.

References

Radio Communication—RSGB
Amateur Radio Operating Manual—RSGB
Members of the 10-UK Group

MODS No. 16

▶▶▶*continued from page 32*

Mr Godfrey wants to know how to extend the frequency range of his FT-208R.

Mr P. Bidwell G6DAU, wants any mods for the Standard C-58.

Jon Kempster wants any mods for the FRG-7.

Roger Smith G6DJL, has written to me twice because he wants me to send him all the mods that I have for the IC-2E. As I hope you will have read Roger, I cannot answer letters. The only way to obtain information that has been printed in this column is to buy the relevant back issue. An index of Mods appeared in the April 1982 issue and the address of the Back Numbers Department is at the front of every issue.

Several people, including Mr A. C. Thomas and Mr R. G. Wojcieechowski, have asked about The Users International Radio Club that I mentioned some time ago. It's a club for Trio and Icom users and full details are available from Mr W. J. Bryan G3RKC, who is QTHR. (Note—"QTHR" means "Address correct in the current Callbook".)

Andrew Haigh G6BJA, and Don Peters are two of the people who have written in with requests for mods to the FT-290R. I have several mods for this set in the pipeline and I hope to devote next month's column to covering both the FT-290R and the FT-480R.

If you can help with any of the above requests or if you have a mod or a request that you would like published, please write to me, R. S. Hall at Room 301, Hatfield House, Stamford Street, London SE1 9LS.

UNCLE ED

▶▶▶*continued from page 33*

voltmeters (high coil resistance values) will make you wonder if the printer hasn't left out the decimal point, for you'll find figures like 15 or 20 per cent, even for good quality movements. Before you get too worried, I should explain that, because of the large value of series multiplier resistor that will have to be used to produce the required full scale deflection (f.s.d.) range, any inaccuracy in the internal resistance value will be swamped.

For example, suppose that we have a 100μA movement with an internal resistance of 2000Ω, and we want to use it to make a voltmeter with an f.s.d. of 50V. To draw 100μA from 50V, the total circuit resistance (by Ohm's Law) must be $50 \div (100 \times 10^{-6}) = 50 \times 10^4 = 500\,000\Omega$, or half a megohm. The resistance of the multiplier must therefore be $500\,000 - 2000 = 498\,000\Omega$ (498kΩ).

If the meter movement's internal resistance of 2kΩ is specified to ±15 per cent, its true value can lie anywhere between 1700 and 2300Ω, in other words ±300Ω. An error of 300Ω in 500 000Ω is only 0·06 per cent, and obviously not worth worrying about, as it will be totally lost in the possible inaccuracy of the multiplier resistance value, which will be typically ±1 per cent. It's all relative, you see.

Next month, I plan to answer a cry from the heart from several readers, and try to explain the relationship between d.c. input power, carrier power and peak envelope power of a radio transmitter. See you then.

NEWS NEWS NEWS

TOPS Electronics Technicians Course

Readers may be interested in the availability of a TOPS Electronics Technicians one-year, full-time course which will commence at Acton Technical College in September 1982. The Course Tutor, John E. Petherick G6BYJ, informs that a telecommunications option may also be offered.

The course, sponsored by the Manpower Services Commission, runs over a 42-week period during which time the students study 15 units of the TEC Certificate in Electronics and also gain work experience in industrial electronics companies. As part of the practical side of the course the students build a digital multimeter which, on completion of the course, they keep. They also study and use microprocessors.

Anyone wishing to apply for the course should contact, as soon as possible, either: Peggy Hammond or Phil Mallet at the Hammersmith Job Centre, tel: 01-741 0455.

RAE Courses

Courses to prepare students for the Radio Amateurs Examination (City and Guilds 765) will be available at the following locations:—

Beckenham—*Beckenham Adult Education Centre, 28 Beckenham Road, Beckenham, Kent,* commencing Tuesday 21 September between 19.15 and 21.15hrs. Details of enrolment etc, from the Course Tutor, Steve Palmer at the centre, tel: 01-650 1383.

Leamington Spa—*Mid-Warwickshire College of Further Education, Warwick New Road, Leamington Spa CV32 5JE,* on Thursdays commencing 16 September, for approximately 30 weeks. Enrolment 2 and 3 September from 09.00 to 12.00, 14.00 to 16.00 and 18.00 to 20.00hrs. Further information from C. A. Smith, Department of Engineering at the College, tel: (0926) 311711.

Manchester—*Pendlebury High School, Cromwell Road, Swinton,* on Thursdays at 1930hrs, commencing late September. Registration details available early September from: The Course Instructor, P. Whatmough G4HYE, Tel: 061-794 3706.

Repeater News

Following an RSGB meeting of the RWG, held on Saturday 15 May, three v.h.f. repeaters are soon to become operational, they are: GB3BT on R2 at Berwick; GB3LD on R3 in the lake district and GB3SB on R0 at Duns in Scotland (however, GB3SB may yet change channel). The H.O. has now received proposals for v.h.f. Phase 5. GB3EL in London which has been "off-air" for several months now, will return soon from a new site.

The five proposed 1.3GHz in-band TV repeater proposals have now passed from RWG vetting to the RSGB License Advisory Committee before presentation to the HO for their consideration and approval. The final list includes GB3GV at Leicester, GB3TV at Luton, GB3UD at Stoke-on-Trent, GB3UT at Bath and GB3VR at Worthing.

One of the longest licensed, but non-operational, u.h.f. repeaters GB3TS on RB14 at Middlesbrough—Teesside finally came "on-air" on 1 January 1982. Also rather long in the tooth is GB3OX on RB15 which is hoped to appear soon.

The holders of the license for GB3ND (u.h.f.) have decided to give it up, so, parties interested in taking over the license for the repeater which covers the Ilfracombe, North Devon area, should contact Mike Dennison G3XDV via the RSGB.

Finally, a successful conclusion has been reached over GB3NN, following the recent emigration of the original license holders, a new group have taken over the installation, resited it and it is now back "on-air".

The Future of RAYNET

A discussion paper entitled *The Future of RAYNET,* has been recently received here at *PW.* This six page document investigates the historical background, structure and future planning and development of RAYNET. Whilst paying tribute to the past involvement of the RSGB, the author, Ingemar Lundegard G3GJW, reports that a drastic reappraisal of RAYNET's relationship with the National Society should be urgently undertaken. It is felt that the time has come either to establish a small professional quality RAYNET committee, the permanent secretary of which would be resident at RSGB Headquarters, or disband the existing RSGB RAYNET Committee structure and create a completely independent organisation. Bearing in mind the large rise in RAYNET membership activity and commitment to the user services, failure to implement such measures could inevitably lead to group fragmentation and the potential loss of a viable emergency radio organisation.

Unlike the parent body G3GJW believes the involvement of CB operators, within a local RAYNET group, should be welcomed and encouraged and says further: "The possibilities of amateur radio in terms of bands and modes are superior to the two CB bands, but the universality of CB licence conditions and the need for amateur/CB interface in the field, demand a CB presence which cannot be ignored in the long run."

A copy of the discussion paper is available, upon receipt of a large s.a.e., from: *L. A. Crane G3PED, Greta Woods, Bromley Road, Ardleigh, Colchester, Essex.*

New Clubs

Recently formed is the "Antrim and District Amateur Radio Club", who meet every third Thursday of the month in the Board Room of the Antrim Forum. The club has applied for affiliation to the RSGB and would like to extend a warm welcome to local amateurs and s.w.l.s.

Further details from: *The Secretary, David Hutchinson GI4FUM, QTHR.*

Readers in the Orpington, Kent area may be interested in the formation of a club that has been set up primarily for s.w.l.s and constructors. The club, in addition to welcoming new members, would like to hear from licensed amateurs who would be prepared to give a talk or lecture to members.

Further details from: *Reg Topley, 8 Homefield Rise, Orpington, Kent BR6 0RU. Tel: (0689) 23687, or Peter Burbeck, tel: (0689) 37001.*

NEWS NEWS NEWS

High-Quality Pictures on Ceefax

The culmination of several years' work by engineers from the BBC's Engineering Research Department has resulted in the first public broadcast of high quality still pictures via the UK teletext system. The pictures and other enhancements were demonstrated to a technical committee of the European Broadcasting Union (EBU) on 11 February, and at a meeting of the Institution of Electrical Engineers (IEE) on 8 March.

The photograph shows an example of the high quality still pictures broadcast for the demonstation

The UK teletext system has, for many years now, represented an efficient and rugged way of transmitting, receiving and decoding data for display on a television receiver. None of the efficiency or ruggedness is lost in the transmission of the enhancements, which include improved graphics, redefinable character sets, more readable character founts, linked pages and broadcast software, as well as full broadcast-quality pictures. The enhancements do, however, preserve the compatibility of existing teletext decoders, whilst demonstrating how a teletext display of the future might look.

Additionally, the BBC Ceefax Unit has for some time now been transmitting teletext software in conjunction with Brighton Polytechnic and several schools to see if it is possible to transmit computer programs by means of Ceefax, which could be loaded into a microcomputer memory.

Most of the enhancements to the Ceefax system require additional memory capacity in the receiver decoder, and it is not likely that the full range of enhancements will become available until later in the decade. Once again, all the enhancements are compatible with existing decoders. For example, viewers selecting the pages carrying the picture information will receive the text without decoding the picture information and probably the editor will fill the space where the picture would have been with a simple graphic so that the viewer is not left with a blank screen.

BBC Engineering Information Department, Broadcasting House, London W1A 1AA. Tel: 01-580 4468.

Rallies and Events

The British Amateur Electronics Club will be holding their 17th annual Amateur Electronics Exhibition between 17 and 25 July 1982, at the Shelter, The Esplanade, Penarth, South Glamorgan. Further details are available from: *Cyril Bogod, "Dickens", 26 Forrest Road, Penarth, S. Glam. Tel: (0222) 707813.*

The British Amateur Radio Teleprinter Group Committee have decided to hold a rally this year, in preference to their usual convention. The rally is to be held at Sandown Race Course, near London, on Sunday 29 August 1982, during the Bank Holiday weekend. Further details from: *The Secretary, BARTG, Edward Batts G8LWY, 27 Cranmer Court, Richmond Road, Kingston-upon-Thames, Surrey.*

The Worcester and District Amateur Radio Club will be holding their annual Radio Rally on Sunday 11 July 1982, at The High School, Ombersley Road, Droitwich. In addition to all the usual exhibits for the radio enthusiast, there will be plenty of attractions to keep the whole family entertained. Further information can be obtained from: *The Rally Manager, Tony Blissett G8NSL, 26 Cherry Orchard, Holt Heath, Worcester. Tel: (0905) 620507.*

The Waterside Shortwave Radio Club have arranged a special event station to coincide with an "open week" at their HQ—the Fawley and District Community Centre, near Southampton. During the afternoons and evenings between the 26 and 31 July, the club will be operating h.f., v.h.f., and u.h.f. stations using the callsign GB2BBC, and also hope to demonstrate reception of ATV on 435MHz. Later, on Sunday 15 August, the club has organised a h.f. picnic at Yew Tree Heath, near Lyndhurst in the New Forest. Visitors and their families will be most welcome and talk-in should be available on 144 and 432MHz bands. On this occasion the club will be using its own callsign G4JYN. Further details of the events and the club's activities are available from: *Philip G6DLJ, tel: (0703) 891975.*

Golden Anniversary

Coventry Amateur Radio Society this year celebrates the 50th anniversary of its founding.

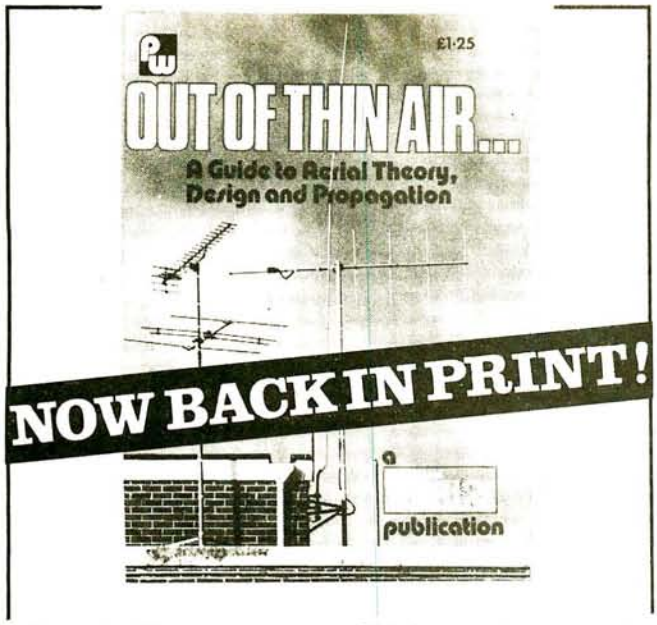
In June, CARS operated a special event station callsign GB2CRS and in September has organised a celebratory dinner. The society meets every week and has recently seen an upsurge in the number of visitors it receives this, however, in no way dilutes the welcome that new visitors will receive.

Further details of the society's activities are available from: *David Farn G4HRY, 14 Corfe Close, Clifford Park, Coventry CV2 2JG.*

Can I Help You!

Are you the secretary, organiser or general dog's body of your local radio club or any other group whose functions may interest readers of *PW*. If so, let me know and I will endeavour to publicise your rally, get-together whatever, through this column. Remember though, we compile the magazine some time ahead of publication day (e.g. this note was written in mid-May), so, the earlier I can have details, the better.

Alan Martin



Aerials and aerial accessories are very definitely among the most popular topics covered in *Practical Wireless*. In response to requests from readers, we've reprinted a selection of articles from the past three years, plus two new features—one by Ron Ham on v.h.f. propagation, the other describing the "Ultra-Slim Jim", a new version of that most popular 2-metre aerial design by Fred Judd.

Out of Thin Air **has 80 pages, 295 × 216mm, and is available from Post Sales Department, IPC Magazines Ltd., Lavington House, 25 Lavington Street, London SE1 0PF, price £1.50 including postage and packing to UK addresses, or £1.80 by surface mail overseas. Please ensure that your name and address are clearly legible.**

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MMT70/144	4M Transverter for 2M Rig	115.00
MMT1296/144	23cm Transverter for 2M Rig	184.00
MML144/25	2M 25W Linear Amp (3W I/P)	59.00
MML144/40	2M 40W Linear Amp (10W I/P)	77.00
MML144/100S	2M 100W Linear Amp (10W I/P)	129.00
MML432/20	70cm 20W Linear Amp (3W I/P)	77.00
MML432/50	70cm/50W Linear Amp	119.00
MML432/100	70cm 10/100W Linear Amp	228.64
MM2000	RTTY to TV Converter	169.00
MM4000	RTTY Tranceiver	269.00
MMC50/28	6M Converter to HF Rig	27.90
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CYBERNET UK CB

By Gordon J. KING

There are currently three models in the Cybernet range of 27MHz CB whose UK agent is the respected house of Goodmans Loudspeakers Limited. The different rigs collectively go under the **Beta** banner—there being models 1000, 2000 and 3000 with ascending order of features and hence price tag.

Being deeply involved with the testing and evaluation of hi-fi f.m. tuners and allied equipment, while having long-standing radio communication connections, my experience and lab facilities have been sought to explore the possibility of providing definitive run-downs on the technicalities of 27MHz f.m. UK CB. Thereby discovering how the equipment fares in relation to the HO CB 27/81 requirements and to assess "on air" as a means of tracing possible shortfalls of the system generally and areas which might be likely to benefit from technical enhancement.

Accordingly, lab investigations were made in an endeavour to discover which measurements would be of the most value to the prospective CBer, to see how the performance in this respect relates to the requirements and, indeed, to find out just what one can expect from the CB medium in practice. Tests have also been made of different antenna configurations and of limited ancillary items—notably s.w.r. and r.f. power meters and antenna matching units. Less detailed investigations have also been made on the interference front—that is, TVI and other interferences that might be placed at the door of the legal CBer.

This feature is in two sections. The first looks at two Cybernet rigs—the Beta 1000 and the Beta 3000. The second delves more into other findings, such as my experiences in using the two Beta rigs mentioned both as a home base and mobile, antenna performances, s.w.r.ing, so-called "DX" prospects, interference, system shortfalls and so forth. Let's start, then, with a look at the two Cybernets.

Beta 1000

This remarkably well-made rig is the least expensive of the Cybernet range, and its mini-dimensions render it ideally suited for mobile fixment and application. It is "smooth" looking and its overall non-glare dark colour finish makes it a non-distracting car rig. This is also aided by the use of a row of four signal-strength-indicating l.e.d.s, the more lit the stronger the signal, which saves having to peer at a thin pointer when mobile. The l.e.d.s also light in the transmit mode—all four on 4W and fewer on low power.

It comes with built-in speaker which radiates from underneath, and with the various items of hardware for car (or, indeed, home base) installation. The microphone, also supplied, is of the dynamic variety with the usual press-to-talk switch and is interfaced to the fascia by way of a reasonable length of spring-coiled mic cable and four-pole screw type termination. The mic is styled for easy handling and is capable of good quality transmission.

The black-backed windowed section at the front through which shows the signal strength l.e.d.s also displays a fairly bright glowing digital indicator. This shows the channel number (1 to 40) as selected by a continuously adjustable 40-position switch, also of good electro/mechanical construction. A dual-concentric control at the other side of the fascia provides volume with power on/off and squelch level setting. The controls are shaped for convenience of operation, but I did find that it was a bit of a job to adjust the squelch level without affecting the volume setting!

10·8 to 15·6 volts d.c. is applied at the rear through a detachable positive-line-fused cable, and the rear also sports a 3·5mm jack socket for interfacing an external speaker—certainly worthwhile if you want that extra audio output and improved sound quality. When the rig was used as a home base a smaller 4 ohm hi-fi speaker made all the difference in the world! It is a requirement of the HO for a reduction in r.f. power by 10dB (10 to power ratio) when the rig is used as a home base station and driving an antenna whose elevation exceeds 7m (about 23ft). Such a power-reducing switch is located at the rear of the Beta—this, seemingly, just dropping the input to the final r.f. amplifier.

The receiver side adopts the double superhet principle as a means of securing the required degree of receiver section i.f. selectivity. Ceramic filters are used, the first i.f. being at the f.m. standard of 10·7MHz and the second dropping down to 455kHz, near the a.m. standard. Design is fully synthesised with the usual phase-lock-loop control, this ensuring incredibly good frequency accuracy on all channels both on receive and transmit—aided, of course, by a quartz crystal.

In the lab the rig measured *remarkably* well. With 13·8V d.c. input (from a stabilised power supply) I was measuring the full 4 watts of r.f. power into an accurate dummy load of 50 ohms. The lower power result was a little more than the expected −10dB, it being more like 12dB below 4 watts, or 252mW; but frankly this had little affect on the copy in low-power mode. Curiously, the Beta 3000 was similar in this respect. The r.f. power held within a fraction of a dB over the 40 channels. Precise r.f. delivery, of course, is a function of the d.c. input, the power output altering by the square of the change in input voltage. If you want the full 4 watts from any CB, therefore, it pays to make sure that the d.c. input is not on the short side—and this applies to protracted non-charging battery use when parked, for example! Further, if you need to use an abnormally long tract of power supply lead make sure that these conductors are stout to avoid undue I^2R loss.

Actually, the current demand in the worst case of transmit is modest at 1·5A nominal so the voltage drop should not be all that impressive. At 13·8V this gives an input loading of 20·7W and an overall efficiency in the normal power transmit mode of around 19 per cent. When used on a regulated power supply the mains loading should not be much more than about 50W (depending on the power supply unit), so at, say, 5p per unit of electricity you could run your CB on transmit for 20 hours and only burn up 5 pence worth of juice. CB is thus not a particularly costly hobby to run as some breakers I have talked to over the channels seem to think!

I was astonished by the frequency accuracy of both models. The HO allow an error up to ±1500Hz, but on no channel was the error on either model greater than 280Hz at 20°C, while the cumulative error, switching between channels 1 and 40, was barely any more. Changes in frequency were detected with temperature change; but even in the worst case tested the frequency held within the requirement.

Into an expensive dummy load the carrier was remarkably pure. Lowest amplitude spurii over the defined bands of the HO were some 80dB below 4 watts, thereby

meeting the requirement of not more than 50nW over these bands. Harmonic amplitude was higher but still down to around 73dB below 4 watts. These fell in the other HO-defined bands where the requirement is for no more than 0·25μW. It was noted, however, that the use of different dummy loads tended to affect the results, as also the rig's connection to a poorly matched antenna system.

Using the microphone supplied it was difficult to exceed ±2kHz deviation from voice. The specification says greater than ±1·5kHz, while maximum deviation stipulated by the HO is ±2·5kHz. The frequency response of the mic and modulator channel is tailored specifically for maximum voice impact without unduly affecting the "naturalness" of the tone or raising the modulation index. This would otherwise result in singularly undesirable higher-order sidebands and possible "bleedover"—as, for example, encouraged by some power mics and speech processors.

On the receive side, maximum audio power output was 2 watts at 1kHz into 8 ohms to peak clipping threshold. At 1W the quality was not particularly hi-fi but adequate for speech communication. On channel 20 the sensitivity was such that a usable 20dB signal/noise ratio obtained with an antenna input as low as 0·2μV. Residual background noise was relatively low with the application of 5μV antenna input. The receiver was essentially free from a.m. response given a suitability high antenna input which, with f.m., tends to minimise the disturbance from electrical interference.

Various ways were tried in order to obtain a realistic measure of adjacent channel selectivity; but the scheme eventually adopted gave an average discrimination of around 45dB, though the i.f. response appeared to be somewhat asymmetrical such that a higher ratio was measured from a given channel on one side than on the other. The capture ratio, which is a function of the f.m. system (not a.m.), was far poorer than I regularly measure on wideband f.m. hi-fi tuners, where ratios as low as 0·75 to 1·5dB are commonly measured. It would seem on narrowband f.m. (n.b.f.m.) that one is lucky to get something as low as 6dB, so while the capture effect is apparent it is not as dramatically so as on hi-fi f.m.

Lack of high-*Q* preselection gives the expected shortfall in terms of relatively poor r.f.i.m. (e.g., 3rd-order intermodulation) and image response rejection ratio, and this is seen in my eyes as one area where CB rigs generally could well be improved—albeit, at higher cost to the consumer.

While for mobile applications the signal strength l.e.d.s are ideal, for home base installations they are often seen by breakers as a significant disadvantage over meter movements carrying some mere degree of "S"-point calibration. This is because breakers like conveying to each other their so-called "pounds" of signal. Little do these breakers realise, however, that the variations of meter sensitivities on the different rigs render such statistics virtually useless!

Anyway, I have "calibrated" the l.e.d. displays on the two Beta models and have given the results in the accompanying lab table. I was bucked to see that both models came out closely on this count, but the wide signal difference between the 3rd and 4th l.e.d. lighting needs a lot of guess work to assess the signal levels between!

Indeed, the results of both models on the parameters measured were remarkably similar. This might be expected because apart from the extra features of the Beta 3000 the fundamental design would appear to be pretty consistent, which then neatly brings me to the description of the 3000.

★ specification

RECEIVER SECTION

Audio power:	2W (1kHz 8 ohms)
Distortion:	1·4% (1kHz 8 ohms)
Sensitivity for 20dB S/N ratio:	0·2μV
S/N with four l.e.d.s lit:	44dB (45·5dB weighted)

Signal input to light		**Adjacent channel breakthrough***	
1 l.e.d.	0·25μV	(ref. channel 20)	
2 l.e.d.s	0·5μV	channel 19	56dB**
3 l.e.d.s	1·0μV	channel 21	24dB**
4 l.e.d.s	20μV	average	45dB**

A.M. rejection ratio:	34dB (20μV input)
Squelch range:	≈1 to 15μV

TRANSMITTER SECTION

Power input 50Ω:	4W (channel 20)
Low power attenuation:	12·4dB
Frequency error channel 20:	+251Hz (20°C)
Spurii	
HO-defined bands:	≈−80dB***
other bands:	≈−73dB***

Notes

For other data please refer to text. Refs. audio power measured to peak clipping; test deviation 2kHz; audio datum 10mW 8Ω

* Refers to channel 20 and 20mV signal at ref. deviation. Input adjusted for ref. audio output using wave analyser on channels 19 and 21.

** These values differ slightly between models 1000 and 3000.

*** Assessed with critical 50Ω dummy load. Results differ with different loads and antenna mismatch.

Beta 3000

This is stylistically similar to the 1000 but is larger and carries more knobs and buttons. In addition to the 1000 features, the 3000 has separate volume (with on/off switch) and squelch controls, a tone control (essentially top cut as the control is retarded) and an r.f. gain control. There are also buttons for the immediate selection of channel 9 (the "mayday" channel), for dimming the digital channel display, for switching on a p.a. facility and for "peaking" the mic channel response more round the middle of the speech spectrum as an aid to breaking through a noisy DX channel. The rear is also equipped with an extra 3·5mm jack socket for accepting a p.a. speaker which, presumably, would be mounted under the car bonnet when the rig is used mobile. The legality of such an installation in one's vehicle is highly dubious for it is understood that a letter of authority from the police or similar office is required when p.a. is to be used in the streets—and even then the precise whereabout of its use has to be recorded beforehand! Perhaps it is different in other countries; but in any event it is hardly a feature, I would have thought, that the normal run of CBers would rank very highly.

The tone control was found useful for reducing the annoyance of the high-pitched interference "tizzle" that commonly backs DX copy. I suppose the quick channel 9 selector button might have value under certain circumstances but it is no hardship to turn the switch knob to channel 9. The dimmer button, again, might have use when night driving; but the signal strength l.e.d.s and the five additional indicator l.e.d.s of this model remain at the normal brightness anyway.

The r.f. gain control failed to help secure improved signal/interference ration on noisy copy and seemed to have only minimal practical value when receiving local copy. As it is backed off so the sensitivity of l.e.d. signal strength indication diminishes. The mic channel response tailoring button could be useful to improve readability under adverse reception conditions. There were cases where it helped and others where the breakers, preferred the "wideband" mode. It will be appreciated, of course, that the foregoing criticisms are not directed solely to the Beta 3000. They apply equally in my terms and with respect to my experiences with CB to date to any CBs having similar facilities.

Essential differences between the specifications of the two Cybernet models lies in the adjacent channel rejection ratio, where it is quoted as greater than 40dB for the 1000 and greater than 50dB for the 3000. Relative dimensions are 149 × 39 × 158mm for the 1000 and 176 × 50 × 202mm (both W × H × D) for the 3000. Both models are easy to fit into a car or, indeed, install with a power supply unit as a home base and represent very good value for money.

PRODUCTION LINES

ALAN MARTIN G8ZPW

Data Display Monitor

A new economical UK manufactured 12 inch monochrome data display monitor has been introduced by Chable Electronics which costs £69.50 plus VAT and £5.00 for carriage and insurance.

Attractively styled in a case that measures 370 x 290 x 300mm, the monitor can be easily lifted with one hand, operates from either 12V d.c. or a.c. mains and is intended for business and scientific users, educational establishments and home computing.

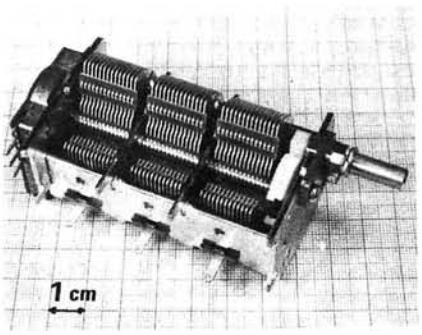
The data display monitor and further information is available from *Chable Electronics Ltd., 3A Commercial Street, Batley, West Yorkshire WF17 5HJ. Tel: (0924) 441128.*

Tuning Capacitor

Ambit International inform me that they are continuing the steady expansion of their "stock" communications components, with a larger range of variable capacitors which includes the ALPS C638W, a three-gang air spaced variable capacitor with a 100kΩ diode law potentiometer fitted at the rear of the unit for varicap applications.

Each section comprises a precision 426pF air spaced variable capacitor and an integral 3:1 anti-backlash reduction drive which utilises spring tensioned nylon drive gears, ensuring smooth operation using direct or indirect tuning mechanisms.

The C638W costs £3.99 plus VAT and 50p p & p, and is available from: *Ambit International, 200 North Service Road, Brentwood, Essex CM14 4SG. Tel: (0277) 230909.*



Azden PCS-300

In *Production Lines,* June 1982, I mentioned the Azden 144MHz hand-held f.m. transceiver. Please note, the transceiver supplied for UK use has a frequency coverage of 144·000 (not 142·000) to 145·9875MHz and frequency synthesiser steps of 12·5kHz (not 5kHz).

My apologies to readers who may have been misled and also Waters and Stanton who provided the review sample.

If you please

Please mention "Production Lines", when applying to manufacturers or suppliers featured on this page.

New Wiring Sytem

A completely new interconnection system has been introduced by BICC–Vero Packaging. Known as Speedwire, the system provides rapid point-to-point wiring using a novel insulation-displacement contact and a specially designed hand wiring pen.

The system produces gas-tight joints using insulated solid-conductor 30a.w.g. wire which is pushed between the tines of a double-forked terminal to cut the insulation and provide a reliable contact. Joints are produced on a "daisy-chain" principle, and with the wiring pen the operator can move smoothly from one joint to the next without having to cut or strip the wire.

At the heart of the system is the double-sided push-fit contact which is suitable for circuit boards 1.6mm thick and for holes with a nominal diameter of 1.65mm. The component side of the terminal incorporates a socket for i.c.s or component leads, whilst the wiring side has the double-forked Speedwire terminal.

The wiring pen pushes the wire between the terminal's tines which cut through the insulation and take a tight grip on the bared wire. Each double-forked terminal will accept one or two wires.

On the component side of the board, a stamped beryllium copper contact clip is selectively gold plated so that it wipes on all four flat faces of an i.c. lead and hence produces a very low contact resistance.

Speedwire is initially being offered as two kits. The first contains a 100 x 160mm plain unpopulated Eurocard, contacts, hand insertion tool, wiring pen and spare wire; while the second kit, contains a fully populated plated-through-hole Eurocard, a wiring pen, a spool of wire, spare wire spools and a pair of miniature cutters. All components of the Speedwire system are available separately.

For further details of price etc. contact: *BICC-Vero Packaging, Industrial Estate, Chandlers Ford, Eastleigh Hants. SO5 3ZR. Tel: (04215) 66300.*

Base Station Microphone

The Tandy Corporation are pleased to announce the availability in the UK of their new "Realistic CB Base Station Microphone" (Catalogue No. 21-9031), which will retail at £19.95.

Features include an easy-adjust microphone head, locking push to talk bar, gain control and a four foot coiled connecting cable.

The microphone requires a 9V battery to power its amplification circuitry and is available at all 290 Tandy Stores and dealers, nationwide.

THE PW MORSE HOW

Steve DAMON G8PYP

PART 2

Following the detailed circuit description of this comprehensive tutorial aid in Part 1, this concluding part provides full constructional and operational details.

Construction

Construction of the *PW* Morse Show should present no problems, providing the following guidelines are observed. As the copper tracks of the double-sided p.c.b. are very fine, a low-wattage, small-tipped soldering iron must be used to prevent excessive heat from "lifting" the copper off the board. The p.c.b. should be inspected prior to assembly and checked for cracks in the copper track and/or spikes between adjacent tracks, on both sides of the board. A few minutes spent at this stage will save hours later when the board is fully assembled. Murphy's Law states that these faults always occur under the i.c.s where they are very difficult to detect, and require the stripping of practically the whole board to rectify!

As the p.c.b. is double-sided, and not of the "plated-through" hole variety, stakes made from 22 s.w.g. wire, or single-sided Veropins, must be inserted in the holes not occupied by a component, in order to make connections between the two sides of the board. Some of the component leads are also used for through connections and these must be soldered to the appropriate pads on both the top and bottom sides of the board.

It is strongly recommended that a "dry run" is carried out first and the components only soldered when their positions have been checked. The use of sockets for all the integrated circuits except IC7 is recommended; this allows for connection to be made to a microprocessor development system and for the program to be changed in the future.

When the positions of the components are confirmed, start the assembly by fitting all the small components, resistors, capacitors etc., taking careful note of the polarity of diode D1 and the electrolytic capacitors, C2, C8, C9 and C11. Several pin-out versions of the TO-92 style BC212 transistor exist. The p.c.b. is designed for the BC212L.

A word of warning about double-sided p.c.b.s, check the first component is in fact inserted on the correct side of the board. It may seem obvious, but the author, who is a professional engineer, has made this mistake more than once!

The next step is to fit all the other components, with the exception of the i.c.s and their sockets. After these components have been fitted it is then fairly easy to see the spare holes where the stakes must be inserted and soldered on both sides of the board. Note that some of these holes are under the i.c.s and before soldering check that the hole is not destined for an i.c. leg, again obvious but . . .

When all the stakes have been fitted, fit the i.c.s and i.c. sockets into their respective positions, taking care to fit them the correct way round; pin 1 is identified either by a dot or with an indentation in the adjacent end of the i.c.

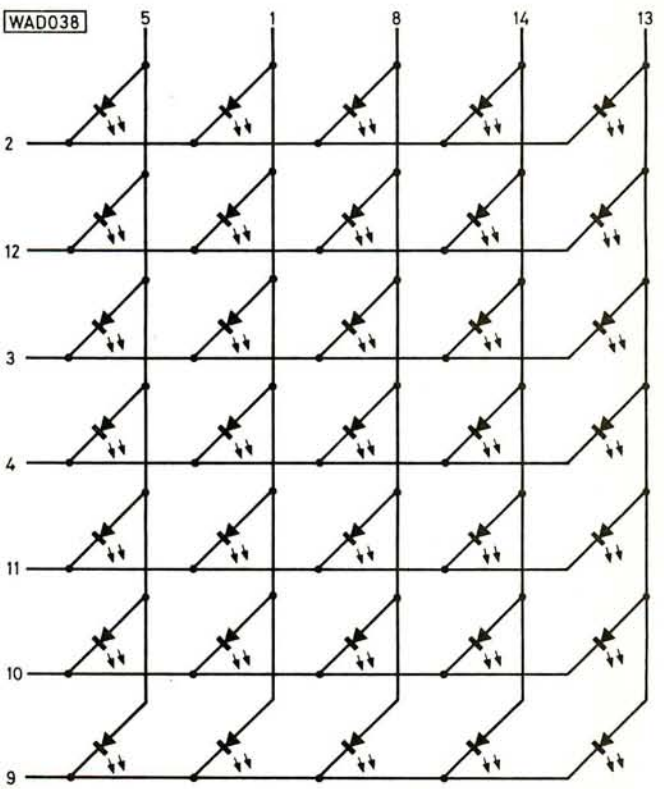
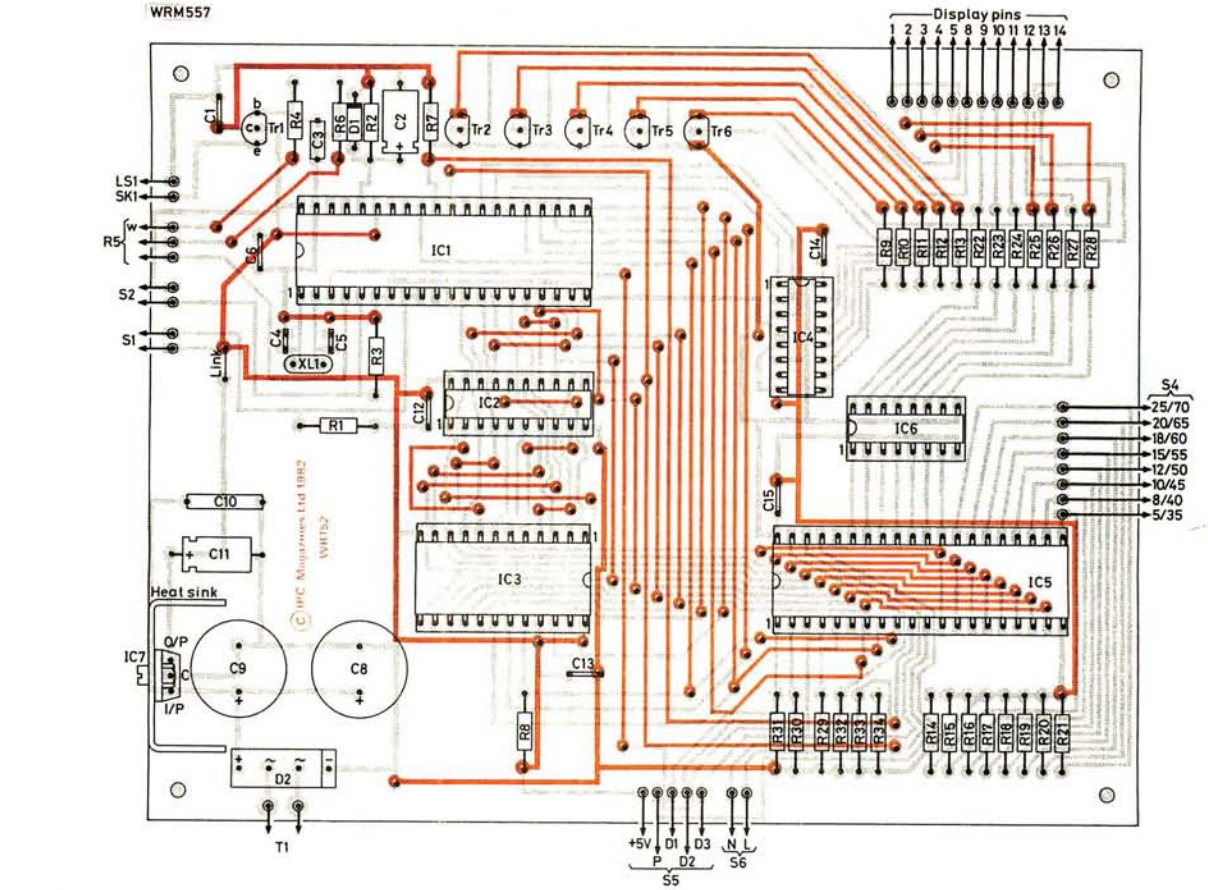


Fig. 2: Internal circuit details of the dot matrix display



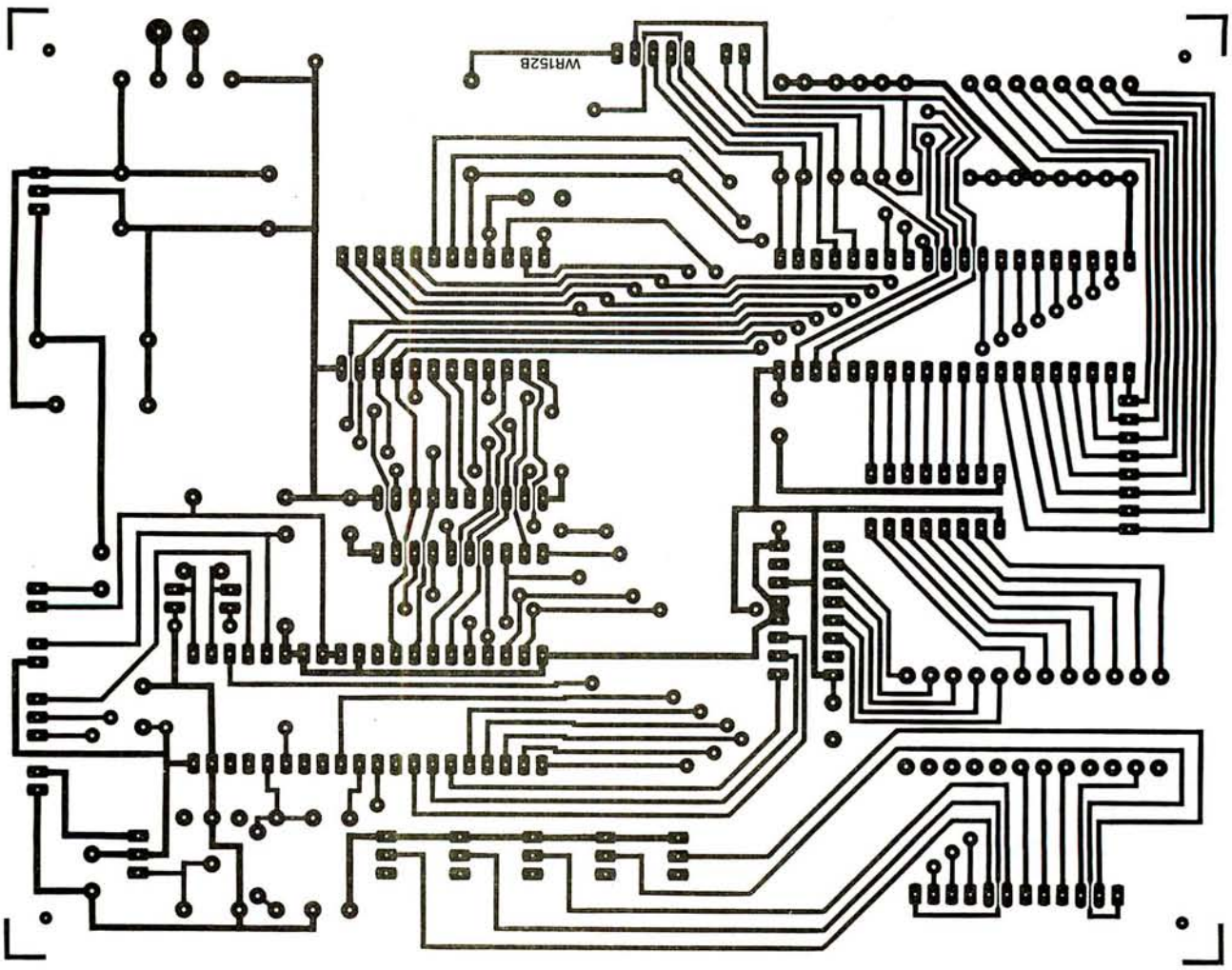
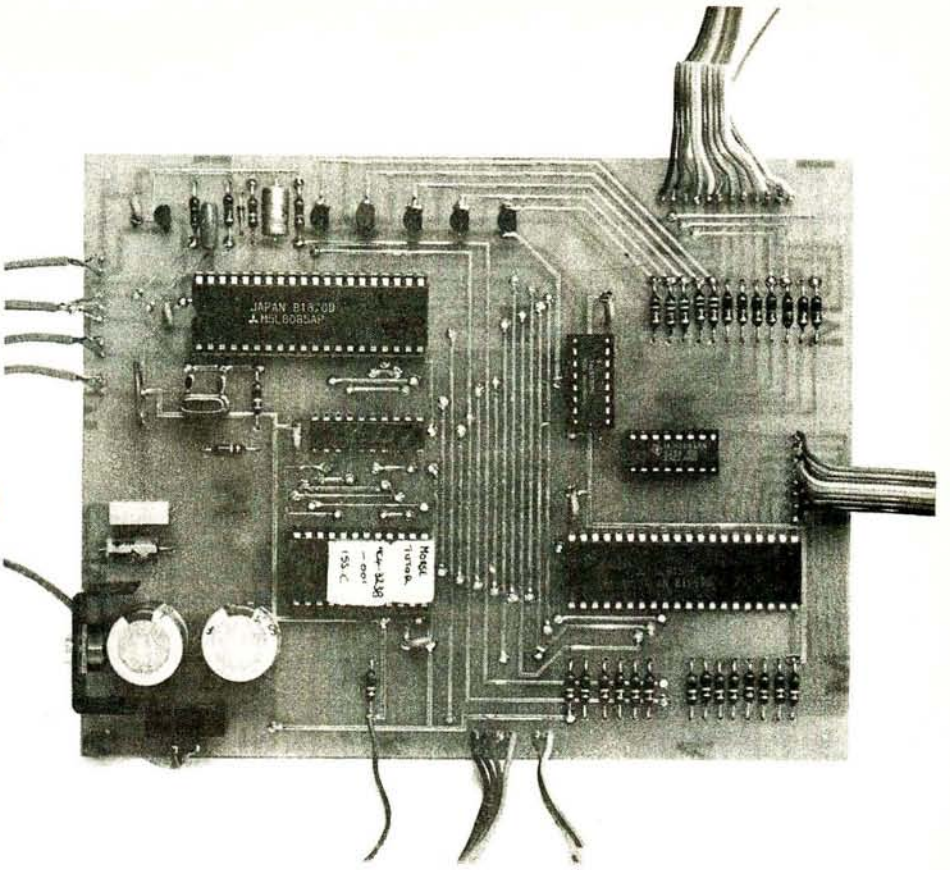


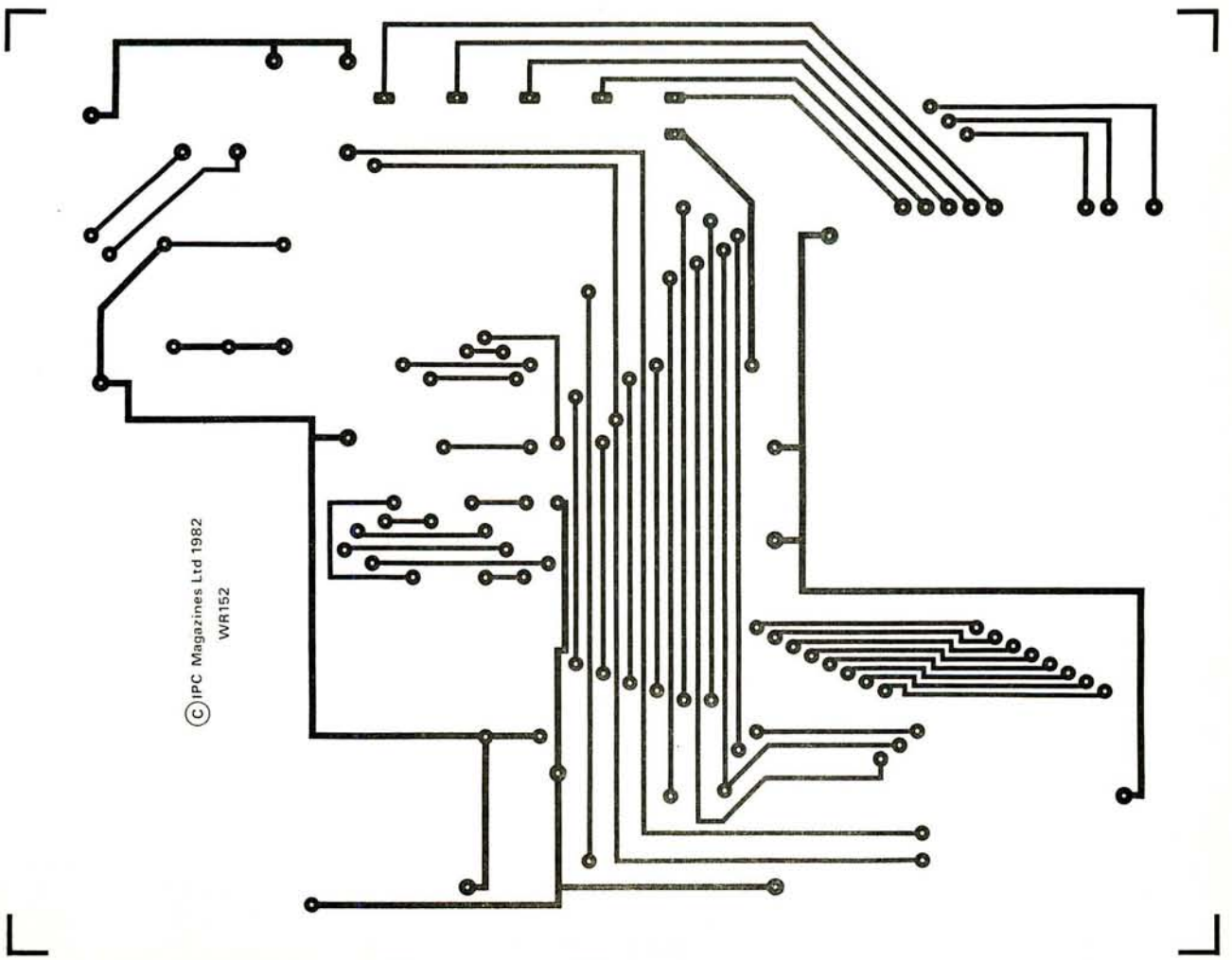
Fig. 3: (Left) Reduced size component layout of the double-sided Morse Show p.c.b.

Fig. 4: (Below left) Non-component side track pattern, shown full size

Fig. 5: (Right) Photograph of the assembled prototype Morse Show circuit board

Fig. 6: (Below) Component side track pattern, shown full size



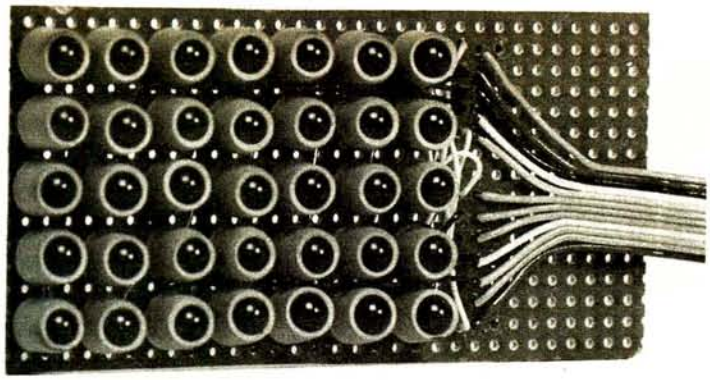


With some new i.c.s the legs may be spaced incorrectly and will require bending in order to fit them into the holes. This is achieved by laying the i.c. on its side, and while applying pressure downwards, pushing the i.c. gently to bend the legs inward; do this once or twice on each side of the i.c.

The method used to interface the l.e.d. display is via 12-way ribbon cable feeding a wire-wrap type 14-way socket. Display mounting is accomplished by directly bonding the display face to the rear of the front panel. A 12mm diameter hole is provided for the viewing aperture, which whilst leaving the dot matrix unobstructed, will allow an adequate area to apply the fixing medium.

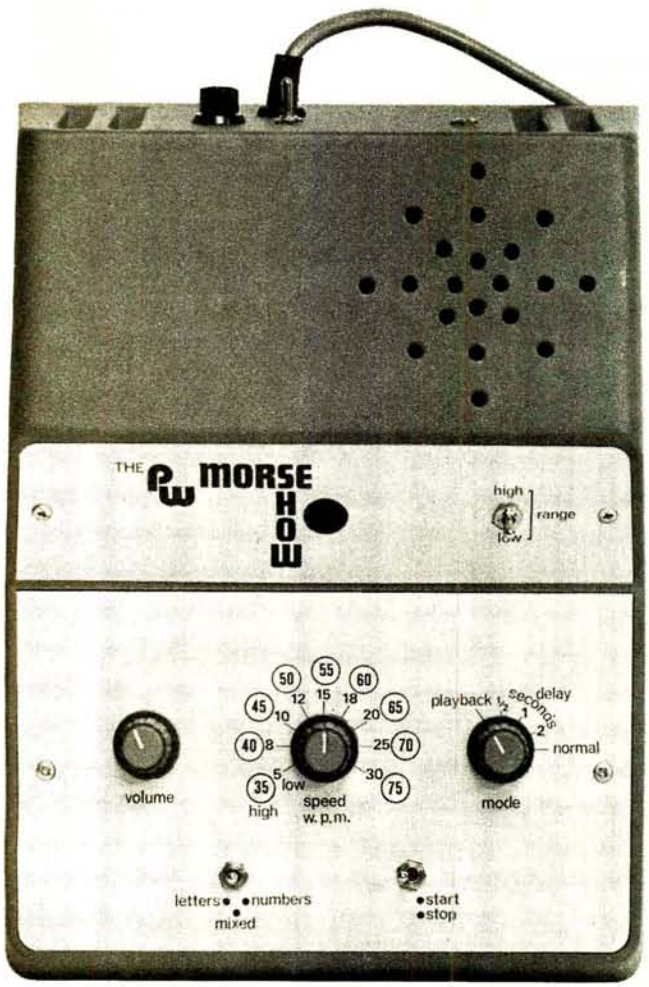
The display obtained by the author was not clearly marked with regard to the position of pin 1, but if the pins are examined it will be seen that there is one missing (pin 6) and this should correspond with the "gap" in wiring to the 14-way socket (pins 6,7). When fitted to the front panel this gap should be towards the bottom of the case. As a further guide to assembly the TIL305 pin 1 is located at the end of the encapsulation featuring two moulded-in pockets. The display contrast is greatly improved by the use of a circularly polarised filter, inserted into the 12mm viewing aperture in front of the display.

Both rotary switches, S4 and S5, are 12-way single-pole devices with adjustable end stops; these are set by removing the fixing nut and lock washer followed by the metal end-stop setting ring, which is then exposed. After removing the setting ring turn the switch fully anti-clockwise, to position 1, and then re-insert the ring into the required hole; position nine for S4 and position five for S5. The switch can then be fitted to the front panel and the lock nut tightened, which will hold the end-stop ring in place.



An alternative display constructed from discrete l.e.d. elements

Extra care must be taken with all mains wiring as the mains supply is at 240V a.c. and can **KILL** if it is abused. Ensure that the earth wire in the mains cable (Green/Yellow) is permanently connected to the front panel and that the incoming live wire (Brown) is connected to 250mA fuse FS1. All exposed wiring and connections must be sleeved to avoid accidental contact with the earthed parts of the case, or the constructor!



Front panel control layout of the *PW* Morse Show

Setting Up and Testing

Before plugging the unit into the mains check the wiring and connections for shorts, etc. Disconnect the wire link provided on the p.c.b. and plug the unit into a suitable mains outlet. Switch on S3 and measure the voltage across capacitor C11; this must be between 4·75 and 5·25 volts d.c. If all is well disconnect the mains supply and re-instate the link wire. Switch the mains back on and recheck the voltage across C11, which should be as previously measured.

Next, set the MODE switch to PLAYBACK; the display should flash on and off every 0·5s. Change the MODE switch to NORMAL and the display should then change to a moving pattern.

Set the SPEED switch to the required speed and select letters, numbers or mixed characters, then press and release the START/STOP switch. The *PW* Morse Show should send $\overline{CT}$ (–·–·–) followed by random Morse code in five-letter code groups; if the MODE switch is changed to a DELAY position delays of 0·5, 1 or 2 seconds will be introduced between each character.

After a minute's worth of Morse (i.e. 10 groups at 10 w.p.m.) or if the START/STOP switch is pressed, the tutor will send $\overline{AR}$ (·–·–·) and return to the standby mode. Now set the MODE switch to PLAYBACK and press the START/STOP switch; the complete sequence will then be played back and characters displayed in turn. If the START/STOP switch is pressed while the *PW* Morse Show is playing back through a sequence it will just return to the standby mode, without sending $\overline{AR}$. The sequence can be played back as many times as required, providing that a new sequence is not played "over the top" of the old one, or the unit is not turned off in the meantime.

Speeds cannot be changed in the middle of a sequence and can only be changed when the unit is in the standby mode. This is part of the protection incorporated into the program to prevent the stored characters from over-

writing the stack (an area of the RAM used by the microprocessor as a DATA store while executing some program instructions).

Using the Morse Show

Morse code cannot be learnt over night, at least not by this author; the only answer to cracking the code is practice.

When using the *PW* Morse Show start with a fairly high speed but with a long gap between the characters; this gives a "feel" for the correct way each character should sound. As proficiency is gained reduce the gap between characters and remember that you are only learning when trying to copy just above your capability. For the amateur Morse test at 12 w.p.m. aim for proficiency at a slightly higher speed, say 15 w.p.m.

If a larger display is required for teaching a class etc., there is no reason why a display cannot be constructed from 35 individual l.e.d.s, connected as shown in Fig. 2.

The author has found the *PW* Morse Show a great help and aims to take the Morse test in the near future.

References

1) *Radio Communication Handbook*, 4th and 5th editions RSGB
2) *MCS 8085 Family, Users Guide;* Intel Corporation
3) *TTL Data Book*, Texas Instruments Ltd.
4) *Optoelectronics Data Book*, Texas Instruments Ltd. ●

the things people say

"QRZ the station calling G6 . . . you are completely unreadable so I don't copy you very well!"

. . . heard by G8KEN

"Yes, I've got a 5-element whip on the car."

. . . heard by GW8YPR

"PA0??? your report is 59. Please repeat your callsign and QRA several times, you are not very strong from GW . . . /P."

. . . heard during a 2m contest by G3PFR

"CQ GW . . . potable, contest, over" Does this mean the drinking competition has finished?

. . . heard during a 2m contest by G3PFR

"You're doing very well from Abingdon on 1½ watts—but then you're very near the repeater aren't you?"

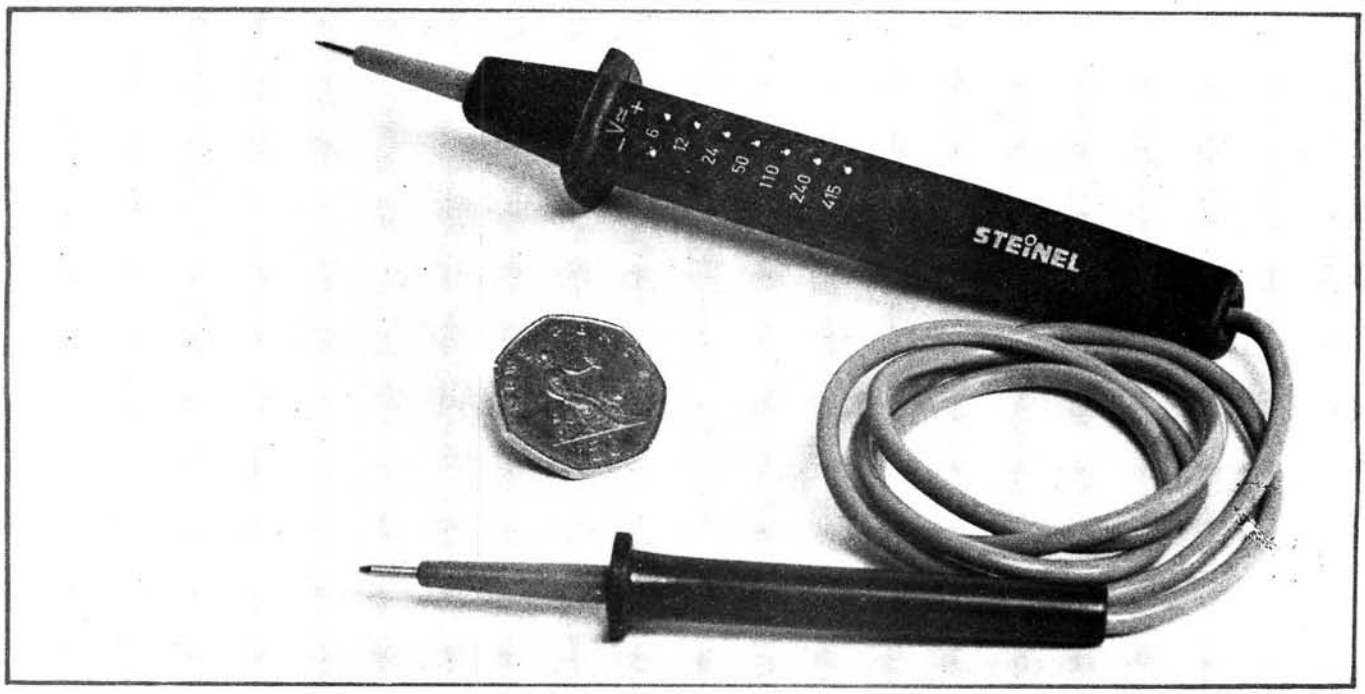
. . . heard on S21 by G8VBI

". . . we could do it on v.h.f., only I don't have the equipment."

. . . heard on 20m by M. R. Welch

Have you heard any (printable) comments, funny peculiar or funny ha-ha? If so, why not send them in to our Editorial offices at Poole. We will pay for every one published.

special offer



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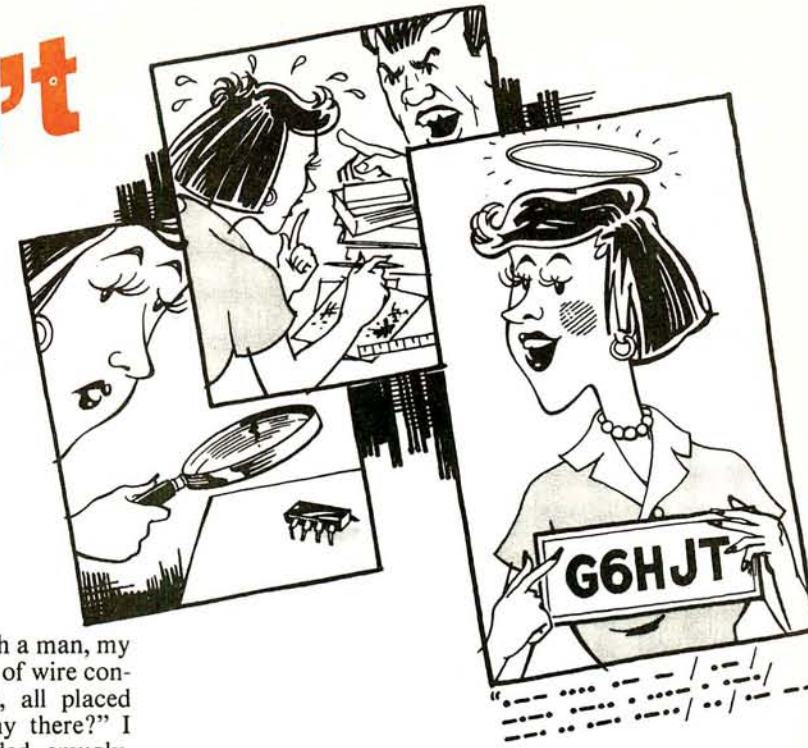
Shelagh IBBS G6HJT



My sorry tale of woe begins (as is normal) with a man, my husband to be exact, and a magnet with a rod of wire connected to a dust-laden, bug-ridden receiver, all placed reverently on top of my chest freezer. "Why there?" I asked, "ground plane" my husband confided smugly. From then on every spare minute was lavished on "the box", but it didn't end there. Suddenly my vacuum cleaner began choking over various bits of electronic junk. These little beasties appeared everywhere; I even jabbed my fingers on them when washing trousers. Their identities were established at my first radio rally, where I discovered that things with eight legs were not really beatles but i.c.s, the pretty striped ones could be anything but were generally cheaper, and there was useless stuff called ribbon cable (you try trimming a dress with it). The strange thing that I noticed were the women, who all seemed to have a far away look and a dejected stance, whist always being accompanied by a strenuously enthusiastic male.

It won't last long I thought, he'll get over it, like the 'flu, but then the phrases "RAE", "only £16 tuition", "think how useful it will be" began to be heard. The next thing I know my husband is studying and getting me to help him! The day of the exam I'd rather forget; suffice it to say that some weeks later at 7.45a.m. my sedate husband is leaping round the loft (sorry—shack) trying to get a contact.

Now at this point the story has an unexpected twist . . . I don't like being talked about, and then told to be quiet as I open my mouth to reply. When someone wishes you 88, well, it's only polite to respond. Deep down something stirred. I put it down to heartburn and tried to ignore it . . . until Steve began Morse classes. Boy, this beat spelling words out in front of the boys to stop them understanding what we were talking about. I got quite good at it, and could catch Steve out by sending him Morse first thing in the morning, or tapping out a message when I wanted his attention—but Morse was my downfall.

September 1981 saw me signing up for a radio class (Steve told me gleefully that I needed my RAE before I could send Morse). With much fear and trembling I walked into that first class, looking desperately for any other female face. To my joy four other girls were present, each looking as relieved as I felt. The mysteries of radio, and especially radio jargon, were revealed to me. No longer were s.w.r., chirp, squelch and many others part of an elite vocabulary; they actually made sense, and I began to sprinkle my conversation with them—just for practice of course. However all was not plain sailing, because maths has never been my strong point; it seems to have a logic all of its own. I dreaded doing the homework but had reckoned without my husband turned sadist who cajoled, encouraged and bullied me through.

The day of the exam finally arrived. I resharpened all my pencils again, cleaned my rubbers and checked I had a clean hankie; after all if I was going to dissolve into tears I didn't want to have to borrow one. We sat in long silent rows, all the cheerful faces of the class now sombre and subdued. The only one who seemed to be enjoying it was the invigilator, a merry fellow with a G4 callsign. I came out of that exam half elated, half despairing depending on which paper I talked about. Steve was patience itself as I gabbled on about the exam. Three days later we decided that I should drop the subject when a classmate had the thoughtlessness to suggest that it was quite easy really. Huh!

Steve kept vigil, phoning the college to see if the results were out, and I kept my head low and feigned disinterest to my friends. My silly husband told me whilst driving that I had gained distinction and credit, and apart from hugging and kissing him, yelping "what a clever girl I am", I took it remarkably calmly—the car only swerved twice—honest!

This is where the story develops an element of farce; the pass slips were late, but as soon as possible I rushed to a friend's to photostat the birth and marriage certificates etc., put them all in an envelope and posted them. When I got back home I was telephoned and asked what I would like my friend to do with the pass slip, which should also be on its way to London. At this point my husband used some little known words, dashed over to collect and post the offending piece of paper, and explained the two-part application to the Home Office.

With the delays from the City and Guilds, the Home Office and the problems with the schedule I began to feel that there was a conspiracy to keep me off the air; however everything's fine now and I am the proud holder of G6HJT.

Oh, don't think I've forgotten the Morse. I began classes as soon as I knew I had passed the RAE, after all the children were picking it up and I needed more speed. Of course I expect this means more "gentle" encouragement from Steve G4LBW—but perhaps it's worth it. ●

From spark to space

Ron HAM

Although a great deal has already been written about the history of radio, I am sure that there are hundreds of stories behind the main facts that have never been published, so, through this column and with your support, I propose to take another look at radio and see if between us, we can find some more of the nuts and bolts of the subject.

National Recognition

Fifty-five years ago in 1927 when wireless or radio, call it what you will, was about 30 years old, the work of Gerald Marcuse made the national news. On September 12 *The Times* wrote: "The first full Empire broadcast from Great Britain took place yesterday morning with permission of the Postmaster General, when Mr. Gerald Marcuse, a pioneer in wireless technique, sent out from his experimental station, 2NM Caterham, a programme designed for reception in Australia," and on November 21 *The Daily Mirror* published a picture of Gerry and his transmitter referring to him as: "A leading wireless amateur" and mentioned that "he has established two-way radio telephonic communication with India, Singapore and South America". It is thanks to the methodical log keeping of the late Miss Barbara Dunn G6YL that these press cuttings have survived the passage of time.

Fig. 1: "Sticker" for 1927 exhibition. Note the early BBC microphone in the centre

Exciting Times

Throughout 1927, Barbara, using a home-brew short-wave receiver, reported on the c.w. transmissions of many early amateurs and listened to such events as the "Tunney-Dempsey" boxing match direct from the USA, the opening of the Beam Wireless Service to India and special programmes from 2FC in Sydney and the Marconi Beam Wireless station near Quebec, as well as plotting the world cruise of HMS *Renown* carrying the Duke and Duchess of York and the RAF troopship *Dorsetshire,* en route to India. These were exciting times and collectors should look out for early amateur log books and QSL cards because these are a mine of contemporary information. Among Barbara Dunn's papers I found a sticker for the National Radio Exhibition at Olympia in 1927, Fig. 1, and an entry in her diary, "A good show, the biggest yet. Good crowd of people, though not uncomfortable".

Named Crystal

One rare item saved by Ken Salmon G2AKM and donated to the Chalk Pits Museum at Amberley, is a round cased, mid-1930s, transmitter crystal made especially for Gerald Marcuse by The Quartz Crystal Co. Ltd., New Malden, Surrey and engraved with its frequency 3728kc and his callsign G2NM.

Memorial by The Sea

Between two of the famous wartime airfields, Tangmere and Thorney Island, on the south coast is the village of Bosham with its Saxon church almost on the sea shore overlooking the bay. Outside is a seat, Fig. 2, dedicated to the late Gerald Marcuse G2NM, past president of the RSGB, founder member of RAOTA and pioneer of Empire broadcasting. In the cemetery, adjacent to the church, is an octagonal stone pillar about 1m high, supporting a sundial, Fig. 3. on which is engraved, "IN MEMORY OF EUGEN GERALD MARCUSE, RADIO PIONEER G2NM".

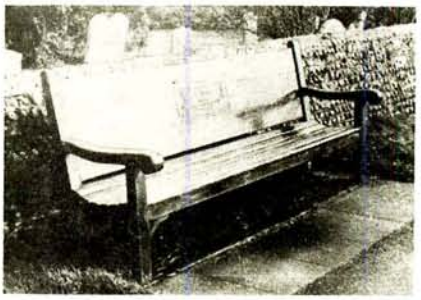


Fig. 2: Memorial seat outside Bosham Church

Around the figures on the dial are three arrows pointing toward his DX achievements, "HAMILTON-RICE EXPEDITION TO RIVER AMAZON, 19.1.25, 5500 miles", "LOS CATOS CALIFORNIA, 5500 miles 1924" and "WELLINGTON NEW ZEALAND, 11700 miles 21.8.25". Two further inscriptions on the dial read, "WAS THE FIRST TO TRANSMIT SHORT-WAVE BROADCAST PROGRAMMES TO THE COMMONWEALTH IN 1927 FROM HIS STATION 2NM IN CATERHAM, SURREY" and "MADE THE FIRST RADIO TELEGRAPH CONTACTS BETWEEN GREAT BRITAIN AND BRAZIL AND CALIFORNIA AND THE RADIO TELEPHONE CONTACT WITH NEW ZEALAND".

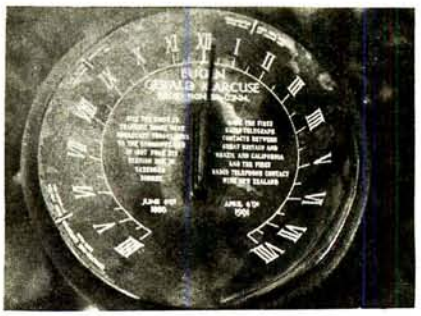


Fig. 3: Memorial sundial to G2NM

On the base of this unique memorial stone at the Holy Trinity Church are the words "TO THE GLORY OF GOD AND IN MEMORY OF A LOVING HUSBAND AND FATHER".

CUT THIS OUT!
(YOU'LL NEED IT ONE DAY!)

a "Western 'Which' Report" on . . . Telescopic Towers

A telescopic self-supporting tower is something to which many of us aspire but cannot afford. If one day, therefore, one can raise the necessary cash for such an investment, it is essential to make the right choice. Basically, the unit must be functional, i.e. do the job for which it was intended; namely to hold your antenna. What you don't want (but will probably get!) is a bent tower and scrap antenna. Here are some guidelines:

YOU MUST

1. Decide what height you require (then check price lists to see if you can afford it!).
2. Decide what antenna you wish to erect.
3. Determine the **HORIZONTAL** wind load of the antenna (from the manufacturers' specification sheet) and at what wind speed this load applies.
4. Look at the tower manufacturers' specification to see whether the tower you require will be strong enough to carry the wind load of the antenna at the stated windspeed. For example a Western 'Penetrator' DX-33 is 28kg headload at 75 m.p.h. windspeed. At 100 m.p.h. this windload increases to 50kg.
   A Westower type 3S/FBP (17.75m high) will take 57kg at 75 m.p.h. The load from a DX-33 at 75 m.p.h. is only 28kg, well within the specification for the tower and is thus safe at 75 m.p.h. A '3S' tower would take 5kg at 100 m.p.h. and so a DX-33 (with 50kg load at 100 m.p.h.) cannot be put on a '3S' tower and survive a 100 m.p.h. wind. A stronger tower is required. A Westower 3HD (Heavy Duty) takes 66kg at 100 m.p.h. and would be suitable.
5. Ask yourself where you live! If that sounds stupid then let us explain. The effect of the wind blowing on your tower may be increased or decreased according to whether you are on a hill, in a valley or an 'average' situation. Decide this and then seek advice if you are in doubt.
6. Look at the quality of the fabrication. Good welds are smooth and flow into parent metal.

DON'T

1. Buy a tower unless you are sure of its specification. There are a number of relevant BRITISH STANDARDS which relate to towers. These are:
   a) British Standard CP3 "Wind Loads"
   b) British Standard BS449 "Engineering Practice"
   c) British Standard BS729 "Galvanising"
   d) British Standard BS4872 "Welding"

FACTS

1. The wind pressure at 50 m.p.h. is 6.4lbs/sq.ft.
   The wind pressure at 100 m.p.h. is 25.6lbs/sq.ft.
   As you see, as you double the windspeed you have 4 times the wind pressure. As the basic windspeed goes up so does the pressure on the tower and so must the overturning moment. We have seen specifications for some towers where the overturning moment goes **DOWN** as the pressure goes up! Not according to B.S. it doesn't!
2. There are three statistical factors known as S1, S2 and S3 in British Standard CP3. In order to provide the consumer with information about the strength of the tower, we at 'Western' assume average values for the "Ground Topography Factor" S1, the "Ground Roughness and Tower Height Factor" S2, and the "Statistical Factor" S3, which relates to the degree of security required and period of time over which security is required. At 'Western' we use S3 as "1" for security over 50 years.

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Western	3S/FBP	80	Western by 110%!	£623.30	Save £63.77 at Western	Western	3HD/FBP	115	Western by 67%!	£764.75	Save £101.95 at Western
Strumech	BP60	38.1		£667.07		Strumech	BP60/HD	69		£866.70	

NOTES: 1. Figures taken at 60 m.p.h. for comparison purposes.
2. Prices include delivery in England/Wales excluding Devon/Cornwall for Western.
Prices include delivery over 100 miles and up to 200 miles for Strumech.
3. Figures at 75 m.p.h. for comparison purposes.

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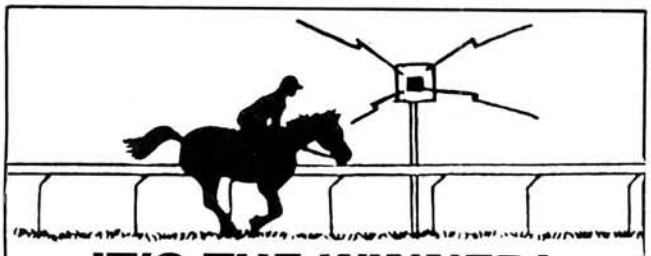

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Have 490 copies of the *Model Engineer* from 1945-55, many copies of *PW, PE* and *WW* from 1951-1966 (too many to count). Garden rotovator made by Shay Engineering, with power take-off point, engine recently overhauled and in good condition. Sheen flame gun X3000 in very good condition. Would exchange for a full coverage communications receiver with digital readout. N. R. Mayes, 9 Noble Avenue, Irthlingborough, Northants, NN9 5XL. Tel. Wellingborough 650121. *N673*

Have Grundig Satellit 1400 h.f. receiver 2 months old, boxed. Would exchange for a v.h.f. mini scanner model MR-1000A + cash adjust, must be in good condition. L. T. Borthwick. Tel. Lilliesleaf 08357 314. *N681*

Have Trio 280S external v.f.o. Would exchange for AT230, Yaesu FC902, Daiwa 1001 auto a.t.u. R. Hamilton G4IAV, 329 North Road, Atherton, Manchester, M29 0RF. *N682*

Have vintage Philips a.c./d.c. mains table radio a.m./f.m. model B3G75U perfect working 1957 model. Would exchange for Roberts table model radio. A. H. Welch. Tel. 01-977 6774. *N683*

Have Eddystone receiver 770R MkII in good condition, 19MHz-165MHz, c.w., a.m., n.b.f.m., f.m. Would exchange for 2m or 70cm hand held RX/TX. P. J. Parker G8CKM Tel. Shawbury 250679. Deliver 100 miles. *N697*

Have FT-202R with S20–23, R0, R5, mic and charger, IC-240. Would exchange for h.f. rig with cash adjustment. B. Mainwaring G4DOV. Tel: 0922 414927. *N.632*

Have free-standing bubble-etching machine with develop, etch, wash, tinning baths. Etch and tinning baths thermostatically heated. Would exchange for s.s.b. 2m transceiver or h.f. transceiver. J.M. Bowers G6BIM, Stanley House, Front Street, High Spen, Tyne & Wear. Tel: Rowlands Gill 4242. *N.700*

Have Yamaha B55 electronic organ. Suit beginner or expert. Value £650. Would exchange for h.f. transceiver plus cash or w.h.y. M.J. Hill, 42 Oaklands Drive, Westone, Northampton. Tel: (0604) 405646. *N.701*

Have Heathkit SW717 short wave receiver plus Praktica SLR camera, flash bracket, electronic flash. All in good condition. Would exchange for a 2m hand-held (e.g. IC-2E), BUK 2S. PO Box 148, Bristol BS9 7HZ. *N.704*

Have Seavoice RT100 Marine v.h.f. radiotelephone as new. Also Stewart Turner double V10 steam engine unused. Would exchange for receiver such as AR88D or HRO. Tel: 0745 570538. *N.716*

Have a Yaesu FRG-7700 as new. Would exchange for a h.f. transceiver (FT-200) and a digital frequency meter. K. Dickens, 26 Knaves Castle Avenue, Brownhills, Walsall, W. Midlands WS8 7PN. *N.717*

Have Zenit-E camera with 135mm telephoto lens, 35mm Beta II enlarger, flashgun, lightmeter etc., all in good condition. Would exchange for 2m hand-held transceiver or w.h.y. N. Beadsworth, 2 Lapwing Way, Clooney Est, Waterside, Londonderry, N. Ireland. *N.718*

Have Prinz Optics Astral telescope, with wooden tripod, as new, 60 x 60mm lens magnification, and astronomy books. Also Tandy Astronaut 5 radio including m.w., f.m., s.w. (4–12MHz), s.w. (12–22MHz) as new. Would exchange for s.w. communications receiver 3–26MHz approx (must have b.f.o.) or a legal f.m. CB transceiver (any number of channels). A. Bunting, 5 Fritchley Close, Chaddesden, Derby. Tel: 672097. *N.732*

Have Sony TC-280 reel to reel. Would exchange for short wave general coverage communications receiver preferably Eddystone type. K.J. Faulkner, 77 Rookfield, Sale, Manchester. Tel: 969 0785. *N.733*

Have Eumig Super 8 and Standard 8 dual silent projector as new, immaculate condition only 5 months old, cost £89. Would exchange for short wave general coverage receiver with b.f.o. W.M. Lawrinson, 21 Ennerdale Road, Mereside, Blackpool, Lancs. *N.740*

Have Icom IC-2E, speaker/mic, mains charger, NiCad pack, battery pack and 10W amplifier ICML1 (new, boxed), 3·2dB portable antenna. Would exchange for h.f. equipment and cash adjustment. Tel: Crowmarsh 695. *N.741*

Have Tektronix 454A twin beam d.c.-150MHz, mint condition. Would exchange for FT-707, IC-730, TS-130S or FT-101ZD. Tel: 031-639 3095. *N.742*

Have motorised 10in power shaper worth £150. Would exchange for 70cm or 2m mobile transceiver or w.h.y. P.L. Denton G6CGF, 42 Trafalgar Road, Wallasey, Merseyside L44 0EB. *N.749*

Have Exacta RTL1000 SLR camera with very comprehensive outfit of lenses, bellows, adaptors, filters, etc. Also Practika super TL2. Would exchange for best sidebander I can get. C.R. Lawrence, 13 St Aubyn Est, Prazean Beeble, Cornwall TR14 0LE. *N.768*

Have Wolfsen 1200 2m receiver v.f.o./crystal tuning (no crystals fitted) hardly used, plus 12V transformer and 2m mag. mount whip. Would exchange for s.w. broadcast band receiver. P. Seaman, 32 The Knoll, Palace Road, Ripon, N. Yorks. Tel: 700565. *N.817*

Have Korg MS-20 synthesiser and Korg SD-200 signal delay, all leads inc. Would exchange for Yaesu FRG-7700 receiver and antenna. G. Bennie, 28 Preston Terrace, Linlithgow, West Lothian, Central Scotland. *N.845*

Have 1961 Ford Popular 100E side valve motor car, good all round condition, recent re-conditioned engine, no MOT (collectors' car). Would exchange for any working h.f. general coverage receiver e.g. FRG-7 or w.h.y. P. Hunter, 70 Knox Rd, Wellingborough, Northants NN8 1JA. *N.846*

Have children's tandem bicycle in as-new condition. Suit age group 8–14. Would exchange for any interesting radio equipment or test gear. Tel: Kidderminster (0562) 3674. *N.847*

Have Texas silent 700 printer with twin high-speed cassettes. Would exchange for good receiver. Barton, Tel. Asthall Leigh 220. *N.868*

Have 2m Search-9 receiver in v.g.c. and a Venner Electronics variable oscillator, 50Hz–1MHz, sine or squarewave output. Would exchange for a h.f. receiver in good condition. J.D. Mendham, 12 Henton Rd, Edwinstowe, Notts. Tel: (0623) 823001. *N.872*

Have Praktica LLC 35mm SLR camera (recently overhauled) 50mm and 135mm lenses, Vivitar 283 flash, extension tubes, Velbon AE-2 tripod. Would exchange for any good general coverage receiver. S. Gore, 162 Spoondell, Dunstable. Tel: (0582) 604958. *N.879*

Have Futaba 6M Radio Control gear complete 1·2m boat with 10c.c. engine 1·5m wingspan Hawker Hurricane with OS61 needs finishing and small fast electric boat complete. Would exchange for FR-101 or TS-130 w.h.y. Tel: (0307) 64619 evenings. *N.880*

Have a *PE* "Ranger" 27MHz CB plus base station. Would exchange for any vintage wireless equipment, books, magazines, etc., or w.h.y. Tel: (0926) 25430 evenings (Leamington Spa). *N.881*

Have Pye Cassette tape recorder (de luxe) new, with built-in mic etc. Pye 4-band radio/cassette recorder, new with built-in mic, counter, etc. Would exchange for communications receiver or split for anything interesting. A. Walton, 40 Rooley Cres, Bradford BD6 1BX. Tel: (0274) 28219. *N.902*

muTek SLNA 144s Switched 144MHz Pre-amplifier

OK I'll admit it, the subject of this review has been lurking in the loft of my home QTH since January—and I'm reluctant to part with it! No I'm not starting to hoard things up there, the location was chosen deliberately to take best advantage of muTek's latest in-line switched 144MHz pre-amplifier.

System Considerations

My normal 144MHz set-up is probably about average, comprising a "straight" IC202S, home-built 30W linear amplifier and 6-element quad antenna, so what improvements can be readily made to the effectiveness of the system?

Thoughts turned to the feeder cable, which is of the "low-loss" UR67 variety and approximately 25m long. Looking up the published attenuation figures for this cable (0·68dB/10m at 100MHz) it became obvious that a significant reduction in the signal to noise ratio was being introduced. A 1dB cable loss at 144MHz would yield 0·891 of the antenna terminal voltage at the receiver's input. If I could reduce this in-built system loss, the effective receiver sensitivity would increase accordingly.

Locating the complete transceiver system at the antenna is not too practical so fitting an r.f. pre-amplifier, effectively the first stage of the receiver, at, or near to, the antenna must be the way to go for improved reception. The subsequent degradation in signal to noise ratio introduced by the feeder would then be very much less apparent.

To allow outgoing r.f. free passage to the antenna requires a low-loss relay system to by-pass the pre-amplifier on transmit, controlled remotely from the transceiver down in the shack. To avoid, as muTek put it, "expensive accidents", the relay control system needs careful design and to this end, the SLNA 144s is provided with both r.f. sensing VOX and direct p.t.t. line alternatives. In the event of a d.c. supply failure to the remote pre-amplifier, the normally energised relays will revert to the "straight through" condition. Should the p.t.t. line control fail the VOX alternative will automatically effect the switching control.

Any components inserted into the receive path will add further noise to the basic signal so to be effective the pre-amplifier stage must have a noise figure which is better than that of the receiver it precedes. In this respect the SLNA 144s features a 3SK88 MOSFET as the active element, which probably has the lowest inherent noise figure of all such available devices. Significant gain is provided by the amplifier to produce an overall system noise figure of under 2dB when used with current 144MHz transceivers.

For normal earth-bound communications this overall noise level is approaching that of the external noise, which is the ultimate limiting factor.

Strong Signals

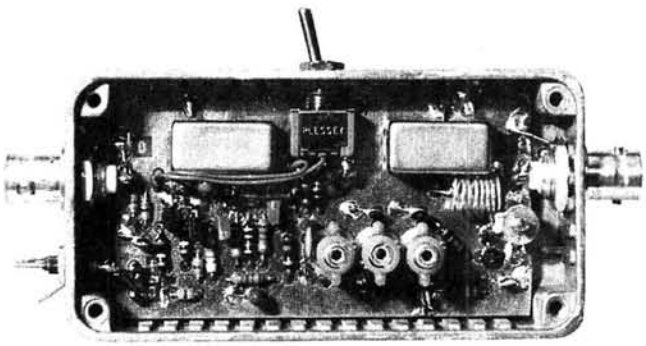
There is a price to be paid for this additional sensitivity and this relates to the reduction in the receiver's tolerance of strong signals. Optimum performance is a compromise between the receiving system noise figure and its strong signal performance.

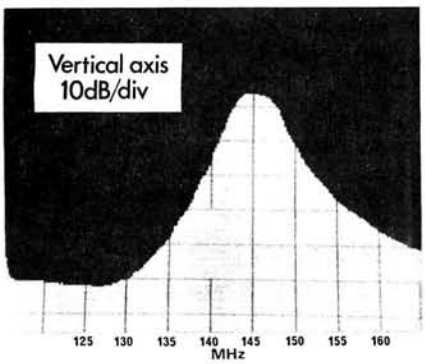
A three-pole Tchebyshev band-pass filter has been included within the SLNA 144s, positioned after the gain stage where its presence does not degrade the input noise figure. The spectrum analyser plot shows the very steep response roll-off above and below the 2MHz wide passband. This filtering action significantly assists the selectivity of the following receiver stages by attenuating the level of all out of band signals.

The pre-amplifier is housed in a 100 x 50 x 25mm diecast aluminium enclosure which is not designed to be weatherproof, so if you decide on the masthead option, additional engineering will be required. Input and output r.f. connectors are 50Ω BNC types with feed-through decoupling capacitors provided for the 12V d.c. supply and p.t.t. control line connections. A miniature toggle switch selects either FAST or HANG relay switching options. The FAST selection is suitable for steady carrier modes such as f.m. and the HANG for s.s.b. where a short time delay is introduced before the pre-amplifier drops back into the receive mode. During operation reports indicated that "chopping" during short speech pauses was minimal when using the r.f. VOX. For permanent installation the hard wired p.t.t. control is recommended, allowing rapid reversion to receive, on release of the p.t.t. switch, and more importantly ensuring that the change over relays have "gone over" before the r.f. arrives.

Internal construction of the SLNA 144s is to a high standard with all components, including the two 100W rated r.f. changeover relays, mounted on a compact double-sided p.c.b. A silicon diode, in series with the supply input, protects against the possibility of incorrect connection.

The manufacturers quoted a typical noise figure of 1·2dB for the pre-amplifier with an associated gain of 15dB, which from our own lab tests we would readily agree with.





The Spectrum Analyser response plot obtained showing the steep roll-off above and below the passband

As I mentioned at the beginning of this review, the pre-amplifier has been in use for several months without any signs of distress. From down here in Dorset the 25W e.r.p. Angus beacon GB3ANG on 145·975MHz and beaming SSE is now audible more often than not. At a distance in excess of 800km I think this gives some indication of the receiving system effectiveness. Switching in the pre-amplifier "lifts" the beacon signal from near the noise level to an average 5/2.

During contest operation the presence of very strong in-band signals has not noticeably affected the receiver's low-level performance, allowing full advantage to be taken from running full power at such times.

Thanks to **muTek Limited, Bradworthy, Holsworthy, Devon EX22 7TU. Tel: 0409 24543,** for the loan of the review sample SLNA 144s which is available at £33·90 inc. VAT + £0·70 carriage.

John M. Fell

Sabtronics 2037A Digital Multimeter Kit

The idea of providing test equipment in kit form so as to reduce the initial purchase price is of interest to the amateur since it can be assumed that he or she will have time to spare assembling the kit. The Sabtronics 2037A d.m.m. in kit form is such a case. The savings over the ready assembled meter amounts to £11.00, obviously a deciding factor.

The meter has a $3\frac{1}{2}$ digit l.c.d. reading up to 1999 maximum with decimal point, negative polarity indication and low battery signal. Selection of the ranges is achieved by side mounted push buttons and the complete instrument can be held in the palm of one hand. It is powered by one 6/F22 (PP3) 9V dry battery.

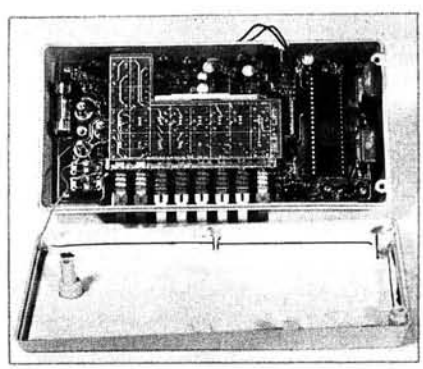
Instructions

The instructions provided with the kit were clear and concise with each step and each component clearly described in a form that was easy for even a novice to follow. A box was provided beside each step so that it could be ticked off as it was completed. A separate sheet was provided giving clear drawings of the different components and details of how certain components were to be mounted. A circuit diagram was also provided but this was reduced to a size where it was getting difficult to read.

The calibration sequences were also given in the instruction manual and these also proved to be simple to follow.

Construction

To test the ease of building the instrument the kit was given to a 15-year-old boy with some previous experience of building very simple electronic projects. He found very little difficulty in successfully putting together a working d.m.m. from the kit, the only problems arising from a very fine track lifting away from the board as a component was inserted. Careful inspection, after the p.c.b. had been fully loaded and soldered, found this and a fine wire link was soldered carefully into place to repair the track. Obviously extra care is needed at each stage of assembly to ensure that this sort of problem does not occur.

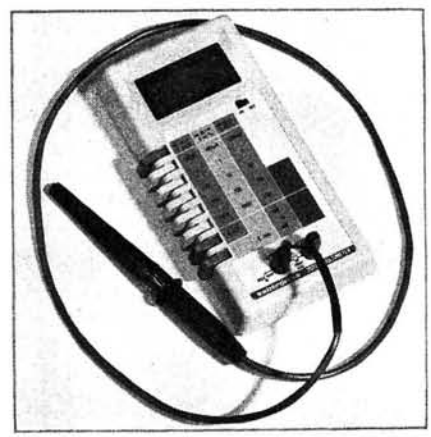


Calibration

The instrument calibrated with no problems and makes a useful addition to the workshop or shack test equipment. An optional touch and hold probe is available and this enables the d.m.m. to hold a reading after the probe has been removed. The instructions warn against holding the same display for longer than 30 minutes. The kit also contained a temperature probe to be used with the special temperature ranges on the 2037A model.

Ranges

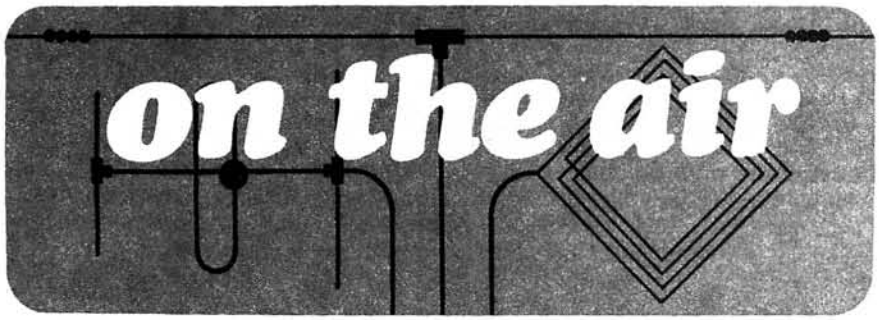
The 2037A measures d.c. volts from 100mV to 1kV with an input impedance of 10MΩ, a.c. volts from 100mV to 1kV with an input impedance of 10MΩ in parallel with 10pF. The resistance ranges cover



100Ω to 10MΩ with the lowest resolution of 0·1Ω on the 100Ω range. The current ranges cover 100μA to 1A a.c. and d.c. and the temperature range covers −55°C to +150°C or the equivalent in Fahrenheit, but not both.

The kit for the Sabtronics Model 2037A d.m.m. costs £56.00 + VAT and is available from **Black Star Ltd., 9A Crown Street, St. Ives, Cambs. PE17 4EB Tel: 0480 62440** who provided the kit for review. The assembled d.m.m. costs £67.00 + VAT and the touch and hold probe costs £13.00 + VAT.

Dick Ganderton



Amateur Bands

by Eric Dowdeswell G4AR

Reports to: Eric Dowdeswell G4AR
Silver Firs, Leatherhead Road,
Ashtead, Surrey KT21 2TW.
Logs by bands in alphabetical order.

Since I am for ever complaining about the cross modulation so prevalent on modern communications receivers (ad nauseum, I can hear the Editor saying!) I feel it is about time that I proposed a possible solution. It is a fact that solid-state devices in the front end of a receiver are very easily overloaded, leading to non-linear operation and weak signals being modulated by strong signals. It is not the fault of the poor things but of the set designers who insist in putting them in positions where they are expected to do a job that they are not designed to do.

The one device that is eminently suitable is the thermionic valve, which is next to impossible to overload in the front end of a receiver. But mention this possibility and everyone bursts into laughter! Look at the number of modern receivers that now sport matching antenna tuning units with the tuned circuits that ought to be in the receiver itself, and used to be before they were "designed" out. Wideband front ends are the "in thing" depriving the operator of yet another control and introducing the worst possible solution to front-end problems.

Now we see r.f. attenuators on the front panel, a tacit admission of the problem of overloading, something very seldom seen on the old valved receivers, as they were quite unnecessary. So why not divert just a little of the vast sums of money spent on developing solid-state devices towards producing a modern version of the old valve? Of course, I don't advocate valves with the old-fashioned type heaters, dissipating several watts at the anode, but what about using modern micro-technology, as is employed in manufacturing integrated circuits, to produce a valve in the shape of an i.c. with similar leadouts? The same i.c. holders could be used and heater and anode dissipation would be measured in milliwatts, disposing once and for all the shouts of "excessive heat" from the anti-valve brigade.

What about the h.t. required? Well, the conventional 250V for the old valves is not really necessary, and I have used valves like the double triode 12AT7 with the same 12V d.c. supply for the heaters and the anodes, with excellent results. Certainly the "micro-valve" I am proposing could run off the low voltage d.c. supplies common on receivers today.

It is amazing how many readers write to say that they are experiencing broadcast stations coming up on the amateur bands wishing that "someone" would do something about it. Seldom do they realise that it is an inherent fault of the receiver itself. Others, reading that an outdoor wire ought to be better than a small telescopic antenna on the receiver, try this only to find, once again, amateur signals being swamped by BC stations and then decry the wire antenna! Utter nonsense of course as, in very general terms, the longer the wire the better the signals. The front end of the receiver is being grossly overloaded by the BC signals on adjacent broadcast bands, or, in some cases the signal is on the image frequency which is not being rejected by the front-end tuned circuits.

The proposed microvalve would have high mutual conductance, which infers high gain, very low inter-electrode capacitances and be altogether much better than its conventional predecessor.

Here and There

Dave Shirley of Hastings is ex-BRS46900 and now G4NVQ which he promptly dubbed "Not Very Quick"! from the time it took to come through. Nice call, that, from the c.w. aspect. I always run a call over in my mind to see whether I like it or not! Some run off the key very nicely and others are just plain awkward. Wonder if other people regard calls like that? It is worth remembering that one can book a call (perhaps one's initials) by asking the HO, but it will not be issued out of sequence so it might mean a wait. Anyway, back to Dave and our congrats and best wishes for a happy time in amateur radio. Reports from readers will be welcomed on any h.f. band.

Matthew Phillips BRS47458, at present at the University of Keele, wants to get something smaller than his HRO for that QTH and is thinking of an FRG-7 plus better i.f. filter and a digital readout and wanted my views on the set-up. Well, Matthew did mention that he intends to take the RAE in December when he will promptly need some 144MHz gear or even some h.f. equipment so, unless money is no object, it would seem imprudent to buy receiving gear now which he would not want once he's on the air.

Bob Gibson (Wadhurst, E.Sx) is not only very angry that he is still waiting after 10 weeks for his licence but more so because the Home Office "cashed" his cheque within three days of receiving it! Well, OM, see if a note of apology comes with the ticket in due course. If not then write and ask for one. I imagine the cheque was cashed in all good faith before the trouble with the new schedule arose which delayed the despatching of licences.

H. N. Kirk G3JDK (Rotherham) draws my attention to a net operating around 6·65MHz, generally with l.s.b., and seeming to be a cross between amateur radio and CB! Well, I am pretty sure this is the same net that started up after the last war about the same frequency using the then prolific surplus No. 19 transceiver intended for general use in the Army. That would have been with the old style a.m. Although the odd pirate was picked up by the Post Office, as it was then, I don't remember any serious steps being taken to stop them. The present net would seem to be the result but using more modern gear of course.

J. Gregory G8HZP is PRO of the Cannock Chase RS and tells me that amateur radio is being put to good use by member G3PIN who QSOs DF6YO daily for the purpose of learning the other's language, being relayed at both ends on v.h.f. for local amateurs. Their towns of Cannock and Datteln are "twins".

DX Notes

Reading *PW* has got **David Freeborough,** aged 14, bitten by the bug so last Christmas he was lucky enough to acquire a Panasonic RF3100 which he is using with its whip antenna for the moment. In Sandbach, Cheshire, David copied HC1JQ, KH6MD, VP9CV and 5N9GD on 14MHz(20m) while 21MHz(15m) threw up A71AD, HP1AJ, TR8DX, VC3ICR (Canada) and VP9KX. Also of note on 28MHz(10m) were YN3OA and ZS1FA.

From Callington in Cornwall **V. Doidge** says he is a keen s.w.l. but only recently has had time to do anything about it. But an FRG-7700 and a long wire were locked on to the 14MHz band to find A71AA, C31YG, J6LPD, KG4W, SU1ER, VP5DD, VQ9CW on Farquar Is, YA8KGF, 5N9GD, 6Y5MS and 8P6BT, which is not bad for a start!

A BC348 and long wire were concentrated on 14MHz by **Stephen Pearson** of Arundel, W.Sx to find JW0P, KG6RM, C53AP, VP5DT, J8KW and a couple of unexpected SPs in the form of SP51X-I/OE and SP2YK/MM. He queries 4N, which is a contest type call used by the YUs. From Ramsgate, Kent, **Archie Magrath** admits to still listening on the BC bands. Surely the amateur bands couldn't have been as bad as all that! He, too, has a long wire antenna, plus Trio R-1000 and a.t.u. to log 7Q7LW, ZP5PX and 9X5SL on 28MHz (10m) s.s.b.,

HV3SJ, VU2BBJ, VP8ANT, 9M2GZ and HI3ENR on 21MHz with only C53AP of note on 14MHz.

In Sheffield **Brian Patchett** runs his EC10 and Grundig 1400 Satellit receivers with their telescopic rod antennas. A 35 metre long wire on the EC10 brought disappointing results due to cross mod from BC stations when on 14MHz. Not entirely unexpected, I suppose. So, on 14MHz with the 1400 Brian found CP6EL, TN8AN, TR8DX, VP9CP, V2AO on Antigua, 6W8DB and 8R1RBF with 21MHz bringing in DU1DBT, HS1KO, VP2MDG (QSL W6FDG), VP2MPC, VU2GI, 5H3JR, and 8P6OL who wants cards via VE3AMJ. With the long wire on the EC10 Brian got VC1YX, a new call for Canada. A pleasant surprise awaited **Bob Gibson** of Wadhurst (E.Sx) on 28MHz finding his first 9V1 in 9V1VV where he also caught 9X5SL, C6ANU, HC1BP, J28Z, P29NSF, with VS6CT coming up on 21MHz. All this with an FRG-7 and fan dipole. Good to hear once again from **Dennis Sheppard** (Earl Shilton, Leics) who used to rule the RTTY roost in this feature. It's s.s.b. only at the moment while sorting out the terminal unit, with Drake receiver, 5/8-wave vertical for 28MHz and a 50 metre long wire 5 metres high, "to avoid upsetting the neighbours". So, to 28MHz and A91ABW, AP2ZR, DF2MH/XZ, TJ1CK, ZD9BV, 3B8CF, 4K1A, 5N6KNC and 6W8HL. For 21MHz it's DU9AD, TU1YE, 4D1EFZ and 9M2OK.

D. Coggins in Knutsford, Cheshire, reckons the bands have been pretty patchy of late but is happy to give the local birds a ride on his rotary 2-element 28MHz beam! He mentions VR6TC on Pitcairn as being around 14·178MHz at 0700Z most mornings, on his FRG-7700, matching a.t.u. and the beam for 28 where he trapped A22AA in Botswana, DL2VK/ST2 with QSLs to DF9FM, H5AHF in Bophuthatswana, S83W on the Seychelles, TL8CK (QSL F6EWM), ZD8JT, Z21FA, 5H3BH and 5N6ATT, plus 7P8BX in Lesotho. Apart from VR6TC only KH6WU was considered of interest on 14MHz. Catches on 7MHz(40m) were PJ9EE and VK7AZ.

From Thurnscoe, near Rotherham, **John Gwynn** reports of his activities on 14MHz s.s.b. with his Unica receiver and 45 metre-long wire in the form of a "V" with tuned feeders, like KH6OR who has DJ0FX as his Euro QSL manager, 5Z4RT, YB2BJM, P29FV, 5N9GD, M1D and 9M8PW.

Jim Dunnett of Prestatyn, Clwyd, has been taking time off to swot for the May RAE and the code test so no RTTY reports this month but he did manage to cover all bands from 1·8 to 28MHz including 10MHz. The AR88 and SRX-30 plus a.t.u. brought in OJ0MR and UA9OM on 3·5MHz, 4K1A on 7MHz, DL2GG/YV5 on 10MHz, FP8CW, FY7CA, G5RV/PY6. KL7MF, UM8PAC, VP8ANT and 4S7WP for 14MHz, all on c.w. On 14MHz s.s.b. there were C53CG, JA0AXV, TU2JB, VP2MDG, 4X4MS/5N9 and 6Y5MS. Back to c.w., on 21MHz this time for CM7OR, FY7BD, HS1ANQ, J2OZ, J6LZA, KH6CF, SV5SW, VQ9VR, VP9DR, YB3MD, and 3X5DX, while s.s.b. logged included HS1AMH, VP2DMG, VS5DD and 9K2BE. On 28MHz c.w. produced FR0GGL, H5AFU, J6LZA, TR8WR, VQ9CM, VS6BZ, XT2AW, 4K1A and 8R1J while s.s.b. catches were J2OZ, K6GXO/V2A, TN8AJ, VQ9JB, VP9AH, 5Z4RT and 8P6OL.

A brief note from **Bernard Hughes** BRS25901 of Worcester on XZ9A who seems to be around 21·161MHz in the afternoons, so a card plus three IRCs to JA8IXM, Masaaki Ito, PO Box 48, Tomakomai City, Hokkaido 053-91, Japan, brought a reply in about three weeks. Bernard also comments on AM01BKC, special World Cup station in Spain.

More news from **Ean Retief** ZS6UD on increased activity around Gough Is and Tristan da Cunha. ZD9BU/MM is very busy, mainly on 21 and 14MHz, from the "Tristania Two". Money that was to be used to finance the DX-pedition to ZD7HH is now purchasing a station for the community on Tristan, also available for any visiting amateur under his own call. First user is Andy ZD9BV, a permanent resident, who wants cards through W4FRU or ZS2DK. Then there is Peter Cook ZD9BW due to start up around the end of July until early '83 with cards to Ean whose QTH is 13 Knoppiesdoorn Avenue, 0380 Thabazimbi, South Africa.

Ean confirms that the republic of Venda, formerly T4, is now V9A. Finally, by the end of the year ZS amateurs who have held the unrestricted licence for three years will be allowed 300W d.c. input or 1·2kW p.e.p. output.

With the Clubs

This time of the year can be the busiest for many clubs what with the various field days and mobile rallies all over the place. The time when the enthusiastic amateur can take his family out for the day and make some small recompense for all the hours he has deserted them when in the shack working the DX. At field days there is a job for every member of the family, including the OM, with everyone contributing to the final result.

Cheshunt & District ARC Every Wednesday at 8pm, Church Room, Church Lane, Wormley, near Cheshunt, Herts with a full programme until November. July 14 is surplus sale night with a day out on the 28th operating 144MHz from Baas Hill Common, Broxbourne, a fairly frequent event it seems. More from Bob Gray G6CNV, 2 Sacombe Green Road, Sacombe, Ware, Herts or Dane End 254.

Radio Society of Harrow at the Roxeth Room, Harrow Arts Centre, High Road, Harrow Weald, Middx at 8pm will do. Club mag *QZZ* says membership now around 117 necessitating a membership directory to keep in touch. A certain amount of anxiety is felt for member Richard Parker G4AWP who was operating as VP8ALD in you know where. Another reminder from *QZZ* on security. Don't tell anyone over the air that "G6XXX is away for a few days", especially on v.h.f., as it is inviting trouble. If a new call it may not be in the book but why take a chance? Want to know more? Try Chris Friel G4AUF on 01-868 5002 weekends and pm.

Conwy Valley ARC Second Thursdays at 7.45pm at Green Lawns Hotel, Bay View Road, Colwyn Bay, with advance notice of a special gathering at that spot on Sunday Aug 22 at 1445 when Lowe Electronics will be showing a collection of Trio gear and answering questions so everyone most welcome especially any amateurs who may be on holiday in the area at that time. Hon sec is Norman Wright GW4KGI, Eleven, Bryn Derwen, Abergele or ring 823674.

Radio Club of Thanet Every other Friday it seems with a series of mini-talks on July 2 with RTTY the subject on the 16th and RAYNET on the 30th, all at Birchington Village Centre at 8pm, preceded by code classes at 7.30. It's Ian Gane G4NEF, 17 Penshurst Road, Ramsgate, Kent.

Stevenage & District ARS First and third Thursdays at the Staff Canteen, Brit Aerospace, Site B, Argyle Way, Stevenage, Herts at 8pm. Activities include RAE and Morse classes, and DF hunts outside on occasions. July 15 will see the club station on the air but a special date is August 19 devoted to a beginner's night at which newcomers will be especially welcome. More from Les Mather G8OKI, 63 Woodhall Lane, Welwyn Garden City, Herts.

Aylesbury Vale RS A reminder of the new club QTH at Stone Village Hall, two miles west of Aylesbury on the A418, but it's a visit to a "radio communications establishment" on Tuesday July 13 with a junk sale on August 10. M. J. Marsden G8BQH, Hunters Moon, Buckingham Road, Hardwick, Aylesbury, Bucks will tell you more by mail or 'phone on (0296) 641 783.

Verulam ARC Informal meetings on the second Tuesday at RAFA HQ, New Kent Road, St Albans, Herts with main gatherings at 7.30 at the Charles Morris Memorial Hall, Tyttenhanger Green, near St Albans on fourth Tuesdays. Much interest ought to be aroused by lecture on July 27 on Repeater working on 1296MHz. Peter Hildebrand G3VJO, Hobbits, 31 Crouch Hall Gardens, Redbourn, St Albans, Herts.

Farnborough & District RS A postmortem on the VHF NFD occupies July 14, followed by a chat on p.c.b. manufacture by G6CMG on July 28 so you can see it is the second and fourth Wed at 7.30 at the Railway Enthusiasts Club, Access Road, off Hawley Lane, near M3 bridge, Farnborough. Don't know QTH of PRO C. J. French G8ZAJ so it's Ivor Ireland G4BJQ, 118 Mytchett

Road, Mytchett, near Camberley, Surrey or Farnborough 543036.

Aberdeen ARS New clubrooms at 35 Thistle Lane, A'deen on Fridays at 7.30. Can't tell you anything about the July meeting but do make a note of Sept 11 when the Society sponsors the Scottish Amateur Radio Convention and Exhibition at Aberdeen University. Trade stands, lectures and evening dinner will make for a busy day for one and all. More from F. Baxter GM3VEY, 24 Hillview Crescent, A'deen or 868263.

Swale ARC Sittingbourne Town Hall second and fourth Mondays at 7.30 with G4EVY holding the floor on July 12, subject unknown. Speakers are hard to come by apparently so if you are inclined to help drop a line to Brian Hancock, now sporting call G4NPM, at Leahurst, Augustine Road, Minster, Sheerness, Kent, which is Minster 873147.

Flight Refuelling ARS Yes, a newly formed club meeting Sunday evenings at 7.30 in the Sports and Social Club, Merley, Wimborne, Dorset. VHF and h.f. stations are already active, plus talks, demonstrations, constructional projects not to mention code and RAE tuition. Soon got airborne, didn't they? Seems Elaine G4LFM of *PW* has already been along to show the lads how to do it! Sec is Mike Owen G8VFY, Hamden, 3 Canford View Drive, Canford Bottom, Wimborne, Dorset (0202) 882271.

Acton, Brentford & Chiswick ARC Subject of discussion on July 20, that's a Tuesday, will be ferrite-cored balun transformers started off by G3IGM, at the Chiswick Town Hall, High Road, Chiswick, London W4, starting at 7.30. A note to W. G. Dyer G3GEH, 188 Gunnersbury, Acton, London W3 will get more info.

Mid-Sussex ARS at the Marle Place Adult Education Centre, Leylands Road, Burgess Hill, W.Sx at 7.30, first and third Thursdays with latest info on club events from prog sec Bob Hodge G4MMI, Corner House, Manor Gardens, Hurstpierpoint, Hassocks, also H'p'point 833559. The club mourns the loss of Nick Carter G3BPV taken ill while running the club's RAE class.

Ipswich RC Usual excellent magazine *QUA* tells members how to make a NiCad battery charger, a simple intercom, f.e.t. voltmeter, how to solder, and a 6-element indoor beam for 144MHz. Enough? Then there is a 2-station headset unit. So get along on second and last Wednesdays at 8pm to the Rose and Crown, 77 Norwich Road, Ipswich. There is even a map showing how to get to the clubroom without (without?) going through the public bars! Other Wednesdays are often devoted to Morse classes but check first. July 11 sees club organising a demo station at the Woodbridge Regatta but regular meeting on July 14 is 144MHz DF hunt, ending at the Rose and Crown, very sensibly. Do contact Jack Tootill G4IFF, 76 Fircroft Road, Ipswich, also (0473) 44047.

Thames Valley ARTS First Tuesday at Thames Ditton Library Meeting Room, Watts Road, Giggshill, Thames Ditton, Surrey which means I must tell you that the August meeting on the 3rd is to be a Ladies Night so just for once get out the bib and tucker chaps and give them a good time. A good time also to get along to the club if you are a potential member. More from Julian Axe G4EHN, 65 Ridgway Place, Wimbledon, London SW19 which is 01-946 5669.

Derwentside ARC Very brief info that it meets every Monday at the RAFA Club, Sherburn Terrace, Consett, Co Durham with a warm welcome awaiting new or potential members. Skeds on h.f. or v.h.f. for Monday nights would be appreciated. So says P. Howes G8WEJ, 26 Hadrians Way, Ebchester, Co. Durham.

Chesham & District ARS has been hard at work for the last nine months on its own extensive premises but now threatens to start entering contests, exhibitions and the like as it used to do. More from J. Alldridge BRS49181, 15 Whichcote Gardens, Chesham, Bucks, or Chesham 786935.

Wakefield & District RS "Alternate Tuesdays" which means July 13 with talk and demo on computer graphics by G4BLT and July 27 for a car treasure hunt, starting from the club at Holmfield House, Denby Dale Road, Wakefield at 7.30pm. Normal meetings start at 8pm. Members services include Morse tutor hire, 144MHz portable beam hire, magazine circulation and component ordering. Our little notes in *PW* have already elicited quite a few enquiries it seems. So ring Rick Sterry G4BLT on W'field 255515.

West Kent ARS Has final meeting before the summer on July 9 when it is a junk sale, at the Adult Education Centre, Monson Road, Tunbridge Wells, Kent, but all is not lost as informal meetings take place at the Drill Hall, Victoria Road, TW, fortnightly starting Tuesday June 29. Brian Castle G4DYF has succeeded in losing the job of secretary but continues to arrange the programme for the club. He can be found at 6 Pinewood Avenue, Sevenoaks, Kent or (0732) 456708 or at the office on 01-739 3464 ext 565.

Worthing & District ARC Tuesdays 8pm, Pond Lane Amenity Centre, Worthing, Sx. Fine club mag *Ragchew* says July 6 is VHF Field Day postmortem time with general questions to follow, while the 13th has G4KIT talking on his 144MHz ZL Special, followed by a club quiz on the 20th. G4HSY is due to hold forth on the 27th but on what I know not. Activities are numerous like slow Morse on 144MHz, morse proficiency award, Worthing Club Award, Friday night net on 3·5MHz, 21MHz club contest and a 7MHz receiving cup. That ought to keep 'em all busy. Oh, yes there is an extensive club library, too. To savour these delights contact Stan Williams G3LQI, 58 Grinstead Lane, Lancing, W.Sx or via Lancing 4017.

Braintree ARC Showing off its new, elegant club magazine *BARSCOM*, with much activity like discos, picnics, construction contest and trips to rallies. First and third Mondays at the Braintree Community Centre, Victoria Street, Braintree which is next to the bus station. First Monday is designated informal, at 8pm, with lectures aimed at junior members starting half an hour earlier. Interested? Then contact Norma Willicombe, 355 Cressing Road, Braintree, Essex.

University of Kent at Canterbury RC Tuesday with natter-nites, foxhunts and contest operating with all-band operation including 144MHz from a site on the highest hill in East Kent. Contact is Steve Smith G4LMX, Darwin College, University, Canterbury, Kent.

Mid-Cheshire ARS Now has new meeting place, Cotebrook Village Hall, Sadlers Lane, Cotebrook, near Tarporley, every Wednesday at 7.30. It's just off the A49 apparently, with talk-in on 145·200MHz. More on latest events from Rick Dodd G8PNL, 7 Thames Place, Winsford, Cheshire or save time with W'ford 57766.

Hastings Electronics & RC Second, fourth and fifth Wednesdays are micro nights with main gatherings on the third, all at West Hill Community Centre. July 21 will deal with antennas and s.w.r.s. Also a reminder of the Sussex Mobile Rally on Sunday July 18. Try George North G2LL, 7 Fontwell Avenue, Little Common, Bexhill-on-Sea, also Cooden 4645.

Edgware & District RS Slow Morse at meetings and on the air from G3ASR are two of the regular features of the club's activities plus a net on Top Band. Otherwise it's meetings on second and fourth Thursdays at 8pm at 145 Orange Hill Road, Burnt Oak, Edgware, Middx. For details of forthcoming events contact Howard Drury G4HMD, 39 Wemborough Road, Stanmore, Middx, also 01-952 6462.

South Manchester RC First mention of this group that meets informally on Monday pm and formally on Fridays, around 8pm, at Sale Moor Community Centre, Norris Road, Sale. New club mag is *"42"* and if I were a follower of *The Hitchhiker's Guide to the Galaxy* it seems I would understand the significance of "42"! On July 9 Tim Winter G4AOK talks on receiver specs and how to understand them and the problems such as intermodulation distortion, all demonstrated on an FRG-7! So it's Dave Holland G3WFT, 32 Woodville Drive, Sale or 061-973 1837.

Wirral & District ARC Quarterly newsletter *Airwaves* says Lowe Electronics will be demonstrating the range of Trio gear on July 14 with the 21st devoted to the annual barbeque, but check up as this was a provisional date. Not sure that I should tell you about the D & W dates! That's "drinking and waffling" an informal gathering of interested members at local pubs, like the Lighthouse at Wallasey Village on July 7. They probably get more business done there than at the proper meetings! Normally it is the second and fourth Wednesdays at 8pm at the Dining Room, on the

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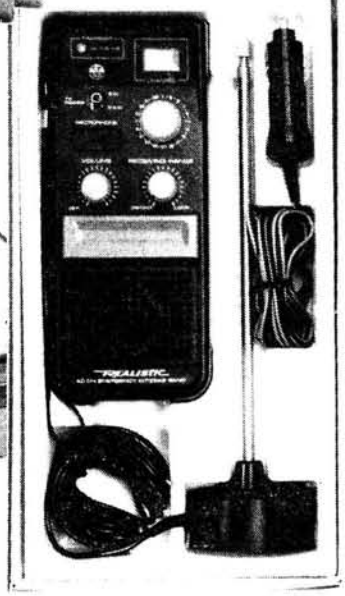

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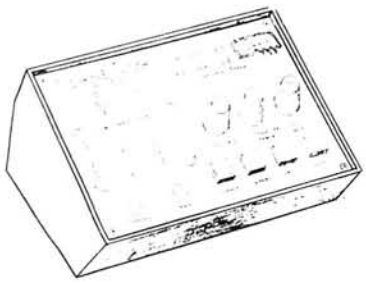

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first floor of the West Kirby Concourse Sports Centre, but holidays are intervening as from July 14 meeting. Secretary is Gerry Scott, 45 Stringhey Road, Wallasey, Merseyside otherwise 051-630 1393 at home or 051-229 3561 at the salt mine.

South Dorset RS Secretary Richard Cridland G3ZGP of 13 Clarendon Avenue, Redlands, Weymouth, Dorset, says the club meets on the first Tuesday at 8pm in the Civilian Mess, Army Bridging Camp, Camp Road, Wyke Regis, Weymouth. And that's all I know but you can ring on (0325) 812893 if you like.

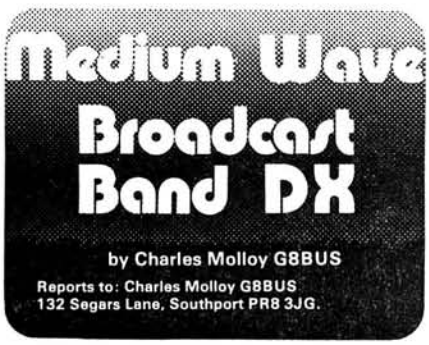
North Wakefield RC Not a lot to convey except that the club gathers at Carr Gate Working Men's Club on Thursdays at 7.45pm. Up-to-date info on events from Neil Horne G8WWE, 81 Derham Grove, Merley, near Leeds. Club call, just received, is G4NOK so those taking part in the code classes will be able to hear how it's really done on the air.

Cheltenham ARA Had to get my calendar out to find that the club meets on the first Thursdays and third Fridays of the month, but as July 1 will have passed by the time this issue is out I can only tell you of the computer natter night on July 16, being repeated because of the success of a similar event last year. I might as well mention now August 5 when G3GWW tells of a fresh approach to antennas. *PW* could be interested in an article about that, not to mention myself. Ah, yes, meetings at the Old Bakery, Chester Walk, Clarence Street, Cheltenham, Glos., but off the record the committee would like a change of venue in order to expand the club's activities. The only contact address I can find in the *CARA News* is A. J. Hope G4INL, 34 Penrith Road, Cheltenham who appears to be the treasurer.

Copeland ARC The Market Hall, Egremont, West Cumbria is the meeting place on the first and third Wednesdays at 7.30pm. Everyone welcome whatever their taste in amateur radio. Bill Duddle G4EDV, 28 Rannerdale Drive, Whitehaven, Cumbria is waiting to hear from enthusiasts, or try W'haven 3548.

Norfolk ARC Meetings at 7.45 every Wednesday at the Crome Centre, Telegraph Lane East, Norwich, July 7 being informal-cum-code classes, July 14 devoted to super-regen receivers by G8MJQ, July 21 informal again, and 28th a briefing before the club's foxhunt. QSO P. Gunther G8XBT, 6 Malvern Road, Norwich or N'wich 610247.

Will all those club secretaries, and other officials, who send handwritten information to me PLEASE ensure that names and addresses, and particularly callsigns, are written clearly, and that club newsletters, magazines, etc., give clearly the name address, at least, of a club contact to whom potential members can write or telephone. Happy holidays to one and all.



Long distance reception on the medium waves is only possible when the path between the transmitter and receiver, or the greater part of it, is in darkness. Last month we tried to predict what reception would be like, a few hours before darkness actually occurred. We did this either by means of pointers, which are stations nearer to us but on the same track as our DX which fade in earlier, or by means of the ionospheric data broadcast by WWV. Predict is probably the wrong word, for all we are doing is finding out what conditions are like at a particular time and hoping there will be no change over a period of a few hours, say from sunset until sunrise the following morning. There are two methods of prediction which really do forecast future events so we will now have a look at them.

11-year Sunspot Cycle

We depend upon the ionosphere which surrounds the earth, for long-distance radio reception. In turn, the ionosphere depends on radiation from the sun to maintain it, so if we can find a way of observing solar activity then we can check indirectly the state of the ionosphere. One way of doing this is to observe the number of sunspots visible on the face of the sun. Do **NOT** be tempted to do this for yourself for if you look at the sun through binoculars or a telescope you will be **instantly and permanently blinded.**

The number of visible sunspots follows a cycle whose average duration is eleven years, going from a minimum to a maximum and back again in this period. At maximum, reception is good on h.f. bands and poor on l.f. bands, while at sunspot minimum the position is reversed. At the moment we are moving towards a minimum which is expected in 1986. When it comes, medium wave reception will be at its peak while the 26MHz band (11m) will probably not be in use. We can look forward to improved conditions on the medium waves, especially to North America, starting this winter, if the predictions are correct.

27-day Cycle

The sun takes 25 days to rotate on its axis. During that period the earth will have moved some distance along its orbit so it takes another two days of solar rotation before a sunspot or other solar feature catches up with and faces the earth again. This is the 27-day synodic period that is of interest to us. A fadeout or ionospheric storm may occur again 27 days later provided of course that the event which caused the disturbance is still in existence. If it has disappeared then there will not be a recurrence 27 days later but many do last for a couple of 27-day periods.

The 27-day period also applies to occasions when reception is good. A featureless part of the sun will be facing the earth again 27 days later provided nothing else has happened in the meantime. Predictions of the return of good reception are probably more reliable at times when the sun is quiet than when it is active. It is interesting to go over the "A Index" daily figures published by some DX clubs to see if there is a 27-day relationship either on the low or the high values.

Loops and Portable Receivers

Regular readers will know that it is not possible to use a medium-wave loop antenna with a receiver that has an internal antenna of its own, usually a ferrite rod. If you try to null out a station with the loop then the receiver will still pick up that station via its own antenna and the directional effect of the loop is masked. This rules out portables and a number of table/communications receivers as well, so if you are interested in medium wave DXing make sure you get a receiver that does not have its own antenna for use on this band. In reply to **Karl Miosga** of Durban RSA. Neither of your two receivers is suitable for use with a medium wave loop.

The usual method of trying to overcome this problem is to mount the receiver, if it is small enough, on a shelf attached to the centre of the loop. The receiver is positioned so that the null from its internal antenna lies in the same direction as the null of the loop. Receiver and loop are rotated together. There is no direct connection between loop and receiver, coupling between them being by induction.

Reader **John Ratcliffe** who lives in Southport, Australia, approaches the problem in a different way. If the ferrite rod is placed in a vertical position then its pick-up should be zero. Turn the receiver on end and you may find a position where nothing at all is heard and if so, you can now connect a loop to it provided there are appropriate A and E inputs to the receiver. If not, then you will have to wind a coupling winding of about 10 turns round the ferrite rod. Problems may arise with some receivers if the internal wiring from the ferrite rod acts as an antenna but I have up-ended my own portable and can easily find a position where I can suppress my local stations, so it does work.

Portable Loop

Reader **David Hyams** has to split his DXing between his home in London and university in Manchester. He has built a new m.w. loop out of four 506mm lengths of "L" cross-section aluminium, Fig. 1. Each section is sawn back for 18mm at one end and bent back as shown. The four pieces are put together by drilling a hole at the opposite end of each and screwing the pieces together to form an "X".

By shaping the section as shown, it is possible to close-wind 8 turns which form a winding of 787mm side. The winding helps to keep the frame rigid. There is a single-turn coupling winding and the tuning range is 530 to 1200kHz so that a switch must be used to tap down one turn in order to extend the h.f. end of the range.

"I built the loop in London, then took it apart, putting all the pieces in a plastic bag which fitted easily in a suitcase (including spanner, wire and capacitor). The antenna was reconstructed in much less than half an hour."

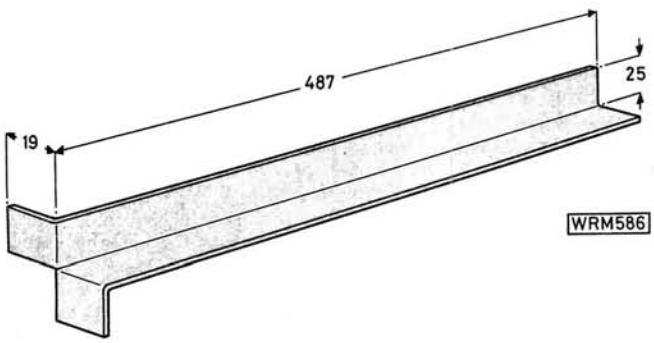


Fig. 1

Spain

Local radio is becoming well established in the UK and in fact it is still expanding but is a relatively new phenomena which complements the high-power national network of the BBC. In Spain, broadcasting developed along these lines from the earliest days. There is a national network of high-power stations run by Radio Nacional Espana which is to be found at the low frequency end of the band, presumably greater range is obtained on the lower frequencies.

Three chains of low-power local stations, the majority having a power of only 2kW, extend across the country. They are allocated callsigns but unlike stations in the USA, these are used only infrequently, usually at the beginning and end of a day's transmission. Station names begin with Radio Popular—and have callsigns with the prefix EAK or, Radio Juventi—with EFJ or, La Voz de—with EFE or simply Radio—with EAJ. There are well over 100 local radio outlets on the medium waves in Spain many of which can be picked up by the DXer in the UK. Listen on 1107, 1134, 1224, 1314, 1395, 1475, 1584 and 1602kHz and use a loop to null-out interference from broadcasters in other parts of Europe. These nearly always lie in a different direction to Spain. Sign-off time, from midnight to 0100UTC is an interesting period. As one station closes down it is replaced by a weaker one until that too goes off and a third becomes dominant. Interesting catches can be made if you persevere.

If you are going on holiday to Spain, don't forget to take a portable radio with you. You can hear several local radio stations from almost any location and if you make use of the directional properties of the internal antenna, by rotating the whole receiver, you should be able to hear a few more on shared frequencies. If you visit the Costa del Sol listen for two broadcasts that come from Spanish enclaves on the north coast of Morocco. Radio Ceuta (pronounced Thayootah) is currently on 990kHz and lies directly south of Gibraltar, while Melilla on 1485kHz is further to the east. From the far south of Spain it should be possible to pick up Gibraltar. Listen on 1458kHz for the Gibraltar Broadcasting Corporation which has programmes in Spanish as well as in English.

Short Wave Broadcast Bands

by Charles Molloy G8BUS

Reports: as for medium wave DX, but please keep separate.

"I heard Radio Japan's news in English—and they stated that the previous transmission on 11·8MHz had been relayed to Europe via Portugal," writes **Tom Mason** of Lewes in Sussex. Tom goes on to ask if many other stations relay their programmes via other countries. The quick answer is that some of the major broadcasters do, either on an exchange basis, by rented time or via overseas relay stations of their own.

Relays and Relay Stations

The evening programme from Radio Canada International at 1900UTC can be heard on four frequencies. The three highest are used by transmitters in Moncton, New Brunswick in Canada but the lowest, which is 5·995MHz, is located at Daventry in the UK and is on loan from the BBC for this broadcast. In return, RCI transmitters at Moncton are "borrowed" by the BBC for the use of their North American service. This is an example of a reciprocal arrangement where two broadcasters make use of each others transmitters to obtain better coverage of the target area.

Radio Japan rents time from the transmitter at Sines in Portugal so that they can put a good signal into Europe at the peak listening period which is in the evening. The best time for direct reception from Japan is in the morning, but how many people want to listen to their programmes at this time of day?

In addition to its reciprocal arrangement with Canada, the BBC has its own relay stations on Ascension Island, Cyprus, Lesotho, Oman, Singapore and Antigua in the West Indies. Deutsche Welle has its relay stations in Rwanda, Montserrat and Malta, Radio Netherlands in Bonaire and Madagascar while the Voice of America relays from about a dozen overseas locations.

Why do broadcasters use relay stations? The main reason is to try to improve reception in the areas in which they are interested. A single reflection from the ionosphere will suffer less degradation in quality than multi-hop reflection but this of course limits reception to a distance of about 4000km from the transmitting station. So the idea is to use a satellite link to send the programme to a transmitter located within single-hop distance of the location you are trying to reach. This can be done at peak listening times, even if the direct path is not open at that time of day.

Occasionally, there are surprises when listening to relay stations. If you want to hear Media Network from Radio Netherlands on a Thursday then the best

A QSL card from the Radio Japan relay in Portugal

time is on the 6MHz band (49m) during the day. After dark, reception deteriorates and what is really required is a move to a lower frequency such as the medium waves. You can get round the problem by listening to their transmission from Bonaire on 17·695MHz at 2050UTC. Although intended for Africa it often comes in well in the UK. The programme goes from Holland via satellite to Bonaire in the Caribbean and then by radio to the UK. I suppose this could be called progress though when I was a schoolboy I used to listen to Holland direct!

DXing and Relays

Although relays are a boon to the short wave programme listener they are a bit of a menace to the DXer, who can never really be sure what country he has picked up. Only a few of the major broadcasters use relays at the moment, probably on grounds of cost, but there are a growing number of transmitters like Sines, who rent out time to religious organisations and to other broadcasters. Usually a relay station will announce its identity as it comes on the air and again at sign-off time, but this does not always happen. Frequency lists can help on occasion but often a country will use the same frequency at more than one location though not at the same time of course.

The International Listening Guide, published four times a year by Bengt Friedewald, Merianstr 2, D-3588 Homberg, West Germany, quotes relay station frequencies, but only for programmes in English. The DXer with a little experience, will soon get to know about realy stations and when they are likely to be heard. It is the newcomer who is confused and disappointed when he finds, for example, that his live programme from Japan is really being broadcast from Portugal.

Receivers for SW Programme Listening

Some readers write to me about the problems they meet with their short wave listening. A few ask for advice on how to improve reception or how to choose another receiver. You can imagine my surprise then when one reader, **E. Roper** of Hinckley who is a pensioner in his seventies, wrote to say that he is satisfied with his receiver. It is a Panasonic RF1105 bought new in 1979 for just under £30.

Our reader has so far logged 58 different countries transmitting programmes in English, using the receiver with its own telescopic antenna. "I very rarely listen after 2100—I use headphones for most of my listening and tuning has to be very sensitive and slight adjustments are necessary from time-to-time. I decided I would write this letter in the hope that it may be of interest to those readers of limited means, such as myself, who wish to enjoy this hobby for a very modest outlay."

The modern portable with its telescopic antenna is a marvellous piece of technology. It is self contained and does not need an additional antenna. It is capable of providing the user with world-wide reception provided he uses it with care and listens on the right bands at the correct time. In general, there is a move from higher frequencies during the day to lower ones at night. Some of the bands at the h.f. end of the spectrum, 17MHz (16m), 21MHz (13m) and 26MHz (11m) go dead after dark.

By and large you get what you pay for with short wave receivers. If you are interested in short wave programme listening rather than DXing or listening to amateurs, then go for a portable with its own antenna. If you can afford it, get one with digital readout. The frequency you are tuned to will be shown on a pocket calculator type of display. It takes all the guessing out of short wave listening, helps with station identification and enables you to go back to any channel with ease and certainty. Next time I will get together recent correspondence on receivers and deal with some of the problems encountered by readers.

QSL Cards, Pennants, Stickers

QSL cards interest **Simon Hamer** (New Radnor) who has been using his Grundig S1400 along with a.t.u. and 9 or 22 metre-long wires plus an earth, to obtain the material for reception reports. Simon received one of a set of twelve "audience cards" from Radio Finland which shows a Finnish girl in costume playing a Kantele. This is a wooden stringed instrument. Radio Denmark sent Simon a provisional card for a report of their transmission on 15·165. "When the new transmitter is taken into use Radio Denmark will issue four new QSL cards," is the latest information from the station.

BRT Belgium sent Simon a fine pennant and sticker after he had completed the application form for membership of the listeners club. Radio Norway are doing a lively set of QSL cards of Norwegian costumes with a short description in English together with their slogan, Radio Top of the World.

News about QSLs is welcome and if you have one that you think might be of interest to readers, send it to me. It will be returned after copying.

Readers' Letters

Thirteen-year-old **David Philpott** of Braintree has an Ekco Mariner 4-valve receiver which he uses with a 5 metre-long antenna. He has been chasing after time-signal stations and reports hearing WWVH in Hawaii on 15MHz and VNC in Australia on 12MHz. A good start on an interesting side of the hobby. In reply to T. Mason of Lewes. Sorry but I cannot help with your questions about coastguard stations. It is illegal in the UK to listen to them and to commercial stations, and I cannot deal with this sort of DXing in this column.

An Amstrad 6010 receiver with telescopic whip antenna pulled in Red Cross Radio on 21·698MHz for **Pete Seaman** who lives in Ripon. The frequency is one used by Swiss Radio International and our reader wonders if this is usual. The Red Cross Broadcasting Service sends test transmissions regularly to different parts of the world using transmitters belonging to the Swiss government. The "station" will QSL. Reports should go to 17 Avenue de la Paix, 1211 Geneva, Switzerland and an International Reply Coupon or return postage in Swiss stamps, is appreciated. Finally an enquiry from **David Pestridge** of Radlett who wonders if anyone has any information on the current situation in Nigeria. Transmitters whose power totals 20 500kW have been installed in that country according to David, and he wonders when they are coming into service.

VHF Bands

by Ron Ham BRS15744

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

With the sporadic–E season now underway and the warmer and more settled weather increasing the numbers of short-lived tropospheric openings, it is obvious from the reports I receive that, despite their outdoor summer activities, my readers are giving a fair amount of time to their sets.

Solar

Although **Ted Waring,** Bristol, counted 16 sunspots on April 19, 54 on the 24th, 24 on the 28th, 12 on May 4 and 16 on May 10, the amount of solar radio noise was very small between April 18 and May 17. In fact the only activity recorded by **Cmdr Henry Hatfield,** Sevenoaks and myself at 136 and 143MHz respectively, was a mild noise storm on April 22 and a few small bursts on the 23rd and May 8th. However, **Reg Taylor,** Shillington, recorded a mild noise storm at 151MHz on the 8th, showing once again how the sun's radio output varies with frequency.

The 28MHz Band

"That was an extraordinary day with openings in all directions" writes **Harold**

Brodribb, St Leonards-on-Sea, about the activity on the 28MHz band on April 18. Quite right Harold, around 1000 I heard a strong signal from a ZL working into G, and at 1854 I logged stations from Sweden and the USA. During the day, Harold received signals from The Azores, Canada, Cyprus, Greece, Guatemala, Iran, Malaysia, a Catholic priest in South-Africa, the USA and the USSR. On the other hand, **George Coulter,** Dover, using an FRG–7 and long-wire antenna, wrote on May 11, "Haven't heard much rare DX lately but one day recently when 28MHz was practically dead, VK9ZH came through loud and clear on s.s.b." This happens George, maybe the sun was too quiet, who really knows the cause? Like Harold, I heard a few European and Russian stations between April 19 and May 17 and although conditions were generally poor throughout this period, **Richard Brownlow** G4LCV, Brighton, worked a station in Chile, on the key, around 2200 on the 15th and heard PY2DSQ working into Europe during the afternoon of the 16th.

The Brownlow family, Gerry G3WMU, Margaret G4LCU and Richard often work portable at the Chalk Pits Museum, Amberley, Sussex using the quad antenna, Fig. 2, which Gerry built for the museum's own shack.

28MHz Beacons

The list of 28MHz beacons, Fig. 1, heard between April 18 and May 17 was compiled from the reports of Richard Brownlow, George and **John Coulter, David Newman** G4GLT, Leicester, Henry Hatfield, Ted Waring and myself. Both David and I noted the marked increase in the signal strengths of the German and Norwegian beacons when sporadic–E was present and David and George reported hearing the Peru beacon sending "OA4CK 12W beacons infor Box 538 Lima Peru", so it looks as though the beacon keeper would welcome reports. Around 1700 on May 9 and 16, Richard heard a beacon signal, about 539 on 28·220MHz, which sounded like '4VHTIAIET', any ideas?

David also reported hearing another German beacon, DF0ANN, on 28·992MHz at 1323 on May 9. One of my new contributors, George Coulter is an ex-RAF WW–II key basher and air crew radar operator. George has kept up his interest in radio ever since and now, like his brother John of Winchester, takes a special interest in beacon signals and DX on 28MHz.

The 50MHz (6m) Band

Around 1705 on May 6, Dave Newman, received 599 signals from the Gibraltar beacon ZB2VHF on 50·035MHz and between 0835 and 1101 on the 9th he received 539 signals from the beacon in Cyprus 5B4CY, both due to the prevailing sporadic–E disturbances.

Sporadic–E

The influence of sporadic–E usually begins around 50MHz and, depending upon the intensity of the event, will spread upward toward 80MHz bringing strong east-European broadcast signals into the UK and downward to about 28MHz so that a variety of continental beacons, both amateur and professional and RTTY and RT stations up to about 50MHz can be heard. Under extreme conditions both Band II and the 144MHz amateur band are affected and although there is often DX in the 70MHz band it is, under these circumstances, blotted out by several Polish broadcast stations. Around 1025 on May 9 and 0935 on the 16th, I counted 10 and 34 respectively, very strong f.m. broadcast stations between 66 and 73MHz, 5 of which were between 70 and 71MHz. For these observations I use an ex-army R216 communications receiver and a Microwave Modules 50MHz converter both fed from a rotatable Band I/III array.

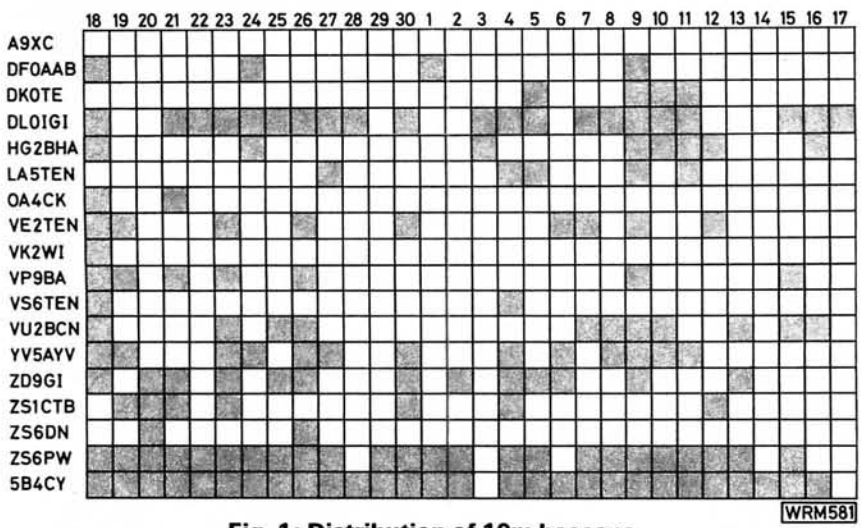


Fig. 1: Distribution of 10m beacons

RTTY

Congratulations to **Mike Rowe** G8JVE, President of the Chichester and District Amateur Radio Society, on winning his own club's constructors contest with a RTTY Terminal Unit on April 4. On the 13th Mike entered the same item at the Worthing club and won their cup as well.

Steve Richards G4OAK, received his licence on May 8 and by midday on the 12th he had completed 13 RTTY QSOs on 14MHz, spread through 10 countries. Steve uses an FT–101Z, ST5 terminal unit, Sagem printer and a half-wave dipole on the h.f. bands and is installing RTTY gear for 432MHz. He will be pleased to arrange skeds with anyone from his QTH at 60 Hormare Crescent, Storrington, Sussex.

Although conditions vary there is usually a lot of activity around 14·090MHz and during the period April 18 to May 17, I copied 145 RTTY stations in 25 countries, CN, CT, DJ, EA, F, G, HB9, HT, I, IT9, K, LA, LZ, OE, OH, OK, PY, SM, UA, UR, UT, VK, YO, 3A and 9K. Among the interesting two-way QSOs I copied were EA9JZ and I0YEM at 0918 on April 20, DL3 MBH and IT9ZDA around 1600 on the 23rd, CT1AMO and I8JTU at 1900 on the 245h, I1PZF and LZ1KDP at 1750 and DU1EFZ and 3A2EE at 1800 on the 30th, CT1BHR and PR8JCM at 0144 on May 8, OE8KOK and VK5XO at 0914 and EA7CLH and SM6BUV at 0920 on the 9th, G4OAK and W10ER at 0113 on the 11th, EA3CQR and IN3KHV at 1932 on the 13th and CT4QB and I8YZP at 0942 on the 14th.

I also found a fair amount of RTTY DX, expecially from the Americas, between midnight and 0200, so if you are about it's worth taking a look on 14MHz.

Tropospheric

The atmospheric pressure, measured at my QTH, was steady around 30·2in (1022mb) from April 12 until 0800 on the 23rd when it began rising sharply to 30·5in (1032mb) at 1000 on the 25th and then started falling gradually on the 27th, reaching 30·0in (1015mb) by 0800 on May 2. The pressure remained below 30·0 intil 2200 on the 6th, when it rose again to 30·1in (1019mb) by midday on the 7th and stayed steady until noon on the 10th. It then began rising slowly toward 30·3in (1019mb) at 1000 on the 13th and then falling rapidly to 30·0in during the period of 0400 on the 14th and 1400 on the 15th.

"I really enjoyed the lift on April 18" writes **Jon Kempster** BRS45205, Berkhamsted, who received signals from 10 different 144MHz repeaters, GB3BM, CF, DA, FR, HH, MH, NL, PI, VA and WH. On April 17, **George Grzebieniak** G6GGE, London, worked ON4YG and DD3KF, on the 18th, PA0JOP, PA3BYO and F1GNQ, on the 25th DF7KF and on May 1 he heard DL6FAW.

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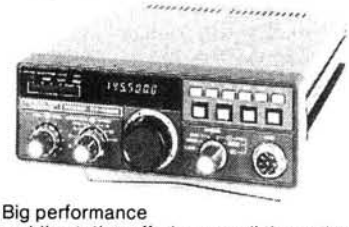

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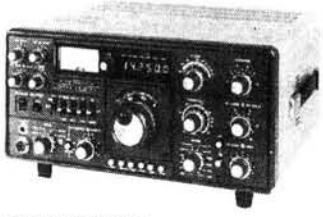

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On May 2, **Tony Gatfield** G8YUE, Hounslow and George entered the 144MHz low power contest and between them made 114 contacts with a best DX of around 425km with GM8YJU and G4EUZ/P in Northumbria.

At 0900 on April 21, **John Fell** G8MCP, our Technical Editor worked GM6ALC in Helensborough and G3ILD in Darlington on 144MHz s.s.b. from his QTH 61m a.s.l. in Corfe Mullen Dorset and on the 24th worked GW6DOK on Anglesey via a difficult path with Snowdonia in the way. John has a 6-element quad antenna with a Mutek SLNA 144s in-line, r.f. switched pre-amplifier situated 6m along the 25m antenna feeder to his Icom 202S. Between April 6 and 26, John received consistent signals from the 144MHz beacon in Angus GB3ANG 144·975MHz and is pleased with the performance of the MML/100/LS linear which he has been testing.

A small group of v.h.f. enthusiasts, **Richard Mumford** G8SVC, **Mark Bridle** G8SVD and **Paul Bunnage** G8SVE, all from Havant, took their RAE together in 1979 and now sport consecutive callsigns. The group. along with **Simon Eastwood** G8XCM, keep in touch on 144MHz f.m. and often work through the Hampshire GB3SN and Sussex GB3BP repeaters. Paul is also a member of the British Amateur Television Club and hopes to be operational on ATV as soon as possible.

Band II

At 1900 on April 17, Harold Brodribb heard 6 French broadcast stations between 88 and 100MHz and by 0800 on the 19th the number had increased to 17 plus 5 editions of BBC Radios 2, 3 and 4 and Radio Cymru from Wenvoe. "I am fascinated by directional reception," writes Harold, who compares his Band II reception with the moving high pressure systems as reported in his national newspaper. He used this during the afternoons of April 20, 21, 22 and 27 when the number of French stations he received, varying with movement of the pressure, was 5, 11, 12 and 4 respectively.

George Grzebieniak received signals from Rennes on 98·3MHz on the 18th and Brest on 97·8MHz on the 25th and between 2100 and 2200 on the 18th, **Simon Hamer,** Presteigne, heard stations in Belgium (Egem), France (Caen and Lille), BBC Radios Manchester and Sheffield and ILR Chiltern Radio. "In general sunrise was the best time for DXing particularly before BBC Radios 3 and 4 come on the air" writes **Ian Kelly,** Reading, who used this method to hear signals from Belgium, France and Holland between April 15 and 25.

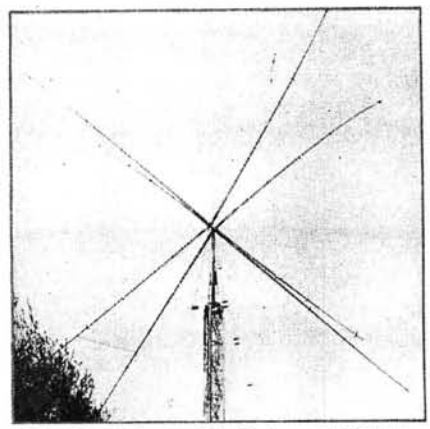

Fig. 2: HF quad built by G3WMU

During the morning of May 9, Simon heard German stations around 92 and 97MHz, TDF–Inter (Rouen) on the 11th and BRT I and II from Egem between 2030 and 2130 on the 12th. In Chippenham, **Brian Renforth** heard a German pop station around 88·7MHz on the 9th and a very good French station at 99·8MHz on the 10th. "A new ILR station for Hereford and Worcester will commence tests early in July on 95·8MHz (Ridge Hill) and 96·2MHz (Malvern)" writes Simon Hamer, who no doubt like many of you will be listening for it.

Microwaves

A new 1296MHz beacon, GB3FRS, radiating 4 watts to an omnidirectional antenna, has been operational on 1296·850MHz in the Farnborough area since March 6 and reports are welcomed by the beacon keeper, Mike Hearsey G8ATK, QTHR. The best so far is from a station in GW.

The South West Herts UHF Group have installed a 10GHz beacon, GB3SWH, operating on 10·368240GHz from a site 145m a.s.l. 3km south-east of Watford. The radiation from the antenna is a figure-of-eight pattern with the major lobes radiating north-east and south-west. Reception reports and any comments are welcomed by Trevor Groves G4KUJ, QTHR or telephone 09277 62201.

934MHz

"Thankyou for putting in the piece about 934MHz (May *PW*) and thanks to all the people who replied" writes **Tim Anderson** who still cannot find a manufacturer of such equipment, so if anyone can help, drop a line to Tim at 24 Highfield Rd, Bowbridge, Stroud, Glos.

Collectors

Can anyone help **David Cochrane** G8IHF, with any bits, pictures or complete McMicheal radio sets for a special collection. David is QTHR or available on Bagshot 74426.

New Items

Congratulations to **Bod Hudson** G4SFN on qualifying for the No. 4 "Mary Rose Award" issued by the Marconi Radio and Electronics Club for working 25 Hampshire stations on 144MHz f.m.

Throughout August, the Southdown Amateur Radio Society will have an exhibition of vintage and amateur radio equipment in the window of the Anglia Building Society in Hailsham, Sussex and during the last weekend of the month they will have a display at the Eastbourne Show, Gildredge Park, Eastbourne. These events are being organised by the club's PRO, Neville Wicks G31JO, who is a member of the Royal Signals ARS and among the callsigns he has held are DL2PA, JY1PB, VS6NEW, VP9DU and VU2ZZ.

TV

by Ron Ham BRS15744

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

"How do you define the start of the sporadic-E season?" asks **George Grzebieniak,** London and "How do you tell the difference between short bursts of sporadic-E and meteor scatter?" asks **Tim Anderson** from Stroud. It is well known George that the "E" region of the ionosphere is most likely to turn sporadic, or unpredictable if you like, at any time during the daylight hours between May and August. Although the first signs of sporadic-E often occur during April, I usually wait for the first disturbance in May, with strong pictures from the USSR on Ch. R1, combined with some hefty signals from east-European broadcast stations, between 66 and 73MHz, before saying that the season has begun.

From my own experience of monitoring television sync pulses, the best answer to Tim's question, which is a grey area, is that meteor scatter propagation is very brief and positive, whereas bursts of sporadic-E are longer and more ragged. A good astronomical reference book will give the dates of the annual meteor showers which will be useful Tim, because this form of propagation increases rapidly as the earth encounters them on its orbit around the sun.

Amateur Television

A group of television enthusiasts from the Mid-Sussex Amateur Radio Society are **Buster Evans** G3ZZX, **Mark Evans** G4MMH, **Colin Edwards** G8FQT and **Dave Holman** G8TOO. Buster has been transmitting colour on 432MHz via an 8/8 slot antenna and receiving on a Microwave Modules converter and a

GEC colour receiver while Mark operates a Hitachi CP5 colour camera. The group are looking for skeds by arrangement, all, except Mark, are QTHR.

"Between May 11 and 16 there was an extensive tropo-opening between my QTH in Aberdeen and the Continent" writes **Jim Panny** GM4JLY. He made 18 two-way ATV QSOs during that time, 9 of them with Dutch stations. After working 50 Belgian, Dutch and German stations on 432MHz s.s.b. and f.m. he made his first continental QSO on ATV with PE1CZG on May 13. Jim uses a JVC GS1000 camera, Microwave Modules 50W linear and a 48-element multibeam at 10·6m a.g.l. on a site 61m a.s.l. On the 14th he heard the Rotterdam beacon PI3RTD, which runs 500mW to an omnidirectional antenna on 432·5MHz.

Tropospheric

With conditions improving, I used my Plustron TVR–5D on high ground and at 1342 on April 23rd, I received strong, negative test cards, with the set's own telescopic antenna, from France TDF–TF1 on Ch. 21 and TDF–FR3 on Ch. 27. **George Garden,** Bracknell, received good pictures on the 27th from Central TV's Waltham transmitter on Ch. 61 and a poorer signal from Oxford on Ch. 60. George wonders if these were reflected signals, because at the time his 46-element antenna was pointing away from the stations. At 2345 he watched *Angling* from Waltham and later a jazz programme. Around 2200 on the 18th, **Simon Hamer** received fair signals from Hannington on Ch. 42, Anglia TV from Sandy Heath on Ch. 24 with adverts for Kellogs Corn Flakes, and a few days later he watched BBC1–East on Ch. 31 with publicity for BBC Radio Cambridge. At 0815 on May 10, **Brian Renforth,** Chippenham, received a good picture from Channel TV, Fremont Point, on Ch. 41. Around 2200 on the 13th I received strong pictures from Central TV on Ch. B8 189MHz, with a dipole antenna feeding the receiver and tried to watch ITN from London on Ch. 23 through massive co-channel interference.

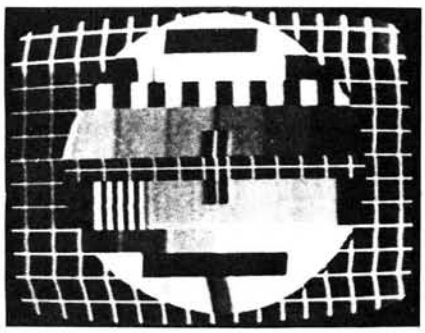

Fig. 1: Polish test card frequently seen on Ch. R1

Fig. 2: Poland's military newscaster

Figs. 3 & 4: Conference speakers received April 23. Polish TV News

These pictures were received by the author on April 23

Fig. 5: People at the conference

Fig. 6: Interview on Polish News

Sporadic-E

On most days between April 20 and May 17, there were frequent, sometimes prolonged bursts of test cards from Czechoslovakia RS–KH, Hungary Budapest and Poland, Fig. 1, on Ch. E2 48·25MHz. The main sporadic–E openings, lasting several hours, took place during the mornings of April 23 and May 9 and 16. Between 0800 and 0900 on the 23rd, the usual bursts of Polish test card were seen but at 0910, colour bars in mono appeared for a longer period and then gave way to the much stronger signals of Poland's *Television News,* with their newscaster in military uniform (Fig. 2). During this news there were such items as officials laying a wreath, a ship's interior, speakers (Fig. 3 and 4) and people at a conference (Fig. 5), the West-German Chancellor at a party meeting, Francis Pym leaving Heathrow for the USA, Argentine paratroops in training and someone being interviewed (Fig. 6). Most items were separated by the Polish "dt" insignia. At 1127 a digital clock appeared, this time from Russia, showing 1427 followed by the TB/CCCP caption and an analogue clock indicating 1430.

"At last the sporadic-E season is here" writes Brian Renforth, who received the test cards from Sweden at 1225 on Chs. E2 and E3 55·25MHz and like myself, from Norge Melhus around 1300. At 1215 on May 1, Brian saw May Day celebrations from TVP Poland on Ch. R1 and later watched the same video on ITN, which enabled him to positively identify it. Between 0830 and 0930 on May 3, strong bursts of the RS–KH test card and Poland's clock were mixing with a programme on Ch. R1 and at 0909 the newscaster (Fig. 2) appeared. Although I only caught a glimpse of him again at 0925 on the 7th, I am sure he was in civilian clothes.

"I erected my first 3-element beam on April 21, ran it through a Hugh Cocks Up Converter and OM335 pre-amplifier into a National Panasonic 5in portable receiver" writes **Simon Beddin.** He received his first taste of a big opening on May 9 when he saw many stations fading in and out and programmes about banger racing, cycling, dancing with YLs in national costume, farming, a test card from Austria and at 1300 a strong picture of a YL announcer with the word "TOTO" on the back cloth.

Another first timer on that day with a similar report was **Tim Anderson** who identified TOTO as "a form of state controlled bingo, the first prize being a Polski Fiat". On May 2, Brian Renforth installed a Telerection 3-element beam on a rotatable mast and was rewarded the following afternoon with programmes from Russia about wildlife and farming and a cartoon film about a frog and his friends. Brian's detailed report for May 9 is headed "an excellent sporadic-E opening this day" and his entry for 1200 reads "All Band I channels jammed with signals", which about sums it up. During the event George Grzebieniak, Brian, Simon and Tim received pictures between them from Austria, Czechoslovakia, Hungary, Italy, Norway, Poland, Spain, Sweden and the USSR. Around 0900 on the 9th I watched a cartoon film with animated elephants, whales, people and TV receivers and at 1008 the cycle racing programme was very strong.

Between 0747 and 1000 on the 16th, a variety of test cards, a YL announcer with a digital clock reading 1144, four hours ahead of GMT, interviews, a programme about gardening, news and several musical turns both pop and classical.

SSTV

Richard Thurlow G3WW, March, one of the UK's leading experts on slow scan television, tells me that Jeremy Royle G3NOX was among the television specialists who attended the 31st Annual Dayton Hamvention in Ohio in April, and Richard learnt through 14MHz QSOs with other TV experts, K1DMU, W0LMD and ZS6BTD who were there, that the attendance figure was around 23 000.

Equipment

I see from the latest catalogue that South West Aerial Systems, 10 Old Boundary Rd, Shaftesbury, Dorset, are marketing several Band I antennas covering 47–68MHz and ranging from a wideband dipole to a 4-element array, as well as DX antennas for Band II and the UOSAT.

Readers interested in satellite TV in the 3·7 to 4·2GHz range should contact Hugh Cocks, Cripps Corner, Robertsbridge, Sussex, who is making a special study of the subject and may soon have equipment available.

swap spot

Have FRG-7 Communications receiver, 6 months old, mint condition. Would exchange for Sinclair ZX81 with either ZX printer or 16K RAM add-on memory. P. D. Pinel, 17 Musgrove Road, Taunton, Somerset, TA1 5LB. Tel. 79929. *N630*

Have Trio 2200G portable 2m rig, xtals 20–23, R0, R4, R7 and reverse R0. Complete with NiCads, charger, carry case and strap. Would exchange for ZX81 printer, trailer, h.f. gear or w.h.y. G8XKN Stanford le Hope 71238, Essex. *N631*

Have a Ferrograph 2 AN/H tape-recorder (faulty wafer in the switching stack, otherwise A1), a Leak 5-valve mono f.m. tuner (perfect performance), a Rotel RA-311 stereo amplifier, 25W p.c. (perfect) and a ZX81 computer with power-pack and a little software. Would exchange for a working communications receiver (age immaterial), a couple of CB rigs or (for the lot and maybe cash too) a Vic-20 computer. John Radford, 50 Little Hallam Lane, Ilkeston, Derbys, DE7 4AH. Tel. Nottingham 320798 (deals done all hours). *N633*

Have TR-9000 multi-mode in first class order in original carton. Would exchange for h.f. rig, must be in good condition. B. J. Mitchell, Trevescan, Tintagel, Cornwall. Tel. 0840 770344. *N635*

Have Yashica TL Electro SLR camera, four lenses, many extras. Would exchange for Bearcat 220/250 scanner. Have complete colour darkroom. Would exchange for good h.f. receiver. D. R. Pellegrini. Tel. Cardiff (0222) 733885 after 6p.m. *N636*

Have two 24in monochrome video monitors, working with sound. Would exchange for two 14in (or smaller) monitors (preferably solid state). A. Wilkes G6BCA, 34 Tideswell Road, Great Barr, Birmingham, B42 2DT. *N645*

Have Drake SPR-4 amateur and broadcast bands receiver, with handbook and loop antenna. Would exchange for 2m s.s.b. base rig. Carver, 14 Newbridge Gardens, Bridgend, CF31 3PB. Tel. 0656 61877. *N646*

Have Sigma BMW M1 Coupé $\frac{1}{8}$ scale off-road RC car, HGK $3\frac{1}{2}$ cc Eng, Futaba 3-channel NiCad radio, 12V starter, NiCad GLO-plug, battery, fuel, plugs, etc. A full kit (nothing else needed to run) plus spares (two clutches one pair tyres new). Value new £280-£300. Would exchange for h.f. receiver or transceiver + bal. Tel. 01-445 0784 Barnet (evenings). *N647*

Have Telephoto zoom lens Tamron 70–210mm macro, case, filter, etc. Would exchange for compact Triband 3-element beam TH3 JR or similar. Have Sunpack auto zoom 3000 flash gun. Automatic power control bounce and mains adaptor. Would exchange for rotator to suit small h.f. beam with 360° heading indicator, Daiwa or similar. Have Microwaves modules 2m converter 144/28. Would exchange for 150W dummy load. Tel. Nigel 0452 75 376. (Gloucestershire). *N648*

Have Kenwood microphone MC-35S and pair of Reyo KW4 traps, all as new boxed. Would exchange for KW Z-match or good s.w.r. power meter. P. Haughey, 7 Pulborough Close, Bletchley. Tel. 0908 642398. *N671*

Have Trio TR2200GX and matching VB2200GX linear amplifier, with all accessories (e.g. charger, NiCads, helical antenna etc.). All in good condition, except some scratches on case of 2200GX. Boxed, with manual. Rig crystalled for S18-23 and R0, R3-R7. Would exchange for FT202R hand-held transceiver with speaker mic, charger and NiCads, must be in good condition. K. A. Blabey, 9 Chestnut Avenue, Gillway, Tamworth, Staffs, B79 8QU. Tel. Tamworth 62014. *N672*

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2N5913	2w	7dB	12	470MHz	£1.95
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2N6080	4w	12dB	12	175MHz	£5.97
SD1143	10w	10dB	12	175MHz	£7.75
2N6081	15w	8.3dB	12	175MHz	£8.88
2N6082	25w	5.7dB	12	175MHz	£9.49
2N6084	40w	4.5dB	12	175MHz	£13.90
SD1428	45w	6.5dB	12	175MHz	£17.55
SD1416	70w	6.7dB	12	175MHz	£28.75
SD1477	100w	8.0dB+	12	175MHz	£31.50
2N5590	10w	5.2dB	13.6	175MHz	£7.10
2N5591	25w	4.4dB	13.6	175MHz	£9.15
2N5944	2w	9dB	12	470MHz	£7.47
2N5945	4w	8dB	12	470MHz	£9.85
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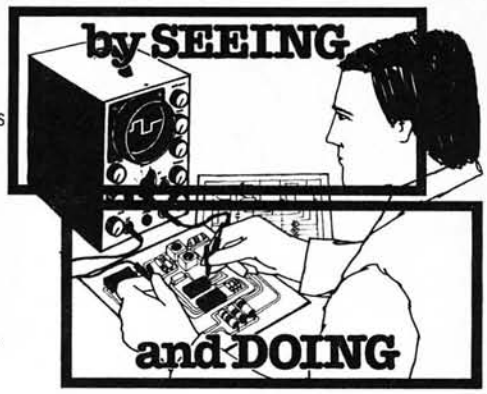

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DF96	0.70	EF804	4.95	PCF82	0.70	UBF89	0.70	6AL5	0.80	6KD6A	2.70	30C17	0.50
DH76	0.75	EF812	0.75	PCF84	0.75	UBL21	1.75	6AL5W	0.85	6Q7G	1.30	30C18	2.45
DL92	0.80	EFL200	1.85	PCF86	1.50	UCC84	0.85	6AK5	0.65	6SA7	1.00	30F5	1.15
DY86/87	0.65	EH90	0.85	PCF87	0.50	UCC85	0.70	6AK8	0.80	6SG7	1.15	30FL2	1.40
DY802	0.70	EL32	1.10	PCF200	1.60	UCF80	1.30	6AL5	4.20	6SJ7	1.05	30FL12	1.25
E55L	14.90	EL34	1.80	PCI201	1.85	UCH42	1.85	6AM6	1.50	6SK7	0.95	30FL14	2.15
E88CC	1.60		2.90*	PCF800	0.50	UCH81	0.75	6AN8A	2.50	6SL7GT	0.85	30L15	1.10
E88CC/01	3.10	EL37	4.40	PCF801	1.75	UCL82	0.95	6AQ4	3.40	6SN7GT	0.80	30L17	1.10
E92CC	1.20	EL81	2.45	PCF802	0.85	UF41	1.25	6AQ5	1.00	6SR7	1.10	30P12	1.15
E180CC	2.80	EL82	0.70	PCF805	2.45	UF80	0.95	6AQ5W	1.80	6SQ7	0.95	30PL13	1.25
E180F	6.30	EL84	0.80	PCF806	1.20	UF85	0.95	6AS6	1.15	6V6G	1.50	30PL14	2.45
EABC80	0.60	EL86	0.95	PCF808	2.75	UL41	2.30	6AT6	0.90	6V6GT	0.95	35L6GT	1.40
EB91	0.60	EL95	0.80	PCH200	1.35	UL84	0.85	6AU6	0.80	6X4	0.75	35W4	0.80
EBC33	1.15	EL504	1.70	PCL81	0.75	UM80	0.90	6AV6	0.85	6X4WA	2.10	35Z4GT	0.80
EBC90	0.90	EL803	5.90	PCL82	0.95	UM84	0.70	6AX4GT	1.30	6X5GT	0.85	40KD6	3.15
EBF80	0.60	EL509	2.70	PCL83	0.60	UY82	0.70	6AX5GT	1.30	6Y6G	0.90	50C5	1.15
EBF83	0.60	EL802	1.70	PCL84	0.95	UY85	0.85	6BA6	0.55	6Z4	0.70	50CD6G	1.35
EBF89	0.80	EL821	8.20	PCL85	1.45	VR105/30	1.25	6BE6	0.60	7B7	1.75	75B1	1.25
EC52	0.85	EL822	9.95	PCL504	1.95	VR150/30	1.35	6BG6G	1.80	7Y4	1.25	75C1	1.70
EC91	3.40	EM31	1.80	PCL508	2.80	X66	0.95	6BJ6	1.30	902	0.70	76	0.95
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ECF82	0.85	GY501	1.30	PL802	3.20	1L4	0.50	6D6	0.70	12BA6	0.90	931A	13.80
ECF801	1.05	GZ32	1.05	PY33	0.70	1R5	0.80	6EA8	3.20	12BE6	1.25	954	0.80
ECH34	2.25	GZ33	4.20	PY80	0.70	1S4	0.45	6F6	1.60	12BH7	1.10	955	0.70
ECH35	1.70	GZ34	2.75	PY81/800	0.85	1S5	0.45	6F6G8	1.10	12C8	0.85	956	0.80
ECH42	1.20	GZ37	3.95	PY82	0.65	1T4	0.45	6F7	2.80	12E1	18.95	957	1.05
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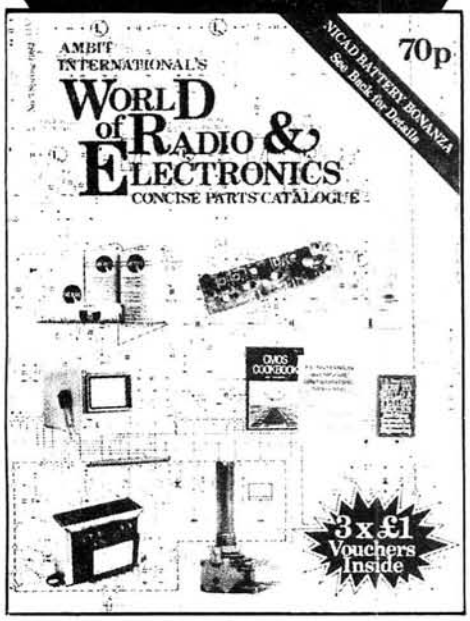

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EF80	0·80	PCL82	1·00	VR150/30	1·92	6EH5	1·85	150C4	2·37
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EF92	5·81	PCL85	1·08	2D21	3·50	6H6	1·50	807	3·75
EF183	0·80	PCL86	1·08	3B28	14·35	6HS6	3·77	811A	18·33
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AC176K	0.31	BC182	0.09	BF258	0.25	TIP47	0.65				
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AC187K	0.28	BC184LA	0.09	BF336	0.34	TIP3055	0.66				
AC188	0.22	BC212	0.09	BFX29	0.30	TIS91	0.20				
AD149	0.70	BC212L	0.09	BFX84	0.26	2N3054	0.59				
AD161	0.39	BC213	0.09	BFX85	0.32	2N3055	0.52				
AD161/2	1.04	BC213L	0.09	BFX86	0.30	2N3702	0.12				
AD162	0.39	BC237	0.09	BFX88	0.25	2N3703	0.12				
AF124	0.34	BC238	0.09	BFY50	0.21	2N3704	0.12				
AF125	0.32	BC307	0.09	BFY51	0.21	2N3705	0.12				
AF126	0.32	BC327	0.10	BFY52	0.25	2N3706	0.12				
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AF239	0.42	BC478	0.20	BT108	1.22	2N5296	0.48				
AU106	2.06	BC547	0.10	BT116	1.20	2N5298	0.50				
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AU110	2.00	BC549A	0.08	BU108	1.69	2SA715	0.95				
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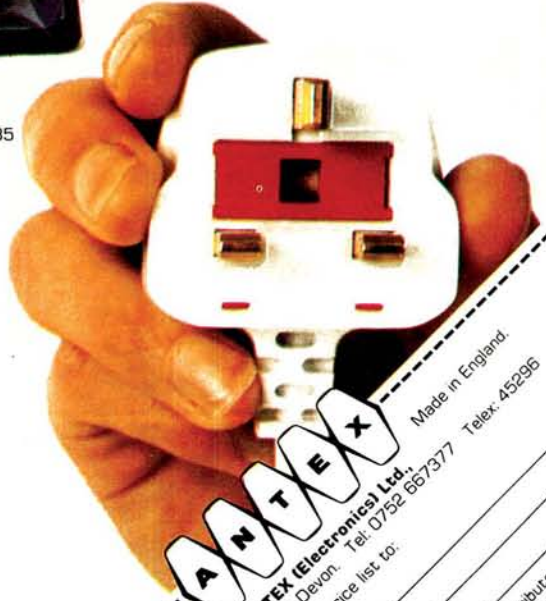

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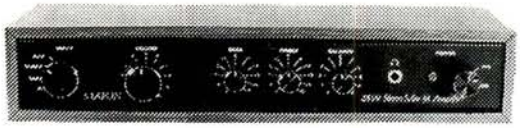

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