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MAY 1982

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Practical Wireless

MAY 1982 VOL. 58 NO. 5 ISSUE 902

contents

EXTRA THIS MONTH
(between pages 44 & 45)
A gatefold pull-out of operating data for your shack wall

The promised article on PRACTICAL MICROWAVE OPERATING has been held over awaiting further information on UK licensing changes (see pages 30–33)

UHF VHF

TR9000 The exciting TR9000 2-metre all-mode transceiver combining the convenience of FM with long distance SSB and CW in a very compact, very affordable package. Because of its compactness the TR9000 is ideal for mobile installation, add on its fixed station accessories and it becomes the obvious choice for your shack.

NEW PRICE

TR9000 was £374.90
Now £359.03 inc VAT

TR9000

2 METRE MULTIMODE MOBILE AND BASE STATION TRANSCEIVER

TR-7800 Trio's remarkable TR7800 2-metre FM mobile transceiver provides all the features you could desire for maximum operating enjoyment. Frequency selection is easier than ever, and the rig incorporates new memory development for repeater shift priority, and scan. The TR7800 by Trio, the only FM mobile.

NEW PRICE

TR7800 was £284.97
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TR7800

2 METRE BAND FM MOBILE 25 WATTS OUTPUT TRANSCEIVER

FREE

WITH EACH TR8400 A NEW PS10 COMBINED POWER SUPPLY, BACK UP SUPPLY & SPEAKER UNIT

Trio 8400 the new way to 70 cm FM mobile, a fully synthesized 430 440 MHz 10 watt output, mobile transceiver with memories, 2 separate VFO's all in a truly amazing compact package. Complete with up/down frequency shift microphone and car mounting bracket, the TR8400 is the way to go . . . 70cm is on the move.

NEW PRICE

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70 cm BAND MOBILE FM TRANSCEIVER WITH 10 WATTS OUTPUT

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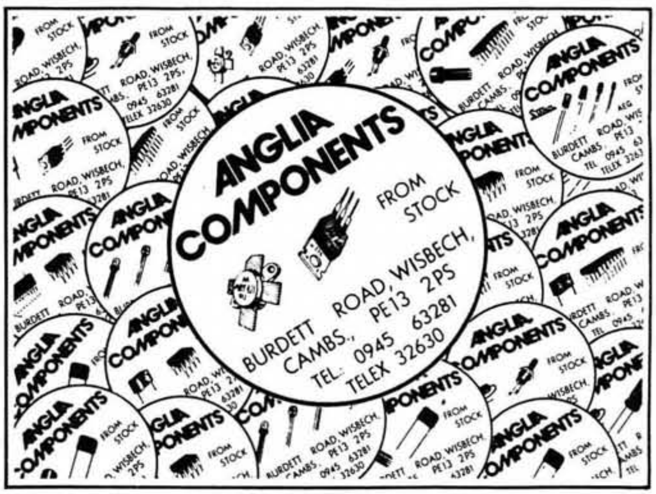

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See revue in February Radd.Comms

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!

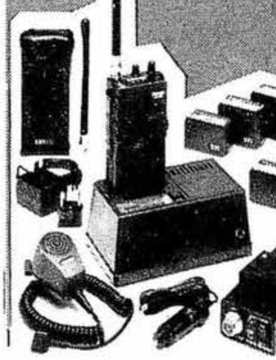
Perhaps one way of dealing with the problem is to look at just what each model offers in its basic form without having to lay out even more hard earned cash on "extras". The IC-720A scores very highly when looked at in this light. How many of its competitors have two VFOs as standard or a memory which 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	BC25	Mains charger as supplied	4 25
BP5	11 volt battery pack	30.00	DC1	12 volt adapter pack	8 40
BP4	Empty battery case for 6 x AA cells	5 80	HM9	Speaker microphone	12 00
BP3	Standard battery pack	17 70	CP1	Mobile charging lead	3 20
BP2	6 volt pack	22 00	IC1 2 3	cases	each 3 60
BC30	Base charger for above	39 00	All prices include VAT		

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IC-290E £366./IC-490E £445.inc.
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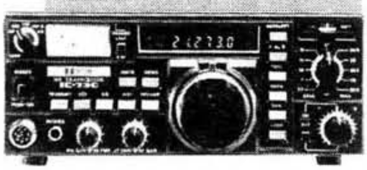
290E-144-146 MHz/490E-430-440 MHz

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.

IC-730 The best for mobile or economy base station
£586.inc.



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.

IC-251 £499.inc.
IC-451 £630.inc.
Great Base Stations

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.

IC-24G
Low-priced mobile
£169.inc.

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.

Well worth thinking about!

IC-25E
The Tiny Tiger
£259.inc.

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.

Tono RTTY and CW computers
7000E-£550/9000E-£650inc.

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!

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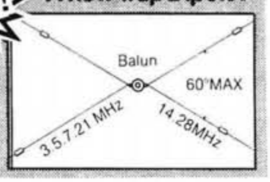
LOOK!
A new Trap Dipole!



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.
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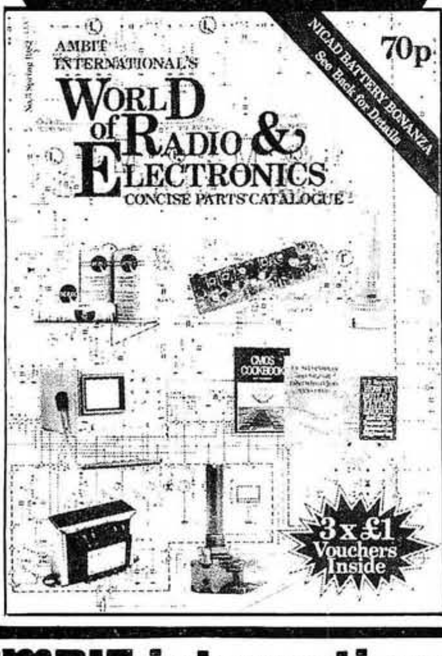

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EF55	2·50	PCH200	1·60	Z803U	7·90	6EA8	2·94	150C2	1·92
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This kit enables you to make a switch that will trigger when a steady beam of infra-red or ordinary light is broken. Main components: relay, photo-transistor, resistors, caps, etc. Circuit diagram but no case. **Price £2.30.**

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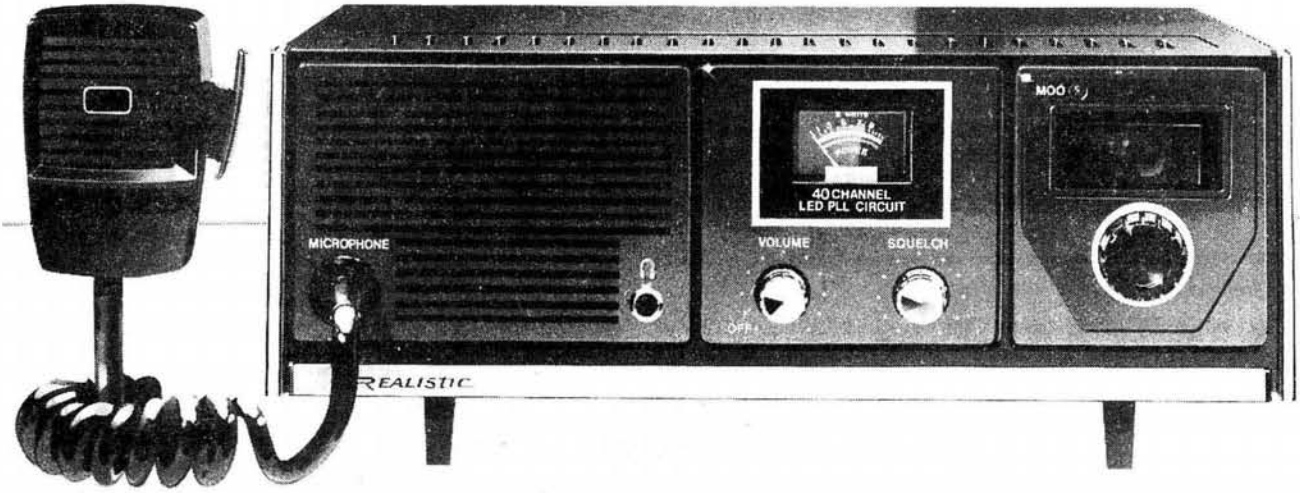

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	1X011	9 + 9	1.66		
	1X012	12 + 12	1.25		
	1X013	15 + 15	1.00		
	1X014	18 + 18	0.83		
	1X015	22 + 22	0.68		
	1X016	25 + 25	0.60		
	1X017	30 + 30	0.50		
50 VA 80 × 35mm 0.9 Kg Regulation 13%	2X010	6 + 6	4.16	£5.83 + £1.10 P/P	£4.93 + £1.10 P/P
	2X011	9 + 9	2.77		
	2X012	12 + 12	2.08		
	2X013	15 + 15	1.66		
	2X014	18 + 18	1.38		
	2X015	22 + 22	1.13		
	2X016	25 + 25	1.00		
	2X017	30 + 30	0.83		
	2X028	110	0.45		
	2X029	220	0.22		
	2X030	240	0.20		
80 VA 90 × 30mm 1 Kg Regulation 12%	3X010	6 + 6	6.64	£6.51 + £1.43 P/P	£5.47 + £1.43 P/P
	3X011	9 + 9	4.44		
	3X012	12 + 12	3.33		
	3X013	15 + 15	2.66		
	3X014	18 + 18	2.22		
	3X015	22 + 22	1.81		
	3X016	25 + 25	1.60		
	3X017	30 + 30	1.33		
	3X028	110	0.72		
	3X029	220	0.36		
	3X030	240	0.33		
120 VA 90 × 40mm 1.2 Kg Regulation 11%	4X010	6 + 6	10.00	£7.55 + £1.43 P/P	£6.38 + £1.43 P/P
	4X011	9 + 9	6.66		
	4X012	12 + 12	5.00		
	4X013	15 + 15	4.00		
	4X014	18 + 18	3.33		
	4X015	22 + 22	2.72		
	4X016	25 + 25	2.40		
	4X017	30 + 30	2.00		
	4X018	35 + 35	1.71		
	4X028	110	1.09		
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	5X015	22 + 22	3.63		
	5X016	25 + 25	3.20		
	5X017	30 + 30	2.66		
	5X018	35 + 35	2.28		
	5X026	40 + 40	2.00		
	5X028	110	1.45		
	5X029	220	0.72		
	5X030	240	0.66		

TYPE	SERIES No	SECONDARY Volts	RMS Current	PRICE inc VAT	PRICE ex VAT
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	6X013	15 + 15	7.50		
	6X014	18 + 18	6.25		
	6X015	22 + 22	5.11		
	6X016	25 + 25	4.50		
	6X017	30 + 30	3.75		
	6X018	35 + 35	3.21		
	6X026	40 + 40	2.81		
	6X025	45 + 45	2.50		
	6X033	50 + 50	2.25		
	6X028	110	2.04		
	6X029	220	1.02		
	6X030	240	0.93		
300 VA 110 × 50mm 2.6 Kg Regulation 6%	7X013	15 + 15	10.00	£13.67 + £1.73 P/P	£11.66 + £1.73 P/P
	7X014	18 + 18	8.33		
	7X015	22 + 22	6.82		
	7X016	25 + 25	6.00		
	7X017	30 + 30	5.00		
	7X018	35 + 35	4.28		
	7X026	40 + 40	3.75		
	7X025	45 + 45	3.33		
	7X033	50 + 50	3.00		
	7X028	110	2.72		
	7X029	220	1.36		
	7X030	240	1.25		
500 VA 140 × 60mm 4 Kg Regulation 4%	8X016	25 + 25	10.00	£18.17 + £2.05 P/P	£15.53 + £2.05 P/P
	8X017	30 + 30	8.33		
	8X018	35 + 35	7.14		
	8X026	40 + 40	6.25		
	8X025	45 + 45	5.55		
	8X033	50 + 50	5.00		
	8X042	55 + 55	4.54		
	8X028	110	4.54		
	8X029	220	2.27		
	8X030	240	2.08		
625 VA 140 × 75mm 5 Kg Regulation 4%	9X017	30 + 30	10.41	£25.10 + £2.70 P/P	£21.54 + £2.70 P/P
	9X018	35 + 35	8.92		
	9X026	40 + 40	7.81		
	9X025	45 + 45	6.94		
	9X033	50 + 50	6.25		
	9X042	55 + 55	5.68		
	9X028	110	5.68		
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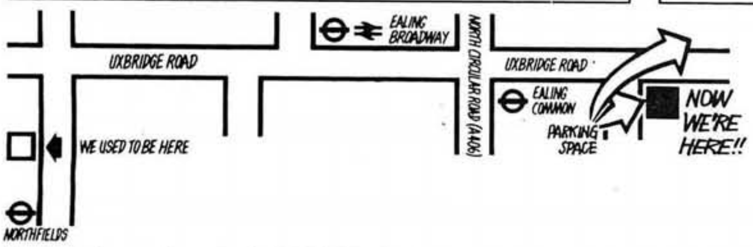

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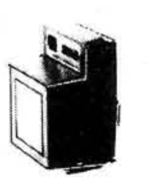

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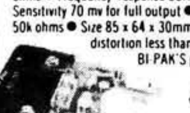

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Disaster Averted?

IN OVER THIRTY YEARS of regular dealings with the UK radio regulatory body in its various forms: Post Office, Ministry of Posts and Telecommunications, and now Home Office, I have found its staff, whether examining, inspecting, or sitting on committees, to be helpful, fair, and generally very competent. It was therefore with considerable surprise that I read the revised Schedule of frequencies, modes and powers for the UK Amateur Licence, published in the *London Gazette* of 12 February 1982. From our regular contact with the Home Office, we had known for several days that an important official announcement was imminent, but it was not until the morning of Monday 15 February that we received the full details.

A total revision of the entire licence has been under way for well over two years, and was planned to include the changes resulting from the WARC '79 Conference, the whole thing being completed to coincide with the implementation of those changes on 1 January 1982. In fact, the licence revision is nowhere near complete, and the relaxations in operating conditions forecast recently are still way in the future.

In a belated attempt to acknowledge the January 1 deadline, an update of the Schedule was rushed through in just two weeks by the Home Office, and published without any prior consultation with the RSGB as representatives of radio amateurs in the UK. On pages 30–33 of this issue, we reproduce the *Gazette* announcement in its entirety, together with our analysis of the latest situation and what it means to the amateur. From this you will see for yourself what the uproar has been all about.

On 21 February the Home Office issued a statement saying that in issuing the revised Schedule, they had no intention of changing the basis of amateur radio operation in the UK, and that if the Schedule contained errors, they would be corrected as soon as possible. We pointed out a number of obvious errors to the Home Office as soon as we received our copy from them, and the RSGB are continuing to make representations seeking alterations to the Schedule.

It is difficult to understand how the Schedule could have been published without being vetted by some-one familiar with the Amateur Service. For a Home Office spokesman to admit that portable or mobile operation at frequencies above 1GHz had not been considered in framing a footnote, when a batch of repeaters for the 1296MHz band had recently been approved, is surprising. Coming only a few months after the UK CB licence was drawn up and published without any allowance being made for antennas suitable for base station operation, it becomes quite frightening.

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.

Binders are available (Price £4.60 to UK addresses and overseas, including post and packing) each accommodating one volume of *PW*. Please state the year and volume number for which the binder is required.

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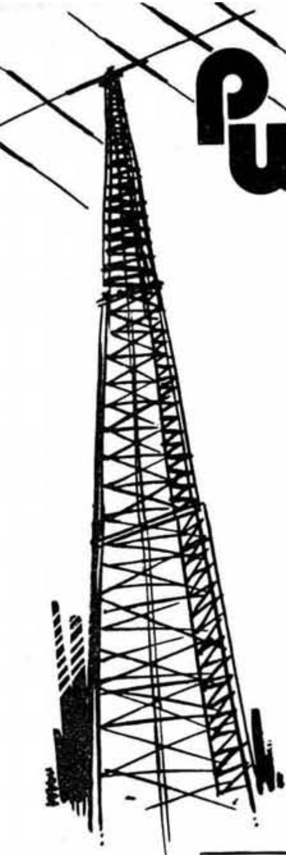

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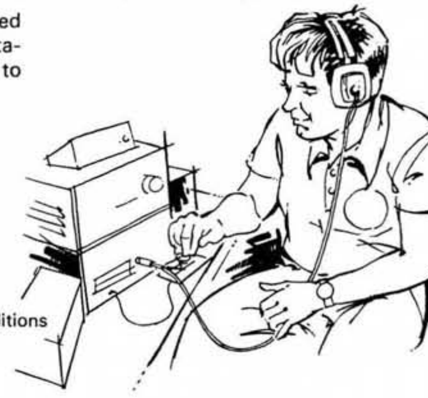

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Please continue list of equipment on a separate sheet if necessary **TOTAL SUM TO INSURE £**

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introducing PW 'RUIS'

Over the past year, the amount of theft and vandalism of amateur and CB radio equipment and antennas has been steadily rising. Hardly a day passes without news reaching us of yet another incident, particularly affecting mobile installations.

Although some household contents and motor vehicle insurance policies can be extended to cover base station or mobile radio communications equipment, the rates quoted are not usually very attractive. Also, household policies do not generally cover "all risks", and on a motor vehicle policy a claim can affect your no-claims bonus.

It has seemed for some time to us on *PW* that there was a need for a competitively priced policy to cover radio communications equipment for the amateur, s.w.l. and CBer, and we have now negotiated a scheme which represents good value to any users of such equipment, and which is also available to radio clubs or to companies using private mobile radio systems.

The *PW* RADIO USERS INSURANCE SCHEME's principal features are outlined on the opposite page. The policy covers loss or damage to the insured equipment, which can include: receivers; base station, portable or mobile rigs; antennas except for suction or magnetic mount mobile types; masts; radio-related test equipment. It does not cover the use of 27MHz a.m., s.s.b. or multi-mode CB equipment. Property seized by the Police or any other authority is not insured. Settlement of any claim following total loss or destruction will be the cost of replacement at the date of the loss (after deduction of the Policy Excess), in a condition equal to but not better than its condition when new. The sum insured shall at all times represent the cost of replacement of all the insured property. The policy is index-linked annually to combat inflation, in accordance with the Durable Household Goods Section of the General Index of Retail Prices published by HMSO.

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The full policy details may be inspected during normal office hours at the offices of:

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In introducing *PW* RUIS, we are reviving an old publishing custom of offering insurance to readers, and we hope that you will find it an attractive scheme.

Letters

Letters to the Editor intended for publication must be original, and not duplicated to or copied from other publications. We reserve the right to shorten or edit them if necessary.

Magic Antenna Solution

Sir: With regard to the "Magic Antenna" article by D. Byrne I would like to give my findings on the matter. My brother bought one of these devices on the I.O.W. from the mentioned vendor for my use, since I live in an area of poor TV reception. Mr Byrne was quite right the device was nothing but a "con" in the form of an electrolytic capacitor and a tuned piece of wire, obviously the quad antenna had an ideal short attached to it!

Having lived on the I.O.W. I know that it is possible to pick up TV signals with the crudest of antenna devices. The device was sold at £2 and was strictly illegal under the Trade Descriptions Act and the vendor should be prosecuted for falsely selling the device.

C.B. Fry BA
Presteigne
Powys

It's on the Cards

Sir: I am an old reader of *PW* of many years' standing, and read with interest *The Key to Morse* in the October 1981 issue.

I have an idea which I have used many times to help budding Morse learners. A set of playing cards is prepared with the Morse letter on one side and the equivalent letter on the other side.

The cards are then shuffled and dealt in turn and whichever comes up, Morse or letter, the dealer tries to remember whichever is not exposed. Shuffling these quickly it is possible to learn the basic Morse alphabet.

This idea can also be used to learn basic data: E is e.m.f. etc., and other basic co-related facts. I think perhaps other readers would be interested in this idea as it seems to work.

S.F. Mason
East Yorkshire

REMINISCENCES 1

S. KEELEY

It's a common thing today to look back with nostalgia and, say that things were better in the "Good Old Days".

No doubt many of the things we talk about so nostalgically are set in a rosy glow. But having recently returned to short wave listening after a lapse of thirty years I have to tell you that we had it better than you ever will.

I recall very well my first incursion into the thrills of radio DX in the mid-thirties.

It all started with "The Modern Boy One-Valver" by courtesy of one of the boys' magazines of the time. We were assured that with a very little money and a lot of ingenuity we could build a receiver which would fetch 'em in from all over the place.

So I had a go; a few bob extracted from Dad's pocket bought a variable condenser, a few capacitors and odd bits.

The coil was a different matter. This, to bring matters within range of a boy's pocket money, was to be wound with cotton-covered wire on a toilet-roll former.

This in itself raised a problem. Like most families in those days toilet habits were assisted by torn-up newspaper hanging on a nail in the Smallest Room. The luxury of a genuine toilet roll was restricted to the Sunday when visitors came to tea; and it took a long time to get down to the cardboard.

But in due time (patience was a virtue) the coil was painstakingly wound. I mounted the valveholder and other impedimenta on a board and looked round for some wire to hook up the circuit via the terminals—no soldered joints then!

I liked the look of the smart shiny wire I eventually bent into right-angles and such, to make a "proper job" of it. The only snag—it looked a treat; but when I switched it on I couldn't get a sound out of it.

Uncle Gilbert—he was a REAL radio expert who had a three-valver which could get Vienna, sorted it out for me. He pointed out diplomatically that the reason the wire was so nice and shiny was that it was shellacked, and though I'd connected it all together I hadn't got a circuit anywhere.

He took it away to re-wire, and returned it with a British General coil—a monstrous thing with a big switch and tappings down the coil which covered the medium and long waves.

For a fortnight I toured Europe deliriously, logging such unheard-of DX as Fecamp in France, Turin—and, on one never-to-be-forgotten occasion—Tangiers in Africa.

But, of course, as time went on I became blasé about such things. What, I wondered, went on on those magic short-waves below the limit of my multi-tapped coil?

Well, I reasoned, if the British General boffins could tap the coil, so could I. So with a piece of wire connected to earth and the other end wound round a needle I plunged into the 26d.c.c. (26 s.w.g. double cotton covered.)

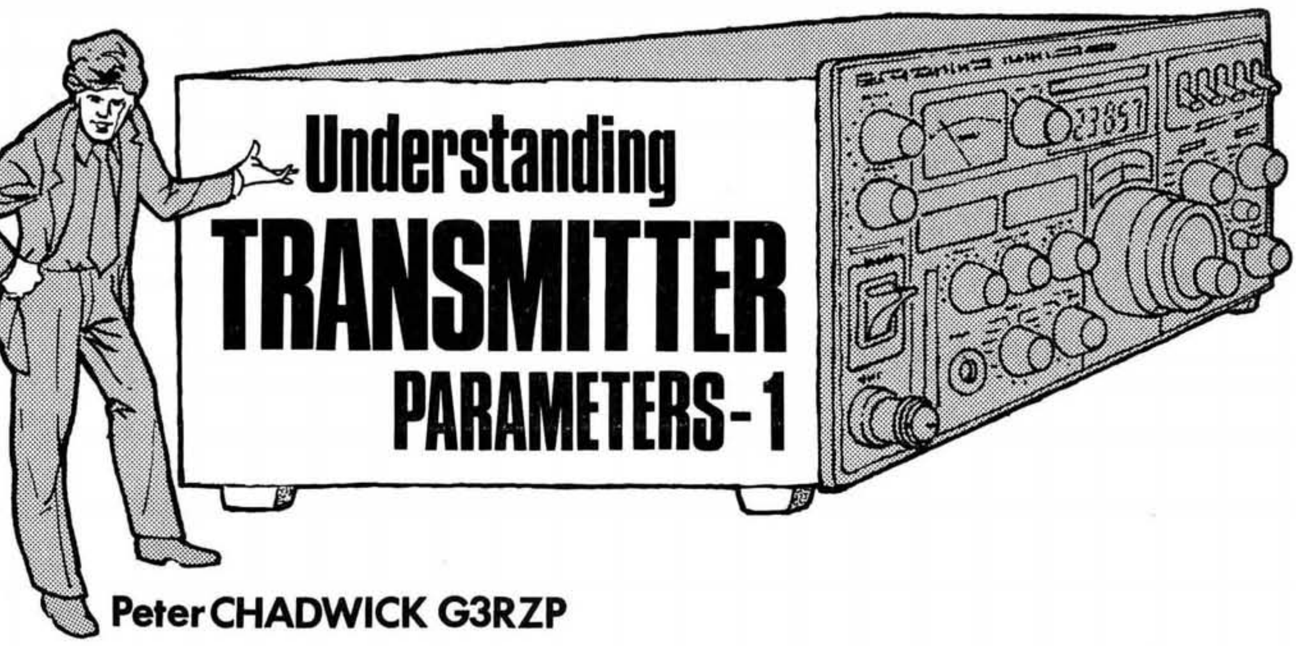
I had no idea where I was in this magic new territory, or what I might find. But suddenly up came a signal which made my experiment a milestone.

For there was a radio-telephone message from the Honourable Someone-or-another on a liner in mid-Atlantic to say he would be arriving in Southampton in a couple of days' time!

Well, that really whetted my appetite. It led to a series of home-built two and three-valve receivers, eventually tuning down as far as 16 metres . . . and the world was my oyster.

It was a very different world then. One could DX with the assistance of the BBC's publication *World Radio,* which published a weekly list of all the transmitters world wide. And, believe it or not, the total could be printed on two pages.

continued on page 43▶▶▶



Understanding TRANSMITTER PARAMETERS-1

Peter CHADWICK G3RZP

Unlike radio receivers, where poor performance is not only obvious, but annoying to the owner in terms of its effects on communications efficiency, poor performance in a transmitter is much more frequently the cause of bad language by other users of the radio frequency spectrum.

Because of the ability of badly adjusted transmitters to produce interference over a wide frequency spectrum, there are fairly strict requirements laid down for their performance. The problem can be divided into two distinct parts:

(a) Distortion of the transmitted signal such as to produce degradation of the transmitted information.

(b) Interference to other services. This includes those operating close in frequency to the transmitter, and those operating at frequencies greatly removed.

The service in which the transmitter is used also affects the degree of degradation of information that is permissible. For example, the amateur mobile f.m. transmitter can obviously stand a higher percentage of harmonic distortion of the modulation than can an f.m. stereo broadcast transmitter, and the surveillance radar transmitter does not require the frequency stability of the point to point h.f. s.s.b. transmitter.

Transmitter parameters will therefore be dealt with under three basic headings:

i. In-channel radiation.
ii. Adjacent channel radiation.
iii. Broad-band radiation.

In-Channel Radiation

Under this heading we can put parameters such as frequency stability and accuracy, modulation distortion, in-channel intermodulation distortion, modulation frequency response and modulation processing. In addition, spurious radiations may or may not be in channel, but are generally treated as being adjacent channel radiations.

The frequency stability and accuracy of a transmitter is dependent upon the service in which it is operating. Broadcast transmitters at low and medium frequencies have stabilities and accuracies normally better than 1Hz; coast station transmitters in the 2MHz range are normally better than 10Hz, while amateur transmitters require very good short-term stability (i.e. around 10 minutes), and relatively poor setting accuracy (100Hz is generally more than adequate). General purpose h.f. s.s.b. mobiles normally use crystal ovens to obtain stabilities better than 50Hz over a 50°C temperature range, and are also fitted with clarifiers. At v.h.f., the private mobile radio service (p.m.r.) requires transmitters to be within 2kHz of the assigned channel frequency under all conditions, and within 2·5kHz at u.h.f.

Again, the amateur v.h.f. f.m. operator is unlikely to need stability over a wide temperature range, although it should be remembered that a mobile rig can operate from say −5°C to +45°C in the UK. (The upper limit represents a closed car in summer with the rig sitting on the seat.) Nevertheless, some consideration must obviously be given to accuracy and stability under these conditions, especially if a lot of time is not to be wasted in calling just off the repeater frequencies! For general amateur use, then, a setting accuracy of 1kHz, and a stability of 100Hz is likely to suffice for s.s.b. work, while an overall tolerance of 2kHz is adequate for f.m. The exceptions to this are to be found above 1296MHz, and for RTTY, moonbounce and meteor scatter work—all modes which require higher stabilities and more accurate frequency setting.

In spite of this, frequency is one of the easiest parameters for the amateur to measure with accuracy. A crystal standard may be set up to an accuracy of better than 1 part in 10^7 with just the use of an h.f. receiver, and modern i.c. technology makes frequency counters simple projects. It is therefore not too difficult to set a transmitter up to within 50Hz of a specific frequency on the 432MHz band, although the stability—whether or not it will stay there—is another matter altogether.

Frequency stability, or v.f.o. drift, is a difficult parameter to measure, basically because there are a number of different ways of measuring it, and all of which are quite capable of producing different answers.

Warm-up

The first method which comes to mind is to switch the rig on and allow a few minutes warm-up time. The frequency is then measured at 5 minute intervals for an hour or two, with supply voltage and temperature maintained constant, and the drift plotted.

This tells us the warm-up drift under constant conditions, but does not relate to drift which occurs when the shack is a shed in the garden warmed up on a cold winter's night. In addition, if the v.f.o. is valved, and the station is running RTTY, a drift may well occur because of a drop in mains voltage on transmit leading to a temperature change of the cathode. Thus, the only safe way to specify drift is in terms of overall departure from a preset frequency under all conditions—a measurement task which is highly daunting to the equipment reviewer, and very difficult for a manufacturer to specify without a lot of extremely expensive testing. Fortunately, the advent of the fully synthesised equipment makes such specification possible, but not easily measurable. Synthesisers, however, have their own penalties.

Digital Display Accuracy

The advent of digital displays for transceivers gives a high apparent accuracy of frequency display. Nevertheless, just because a display is digital does not necessarily mean that it is accurate, and some care must be exercised in the use of such displays. For example, drift of the frequency standard in a frequency counter can lead to appreciable error in the displayed result, with possible disastrous results.

Modulation Frequency Response

Modulation distortion is usually only specified for transmitters in the broadcast or radio link services. It is, however, tied in with depth of modulation or the deviation, as overmodulation protection by speech clipping used in a.m. and f.m. transmitters introduces distortion. Similarly, speech compressors can introduce distortion, although processing distortion is dealt with later. The distortion introduced is not generally a problem, as most services, other than broadcast, do not offer a signal to noise ratio that is good enough for less than 3 to 5 per cent, at best, total harmonic distortion to be detected. Even this is extreme; the average signal to noise ratio corresponding to S9 is about 25dB, and so 3 per cent t.h.d. products will be below the noise. Gross modulation distortion is therefore generally caused by a fault in the system, although occasionally excessive deviation or modulation may give the same results.

The capability of a transmitter to operate at the maximum possible modulation or deviation without exceeding 100 per cent or the permitted deviation respectively is important. This is because the system signal-to-noise ratio is dependent upon the amount of modulation, and is why some operators appear to "talk it up" better than others. In this respect the modulation frequency response of the transmitter is important, and especially on s.s.b., is seldom optimum, and here it should be noted that the YL operator often produces a better signal from those transmitters where the a.f. speech band extends up to 3kHz.

The Oriental YL operator with a transmitter which has a 2·1kHz mechanical filter with an upper frequency limit of about 2·3kHz is often unreadable under poor conditions, and this is because the energy distribution in the frequency spectrum differs from male to female, and from ethnic group to ethnic group. Fortunately, the differences are not excessive, but the use of 2·7kHz bandwidth is desirable.

The specification for v.h.f. marine radio has a rising characteristic to 3kHz, and then a rapid roll-off at frequencies above this, while the p.m.r. specification calls for a roll-off of 6dB per octave from 3 to 6kHz, and 14dB per octave beyond this frequency. It should be noted that shaping of the audio frequency response allows the modulation of an f.m. transmitter to be turned into p.m., and vice versa.

Setting the modulation depth on a.m. or the deviation on f.m. is best done with a modulation meter. Lacking such a device, an oscilloscope is very useful for a.m., while f.m. can be done with the use of a selective receiver. As the deviation of an f.m. signal is increased, the power in the carrier decreases until at a modulation index of 2·4, the carrier disappears.

The way in which the power of the carrier and the sidebands vary with the deviation are governed by a mathematical series of functions known as Bessel functions, and various reference books provide tables of the ratios of carrier to sideband power ratios at given modulation indices. (Modulation index is the ratio of the deviation to the modulating frequency.)

Thus, a transmitter modulated by a 1kHz tone will have the carrier disapear at a deviation of 2·4kHz, and again at 5·52kHz deviation. By using a selective receiver with a crystal filter, the carrier may be "nulled" out for the appropriate modulation frequency and deviation required.

Of course, a spectrum analyser may be similarly used, but, generally speaking, anyone with a spectrum analyser has a modulation meter as well—or, rather, his employers have!

Speech Processors

Speech processing is becoming more and more common in modern transmitters. Some processing is obtained by shaping of the frequency response, as above, but more common is the use of some extra processing or compression. Speech compression may take a number of forms; for example, the long time-constant compression of a.g.c. systems such as v.o.g.a.d.s (voice operated gain adjusting devices), which are readily available in integrated circuit form, or short time-constant clipping.

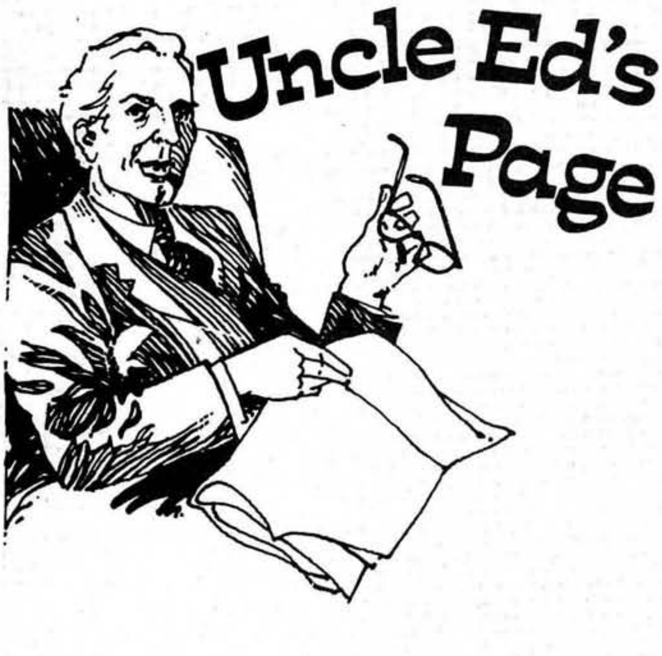
The v.o.g.a.d. finds its main use in making provision for different operators or different input signal levels, and is not a true signal processing device *per se*; it does however often serve a useful function. Unfortunately, the range of most of the i.c.s available is a little excessive for amateur use, and some 10 to 15dB of gain compression is more desirable than the 30dB or so generally available. This is because the increase in gain produced when the operator ceases to speak into the microphone is often enough to allow one's wife, the telly, next door's kids and the dog fight down the street to modulate at the same level, which is not generally highly desirable!

The main reason for using speech processing is to raise the average level of the modulation by reducing the peak to average ratio. This ratio is about 9:1 for the English speaking male although some authorities claim ratios as high as 15:1 but without sufficient specification to determine the accuracy. In the case of an s.s.b. transmitter of 1kW output, the average power output using unprocessed speech is about 110 watts: obviously, if this could be improved to 450 watts, then a 6dB improvement in signal to noise ratio is possible. Unfortunately, because of the peak power that the transmitter must handle, this cannot be done merely by increasing the gain, and it is here that processing comes into its own.

Syllabic Compression

One way in which this processing may be achieved is by syllabic compression, which is a fast-acting audio compressor capable of reducing the gain of the transmitter only for the high energy speech peaks. More popular is the r.f. clipper, which can take several forms. One popular commercial unit generates s.s.b. by a phasing method, clips the resultant r.f. and then converts the s.s.b. back to

continued on page 43▶▶▶



Uncle Ed's Page

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.

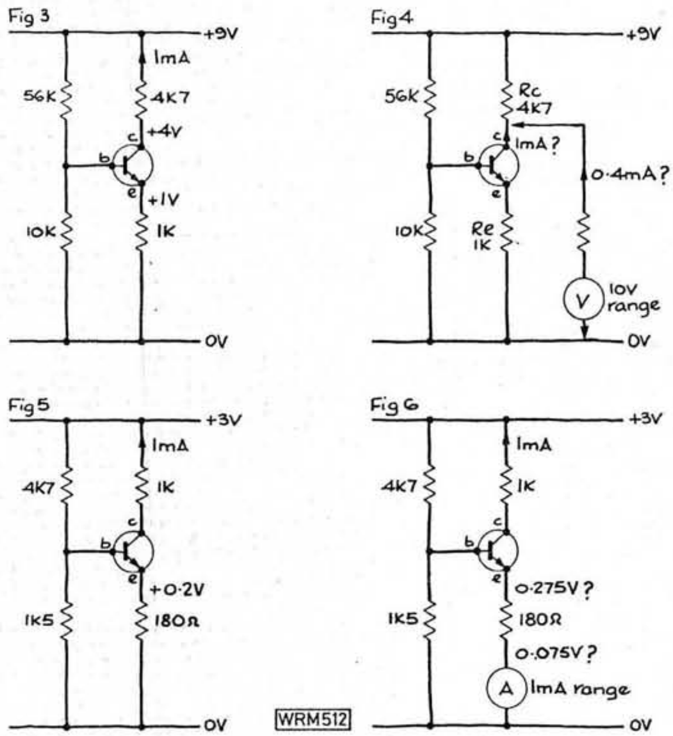
METERS—2

Last month, we saw that although the needle of a meter is deflected by the current flowing through the coil of the movement, there will also be a certain voltage dropped across the movement, due to its resistance. This current consumption and voltage drop are both unwanted items so far as the circuit you want to make measurements on is concerned.

Suppose we want to measure the voltage on the collector of the transistor in Fig. 3 (I've calculated what the various voltages will be and shown those on the circuit). Connecting our 1mA meter between the collector and 0V rail, with the appropriate multiplier resistor to increase its f.s.d. to 10V, would mean that the meter would need to pass a current of 0·4mA to make it indicate the calculated 4V. (See Fig. 4.) Now, the 1mA flowing through Rc in Fig. 3 drops 4·7V, and I've called that 5V (9V − 5V = 4V, OK?). But, if you pass an extra 0·4mA through the meter, 1·4mA would have to flow through Rc, and the voltage drop across it would go up to 1·4 × 4·7 = 6·58V; call it 7V. So connecting the meter would change the circuit conditions, not a very desirable state of affairs. In fact, if the collector voltage **had** gone down to 2V (9V − 7V = 2V), then the current through the meter wouldn't be 0·4mA at all, but 0·2mA instead. So the voltage drop across Rc wouldn't be what we just calculated. Yes–it's a round-and-round-in-ever-decreasing-circles situation. The solution is to work out the answer from the meter resistance, which does stay constant (providing you keep to the same f.s.d. range), and the effective emitter/collector resistance of the transistor (not forgetting to add in the emitter resistor), treating them as a series-parallel resistor network.

I have it in mind to talk about such series-parallel networks in a future column, following a plea from a reader, so I won't go further into the subject here.

If the meter took less current, compared with the normal circuit current, it wouldn't upset things so much. A 20kΩ/V (50μA) meter, for example, would disturb the circuit 20 times less, and its effect could generally be ignored. Therefore, a meter to measure voltage should have a high sensitivity, which means it takes a small current to drive it. Note though that it's all relative. If the collector current had been 10mA, the current drawn by the 1mA meter would have had negligible effect. On the other hand, if the collector current had been only 100μA, even a 50μA meter (trying to draw 20μA if the circuit voltages were the same) would have badly upset the circuit conditions.



When we come to measure the current flowing in a circuit, the necessary voltage drop across the meter movement becomes a problem. In Fig. 5 we have a transistor stage operating from a very low voltage rail of +3V. In a circuit like this there is very little voltage to spare, and the emitter bias resistor will be a lot lower in value, so that the emitter sits at about +0·2V. If we put our 1mA (75mV f.s.d.) meter in series with the emitter resistor to measure the current flowing, it will add 75mV (0·075V) to the voltage at the emitter, raising it to 0·275V (Fig. 6). In fact, it will change the bias on the transistor, so that less current will flow, and the circuit conditions will change, just as they did in the voltage case.

So, to measure current without upsetting the circuit being measured, we need the voltage drop across the meter movement to be as low as possible, which means the movement must have as low a resistance as possible.

There are various electrical and mechanical limits to what can be done to make voltmeter movements have a high resistance and ammeter movements a low resistance. To go beyond those limits, you must put an amplifier between the measuring terminals and the movement of the meter. The first amplifiers used valves, as in valve voltmeters, but present-day designs of electronic multimeters use transistor or integrated-circuit amplifiers.

Next month, how to measure meter movement resistance, plus practical considerations of meter range selection.

The February 12 Schedule Revision

The London Gazette Notice in full

WIRELESS TELEGRAPHY ACT 1949

To all Holders of Amateur (Sound) Licence A and Amateur (Sound) Licence B

The Secretary of State for the Home Department hereby gives notice that, as from 1st January 1982, all licences as amended from time to time of the above types granted by him on or before 31st December 1981 shall be and are hereby varied by the deletion of the schedule thereto and replaced by the following:

THE SCHEDULE

See facing page ▶

FOOTNOTES

1. This band is allocated to stations in the amateur service on a secondary basis on condition that they shall not cause interference to other services.
2. This band is shared with other services.
3. This band is available to amateurs until further notice provided that use by the Licensee of any frequency in the band shall cease immediately on the demand of a Government official.
4. The type of transmission known as Radio Teleprinter (RTTY) may not be used in this band.
5. Use by the Licensee of any frequency in this band shall be only with the prior written consent of the Secretary of State.
6. This band is not available for use within the area bounded by 53°N02E, 55°N02E, 53°N03W and 55°N03W.
7. In this band the power must not exceed 10 dBW erp (effective radiated power).
8. Use by the Licensee of any frequency in this band shall only be with written consent of the Secretary of State and such consent shall indicate the power which may be used, taking into consideration the characteristics of the Licensee's station.
9. Slow Scan Television may be used in this band.
10. High Definition Television (A3F, C3F) may be used in this band.
11. Facsimile Transmission (A3C, F3C) may be used in this band, with a bandwidth not greater than 6 kHz.
12. The amateur-satellite service also has an allocation in this band.
13. This band is allocated to stations in the amateur-satellite service on a secondary basis, on condition that they shall not cause interference to other services.
14. The amateur-satellite service may operate in this band in accordance with international Radio Regulation 2741, viz.:

    Space stations in the amateur-satellite service operating in bands shared with other services shall be fitted with appropriate devices for controlling emissions in the event that harmful interference is reported in accordance with the procedure laid down in Article 22 of the Radio Regulations. (Administrations authorising such space stations shall inform the IFRB and shall ensure that sufficient earth command stations are established before launch to guarantee that any harmful interference which might be reported can be terminated by the authorising administration (see RR 2612).)
15. The use of the amateur-satellite service in the following bands shall be limited to the direction stated below:

    1260–1270 MHz Earth to Space
    5650–5670 MHz Earth to Space
    5830–5850 MHz Space to Earth
16. The bands allocated to the amateur service at 3·5, 7·0, 10·1, 14·0, 21·0, and 144 MHz may, in the event of natural disasters, be used by non-amateur stations to meet the needs of international emergency communications in the disaster area in accordance with regulations of the Radio Regulatory Department.
17. Radiation Hazard Microwaves can, by thermal effect, be harmful to the human body. A rise in body temperature can occur if the microwaves heat the body to such an extent that the body's own temperature regulation system can no longer maintain a constant temperature. The eyes are particularly susceptible. The following safety precautions are to be taken when operating in the bands to which this footnote applies:

    (i) At no time should the transmit power density exceed 10 mW/cm² across the antenna aperture.
    (ii) Transmit antenna should be sited to offer the least potential radiation hazard and should be mounted upon a mechanically sound structure which ensures that no part of the antenna is less than 3 metres above ground level.
    (iii) The antenna must be directed away from any vantage point to which the public may have access.
18. To safeguard operating personnel and the public, the use of an eirp greater than 30 dBW will require the prior consent of the Secretary of State, for which application should be made to the Radio Regulatory Department.

A. The symbols used to designate the classes of emission have the meaning assigned to them in the Telecommunication Convention. They are:

Amplitude Modulation

A1A—	Telegraphy by on-off keying without the use of a modulating audio frequency.
A1B—	Automatic telegraphy by on-off keying, without the use of a modulating audio frequency.
A2A—	Telegraphy by on-off keying of an amplitude-modulating audio frequency or frequencies, or by on-off keying of the modulated emission.
A2B—	Automatic telegraphy by on-off keying of an amplitude modulating audio frequency.
A3E—	Telephony, double sideband.
A3C—	Facsimile Transmission.
R3E—	Telephony, single sideband, reduced carrier.
B3E—	Telephony, two independent sidebands.
J3E—	Telephony, single sideband, suppressed carrier.
A3F/C3F—	High Definition Television.

Frequency Modulation

F1A—	Telegraphy by frequency shift keying without the use of a modulating audio frequency: one of two frequencies being emitted at any instant.
F1B—	Automatic telegraphy by on-off keying without the use of a modulating audio frequency.

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Frequency Bands in MHz	Footnote number	Classes of Emission (see A overleaf)	Power Limitations dBW: Carrier Power supplied to the antenna	Power Limitations dBW: Peak Envelope Power supplied to Antenna for R3E—— for J3E——
1·81 – 1·85	2	A1A——A1B—— A2A——A2B—— A3E——A3C—— R3E——B3E—— J3E——F1A—— F1B——F2A—— F2B——F3E—— F3C——F3F——	9 dBW	15 dBW
1·85 – 2·0	2 and 4			
3·5 – 3·8	2, 9 and 16			
7·0 – 7·1	9, 11, 12 and 16		20 dBW	26 dBW
10·1 – 10·15	1 and 16			
14·0 – 14·25	9, 11, 12 and 16			
14·25 – 14·35	9, 11 and 16			
21·0 – 21·45	9, 11, 12 and 16			
28·0 – 29·7	9, 11 and 12			
70·025– 70·5	1 and 3		16 dBW	22 dBW
144·0 – 146·0	9, 11, 12 and 16		20 dBW	26 dBW
430·0 – 432·0	1, 6 and 7	A3F——C3F—— A1A——F1A—— A1B——F1B—— A2A——F2A—— A2B——F2B—— R3E——F3E——	See Footnotes	See Footnotes
432·0 – 435·0	1, 10 and 14		20 dBW	20 dBW
435·0 – 438·0	1, 10 and 14			
438·0 – 440·0	1, 10 and 14			

Frequency Band in MHz	Footnote number	Classes of Emission (see A overleaf)	Maximum Equivalent Isotropically Radiated Power	SSB Operation
1,240·0 – 1,260·0	1, 10, 17 and 18	A1A——A1B—— A2A——A2B—— A3E——R3E—— B3E——J3E—— F1A——F1B—— F2A——F2B—— F3E——M2A—— Q2A——V2A——	30 dBW	35 dBW
1,260·0 – 1,270·0	1, 14, 15, 17 and 18			
1,270·0 – 1,325·0	1, 10, 17 and 18			
2,300·0 – 2,400·0	1, 10, 17 and 18			
2,400·0 – 2,450·0	1, 10, 13, 14, 17 and 18			
3,400·0 – 3,475·0	1, 17 and 18			
5,650·0 – 5,670·0	1, 10, 13, 14, 15, 17 and 18			
5,670·0 – 5,680·0	1, 10, 17 and 18			
5,755·0 – 5,765·0	1, 10, 17 and 18			
5,820·0 – 5,830·0	1, 10, 17 and 18			
5,830·0 – 5,850·0	1, 10, 13, 14, 15, 17 and 18			
10,000·0 –10,450·0	1, 10, 17 and 18			
10,450·0 –10,500·0	1, 10, 13, 14, 17 and 18			
24,000·0 –24,050·0	8, 10, 12, 17 and 18			
24,050·0 –24,250·0	1, 8, 10, 17 and 18			
2,350·0 – 2,400·0	1, 5, 13, 17 and 18	K1A——L2A—— K2A——L1E—— K1E——M2A—— Q2A——V2A——		
10,050·0 –10,450·1	1, 5, 17 and 18			
5,755 – 5,765 5,820 – 5,850	1, 5, 13, 17 and 18			

F2A—— Telegraphy by on-off keying of a frequency modulating audio frequency or on-off keying of a frequency modulated emission.
F2B—— Automatic telegraphy by on-off keying of a frequency modulating audio frequency.
F3E—— Telephony.
F3C—— Facsimile Transmission.
F3F—— Slow Scan Television.

Pulse Modulation

K1A—— Telegraphy by on-off keying of a pulsed carrier without the use of a modulating audio frequency.
K2A—— Telegraphy by on-off keying of a modulating audio frequency or frequencies or by on-off keying of a modulated pulsed carrier—the audio frequency or frequencies modulating the amplitude of the pulses.
L2A—— Telegraphy by on-off keying of a modulating audio frequency or frequencies or by on-off keying of a modulated pulsed carrier—the audio frequency or frequencies modulating the width (or duration) of the pulses.
K1E—— Telephony, amplitude modulated pulses.
L1E—— Telephony, width (or duration) modulated pulses.
M2A—— Telegraphy by on-off keying of a modulating audio frequency or frequencies or by on-off keying of a modulated pulsed carrier—the audio frequency or frequencies modulating the position or phase of the pulses.
Q2A—— Telegraphy by on-off keying of a modulating audio frequency or frequencies or by on-off keying of a modulated pulse carrier—the audio frequency or frequencies in which the carrier is angle modulated during the period of the pulse.
V2A—— Telegraphy by on-off keying of a modulating frequency or frequencies or by on-off keying of a modulated pulsed carrier—which is a combination of the foregoing, or is produced by other means.

*See over.

B. As an alternative for R3E and J3E single sideband types of emission, the power shall be determined by the peak envelope power (PEP) under linear operation.

C. Double Sideband Suppressed Carrier emissions are permitted within the terms of this Licence.

D. Data transmission may be used within the frequency bands 144–145 MHz and above provided: (*a*) the Station callsign is announced in morse or telephony at least once every 15 minutes and (*b*) emission is contained within the bandwidth normally used for telephony.

E. *Interpretation*

(i) *Carrier Power of a Radio Transmission.* The average power supplied to the antenna from a transmitter during one radio frequency cycle under conditions of no modulation. This interpretation does not apply to pulse modulated emissions.
(ii) *Peak Envelope Power of a Radio Transmitter.* The average power supplied to the antenna by a transmitter during one radio frequency cycle at the highest crest of the modulation envelope, taken under conditions of normal operation.
(iii) *Effective Radiated Power.* The power supplied to the antenna, multiplied by the relative gain of the antenna in a given direction.
(iv) *Equivalent Isotropically Radiated Power (eirp).* The product of the power of an emission as supplied to an antenna and the antenna gain in a given direction relative to an isotropic antenna.

**Classifications of emissions*

Basic Characteristics

The basic characteristics of a radio emission are described by three symbols as follows:
(i) first symbol-type of modulation of the main carrier.
(ii) second symbol-nature of Signal(s) modulating the main carrier.
(iii) third symbol-type of information to be transmitted.

Optional Additional Characteristics

For a more complete description of an emission two optional additional characteristics may be used. These are known as the Fourth and Fifth Symbols.

Where the Fourth and Fifth Symbol is not used this should be indicated by a dash where each symbol would otherwise appear in the full designation of the emission.

For simplicity these two additional characteristics have been omitted from this Schedule.

W. J. A. Innes, on behalf of the Secretary of State for the Home Department

2nd February 1982.

The February 12 Schedule Revision

An Analysis by G3GSR, G4LFM, G8MCP & G8VFH

Several decisions taken at the World Administrative Radio Conference in Geneva in 1979 (WARC '79) were due to be implemented on 1 January, 1982.

So far as the UK amateur is concerned, these were the introduction of the 10·1–10·15MHz h.f. band, the adoption of a new method of classifying emissions (see *All Change,* in the August 1981 issue of *PW* for further details), and some minor adjustments to the limits of several bands at v.h.f. and above.

The Notice amending the Schedule of Frequencies, Emission Classes and Powers, published in the *London Gazette* of 12 February, 1982, introduced far more sweeping changes than these, and contained several obvious errors and inconsistencies, plus quite a few more questionable changes. In the order in which they appear in the Notice, they are as follows.

1. The Notice is addressed to Holders of Licence A and Licence B, without any difference as to the bands or modes permitted. Some holders of Class B Licences really enjoyed themselves for about ten days, until that part of the February 12 Notice which was omitted due to a printer's error was published in the *Gazette* of February 26. The correction reads: "except that holders of Amateur "B" Licences are not permitted the use of radio frequencies below 144MHz or the use of A1A, A1B, A2A, A2B, F1A, F1B, F2A, K1A, K2A, L2A, M2A, Q2A or V2A transmissions."

2. The Notice claims to be effective from 1 January, 1982. Clause 12 of the UK Amateur Licence clearly states that "... Revocation and Variation ... *Any notice* given under this clause may take effect either forthwith or on such subsequent date as may be specified in the notice." In other words, it **cannot** be back-dated.

3. The way in which power limitations are stated is totally changed. Powers are now given in dBW—decibels relative to one watt. Possibly power meters in the Home

Office laboratories are scaled in dBW, but we have yet to see one used by an amateur scaled in anything but watts. Conversion is not difficult, but it all seems rather unnecessary, since it confers no obvious advantage to use dBW. For your information:

9dBW = 8W	22dBW = 160W
15dBW = 32W	26dBW = 400W
16dBW = 40W	30dBW = 1kW
20dBW = 100W	35dBW = 3·2kW

All figures have been rounded where necessary.

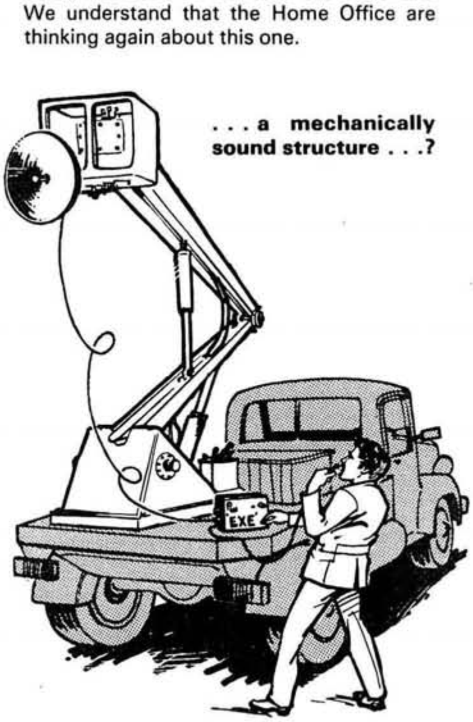
The change from "d.c. input power" to "carrier power supplied to the antenna" for non-s.s.b. modes had been long expected, and seems generally sensible as it allows for varying output stage efficiencies and for feeder losses. Conversion from the old figures to the new has been based on 66·6 per cent efficiency in the p.a.

4. As published, the Schedule limits power on the band 3·5–3·8MHz (80m) to the same as 1·81–2MHz (160m), in other words 8W carrier, 32W p.e.p. Although Home Office spokesmen said on two occasions that this was intentional, and was based on a new "international limit," we now understand that it has been admitted to be a mistake, and the line across the last two columns of the Schedule was drawn in the wrong place. Those "80 metre" nets are safe after all!

5. Still on 3·5–3·8MHz, the Footnotes do not permit facsimile operation (now A3C, F3C), but the Class of Emission column does. This one is still to be resolved.

6. Formerly, the class of emission using one sideband and full carrier (A3H, also known as "compatible s.s.b.") was permitted on all amateur bands except 430–432MHz. The new code for this emission (used in place of A3 in several rigs such as the Drake TR7) is H3E, but it does not appear on the new Schedule. Another one still to be resolved.

7. A mode not previously permitted for use by amateurs, telephony with two independent sidebands (formerly A3B but now B3E), has been written into the Schedule. We understand that the Home Office are thinking again about this one.



. . . a mechanically sound structure . . .?

8. The two spot aeronautical frequencies, 144·0 and 144·54MHz, formerly barred to amateur use, are not mentioned in the new Schedule. The Home Office are checking to see whether this is correct! In the meantime, we would recommend that you continue to avoid these frequencies until the situation is confirmed.

9. For the band 430–440MHz, the new Schedule does not allow either telephony, double sideband (formerly A3, now A3E) or telephony, single sideband, suppressed carrier (formerly A3J, now J3E). The mode telephony, single sideband, reduced carrier (R3E, formerly A3A) is permitted by the new Schedule, but there seems to be some uncertainty as to any agreed international definition for "reduced". ("Suppressed" is usually specified as 40dB or more below the peak sideband power.) Common figures for "reduced" used to be −16dB or −26dB, but the only recent reference we can find quotes −18dB, apparently stemming from the *1976 ITU Radio Regulations.*

We now understand that the Home Office have admitted that J3E was omitted in error, so owners of "70cm" multi-modes can breathe again!

10. On the band 430–432MHz, Footnote 10 which permits high-definition TV operation is not mentioned. On the other hand the codes A3F, C3F do appear in the Class of Emission column. ATV operation was not previously permitted in this sub-band, and we would imagine that the prohibition still applies. The Home Office have still to pronounce on this one.

We understand that the Footnote 14 reference is to be deleted from the bands 432·0–435·0MHz and 438·0–440·0MHz.

11. For the band 430–440MHz, the figures for carrier power and p.e.p. are the same. The Home Office admit this is a mistake, and that the figure in the p.e.p. column should read 26dBW.

12. For the microwave bands, now categorised as frequencies above 1GHz, so far as the Amateur Service is concerned, a different concept of power measurement was introduced in the new Schedule. This is Equivalent Isotropically Radiated Power (e.i.r.p.), defined under E (iv) of the Schedule. Apart from the questionable point of relating a limit to a type of antenna which does not actually exist, there is a technical problem for the amateur experimenting in the field of antenna design, in that he will often not have the equipment to make the necessary measurements.

We understand that the Home Office, following representations from *PW* and the RSGB, have reverted to the old d.c. input power figures for this band, pending further discussions.

13. Footnote 17 is, we are told, based on data contained in *Safety Precautions Relating to Intense Radio-Frequency Radiation,* a booklet published by HMSO for the then Post Office in 1960. We don't quite see how!

The limitation of Footnote 17 (ii) seems effectively to rule out any future operation mobile in the 1296MHz (23cm) band, or portable in the 10GHz (3cm) band except by very tall amateurs. The wording of 17 (iii) should surely include some qualification on how near the vantage point might be. Otherwise, pointing an antenna anywhere but up into the sky is forbidden.

We understand that the whole question of radiation hazards, a subject of which **every** amateur should be aware, is being looked at again, and this footnote will hopefully be revised to a more sensible format. Apparently, the Home Office had not realised that mobile and portable operation took place on bands above 1GHz, and framed the footnote with fixed stations only in mind.

14. The general power limitation on microwaves (see also our comment 12) and Footnote 18 could cause some problems for anyone experimenting with e.m.e. (moon-bounce) and other high-power modes.

15. Under Note "A", the meanings of the various emission code symbols are listed.

Under the old system of emission codes, frequency modulation (modulation of the carrier oscillator in frequency) and phase modulation (modulation of phase of the carrier signal in one of the transmit amplifiers) were lumped together under the designation F3. The new emission codes separate them, so that frequency modulated telephony becomes F3E and phase modulated telephony becomes G3E, both under the heading of angle modulation, an unfortunate choice of terminology, since when abbreviated by the unwary it becomes a.m., the same as for amplitude modulation.

However, in the new Schedule, phase modulation doesn't appear, which apparently leaves a large proportion of "f.m." rigs which actually use phase modulation in a rather embarrassing position. Do not fret, though, because the Home Office have said sorry, and stuck phase mod in on an equal status with frequency mod.

Under Frequency Modulation, the definition for F1B is wrong, and should read: "Automatic telegraphy by on-off keying **with** the use of a modulating frequency."

As we go to press at the beginning of March, further meetings are planned between the RSGB and the Home Office, and we will bring you the latest news in our next issue. ●

FM MAINS INTERCOM

Nick ALLEN-ROWLANDSON BSc G4JET

The majority of intercom systems rely on transmitting an audio signal along wires to the receiving station rather like the telephone system. Although quite complex systems can be realised this way (i.e. multiple slave units) their main disadvantage is that they must be connected by a system of wiring dedicated to that purpose.

The same applies even if other transmission sytems, such as optical fibres, are used, but the f.m. mains intercom described in this article uses the domestic 240V mains wiring as the transmission medium. In practical terms this means that the individual radio transmitter and receiver combinations can be used anywhere within a building by just plugging the units into convenient mains sockets.

The mains intercom works in the same way as a normal f.m. radio except that the carrier wave is only at 100kHz. Both a.m and f.m. systems have been used for mains intercoms but to help eliminate mains-borne noise produced by domestic appliances, light dimmers, etc., f.m. was chosen for this project.

In order to understand the operation of the individual transceiver units it is convenient to consider the transmitter and receiver separately.

Transmitter

The transmitter consists of three main sections:

1) Oscillator and phase locked loop
2) Microphone amplifier, automatic gain control (a.g.c.)
3) Output stage (Fig. 1)

Oscillator and Phase Locked Loop

The 100kHz carrier frequency is generated by a Colpitts type oscillator formed by Tr1, and tuned by L1 and C1. The output from the oscillator is applied to the input of the 4046 c.m.o.s. phase locked loop, IC1. The comparator section of the p.l.l. compares the phase of the voltage-controlled oscillator (v.c.o.) against the reference input frequency from Tr1. Any difference between these two inputs generates an error signal from pin 13 which is filtered by R4, C7 and C8, and fed to the v.c.o. input pin 9 to bring the v.c.o. to the same frequency as the 100kHz reference. The system is then "locked".

The v.c.o. timing resistor R3 is initially set so that the voltage on pin 9, when the p.l.l. is in lock, is 6 volts. When the supply is switched to the transmitter by S1, capacitors C7 and C8 form a capacitive divider so that their junction is at 6V at switch on. This helps the p.l.l. to achieve lock quickly.

Microphone Amplifier and Modulator

A Plessey Semiconductors SL6270 v.o.g.a.d. integrated circuit is used to give a tailored audio response, of constant output voltage, over a large range of microphone input voltages. This technique enables the intercom unit to cope with widely ranging sound levels, allowing it to be used, for instance, as a baby alarm as well as a straight intercom.

The SL6270 is provided with its own 5 volt supply from Zener diode D1, which also provides the voltage rail for the sensitive electret microphone insert. Provided on the p.c.b. is a facility to use the SL6270 in its differential input mode, where the microphone input is applied to pins 4 and 5 with R8 removed. The attack time is defined by C16, the decay time by R9 and C16 and the audio response by C17 and C18.

If a high output microphone is used it may be necessary to reduce the amount of deviation by adding a resistor from pin 12 of the 4046 i.c. to ground. If this is done the total value of resistance between pin 11 and ground may have to be increased. An attenuator may be needed if the microphone output is of a very high level.

Audio output, from pin 8 of IC3, is applied through the electrolytic capacitor C9 to the v.c.o. control pin of the p.l.l. The v.c.o. characteristic is virtually a linear function of the input voltage so the frequency deviation obtained can be calculated from the amplitude of the audio signal applied to pin 9.

The v.c.o. frequency of 100kHz is at a 6V level and the applied audio amplitude is approximately 90mV r.m.s., which is equal to $2 \times \sqrt{2} \times 90$mV peak-to-peak, or approximately 255mV p.p. If the v.c.o. frequency response is linear then the total deviation is equal to $0{\cdot}255 \times 100 \div 6 \simeq 4{\cdot}243$kHz. This level of deviation is compatible with the receiver section of the intercom.

The phase comparator of the v.c.o. detects this change in frequency and tries to correct it so the filter time constant R4, C7 and C8 must be made large in comparison with the modulation frequency, otherwise the p.l.l. would cancel out the modulation completely, leaving an unmodulated carrier once again.

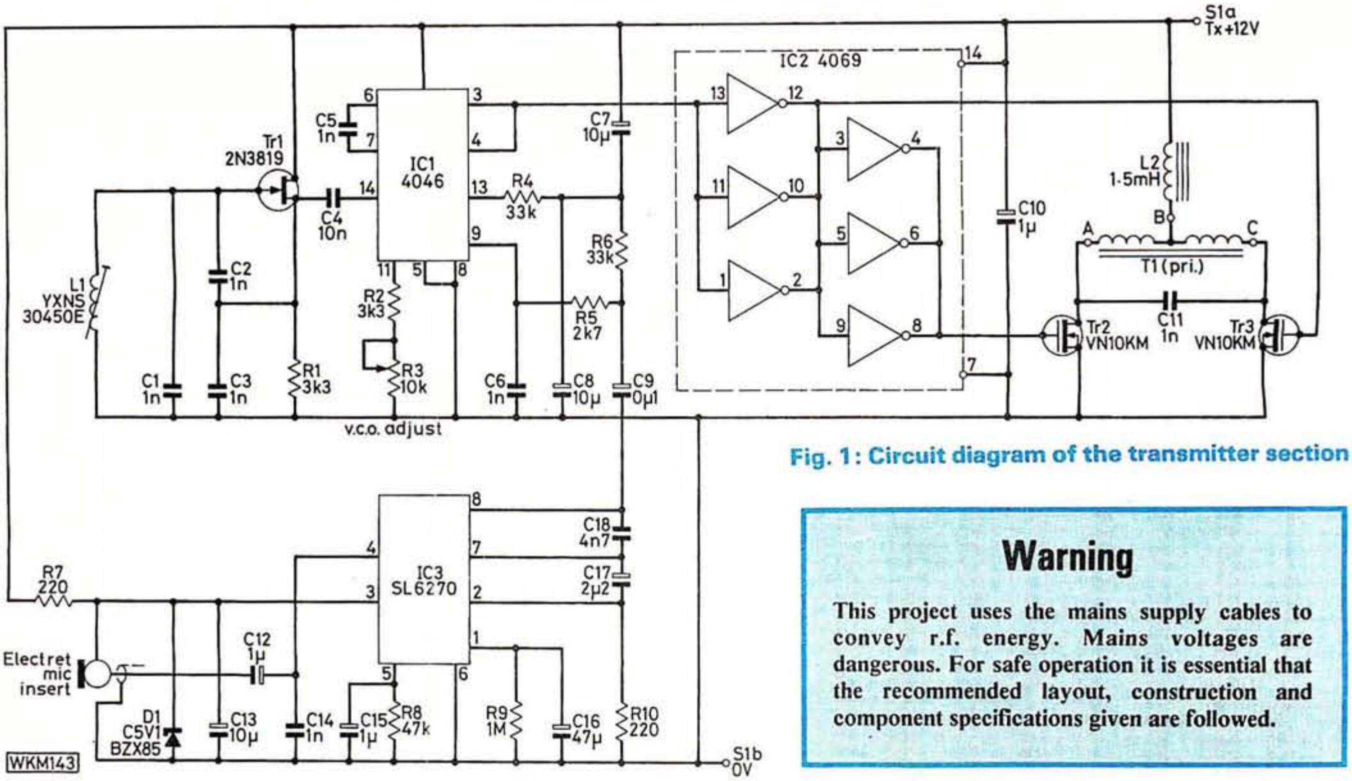


Fig. 1: Circuit diagram of the transmitter section

Warning

This project uses the mains supply cables to convey r.f. energy. Mains voltages are dangerous. For safe operation it is essential that the recommended layout, construction and component specifications given are followed.

Output Stage

The v.c.o. output is a logic signal at the modulated carrier frequency. This signal is applied to an inverter stage formed by IC2 so that two out of phase signals are available to drive the v.m.o.s. transistor output stage. In this application v.m.o.s. devices are well suited as their relatively large on-resistance is of no consequence and due to their insignificant turn-off delay ($\simeq$ 5ns) they can be driven directly from the c.m.o.s. source, without the fear of turning one transistor on before the other has had time to turn off.

Transformer T1 is a very important item because it provides the interface, and isolation from, the mains wiring used to convey the r.f. signals. It is therefore recommended that the information given on the construction of the transformer, although relatively simple, is followed carefully.

The primary winding of T1 is centre tapped and brought to resonance by capacitor C11. The mains interfacing secondary of T1 is blocked to the 240V 50Hz supply by C19, which **must** be rated for at least 250V a.c. working and be of a non-polarised construction. Whilst blocking successfully 50Hz, the value of C19 has been selected to pass the 100kHz carrier frequency into the mains wiring.

Receiver

The receiver uses the MC3357 low power f.m. i.f. integrated circuit. This device has been written about several times so only the block diagram, Fig. 2(b), has been given here. On-chip facilities consist of an internal oscillator connected to pins 1 and 2, an input to the mixer on pin 16 and a limiter/demodulator whose input is pin 5. A squelch circuit is also included, which incorporates the components from pin 9 to pin 14.

The frequency of the internal oscillator is determined by the carrier frequency. If the carrier frequency is 100kHz, as in this case, and a 455kHz intermediate frequency is required, then the local oscillator may be at either 355kHz or 555kHz. The component chosen for L3 together with its own self capacitance sets the local oscillator frequency at 355kHz.

A 455kHz signal is generated by the mixer from the incoming 100kHz and 355kHz local oscillator sum and is taken from pin 3 of IC4, through a 455kHz i.f. transformer and then applied to pin 5, the input of the limiter/demodulator section.

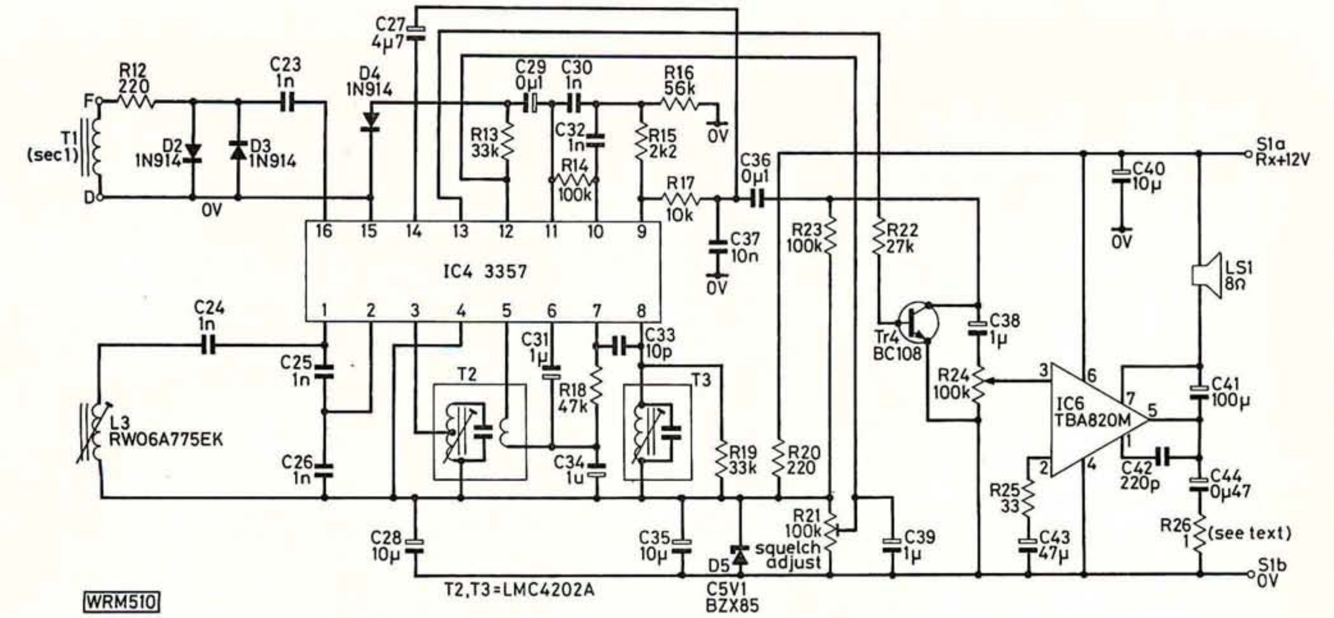
Demodulated audio is available from pin 9 and is then taken through a low pass filter, to reject the i.f., before going to the volume control R24 and the TBA820 audio amplifier, IC6.

CONSTRUCTION RATING Intermediate

BUYING GUIDE

All components for this project are available from normal sources. A part kit consisting of a single p.c.b., mains transformer and RM6 core is available from Electronic Design Services, 19 Kings Ave, Christchurch, Dorset BH23 1NA, price £8.00 inc p&p. A pair of the above kits costs £15.00.

APPROXIMATE COST £33 PER STATION



The squelch circuit of IC4 operates by monitoring the demodulated audio output for high frequency noise. If noise is present, i.e. when no carrier is being received, C29 and D4 generate a negative going voltage. If the voltage to pin 12 goes below 0·7V, pin 14 (open collector output) is held at 0V and shorts the audio signal to ground through C27. In practice, the MC3357 also injects noise (a shortcoming many users have gone to a lot of trouble to get around) so another low impedance short to ground is provided through Tr4.

The audio amplifier i.c., despite its small size, is capable of delivering its output of over 1 watt into an 8Ω loudspeaker, which is much more than is normally required.

Construction

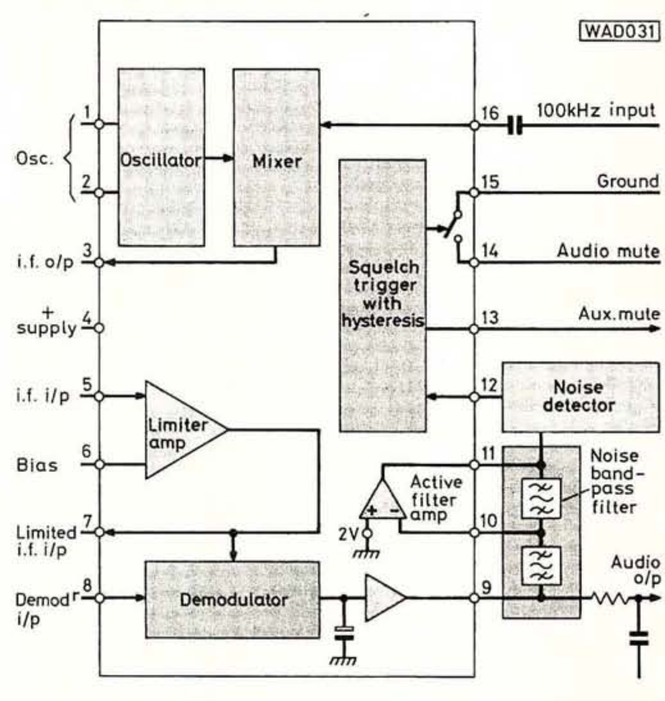
Before attempting to fit any components to the p.c.b.s, a close inspection must be made to ensure that no bridged tracks are present. Particular care must be taken with respect to the mains input area.

Providing all is well the components with the exception of transistors Tr2, 3 and ICs 1, 2 and 3 may be mounted and soldered as shown in the component layout diagram, Fig. 4. Sockets should be used for mounting all i.c.s.

Before constructing the transformer T1, remember that the secondary, depending on the supply lines chosen, may be at 240V a.c. mains potential. It is therefore essential that the secondary winding is properly isolated from the primary and also from the transformer cores, as they have sharp edges which may damage the insulation on the wire and short circuit to the conductive core.

▲ Fig. 2(a): (Above) Circuit diagram of the receiver section

▼ Fig. 2(b): Block diagram of the MC3357 i.c.



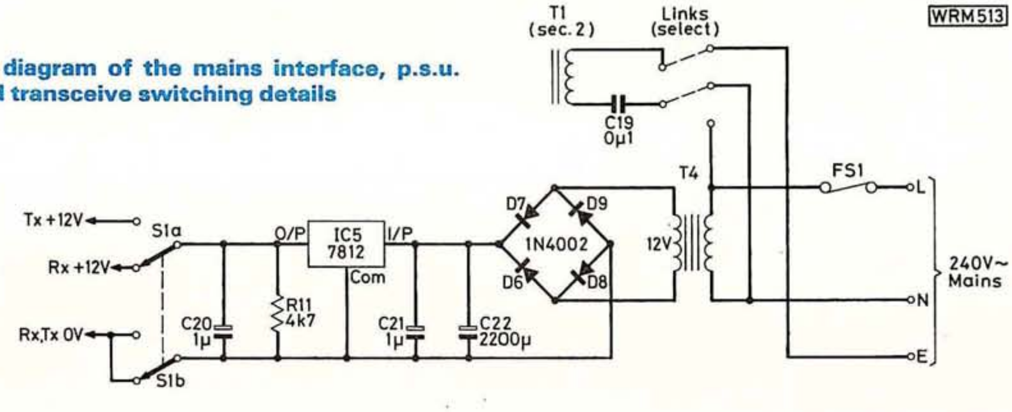


Fig. 3: Circuit diagram of the mains interface, p.s.u. and transceive switching details

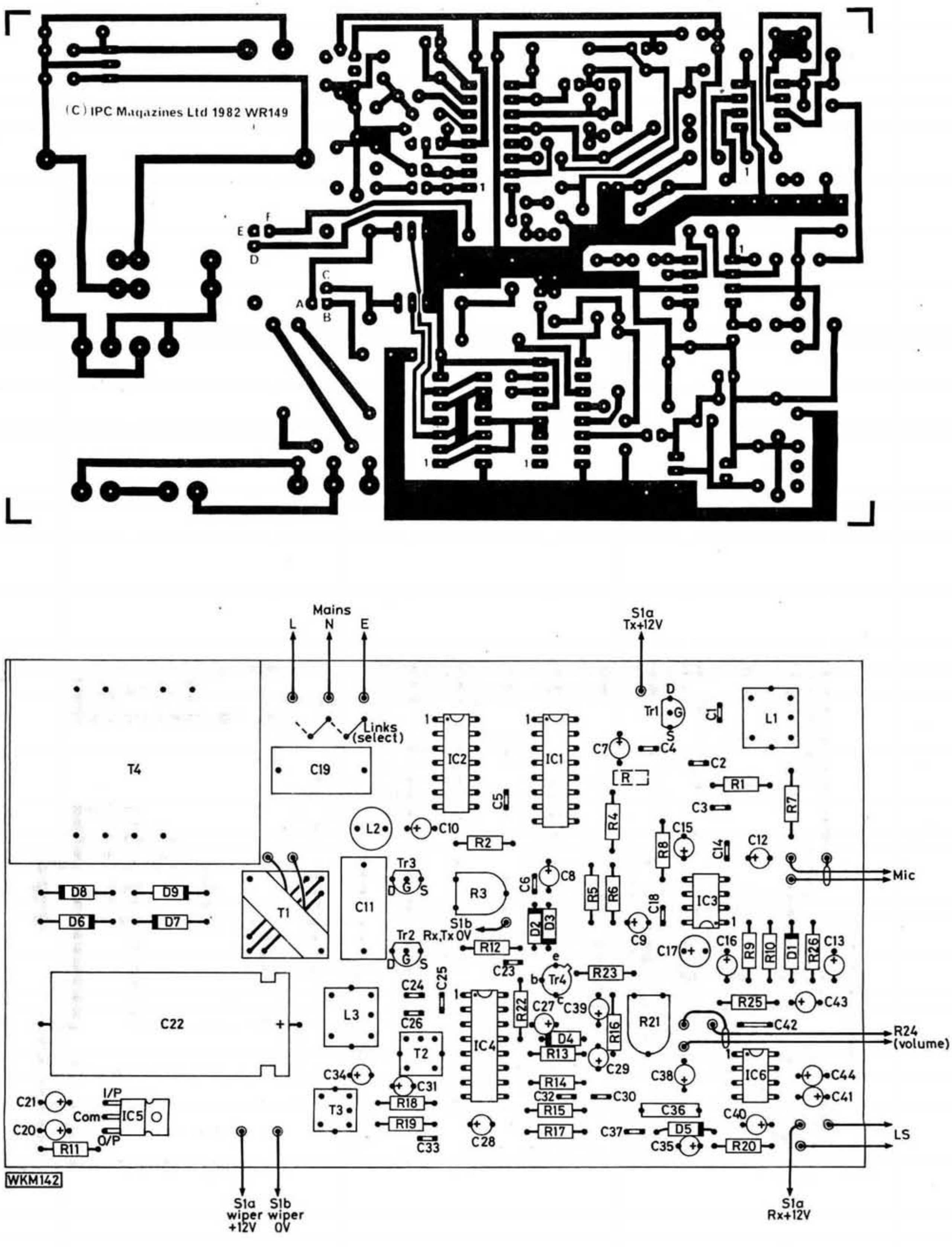


Fig. 4: Printed circuit board track pattern, shown full size, plus component layout of a single transceive module

★ components

Quantities shown are for 1 transceive section only

Resistors

¼W 5% Carbon Film

1Ω	1	R26
33Ω	1	R25
220Ω	4	R7, 10, 12, 20
2·2kΩ	1	R15
2·7kΩ	1	R5
3·3kΩ	2	R1, 2
4·7kΩ	1	R11
10kΩ	1	R17
27kΩ	1	R22
33kΩ	4	R4, 6, 13, 19
47kΩ	2	R8, 18
56kΩ	1	R16
100kΩ	2	R14, 23
1MΩ	1	R9

Miniature horizontal preset

10kΩ	1	R3
100kΩ	1	R21

Midget carbon potentiometer

100kΩ log	1	R24

Semiconductors

Diodes

1N4002	4	D6–9
1N914	3	D2–4
BZX85 C5V1	2	D1, 5

Transistors

BC108	1	Tr4
VN10KM	2	Tr2, 3
2N3819	1	Tr1

Integrated Circuits

SL6270	1	IC3
TBA820M	1	IC6
3357	1	IC4
4046	1	IC1
4069	1	IC2
7812	1	IC5

Capacitors

Miniature ceramic

10pF	1	C33
220pF	1	C42
1nF	12	C1–3, 5, 6, 14, 23–26, 30, 32
4·7nF	1	C18
10nF	2	C4, 37

Monolithic ceramic

0·1µF	1	C36

Tantalum 16V

4·7µV	1	C27
10µF	6	C7, 8, 13, 28, 35, 40
47µF	2	C16, 43

Tantalum 35V

0·1µF	2	C9, 29
0·47µF	1	C44
1µF	9	C10, 12, 15, 20, 21, 31, 34, 38, 39
2·2µF	1	C17

Tantalum 10V

100µF	1	C41

Polypropylene 350V a.c.

1nF	1	C11 (see text)

Electrolytic 25V

2200µF	1	C22

Polyester 250V a.c.

0·1µF	1	C19 (see text)

Inductors

RW06A775EK	1	L3 (Toko)
YXNS30450NK	1	L1 (Toko)
1·5mH 8RB	1	L2 (Toko)

Transformers

FX3432 (RM6)	1	T1
LMC4202A	1	T2, 3 (Toko)
12V 6VA mains	1	T4 (RS 207–756)

Miscellaneous

Moulded case 215 × 130 × 47mm (RS 508–475); Fuse 20mm 100mA anti-surge, with holder; Loudspeaker 8Ω 5 × 3in elliptical; Electret microphone insert; Miniature d.p.d.t. switch; Cable gland; Sockets for integrated circuits; Printed circuit board.

Resonating capacitor C11 is chosen to be 1nF and by using the following formula the required inductance to resonate at 100kHz is obtained.

$$L = \frac{1}{4\pi^2 f^2 C} \quad \text{where } f = 100 \times 10^3\text{Hz and } C = 1000 \times 10^{-12}\text{F}$$

$$= \frac{1}{4 \times 10 \times 10^{10} \times 10^{-9}}$$

$$= 2{\cdot}5 \times 10^{-3}\,\text{H} = 2{\cdot}5\text{mH}$$

The specified transformer cores have an inductance factor (A_L) of 1930nH/turn. A figure for the total number of turns required is given by the formula:

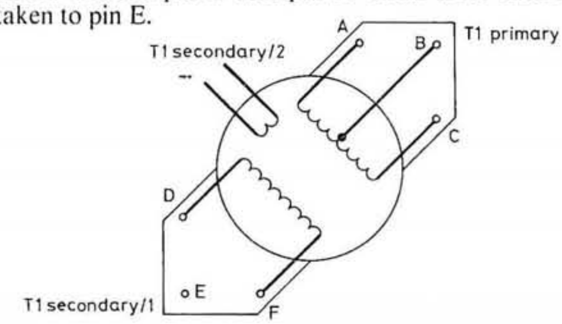
$$n = \sqrt{\frac{L}{A_L}} = \sqrt{\frac{2{\cdot}5 \times 10^{-3}}{1{\cdot}93 \times 10^{-6}}}$$

$$= 36$$

As this is for the full winding, the required centre tap is taken at 18 turns.

Start by soldering one end of T1 primary to bobbin base pin A, Fig. 5; wind 18 turns evenly and terminate at pin B, without cutting the wire. Continue in the same direction for another 18 turns and then terminate the winding at pin C.

The receiver winding, T1, sec. 1, is wound on top of the transmitter primary winding and comprises three turns connected between pin D and pin F. There is no connection taken to pin E.



T1 schematic plan view

Fig. 5

Next, cut a length of insulating tape to the correct width and wrap round the existing windings twice.

The mains secondary, T1 sec. 2, is now made by winding a single turn on to the insulating tape covered windings. The two free ends should be threaded into pieces of sleeving which should then be secured to the bobbin with thread. The bobbin may now be fitted into the cores and located on the p.c.b.

With the component values given, the power into the mains wiring is approximately 100mW, and was found to be quite satisfactory for use around the house and even gave good performance throughout a three-storey office block.

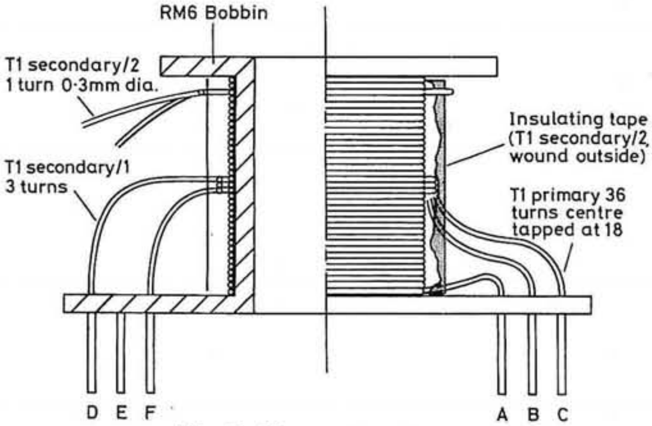


Fig. 6: T1 construction

The isolation between the mains side of T1 sec. 2, and the choke L2, must be inspected next. If the correct high level of resistance is found the three c.m.o.s. i.c.s may be fitted to the board, observing the usual static discharge precautions when handling. All off-board connections utilise soldered-in Veropins.

Setting Up—Transmitter

It is advisable to perform all the initial tests using a bench power supply to avoid any possibility of electric shock while commissioning the units.

With Tr2 and Tr3 still out of the board, connect the 12V output of the voltage regulator IC5 to the transmitter section via d.p.d.t. switch S1. Similarly connect the 0V rail.

Apply 15V d.c. to the input of the voltage regulator and check that the transmitter supply voltage on S1 is 12V.

Adjust L1 so that it operates at 100kHz (or the chosen carrier frequency) and check that this frequency is available at pins 3 and 4 of IC1 as a logic signal. If the p.l.l. is not in lock then adjust R3 until lock is obtained and then finally set R3 so that the junction of C7 and C8 is at 6V. If all is well, the drive to the v.m.o.s. transistors should be two signals 180° out of phase at a frequency of 100kHz.

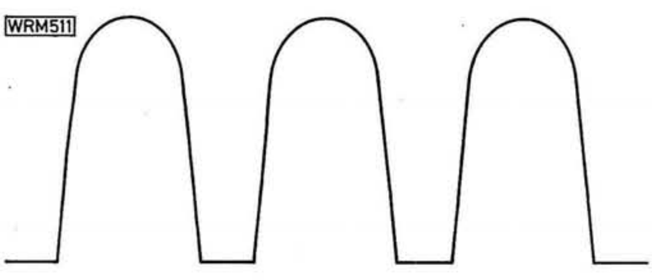


Fig. 7: Voltage waveform at the drain of Tr2 and Tr3

The v.m.o.s. devices can now be soldered into the board and when the supply is re-applied the voltage waveform on the drain of Tr2 or Tr3 should be as shown in Fig. 7.

Once again, if all is well, make the on-board links to the mains input from T1. The p.c.b. has been laid out so that the carrier can be injected into:

a) live and neutral.
b) live and earth.
c) neutral and earth.

On the prototype, neutral and earth proved to give the best performance.

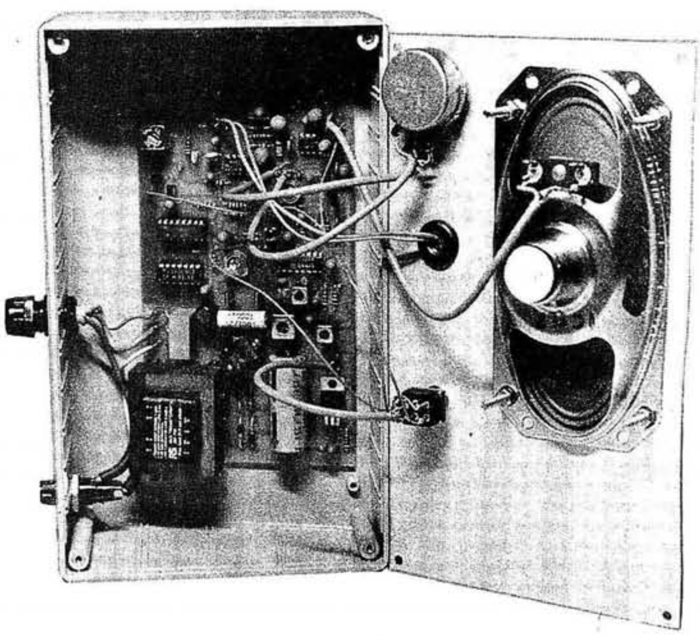
Setting Up—Receiver

Apply the 12V supply, via S1, to the receiver section of both stations and check that the local oscillator of IC4 (pins 1 and 2) is running at approximately the correct frequency of 355kHz.

Check that the on-board links of both units are in the same positions and then plug the two mains plugs into a common two-way adaptor. **Do not yet plug into the mains supply.**

With both boards energised, one station set to transmit, the other to receive, the 455kHz i.f. should be visible at pin 5 on IC4 of the receiving unit. Adjust T2 for maximum response; if there is not enough adjustment available, retune L3 and repeat the adjustment. Quadrature coil, T3, should be adjusted next to obtain the best audio response from the loudspeaker.

The TBA 820M sometimes has a tendency to go unstable which introduces severe distortion to the audio signal. To overcome this tendency R26 may be replaced with a wire link.



When the intercom is completed check that the mains lead has been wired correctly to the board and at the mains plug. The metallic front panel should be permanently connected to the input earth pin by means of a wire link. Do not exceed the 100mA rating of fuse FS1.

Only when everything is working correctly should the two units be connected via the mains wiring.

Final adjustments should be made with the units in separate rooms using a suitable audio source for the transmitter. Remember that areas of the p.c.b. have mains on them, so great care should be taken when handling. ●

NEW BOOKS

OBTAINABLE FROM BOOKSHOPS

The following books are published by Newnes Technical Books.

TRANSISTORS QUESTIONS AND ANSWERS
4th Edition
by Ian R. Sinclair
104 pages, 165 × 110mm. Price £1.75

A book providing simple and concise answers to many questions that puzzle both the beginner and more knowledgeable student on transistors. It explains the basic features of transistors, how they work, what they can do and where they are used.

TWO-METRE ANTENNA HANDBOOK
by F. C. Judd G2BCX
157 pages, 186 × 121mm. Price £3.95

Those new to the 2m band will find this book useful, and even experienced operators may like to try some of the antenna designs. The book also covers the basics of propagation, transmission lines and matching antennas.

THE WORLD'S RADIO BROADCASTING STATIONS and European FM/TV
Edited by C. J. Both
214 pages, 213 × 143mm. Price £5.50

This book can be used in two ways:
1. You want to listen to a certain programme or station from a specific transmitter and therefore need to know the frequency or wavelength it is transmitting on.
2. You are listening to a programme and need to identify the station and which transmitter is broadcasting.

OSCILLOSCOPES How to use them How they work
by Ian Hickman
122 pages, 216 × 315mm. Price £3.45

Anyone who is interested in 'scopes, how they work or how to operate them will find this book useful. This is not a text book but it explains how 'scopes work so that you can operate them using the facilities to the full.

ELECTRONICS BUILD AND LEARN
by R. A. Penfold
104 pages, 215 × 134mm. Price £2.80

The purpose of this book is to help the complete beginner to understand what the main electronic components do, and how they are used in practical circuits.

SEMICONDUCTOR DATA BOOK, 11th Edition
by A. M. Ball
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Data on more than 10 000 semiconductor devices from major American, Japanese and European manufacturers is provided in this book. Device outlines and pinouts are also included.

LONG DISTANCE TELEVISION RECEPTION (TV–DX) FOR THE ENTHUSIAST Revised Edition
by Roger W. Bunney
Published by Bernard Babani (publishing) Ltd.
134 pages, 180 × 107mm. Price £1.95

The author has extensively revised, enlarged and completely updated his original work. Included are many units and devices which have been designed by experienced enthusiasts. The information in this book is a practical guide for the beginner and a source of reference for the established enthusiast.

ELECTRONICS FOR THE BEGINNER
Published by Howard W. Sams & Co.
(UK Distributors Prentice-Hall International)
160 pages, 216 × 135mm. Price £4.50

Each project both tells and shows you everything you need to do, step-by-step, wire-by-wire in order to build the units described.

BASIC ELECTRICITY Parts 1 and 3, 3rd edition revised
Published by Oxford Technical Press
128 pages, 246 × 155mm. Price £3.95 each

Originally prepared for a mainly American readership on basic electricity and electronics. The book is presented in a semi-pictorial format to make understanding that much easier.

ELECTRONIC PROJECTS—4, TEST GEAR PROJECTS
Published by Papermac
101 pages, 213 × 134mm. Price £3.95

An assembled variety of projects enabling you to measure what you are doing rather than your having to guess! Fault finding etc., is much easier to solve if you are equipped with an array of reliable test gear.

RADIO AND TELEVISION SERVICING, 1980-1981 models
Editor R. N. Wainwright, T.Eng. (CEI) FSERT
Published by Macdonald
815 pages, 222 × 151mm. Price £17.50

A hardback book that provides the only collected reference source of service information for a comprehensive range of domestic entertainment products currently available from retail outlets.

THE GUNNPLEXER COOKBOOK
by Rob Richardson W4UCH
Published by The Ham Radio Publishing Group Communications Technology, Inc., Greenville, New Hampshire, USA.
335 pages, 226 × 152mm. Price $12.95 (inc p&p to UK addresses)

Written for the radio amateur who is interested in the theory and practices of 10GHz Microwave activity, the *Gunnplexer Cookbook* will be a valuable reference source.

The initial chapter examines the basic theory of negative-resistance microwave devices such as the Esaki, Impatt and Gunn diodes, together with a description of their fabrication, and concludes with a description of the Microwave Associates Inc., 10GHz Gunnplexer source.

Subsequent chapters cover theoretical topics of propagation, path loss and range *vs* i.f. bandwidth, leading to practical details required for the construction of microwave transceivers and test equipment.

As the pages unfold, the fully-detailed projects progress from basic wideband f.m. to crystal controlled, narrow bandwidth s.s.b./c.w. systems, concluding with fast scan TV and data links.

REMINISCENCES 1

▶▶▶continued from page 22

You knew where you were, too. If a station announced in Spanish, you knew it was either Spanish or Latin-American. They were well-spaced in the bands with little or no QRM. They played the national popular music of their country, and gave their interval signals and callsigns every quarter of an hour.

For me the cream on the top of the jug were the American stations of NBC, MBC and CBS. No political propaganda then—they all relayed their popular domestic programmes. So from about 1400GMT it was a diet of soap operas . . . *Ma Perkins, John's Other Wife*—the *Coronation Street* and *Crossroads* of Americans as they listened at the start of a new day.

It was complete, too, with the commercials—blandishments to pop down Main Street to Minsk's where we were assured you could get a pair of pants ten cents cheaper than anywhere else; strange outlandish ads redolent of a world we knew only by the cinema screen.

W2XAD Schenectady . . . W3XAL Bound Brook . . . W2XE Wayne, New Jersey—all names which make music to any ancient DXer.

Most of these stations transmitted on a wing and a prayer with the simple technology of the early thirties. We DXers were thrilled to bits to get them—and they were equally pleased to know they were being heard so far away. So a reception report was a valued item, and seldom failed to elicit a prompt QSL card.

TRANSMITTER PARAMETERS—1

▶▶▶continued from page 26

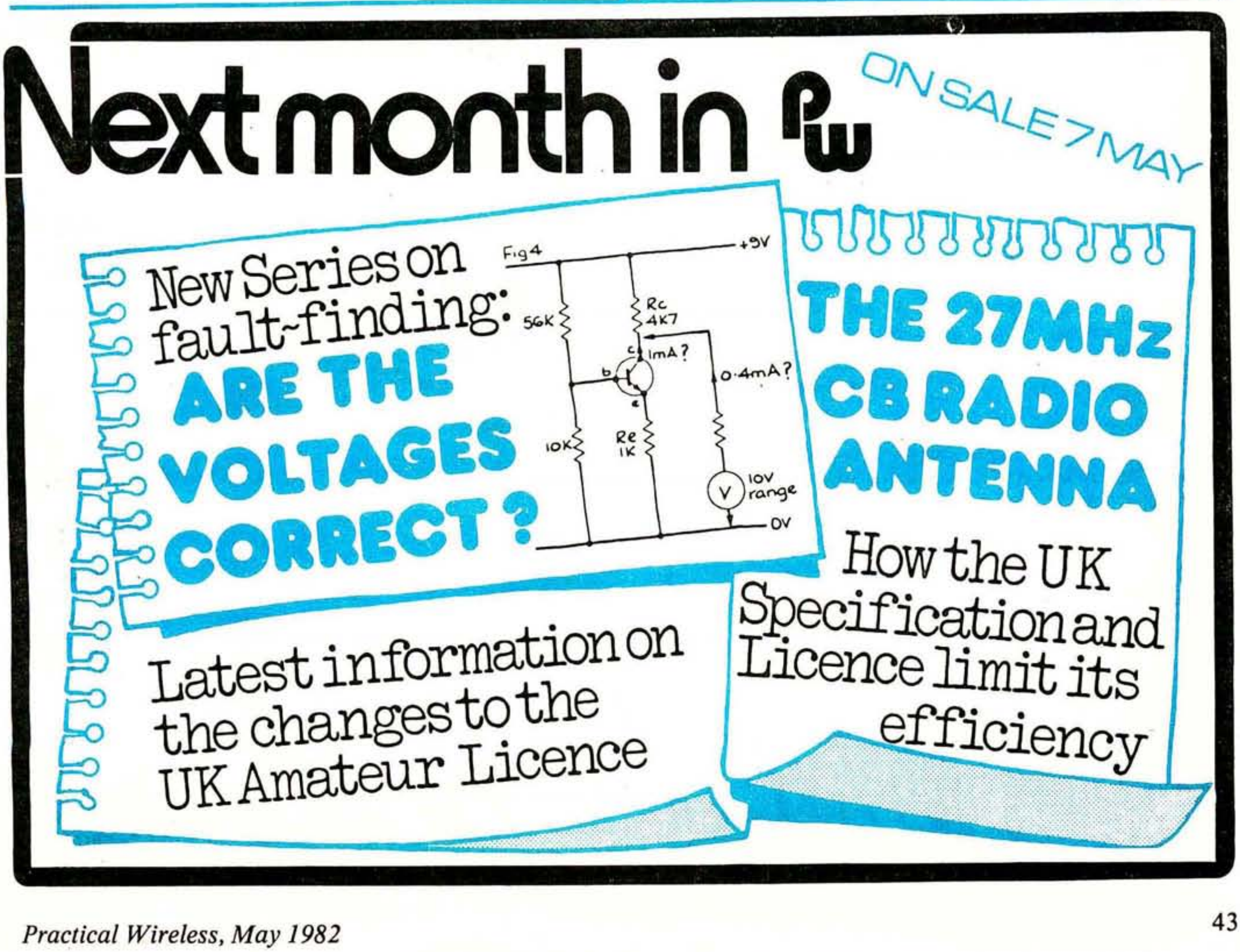
audio for feeding into the transmitter. Unfortunately, all speech clippers introduce harmonics and intermodulation products, and these intermodulation (i.m.d.) products still exist in the output signal.

These products are of such level that the received signal is degraded in quality by the distortion products if the received signal to noise ratio exceeds 17dB, while the processor only helps for signals above about 6dB. Nevertheless, the majority of amateur signals on the h.f. bands tend to fall within this band.

Another method, which is becoming popular on modern transceivers, is to clip the generated s.s.b., and to pass the resultant clipped s.s.b. through another s.s.b. filter to limit its bandwidth. Although the increase in average power which results is very noticeable, the effect of the less than perfect differential group delay of the s.s.b. filter is also noticeable. The best approach to speech processing is probably that of the fast a.f. compressor, using the a.f. path to produce the signal to control the compression, but putting the actual gain variation circuitry in the r.f. path—a system known as "feed-forward compression". Unfortunately, the complexity of this system has militated against its general introduction.

Part 2

The second part of this article will look at power measurements and out-of-channel radiation.



EXTRA—OUR GATEFOLD PULL-OUT

Our Gatefold Extra this month is a companion to the one which appeared in our March issue. The World Map gives you at-a-glance information on where that distant amateur station you've just heard is located. It's as up-to-date as we can make it, though with the pace of life these days, anything like this tends to be out of date by the time it's printed. Time-zone data is also shown.

On the other side of the sheet there's a collection of charts and tables we hope you'll find helpful when you're on the air, if only to let you feel slightly less inferior when the local conditions reports from some overseas amateurs make it sound as if they've got a private readout from the local met office!

The Beaufort Scale table gives you a rough idea what the speed of the wind is, by watching the effect it has on your local trees (and passing people). The Compass Rose relates bearings and compass points, and around the outside has what might be described as a poor man's Great Circle Chart, giving approximate true bearings of distant parts of the globe, based on London.

Humidity—how much moisture there is in the air—can be calculated from readings taken from an instrument known as a Mason's Hygrometer, which contains two mercury thermometers. One (called the "Dry Bulb") reads air temperature in the normal way. The other (called the "Wet Bulb") has a wick tied around its bulb. The other end of this wick sits in a small container of water, and the thermometer's reading is lowered (or "depressed") due to evaporation from the wick. If you plot the "Dry Bulb" temperature on the scale on the left-hand edge of the humidity chart, and the depression of the "Wet Bulb" (how much lower it is than the "Dry Bulb" reading) on the scale along the top of the chart, the percentage relative humidity will be indicated where the two lines cross. When the wet bulb goes below freezing point, results are rather unpredictable, so we've cut the chart off at that point.

Remember that any hygrometer indicates humidity at the place where it's installed. If it's inside the shack, it only tells you how good your heating and ventilation are. It should be out in the open if you want the readings to relate to local weather conditions.

The conversion scales for barometric pressure (millibars to inches or millimetres of mecury) and temperature need no explanation. The metric conversion scales have been chosen to cover the general ranges of typical antenna height or distance from a major town, but can easily be extended by multiplying by 10, or whatever.

The cloud recognition pictures have been arranged to form a potted introduction to recognising weather trends. Starting from the photograph at the top, conditions might develop in one of the three ways in columns "A", "B" or "C". Radio propagation at v.h.f. and above depends very much on weather conditions, a topic we hope to expand upon in a future article.

What do you do with double-sided wall-charts if you haven't got glass walls? Well, we've tried to choose the subject matter so that one side will appeal mainly to short-range (v.h.f./u.h.f.) enthusiasts, and the other side mainly to long-range (h.f.) operators and listeners. If you want to use both sides, our only suggestion is to buy two copies of *PW!*

As if to prove the point made in the first paragraph, we have just learned of two changes to the prefixes given in our March Gatefold. Belize has become V3 (V3A was a special prefix for Independence Day, 21 September 1981, only). Antigua has become V2 following Independence. These affect our map too.

PW "SWAP SPOT"

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

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

BEGINS NEXT MONTH

the things people say

"This time your signal was slightly down on the meter but it was stronger, if you know what I mean."

. . . heard by N. Singh

"My XYL has given me an ultimatum. I must choose between her and my short wave activities. It's a pity, because I'm going to miss her!"

. . . heard by G. Curtis

kindly note!

Mobile Radio Alarm, April 1982

In the heading of this article, we somehow managed to transfer Mr. A. Smith's callsign to Stephen Ibbs, who is really G4LBW. Our apologies to both of these gentlemen for any embarrassment caused.

PRODUCTION LINES

ALAN MARTIN G8ZPW

Latest from Trio

I have just received, via a photostat of one of the few brochures in the UK, details of the latest mobile/base station rig from Trio, called the TR-9130.

As the photograph shows, it is a 2m all-mode transceiver covering frequencies between 144·000 and 146·000MHz. A newly developed high power linear module provides a clear 25W of r.f. power and mode selection is via a five position switch, selecting FM1, FM2, USB, CW and LSB.

Other main features include: six memories; automatic band scan; memory scan; up/down microphone switch for full band scanning; reverse repeater switch (to determine, as the brochure states, if a repeater is upside down); five digit readout with green l.e.d.s; dual digital v.f.o.s; low-noise dual-gate MOSFET front-end, together with two crystal filters; high performance noise blanker for s.s.b. and c.w.; r.f. gain control; high/low power switch (25W/5W); r.i.t. circuit for s.s.b. and c.w.; l.e.d. function indicators and squelch facilities are available on all modes.

The TR-9130 should be available, in the UK, around the end of April—beginning of May 1982, at a very provisional price of around £405.

For further details contact: *Lowe Electronics, Chesterfield Road, Matlock, Derbyshire DE4 5LE. Tel: (0629) 2817/2430.*

RF Screening

RFI Shielding Ltd., of Braintree, Essex, have introduced a new acrylic coating material which can be applied to non-conductive materials to provide them with r.f. integrity and anti-static properties. Called Conductocoat 981, it is a liquid containing metal compounds that can be applied to the receiving surface by spray, dip, brush or roller coating.

When applied to materials such as wood or plastics at a thickness of 0·05mm, Conductocoat 981 will ensure a surface resistivity of only 0·5ohms/square or less, when tested according to ASTM D257. This coating provides a typical shielding effectiveness of greater than 30dB at frequencies up to 30MHz, and greater than 60dB at frequencies between 30MHz and 1GHz.

Whichever method of application is employed, a continuous film of 0·04 to 0·05mm is the optimum and coverage is estimated at five square metres per litre.

Conductocoat 981 can be cured at room temperature in 24 to 36 hours, or baked at 60°C for 15 to 20 minutes.

Available in quantities of 1, 2·5, 5 and 25 litres, Conductocoat 981 typically costs £24·50 for 1 litre, £60·00 for 2·5 litres and £117·98 for 5 litres.

Conductocoat 981 is obtainable on a cash-with-order basis from: *RFI Shielding Ltd., Warner Drive, Springwood Industrial Estate, Rayne Road, Braintree, Essex CM7 7YW. Tel: (0376) 42626.*

New Antenna Products

South Midlands Communications have supplied us with details of some of their latest antenna products.

First, the SMC70N2M, a 144/432MHz dual band antenna from Hokushin, which basically performs as a $\frac{5}{8}\lambda$ whip on 144MHz and as a $\frac{5}{8}\lambda$ over $\frac{5}{8}\lambda$ colinear on 432MHz.

Specifications are as follows:—impedance 50Ω; v.s.w.r. 1·5:1; gain 2·7dB (144MHz) and 5·1dB (432MHz) and power handling is 100W p.e.p.

Measuring 880mm overall, the antenna weighs 0·239kg and costs £12.50 plus VAT. A base station version (SMC70N2V) is also available and costs £24.00 plus VAT.

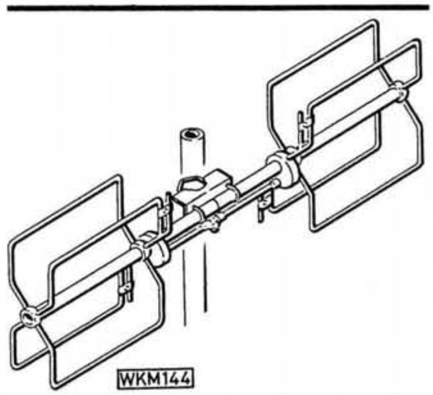
Second on the list is the HS-770, a 144/432MHz diplexer manufactured by Maldol. This device when fed by a dual band antenna (such as the previously mentioned SMC70N2M/V) allows two separate rigs—one covering 2m and the other 70cm—to be operated, either individually or simultaneously.

The diplexer comprises two band-stop filter elements to achieve an isolation between ports of over 30dB with a v.s.w.r. of better than 1·2:1 in the respective bands. Maximum power handling is 50W with an insertion loss of less than 0·5dB. The common antenna connector is an SO239 socket with rig feeds, via 50Ω coaxial cables, terminated in PL259 plugs.

Housed in a die cast box measuring only 65 × 45 × 30mm, the HS-770 costs £12.00 plus VAT.

Last, but by no means least, is the SQ-144, a "Swiss Quad" antenna, which is a close-bayed twin two-element quad array.

As the illustration shows, both sets of elements are mounted on a common boom and are supplied with phasing harness and gamma matching networks. With a forward gain of 16dB over unspecified reference, front-to-back ratio of better than 20dB and a v.s.w.r. of 1·5:1, the SQ-144 covers the frequency range 144 to 146MHz. The impedance of the system is 50Ω with a power handling of 500W p.e.p. and a turning radius of 1005mm.



The SQ-144 weighs 1·9kg and costs £42.61 plus VAT.

There will be a carriage charge on these products, so please check before ordering from: *South Midlands Communications Ltd., S. M. House, Osborne Road, Totton, Southampton SO4 4DN. Tel: (0703) 867333.*

air test

USER REPORTS ON SETS AND SUNDRIES

YAESU FT-208R (VHF) & FT-708R (UHF)

Hand-held Transceivers

The FT-208R (left) & FT-708R

Currently the latest hand-held f.m. transceivers from the Yaesu stable are the FT-208R which covers the 144MHz (2m) band and the FT-708R for the 432MHz (70cm) band. Both transceivers are housed in almost identical cases and their basic features and facilities are the same.

I will deal particularly with the FT-208R (model C) and describe features common to both transceivers, any differences in the FT-708R (model B) will be shown in brackets or dealt with later.

The transceiver is supplied soundly packaged, with a flexible rubber helical antenna fitted with a BNC connector, a purpose-designed 10·8V 450mAh NiCad battery pack, earphone, vinyl carrying case and shoulder strap. Also included is a most comprehensive, 48-page instruction manual, which is fully illustrated with photographs and line drawings.

Moving on to the operational features, the FT-208R covers frequencies between 144·000 and 147·9875MHz (FT-708R—430·000 and 439·975MHz) in steps of either 12·5kHz or 25kHz (25kHz), with r.f. power out at 2·5W HIGH (1W) and 300mW LOW (200mW). It is important to note that with regard to the FT-208R (model C) the upper frequency limit exceeds the permissible UK allocation of 146·000MHz, so care must be taken not to inadvertently operate out of band. SMC advise me that sets supplied by them will be limited, to conform with the UK bandwidth.

Ten memory channels are available, with a scanning facility which allows the band or the memories to be scanned manually and automatically for busy or vacant channels. Another important facility is the limited band scanning mode, whereby a favourite segment of the band may be scanned particularly, or alternatively any section of the band may be selected to be excluded from the scan. The memory channels are protected by a lithium backup cell which has an estimated life of more than five years; it is imperative that the backup cell is switched into circuit before attempting to operate the memory functions. The switch is located beneath the main NiCad battery pack.

A view with the back removed

Operation of the transceiver is quite straightforward as the photograph of the top control panel indicates. The SHIFT switch selects the operating mode; SIMP, simplex; ±RPT, repeater

The top control panel

shift ±600kHz; ±SET, allows non-standard shifts to be selected and MS permits split frequency operation, i.e. reception on the dial frequency and transmit on any programmed memory channel frequency. The on/off switch is also the volume control and the separate squelch control, which enables the receiver audio to be silenced until a signal is received, could when rotated to the TONE position, activate an optional tone squelch unit, FTS-32, which allows silent monitoring of busy channels.

Initially, I found it took some time getting used to all the features the transceivers provide. However, once mastered one could really appreciate the superb performance they supplied, being at least as good as the handbook specification claimed.

The units, as they stood, proved to be totally adequate for all local portable work through repeaters etc. and when used as a base station or mobile installation the performance remained equally good. The receiver sensitivity should, in fact, allow the use of an additional power amplifier and provide a potent mobile or base station set-up. On-air contacts with several local amateurs confirmed that the transmitted signals as received were clear and undistorted.

Our tests in the laboratory produced the following results which were carried out with the NiCad battery packs depleted by approximately 50 per cent:

The figures in brackets represent the manufacturer's specification.

FT-208R			Receiver Sensitivity
r.f. power out	High	Low	(Better than 0·25μV for 12dB SINAD)
144·000MHz	3·25W	750mW	For 10dB $\frac{S+N}{N}$ where N = unmodulated carrier and
145·000MHz	3·25W	750mW	S = 1kHz tone at 3kHz f.m. deviation.
146·000MHz	3·25W	750mW	0·125μV p.d. across full bandwidth

The same parameters apply for the FT-708R.

FT-708R			Receiver Sensitivity
r.f. power out	High	Low	(Better than 0·4μV for 12dB SINAD)
430·000MHz	1·6W	450mW	0·158μV p.d.
435·000MHz	1·7W	450mW	0·141μV p.d.
440·000MHz	1·6W	400mW	0·178μV p.d.

Referring specifically to the FT-708R, its overall performance proved to be similar to the FT-208R, excepting that Yaesu unfortunately supply the transceiver with the repeater shift (RPT) set to 7·6MHz, not 1·6MHz the UK standard, which is rather odd when one considers the high proportion of the world's 432MHz repeaters located in the UK. However, the problem is very simply resolved by utilising either the non-standard shift selector (SET) or the split operation facility, which uses one of the memory channels.

A full range of accessories includes a complete selection of battery chargers, hand microphone, additional NiCad battery pack, tone squelch unit and mobile window-mounting bracket.

The VAT and carriage inclusive prices of the two units are: FT-208R £209.00 and FT-708R £219.00. Both of these products are available from **South Midlands Communications Ltd., S.M. House, Osborne Road, Totton, Southampton SO4 4DN, tel: Totton (0703) 867333,** to whom we offer our thanks for kindly supplying the review samples.

Alan Martin

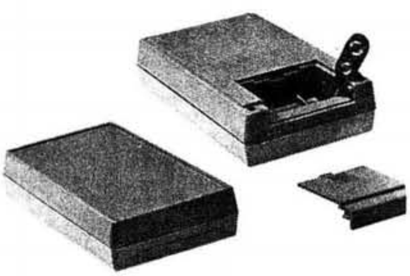
PRODUCTION LINES

ALAN MARTIN G8ZPW

Useful Case

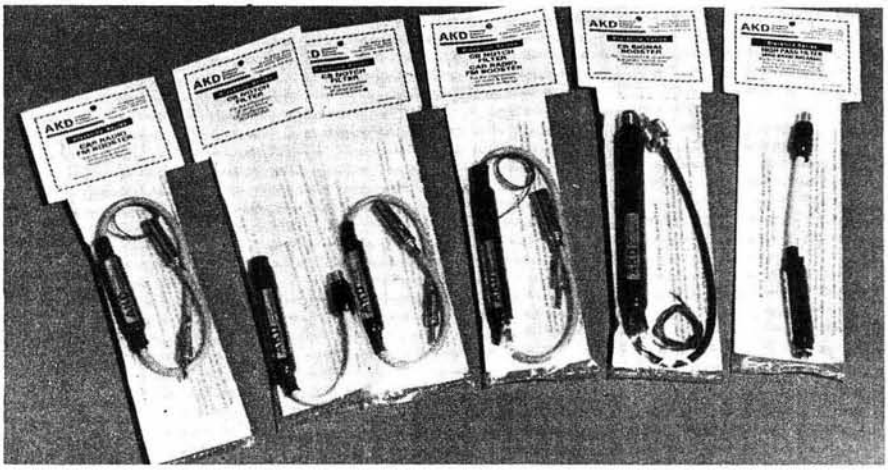
OK's PacTec series enclosures are now available with a battery compartment for standard 9V batteries.

Measuring 146 × 96 × 28mm, the case is constructed of ABS material, providing durability, excellent impact resistance and is presented with an attractive textured finish, all of which makes it ideal for housing small hand-held instruments.



The carriage and VAT inclusive price of the HP-BAT-9V enclosure is £3·99 and it is offered in four standard colours, grey, tan, black and blue.

For details of other options, colours and accessories contact: *OK Machine & Tool (UK) Ltd., Dutton Lane, Eastleigh, Hants SO5 4AA. Tel: (0703) 610944.*



In-line Filters & Signal Boosters

Recently announced by AKD is a range of in-line filters and signal boosters entitled the Blackline series. Each circuit is housed in either a copper or aluminium tube and finished in a tough black heat-shrunk casing. Connecting leads are terminated with appropriate plugs and sockets.

The photograph shows, from left-to-right; PA1, an f.m. signal booster which requires connection to the vehicle's voltage supply—suitable for negative earth vehicles only (price £9·50); CBF1, CB notch filter, model 1 (left) is terminated for TVs etc. and model 2 for the car radio (both priced £5·80); PACB2, f.m. booster and CB notch filter (£12·00); CBPA1, CB signal booster (receive only) this unit requires connection to the vehicle's voltage supply (price £12·50) and finally the HPF1, high-pass filter and braid breaker (£5·50). The prices quoted do not include VAT; further information and details of availability from: *AKD, 10 Willow Green, Grahame Park Estate, Hendon, London NW9 5GP. Tel: 01-205 4704.*

Please Note!

Last month (April 1982) in "Production Lines", page 74, I inadvertently transposed the photographs of the two products featured there.

My apologies to any readers who may have been misled by this error.

G8ZPW

NEWS NEWS NEWS

PW "Tardis"

As several radio and electronics magazines have been holding forth lately about how much test equipment they have, we thought it was about time we showed you the Practical Wireless test facility, recently totally re-equipped.

The photograph shows the interior of our new screened room (nicknamed the PW "Tardis" by some of our colleagues), which houses a comprehensive range of test equipment from Marconi Instruments Ltd: Spectrum Analyser TF2370/TK2373, covering from 30Hz to 1·2GHz. Signal Generators 2017 and 2019, each covering to over 1GHz with very low noise. Both generators can be amplitude or frequency modulated, and between them offer a wide range of sweep and memory facilities. Frequency Meter 2435, featuring 8-digit readout to 2GHz. Modulation Meter TF2304 for a.m. and f.m. measurements. Automatic Distortion and SINAD Meter TF2337A. Two-tone Audio Generator TF2005R. Audio Power Meter TF893A. High-Z f.e.t. Multimeter TF2337A. Several of these instruments can be computer-controlled, giving us the opportunity to automate some tests in the future.

From other manufacturers come a Bird Thru-Line r.f. Power Meter; Shackman oscilloscope/analyser camera; two-channel chart recorder, plus all the usual power supplies, dummy loads, etc.

The investment of well over £30 thousand in these new facilities will help us to give readers an even better service, both in our constructional projects and our equipment reviews. Certainly no other UK radio/electronics hobby magazine has a more comprehensive or up-to-date test laboratory devoted to its exclusive use.

OSCAR News

Members of AMSAT-UK will have recently received their copy of the Winter 1981 edition of *OSCAR News*.

Contained within its 40 pages is a host of very interesting material, which includes an article on "The Great Meteorite Bonanza", a search for uncontaminated meteorite debris, "deep frozen" in the Antarctic icecap, and the suggestion of the presence of amino acids—the building blocks of life—a discovery which should please Sir Fred Hoyle. Constructional features describe "A Simple 29MHz Direct Conversion Receiver" designed for the reception of OSCAR satellites, and details of an "Uplink Mode 'J' Antenna". The editorial appeals for more feedback information, especially from the 500-plus schools and educational institutions associated with AMSAT-UK.

Latest news tells us that the charge-coupled-device (c.c.d.) camera aboard UOSAT-OSCAR 9 was opened for the first time on Sunday 14 February, 1982 and initial results appeared to be satisfactory. Those wanting the c.c.d. camera output decoder kits are reminded that AMSAT will not release boards until conclusive tests of the systems performance have been made.

For further imformation and membership details, enquiries should be addressed to: *The Secretary, Ron Broadbent G3AAJ, AMSAT-UK, 94 Herongate Road, Wanstead Park, London E12 5EQ.*

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 February), so, the earlier I can have details, the better.

Alan Martin

NEWS NEWS NEWS

2m f.m. Contest

The Stevenage and District Amateur Radio Society will be running a 2m f.m. contest on Sunday 11 April, 1982 between 1300 and 1700 GMT in the 144·500–144·845MHz and 145·200–145·575MHz sections of the band.

The contest is open to both members and non-members of the Society and there will be three classes of entry: 1. Stations running up to 25 watts output; 2. Stations running more than 25 watts output and 3. Short Wave Listeners.

Further information is available from: *The Secretary, Stephan Clarke G8LXY, 126 Putteridge Road, Luton, Beds.*

Catalogue

A revised edition of the Toolmail catalogue is now available; this 96-page publication costs £1, which includes p&p, and contains details of over 1200 items all illustrated in colour.

Toolmail prefers to buy British tools where possible, so most of the products listed are made by established British manufacturers, many with traditions of craftsmanship going back hundreds of years. All the lines held in stock are supplied at competitive prices, with a "no-quibble" guarantee, free delivery and orders are normally despatched within 48 hours.

The catalogue which should prove of particular interest to *PW* readers is obtainable from: *Toolmail Ltd., Parkwood Industrial Estate, Sutton Road, Maidstone, Kent ME15 9LZ. Tel: (0622) 672 736.*

Mobile Rally

The Drayton Manor Mobile Radio Rally, organised by The Midland Amateur Radio Society and The Stoke-on-Trent Amateur Radio Society, will take place on Sunday 25 April, 1982 at Drayton Manor Park, near Tamworth, Staffordshire. The Park is located on the A4091 which is within easy reach of the M1, M5 and M6 motorways.

Starting at 1100 hrs, there will be all the usual attractions for the amateur radio enthusiast plus side shows, refreshments, children's entertainments and zoo which should provide an interesting day out for the whole family.

Further details and car stickers etc. are free on request from: *Norman Gutteridge G8BHE, 68 Max Road, Quinton, Birmingham B32 1LB. Tel: 021-422 9787.*

CB Licences

Readers may be interested to know that between 2 November, 1981 and 5 February, 1982 a total of 152 377 CB licences were issued.

This total is currently being added to at the rate of approximately 9000 per week.

This information was kindly supplied by the Home Office.

World Radio TV Handbook

The 1982, 36th edition, of the World Radio TV Handbook is now available.

The volume costs £9.95 and is obtainable from most good book shops. Alternatively, for an extra £1.00, to cover post and packing, it can be purchased from: *Argus Press Ltd., 14 St. James Road, Watford, Herts.*

Morse Short Course

A Morse Short Course, comprising 12 two hour lessons, is to be held at Beckenham Adult Education Centre. The Course will start at 1930 hrs on Wednesday 28 April, 1982 and is designed to cater for those with no prior knowledge of the subject.

Further information is available from: *The Course Tutor, Steve Palmer, Beckenham Adult Education Centre, 28 Beckenham Road, Beckenham, Kent. Tel: 01-650 1383.*

Repeater News

Talk-Thru 82: The RSGB Repeater Working Group in conjunction with the UK FM Group Western are holding an open meeting on Saturday, 8 May, 1982, at the Post House Hotel, Clayton Road, Newcastle-under-Lyme, Staffs., which is near junction 15 on the M6, follow signs for Stoke South/Newcastle-under-Lyme.

The meeting opens at 1330 with a 30 minute talk and slide show, detailing the projects undertaken by UK FM Group Western, and continues with the main RSGB RWG forum at 1400.

Admission to all interested parties is free and refreshments are available.

Phase 7 Update: Following our outline of the Phase 7 proposals listed in the *News* column last month, it is anticipated that some 20 proposals will be vetted by the RWG prior to submission to the Home Office. Latest additions included within the proposals are: Biggin Hill GB3KB on RB0; Medway Towns GB3MD on RB11; Preston GB3PP on RB15 and York GB3CY on RB13, plus a specific r.t.t.y./data installation at Leicester GB3ED on RB12. Should the York repeater (GB3CY) receive approval the other Yorkshire u.h.f. proposal for the Leeds City repeater (GB3LA) will be amended to operate on either RB0 or RB11.

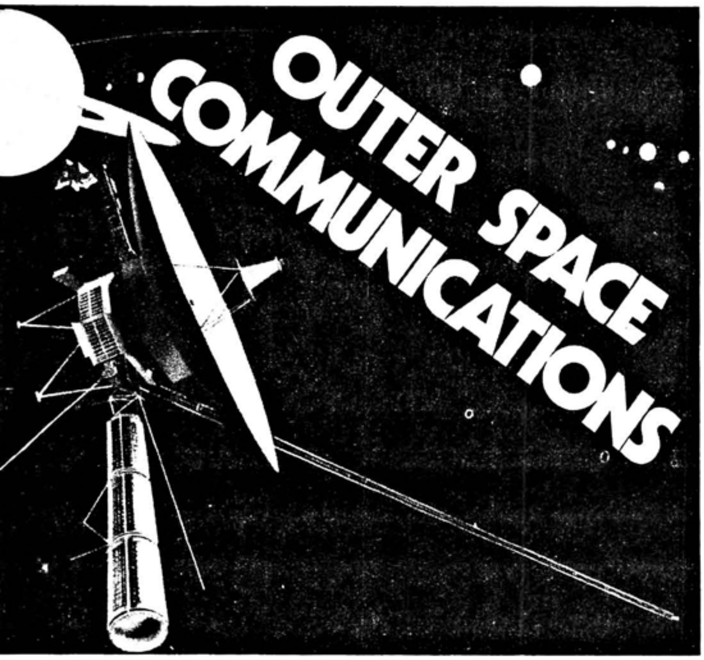
Silent Repeater: Those of you with a long memory will be aware that approval was given, in September, 1977, for an Oxford u.h.f. installation GB3OX. Since then the repeater has failed to come "on–air"; however, the Vale of the White Horse Repeater Group have now taken up the licence and intend to bring the repeater into operation, from a revised site, on RB15, as soon as the H.O. has cleared their application.

Once again, our thanks to RWG chairman, Mike Dennison G3XDV, for keeping us supplied with current information.

On the Move

Home Radio notify us that they have moved. The postal address for orders remains unchanged at: *PO Box 92, 215 London Road, Mitcham, Surrey.*

However, the new address for callers, and new telephone number will be: *Home Radio (Components) Ltd., 169 London Road, Mitcham, Surrey. Tel: 01-648 3077.*



Part 2 **Brian DANCE**

In this concluding part of the article we examine antenna performance, control station facilities and future developments for outer space communications.

Antenna Feed and Performance

The 64m antennas employ Cassegrainian sub-reflector systems of the type used in optical telescopes. A signal from a distant spacecraft is focused by the main reflector towards the 6·4m diameter sub-reflector, mounted on a quadripod structure above the main reflector. The sub-reflector can be positioned so that the signal is directed into the feed horn of any one of three cones.

A maser in the feed horn amplifies the signal by some 50dB. The maser is cooled in liquid helium to a temperature of −269°C, 4K. A maser introduces less noise than any other type of amplifier device. The output from the maser is fed to a receiver where it undergoes further amplification before being converted into a lower frequency signal to feed the control station.

The performance of the 64m diameter sub-network antennas has been checked and the reflector system accurately focused at X-band frequencies using three powerful radio astronomical sources, 3C274 (Virgo A), 3C218 (Hydra A) and 3C123. Effective noise temperatures down to 26K, 26 degrees above absolute zero, were measured with the antennas directed at points well above the horizon, increasing to some 40K at an angle of elevation of 20° above the horizon. These figures apply to the X-band frequency input to the maser amplifier and include noise added by the maser as a contribution to the effective input noise. Heavy rain affects the noise temperature and degrades the performance, whilst thick clouds at the receiving station produce a smaller effect.

Control Stations

The control station contains a computer which processes the signal so that it is in a suitable form for recording and, in the case of the stations at Madrid and Canberra, for transmission by satellite or sub-oceanic link to the Network Control Centre in the US. Control room computers at each station also process information and commands for transmission to the spacecraft. These computers extract precise velocity and range information from the received signals for the navigation of the craft.

Apart from the 64, 34 and 26m parabolic antennas, each station must employ computers, special receivers, analogue and digital signal processing equipment, together with monochrome and colour television equipment and screens.

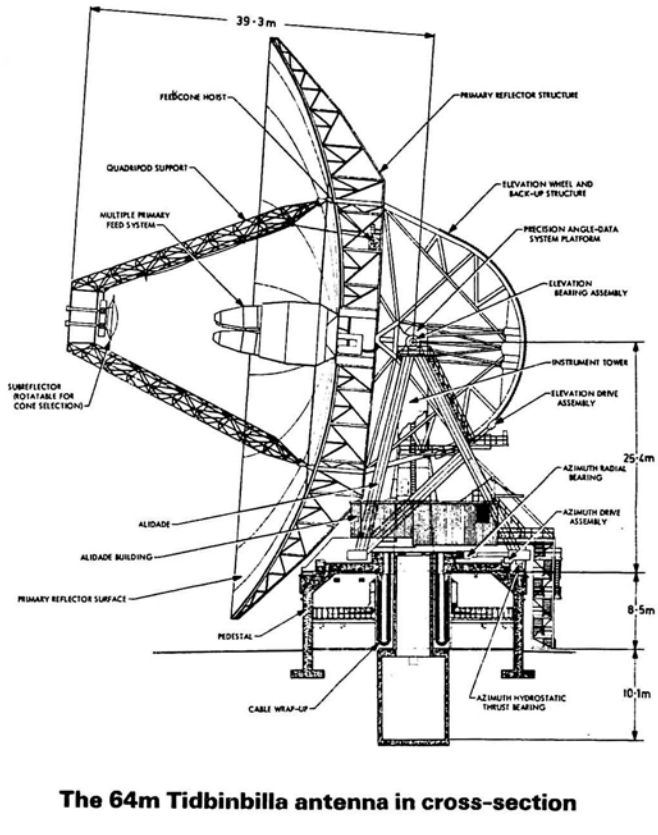
In addition, each site must have its own power plant to supply the requirements of the whole station, removing the risk of losing a wanted signal through failure of the mains electricity supply, whilst performing such expensive experiments. Each station must also have an atomic time standard accurate to one second in 300 years.

Future System Improvements

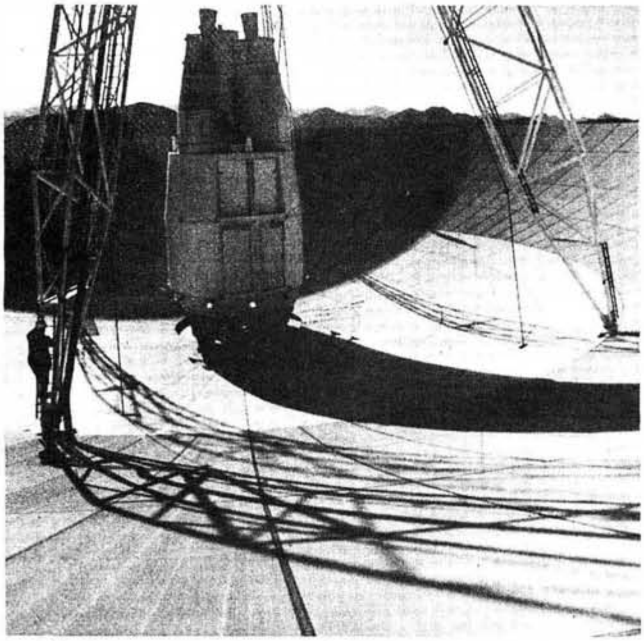
The construction of a 100m diameter antenna for the deep space system was under consideration but, unfortunately, as the diameter of an antenna increases, so the engineering problems become far more difficult and expensive, for a relatively small increase in signal strength. One of the main problems is that of constructing a reflector which is extremely heavy, yet very accurately shaped.

The construction of a relay station in earth orbit has some attractive advantages for the future, since the effective weight would be negligible, a large reflector could be constructed away from the atmosphere of the earth. It will, however, be some time yet before technology can advance to the point where construction of such an antenna becomes possible; presumably the Space Shuttle will be employed to carry the parts of such antennas into space. An orbiting antenna will be very costly and an earth station would also be required.

Time standards are vital when calculating spacecraft trajectories. In addition to the rubidium vapour oscillators, caesium time standards and hydrogen masers have been introduced to provide a more accurate time standard. Very long baseline interferometry techniques are under consideration for increasing the precision with which the location of each of the Deep Space Network earth stations is known.



The 64m Tidbinbilla antenna in cross-section



Inside the 64m Goldstone reflector; the enormous size can be seen against the men also shown in the picture

(Jet Propulsion Laboratory)

The European Complex

The Madrid Space Station of the US Deep Space Network, known as the European Complex, was created and operates under the bilateral agreements established between the US and Spanish Governments. These agreements, signed on January 29th, 1964, and October 11th, 1965, are for mutual co-operation in the scientific investigation of outer space.

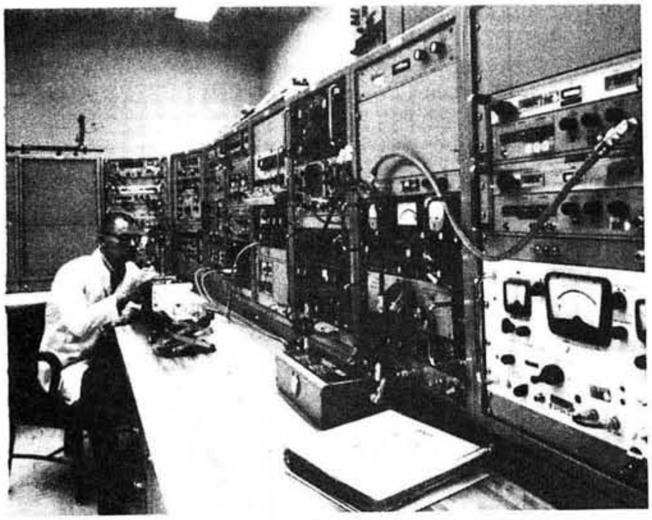
The complex is composed of four facilities, Robledo I, Cebreros, Fresnedillas and Robledo II, named after their neighbouring towns. Each of the four facilities has been designed as a separate, independently operational centre with all the necessary equipment to function with complete autonomy. For example, during 1975, there were times when Robledo I was tracking *Pioneer II* on its way to Saturn, the Cebreros facility was linked to *Helios 1*, then in orbit around the sun, whilst Robledo II was receiving pictures of Mercury transmitted by *Mariner 10*. In addition, the Fresnedillas facility was receiving scientific data from the automatic ALSEP Laboratories left on the moon by the *Apollo 12, 14* and *15* astronauts.

Robledo I, Deep Space Station 61, was the first European facility, which became operational in July 1965, just in time to take part in the reception of the images of Mars transmitted by *Mariner 4*, the first close-up pictures of another planet obtained by man. Robledo I has also taken part in the exploration of the moon by the *Lunar Orbiter, Surveyor* and *Apollo* projects, whilst it has also participated in the planetary work of the *Pioneer, Mariner* and *Viking* projects.

The Cebreros facility has similar equipment to Robledo I, including a 26m diameter antenna and support buildings. The station has actively participated in the unmanned *Lunar Orbiter* exploration of the moon and in the Mars, Venus and Mercury, *Mariner* projects. Also, the *Pioneer* Jupiter project, as well as the *Pioneer* and *Helios* projects for inter-planetary space. It became operational in 1966 and has been totally operated by Spanish personnel since 1969.

The third European station, at Fresnedillas, became operational in 1967. It has a 26m diameter antenna, able to operate simultaneously at 2GHz and at 400MHz, because of its dichroic sub-reflector. Its maser pre-amplifiers can operate in the diversity mode. The station was designed to provide direct continuous contact with astronauts during lunar missions. A data rate of 200Kbits/second can be maintained, together with a television colour channel. This facility is part of the STDN network and has played an important role in all of the manned space flights, *Apollo, Skylab* and *Apollo-Soyuz*.

Construction of the fourth station, Robledo II, deep space station 63, commenced in mid-1970, and became operational in 1973. It has a 64m diameter antenna which can be pointed to anywhere in space, above the horizon.



One of the microwave laboratories at a Deep Space Station

(Jet Propulsion Laboratory)

Conclusion

The Deep Space Network has been an absolutely essential element of the success of the US inter-planetary missions. Although enormously expensive and requiring a large number of staff at three widely separated points on the earth, not to mention further staff at the Jet Propulsion Laboratory, this network has to date provided excellent and detailed images of the planets out to Saturn.

Further images are expected from *Voyager II* which should reach Uranus in 1986 and Neptune in 1989. Images of planets may be most impressive to the layman, but other scientific results are probably more vital to our understanding of the solar system. A steady flow of scientific papers is still coming from the data returned by spacecraft, as the results are analysed over periods of years.

Strangely enough, the US inter-planetary missions may be coming to an end for lack of funds. Such missions have to be planned many years ahead. As far as is known, Project Galileo is still going ahead for a detailed study of Jupiter, although it has been modified and delayed. Funds have been made available for another Venus *Orbiter*, but little else is planned. Indeed, it has been reported that funds for the Deep Space Network may be cut off before *Voyager II* reaches Uranus and Neptune, although this is unlikely.

Some people feel that Japan will enter the space race in earnest and will undertake much of the future work. However, now that the Space Shuttle has been successfully tested, this should provide a very economical way of placing heavy loads into earth orbit, from where launching into deep space can be much more easily effected.

Acknowledgements

The writer would like to express his sincere thanks to Mr Done Bane of the Jet Propulsion Laboratory, Pasadena, California, for the volumes of information he has kindly provided about the Deep Space Network and the US inter-planetary missions. Thanks are also due to Hughes Aircraft Co. for spacecraft information and photographs, and to Ms. Kit Weinrichter of the NASA, Ames Research Center, California, for a wealth of material on the US inter-planetary missions. ●

CB RIG CHECK

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.

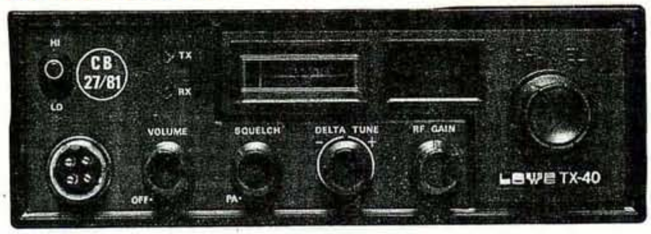
HOW MUCH?

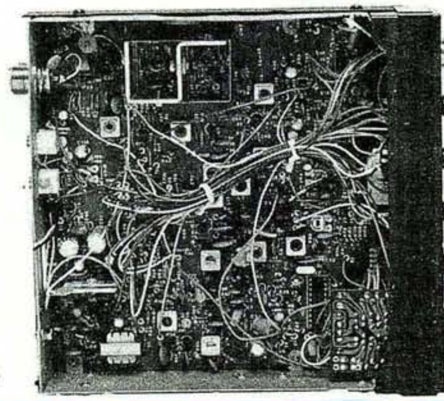
Lowe TX-40. This rig will cost you £55·00, and is available only from Lowe Electronics, Chesterfield Road, Matlock, Derbys. Tel: 0629 2817, to whom we extend our thanks for the loan of the review rig.

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.

LOWE TX-40

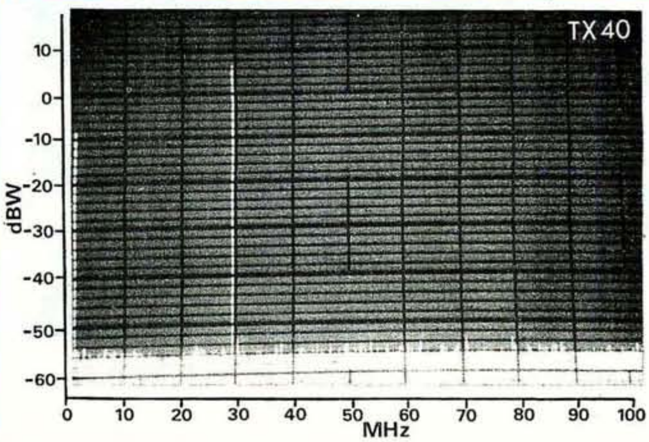




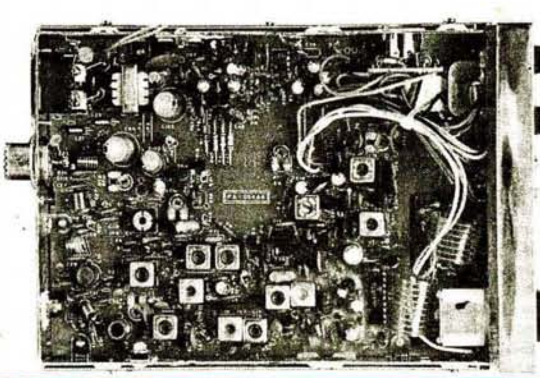
Feature	Spec	On test
Transmitter		
Power out: HI	4W	6·8W (1)
LOW	0·4W	0·8W (1)
Spurious:	As MPT1320	(2)
Frequency tolerance	±1·5kHz	−150Hz
Receiver		
Sensitivity:	0·25μV	0·17μV p.d. (3)
Selectivity: (±4·5kHz)	−6dB	
Squelch sensitivity:	0·5μV	0·4μV
IF	10·7MHz and 455kHz	
Audio output: (8Ω, 10% t.h.d.)	2·5W	2·5W
General		
Consumption:		
Standby	300mA	
Transmit	1A	
Size:	200 × 180 × 60mm	
Weight:	1·7kg	

Notes

1. Supply voltage 13V d.c.
2. Test equipment available for these tests would not measure below 0·4μW. All spurious outputs below this level.
3. For 12dB SINAD.



REALISTIC TRC-2001



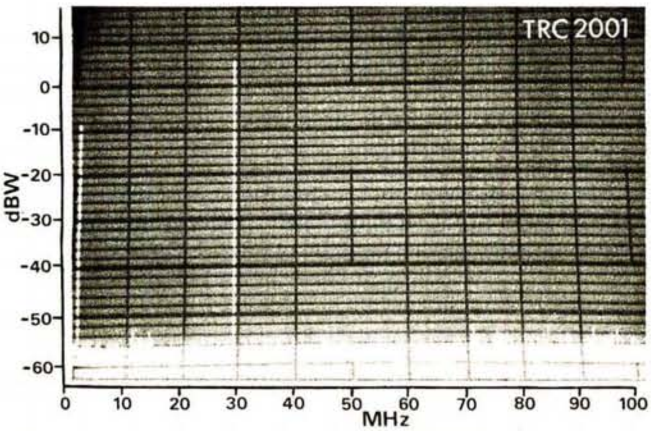
Feature	Spec	On test
Transmitter		
Power out: HI	4W	4·8W [1]
LOW	0·4W	0·5W [1]
Spurious:	As MPT1320	[2]
Frequency tolerance	±555Hz	−60Hz
Receiver		
Sensitivity:	0·7μV [3]	0·35μV p.d. [4]
Selectivity: (±10kHz)	−65dB	
Squelch sensitivity:		0·2μV
IF	10·7MHz and	455kHz
Audio output: (8Ω, 10% t.h.d.)	2W	

General

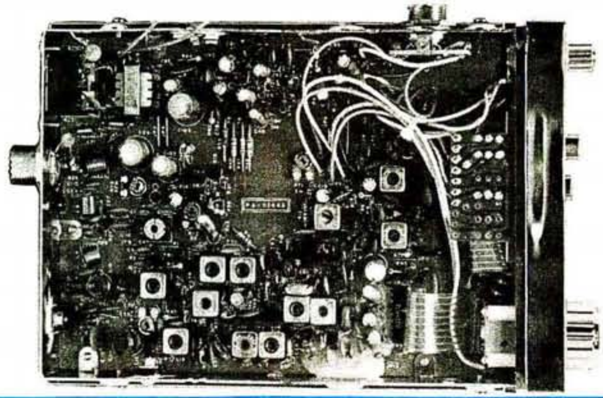
Size: 140 × 205 × 40mm

Notes

1. Supply voltage 13V d.c.
2. Test equipment available for these tests would not measure below 0·4μW. All spurious outputs below this level.
3. For 20dB (S + N)/N.
4. For 12dB SINAD.



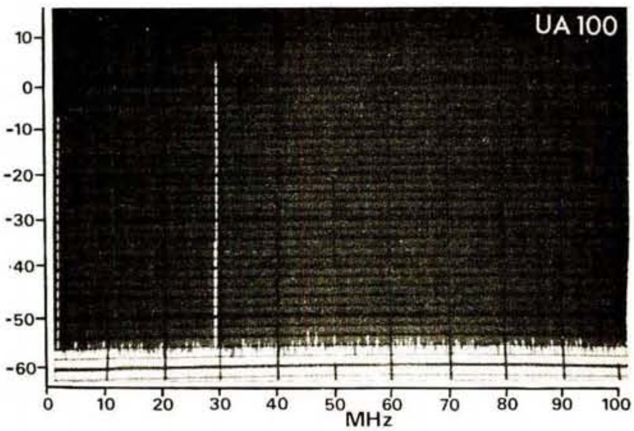
UNIDEN UNIACE 100

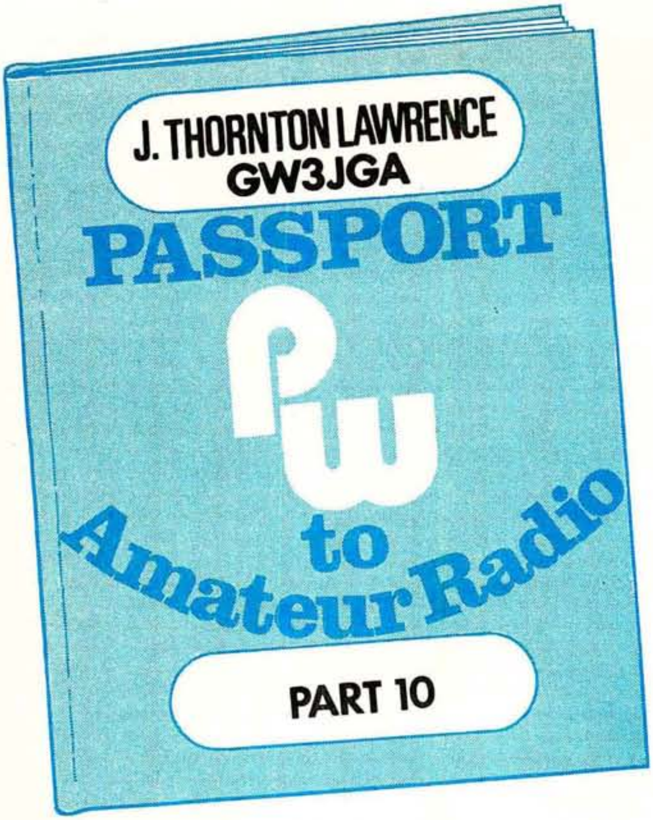


Feature	Spec	On test
Transmitter		
Power out: HI	4W	4·8W [1]
LOW	0·4W	0·4W [1]
Spurious:	As MPT1320	[2]
Frequency tolerance	±555Hz	−170Hz
Receiver		
Sensitivity:	0·7μV [3]	0·28μV p.d. [4]
Selectivity: (±6kHz)	−6dB	
Squelch sensitivity:		0·2μV
IF	10·7MHz and	455kHz
Audio output: (8Ω, 10% t.h.d.)	1·8W	
General		
Consumption: Transmit	2A (max)	
Size:	140 × 205 × 40mm	

Notes

1. Supply voltage 13V d.c.
2. Test equipment available for these tests would not measure below 0·4μW. All spurious outputs below this level.
3. For 20dB S/N.
4. For 12dB SINAD.





In this the final part of the series, we will deal with interference, suppression, operating practices and procedures.

Interference

Non-interference with other radio users, whether they be military, commercial, amateur or domestic, is a condition of the Licence.

An understanding of the way in which interference is caused and how it can be avoided or cured is needed, not only for the RAE, but later on, when you obtain your Licence; you will then be in a position to maintain a good clean transmission and live in peace with your neighbours (and the Home Office Inspector).

No practical transmitter is absolutely perfect and in addition to its correct output, is bound to radiate some spurious signals, however small. If these are not kept to a very low level, interference with receivers (TV or radio) operating nearby may result.

Similarly, no practical receiver is absolutely perfect, so when it is tuned to a particular frequency it may be subjected to interference by strong signals on other frequencies, as may be the case if it is situated in close proximity to a radio transmitter.

Interference can also be caused to audio systems, etc., when subjected to strong r.f. fields. Here, the signal enters the equipment and is then rectified or amplitude demodulated, usually by the emitter-base junction of a transistor in the audio pre-amplifier stages, resulting in breakthrough. Many hi-fi systems employing transistors are prone to interference of this nature.

TVI, BCI, and AFI

Interference can usually be separated into three main categories: television (TVI), radio broadcast (BCI), and audio (a.f.i.).

Television and radio broadcasting are "protected" services and the Post Office may be called upon to investigate cases of interference with these and other authorised transmissions. Audio amplifiers, on the other hand, are not intended to be "radio receivers" and so will not be afforded the same facilities.

In general, all interference results either from deficiencies in the transmitter or the apparatus being interfered with. Let us look initially at the transmitting end.

Deficiencies at the Transmitter

Design and Construction: It is important that the various r.f. signals present within the transmitter are not allowed to radiate directly. Efficient screening is essential, as in the filtering of h.t. and other power supplies, particularly the mains input. A suitable mains filter is shown in Fig. 92. Decoupling and by-pass capacitors should be of mica or ceramic, having low inductance properties and adequate voltage rating (see the section on capacitors). The wiring should be short and direct to minimise stray inductance and capacitance.

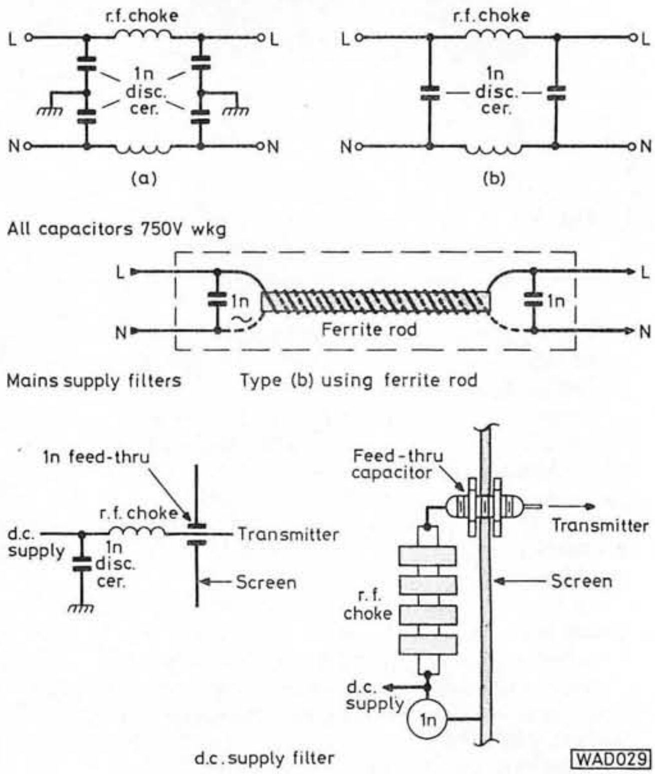


Fig. 92: Power supply filters

Tuning capacitor spindles protruding through front panels are often a source of spurious signals and should therefore be of an insulating material or have an insulated coupling.

The cut-out for a panel meter or dial can often cause problems and a screening cover over the rear of the opening is desirable.

In general, try to ensure that the case of the transmitter is radiation-proof. Commercially made transmitters, including those for the amateur market, already incorporate most of these features and the maker's data sheet usually quotes the level of spurious emissions one may expect.

The block diagram of a well-screened transmitting station is shown in Fig. 93. The transmitter is well protected and its supply leads filtered, ensuring negligible direct radiation.

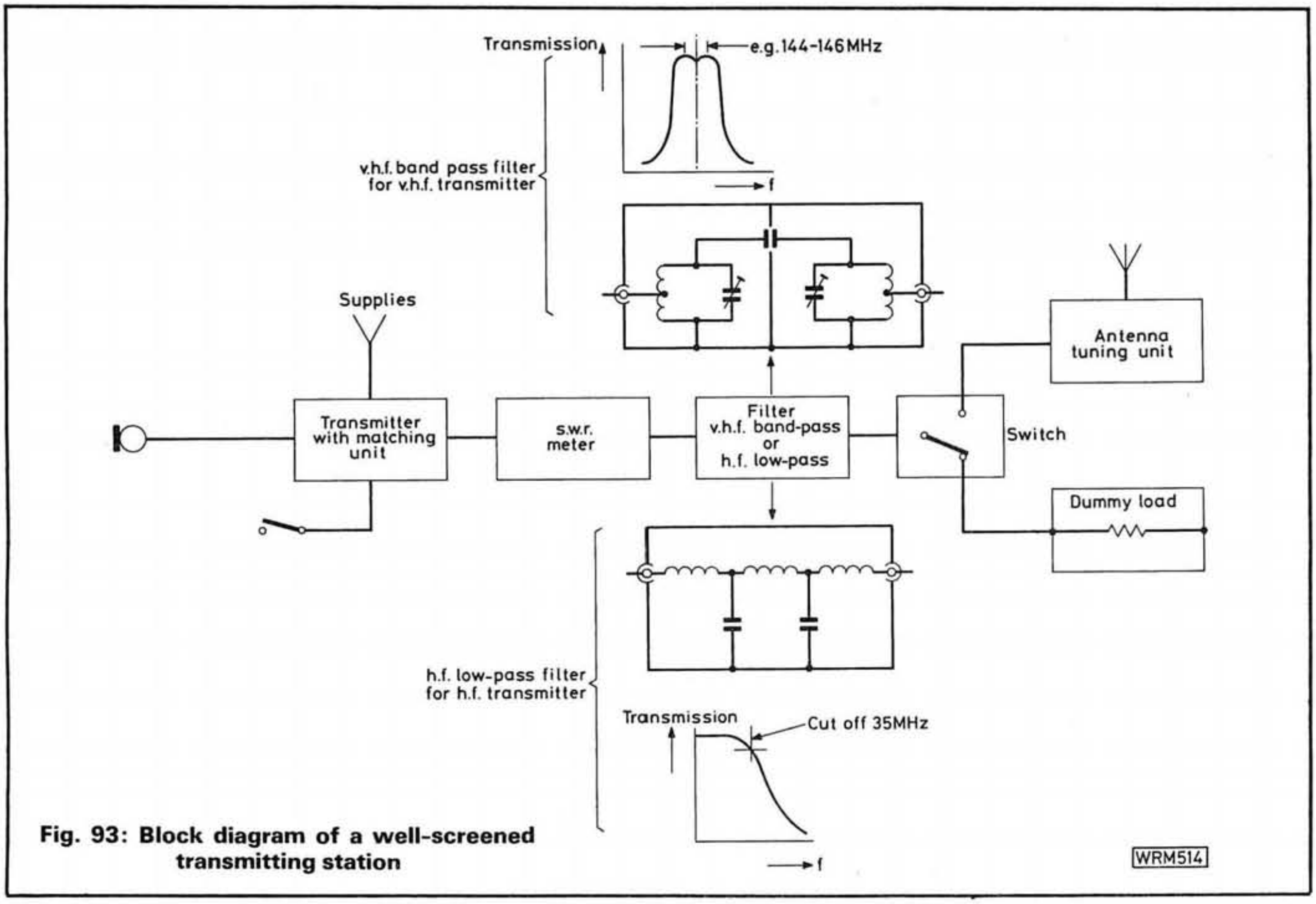


Fig. 93: Block diagram of a well-screened transmitting station

The output passes via a coaxial cable to the standing-wave ratio (s.w.r.) bridge, which indicates relative forward and reflected power levels.

From here it is fed through a filter, housed in a screened box which, in the case of a transmitter operating on bands up to 30MHz, would be of the low-pass type, attenuating spurious signals above this frequency. For a v.h.f. transmitter (144MHz), a bandpass filter attenuating spurious signals either side of the pass-band frequencies would be used.

In practice, the transmitter tuning would first be adjusted into a dummy load. The output would then be switched to an antenna tuning unit (a.t.u.) which is used to provide optimum matching to the antenna with the minimum of reflected power (indicated on the s.w.r. bridge). Note: all interconnecting coaxial cable plugs and terminations should be well soldered.

Antennas and Feeders

The antenna should be sited as high as possible away from neighbouring buildings, TV and radio antennas, etc.

A vertical transmitting antenna is more likely to induce strong fields into nearby equipment than a horizontal one. This is due to the fact that it relies on a ground connection which can cause interfering currents in nearby conductors. In addition, vertically polarised signals are much more likely to be picked up by vertical down-leads, such as those used for television antennas.

It is important that all the transmitter power should be radiated by the antenna proper and that no emission should take place from the feeder cable itself. This means that the currents in each conductor of the feeder should be equal and opposite.

Where a dipole antenna is fed by an unbalanced coaxial cable, there is a significant imbalance in the current distribution and some radiation from the feeder results.

The feeder, usually being vertical, readily causes interfering currents to be induced into nearby television down-leads. To overcome this problem, a balance-to-unbalance transformer (balun) is connected at the centre of the dipole, as shown in Fig. 90. In other types of antenna, and feeders, correct adjustment of the tuning unit is all-important in reducing feeder radiation to a minimum.

Transmitter Operation

Excessive drive in any of the transmitter stages will increase the level of harmonics, so power should be kept to the minimum consistent with efficient operation.

Tuning of the final power amplifier and adjustment of the a.t.u. will have a considerable effect on the amount of spurious signals radiated. When tuning the transmitter power amplifier into a dummy load, increase the coupling only until the correct power level is obtained. Do not over-couple the transmitter or the "Q" of the p.a. tank circuit will be reduced, with a consequent increase of spurious emissions. This also applies when adjusting the a.t.u.

An abrupt keying characteristic causes excessive side frequencies, so check each side of your transmission for key clicks.

Overmodulation produces excessively wide sidebands and causes splatter; always monitor the modulation level and ensure that overmodulation does not occur.

The audio bandwidth necessary for good speech communication is about 3kHz. The modulation circuits of the transmitter should therefore have a rapidly falling response above 3kHz in order to avoid the radiation of excessive and unnecessary sidebands.

Summary

Let us summarise the requirements for keeping deficiencies at the transmitter to a minimum:

1. Use correct components in the transmitter, well laid out.
2. Prevent direct radiation from the transmitter and associated leads by screening and filtering.
3. Use appropriate filters in the transmitter output.
4. Use a dummy load for tuning up and a suitable antenna tuning unit. Do not overcouple.
5. Keep antennas in the clear and avoid radiation from the feeder cable (balun transformer).
6. Tune up carefully: do not overdrive or overmodulate.
7. Avoid excessive sidebands by restricting the audio bandwidth to 3kHz.
8. Check your transmissions regularly.

Deficiencies at the Receiver

In many instances, interference is the result of a receiving installation of poor standard; e.g. indoor antenna, antenna incorrect type for area, downlead incorrectly installed, receiver incorrectly installed, excessively long mains leads or speaker leads, etc., etc.

Considering the problem of TVI, strong signals can enter the receiver via the antenna and cause interference by cross-modulation in the r.f. or subsequent stages. A high-pass or rejection filter for the frequency concerned must be fitted in the antenna lead, as shown in Fig. 94.

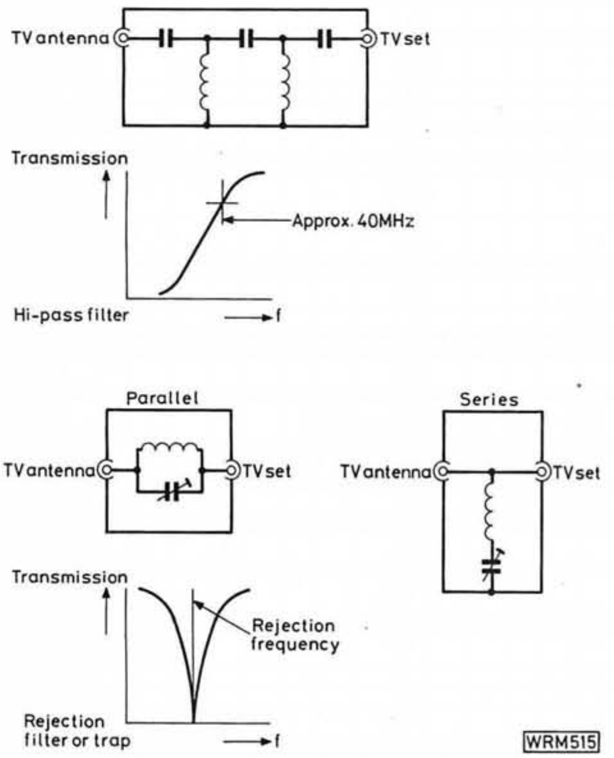


Fig. 94: TV interference rejection filters

Mast-head amplifiers are a notorious cause of interference as they have broadband input characteristics, some extending from 10MHz to 1000MHz. Cross-modulation and swamp effects are common. A high-pass filter should be fitted between the antenna and the input to the amplifier, but in practice difficulties arise here because the antenna has to be taken down and the filter made weatherproof.

A personal view is that many TV mast-head amplifiers have been fitted unnecessarily and where only a short feeder cable is in use, removal of the amplifier overcomes the cross-modulation with no noticeable change in picture quality.

However, the most common method by which r.f. will enter the receiver is by the presence of "braid" currents in the antenna downlead. These r.f. currents flow through earthy parts of the receiver causing r.f. voltages to be produced in susceptible parts of the circuit.

A "braid breaker" suitable for u.h.f. television is shown in Fig. 95. The reactance of the series capacitors is high at frequencies below 30MHz, effectively "breaking" the downlead, but at u.h.f. it is low, resulting in negligible attenuation of the television signal.

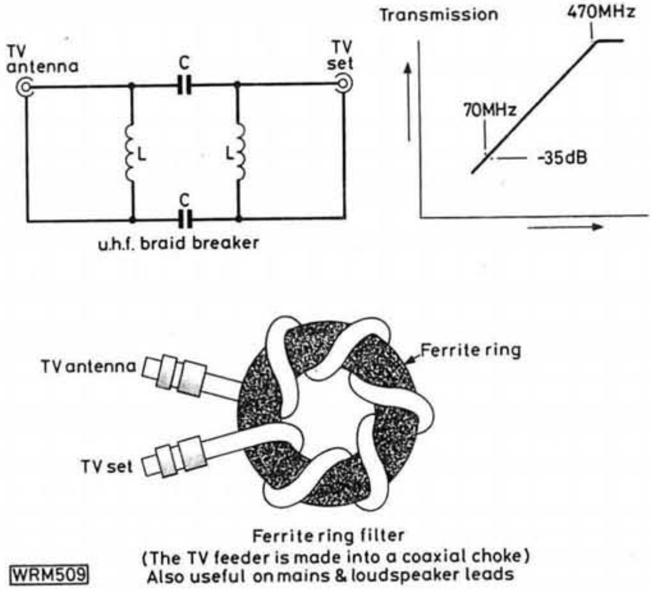


Fig. 95: "Braid breakers" for u.h.f. and h.f./v.h.f.

Where "braid currents" in the downlead cause interference at h.f. and v.h.f. an alternative circuit can be used. Here a short length of the coaxial downlead cable is wound on a ferrite ring, increasing the inductive reactance of the outside braid without affecting the signals within. An alternative to the ferrite ring, and almost as effective, is to wind the coaxial cable around a ferrite rod antenna.

If the interference is entering the receiver by way of the mains lead, a mains filter as shown in Fig. 92 should be installed. In the case of hi-fi systems, it can also be picked up on speaker leads, so de-coupling these with a disc ceramic capacitor of 1nF to 10nF is often effective. A ferrite ring may be required in addition, if the problem is really severe.

It is unwise to incorporate modifications inside the receiver, as you may invalidate its warranty and be held responsible for any subsequent malfunction. In difficult cases it would be wise to consult the dealer or manufacturer.

Summary

1. Check that the receiving installation is of adequate standard for the reception area.
2. If the interference is entering via the antenna lead, fit a high-pass or rejection filter.
3. If cross-modulation occurs in a mast-head amplifier, fit a high-pass filter in the antenna feed to it, or possibly remove it altogether.
4. If the interference is entering via the downlead braid, fit a ferrite ring or capacitive braid-breaker.

5. If the interference is entering via the mains lead or other cables, fit a mains filter or ferrite ring.
6. If the problems are caused by direct radiation, try repositioning the antennas, feeders, etc. Whenever possible, avoid making internal modifications to receivers or audio systems. In difficult cases, refer to manufacturer.
Note: An excellent collection of articles on interference appeared in *Radio Communication,* May 1975. Your local Radio Club or a nearby radio amateur may be able to help with a copy. The Radio Society of Great Britain, 35 Doughty Street, London WC1N 2AE also publish *Television Interference Manual (2nd Edition).*

Operating Practices and Procedures

Telegraphy (c.w. A1A): Two important requirements in radio communication are accuracy and speed. In professional telegraphy this implies the use of internationally agreed symbols and codes, such as the **International "Q" Code** which, for routine messages, also overcomes any language difficulties there may be.

Radio amateurs using telegraphy have adapted many of the "Q" codes and use these (as nouns) along with other abbreviations to cover popular expressions so that greetings, reports and information can be speedily exchanged with other amateurs irrespective of their native tongue.

Good operating on A1A is a matter of practice and consideration for others, avoiding interference by listening on a frequency before transmitting, sending more slowly or repeating messages when requested. In fact, "courtesy on the air".

Telephony (Phone, A3E, J3E, F3E, G3E): Poor or inconsiderate operating on A1A usually only inconveniences other amateurs, but slovenly operating on telephony discredits the radio amateur generally. A listener judges our hobby by what he hears on the air and here jargon and abbreviations should be avoided where possible and normal expressions used.

The amateur using telephony should follow the pattern of calling procedures, should speak clearly and make use of the recommended phonetic alphabet when giving callsigns and also for spelling names and locations, when conditions are difficult.

Note that words which are facetious or objectionable are forbidden for this purpose, by the Licence conditions.

Establishing Communication

There are basically two ways of establishing communication with another amateur station:

a. by calling a specific station.
b. by transmitting a "CQ" or general call.

On most amateur bands there are usually several stations calling CQ, so it is generally preferred to answer a CQ call rather than to originate one. However, when activity is low, a CQ call may be the only way of establishing a contact.

The following examples of procedure apply particularly to A1A (Morse) but the general calling procedure is also followed when using telephony.

Calling a Specific Station

Should I wish to call a specific station (e.g. G4ZZZ) who is calling CQ I first tune my transmitter on to the same frequency (or channel) then wait until he stops transmitting. The basic call in Morse would then be:

G4ZZZ G4ZZZ G4ZZZ DE GW3JGA GW3JGA GW3JGA $\overline{\text{KN}}$

DE is used to separate the two callsigns, that is, the station called and the calling station.
$\overline{\text{KN}}$ is the invitation to the specific station (G4ZZZ) to reply. (The bar over the top means that the letters are sent joined together, dah-di-dah-dah-dit.)
On phone, I would simply say,
G4ZZZ G4ZZZ G4ZZZ from GW3JGA, Golf Whiskey three Juliett Golf Alfa GW3JGA is listening.

Making a "CQ" General Call

I first ensure that the frequency (channel) is not already occupied by listening carefully for a few minutes before transmitting.

The basic CQ call would be:
CQ CQ CQ DE GW3JGA GW3JGA GW3JGA K
K is a general invitation for **any** station to reply.

Depending on conditions on the band, the complete CQ may be repeated several times.

Never send a long string of CQs without interspacing with your callsign.

Under poor conditions it may be difficult to identify the station replying and the signal QRZ ("who is calling me?") may be used:
QRZ QRZ DE GW3JGA GW3JGA GW3JGA $\overline{\text{KN}}$.

Having established contact, the QSO (communication) might continue as follows:
GW3JGA GW3JGA de G4ZZZ G4ZZZ = GE OM ES MNI TNX FER CALL = VY PSED TO QSO U = UR SIGS RST 589 = QTH IS MANCHESTER = NAME IS DOUG = HW? $\overline{\text{AR}}$ GW3JGA GW3JGA DE G4ZZZ G4ZZZ $\overline{\text{KN}}$
HW? means "How do you receive me?"
$\overline{\text{AR}}$ means "end of message" di-dah-di-dah-dit
= is a break sign dah-di-di-di-dah

continuing now to the last "over":
G4ZZZ G4ZZZ DE GW3JGA GW3JGA = R ES TNX ALL = MNI TNX QSO ES HPE CUAGN SN = VY 73 DOUG ES GD DX = G4ZZZ G4ZZZ DE GW3JGA GW3JGA $\overline{\text{VA}}$ CL
$\overline{\text{VA}}$ means I have finished
CL indicates that I am closing down.

Repeaters and Satellites

Repeaters and Satellites help v.h.f. and u.h.f. operators to increase their range by receiving and re-transmitting their signals. The UK has a network of amateur repeater stations operating on the 144MHz (2m) and 432MHz (70cm) bands. Satellites capable of handling amateur transmissions are generally of an experimental nature, each new satellite launched having improved performance and facilities.

Repeaters receive (on the "input channel") v.h.f. or u.h.f. signals from mobile or portable stations and re-transmit them on a different frequency (on the "output channel") within the same amateur band.

Repeater stations are usually located on high ground, frequently at the site of a commercial or broadcast transmitter and often using the same antenna mast. They are unmanned and entirely automatic in operation.

The repeater does not transmit continuously but is turned on remotely by the user. This is known as "accessing" the repeater and is done by transmitting a "tone-burst" of 1750Hz $\pm$ 25Hz tone for about 0·5 seconds.

When an "over" is finished and the incoming signal disappears, the repeater will, after a short delay, transmit

WAD030 AMATEUR RADIO STATION LOG

Date	GMT Start	GMT Finish	Band	Called/ heard	Called by	Emission	Power	Their RST	My RST	QSL Sent	QSL Rec'd	Remarks
1982 2 Feb.	21·00	21·02	1·8	CQ		A1A	8					No reply
"	21·05	21·15	1·8	G4ZZZ		"	8	579	569	✓		Bob Manchester
"	21·15	21·30	1·8		G4YYY	"	8	459	449	✓		Fred Bournemouth QSB
"	21·45	Station		closed	down							

Compulsory — Voluntary

Fig. 96

an indication of its readiness to accept another input transmission.

Each repeater has a specific output frequency with the input 600kHz lower in the 144MHz band and 1·6MHz higher in the 432MHz band, and can handle only one F3E, G3E (n.b.f.m.) transmission at a time.

Satellites in the OSCAR (Orbiting Satellite Carrying Amateur Radio) series are **transponders.** They receive transmissions of any mode, but preferably c.w., s.s.b. and RTTY (Teletype) over a **band** of frequencies in one amateur band and then re-transmit them back in another amateur band, examples are given below.

UP	DOWN
432MHz	144MHz
144MHz	432MHz
144MHz	28MHz

Acceptable performance can be obtained using fixed antennas but for best performance the transmitting and receiving antennas must move in azimuth and elevation to track the satellite properly.

Log Keeping

The Amateur Licence requires that an indelible record be kept in one book (not loose leaf) showing details of the operation of the station including all transmissions. Full details of these requirements are given in *How to Become a Radio Amateur,* paragraph 6 of "The Conditions of the Amateur Licence".

In addition to the information which you are obliged to record, the usual printed Radio Amateur's Log Book has space for signal reports, operator names and other personal notes. A typical example of a completed log entry is shown in Fig. 96.

Safety

Electrical hazards are different from most other dangers because they do not alert any of our senses. The effects of electric shock depend on so many factors that there is no certain lower limit of voltage which is "safe to touch".

The RSGB Safety Recommendations for the Amateur Radio Station are given in Appendix 2 of the *Radio Amateur's Examination Manual* and should be carefully studied.

The most important precautions are:

1. All equipment should be controlled by one master switch, marked and well known to others.
2. All equipment should be properly connected to a good and permanent earth.
3. Switch off and disconnect from the mains supply before attempting the investigation or repair of any equipment.
4. Ensure that all high voltage capacitors are correctly fitted with bleed resistors and confirm that their discharge is complete using an earth probe.
5. When making adjustments to live equipment, keep one hand in your pocket, stand on an insulating mat, remove headphones or neck microphone.

Licensing Conditions

In the previous sections of *Passport to Amateur Radio* we have covered the majority of topics in the RAE syllabus, with one notable exception—Licensing Conditions.

This topic is examined in the first examination paper, 765–1–01 with 23 out of 35 questions devoted to Licensing Conditions, the remainder covering Transmitter Interference.

It is obvious that success in the first paper will largely depend on having a clear understanding of the Amateur Licence conditions, the frequency bands, emissions, etc.

Careful study of *How to Become a Radio Amateur,* Appendix A and B will be necessary. This will mean committing certain sections to memory, such as the Schedule of Frequency Bands, footnotes and classes of emissions. For the rest, it will be to your advantage to know them very thoroughly indeed.

Some Q-Codes have taken on a more informal meaning in the Amateur Service, and become simply abbreviations.

QRM	Interference from other stations.
QRN	Interference from atmospheric noise or electrical apparatus.
QRO	High power.
QRP	Low power.
QRT	Closing (closed) down.
QRX	Wait—Stand by.
QSB	Fading.
QSD	Bad sending.
QSL	Confirm contact; verification card.
QSO	Radio contact.
QSP	Relay message.
QSY	Change frequency.
QTH	Location.

INTERNATIONAL Q-CODE

Codes commonly used in the Amateur Service

QRA	What is the name of your station? The name of my station is . . .
QRG	Will you tell me my exact frequency (*or* that of . . .)? Your exact frequency (*or* that of . . .) is . . . kHz (*or* MHz).
QRH	Does my frequency vary? Your frequency varies.
QRI	How is the tone of my transmission? The tone of your transmission is . . . (amateur T1–T9).
QRK	What is the intelligibility of my signals (*or* those of . . .)? The intelligibility of your signals (*or* those of . . .) is . . . (amateur R1–R5).
QRL	Are you busy? I am busy (*or* I am busy with . . .). Please do not interfere.
QRM	Are you being interfered with? I am being interfered with.
QRN	Are you troubled by static? I am troubled by static.
QRO	Shall I increase transmitter power? Increase transmitter power.
QRP	Shall I decrease transmitter power? Decrease transmitter power.
QRQ	Shall I send faster? Send faster (. . . words per minute).
QRS	Shall I send more slowly? Send more slowly (. . . words per minute).
QRT	Shall I stop sending? Stop sending.
QRU	Have you anything for me? I have nothing for you.
QRV	Are you ready? I am ready.
QRX	When will you call me again? I will call you again at . . . hours (on . . . kHz (*or* MHz)).
QRZ	Who is calling me? You are being called by . . . (on . . . kHz (*or* MHz)).
QSA	What is the strength of my signals (*or* those of . . .)? The strength of your signals (*or* those of . . .) is . . . (amateur S1–S9).
QSB	Are my signals fading? Your signals are fading.
QSD	Is my keying defective? Your keying is defective.
QSL	Can you acknowledge receipt? I am acknowledging receipt.
QSO	Can you communicate with . . . direct (*or* by relay)? I can communicate with . . . direct (*or* by relay through . . .).
QSP	Will you relay to . . .? I will relay to . . .
QSV	Shall I send a series of V's on this frequency (*or* . . . kHz (*or* MHz))? Send a series of V's on this frequency (*or* on . . . kHz (*or* MHz)).
QSY	Shall I change to transmission on another frequency? Change to transmission on another frequency (*or* on . . . kHz (*or* MHz)).
QSZ	Shall I send each word or group more than once? Send each word or group twice (*or* . . . times).
QTH	What is your position in latitude and longitude (*or according to any other indication*)? My position is . . . latitude . . . longitude (*or according to any other indication*).
QTR	What is the correct time? The correct time is . . . hours.

Q-Codes take the form of a question when the code-group is followed by a question mark.

THE RST CODE

Readability

R1	Unreadable
R2	Barely readable, occasional words distinguishable
R3	Readable with considerable difficulty
R4	Readable with practically no difficulty
R5	Perfectly readable

Signal Strength

S1	Faint, signals barely perceptible
S2	Very weak signals
S3	Weak signals
S4	Fair signals
S5	Fairly good signals
S6	Good signals
S7	Moderately strong signals
S8	Strong signals
S9	Extremely strong signals

Tone

T1	Extremely rough hissing note
T2	Very rough a.c. note, no trace of musicality
T3	Rough, low-pitched a.c. note, slightly musical
T4	Rather rough a.c. note, moderately musical
T5	Musically modulated note
T6	Modulated note, slight trace of ripple
T7	Near d.c. note, smooth ripple
T8	Good d.c. note, just a trace of ripple
T9	Purest d.c. note

A letter is sometimes added to the "T" report to give further information:

C	Chirp	K	Key clicks
D	Drift	X	Very stable note, sounding like a crystal-controlled transmitter

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

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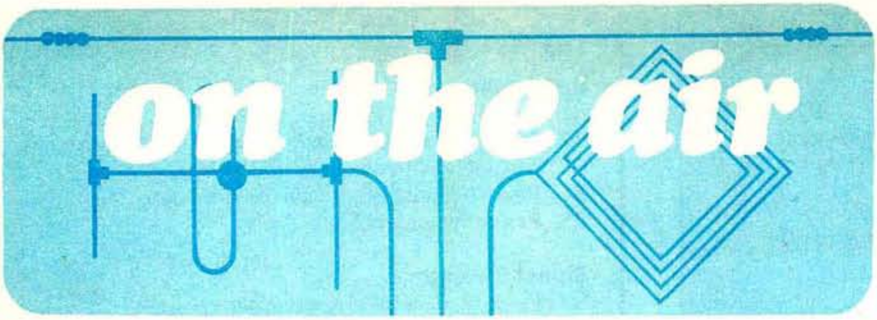

Amateur Bands

by Eric Dowdeswell G4AR

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

Back to the filter saga started last month but first a word to those who prefer to buy a filter rather than make one from a published design. The characteristics of a filter are based by the designer on a given input and output impedance, and if the eventual user of such a filter does not observe these impedances a mismatch will occur and the expected results will not be obtained, the filter and the manufacturer being summarily written off as "lousy" for all time, which is patently unfair.

For example, an audio filter may have a low impedance output of, say, 8 ohms yet the headphones used with it may be high impedance, perhaps several thousand ohms. Any peak or notch controls will not seem very effective although signals will still be heard. So always check the impedances involved before condemning any filter. Better still, check from the literature before buying the filter that it is suitable for the task in hand.

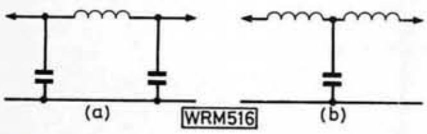

Fig. 1: Pi-section and T-section filter circuits having low pass characteristics

Frequently met are the pi-section ("pi" from the Greek letter π ("p")) and T-section, both reflecting the way in which the components are shown in circuit diagrams. Fig. 1(a) pi-section and (b) T-section are both low pass filters while Fig. 2(a) and (b) show the high pass equivalents. The filters shown are for unbalanced circuits, usually where one side of the circuit is earth, but for balanced circuits Fig. 3 is applicable, the effective value of the components being the same as in Fig. 1(a).

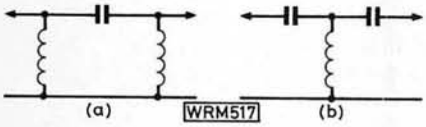

Fig. 2: The high pass equivalent circuits of Fig. 1. Note the transposition of the capacitive and inductive elements

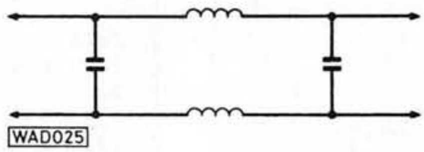

Fig. 3: Design for a balanced pi-section filter

A widely-used version of the pi-section filter, Fig. 4, is used in transmitter output (p.a.) stages enabling the output impedance of the transmitter to be closely matched to the input impedance of the antenna feeder. Capacitor C1 resonates the circuit to the appropriate frequency while C2 adjusts the degree of loading of the antenna circuit on the p.a. There is a considerable degree of inter-dependence between these two controls as one would expect.

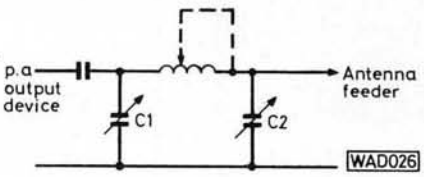

Fig. 4: Basic circuit of a transmitter output stage (PA) using a pi-section filter configuration

Following the widespread use of low impedance (50 or 75 ohms) coaxial cable to link transmitter and antenna after WWII it became common practice to make C2 a suitable fixed value for each band thus obviating the need for C2 as a panel control. One drawback is that if the coaxial cable has an impedance much different from the design value it is impossible to avoid a possibly unacceptable high value of standing wave ratio.

While the p.a. circuit of Fig. 4 does provide a fair amount of attenuation to harmonic frequencies it is usually desirable to insert a low pass filter in the coaxial cable at a point close to the transmitter output socket. The circuit of Fig. 5 is typical of a practical design for such a filter. If it is for use on the h.f. amateur bands it is generally sufficient to follow the published design fairly closely without the need for any alignment.

A word or two about interpreting filter response curves might prove of interest to some readers. Fig. 6 is the very familiar diagram associated with i.f. filters, f_0 being the centre frequency, say 455kHz, with the left-hand vertical axis marked in decibel units. Since the decibel is a ratio of two voltages (in this case), the scale ought to be logarithmic also but it would be very cramped in places. Hence a linear scale is used where equal numbers of dB have equal spacing on the scale.

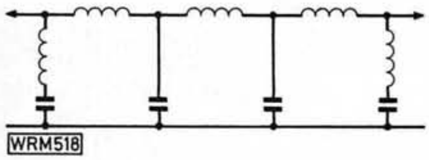

Fig. 5: Typical low pass filter circuit for suppressing harmonics from a p.a. stage. In practice the filter would be constructed inside a metal screening box

The right-hand scale is attenuation in terms of voltage. An example will explain all. Suppose an i.f. signal of 100mV at 455kHz is applied to the filter, corresponding to the zero level at the top of the diagram, then the output at a point 40dB down will be a ratio of 1:100 (from right-hand scale) or 1mV. This derives from the formula: ratio (dB) $= 20 \log_{10}(V1/V2)$ in this case ratio dB $= 20 \log_{10} 100$, or $20 \times 2 = 40$dB.

Similarly 60dB down is a ratio of 1:1000 or an output of 100µV in this example. The "goodness" of an i.f. filter is measured by taking the total width of the curve at −6dB and −60dB the unachievable ideal being when they are both the same! The ratio of the two widths being known as the "shape factor". If the width is 2·7kHz at −6dB and 5·4kHz at −60dB then the shape factor is 2:1.

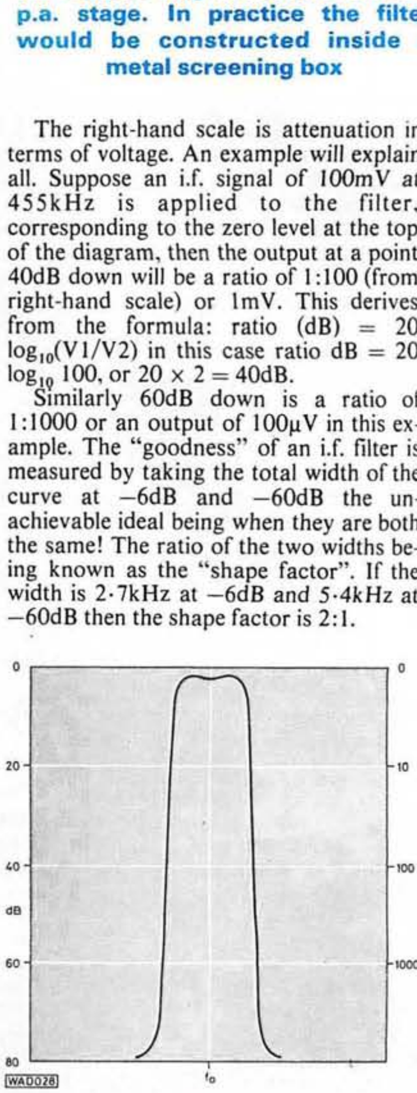

Fig. 6

Filters appear in almost every circuit we look at, from high value capacitors and associated resistors in power sup-

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plies, to r.f. chokes and capacitors in mobile radio installations, for suppressing ignition interference. Filters are used to keep signals to the particular part of the circuit where they belong and prevent interaction between circuits. Come to think of it, almost every circuit is a filter of some sort or other!

DX Time

One of many candidates in the December RAE, **Archie Magrath** BRS48064 of Ramsgate bemoans the time it is taking to hear the results of his efforts. *PW's Passport to Amateur Radio* was his mainstay in studying. The Trio R-1000 plus a long wire brought in CP5GIQ, Z21GL, VS6CT, HC1HV and ZP5RG on 28MHz (10m) with Z21EF, VQ9CW and C6ANU for 21MHz (15m). Only catch on 14MHz (20m) was 4K1A.

First contact with the column for **Ted Macko** (London W3) who has abandoned the BC bands once and for all, finding all sorts of goodies with his FRG-7700, starting with a wire round the fence which came down with the snow, so the TV antenna was pressed into use. A decent wire plus a.t.u. is in the offing. Catches included CT2CR, HK4EIM, TU2JB, ZD9BU/A, 5Z4RT and 9J2KA on 28MHz, CR9AN, EA9JV, KC4AAC, VS5TT, 5B4SP, 6Y5BA and 8R1Y appearing on 21MHz plus AP2FQ, JX7FD, KC4AP, OY6F, 9J2LL, and 9Y4CR for 14MHz. Finds on 7MHz were JA6LDD, VP2MCK, XT2AW and 9K2DR.

Stephen Bowler of Wakefield has only been at it for a year with his R-1000 and HF5 vertical antenna but manages to log things like YS1ECB on 28MHz and W6KG/PZ1 at the other end on 3·5MHz (80m). The 14MHz band seems the most popular with Stephen with KL7IF, 4K1A (QSL UA3AEL), YJ8RG, KH6BB, JX6BAA, SP2BHZ/JW plus Z24JH, Z28JD and Z22JK.

An experimental VK2ABQ beam has been taking up the time of **Dave Coggins** in Knutsford, Cheshire, but poor conditions on the h.f. bands has meant a trip to the 144MHz (2m) band now and again. So on 28MHz it was DU1RD, FS0YP, VK9YC on Cocos-Keeling Island, Z21AN which is the new prefix for Zimbabwe in case you are out of touch, 9N1BMK who wants cards via JA8MWU, and 9X5SL via DL8DF. The 7MHz (40m) band produced a few nice ones, JA2BAY, ZL4BO, 6W8AR and 8P6OR, with JA5ANP, VK2AVA and ZL2BT on 3·8MHz. On 1·8MHz (160m) the only s.s.b. of note was EA6ET. On c.w. the new 10MHz band produced VK2AVA, VK3AUZ, ZL2ADX and ZL4LL.

Anne Edmondson BRS47285 (Edinburgh) was delighted with a score of 47 329 points in the White Rose SWL contest, mostly obtained on the 3·5MHz (80m) band, with her Realistic DX-100 and a short wire antenna indoors. Anne's log this time concentrates on the 3·5MHz (80m) band with CO1FR, FM0GA (QSL N6ZV), HI8XJO, J3AE who wants cards direct, W6KG/PZ1 (QSL YASME Foundation), YV3BQS, 4Z4DX, special call 6D5OX in Mexico, and 6W8DY. From Swansea, **Philip Morris** admits quite openly that he almost sold his CR-100 in order to buy a CB rig! Fortunately it was only a passing craze so he went on with his set plus a 3·5MHz band long wire to copy a couple of EA6's on Top Band, AP2ZR, JA6XMM, W6KG/PZ1, ZL1AZV, ZL4BO, 7Z2AP, EP2TY, VP8ANT and 6W8AR all on 3·5MHz s.s.b. On 7MHz he entrapped ZD8MW, TI5AOS and ZL2AGW, while 14MHz came up with a rare one in VQ9DL on Diego Garcia, 3X1Z, ZL4PO/C for another rare one, on Chatham Island, 5V7HL, CR9BH, YJ8RG and 4S7DJ. Finally 21MHz also put up an excellent one in 3C0BC (Annobon), then ZS3NH in Namibia, 5H3BH and 3D6BP.

Jon Kempster BRS45205 (Berkhamsted, Herts) still has his FRG-7 in spite of threats to swop it for an FR5OB. Jon comments on the CB QRM on the 28MHz band but still managed to find some good DX like HP1XKZ, FG7XL, W6QL/8R1 (QSL W6RGG), J87BI, W6KG/PZ1 and HC1JQ. A Canadian special call on 21MHz was CG5MC where Jon also copied ZC4SR, and 5H3LM. Unusual on 14MHz was SV8OX/1 about which I am very doubtful, JY5OM, 5N9GM and CT2DL. Jon now admits to taking the RAE last December and waits patiently like so many more.

Jim Dunnett in Prestatyn has been playing around on the v.l.f. bands copying things like GBR on 16kHz and wonders if amateurs will ever have a band down there! Gear is an AR-88D plus SRX-30 and a direct conversion receiver, with a.t.u. and audio filters, into which he feeds folded dipoles and a long wire. On the RTTY side an ST5 TU runs a Creed 7B printer. RTTY copied included DK, EI and SM on 3·5MHz while 14MHz brought forth CN8BI, DU1EFZ of POB AC166 Manila, VS6CT, YB2SV, 3A2EE and 9K2KA. A goodie on 28MHz was VK8HA calling CQ with no takers. In the c.w. mode Jim got lots of Euros on 1·8MHz, then PZ1AP, SV1JG and UH8BBF and more Euros on 3·5MHz. On 7MHz only CT4KQ and SV1HS seem worthy of note, but on the new 10MHz band C6ABA and DL2GG/YV5 were logged. Interesting on 14MHz were CO8AY, FG7AS, FY7BC and FY7FOL, PA0VDV/PJ7, W6KG/PZ1, KA2MZJ/SV9 (Crete), TU2JB, ZD8TC, the last also appearing on 21MHz (915m) plus FY7YE and M1C. On 28MHz CE5RN, J28DP (QSL F2GA), VP2MM were logged. In the s.s.b. mode Jim caught HS1KO (POB 2199 Bangkok), VS5DD, 3X1Z and 5B4HS on 14MHz and a real rare one in D68AM on the Comoro Islands, and VK5AZ on 21. Only ones worthy of mention on 28 s.s.b. were EA9KF (POB 265 Melilla), HK0EHM on San Andreas and TI2TS.

In Wadhurst, East Sussex, **Rob Gibson** also waits among the 5000 odd who took the May RAE. In the meantime the FRG-7 and fan dipole for 14 and 28MHz sought YJ8RG, 3C0BS (Annobon), 3X1Z, 5N9GM, C53AP, P29FV, VK0AN, VK9NS, all on 14MHz s.s.b. On 21 it was 5N0ESA, C53AP again, HL1SX and a fine catch in JR6VNC on Okinawa, ending with 5N8PBN, 6D5AE of XE-land, FY0FOL and G3ZRK lurking as /SU. The FRG-7700 and matching a.t.u. plus long wire of **John Hayes** (London N9) looked at 1·8MHz (160m) but only found a few Euros on s.s.b. On 28MHz it was a different story with DU1CPL, H5HA (?), J73PP, TU2IZ, Z21EI, 5N9GM with a switch to 21MHz producing 6W8AR and C53AL. Better results on 14MHz meant VP2MH, 3B8FA, 6W8AAQ, 8P6OR, 9Q5MA, 9Y4NP which meant that John covered just about all the h.f. bands which every good listener should do if he/she is to get the most out of DXing.

David Warr BRS44127 of Weymouth, Dorset promises to get on with his code practice and go straight to G4, when he gets his RAE result that is! He also admits to having a legal CB rig and chats to the several amateurs in his area who also find 27MHz entertaining. A foray on to 1·8MHz or so gave encouraging results with several Americans logged on s.s.b., with HT1MAT on 3·8MHz, 6W8AR on 7MHz and VP5WJR on 21MHz. In Burton-on-Trent **Bryan Johnson** swots hard for his RAE and listens on a Trio R-1000 plus KX2 a.t.u. and 30 metre-long wire but only mentions one band, 14MHz, where it was VR6TC, ZD7BW, 5B4HF, 8P6JC and 9H1EU. The much treasured QSL from Tom Christian VR6TC has already been received.

Very little indeed on the happenings on our new 10MHz band perhaps because it is restricted to c.w. and RTTY but reports to date indicate a lot of activity especially on c.w. So what about some more reports from those who can copy the dots and dashes?

Wise Mick Worsfold G8XCY decided on the *PW* Exe 10GHz transceiver as his project in the Guildford & District RS annual construction contest. Society President Dick Ramsey G3ARM, centre, presented the prizes, with runner-up Stan Casperd G3XON demonstrating his flashing callsign badge!

In Passing

Some two years or more ago it seems I started **Rick Barker** of East Croydon, Surrey on the slippery slope of amateur radio. Now he writes to say he is

G8UUK and practising his code on the CCF nets so that his 14w.p.m. ought to get him a G4 any day now, when he is able to get to a test centre. Another reason why he has had a go at the code could be that his 18th birthday brought a Ten-Tec Argosy rig!

Fourteen-year-old **John Stowell** in Douglas, IOM, is also BRS45003 and started s.w.l.ing when only nine, with a grandad-made seven-transistor receiver, later replaced by a GR78 from the same source, copying KH6 and 9X5 on 14MHz as best DX. The 25 metre-long wire came down in the blizzards but logs are promised for the future.

Finally, for those of you who work on the railways (nobody is, as I pen this lot!) the British Railways ARS is always looking for more members says secretary **G. Sims** of 85 Surrey Street, Glossop, Derbys, with the big event in Lowestoft in November, the International Congress of Railway Radio Amateurs. Contests are held and there are UK and international nets on c.w. and s.s.b.

Readers with TV sets equipped for teletext reception may not know that the ITV Oracle service has two or three pages devoted to amateur radio matters, starting at page 362. It has just announced that because of a backlog of work the Home Office has not issued any amateur licences for several weeks! No wonder the RAE results have not come out yet! Just imagine another 3000-odd applicants hammering at the doors of the HO. Shades of illegal CB!

Club Time

Readers probably appreciate that it is not possible to include in this column details of every club that sends in information on its activities so this month I will concentrate somewhat on new and possibly some of the smaller clubs.

North Wakefield RC Thursdays at 7.45 at Carr Gate Working Men's Club where Neil Horne G8WWE will welcome you. Normally he is to be found at 81 Denshaw Grove, Morley, Leeds. A visit to BBC Radio Leeds is on the cards for April but more positive is a night on the air on April 29. One regular feature is Morse code training classes.

Plymouth RC It is the Tamar Secondary School, Paradise Road, Millbridge, Plymouth on "alternate Mondays" which seems to be the second and fourth Mondays from the events diary with the AGM on April 26. For your diary is the third annual rally on Sunday May 30 at the Tamar school with GB2PRC to help you on S22. M. Wogden G4KXQ, RNEC, Manadon, Plymouth can tell you more.

Wakefield & District RS (G3WRS) Secretary R. Sterry G4BLT also says "alternate" Tuesdays which makes April 6 a date for G3KWT to talk on the RAYNET set-up, with the AGM falling on the 20th, both at Holmfield House, Denby Dale Road, Wakefield at 8pm. G4BLT lives at 1 Wavell Garth, Sandal, W'field or W'field 255515.

Denby Dale & District RS Looks like this and the previous lot can't be far apart! It is every Wednesday at the Pie Hall, Denby Dale, at 8pm although the more formal meetings are on the second and fourth Weds. The club's second mobile rally takes place at the Shelley High School on Sunday June 20 with S22 and SU8 to get you in. Plenty of non-amateur stands ensures something for all the family. More from re-elected sec Jack Clegg G3FQH, 8 Hillside, Leak Hall Lane, Denby Dale, Huddersfield or (0484) 862390.

Thornbury & District ARC Adult Education classes held at Castle School, Thornbury, last year has led to the formation of this new club with meetings held there on the first Wednesdays, like April 7 when the talk is on the making of p.c.b.s and you may like to know that May 5 will concentrate on 144MHz band converters. The May RAE will also be held at the school, which is nice for club members. Contact is Alan Jones G8AZT, 9 Queens Walk, Thornbury, near Bristol.

Bury RS (G3BRS and G6BRS) Every Tuesday at 7.30 Mosses Centre, Cecil Street, Bury with activities like operating the two club stations, building an h.f. bands linear amplifier, holding code classes, or just relaxing. Main meeting is the second Tuesday and visitors are always welcome. Try D. Hensby G8TKD, 28 Moorland Crescent, Whitworth, near Rochdale, Lancs or Whitworth 2213 in the daytime.

Stanford Le Hope & District ARC Following the collaboration of a number of local amateurs and s.w.l.s with the Scout group taking part in the autumn JOTA event, a new club has been formed, meeting at the Scout Hut, Hardie Road, S-L-H on Mondays at 8pm with Morse tuition available. On-the-air slow c.w. on 28·200kHz Wednesdays at 9pm comes from hon. sec Alan Taylor G4KJI, 11 Kathleen Close, S-L-H, Essex who is on S-L-H 5057. Good luck to this new venture.

Verulam ARC Attraction of the month is a chat on maritime communications by G. Price on April 27 at 7.30 at the Charles Morris Memorial Hall, Tyttenhanger Green, near St Albans, Herts where the club meets on the fourth Tuesday. However informal do's take place on the second Tuesdays at the new RAFA HQ in New Kent Road, St Albans, where visitors are equally welcome. So says new sec Peter Hildebrand G3VJO, "Hobbits", 31 Crouch Hall Gardens, Redbourn, St Albans, Herts or Redbourn 2761.

Southgate RC New publicity organiser is John Fitch G8EWG, of 16 Kent Drive, Cockfosters, Barnet, Herts who says the club meets on the second Thursdays at St Thomas' Church Hall, Prince George Avenue, Oakwood, London N14. April's date sees a surplus gear sale while in May the subject will be crime prevention. Imagine the main theme will be on the matter of safety of amateur gear in cars!

Horsham ARC Meetings at the Guide HQ, Denne Road, Horsham, Sussex, but times not too clear. However, well in advance, is G4EUG talking on automatic test equipment on Thurs May 6 while June 1, a Tuesday, is home brew evening. But I'm sure that Mrs N Hubbard G6DHH of 33 Amberley Road, Horsham will straighten out the situation for you.

Aberdeen ARS Short and sweet! Meets Fridays at the club's new club rooms at 35 Thistle Lane, Aberdeen at 7.30 Ring Stan on A'deen 691716 for details. Not enough info even for me to acknowledge receipt!

Biggin Hill ARC Yet another newcomer to the list of clubs. Welcome! At the Biggin Hill Memorial Library, 8pm, last Tuesday of the month (I think) with April 27 being devoted to the calibration of members' equipment and for May 25 a talk on the engineering side of the IBA is being arranged. More from Ian Mitchell G6EMW, 37b The Grove, Biggin Hill, Westerham, Kent.

Acton, Brentford & Chiswick ARC Chiswick Town Hall at 7.30 on Tuesday May 18 sees a discussion on interference to domestic entertainment equipment (r.f.i.) when new members and visitors will be equally welcome. More on the club's activities from W G Dyer G3GEH, 188 Gunnersbury Avenue, Acton, London W3.

Cheshunt & District ARC (G4ECT-G6CRC) A busy month with a junk sale on April 7, a visit to Air Traffic Control at Stansted Airport on the 14th, and Dave G8XYJ holding forth on broadcasting techniques on the 28th. So it's every Wednesday at 8pm at the Church Room, Church Lane, Wormley, says Chairman Jim Sleight G3OJI of 18 Coltsfoot Road, Ware, Herts, also (0920) 4316.

Barry College of Further Education RS (GW4BRS-GW3VKL) Glad to report four new members enrolled as a direct result of publicity in *PW*, which is all very gratifying. Every Thursday at 7.30, College Annex, Weycock Cross, Barry with the first Thursday devoted to lectures or demonstrations, and the third to equipment matters. John Share GW3OKA on (0222) 702455 will be happy to fill in the gaps.

Bournemouth RS First and third Fridays at the Kinson Community Centre, Pelhams, Millhams Lane, Kinson, B'mouth says newsletter editor Elaine Howard G4LFM who points out that editors are supposed to edit and what about some material from the members! How about drawing lots every month for articles from the members? Seems to be successful in other clubs. Contact Elaine via *PW*.

Cannock Chase ARS Every Thursday, the first one being formal, more or less, at Bridgtown War Memorial Club, Union Street, Bridgtown, near Cannock. More from PRO Joe Gregory G8HZP, 22 Tower View Road, Parklands, Great Wynley, Walsall, S. Staffs.

Watford RC First and third Wednesdays at 8.30 in the Small Hall, Christ Church, St Albans Road, Watford, Herts, with advance dates of a special events station (GB8LFS?) at the fete at Lee Farm Scool, Garston on May 3 (May Day) and at the Watford Carnival on Sat, Sun and Mon, May 29, 30 and 31. May 19 sees G3WCY telling all he knows about SSTV. More from G8RCK on Garston 72832.

Edgware & District RS (G3ASR) The Watling Community Centre, 145 Orange Hill Road, Burnt Oak, Edgware on the second and fourth Thursdays plus club net on 1875kHz at 2200, in addition to which there are slow Morse sessions both at the club and on the air from G3ASR. Howard Drury G4HMD, 39 Wemborough Road, Stanmore, Middx can give up-to-date info on club happenings, especially on 01-952 6462.

Swale ARC The ink is hardly dry on the letter from Brian Hancock G6HZZ of Leahurst, Augustine Road, Minster, Sheerness, Kent telling me of this brand new society, meeting at the Town Hall, Sittingbourne, probably once a fortnight initially. But everyone in the area ought to get along and support this new venture on April 19, which is a Monday, when Andrew Emmerson G8SUY will talk on amateur TV.

North Bristol ARC The club is mourning the loss of long time chairman Ernie Theobald G2DWI after an extended illness. Welcome visitor was F6FYN now studying in Bristol. Details of club's many activities from sec W. Bidmead G4EUV, 4 Pine Grove, Northville, Bristol, but you can go along to the Self-Help Enterprise Centre, Braemar Crescent, Northville at 7.30 on any Friday.

Bedford & District ARC Two miles north-east of Bedford town you will find the club shack, at Church End, Ravensden, with members gathering there every Wednesday but April 14 is different, a visit to the Mullard Radio Astronomy Labs. Lucky lads and lasses! If you are in the area repeater GB3BD will guide you in. In the meantime Julian Wanden G8ATI, 109 Hillgrounds Road, Kempston will appreciate a letter or ring him daytime on (0442) 3272 Ext 248.

St Helens & District ARC Every Thursday 7.45pm, Conservative Rooms, Boundary Road, St.H but turn up half an hour earlier if you want to take advantage of the code practice sessions. Then there is the club net on S9 on 2m f.m. at 1130 on Sundays. April 8/15 are construction nights on the v.h.f./u.h.f. wavemeter club project. The 22nd sees Al Neilson G4CVZ describing a contest computer while the 29th will be an h.f. bands night-on-the-air. It's Paul Gaskell G4MWO, 131 Greenfield Road, St. Helens, Merseyside, or St H 25472. Perhaps I should tell you now of the d.f. foxhunt on 144MHz on May 6.

Torbay ARS Site approval for repeater GB3TR being received it's all hands to complete the installation. Otherwise every Friday at 7.30 at Bath Lane, rear of 94 Belgrave Road, Torquay, says PRO Les Mays G2CWR, Atlantis, Clennon Avenue, Paignton.

Isle of Wight RC (G3SKY) Tuesday nights are operating nights for club station G3SKY at County Hall, Wootton Bridge, near the Sloop Inn it seems. More serious matters are attended to on Friday nights. A newsletter has been published which, it is hoped, will become a regular feature. Write to I. Moth G4MBD, Claygate, Colwell Road, Solent Hill, Freshwater, IOW for latest news on club events.

Greater Peterborough ARC Nice to hear from this club for the first time, I think. Usually the fourth Thursday at Southfields Junior School, Stanground at 7.30. April 22 has Dennis G4OO on "Fifty years of amateur radio", with an illustrated talk on TVDX reception by Dave G8BKG on May 24. Newly appointed secretary is Frank Brisley G8ZVW, 27 Lady Lodge Drive, Orton Longueville, Peterborough, also (0733) 231848.

Dumfries & Galloway Radio and Electronics Club (GM4HAA) First and third Mondays, 7.45, at the Cargenholm Hotel, New Abbey Road, Dumfries. Big event on Saturday May 22 is special event station GB2DHE at the Dumfries Hobbies Exhibition, also scheduled to be active during JOTA. Contact secretary Crosbie Rodgers GM4NNC, 5 Elder Avenue, Lincluden, Dumfries.

Radio Club of Thanet (G2IC) Birchington Village Centre at 8pm, with April 9 devoted to a talk on repeaters and the 23rd to a quiz, which all looks like the second and fourth Fridays every month. In addition GB2TM will be operated on April 18 for the Isle of Thanet Marathon Race, both 144MHz and the h.f. bands. More from Ian Gane G8HLG, 17 Penshurst Road, Ramsgate, Kent or (0843) 54154.

Ipswich RC (G4IRC-GB2IRC) The Rose and Crown, Norwich Road, Ipswich at 8pm will find much activity on the second and last Wednesdays but sec Jack Toothill G4IFF says the room is separated from the pub itself so juniors and teetotallers need not be alarmed. April 14 has G4LSP talking on motor racing at club level (he's got in the wrong club!) but, more seriously, it's the AGM on the 28th. Don't forget the East Suffolk Wireless Revival on May 30, a *Sunday*. More from Jack at 76 Fircroft Road, Ipswich or on (0473) 44047.

That's it for another month and don't forget the deadline, the 15th of the month, but do allow for postal strikes, blizzards, railway strikes, go-slows, no-goes, eclipses and heavy sunspot activity, and civil servants.

Medium Wave Broadcast Band DX

by Charles Molloy G8BUS

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

Many DXers start off in the hobby using a simple receiver such as a domestic portable. The operating technique required could hardly be simpler for all you have to do is to tune in the station and turn up the volume to a comfortable level. Unfortunately, the DXer may not be encouraged to improve his technique when he moves to a more complicated set. The handbook probably tells him to turn the r.f. gain control to maximum, or the attenuator to minimum and to adjust the set by means of the a.f. gain control. This is standard procedure when tuning at random round the short wave bands but it will not yield the best results for the m.w. DXer. It is probable that many DXers would do better on the medium waves with their existing gear if they could improve their operating technique. This month we will have a look at some of the controls and facilities offered by a communications receiver. What they do and how to get the best from them?

"S" Meter

This meter responds to the strength of the incoming signal and is very useful for comparing the strength of different stations. There is another very important use for the "S" meter. It tells you if there is more than one station on a channel. Look at the needle while listening to a DX signal. If it isn't steady but is moving quickly up and down then it may be responding to the beat caused by the slight difference in frequency between two stations on the same channel. One of them may be too weak to be audible but still strong enough to cause a visible beat on the "S" meter.

You can even find the direction of this weak station. Rotate your loop antenna until the beat stops. The weak station has now been nulled-out and it lies in the direction of one of the two nulls of the loop. If you cannot null out the beat then the two stations must lie in the same or opposite directions. Fast fading could also simulate a beat but this type of fading is rarely encountered on the medium wave.

This technique of searching for co-channel DX is very useful when you remember that DX signals on the medium waves are nearly always subjected to slow cyclic fading. If you see a beat on the "S" meter stay on the channel for a few minutes. The strong signal will fade and the weak one may come up, giving you a pleasant surprise.

Selectivity Control

Use the maximum selectivity available when DXing on the medium waves i.e. with the control set to narrow. You now have a narrow "window" into the radio frequency spectrum. Why do this? There are two reasons. The obvious one is to reduce interference (QRM) from adjacent stations. If the selectivity is narrow enough then speech quality will deteriorate. If it does, then detune slightly and quality will improve. The programme is carried twice, on sideband, one on either side of the carrier. Choose the sideband that gives minimum QRM.

The second use for selectivity is as an aid to reducing static. When static is present it is usually spread over part of, or all of the band, so clearly the narrower your window the less of it you will pick up. There are occasions when you will use maximum selectivity in the absence of QRM, just to improve the signal-to-noise ratio.

Beat Frequency Oscillator

The b.f.o. is required for the reception of c.w. (Morse) or to re-insert the missing carrier when listening to single sideband (s.s.b.) transmissions. It has another use on the medium waves. When looking for DX between strong locals, switch on the b.f.o. and listen for the whistle that indicates the presence of the weak DX. You can check its bearing with your loop and if it looks promising then switch off the b.f.o. and wait for a few moments. The station may be in the trough of a fading cycle and could increase to a level where it can be copied. You can also check by this method, if a particular path, say to North America, is open.

RF Gain Control/RF Attenuator

These two controls do different things to achieve the same result, namely control of the sensitivity of the receiver. The r.f. gain control adjusts the gain of the early part of the set (nearest to the antenna). The attenuator adjusts the strength of the signal coming from the antenna.

In the absence of QRM, operate the receiver with the r.f. gain at maximum or with the attenuator at minimum (out). The best signal-to-noise ratio is obtained this way.

With QRM present, reduce the r.f. gain or increase the attenuation. Weak co-channel QRM can be reduced to inaudibility leaving a reasonable signal from the wanted station. Overloading, splash, cross-modulation, spurious responses etc will be reduced but so unfortunately will the strength of weak DX so a compromise is required. The aim is to operate with the maximum r.f. gain/lowest attenuation that you can get away with.

North American DX

A good log of NA DX comes from **David Hyams** (London) who used an FRG-7700 with a medium wave loop antenna. From Canada he picked up CBNA in St Anthony Newfoundland on 600kHz and CBGY in Bonavista Bay Newfoundland, both of them relaying the CBC programmes which makes identification difficult. CJYQ St John's Newfoundland on 930kHz, CKCV Quebec on 1280 which broadcasts in French, CHNS in Halifax Nova Scotia on 960kHz and

WORTH HEARING...

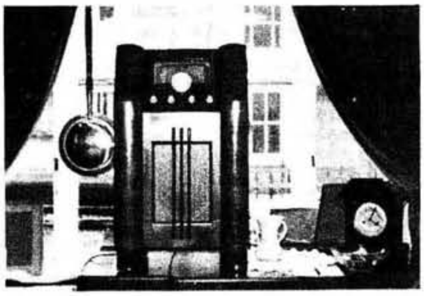
W B R I Radio

1500 AM

WBRI is in Indianapolis (5kW daytime only)

VOCM St John's on 590kHz. DX from the United States included WNBC on 660kHz, WABC on 770, WINS on 1010 and WHN on 1050, all in New York City, WBZ in Boston on 1030 and WHDH also in Boston on 850kHz.

David, who spends part of his time in London (home) and part in Manchester (university) comments "I am in the fortunate position of being able to compare DXing from these two cities. In fact I have been amazed at some of the differences that a distance of 200 miles can make." QRM is lighter in the north and consequently North American DX comes in earlier. CJYQ on 930kHz can be heard before close down of the Belgian on 927kHz in Manchester but not in London.



Ted Jones's vintage receiver

North American DX continues right through the summer. Even in mid-June the east coast of North America can be picked up for an hour before sunrise while at this time of year it should fade in between midnight and 0100UTC. The band is quieter in summer since QRM from Eastern Europe is absent as stations do not sign on until after it is daylight at the transmitting end of the DX path. Static can be a problem but usually it comes from the south and can easily be dealt with by a loop without affecting DX from North America.

Readers' Letters

A vintage RAP radio has fallen into the hands of **Ted Jones** of Woking. This receiver which has Radio Normandy on the dial, is currently being renovated by Ted who hopes to use it for medium wave DXing. Look forward to receiving a log from you.

WARU 1600

"THE GREAT ENTERTAINER"

WARU is in Peru Indiana (1kW Daytimer)

The boosted TV sockets in his flat at Bath attracted the attention of **Peter Ward.** "Plugging my Vega Spidola 250 into the centre of the socket brought in the following: Kalundborg 1062kHz, Vigra 630, Stavanger 1314, Gothenburg 981 and Horby 1179. Peter, who is studying Swedish, says that reception is best in the morning though there is some internal interference from time to time when other tenants are using their TV sets.

G8VVU **(M. Strange)** who is a TV service engineer was interested in Fred Ainslie's comment on line timebase radiation from TV receivers (January issue). He mentions cable TV, which comes via a multi-pair cable. "When you consider the number of TVs hanging on the end of these cables a lot of radiation can get back up the feeders and cause havoc to any receivers nearby. The carrier frequency is 8·9MHz using lower sideband, as a matter of interest.

Breakthrough (February issue) of Morse signals is raised by **Peter C. Jones** of Putson who thinks that a parallel wavetrap would be more effective, in a valve receiver, if it is inserted in the cathode of the r.f. valve. "The same system could no doubt be used in transistor circuits." Quite right, this method is used commercially but it isn't everyone who knows how to connect it up. It was a lot easier to fiddle about with valved equipment than with modern printed boards or at least that is my experience.

Reader **Len Styles** (Ingatestone) has sent me a couple of US a.m. car stickers which he thinks might be of interest to readers. The third one is a pirate Len, they have them in the US as well!

Short Wave Broadcast Bands

by Charles Molloy G8BUS

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

Last month we had a look at the best known and most popular of the programmes in English, which are aimed at the DXer or s.w.l. There are as well, a number of lesser known features which are shorter or come from less conspicuous broadcasters on the bands and these too are a source of interest and entertainment to the listener. This time we will examine four, all of which are on the air on Sundays.

From Vienna, at the early hour of 0900UTC (GMT) comes the *Austrian SW Panorama*. It can be picked up on 6155kHz (49m band) and on 9770kHz (31m band), with quite a strong signal in the UK. There are repeats at 1233 on both frequencies and at 1805 on 6155. This programme is for the general s.w.l. and has recently covered subjects such as community radio in Sri Lanka and the role of the ITU (International Telecommunications Union) in Berne. The address of the station is ORF, Short Wave Service, A-1136 Vienna, Austria.

In contrast, the *World DX News* is for the DXer. Produced by members of the Danish Short Wave Clubs International it is aired at 0930 on Sundays as part of the Adventist World Radio broadcast on 9665kHz (31m band). It comes from a transmitter at Sines in Portugal and puts in a good strong signal at my QTH. The programme lasts for 15 minutes and at the time of writing there is a series on propagation and also DX tips. The address for a QSL and schedule is AWR, The Voice of Hope, 123 Regent St., London W1R 7HA.

Spanish Foreign Radio

The *DX Programme* from Madrid lasts about ten minutes and is usually based on information from various DX clubs plus short talks on a variety of subjects related to DXing. It can be heard on 9765kHz (31m band) at 1950 and again an hour later. Reception of the first transmission is often quite good in my part of the country. Write to the English Section, Spanish Foreign Radio, Apartado 150 039, Madrid 24, Spain, for further information.

Israel

Lastly, there is *DX Corner* from Israel. This is a five minute slot in IBA's half-hour Sunday evening programme. It appears around 2020 on 9·815MHz and can also be heard on out-of-band 9·009MHz with a weaker signal free of QRM. Although short in duration there are often useful snippets of information in DX Corner. It was in this programme that I heard a re-broadcast of the final sign-off of the Voice of Peace at the end of 1981. The address of DX Corner is PO Box 1082, Jerusalem, Israel.

Frequencies and schedules are constantly changing on the short waves and the introduction of summer time in some countries only adds an extra dimension to problems of tracking down individual broadcasts. If you fail to hear these programmes at the times stated, then try again an hour later or write to the station for a copy of its latest schedule.

Indonesia

DXing Indonesia is the title of a ten-page A4 size publication produced by Radio Netherland about a part of the world that has close connections with Holland. "The media system in the former Dutch colony of Indonesia must rank as one of the most interesting in the world for the short wave listener" is the introduction to a rather specialised but rewarding field for the DXer.

One problem about DXing this part of the world is getting a QSL. Radio Netherland suggests it is because of language difficulties, so they have produced a report letter in Indonesian with a comprehensive English/Indonesian vocabulary that should cover most occasions. "When and Where to Listen" gives hints on the best times for DXers in the UK to search for Indonesia.

The guide, which concludes with a useful reference that mentions two clubs which specialise in DXing this area, has been compiled by Jonathan Marks and is obtainable free of charge from Radio Netherlands, Box 222, Hilversum, Holland.

25·6MHz Band Reception

In spite of declining solar activity, the 25·6MHz (11m) band is still very much alive. *PW* reader **David Hyams** (Manchester) has made a survey of reception on this band using his FRG-7700 plus a.t.u. and four metre indoor antenna. Stations heard were Israel on 25·605MHz and 25·64MHz, BBC on 25·65, Radio Liberty on 25·69, Algeria on 25·70, Norway 25·88, Paris 25·90, VOA (Morocco) 25·92, Finland 25·95, VOA (Philippines) 26·00, VOA (USA) 26·04, Belgium 26·05, Unid (perhaps Norway) on 25·615. Swiss Radio International is also on this band from 1030 to 1300 on 25·78MHz in a transmission intended for Africa.

Readers' Letters

Carlos Lerner, Mitre 278, 6450 Pehuajó, Argentina, is 20 years old and has been DXing since 1976. During this time he has QSLed 71 different countries and he would now like to exchange cassettes of station identification, interval signals, slogans etc., with DXers in this country. Welcome aboard, Carlos, hope you are successful and we look forward to hearing from you again.

"A personal note from New Zealand" comes from RNZ with their schedule for the period 7 March until 2 May. The Pacific Service can be heard from 1800–2100UTC on 11·96MHz and 15·485MHz, from 2115 to 0815 on 17·705 and from 0825 to 1215 on 15·485 while the Australian/NW Pacific service is on 15·485 from 2115 to 0815 and on 11·96 from 0825 to 1215. *New Zealand Calling* with Tony King, Arthur Cushen and Tomoko Grainger is broadcast on the first and third Monday in the month at 0315 and 1015.

RNZ still use the vintage 7·5kW transmitters which were obtained from military sources at the end of the last war. The transmissions are not beamed to

A card from Adventist World Radio

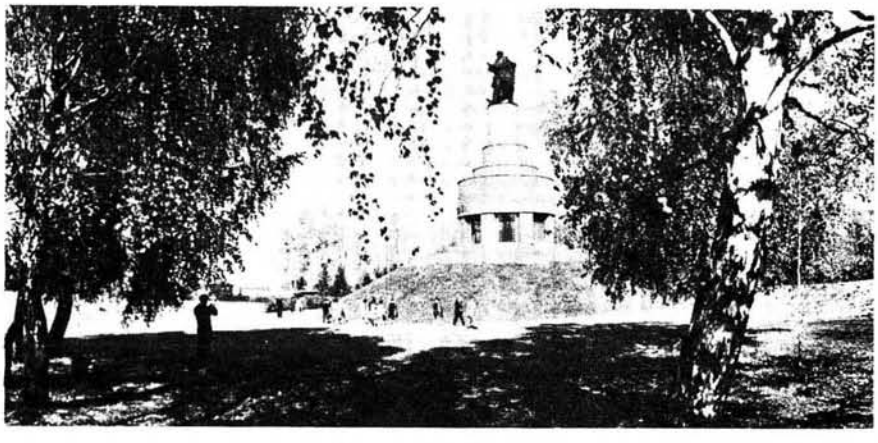
Europe and it is surprising that we can hear them at all. They can be picked up, often with a good strong signal, before breakfast time in the UK.

David Shannon who lives at Killorghin in Eire acquired a Gold Star RQ-740 receiver at Christmas and he would like to contact the World DX Club. Write to the WDXC, 17 Motspur Drive, Northampton NN2 6LY in the UK. Joining a DX club is a very good way of making contact with the hobby and with other DXers. In reply to **Gerard Nicholson** and **J. D. Pyle.** Sorry, but I cannot help with the identification of non-broadcasting stations as it is illegal to listen to them.

Stations Heard

Reader **David A. Dodds** (Dunfermline) has been using an Eagle RAD-30 portable which cost him only £16 in last year's January sales. "It is astonishing just what this receiver has managed to pick up with the help of a 12 metre-long wire," he writes. Radio Norway puzzles David as he has only heard it once on 5·95MHz in English from 1400–1430. Their sole English programme, *Norway this Week*, is broadcast on Sundays, only at various times throughout the day. Write to Radio Norway, N-Oslo 3, Norway, for their latest schedule. Radio Pakistan is in English at 1645 on 11·67MHz and 15·5MHz at the time of writing, but frequencies often change, presumably to avoid interference. Their address is PO Box 443, Karachi.

"I enjoy listening to Radio Canada International's relay of the CBC



Kiev sent this one

The French speaking network in Belgium

programmes *The World at Six* and *As it Happens*," writes **Colin Watson** of Cumbernauld. He is referring to the transmissions on 5·995, 9·76, 11·825, 15·325 and 17·875 which are intended for Canadians living abroad and can be heard from 2200 to 2300UTC (GMT). **Anthony Stainland** (Plumstead) has been trying out his Sony 6700W and he reports hearing Dubai on 15·32 in English at 1640. **Martin Whittington** (Dartford) has a Sony ICF 5900 with whip antenna which brought him Tashkent in English at 1400 (they have a DX programme at 1420 on the third Saturday of the month), Radio Clarin in the Dominican Republic on 11·7MHz at midnight and Sri Lanka on 11·8 in English at 2020. **Harry Pitt** (Ascot) used a JVC portable with whip to pick up Radio Bras in Brasil on 15·125 in English at 1900, Radio Australia on 6·035 at 2150 and Kinze in South Korea on 9·87 at 2048.

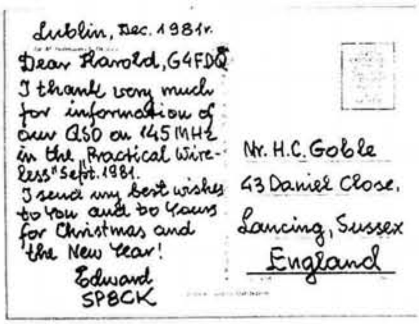
Fourteen year old **Gordon Hadley** has been a s.w.l. for six months and he thinks it is a fascinating hobby. He uses a "simple receiver" with inverted L antenna and he received his first QSL card recently from Spain for their broadcast on 15·395. This is on the air during the evening. An ITT Touring portable with digital readout is in use at Stoke on Trent by reader **D. R. Degg,** who reports hearing RAE Argentina on 11·71 at 2309, Voice of Chile in Santiago on 11·997 at 2330, Radio Free Grenada on 15·045 at 2330 and the Voice of Truth in Santiago on 17·799 at 2315. Good listening from a portable and whip. Finally, **Keith Nockels** (Ipswich) reports hearing the American Radio Network in the 6MHz (49m) band at 0430 using his Fidelity Rad 21 (AFRTS on 6030?).

VHF Bands

by Ron Ham BRS15744

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

In our September 1981 issue I reported that **Harold Goble** G4FDQ, Lancing worked **Edward Kawczynski** SP8CK on the 144MHz (2m) band f.m. during a massive sporadic-E disturbance on June 7. Harold posted a copy of that September *PW* to Edward who lives in Lublin, near the Russian border and for some time Harold and his son David G8HDF wondered if our magazine had got through. However, all was well and they were both delighted to receive a Christmas card from Edward, Figs. 1 and 2 acknowledging the *PW* and they noticed that the card was posted about 3 days before the Polish borders were closed when martial law was declared.



Lublin, Dec. 1981r.
Dear Harold, G4FDQ
I thank very much for information of our QSO on 145 MHz in the Practical Wireless Sept. 1981.
I send my best wishes to you and to yours for Christmas and the New Year!
Edward
SP8CK

Mr. H.C. Goble
43 Daniel Close,
Lancing, Sussex
England

Fig. 1: Part of the Christmas card from SP8CK

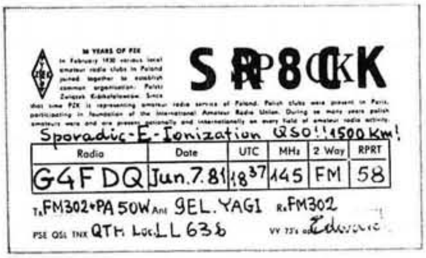


Fig. 2: Part of the QSL card from SP8CK

Solar

Both **Cmdr Henry Hatfield,** Sevenoaks and I recorded a limited solar noise storm at 136 and 143MHz respectively on January 19th and a variety of individual bursts of noise on the 25th and 28th and February 4, 5, 6, 11, 12, 13, 15, 16 and 17. While Henry was using his spectrohelioscope on February 2 he reckoned there were between 60 and 70 sunspots in 9 groups including 2 very long chains of spots spread across the central meridian (c.m.) of the sun. Down in Bristol, **Ted Waring** counted 16 sunspots on January 23, 29 on the 27th, 60 on February 6 and 38 on the 9th and writes "there was a complex spot group with a good deal of penumbra around the two main spots near the c.m. on the 9th and the total for the 6th resulted from a scattering of small spots then still visible in the western half".

I was not surprised to receive these optical reports because we both recorded a severe noise storm which raged on the sun from January 29 to February 3. This was no doubt responsible for the ionospheric disturbance reported by the BBC World Service around 0230 on February 1st, the auroral manifestations during the evenings of the 1st and 3rd and the quietness of the 28MHz (10m) band throughout the life of the storm. Another solar storm began on the 7th, sent both Henry's and my recording pens to f.s.d. at its peak on the 10th and had a final fling on the 14th. Henry also reported solar noise at 198MHz and we both noted the 28MHz band was frequently very dead between the 11th and 14th.

Aurora

At any time when the sun is active, solar particles can enter the earth's polar atmosphere and cause an aurora which in turn gives a sporting chance for some real v.h.f. DX. Some time ago, **Phil Hodson** G8RBY, established an auroral warning network from his home in Melton Mowbray and directly he knows about an aurora he telephones G8JNV Peterborough, G8WPD Derby, G8ZRR Leicester and GW8ZCP Wrexham who in turn each pass the word to their particular list of amateurs, specific nets and s.w.l.s. The list is long and the route via G8JNV links with Charlie Newton G2FKZ in London, the RSGB and IARU auroral co-ordinator who has a vast European net under his control.

The 28MHz Band

For most of the period January 19 to February 17, conditions on the 28MHz band were generally poor and at times completely dead. **Harold Brodribb,** St Leonards-on-Sea, and I both received strong signals from Canada and the USA during the afternoon on several days and at 1545 on February 3 he heard a South African station telling a "G" about the prevailing solar storm. Despite the poor conditions I did hear a weak VK at 0935 on January 24 and a few JAs around 0930 on February 8 and 10 while Harold, using his ex-RAF RL85 communications receiver checked the daily maximum usable frequency (m.u.f.) and between January 19 and February 10 it ranged between 37 and 45MHz.

Jon Kempster RS45205, heard several stations on 28MHz from his QTH in Berkhamsted including his best DX to date FG7XL, HP1XKZ, OD5ET, W6QL/8RI and 8P6HZ.

28MHz Beacons

Among the contributors to the beacon chart, Fig. 3, are **John Coulter,** Winchester, Henry Hatfield, Ted Waring and I. As usual the most consistent beacon signals were from Bahrain A9XC and Germany DL0IGI and reference to the chart will show that the two Australian beacons, VK2WI and VK5WI were seldom heard. John Coulter has also been listening to the 28MHz down link from the Russian satellites RS3, RS5 and RS7, on 29·321, 29·331 and 29·341MHz respectively.

WRM519	19	20	21	22	23	24	25	26	27	28	29	30	31	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
A9XC																														
DF0AAB																														
DF0IGI																														
HG2BHA																														
U2ABJ																														
VE2TEN																														
VK2WI																														
VK5WI																														
VP9BA																														
VS6HK																														
YV5AYV																														
ZS6PW																														
5B4CY																														

Fig. 3: Daily reception of 28MHz beacon signals

The 50MHz (6m) Band

When I installed a Microwave Modules 50MHz converter to my system I used an Antiference AS11 TV antenna switch to change the antenna input on my FR-101 communications receiver from long wire to the 28MHz output of the converter. This unit is also useful for listening for the television sync pulses on Ch. R1 49·75MHz, a good sporadic-E warning device.

Fig. 4: VK6RO at Broome

Graham Rogers VK6RO, Bunbury, Australia often sets up a static/mobile 50MHz station, Fig. 4, at Broome where he frequently works into JA. The two short antennas on his car are quarter wave for 52MHz and the longer one for 28MHz. Both antennas feed his FT-660R which is situated by the passenger seat in the front of his car and judging from a tape recording that Graham sent me there are many 50MHz operators in Japan proudly sporting his QSL card, Fig. 5.

RTTY

Between January 19 and February 17, I copied signals from 185 stations, transmitting RTTY, spread over 20 countries, CN, CT, DL, EA, F, G, GI, HA, HB9, I, LA, LX, N, OE, OK, OZ, SM, UA, YU and 9G1. Among the interesting two-way QSOs I received were those between I5FLM and OK1JMK at 1346 on January 23rd, I4LFJ and OE1JRU at 0912 on the 28th, DL3OV and I6KZR at 0915 on the 31st, GI4AHP and I3FWY part of a 3 ways QSO with an SM at 1345 on February 6, SM6CYZ and UA3HR at 0944, F8XT and I8AA at 0950 and DF8LP and HB9SS at 1358 on the 7th, DL5RAL and SM6JMA at 0925 on the 11th, I0GDN and OE1KGA at 1409 on the 12th, CN8AT and DF2PY at 0924 on the 15th and DF2IC working the ITU station in Geneva 4U1ITU at 1427 on the 17th. I also read such signals as HB9AVK in Zurich signed HB9AK (Mail-Box service of the Swiss ARTG), F6GJM +Marseille+ and EA2AAA/EC2XI, op PEDRO + Radio club De Aragon+ between 0900 and 1100 on the 7th and at 0940 on the 13th I copied, "It is 0440 in the morning, couldn't sleep so thought I would see what's on hi", from W4NYA as he worked into Spain.

Although the majority of the signals I received were found around 14·090MHz some 28 were copied on 21·090MHz. "The ARRL station W1AW regularly transmits, on 21·090MHz, a news bulletin Monday through Thursday and a DX bulletin on Friday at 1600GMT. The news bulletin contains a very good h.f. propagation forecast which is well worth noting" writes **Frank Wyer** G8RY, Wolverhampton. Although h.f. conditions have not been too good, Frank kept his regular RTTY sked with W3HQO on 21·090MHz on 17 days in January and most of the days in February up to the 13th. Frank was first introduced to a teleprinter when he went for his Morse test at his local Post Office in 1937. The examiner showed him how the machine worked and then Frank had brief dealings with them during World War 2. Some 2½ years ago he obtained a Creed 7ERP and two tape readers, which he uses for automatic CQ and for his station description.

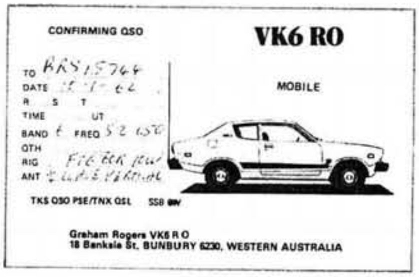


Fig. 5: Mobile QSL card of VK6RO

Tropospheric

Since the tropospheric opening on January 14 and apart from a drop to 29·6in. (1002mb) during the evening of January 26 and to 29·8 (1009mb) on February 13, the atmospheric pressure has remained above 30·0 (1015mb), peaking 30·4 (1029mb) on the 31st, from January 18th to February 17th, which meant that v.h.f. conditions were generally better.

"I have been enjoying some big tropo openings here in Sweden" writes **Henrik Nykvist** who received signals from Radio Varmland and Radio Trestad, both at 150km.

Between 0030 and 0205 on February 10, **John Parry** GJ8RRP, St Saviour, was mobile on the north coast of Jersey, and worked PE1EWR, G8BHD and G4HFJ through the 432MHz repeater GB3IH in Ipswich on RB4. John uses a Standard C-7800 rig with a roof mounted co-linear antenna on his car.

Band II

On January 14 and 15, **David Hackwell,** Warrington, received Radio Ulster and Radio Newcastle on his Grundig "Melody Boy" and from Norwich, **Julian Clover,** using a Grundig "Music Boy" received BBC Radios Humberside and Lincolnshire and Independent Local Radios Capital, Chiltern, Essex and LBC. From Sussex on the 14th, Harold Brodribb, counted 15 French stations and a strong one from Wales and between January 28 and February 2, **Ian Kelly,** Reading heard 7 editions of France-Inter, 8 of France Culture and France Musique and several stations in Belgium. During the falling pressure on February 2nd, Julian heard BBC Radio Stoke and a French station and Harold logged 18 French stations and 5 editions of BBC Radios 2, 3, and 4. During the disturbance on the 9th, Harold counted 27 French stations between 87·5 and 102MHz and many were so strong that they overpowered the local BBC signals. **Brian Renforth** received excellent signals, in mono and stereo, from France on the 9th and between 1700 on the 9th and 0830 on the 10th, Ian Kelly logged 43 stations from Belgium, France, Holland and Germany between 87 and 104MHz and heard many of his favourite programmes.

Contests

Between 1004 and 1457 on February 7, **Colin Leonard** G4ERO, **Elaine Howard** G4LFM and **Nick Foot** G8MCQ, using the call-sign G4ERO/A from a site in Bournemouth, took part in the RSGB's 432MHz Fixed Station contest and worked 41 stations ranging from

Guernsey to Nottingham and Minehead to Ipswich and across the sea to Holland. The group used a FT-200, Microwave Modules Transverter, 2 × 4CX250Bs into an 18 element parabeam some 9 metres a.g.l. During the same event, **John** and **Jackie Brakespear,** G8RZP and G8RZO made 95 contacts from their home in Minster, Isle of Sheppey, where they use a FT-225, MM Transverter, into an 88 element multibeam and their best DX was Germany, DL4EA. John and Jackie worked several stations in France, one in West Yorks and another in the Channel Isles on the 432MHz (70cm) band during the opening on February 9. Unfortunately, a neighbour keeps racing pigeons and some of these birds have impaled themselves on the multibeam and Jackie told me that they were desperate for ideas to protect the birds from this hazard. The Brakespears have a good site some 73 metres a.s.l. and are also active on the 144MHz (2m) band with a FT221R, home brew linear and a 14 element parabeam. In 6 months they have worked 106 stations on 144MHz and last September they chalked up their best 144MHz DX, ZB2BL. John and Jackie have won several awards for their amateur radio activities and monitor the 144MHz band throughout the day.

On February 1, Jon Kempster, noticed an improvement in v.h.f. conditions and after turning his 2 element beam toward the north, he received a strong signal from G6CMJ in Halifax.

934MHz

"We have just started a 934MHz club in this area called 'Cotswold High Flyers'" writes **Tim Anderson,** who adds "We would like to hear from anyone interested in 934MHz at P.O. Box 6, Stroud, Glos."

TV

by Ron Ham BRS15744

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

With the 1982 sporadic-E season almost with us and the rapidly growing interest in amateur television, especially for recording and transmitting outside events, it suggests to me that the forthcoming summer months will be very time consuming for a large number of video enthusiasts.

Sporadic-E

During the early mornings of January 20, 21 and 22 and February 2, 5, 6 and 15, I received several strong bursts of test card from Poland on Ch. R1 49·75MHz and from Austria on Ch. E2 48·25MHz on January 22 and February 5 and 15. At 0920 on February 1st, I watched a long burst of picture from Poland showing a uniformed announcer and a clock indicating 1020, at the top right and the Polish insignia "dt" below it. Around 0930 on the 3rd, another military looking gent appeared in what looked like a Polish news studio and between 0900 and 0915 on the 7th I received a brief glimpse of a forthcoming programme list and an Ice Hockey match. Long bursts of unidentifiable pictures were seen on Ch. R1 at various times on January 23, 24 and 27 and February 14 and 16. At 1145 on the 23rd, **Brian Renforth,** Chippenham, received the plain PM5544 test card from Poland and between 1605 and 1700 on February 7 he noted an opening toward Scandinavia and logged test cards from Norway labelled, "NRK", "NORGE MELHUS", with digital clock, "NORGE GAMLEM", and "NORGE NRK". At 1605, Brian saw bursts of a cartoon programme on Ch. E3 55·25MHz which faded until 1610 when the signal returned showing Japanese puppets followed by a YL announcer and the *Dick Van-Dyke Showcase.* "This was in English with a Swedish commentary which helped me identify it as SR-SWEDEN TV1," writes Brian who also saw an advert for Atrixo hand cream after the *Dick Van-Dyke Showcase* from Sweden at 1700. Brian had hopes of another opening at 1650 on the 8th when he identified a burst of picture from Russia on Ch. R1, but this soon died away. "I should think Edward Gittins from Wrexham will enjoy the pleasure of TV DXing, especially as the 1982 sporadic-E season is yet to come" says Brian who sent a picture of the caption "TELEVIZIUNEA ROMANA", Fig. 1, which he received during a big disturbance on July 9 1981.

Fig. 1: Received by Brian Renforth

Tropospheric

"A steady atmospheric pressure of 1025mb between January 15 and 18 resulted in one of the finest tropospheric openings we have had up here for some considerable time" writes **David Appleyard,** Uppsala, Sweden. At 2100 on the 15th using his National receiver he saw an episode of *Dallas* from Finnish TV2 on Ch. 33 and during the morning of the 18th he received test cards from Finland YLE-HLKI on the v.h.f. Chs. 5, 7 and 8 and u.h.f. Chs. 32 and 33 and while adjusting the direction of his 4 element table top antenna he found Soviet TV, probably from Tallin, on Ch. 28 who were transmitting a children's programme with Balloons, Clowns and a puppet theatre. Also from Sweden, **Henrik Nykvist,** my opposite number in the Swedish journal *FADING,* received pictures from Denmark via tropo and often uses an early Philips video recorder, Fig. 2, to log the DX and says "It is about 10 years old, has no internal TV receiver and still gives excellent recording results". Henrik has modified it to get a slow motion picture which is useful when just a glimpse of a signal appears on the screen.

"Thursday January 14 provided quite intense DXTV reception" writes **George Garden** from Bracknell who frequently altered the direction and polarity of his u.h.f. antenna during the event and received BBC signals from Crystal Palace and Heathfield and the IBA from Anglia, Yorkshire and TV South. **David Hackwell** has installed a rotatable Wolsey "Colour King" antenna some 9m a.g.l. at his home in Warrington and can receive pictures from Central TV, Tyne Tees TV, Yorkshire and HTV, plus Granada and BBC1 and 2.

Fig. 2: Early Philips Video Recorder

Among the u.h.f. DX received by **David Girdlestone** in Norwich is Nederlands 1 and 2, a West German station, Fig. 3, and a test card, Fig. 4, which David also thinks is of German origin. "A superb u.h.f. lift on January 13 and 14 certainly brought some good cheer with Crystal Palace, Sandy Heath and Hannington putting in some really good colour signals on our Mitsubishi set" writes **Simon Hamer** from Presteigne who continued "all the u.h.f. DX literally thrived on the hard freezing conditions and on the 14th, the BBC 2 programme *Ennals Point* was ruined, but I was able to resurrect good reception by tuning away from Ch. 28 (local Ridge Hill) to neighbouring Ch. 27, Sandy Heath.

Between 1730 and 2015 on February 9, Brian Renforth received strong pictures from TDF France and despite negative pictures he identified "Nouvelies Antenne 2" caption on Ch. 46. He also saw the Channel TV clock and the 1745 news followed by a local news programme *Channel Report* at 1800 from Freemont Point on Ch. 41 and later received very good pictures from IBA Anglia on Ch.

Fig. 3: German caption received by David Girdlestone

41, Belgium BRT 1 on Ch. 43 and BRT 2 on Chs. 46 and 47. I received strong pictures from Central TV, including their final programme *Tuesday Jazz and Blues* on Ch. B8, with only a dipole antenna feeding my receiver, throughout the evening of February 9 and like **Ken Smith** BRS20001, Horsham, noted the severe patterns on most u.h.f. channels and as conditions deteriorated, the BBC warned viewers about the disturbance. At 0748

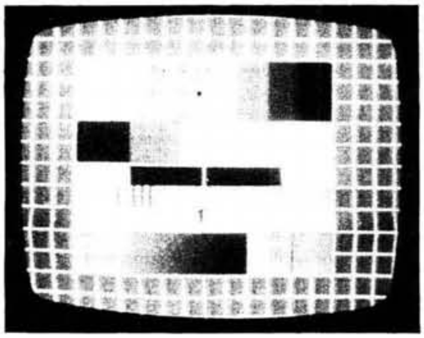


Fig. 4: Test card, possibly German

on the 10th I logged a colour test card, PTT-NED-1 on Ch. E6. **Ian Kelly,** Reading, also commented about the severe co-channel interference during the evening of the 9th and at 0830 on the 10th he received 3 editions of NOS Nederland 1 with his Decca receiver and 16 element array.

Amateur TV

Congratulations to all concerned who spent a great deal of time to put both the technical and practical aspects of amateur television in the news and show the public, through the media of television, what it is all about. Back in December, Rod Timms G8VBC and G3XKX showed their equipment on the Midlands Programme *ATV Today*. On February 9, John Betts G4HMG along with G3NQR, G3YDI and G8ASI gave an impressive display of their activities in the Thames TV programme, *Reporting London* and around the same time, Roy Humphreys G6AIW, Robin Stephens G8XEU and Andy Hearn G3UEQ were being filmed with their ATV gear by the BBC for their local news programme *South Today*. Ironically, when I watched the London lads my normal crisp signal from Crystal Palace was shattered with co-channel interference caused by the prevailing tropospheric opening.

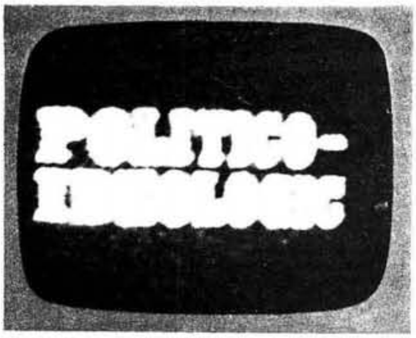


Fig. 5a: Romania R3 77·25MHz

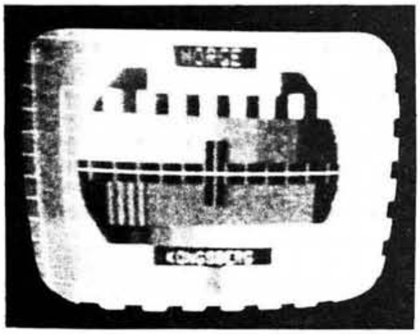


Fig. 5b: Norway E4 62·25MHz

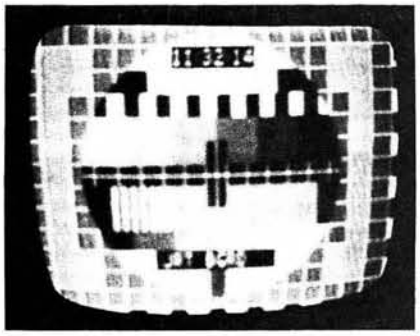


Fig. 5c: Yugoslavia E4 62·25MHz

There was further good news for **Roy Humphreys,** because, as a private entry, he came 2nd in the BATC Cumulative Activity Contest and was a member of the Worthing and District Amateur Radio Club TV team that took first place in the RSGB International ATV contest held last September. On both occasions, Roy operated from Chanctonbury Ring, a famous high spot on the Sussex Downs. During the Cumulative event, Roy made 55 two-way video contacts ranging from G8XEU in nearby Worthing to G8VBC at 223km in Derby and with fellow enthusiasts G6CUT, G8XEU and G8KOE, worked into Paris with the Worthing Club station G8GCP/P.

Congratulations to G4BPO who took first place in the Cumulative with a best DX of 280km and to the teams of G8MNY/P in South Oxford and G4ARD/P, the Dunstable Downs ARC who made 2nd and 3rd places respectively in the international event.

The British Amateur Television Club have arranged another cumulative contest to take place between 1900 and 2200 GMT on May 8, 16 and 24 and June 1 and 8. Higher points will be awarded for contacts on 432, 1296MHz and 10GHz.

Further details from G3VZV QTHR.

Equipment

I note from a February issue of the *Electrical and Radio Trader* that Hitachi, Sinclair and Sony plan to market small, flat screen TV receivers with liquid crystal displays instead of the orthodox Cathode Ray Tube.

Simon Hamer has purchased a "Triac Bow Tie" antenna from South West Aerial Systems and a couple of pre-amplifiers from Electronic Mailorder Ltd and is testing this lot on a variety of u.h.f. TV channels.

I was interested to read in the January Mullard Bulletin that they have developed a down-converter for the reception of micro-wave signals from the OTS-2 TV satellite. The converter, model 1100JM, is designed to handle 11·4 to 11·7GHz, f.m. signals in conjunction with a 90cm parabolic "dish" antenna.

Special Reports

"I have always been mystified by the variations in middle distance TV reception" writes **Harold Brodribb** from St Leonards-on-Sea, who noted this on the Ch. 1, 45MHz signal from London and on the French signals on Chs. F2 and F4, 52·4 and 65·55MHz respectively. Harold has made daily comparisons with his RL85 v.h.f. communications receiver. "The French Ch. F2 was a tremendous signal on February 2nd, stronger than the BBC from London" writes Harold who, by very careful adjustment of the fine tuning on his TV receiver, saw clear, double 819 line pictures of a Ski competition.

David Meers RS490107, Rossendale, has been an s.w.l. for some time and hopes soon to install some gear for DXTV and study for the RAE and another s.w.l., **Paul Stringer,** Christchurch, New Zealand, currently uses a FRG-7000 communications receiver, also hopes to take up TVDXing and asks "What does YL stand for?", Young Lady, Paul, an abbreviation deep rooted in the world of amateur radio.

Lionel Watkins-Field, who normally lives in northern Cyprus, writes from Leamington Spa to say that in Cyprus he uses a Skantic colour TV and with an 18 element yagi he can receive colour pictures from Syria and periodically from Turkey when they transmit colour for such special events as our Royal Wedding.

During 1981, Henrik Nykvist received a variety of signals due to both sporadic-E and tropospheric disturbances and a few of these appear in Fig. 5 along with their respective channel numbers and radio frequency. Sometimes test cards have active features such as the digital clock at the top of Fig. 5c.

Wenlock Burton, Melbourne, Australia received TV signals from New Zealand, almost daily during the first 10 days of January, but what about this for dedication to the hobby and I quote from his log . . . "Receptions of the month are: 4.1.82 opening from NSW (sp-E)............and 5.1.82 I received BC NZ TV 1 (NZTV1-1) on a small set while walking home from the library in Lalor.

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D 70C	70cms.	10W in – 200W out	£499
D 200S	2mtr.	1kW p.e.p ssb. (500 FM)	£600
D 200	2mtr.	500W p.e.p. ssb. (300 FM)	£499
D 200C	2mtr.	350W p.e.p. ssb. (150 FM)	£300

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IC2E FM 2m	£159.00
IC4E 70cm	£199.00
IC202 SSB	£169.00
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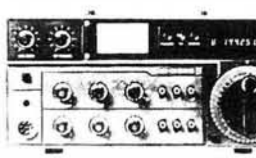
All accessories available – see below

ICOM MULTIMODES



IC251 2m	£495.00
IC451 70cm	
IC290 2m	£366.00

ICOM FM MOBILES

IC24G	£165.00
IC25E	£259.00

ICOM HF TRANSCEIVERS

IC2KL 500W linear	£839.00
IC2KLPS Power supply	£211.00
A.T. 100 A.T.U.	£249.00
A.T. 500 Auto A.T.U.	£299.00

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IC730 200W HF	£586.00

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BP5 IIV Pack	£30.50
BP4 Empty case for 6XAA	£5.80
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BP2 6V Pack	£22.00
BC30 Base charger	£39.00
DC1 12V adaptor	£8.40
WM9 Mic speaker	£12.00
CP1 Mobile Charging load	£3.20
LC1/2/3 cases	£3.50
ICMLI 10W Mobile booster for 2E	£49.00
BC30 Base charger	£39.00
MML1 10W Booster	£49.00

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PBM 10/2M 10 ELEMENT PARABEAM	£39.00
8XY/2M 8 ELE X YAGI	£31.00
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TR7800 VHF mobile	£285.00
TR7850 HP FM 2m	£295.00
TR7730 2m FM	£235.00
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FV707DM VFO FC · FT	£203.00
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FT7670X	£619.00
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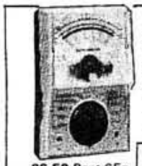

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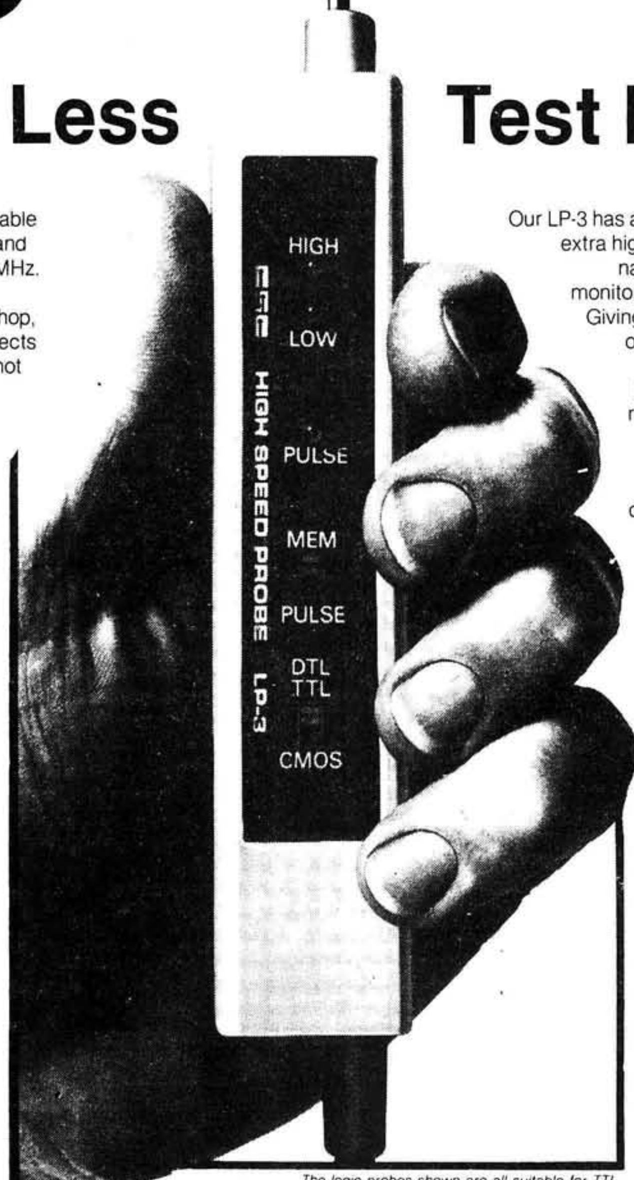

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TELEPRINTERS, two "Creed" 7B. £15 and £10. Buyer collects. Ring Alsager 3045.

FOR SALE. Collector's items. T1154 Transmitter, 19 set, several valve radios 1930-50, 78rpm portable disc recorder, isotope counter, HV power packs, 1035DB oscilloscope. Tel. Oxford 68930.

DX 300 Digital Readout BFO Total Coverage. Mint condition. £100. Whitley Bay 520403.

Wanted

ELECTRONIC COMPONENTS PURCHASED. All types considered – Must be new. Send detailed list – Offer by return – WALTONS, 55A Worcester Street, Wolverhampton.

WANTED PRACTICAL WIRELESS. June 1951, 1952, 1960, October 1952. Good price paid. Box No. P.WI 157.

Record Accessories

STYLI for Music Centres etc. Free list for S.A.E., includes other accessories. FELSTEAD ELECTRONICS, Longley Lane, Gatley, Cheadle, Cheshire SK8 4EE.

Books and Publications

NEW HANDY FREQUENCY CHECKLIST (MW, LW; Europe, U.K.) with unique map for bearings, £1 post paid or 6 IRC. – Dial-Search, 9, Thurrock Close, Eastbourne BN20 9NF.

"WORLD RADIO TV HANDBOOK" 1982. Write for details. "Broadcasts to Europe", quarterly frequency guide, £1.30, full year £4.50. Trade/club enquiries welcome. Pointsea, 25 Westgate, North Berwick, East Lothian.

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PRACTICAL WIRELESS PCB's

Drilled 1·5mm Glass Fibre Fry's Roller Tinned

	70cm/2m Converter WK103	£3.64
DEC 81	Crystal calibrator WR135	£1.69
JAN 82	RF Noise bridge WR137	£1.25
	Morse practice osc WR138	£1.20
FEB 82	3 Band Short Wave Converter WR140-1-2	
MAR 82	Iambic Keyer WR144	£1.87
APR 82	ATV UP Converter WR143	£3.23
	Mobile Radio Alarm WK104	£1.23

For full list and current pcb's send SAE. Pcb's also produced to customers own masters. Trade enquiries welcomed. Write for quote. CWO Please. **Postage** – add 35p postage and packing to complete order. Europe 70p.

PROTO DESIGN
14 Downham Road, Ramsden Heath, Billericay, Essex CM11 1PU. Telephone 0268-710722

CURE M.W. TV BUZZ. Co-Channel. Interference £1 + SAE for details. WHITEHURST, 45, Burns Road, Congleton, Cheshire.

RECHARGEABLE BATTERIES

PRIVATE & TRADE ENQUIRIES WELCOME
FULL RANGE AVAILABLE. SAE FOR LISTS. £1·45 for Booklet "Nickel Cadmium Power" plus Catalogue. Write or call, Sandwell Plant Ltd, 2 Union Drive, BOLDMERE, SUTTON COLDFIELD, WEST MIDLANDS. 021 354 9764. AFTER HOURS 0977 84093.
• NEW SEALED LEAD RANGE AVAILABLE •

WAVEGUIDE, FLANGES & DISHES. All standard sizes & alloys stock. Special sizes to order. Call Earth Stations, 01-228 7876, 22, Howie Street, London SW11 4AR.

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SWG	1 lb	8 oz	4 oz	2 oz
8 to 34	3.30	1.90	1.00	0.80
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40 to 43	4.87	2.65	2.05	1.46
44 to 47	8.37	5.32	3.19	2.50
48 to 49	15.96	9.58	6.38	3.69
SILVER PLATED COPPER WIRE				
14 to 30	6.63	3.86	2.28	1.50
TINNED COPPER WIRE				
14 to 30	3.97	2.41	1.39	0.94

10 × 10 Mtr reels 3 amp PVC cable mixed colours £5.00.
Prices include P&P and VAT. Orders under £2 add 20p.
SAE for list of Copper/Resistance Wire.
Dealer enquiries welcome.

ICOM TRIO/KENWOOD OWNERS. Very informative separate newsletters. Details: S.A.S.E. G3RKC Q.T.H.R.

CENTURION BURGLAR ALARM EQUIPMENT. Send SAE for list or a cheque/PO for £11.50 for our special offer of a full sized signwritten bell cover, to: Centurion, Dept PW, 265 Wakefield Road, Huddersfield, W. Yorkshire. Access & Barclaycard. Telephone orders on 0484-35527.

BURGLAR ALARM EQUIPMENT. Ring Bradford (0274) 308920 for our catalogue or call at our large showrooms opposite Odsal Stadium.

PARAPHYSICS JOURNAL (Russian translations). Psychotronic generators. Kirlianography. Gravity Lasers, Telekinesis. Details S.A.E. 4" × 9" Paralab, Downton, Wilts.

TIME WRONG?

MSF CLOCK is ALWAYS CORRECT – never gains or loses, SELF SETTING at switch-on, 8 digits show Date, Hours, Minutes and Seconds, auto GMT/BST and leap year, also parallel BCD output for computer etc, receives Rugby 60KHZ atomic time signals, built-in antenna, 1000Km range, GET the TIME RIGHT, **£62.80.**

V.L.F.? EXPLORE 10-150KHz, Receiver **£16.50.**

LOSING DX UNDER QRM? DIG it OUT with a Tunable Audio Notch Filter between your receiver and speaker, BOOST your DX/QRM ratio, 40dB notch, hear WEAK DX, **£13.80.**

Each fun-to-build kit includes all parts, printed circuit, case, instructions, postage etc, money back assurance so GET yours NOW.

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45 (PE) Old School Lane, Milton, Cambridge.

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WATFORD ELECTRONICS

33/35, CARDIFF ROAD, WATFORD, HERTS, ENGLAND
TEL. WATFORD (0923) 40588. TELEX 8956095

ALL DEVICES BRAND NEW. FULL SPEC. AND FULLY GUARANTEED. ORDERS DESPATCHED BY RETURN OF POST. TERMS OF BUSINESS: CASH/CHEQUE/P.O.s OR BANKERS DRAFT WITH ORDER. GOVERNMENT AND EDUCATIONAL INSTITUTIONS OFFICIAL ORDERS ACCEPTED (TELEPHONE ORDERS BY ACCESS NOW ACCEPTED Minimum £10·00 please). TRADE AND EXPORT INQUIRY WELCOME. P & P ADD 50p TO ALL ORDERS UNDER £10·00. (excluding VAT). OVERSEAS ORDERS POSTAGE AT COST.

VAT Export orders no VAT. Applicable to U.K. Customers only. Unless stated otherwise, all prices are exclusive of VAT. Please add 15% to the total cost including p & p.

We stock many more items. It pays to visit us. We are situated behind Watford Football Ground. Nearest Underground/Br. Rail Station: Watford High Street. Open Monday to Saturday 9 a.m.-6 p.m. Ample Free Car Parking space available.

POLYESTER RADIAL LEAD CAPACITORS: 250V;
10n, 15n, 22n, 27n **6p**; 33n, 47n, 68n, 100n **7p**; 150n, 220n **10p**; 330n, 470n **13p**; 680n **19p**; 1µ **23p**; 1µ5 **40p**; 2µ2 **46p**.

ULTRASONIC TRANSDUCERS
395p per pair

ELECTROLYTIC CAPACITORS (Values in µF).
500V: 10 **52p**; 47 **78p**; **63V:** 0 47, 1 0, 1 5, 2 2, 3 3, **8p**; 4 7 **9p**; 6 8, 10 **10p**; 15, 22 **12p**; 33 **15p**; 47 **12p**; 100 **19p**; 1000 **70p**; **50V:** 47 **12p**; 68 **20p**; 220 **24p**; 470 **32p**; 2200 **90p**; **40V:** 4 7, 15, 22, **9p**; 3300 **90p**; 4700 **120p**; **25V:** 1 5, 6 8, 10, 22 **8p**; 33 **9p**; 47 **8p**; 100 **11p**; 150 **12p**; 220 **15p**; 330 **22p**; 470 **25p**; 680, 1000 **34p**; 2200 **50p**; 3300 **76p**; 4700 **92p**; **16V:** 40, 47, 100 **9p**; 125 **12p**; 220 **13p**; 470 **20p**; 680 **34p**; 1000 **27p**; 1500 **31p**; 2200 **36p**; 3300 **74p**; 4700 **79p**.
TAG-END TYPE: 70V: 4700 **245p**; **64V:** 3300 **198p**; 2200 **139p**; **50V:** 3300 **154p**; 2200 **110p**; **40V:** 4700 **160p**; **25V:** 10,000 **320p**; 15,000 **345p**.

TANTALUM BEAD CAPACITORS:
35V: 0 1µ, 0 22, 0 33 **15p**; 0 47, 0 68, 1 0, 1 5 **16p**; 2 2, 3 3 **18p**; 4 7, 6 8 **22p**; 10 **28p**; **16V:** 2 2, 3 3,**16p**; 4 7, 6 8, 10 **18p**; 15 **36p**; 22 **30p**; 33, 47 **40p**; 100 **75p**; 220 **88p**; **10V:** 15, 22 **26p**; 33, 47 **35p**; 100 **55p**.

POTENTIOMETERS: Carbon Track
0 25W log & Linear Valves.

470Ω, 680Ω 1K, 2K (Lin only) Single	29p
5KΩ to 2MΩ Single gang	29p
5KΩ to 2MΩ Single with D/P switch	78p
5KΩ to 2MΩ Dual gang	88p
1W Wirewound 50Ω-20K	115p

POLYESTER (MYLAR) CAPACITORS:
100V: 1nF, 2n, 4n, 4n7, 10n **6p**; 15nF, 22n, 30n, 40, 47 **7p**; 56, 100n, 200 **9p**; **50V:** 470nF **12p**.

SLIDER POTENTIOMETERS
0 25W log and linear values 60mm track

5KΩ 500KΩ Single gang	70p
10KΩ 500KΩ Dual gang	110p
Self-Stick graduated Alum. Bezels	40p

CERAMIC CAPACITORS 50V
Range: 0 5pf to 10nf **4p**
15nF, 22nF 33nF, 47nF **5p** 100nF **7p**

PRESET POTENTIOMETERS

0 1W 50Ω-2 2M Mini Vert. & Horiz	7p
0 25W 100Ω-3 3MΩ Horiz. larger	10p
0 25W 250Ω-4 7MΩ Vert	10p

POLYSTYRENE CAPACITORS
10pF to 1nF, **8p** 1 5nF to 12nF, **10p.**

RESISTORS-5% carbon, High Stab. Miniature, Low Noise.

	Range	Val.	1-99	100+
0 25W	2Ω2-4M7	E24	2p	1p
0 5W	2Ω2-5M1	E12	2p	1p
1W	2Ω2-10M	E12	5p	3p
2% Metal Film	10Ω-1M	E24	6p	4p
1% 0 5W	51Ω-1M	E24	10p	8p

N.B. 100+ price applies to Resistors of each type not mixed values.

OPTO ELECTRONICS

LEDs plus clip	
TIL209 Red 3mm	13
TIL211 Grn 3mm	18
TIL212 Yel 3mm	18
2" Red	14
2" Green or Yellow	18
Rectangular LED's Red, Green, Yellow with bezel	29
3½ Digit LCD	525
4 Digit LCD	650
OCP71	120
ORP12	86
2N5777	45
(Infra Red Emitter) LD271	46
TIL32 Detector	58
SFH205	91
TIL78	55

7 Seg. Displays Red

3" C Cath	99
3" C Anod	99
3" +1 Red or Grn	150
5" C Cath	115
5" C Anod	115
6" C Cath	180
8" Orange	275
Burgraph 10 seg	225

CRYSTALS

100KHz	270
455KHz	370
1MHz	295
1 008M	295
1 6MHz	395

VEROBOARDS: 0 1"

	Clad	Plain
2½×3¾"	73p	52p
2½×5"	83p	—
3¾×3¾"	83p	—
3¾×5"	95p	79p
3¾×17"	326p	211p
4¾×17"	426p	—

Pkt of 100 pins **50p**; Spot face cutter **118p**; Pin insertion tool **162p**
'VQ' Board **150p**; 'DIP' Board **330p**; Vero Strip **144p**

PROTO-DECs: Veroblock **375p**; S-DeC **350p**; Eurobreadboard **520p**; Bimboard 1 **550p**; Superstrip SS1 **£13**

COPPER CLAD BOARDS

Fibre Glass	Single-sided	Double-sided	SRBP 9 5"×8 5"
6"×6"	90p	110p	95p
6"×12"	150p	200p	

FERRIC CHLORIDE
1 lb **195p** + 50p p&p

DALO ETCH RESIST PEN
plus Spare Tip **90p**

SOLDERCON PINS
100 pins **70p**; 500 pins **325p**

VERO WIRING PEN
+ spool **310p**; spare spool **75p**; combs **6p.**

DIL SOCKETS

	Low profile	Wire wrap
8 pin	8p	25p
14 pin	10p	35p
16 pin	10p	42p
18 pin	16p	52p
20 pin	22p	60p
22 pin	25p	70p
24 pin	25p	70p
28 pin	28p	80p
36 pin	—	105p
40 pin	30p	99p

EDGE CONNECTORS TEXAS

	1	156
2 10 way		135p
2 15 way		140p
2 18 way	180p	145p
2 22 way	199p	200p
2 23 way	210p	
2 25 way	225p	220p
2 30 way	245p	
2 36 way	295p	
2 40 way	315p	
2 43 way	395p	

DENCO COILS
Dual Purpose 'DP' VALVE TYPE
Ranges: 1-5 Bl. Yl. Rd. Wht. **122p**
6-7 B, Y, R **110p**
1-5 Green **150p**
'T'-type (Transistor Tuning). Ranges: 1-5 Bl. Yl. Red, White **150p**

B9A Valve Base	42p
RDT2	145p
RFC 5 chokes	140p
RFC 7 (19mH)	160p
1FT 13/14/15/16 17	120p
1FT 18/16	135p
1FT 18/465	152p
TOC1	124p
MW 5FR	122p
MW/LW 5FR	154p

JACKSONS VARIABLE CAPS.

Dielectric 100/300pF	220p
500pF	250p
6:1 Ball Drive 4511/DAF	185p
Dial Drive 4103 6:1/36:1	775p
Drum 54mm	59p
0-1-365pF	350p
00-2-365pF	435p
00-2-650pF	650p
0-2-365pF with slow motion Drive	495p
00-2-208/176	435p
with slow motion drive	495p
C804: 5pF; 10	278p
25pF	290p
50pF	290p
100;150pF	350p
'L' 3×310pF	725p
00-3×25pF	575p

TRANSISTORS

AC125	35	BD140	40	OC170 1	50	2N3773	270	LS15	15	LS221	60
AC126 7	35	BD144 5	198	OC200	50	2N3819	22	LS20	15	LS240	96
AC128	30	BD205	110	TIP29A	36	2N3820	38	LS21	15	LS241	96
AC141 2	30	BD214	115	TIP29C	60	2N3822 3	50	LS22	15	LS242	85
AC176	28	BD245	75	TIP30A	48	2N3866	90	LS26	18	LS243	85
ACY17 18	70	BD378	70	TIP30C	58	2N3903 4	15	LS27	15	LS244	80
ACY19 20	75	BD434	75	TIP31A	45	2N3905 6	15	LS28	20	LS245	118
ACY21 22	75	BD517	75	TIP31C	55	2N4037	46	LS30	18	LS247	40
ACY28	75	BD695A	99	TIP32A	48	2N4058	10	LS32	15	LS248	65
AD149	79	BD696A	99	TIP32C	60	2N4061 2	10	LS33	16	LS249	68
AD161 2	42	BDY56	180	TIP33A	65	2N4427	80	LS37	16	LS251	40
AF106	70	BF115	35	TIP33C	78	2N4859	78	LS38	16	LS253	40
AF118	90	BF167	29	TIP34A	74	2N4871	55	LS40	16	LS257	48
AF139	40	BF180	38	TIP34C	88	2N5172	18	LS42	35	LS258	40
AF178	75	BF194 5	12	TIP35A	160	2N5179	45	LS47	40	LS259	85
AF239	78	BF196 7	12	TIP35C	185	2N5191	75	LS48	80	LS261	195
BC107	10	BF198 9	16	TIP36A	170	2N5305	24	LS49	60	LS266	25
BC107B	12	BF200	30	TIP36C	199	2N5457	30	LS51	15	LS273	90
BC108	10	BF224	24	TIP41A	55	2N5485	30	LS54	15	LS275	290
BC108B	12	BF244	30	TIP41B	68	2N5642	750	LS55	30	LS279	88
BC108C	12	BF244B	30	TIP42A	60	2N5777	45	LS63	150	LS280	250
BC109	10	BF256	35	TIP42B	75	2SA715	60	LS73	25	LS283	45
BC109B	12	BF257 8	32	TIP120	90	2SC495	70	LS74	25	LS290	57
BC109C	12	BF259	35	TIP121	99	2SA496	70	LS75	28	LS293	46
BC140	30	BF274	42	TIP142	120	2SC1096	85	LS76	20	LS295	215
BC141 2	30	BF336	40	TIP147	120	2SC1173	125	LS78	24	LS298	130
BC143	30	BF451	35	TIP2955	60	2SC1306	100	LS83	50	LS299	420
BC147	9	BF594	30	TIP3055	60	2SC1307	150	LS85	70	LS300	175
BC147B	10	BF595	39	TIS43	32	2SC1449	85	LS86	38	LS302	175
BC148	9	BFR39	23	TIS44 5	45	2SC1678	140	LS90	35	LS320	270
BC148B	10	BFR40 41	23	TIS88A	50	2SC1923	50	LS91	80	LS323	270
BC148C	10	BFR79	23	TIS90	30	2SC1945	225	LS92	36	LS324	200
BC149	9	BFR80 1	24	TIS91	32	2SC1953	90	LS93	36	LS325	320
BC149C	10	BFR98	105	ZTX107	11	2SC1957	90	LS95	45	LS326	330
BC153 4	27	BFX29 84	28	ZTX109	12	2SC1969	140	LS96	120	LS327	315
BC157 8	10	BFX85 6	28	ZTX300	13	2SC2028	85	LS107	43	LS347	150
BC159	11	BFX87 8	28	ZTX301 2	16	2SC2029	210	LS109	30	LS348	190
BC160	45	BFY51 2	28	ZTX303	25	2SC2078	170	LS112	30	LS365	37
BC167 8	10	BFY56	32	ZTX304	17	2SC2091	85	LS113	40	LS366	37
BC168C	10	BFY64	35	ZTX314	25	2SC2314	85	LS114	35	LS367	37
BC169C	10	BFY81	120	ZTX326	30	2SC2122	165	LS122	44	LS368	90
BC170	15	BRY39	40	ZTX341	30	2SC1679	190	LS123	55	LS373	75
BC172 3	11	BSX20	20	ZTX500	14	2N6027	32	LS124	105	LS374	75
BC177 8	16	BSY95A	25	ZTX501 2	15	3N128	112	LS125	30	LS375	48
BC179 81	20	BU105	170	ZTX503	18	3N140	112	LS126	30	LS377	90
BC182 3	10	BU205	190	ZTX504	25	40311	60	LS132	45	LS378	69
BC184	10	BU208	200	ZTX531	25	40313	125	LS133	35	LS379	65
BC182L	10	E421	250	ZTX550	25	40315	90	LS136	28	LS384	250
BC183L	10	MD8001	250	2N697	23	40316	85	LS138	35	LS390	62
BC184L	10	MJ400	150	2N698	40	40361	70	LS139	38	LS393	60
BC187	26	MJ491	175	2N699	48	40362	70	LS151	39	LS395	199
BC212	10	MJ2955	90	2N706A	19	40407 8	75	LS153	39	LS398	275
BC212L	10	MJE340	54	2N708	19	40411	280	LS155	39	LS399	220
BC213	10	MJE370	100	2N918	35	40467	95	LS156	39	LS445	140
BC213L	10	MJE371	100	2N1131 2	24	40468	60	LS157	35	LS447	195
BC214	10	MJE2955	99	2N1303	60	40594	90	LS158	36	LS490	245
BC214L	10	MJE3055	70	2N1304 5	65	40595	98	LS160	41	LS541	135
BC236	10	MPF102	50	2N1671B	160	40603	90	LS161	41	LS668	175
BC237	14	MPF103 4	30	2N2219A	28	40673	85	LS162	41	LS670	175
BC307B	15	MPF105	30	2N2220A	26			LS163	41	LS673	550
BC308B	16	MPF106	40	2N2221A	25			LS164	48	LS674	750
BC327	15	MPSA05	25	2N2222A	25			LS165	145		
BC338	15	MPSA06	25	2N2369A	17	**74LS (TEXAS)**		LS166	85		
BC441	34	MPSA12	32	2N2646	45			LS170	170		
BC461	34	MPSA55	30	2N2904 5	28	74LS00	12	LS173	72	**74S**	
BC477	40	MPSA56	30	2N2906 7	26	LS01	13	LS174	72	74S00	60
BC516 7	40	MPSA70	25	2N2926G	10	LS02	14	LS175	58	74S132	138
BC547 8	12	MPSU06	55	2N3053	26	LS03	14	LS181	130	74S138	240
BC549C	14	OC28	130	2N3054	58	LS04	15	LS183	275	74S158	240
BC557 8	12	OC35	125	2N3055	48	LS05	15	LS190	58	74S188	210
BC559	15	OC36	75	2N3442	140	LS06	15	LS191	58	74S189	158
BCY70	16	OC41 2	75	2N3663	15	LS08	15	LS192	58	74S194	360
BCY71 2	20	OC43	55	2N3702 3	10	LS09	15	LS193	65	74S201	620
BD131 2	48	OC44	75	2N3704 5	10	LS10	15	LS194	40	74S241	540
BD133	60	OC45	40	2N3706 7	10	LS11	15	LS195	40	74S262	850
BD135	45	OC70 71	40	2N3708 9	10	LS12	15	LS196	58	74S287	325
BD136 7	40	OC74 76	50	2N3710 11	10	LS13	30	LS197	85	74S288	210
BD138 9	40	OC81 82	50	2N3771	179	LS14	48	LS200	345		
		OC83 4	40	2N3772	195			LS202	345		

LINEAR IC's

702	75	LM380	75	TA7310	175	4118 200	400
709C 8 pin	35	LM381N	145	TAA621AX1	295	4164 200	620
710*	48	LM382	125	TAA661A	190	4315 CMOS	795
733	75	LM386	90	TBA120S	70	4334 3	325
741 8 pin	14	LM387	120	TBA641 A12		4864 3	785
747C 14 pin	65	LM389	95	BX1 or BX11	350	6116 150N	450
748C 8 pin	36	LM1458	45	TBA651	190	6502	399
753 8 pin	185	LM3900	50	TBA800	80	6521	150
810	159	LM3909N	85	TBA810S	95	6522	350
9400CJ	350	LM3911	125	TBA820	80	6530	£12.00
AY 1 0212	675	LM3914	210	TBA920Q	290	6532	625
AY 1 1320	225	LM3915	220	TCA965	120	6545	999
AY 1 5050	99	LM3916	220	TDA1004	290	6551	650
AY 3 1270	840	LS7220	280	TDA1008	310	6800	300
AY 3 8910	600	M252AA	625	TDA1022	525	6802	400
AY 5 1230	450	M253AA	1150	TDA1024	105	6804	160
AY 5 8100	775	MB3756	440	TDA1490	290	6805	670
CA3020	186	MS1513L	230	TDA2020	320	6807	997
CA3028A	80	MS1515L	320	TDA2030	320	6810	120
CA3043	275	MC1304P	260	TL061CP	40	6821	150
CA3045	365	MC1310P	150	TL062CP	60	6840	420
CA3046	70	MC1495	350	TL064CN	98	6845	975
CA3048	214	MC1496L	70	TL071CP	30	6847	850
CA3059	225	MC1596	225	TL072CP	50	6850	150
CA3080E	70	MC3340P	120	TL074CN	100	6852	255
CA3089E	215	MC3360P	120	TL081CP	25	8080A	350
CA3090AQ	375	MC3403	110	TL082CP	45	8085A	550
CA3130	90	MC3405	150	TL083CP	75	81LS95	90
CA3140	48	MFC6040	97	TL084CN	95	81LS96	90
CA3189	200	MK50398	635	UA2240	120	81LS97	90
HA1336W	240	MM5303	635	UAA170	170	8224	200
ICL7106	750	MM5307	1275	UAA180	170	8251	320
ICL7107	975	MSM5526	820	UAA1003	935	8253	799
ICL8038CC	300	NE543K	225	UPC575	270	8T26A	99
ICM7205	1150	NE544	210	UPC1025H	375	8T28A	115
ICM7215	1050	NE5534	125	UPC1156	270	8T95N	99
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ICM7217A	790	NE556DB	45	XR2206	350	AY 3 1015	300
ICM7555	80	NE560	325	XR2266	360	AY 5 1013	300
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LA4031P	340	NE562B	410	ZN424E	130	MC1488	55
LA4032	295	NE564	420	ZN425E	345	MC1489	55
LA4400	440	NE565A	120	ZN426E	300	MC14411	695
LC7210	300	NE566	120	ZN427	600	MC14412	795
LC7130	340	NE567V	140	ZN1034	200	MM5280D	695
LF351	48	NE570	425	ZN1040E	675	RO 3 2513	600
LF353	95	NE571	420			SFF96364E	800
LF355	85	RC4136D	69			TMS6011	365
LF356	95	S566B	245	**COMPUTER ICs.**		ULN2003	100
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LM13600	125	SAB3210	295	1802CP	700	Z80ACPU 4	385
LM301A	26	SN76013N	350	2114L 300n	87	Z80 DART	450
LM308T	95	SN76023N	350	2114L 200n	87	Z80PIO	290
LM311H	70	SN76033N	350	2532 32K	395	Z80APIO	320
LM318	200	SN76477	175	2708	175	Z80A DART	475
LM324	30	SP8629	299	2716 5V	200	Z80CTC	300
LM33	54	TA7120	150	2732 450	400	Z80A CTC	325
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LM349	115	TA7204	225	4116 200N	80		
LM379	480	TA7205A	220				
		TA7222	175				

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7404	14	94	34	74188	290	4032	125	4194	105		
7405	18	95	50	74190	70	4033	165	4408	790		
7406	28	96	45	74191	70	4034	195	4409	790		
7407	28	97	120	74193	65	4035	95	4410	725		
7408	16	100	85	74194	75	4036	275	4411	695		
7409	16	104	54	74195	65	4037	115	4412	800		
7410	14	105	55	74196	65	4038	110	4415	480		
7411	20	107	32	74197	65	4039	290	4419	280		
7412	20	109	35	74198	99	4040	59	4422	770		
7413	24	110	40	74199	99	4041	78	4433	770		
7414	32	111	55	74221	80	4042	60	4435	850		
7416	25	112	170	74246	150	4043	70	4440	999		
7417	25	116	88	74247	150	4044	65	4450	350		
7420	16	118	80	74248	150	4045	170	4451	350		
7421	20	119	90	74249	150	4046	75	4490	350		
7422	20	120	75	74251	80	4047	75	4500	675		
7423	22	121	30	74265	65	4048	55	4501	28		
7425	28	122	45	74273	195	4049	30	4502	90		
7426	30	123	50	74278	160	4050	30	4503	50		
7427	27	125	42	74279	90	4051	78	4504	105		
7428	28	126	40	74298	100	4052	78	4506	65		
7430	16	128	42	74365	55	4053	78	4508	265		
7432	26	132	48	74366	55	4054	125	4510	68		
7433	27	136	35	74367	55	4055	125	4511	68		
7437	27	141	70	74368	55	4056	120	4512	75		
7438	27	142	190	74390	99	4057	1915	4513	199		
7440	17	143	250	74393	99	4059	480	4514	195		
7441	68	144	250	74490	120	4060	90	4515	198		
7442	38	145	70			4061	1225	4516	75		
7443	90	147	99	**CMOS***		4062	995	4517	415		
7444	90	148	75	4000	14	4063	99	4518	42		
7445	65	150	80	4001	14	4066	36	4519	29		
7446	55	151	45	4002	14	4067	399	4520	78		
7447	50	153	45	4006	66	4068	22	4521	200		
7448	50	154	75	4007	18	4069	20	4522	125		
7450	16	155	75	4008	62	4070	26	4526	95		
7451	16	156	75	4009	35	4071	20	4527	115		
7453	16	157	45	4010	40	4072	20	4528	80		
7454	16	159	99	4011	15	4073	20	4529	150		
7460	16	160	60	4012	18	4075	20	4530	90		
7470	35	161	60	4013	34	4076	60	4531	130		
7472	30	162	62	4014	75	4077	26	4532	110		
7473	30	163	64	4015	66	4078	26	4534	500		
7474	25	164	64	4016	32	4081	26	40097	88		
7475	40	165	62	4017	48	4082	21	40100	215		
7476	30	166	65	4018	68	4085	65	40101	130		
7480	48	167	185	4019	42	4086	70	40102	180		
7481	120	170	168	4020	61	4089	140	40103	175		
7482	70	172	290	4021	70	4093	43	40104	95		
7483	50	173	65	4022	66	4094	168	40105	115		
7484	80	174	72	4023	20	4095	90	40106	75		
7485	95	175	72	4024	45	4096	90	40107	60		
7486	26	176	55	4025	19	4097	320	40108	450		
7489	205	177	75	4026	130	4098	88	40109	100		
		178	95	4027	38	4099	95	40110	300		
		180	65			4160	95	40114	240		
						4161	99				

VOLTAGE REGULATORS

1A +ve 5V 12V 15 18 24V	50p
1A -ve	55p
100mA +ve 5V 6 8 12 15V	30p
100mA -ve	65p
LM309K	135p
LM317K	350p
LM323K	500p
LM723	38p
78H05	550p
78HG05	599p
79HG	785p
TBA625B	75p

BRIDGE RECTIFIERS

1A/50V	18
1A/100V	22
1A/400V	29
2A/50V	35
2A/400V	46
2A/600V	65
6A/100V	83
6A/400V	95
10A/200V	215
10A/600V	350
25A/200V	240
25A/600V	395
BY164	56
VM18 DIL	55

SCRs THYRISTORS

1A/200V	58
5A/100V	32
5A/400V	40
5A/600V	48
8A/300V	60
8A/600V	95
12A/400V	95
12A/800V	188
BT106	150
BT116	180
C106D	38
TIC44	24
TIC47	35
2N4444	130

TRIACS

3A/100V	48
3A/400V	56
3A/800V	85p
8A/100V	60
8A/400V	69
8A/800V	115
12A/100V	78
12A/400V	82
12A/800V	135
16A/400V	105
16A/800V	220
25A/400V	185
25A/800V	295
30A/400V	525
T2800D	120

DIAC
ST2 **25p**

DIODES

AA119	15
BY100	24
BY127	12
CR033	250
OA9	40
OA70	12
OA79	15
OA81	15
OA85	15
OA90	8
OA91	8
OA95	8
OA200	8
OA202	8
1N914	4
1N916	5
1N4001 2	5
1N4003 4	6
1N4005 6	6
1N4007	7
1N4148	4
3A 100V	15
3A 400V	16
3A 600V	17
3A 1000V	19
6A 400V	50
6A 800V	65

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7420	17p
7421	30p
7425	28p
7427	25p
7430	15p
7432	25p
7437	27p
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74161	60p
74162	60p
74163	60p
74164	65p
74165	60p
74166	70p
74170	160p
74172	300p
74174	70p
74175	70p
74190	70p
74191	70p
74192	70p
74193	70p
74196	60p
74197	60p
74221	75p
74283	75p
74284	200p
74285	200p
74365	55p
74366	55p
74367	55p
74368	55p
74390	100p
74393	100p

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4006	65p
4007	18p
4010	40p
4011	16p
4012	20p
4013	35p
4016	30p
4017	50p
4020	60p
4022	70p
4023	24p
4024	40p
4025	20p
4026	130p
4027	32p
4029	75p
4030	40p
4032	125p
4034	160p
4040	60p
4042	55p
4043	60p
4046	80p
4047	75p
4049	30p
4050	30p
4051	60p
4052	80p
4053	60p
4059	500p
4060	90p
4066	35p
4067	400p
4068	18p
4069	20p
4070	20p
4071	20p
4076	60p
4077	40p
4078	20p
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TIP31A	40p
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TIP32A	45p
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TIP33A	75p
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TIP34C	120p
TIP35A	160p
TIP35C	180p
TIP36A	160p
TIP36C	200p
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ZTX1502	18p
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VN66	80p
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2N3055	48p
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2N3553	240p
2N3584	250p
2N3643/4	48p
2N3702/3	12p
2N3704/5	12p
2N3706/7	12p
2N3708/9	12p
2N3773	300p
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2N3820	50p
2N3823	70p
2N3866	90p
2N3902	700p
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2N4037	65p
2N4123/4	27p
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2N4401/3	27p
2N4427	90p
2N4871	60p
2N5087	27p
2N5089	27p
2N5172	27p
2N5191	90p
2N5194	90p
2N5245	40p
2N5298	65p
2N5401	50p
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2N5459	40p
2N5460	60p
2N5485	44p
2N5875	250p
2N6027	48p
2N6052	300p
2N6059	325p
2N6107	65p
2N6247	190p
2N6254	130p
2N6290	65p
2SC1172	150p
2SC1306	100p
2SC1307	150p
2SC1957	90p
2SC1969	150p
2SC2028	95p
2SC2029	250p
2SC2078	200p
3N128	120p
3N140	120p
3N141	110p
3N201	110p
3N204	120p
40290	260p
40361/2	75p
40408	90p
40409	100p
40410	100p
40411	300p
40594	120p
40595	120p
40673	75p
40871/2	100p

DIODES

BY127	12p
BYX36 300	20p
OA47	8p
OA90/91	9p
OA95	9p
OA200	9p
OA202	10p
1N914	4p
1N916	7p
1N4148	4p
1N4001/2	5p
1N4003/4	6p
1N4005	6p
1N4006/7	7p
1N5401/3	14p
1N5404/7	19p
IS920	9p

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1A 600V	30p
2A 50V	30p
2A 100V	35p
2A 400V	45p
3A 200V	60p
3A 600V	72p
4A 100V	95p
4A 400V	100p
6A 50V	80p
6A 100V	100p
6A 400V	120p
10A 400V	200p
25A 400V	400p

TRIACS PLASTIC

3A 400V	60p
6A 400V	70p
6A 500V	88p
8A 400V	75p
8A 500V	95p
12A 400V	85p
12A 500V	105p
16A 400V	110p
16A 500V	130p
T2800D	130p

THYRISTORS

3A 400V	100p
8A 600V	140p
12A 400V	160p
16A 100V	180p
16A 400V	180p
BT106	110p
C106D	45p
MCR101	36p
TIC44	27p
2N3525	130p
2N4444	140p
2N5060	34p
2N5064	40p

ZENERS

2.7V-33V

400mW	9p
1W	15p

OPTO-ELECTRONICS

2N5777	45p	ORP60	120p
OCP71	180p	ORP61	120p
ORP12	120p	TIL78	55p

OPTO-ISOLATORS

ILD74	130p	TIL111	90p
MCT26	100p	TIL112	90p
MCS2400	190p	TIL113	90p
ILQ74	240p	TIL116	90p

LEDS

0.125"		0.2"	
TIL32	55p	TIL220 Red	15p
TIL209 Red	13p	TIL222 Gr	15p
TIL211 Gr	16p	TIL228 Yel	22p
TIL212 Ye	18p	Rectangular LEDs (R, G, Y)	30p
TIL216 Red	18p	NSB5881	670p
		TIL311	600p

DISPLAYS

		TIL312/3	110p
3015F	200p	TIL321/2	130p
DL704	140p	TIL330	140p
DL707 Red	140p	7750/60	200p
FND357	120p	**DRIVERS**	
FND500	90p	9368	250p
FND507	90p	9370	300p
MAN3640	175p	UDN6118	320p
MAN4640	200p	UDN6184	320p

VOLTAGE REGULATORS

FIXED PLASTIC

1A	+ve		-ve	
5V 1A	7805	50p	7905	55p
12V 1A	7812	50p	7912	55p
15V 1A	7815	55p	7915	60p
18V 1A	7818	55p	7918	60p
24V 1A	7824	55p	7924	60p
5V 100mA	78L05	30p	79L05	60p
12V 100mA	78L12	30p	79L12	60p
15V 100mA	78L15	30p	79L15	60p

OTHER REGULATORS

LM309K 1A 5V	135p	78HGKC	600p
LM317K	325p	78HOSKC	550p
LM317T 1A Adj	200p	78MGT2C	140p
LM337T	225p	78GUIC	200p
LM323K 3A 5V	500p	79GUIC	225p
LM723 150mA Adj	37p	79HGKC	700p
TL494	400p	TL497	300p
78S40	300p	LM305AH	250p

CB COMPONENTS

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LC7130	£3.25
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TA7204	£1.95
TA7205	£0.90
TA7222	£1.60
TA7310	£1.60
TBA810	£1.00
TC9109	£10.00
2SC1306	£1.00
2SC1307	£1.50
2SC1957	£0.90
2SC1969	£1.50
2SC2028	£0.95
2SC2029	£2.50
2SC2078	£2.00
UPC575	£2.75
UPC1156H	£2.75

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6V DC coil SPDT 2A 24V DC	160p
12V DC Coil SPDT 2A 24V DC	160p
12V DC Coil DPDT 5A 24V DC/240V AC	200p

LOUD-SPEAKERS

Size		
2¼"	64R	80p
2½"	8R	80p
2"	8R	90p
1½"	8R	100p

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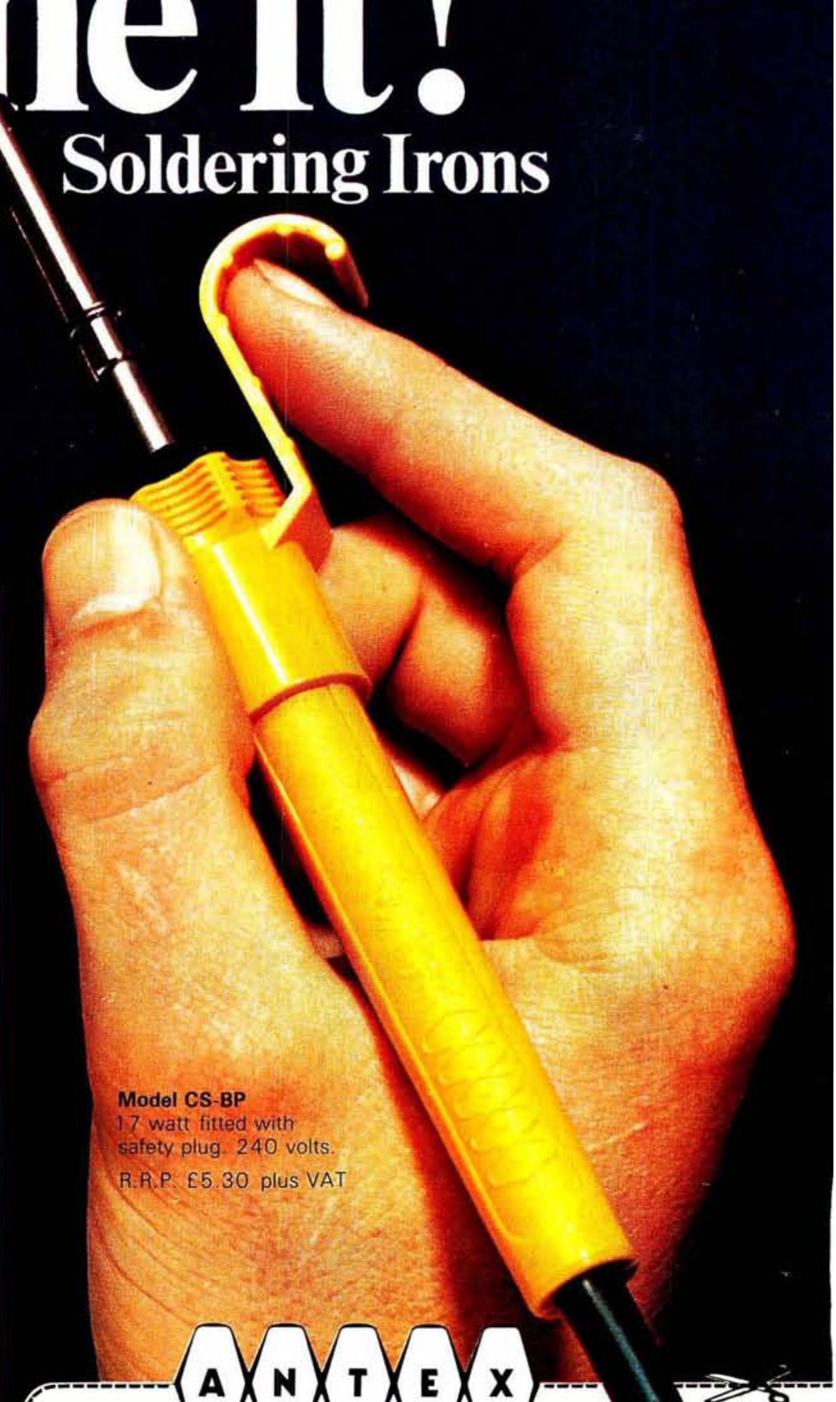

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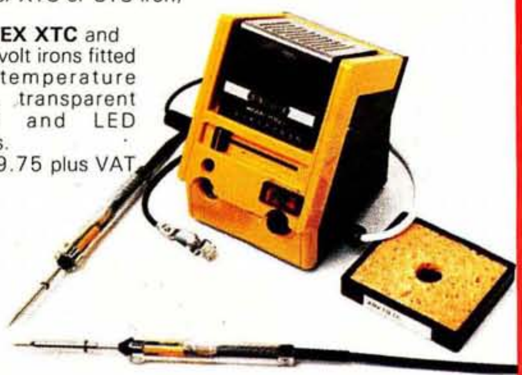

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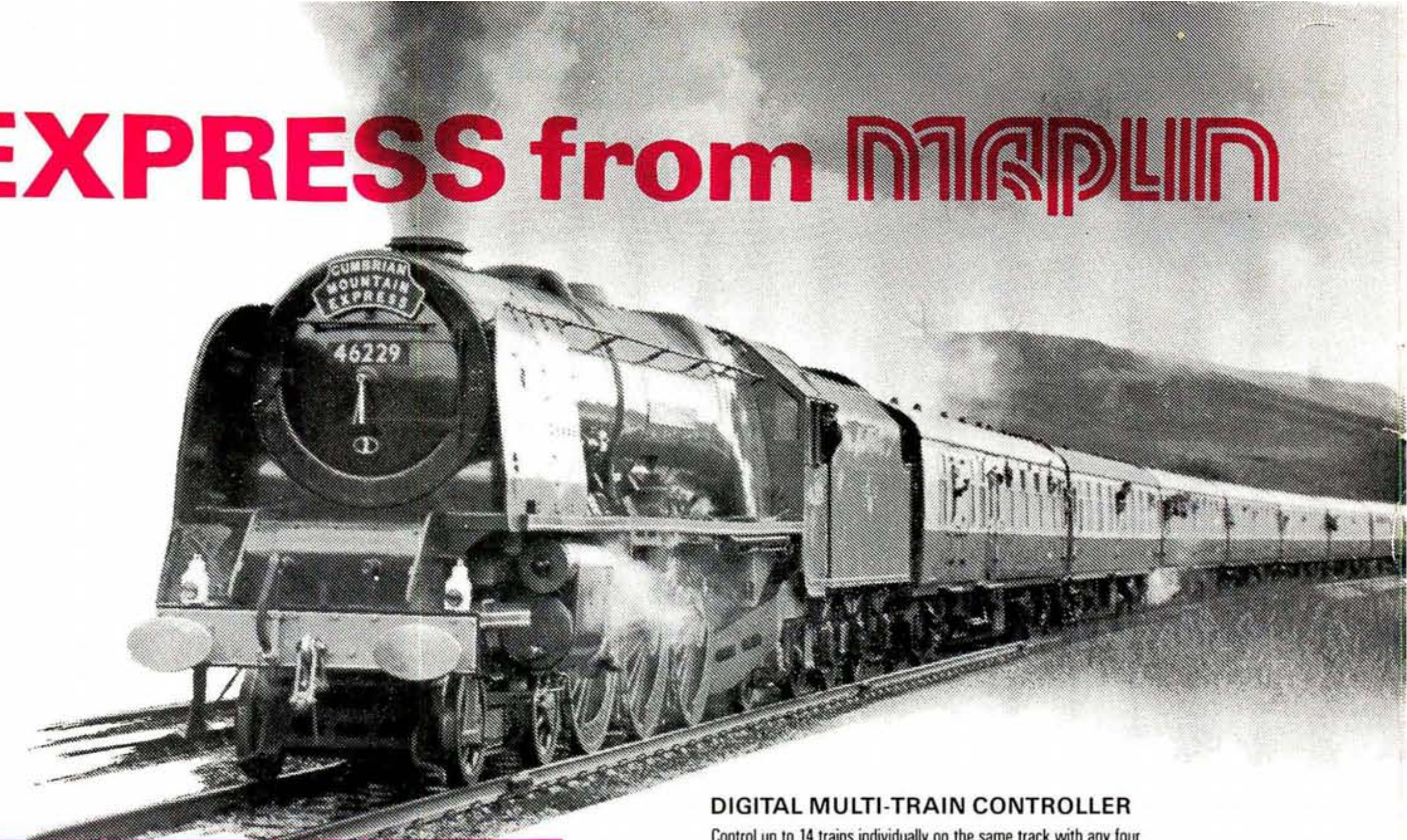

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