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JULY 1982

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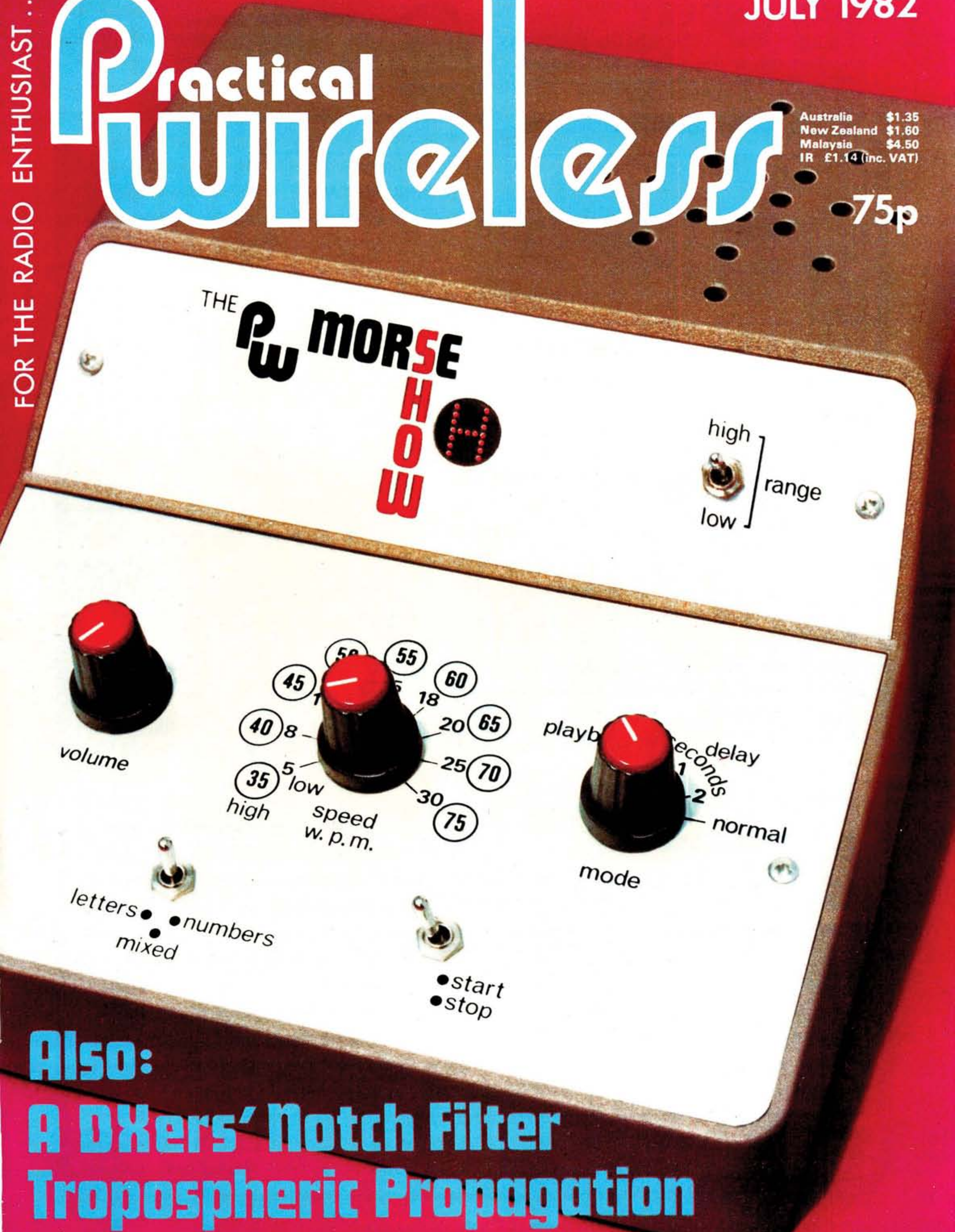

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Practical Wireless

JULY 1982 VOL. 58 NO. 7 ISSUE 904

contents

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.

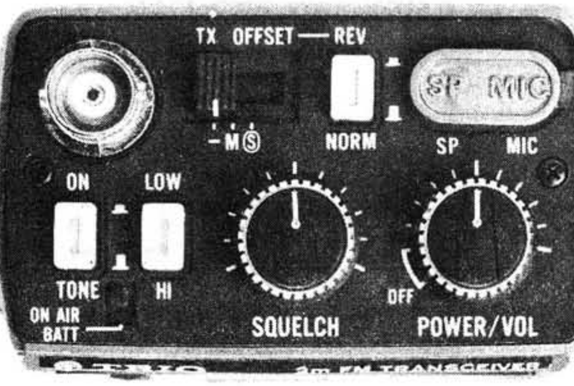
NEW VHF

TRIO

The TR-2500 is a compact 2 meter FM handheld transceiver featuring an LCD readout, 10 channel memory, lithium battery memory back-up, memory scan, programmable automatic band-scan and Hi/Lo power switch.

TR-2500 FEATURES:
● Extremely compact size and light weight 66 W × 168 H × 40 D, mm, 540 g, with Ni-Cd pack. ● LCD digital frequency readout, with memory channel and function indication. ● Ten channel memory, includes "MO" memory, for non-standard split frequencies. ● Lithium battery memory back-up, built-in, saves memory when Ni-Cd pack discharged. ● Memory scan, stops on busy channels, skips channels in which no data is stored. ● UP/DOWN manual scan in 5 KHz steps. ● 2.5 W or 300mW RF output. (HI/LOW power switch.) ● Programmable automatic band scan allows upper and lower frequency limits and scan steps of 5 KHz and larger (5, 10, 15, 20, 25, 30 Khz . . . etc) to be programmed. ● Repeater reverse operation. ● Optional power source, MS-1 mobile or ST-2 AC charger/power supply allows operation while charging. (Automatic drop-in connections.) ● Battery condition indicator. ● Two lock switches for keyboard and transmit. ● Flexible rubberized antenna with BNC connector. ● 400 mAH heavy-duty Ni-Cd battery pack. ● AC charger.

OPTIONAL ACCESSORIES:
● ST-2 Base station power supply and quick charger (approx. 1 hr.) ● MS-1 13.8 VDC mobile stand/charger/power supply. ● SMC-25 Speaker microphone. ● PB-25 Extra Ni-Cd battery pack, 400 mAH, heavy-duty.



the TR2500

£207.00 inc VAT Securicor Carriage £5.00

NEW UHF VHF

With the arrival of the TS780, the dual bander rig has come of age, giving the two band multimode facilities of the original concept, plus a wealth of additional operating facilities. Taking a trip across the front panel of the rig we have the repeater facilities, a non-locking tone switch, ideal now that most repeaters are tone accessed and carrier maintained. The tone, of course, only works whilst the rig is in the FM mode. Below the tone switch is the TX offset switch giving plus or minus 600 KHz or 1.6 MHz, depending on whether 2 metres or 70 cm is selected and last, but certainly not least, reverse repeater – to my way of thinking proof that the TS780 was designed for amateurs by amateurs.

The meter functions on receive as S. meter, ALC meter or as a centre meter, the functions being controlled from a panel switch. On transmit the meter reads relative RF output. Immediately above the digital frequency and memory/VFO indicator are indicating leds: a "busy" led indicating in FM mode whether the squelch is open thereby, assuming the squelch level is correctly set, that the other station is transmitting. A "frequency lock" led tells that the F lock switch is pressed and the VFO knob inoperative. The "on air" led indicates the rig is transmitting and the "offset" led reminds you that the TX offset switch is set to repeater.

The memory operation has been updated: instead of having to progressively move through the memory content in sequence, by means of a rotary switch any of the ten memories (two more than the TS770's) can be selected at will. Entering frequencies into the memory is easier, as anyone who has a TS770 series will explain. Two priority frequencies are included: 9 and 10. Push buttons to the left of the VFO knob allow either of the two programmed frequencies to be quickly selected, immediately cancelling the previous instructions given to the rig. Just the thing for local net frequencies. SSB mic gain needs no explanation, as does the AF/RF gain control.

On the same control knob as the squelch level is a switch enabling the frequency width of scan to be determined. Briefly, when the rig is set to scan either in FM, FM step or SSB mode you can determine the amount of band to be covered.

The ranges are 0.5, 1, 3, 5 and 10 MHz, thus you can limit the rig to scan just the section of the band used by the mode you have selected. Example: scan width 0.5 MHz, VFO set at 144.000, coverage – 144.000 to144.5, mode side band – result: free scanning of the SSB portion of the band. On FM the scan locks if a signal is present. On SSB the scan does not stop but you are made aware that there is activity on the band.

Another new control on the TS780 is the IF shift. Available for some time on HF equipment to cope with crowded band conditions, obviously the Trio design engineers have recognised that the 2 metre SSB end of the band can become crowded during contests or when there is "a bit of a lift on". At these times a rig that has the "IF shift" facility will certainly "score points".

The send/receive Vox/Man, meter function, NB, low/high power switches are all well known and have been found on previous generations of Trio base station equipment and again require no explanation. I could say the same thing about the mode switch but here you will notice alongside the standard FM position another marked FM CH. Put the mode switch in this position and instead of a free-running VFO you have a mechanical "click" step feel, the frequency now moving in either 12.5 KHz or 5 KHz steps. Of course the rig will also scan in these steps, controlled either by the scan switch or the up/down shift microphone. Again the Trio amateurs who design the equipment have here a major triumph.

By now you may be seeing why I am so enthusiastic about the TS780 but there is still more to come. How about a memory scan system that will scan either the 2 metre frequencies stored in the memory or the 70 cm ones or, if you wish, both. Well that's another feature of the TS780. Add to this list variable VFO steps of either 20 Hz or 200 Hz, a selectable braked feel to the VFO knob, rapid up and down MHz switching and you have the most comprehensive rig ever seen.

Too complicated some may say. Rubbish say I. Trio thrive on rigs designed to be simple to operate. Do you remember what John wrote in Radcom about the TR7500 and its competitors? And, finally, how about a rig that without resorting to a MHz switch will, by use of the VFO knob, tune from 144 to 146 MHz and from 430 to 440 MHz – only one rig –

the TS 780

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See revue in February Radd.Comm.

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

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

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

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

IC-PS15 Mains PSU £99

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.

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Frequency selection – by thumbwheel switches, indicating the frequency. 5KHz switch – adds 5KHz to the indicated frequency.
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External speaker jack – for speaker or earphone. This little beauty is supplied ready to go complete with nicad battery pack, charger, rubber duck.

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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	1[illegible] 70	CP1	Mobile charging lead	3 20
BP2	6 volt pack	22 00	IC123	cases	each 3 60
BC30	Base charger for above	39 00		All prices include VAT	

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

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

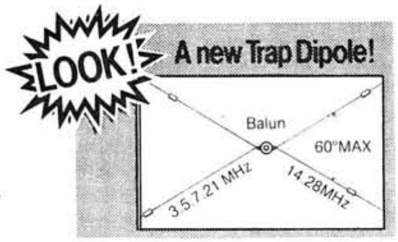
Both are really well designed and engineered multi-mode transceivers capable of being operated from either the mains or a 12 volt supply. Both contain such exciting features as scan facilities, automatic selection of the correct repeater shift for the band concerned, full normal and reverse repeater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

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

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

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

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



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

Thanet Electronics

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*Options

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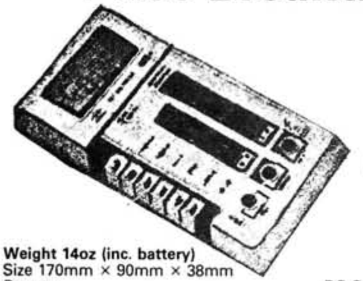

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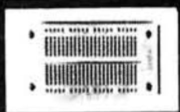

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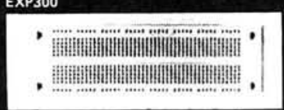

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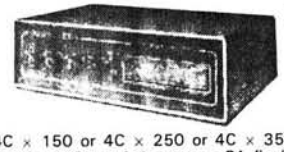

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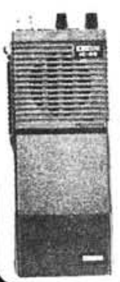

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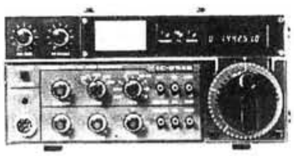

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comment...

At the Shows

HAVING exhibited at one show (*RSGB,* Alexandra Pavilion) and visited two more (*All Electronics Show* at the Barbican Centre and *Communications '82* at the Birmingham National Exhibition Centre) in the space of a week and a half, I'm feeling slightly punch-drunk. It was a good opportunity though to compare three modern exhibition halls, two of them brand new, and what they offer to the visitor.

When the NEC first opened, I used to find it very difficult to know which way I was facing in the halls, and therefore where to find any particular stand, or even the exit. Now, the recession has meant that the stands are less flamboyant, and therefore easier to see round and over, and direction finding is no longer a problem. I'm sure they've lengthened the walkway from Birmingham International station though!

Finding where you are has now become the problem in the exhibition halls at the Barbican. These are two-tiered affairs, in awkward shapes, with ceiling heights for the most part no greater than in a modern house. Even standing in front of one of the numerous "You Are Here" plans I felt utterly lost, and I'm sure that I missed quite a few stands. I know I found some no less than four times! Compared with the gracious elegance enjoyed by the *All Electronics Show* at the Grosvenor House Hotel in bygone years, the Barbican halls are a disaster.

By contrast, the new Alexandra Pavilion, designed to give a home to exhibitions for five years whilst the fire-damaged Palace is rebuilt, is spacious and tall (though not quite as tall as the "Talk-in" station antenna erection team seemed to expect). Ventilation is not good, as the warm weather on Saturday, April 17 proved, and it seemed that at least one of the public address system microphone positions has a severe resonance problem. It **was** possible to get understandable announcements out of the system, but not very often. Refreshment facilities are an enormous improvement over those in the old Grand Hall, and were I am sure appreciated by many.

Looking around AP '82, I could not help wondering why it is that hi-fi, disco equipment and toys can be sold at RSGB-sponsored events, whilst legal CB equipment cannot.

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.

BACK NUMBERS AND BINDERS

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

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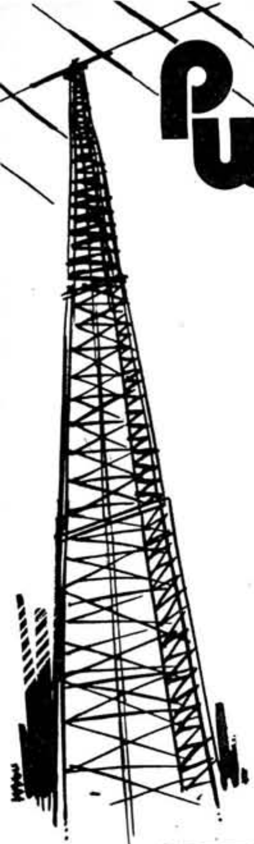
INSURANCE

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



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I/We hereby apply to insure the equipment detailed below

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	Manufacturer's Name	Model	Serial No.	Description of equipment to be insured e.g. Base station; Mobile; CB; etc.	VALUE £
1					
2					
3					
4					
5	Antennas (Aerials), s.w.r. meters, etc.				

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

DECLARATION: I/We hereby declare that: 1. The sums insured represent the full replacement value of the equipment. 2. I/We have not* had insurance cancelled, declined, restricted, or other terms imposed in any way other than the normal Policy terms. 3. This proposal shall be the basis of the contract and that the contract will be on the Underwriters normal terms and conditions for All Risks and Legal Costs/Expenses cover unless otherwise agreed. 4. I/We have not* sustained any loss or damage to any radio communications equipment or been involved in litigation relating to use of radio equipment during the past three years, whether insured or not. 5. All the above statements made in connection with this proposal are true and no material information has been withheld. 6. I/We understand no liability shall attach until this proposal shall have been accepted by Laymond's and the premium paid in full and a Certificate issued.

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DELAY IN ARRANGING COVER COULD COST YOU A GREAT DEAL OF MONEY. COMPLETE THIS APPLICATION AND POST WITH YOUR PREMIUM MADE PAYABLE TO "LAYMOND'S" NOW. ADDRESS TO: PRACTICAL WIRELESS (INSURANCE), B. A. LAYMOND & PARTNERS LTD., 562 NORTH CIRCULAR ROAD, LONDON NW2 7QZ. TELEPHONE: 01-452 6611.

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.

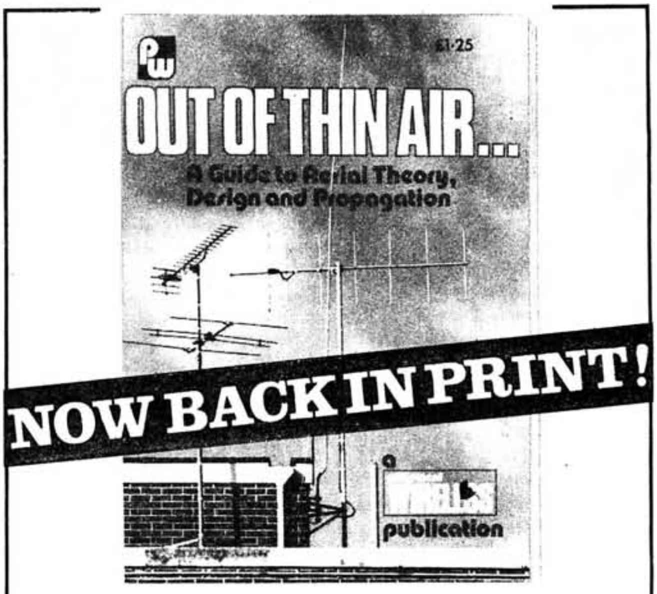
The *PW* RADIO USERS INSURANCE SCHEME's principal features are outlined on the opposite page. The policy covers loss or damage to the insured equipment, which can include: receivers; base station, portable or mobile rigs; antennas except for suction or magnetic mount mobile types; masts; radio-related 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.

The scheme also covers legal costs and expenses involved in the pursuit of legal rights, in or out of court, relating to any criminal prosecution brought under the Wireless Telegraphy Act 1949 and subsequent Acts and Amendments, or in an appeal against the decision of an official or administration to revoke, suspend, or curtail an existing radio licence. Providing that the insured person holds a valid radio licence or is authorised to operate the equipment under the terms of the licence. Claims are subject to a limit of £500 per incident. Prosecution shall not be deliberately or intentionally sought.

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

1. B. A. Laymond & Partners, Ltd., 562 North Circular Road, London NW2 7QZ, telephone 01-452 6611.
2. Practical Wireless, Westover House, West Quay Road, Poole, Dorset BH15 1JG, telephone Poole (0202) 671191.

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.



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

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

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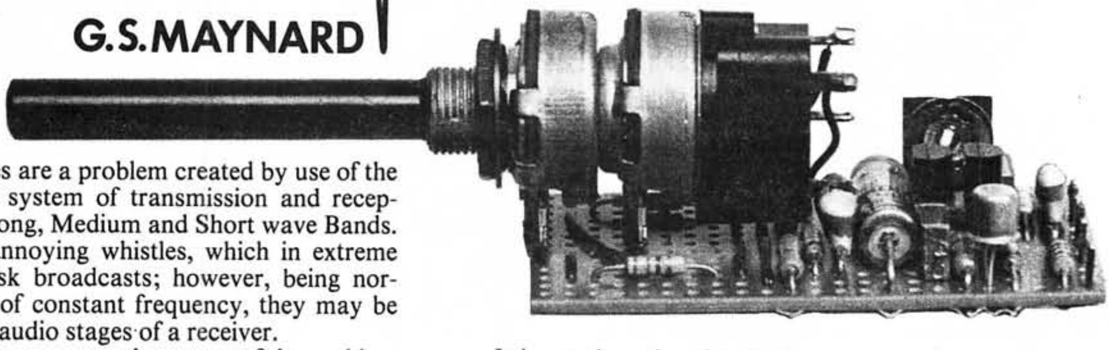


Unwanted heterodynes are a problem created by use of the amplitude modulated system of transmission and reception throughout the Long, Medium and Short wave Bands. Heterodynes create annoying whistles, which in extreme cases completely mask broadcasts; however, being normally sinusoidal and of constant frequency, they may be filtered out within the audio stages of a receiver.

Following a brief discourse on the nature of the problem this article describes an inexpensive notch filter capable of reducing audible whistles by 40dB. The filter may be panel mounted within existing sets, and uses a single knob control for On/Off and Tuning. The resulting installation represents a simple solution for both the serious listener and DXer, when using a receiver without this facility.

The Problem

Whistles often appear on a.m. receivers and it is worth considering two types which may be encountered.

(1) The most common is the **constant** note caused by beating carriers which occupy adjacent channels. These whistles may be audible at the receiver output as either transmission is tuned, and are normally more severe on the weaker signal.

Channel spacing on the European l.w. and m.w. broadcast bands results in the generation of 9kHz whistles, though these are seldom heard because of i.f. and a.f. amplifier design practices. Unfortunately, when DX or s.w. listening the received stations are not always so widely separated and beats often produce annoying notes, commonly of 1, 2, 3, 4, 5 and 6kHz. Using narrow passband i.f. amplifier filters it is possible to reduce the level of whistles above 3kHz; however, cutting bandwidth below this frequency will severely degrade the signal copy.

To cure this kind of interference requires one of the carriers to be removed, within either the r.f. or i.f. amplifier stages, or the resultant beat must be filtered out after demodulation. Clearly the last method is most universally applicable and the filter, known as an audio frequency "notch filter", allows r.f. and i.f. circuits to be adjusted for optimum reception.

(2) The other common type of heterodyne occurs where a superhet receiver picks up harmonics of its own i.f. amplifier(s) or local oscillator(s) and these beat with the incoming signal, or its harmonics, creating an audible note whose pitch **varies** with receiver tuning. Usually generated within the receiver itself, these spurious whistles change frequency at a rate different to the main receiver tuning.

The whistle becomes audible at a note similar in frequency to the i.f. bandwidth, passes through zero and increases again to bandwidth frequency as receiver tuning progresses through a small portion of the desired signal. The listener will often accept a slightly "off tune" situation when this type of interference is present; however, using a notch filter it should be possible to cancel the offending note, once correct tuning has been established.

It is worth noting that British m.w. stations do not use frequencies within 15kHz of the second or third harmonics of the normal 465 to 470kHz intermediate frequencies. Clever pioneers?

There are many other causes of constant note whistles, e.g. beat frequency oscillators, poor receiver design, transmitter test tones or faults on modern digital equipment, including frequency meters etc. It is *possible* that a notch filter will offer some improvement with these also.

Filter Description

The completed notch filter consists of about 20 components on a small piece of 0·1in Veroboard soldered to the tags of a dual-gang potentiometer with ganged switch, and should therefore be easy to install within an existing receiver.

Voltage gain is unity and the null, within an operating range of 400Hz to 10kHz, is not less than 40dB at the tuned frequency f tapering to minus 6dB points at $f/2$ and $2f$.

CONSTRUCTION RATING Intermediate

BUYING GUIDE

Constructors should have no problems purchasing components for this project with the possible exception of potentiometer R11/12. This item is available from Electrovalue

APPROXIMATE COST £4.50

The notch filter circuit consumes 2mA from a 9V d.c. supply and should be connected into the small-signal audio stages of the receiver, preferably just before, or after, the volume control.

The circuit diagram of the notch filter is shown in Fig. 1. Incoming audio passes through C1, is buffered by Tr1 and fed to the base of Tr2, a phase splitter. Voltages at the collector and emitter of Tr2 are 180 degrees out of phase and these supply the notch filter resistor capacitor networks.

Taking first the case where switch S1 is open circuit. Output from the emitter of Tr2 is fed without loss to the base of the output buffer Tr3, via C5, R10 and R12. The signal from Tr2 collector is unable to pass the switch or 10MΩ resistor R9 and consequently has no effect on the output of Tr3. Therefore with S1 open the filter circuit is effectively a series of three d.c. coupled emitter followers, having unity gain, high input impedance and low output impedance.

With S1 closed, the signal arriving at the base of Tr3 is a mix of Tr2 output, from the collector via C3, R8 and R11, and the emitter via C5, R10 and R12. With C3 equal to C5, R8 + R11 equal to R10 + R12 and equal but opposite voltages at the collector and emitter of Tr2, a frequency will exist where phase cancellation occurs at the wipers of R11 and R12. Resistors R11 and R12 form the dual-gang potentiometer used for notch tuning and S1 the ganged ON/OFF switch.

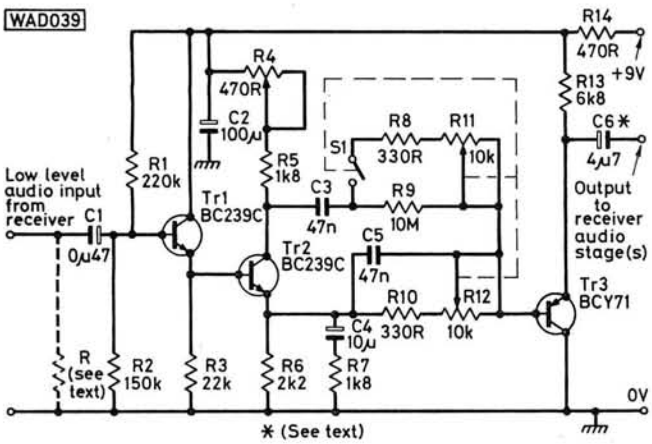


Fig. 1: The complete circuit diagram of the notch filter

If the filter input is connected in place of a receiver volume potentiometer track then resistor R (shown in dotted lines on the circuit diagram), having an equivalent value, may be fitted to preserve automatic gain control characteristics of the receiver.

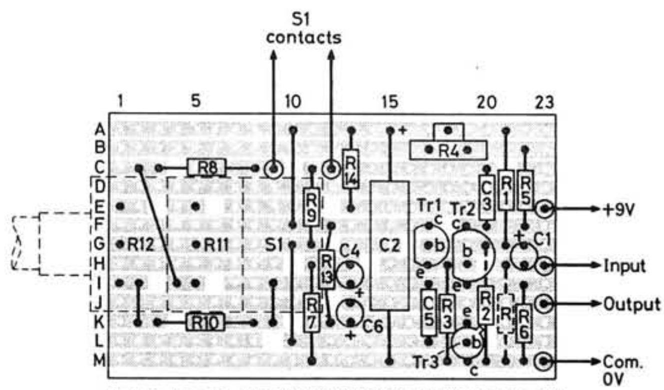
Resistor R4 is a small preset control which is adjusted for the deepest null and then sealed. Click-free filter switching is ensured by R9 by maintaining a voltage drop across C3 when S1 is open. Resistor R14 and capacitor C2 decouple internal rails from supply line ripple, and C1 and C6 provide d.c. blocking at the input and output.

The value of C6 is quoted as 4·7µF to suit normal circuitry, but a value of 470nF will improve sub-audio decoupling when driving stages or potentiometer tracks of greater than 47kΩ impedance.

Filter use with positive earth receivers is possible by reversing the polarity of capacitors C1, C2, C4 and C6, and fitting BCY71 transistors at the Tr1 and Tr2 positions, with a BC239C used for Tr3.

★ components

Resistors		
¼W 5% Carbon Film		
330Ω	2	R8,10
470Ω	1	R14
1·8kΩ	2	R5,7
2·2kΩ	1	R6
6·8kΩ	1	R13
22kΩ	1	R3
150kΩ	1	R2
220kΩ	1	R1
10MΩ	1	R9
Potentiometers		
Dual reverse log law with s.p.s.t. switch (Electrovalue)		
10kΩ	1	R11,12
¼W Vertical mounting carbon preset		
470Ω	1	R4
Capacitors		
Tantalum bead, 35V		
0·47µF	1	C1
Tantalum bead, 16V		
4·7µF	1	C6
Tantalum bead, 6·3V		
10µF	1	C4
Electrolytic, 10V double-ended		
100µF	1	C2
Polyester film, 250V		
47nF	2	C3,5
Semiconductors		
Transistors		
BC239C	2	Tr1,2
BCY71	1	Tr3
Miscellaneous		
Veroboard, 0·1in Matrix. Terminal pins.		



Track breaks at: B18, C4, C10, C21, E3, E6, E12, F18, G12, G16, H10, H14, H20, I3, I6, J12, K4, K10, K20, L9, L20

Fig. 2: Component layout shown full size, incuding Veroboard track breaks

Construction and Performance

Construction of the notch filter is straightforward and follows the general layout illustrated in Fig. 2. The Veroboard tracks are cut as detailed.

A suggested order of mounting components is: wire links, resistors, capacitors, potentiometers and then finally the transistors. Connect the two flying leads marked S1 contacts to the top pair of switch tags on the ganged potentiometer R11/12.

When completed and checked the filter should be connected into the small signal audio stages of a receiver, providing a signal level of 250mV r.m.s. maximum, and powered from a 9V line. For use with higher voltage supplies, series dropping resistors may be connected in the positive line with approximately 1kΩ required for every 2 volts above the quoted supply voltage; e.g. with an 18V rail use a 4·7kΩ series resistor.

The preset control R4 must be trimmed to null an audible whistle, either one tuned on the receiver, or a 3kHz sinewave applied to the filter input from an external signal generator.

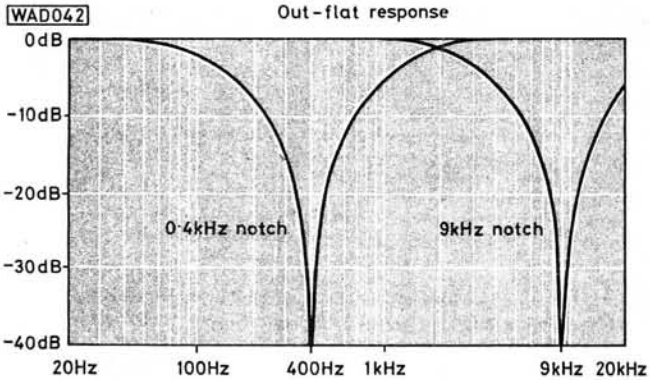
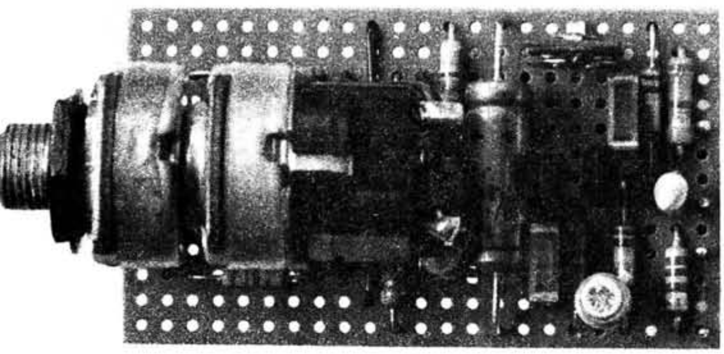


Fig. 3: Frequency response curves shown for two separate notch frequencies

A signal generator might also be used for filter calibration at say 0·4, 1, 3, 6 and 9kHz reference settings. The scale shown in Fig. 4 is representative, and also shows the limits of 0·35 and 10·5kHz.

On prototypes nulls of 50dB were achieved with frequencies of up to 3kHz, but there was a degradation with increasing frequency, the figure falling to 40dB at 10·5kHz.

An indication of frequency response, when switched out and tuned to 0·4 and 9kHz, is shown in Fig. 3. Note the similar curves; notch characteristic is repeatable for all operating frequencies.



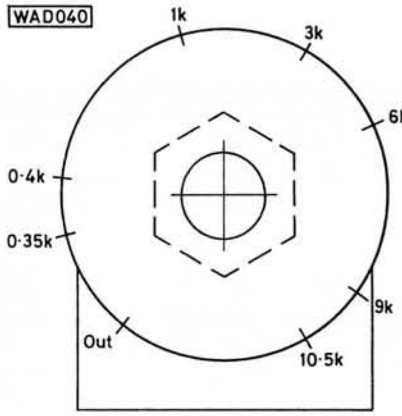


Fig. 4: Calibrated scale markings of the prototype

In Use

There are other methods of nulling unwanted heterodynes, but there are few that compete in terms of size, cost and convenience.

Operation could not be more simple; if there is an offending whistle on the audio just turn on the notch filter and tune it out. Some frequencies close to the unwanted one will suffer phase distortion and attenuation but human hearing is tolerant and capable of accepting the new sound.

If a constant note is received at some frequency on the dial, try to reveal stations by nulling it. Remember also that if you can determine the beat of adjacent stations, and one of them has been previously logged, then addition or subtraction of this beat will give an approximate frequency indication of the unknown signal. Happy listening. ●

AIR TEST

USER REPORTS ON SETS AND SUNDRIES

PLUSTRON TVR5D TV/Radio Receiver

Some months ago, whilst preparing the *PW* ATV Up-Converter project, it became apparent that a fully portable alternative to the immobile domestic TV would be of great advantage. Rapid consultations with our friends at South West Aerial Systems revealed the readily available Plustron TVR5D.

On its arrival at the *PW* offices the 5in (diagonal) screen monochrome portable created a good impression from the start. Using its own telescopic rod antenna a good u.h.f. Band V picture could be obtained from within the office from the IOW main transmitter site at Rowridge. Big deal! I hear you cry, but our office is contained within a steel framed building 3m a.s.l. and severely shadowed by a 70m high ridge, hence the recent provision of a local vertically polarised TV repeater.

Prompted by this initial success our prototype *PW* ATV Up-Converter was connected to the switched, rear mounted, Belling Lee external antenna input socket. With a $\frac{1}{4}\lambda$ 432MHz antenna feeding the Up-Converter (held at arm's length by our esteemed Editor), the figure of ATV enthusiast Nick Foot G8MCQ filled the screen.

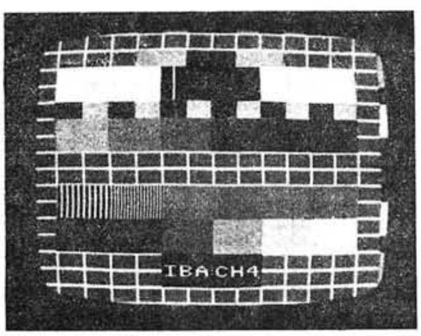
Until this point we had not referred to the supplied handbook, an indication of the straightforward operating layout, so this was next consulted to determine the extent of facilities available.

The TVR5D has a separate radio section covering the l.w. (150–250kHz) and m.w. (535–1605kHz) bands together with v.h.f. Band II (88–108MHz). Handbook figures quote sensitivities of 630µV/m, 200µV/m and 8µV respectively. Tuning of the radio section is accomplished by adjustment of a side-mounted 35mm diameter knurled knob with corresponding frequency indication provided by a calibrated drum, viewed through a front panel viewing aperture. An engraved horizontal red cursor line allows for ready resetting.

Front panel controls include three large "paddle" operated switches, providing selection of Radio/TV and their band options, in addition to a rotary volume control and l.e.d. power indicator. External user adjustable controls for the TV section, with the exception of a second 35mm side-mounted varicap tuner knob, are located on the rear apron. These presettable controls allow adjustment of the screen parameters of contrast, brightness, horizontal and vertical hold. All these controls are well within reach when in direct viewing range of the screen.

For portable operation the receiver is provided with its own telescopic rod antenna, which has a universal swivel base and may be stowed within the durable carrying handle on the top of the moulded plastics case. As mentioned previously the rear apron also contains a switch selectable external antenna socket.

A particularly good feature of the TVR5D is its ability to run from a variety of power sources. These include 240V a.c. mains, via supplied twin cord, 12V d.c. vehicle supply, via jack socket, and from either 9·6V Nickel Cadmium rechargeable pack or nine, R20 (HP2), dry cells. If the optional NiCad battery pack is installed in the base-mounted battery pod it may be charged from the in-built regulator circuit. The charge facility is selected by rear apron switch and disables the set when in use. Power consumption is quoted at 14W, making the dry cell option somewhat expensive for permanent operation.



Returning to the TV section of the TVR5D, which operates on 625-line B/G or I, coverage of v.h.f. Bands I and III (47–68MHz and 174–230MHz, channels E2–E12) and u.h.f. channels 21–69 (470–862MHz) is provided, readout being by means of an identical drum/cursor system. The handbook specifies receiver sensitivities of 20µV, v.h.f. bands I/III and 30µV over u.h.f. bands IV/V.

In use attention was principally focused on the visual side of the unit; however, the radio sections compare favourably with current portable receivers and, if nothing else, will probably assist a fair bit when trying to persuade the wife to part with the funds to purchase! Maximum audio output is rated at 580mW (400mW at 10 per cent t.h.d.), fed to either an internal 75mm speaker or 3·5mm jack socket.

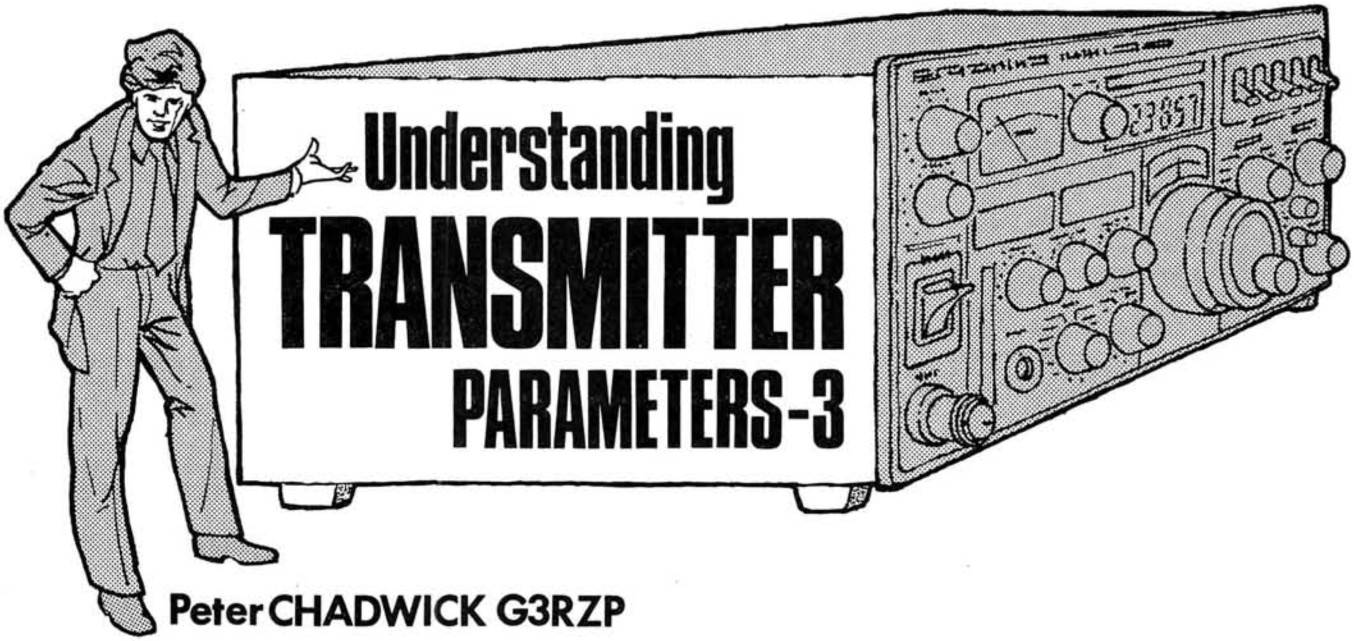
Performance of the TV section was generally found to be very good, providing a noticeable increase in sensitivity when compared with similar domestic portable and larger screen devices. When used under weak signal conditions, often encountered when receiving DX or ATV sources, the picture would lock with very low-level inputs. During lift conditions, allowing reception of western European system B/G transmissions, a rear apron switch allows selection of the appropriate 5·5MHz sound/vision intercarrier offset.

A detailed description of the many different systems employed for broadcast TV is contained within the 134 pages of the recently revised book by occasional *PW* contributor Roger Bunney entitled *Long Distance Television Reception (TV-DX) For The Enthusiast.* This book is recommended reading for the potential TVR5D purchaser, containing a wealth of practical information on antennas, preamplifiers, station identification and much more.

In conclusion the Plustron TVR5D seems to represent all things to all men. An ideal portable source of entertainment for both the away from home viewer/listener, a useful set/monitor for the potential TVDXer and Amateur TV enthusiast—and it even copes as a v.d.u. for the home microcomputer.

Thanks go to **South West Aerial Systems, 10 Old Boundary Road, Shaftesbury, North Dorset. Tel. (0747) 4370** for arranging the loan of the review unit. The TVR5D costs £96.50 inc. VAT from the above address.

John M. Fell



Understanding TRANSMITTER PARAMETERS-3

Peter CHADWICK G3RZP

This month brings us to the final section, which covers out-of-channel radiation. The badly adjusted s.s.b. transmitter is probably better at causing annoyance to other band users than the a.m. equivalent, but the author claims that "G3RZP's Law" should not be forgotten. This states that "the station interfering with your QSO does so because of a lousy transmitter, while the QSO you are accused of interfering with only suffers because of their lousy receivers"! Anyone doubting the widespread application of this law need only listen to some of the "experts" on 3·5MHz.

Adjacent channel radiation is specified for professional transmitters where fixed channels are allocated. It is obviously impracticable to have no radiation in the adjacent channel, but specifications generally attempt to obtain the best compromise between cost and the acceptable level of adjacent channel signal. For v.h.f. p.m.r. use, the adjacent channel power is required to be 55dB below the transmitter carrier, while for v.h.f. where the channel spacing is doubled to 25kHz, it is required to be −65dB rel. carrier.

The h.f. s.s.b. maritime specifications, which provide the nearest approach professionally to the amateur service, require components 3·4kHz away from the suppressed carrier in the wanted sideband to be more than 40dB below p.e.p.

Measurement of this out-of-channel radiation really requires a spectrum analyser, although as already discussed, the measurements can be made with a good receiver.

One of the questions that can arise at this stage is "where does the adjacent channel radiation come from?"

In the case of the a.m. transmitter, it is usually caused by high modulation frequencies, either as harmonics of the modulation or parasitic oscillations in the p.a. or modulator. Morse (c.w.) transmissions appear wide because of keyclicks, and s.s.b. transmitters because of Intermodulation Distortion. Frequency modulated transmitters usually "spread" because of excessive deviation, insufficient modulation frequency roll-off, or, with frequency synthesisers, because of the synthesiser.

Frequency Synthesisers

This last occurrence has become more widespread because of the popularity of the fully synthesised f.m. transceiver. In these equipments, the injection to a mixer in the transmit chain is derived from a voltage controlled oscillator (v.c.o.). This v.c.o. frequency is also divided, or mixed to a lower frequency and then divided to a comparison frequency, from whence it is routed into a phase detector. The other input of the phase detector is a reference frequency, derived from a crystal standard, and the output from the phase detector is such as to alter the v.c.o. to make the comparison frequency exactly equal to, and in phase with, the reference frequency.

Because the phase detector is effectively sampling the phase relationships between the two signals at the reference frequency, some output at this frequency exists. Although extensive filtering is used, it is very difficult to prevent some of the comparison frequency signal reaching the v.c.o. where it produces sidebands on the v.c.o. output at the reference frequency and its harmonics. Although a well designed synthesiser can have these sidebands 80dB or more down, they can well produce interference in the adjacent channel.

"Clean" signals are very hard to define; what is clean for the amateur on Benbecula or South Uist with no local activity can be very different for the amateur in London, and in recent years this has been made very clear by the increase in v.h.f. activity throughout the country. Transmitter deficiencies tend to be more noticeable at v.h.f. because of the low background noise, weak wanted signals, and directional antennas, which make localisation of offending splatter more easy.

The author's contention that maritime radio specifications are a reasonable point of comparison for h.f. amateur equipment is usually challenged on two grounds. These are by the manufacturers that the specifications are too tight, and by the technically competent users in that they are too easy! Certainly, the receiver specifications at h.f. are not only easy to meet, with modern technology, but are also inadequate for the serious h.f. operator. In terms of transmitters, however, things are slightly different. Nevertheless, it is generally accepted that the i.m.d. levels of h.f. transmitters should be no worse than −25dB on each tone of a two tone signal if undue interference is to be avoided. However, professional specifications also determine the amount of energy that can be radiated in the adjacent channel, and here there is some argument as to the applicability of such specifications to amateur radio.

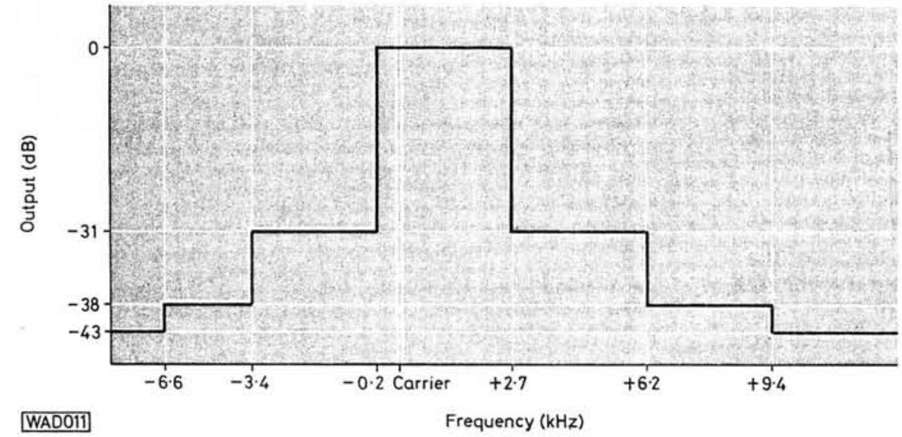


Fig. 4: Adjacent channel radiation, marine h.f. s.s.b. specification, 2-tone test with a.f. tones to give all i.p.s above +3kHz and below −200Hz relative to carrier

The amateur service is one in which the spectrum utilisation is greater at h.f. than for most other services, and bearing in mind the narrow bands and ever-increasing numbers using them, some diminution of adjacent channel radiation is needed.

Maritime radio specifications require the transmitter to be modulated with two tones, the frequencies of which are chosen to place all i.p.s more than 200Hz away in the unwanted sideband, and more than 3kHz away in the wanted sideband. The allowable energy distribution is then shown in Fig. 4. Unfortunately, the higher order linearity of the wide band, solid state final is noticeably worse than that of the comparable valved p.a., and thus the higher order i.p.s are significantly worse. This explains why careful observation on the air will show wider signals from stations using such p.a. stages. It is, of course, impracticable for the amateur to measure his transceiver, and therefore such specification limits provide only a standard of comparison, but it is not impracticable for manufacturers to design and derate sufficiently for clean signals to be obtained.

Measurements of i.m.d., as stated earlier, are usually made with a two-tone signal, and indeed, such measurements are often referred to as "Two-Tone Tests". It is very important that the two a.f. signals used are not harmonically related, as the result of such relationship is likely to give an inaccurate answer to any measurements. This is because the addition of the two harmonically related signals alters the resulting composite waveform by the Fourier Synthesis. (This is the reverse process to Fourier Analysis, where it can be shown that any complex waveform can be produced from a fundamental frequency and its various harmonics.)

Over the years, much has been written about the suppression of key clicks from c.w. transmitters. One of the best ways of determining the acceptability or otherwise of a transmitter under keyed conditions is by listening, but again the marine specification shown in Fig. 5 gives a good idea of the acceptable bandwidth occupied, while Ref. 3 gives a very good practical discussion of the subject.

Broad-band Radiation

As one moves further away in frequency from the transmitted frequency, one moves from looking at adjacent channel radiation to broad-band radiation, and it is not easy to determine exactly where the dividing line actually occurs. Broad-band radiation covers such parameters as wide-band noise, harmonics and parasitics, in addition to spurious output signals.

Wide-band noise is a phenomena which has started to become important relatively recently, mainly because of the introduction of wide-band transmitters. It manifests itself as a wide noise transmission at some level below the transmitted signal, and thus raises the noise level on channels some distance from that in use. Especially noticeable at v.h.f., it is a particular problem with repeaters and such co-sited stations. Typically, a good solid-state p.a. might have a noise floor some −120dB relative to carrier, which for a 25W carrier would be −76dBm (dB relative to 1mW into 50 ohms).

If the separation between antennas is such as to give 40dB loss between antennas, the wide-band noise is then received at −116dBm, or about 0·3 microvolts, which would raise the noise floor of a good receiver by a minimum of 10dB. When the effects of receiver reciprocal mixing are taken into account, the real loss in sensitivity can be much greater. Unfortunately, a number of home-brew rigs on 144MHz are quite bad in this respect, and the rise in the noise floor when operating 200kHz, and 8km away from a station can still be quite high.

At h.f., the problems are not usually quite so bad. This is not because the transmitters are any better, but it is unusual to attempt to operate two stations geographically so close that the antenna coupling is so low; this is especially so since simultaneous operations are almost invariably on bands separated by an appreciable portion of an octave, and most h.f. transmitters still have tuned valved p.a. stages.

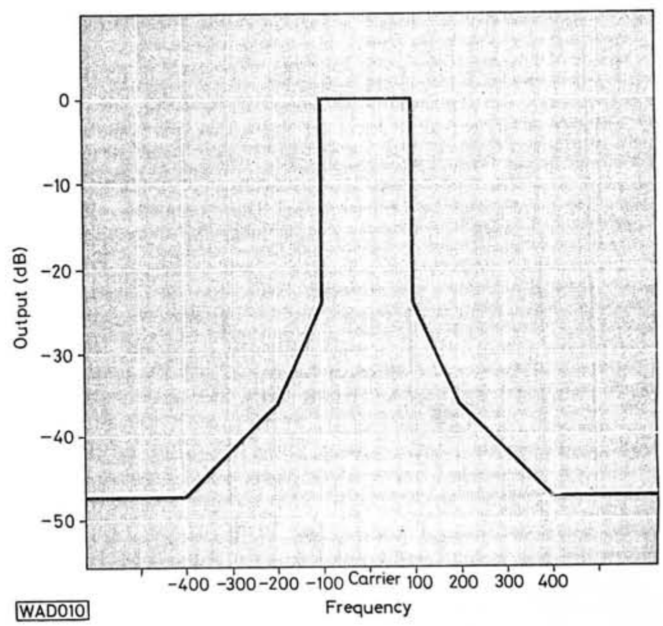


Fig. 5: Out-of-channel radiation for c.w. marine transmitters keyed at 30 bauds

Whether or not this will continue is debatable with the increased number of solid state rigs coming onto the market, and it may well be found that where an exhibition station could operate transmitters on 3·5, 14 and 21 MHz simultaneously with valved transmitters, this becomes impossible with solid-state transmitters.

Harmonic Outputs

Harmonic radiation is well known. The advent of u.h.f. TV has certainly reduced its importance for the UK amateur, but those parts of the world with a v.h.f. low-band TV service are not so lucky. For many years, the standards have been that all harmonics should be −43dB with respect to full power, but should not exceed 50mW for h.f., and −70dB without exceeding 2·5μW at v.h.f. These standards have been varied in some countries, and the h.f. requirement is not hard to meet.

Tightening up on the h.f. requirement for the transmitter alone is easier if separate filters are used for each band, as in most solid state transmitters, but the basic pi-network system will only just about meet this requirement on the second harmonic. Since wide-band antennas are not generally used by amateurs, this has not proved too much of a problem in the past, and where higher harmonic rejections have been required, such as for combating TVI, a low-pass filter has generally proved adequate.

Harmonic radiation does not seem to be much of a problem for the UK amateur these days—even from 144MHz, where both the 4th and 5th harmonics fall in the u.h.f. TV band. However, the use of a low-pass filter cutting off at about 30 to 35MHz is probably still justified, insofar as it minimises the danger of harmonic interference to broadcast, and p.m.r. and public service (Police, Fire and Ambulance) communications in the v.h.f. low band.

Parasitics

Parasitic oscillations, as they are more correctly called, can be very troublesome. At one stage, 807s and 6146s had a very bad name for suffering from them, and the QV08–100 was very difficult to cure. Parasitics are generally v.h.f. oscillations appearing in h.f. transmitters, usually because the anode and grid leads are long enough to resonate with valve and stray capacitances to form an oscillator.

The usual method of curing the problem is to place a v.h.f. choke in the anode lead, and to load the choke resistively to lower the Q of the v.h.f. circuit. Because the choke has some reactance at the upper end of the h.f. band, there can be an appreciable signal frequency voltage appearing across the choke, and the resistors must be suitably rated for this power which is then dissipated in them. It has been claimed that the use of ferrite beads is more effective, but it is interesting to note that the majority of transmitter manufacturers stick to resistors and chokes.

Another very valuable technique in parasitic suppression is to place a small resistor in series with the grid pin of the valve, and another in series with the screen grid pin. Values such as 47 ohms are common with valves of the 6146 variety, with decreasing values for higher powers. However, some care needs to be exercised, as there can be an appreciable r.f. grid current flow, which means that not only is there dissipation in the grid resistor, but considerably more drive is needed. A 6146B at 28MHz has a capacitive input reactance of some 400 ohms, and the 30V r.m.s. drive needed for full output in AB1 single tone represents some 70mA of r.f. grid current, representing about $\frac{1}{4}$ watt of dissipation in the parasitic suppression resistor. As class AB1 stages are generally considered as requiring no drive power, the possibilities of the old cry "I want more drive on Ten!" appearing can be quite high.

Parasitics in valve h.f. transmitters are best checked for by running the p.a. stage with no drive, and sufficient bias to maintain the anode dissipation within safe limits. The tuning and loading capacitors are then varied throughout their range while the anode current is carefully monitored, special attention being paid to the performance at the maxima and minima of the tuning and loading capacitors. This test should be repeated on all bands. Occasionally, l.f. parasitics occur, usually in the 100 to 300kHz region, and these are caused by the use of r.f. chokes of the same inductance in anode and grid circuits. One very old, but applicable, test is to put a small neon lamp close to the anode circuit wiring.

Parasitics at v.h.f. lead to the lamp glowing with a distinct purple tinge, while l.f. parasitics lead to a deep red colour. In addition, the v.h.f. parasitics cause the brightness to vary appreciably as the lamp is moved along the wiring, while l.f. parasitics show little change. The use of a wide-band (350MHz or more) oscilloscope will show up parasitics on a two-tone test, or often on a keyed c.w. signal. Alternatively, a wide-band spectrum analyser may be used, if available.

From the above, it may be conjectured that parasitics are not a problem with solid-state equipment. Unfortunately, this is not so, and great care is needed when building solid-state p.a. stages to avoid parasitics. These parasitics may well be of sufficient intensity to destroy transistors and thus need to be treated carefully. Especially at v.h.f., the oscillations can be dependent upon the tuning of the stage, while at all frequencies, bypassing of supply lines is important, frequently needing a number of capacitors to provide effective decoupling at all frequencies from low audio to several hundred MHz.

Modern high-gain transistors offer very high possibilities of producing oscillations, and it is unfortunate that adjustment into a wide-band 50 ohm dummy load is often unsatisfactory, as a practical antenna represents a good v.s.w.r. (hopefully!) at the working frequency, and a rising v.s.w.r. at other frequencies.

Depending on the feedback impedances of the transistor, oscillations may occur with certain v.s.w.r. loads, or even with the wrong sort of low-pass filter on the output. Having built a number of solid-state p.a. stages, the author is very dubious about commissioning such a stage without a spectrum analyser, although it is readily admitted that many people seem to manage it without apparent problems.

Spectrum Analysers

In this vein, incidentally, it should be noted that although the spectrum analyser is a very powerful tool for the equipment designer, its use does not always bring unmitigated blessings, as its capacity for revealing that which one would rather have hidden is at times embarrassing.

Varactor multipliers are capable of producing virulent spurious outputs if incorrectly tuned. Some years ago, at the RSGB Exhibition, the Post Office, as it then was, had a demonstration using a spectrum analyser of the possibilities obtainable with one of the standard amateur designs of the day.

The results were frightening! Nevertheless, intelligent use of simple test equipment can allow such a multiplier to be tuned up without too much trouble. Tunnel diode

continued on page 35▶▶▶

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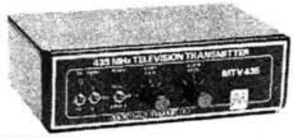

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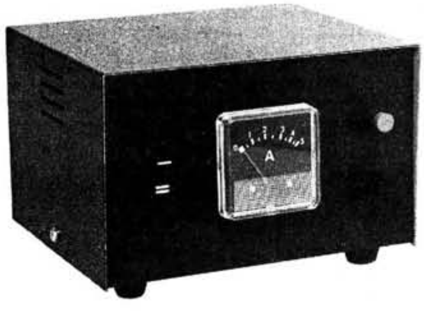

Frémark Electronics, the Melksham based power supply specialists, announce the introduction of the PSU4, a mains supplied power source providing a stabilised and regulated 13·8V d.c. which is capable of running at four amps continuously.

The PSU4 is suitable for powering portable or mobile amateur rigs, used as base stations, running at up to a typical maximum of 10W r.f. out, also it is ideal for CB base stations and 12V radio receivers, tape players and amplifiers.

An electronic current limit circuit prevents damage if the output is short circuited, also the unit is fitted with thermal shutdown to prevent overheating and internal r.f. decoupling. Crowbar overvoltage protection is fitted, which monitors the output voltage continuously, and shuts the unit down if, in the event of regulator failure, the output voltage becomes excessive, thus preventing damage to the equipment being powered. Should the overvoltage situation be of a transitory nature the shutdown will last for approximately 15 seconds, when the unit will automatically switch back on. Additionally, a moving coil meter is provided to allow the output current to be visually monitored.

An added bonus with the unit is that it can be used as an automatic battery charger for 12V batteries with the inbuilt voltage regulation circuitry preventing overcharging. When used as a charger, a 10 amp fuse must be connected between the PSU4 and the battery, to protect the crowbar shutdown thyristor.

Priced at £19·95, which includes VAT and p&p, the PSU4 is available direct from: *Frémark Electronics, Unit 1, Strattons Walk, Melksham, Wiltshire SN12 6LA. Tel: (0225) 705516.*

Antenna Noise Bridge

LAR Modules Ltd. announce the introduction of their newly designed Antenna Noise Bridge, a simple to use and very useful item of test equipment, that permits resonance and impedance tests to be carried out on antennas, feeders, tuned circuits etc.

Major features of the unit are: frequency range 500kHz to 200MHz; impedance measuring range 0 to 220Ω; powered by a 9V (PP3) battery and contained within a case measuring 96 × 85 × 70mm. Connections are via two SO239 sockets and the unit weighs 260g.

Priced at £31·00, which includes VAT, the Antenna Noise Bridge is available from dealers or direct (add £2.00 p&p) from: *LAR Modules Ltd., 60 Green Road, Leeds LS6 4JP. Tel.: (0532) 782224.*

New from Microwave Modules

Latest expansion to the range of r.f. related products from Liverpool based MM include the MML 144/100-LS, 144MHz, 12V linear amplifier. This unit has been developed to complement the upsurge in low power mobile/portable equipment. The 144/100-LS incorporates an additional stage of amplification before the final, allowing the generation of 100W of r.f. from input drive levels of 1 and 3W. The input level is switch selectable (built-in attenuation network) as are f.m./s.s.b. modes, pre-amplifier and the p.a. itself.

The integral pre-amplifier uses a 3SE88 MOSFET which provides a useful increase in receiver sensitivity. Current price is £145 including VAT and an alternative 30W output unit, the MML 144/30LS, is available at £65 including VAT.

For the 432MHz QRO station the MML 432/100, 100W linear amplifier should also be of some interest. This device requires an input of 10W for its

nominal rated output; supply requirements are quoted as 12·5V nominal at 20A for 100W.

A very comprehensive protection system has been designed-in and will guard against high v.s.w.r., thermal (over-temperature) and reverse/over-voltage. Visual confirmation is provided in respect of shutdown due to v.s.w.r. or thermal effects. In the case of high v.s.w.r., greater than 2·5:1 at the antenna socket, the amplifier will switch into a "straighthrough" mode, whilst checking for an improvement every eight seconds and returning to full power if found. The MML 432/100 is available at the VAT inclusive price of £228·65.

Into Amateur TV (ATV) yet? The MMC 435/600 is a ready-built 435MHz up-converter providing ATV inputs when fed from a suitable antenna, to an unmodified domestic television receiver. Price is £27·90 including VAT.

The MTV 435 is a high performance ATV transmitting system consisting of dual-channel exciter, video modulator and two stage 20W linear amplifier. Video bandwidth is suitable for both colour and monochrome and a test waveform generator is built-in. The price is £149 including VAT.

Details of these and the remaining items within the extensive range of products are contained in the 1982 catalogue, which is available at a post inclusive price of £0·40 from: *Microwave Modules, Brookfield Drive, Aintree, Liverpool L9 7AN. Tel: 051-523 4011.*

The April 16 Schedule Revision

The London Gazette Notice in full

WIRELESS TELEGRAPHY ACT 1949

To All Holders of Amateur (A) Licences and Amateur (B) Licences

The Secretary of State for the Home Department hereby gives notice that, as from the date this notice is published, all licences, as amended from time to time of the above types currently in force shall be and are hereby varied by the deletion of the Schedule thereto and the substitution of the following:

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, F3F, G3F) may be used in this band.
11. Facsimile Transmission (A3C, F3C, G3C) 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. Since high intensities of RF radiation may be harmful, the following safety precaution must be taken: in locations to which people have access, the power density on transmit must not exceed the limits recommended by the competent authorities. Currently this limit is 10 mW/cm^2.
18. Data transmission may be used within the frequency bands 144 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.

A. DC input power is the total direct current power input to (i) the anode circuit of the valve(s) or (ii) any other device energising the antenna.

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 Side Band suppressed carrier emissions are permitted within the terms of this licence.

D. 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 or frequencies, or by on-off keying of the modulated emission.
- A3E Telephony, double sideband.
- A3C Facsimile Transmission.
- H3E Telephony using single sideband full carrier, amplitude modulation.
- R3E Telephony, single sideband, reduced carrier.
- J3E Telephony, single sideband, suppressed carrier.
- A3F/C3F Slow scan television and 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 frequency shift keying without the use of a modulating audio frequency.

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Frequency Bands in MHz	Footnote No.	Power Limitations		Classes of Emission (see C and D overleaf)
		Carrier Power supplied to the Antenna	Peak Envelope Power supplied to Antenna for SSB Operation	
1·81 – 1·85	2	9 dBW	15 dBW	A1A
1·85 – 2·0	2 and 4			
3·5 – 3·8	2, 9, 11 and 16	20 dBW	26 dBW	A1B
7·0 – 7·1	9, 11, 12 and 16			
,10·1 – 10·15	1 and 16			A2A
14·0 – 14·25	9, 11, 12 and 16			
14·25 – 14·35	9, 11 and 16			A2B
21·0 – 21·45	9, 11, 12 and 16			
28·0 – 29·7	9, 11 and 12			A3E
70·025– 70·5	1 and 3	16 dBW	22 dBW	R3E
144·0 – 146·0	9, 11, 12, 16 and 18	20 dBW	26 dBW	
430·0 – 432·0	1, 6, 7 and 18	See f/note 7	See f/note 7	H3E
432·0 – 435·0	1, 10 and 18	20 dBW	26 dBW	
435·0 – 438·0	1, 10, 14 and 18			J3E
438·0 – 440·0	1, 10 and 18			F1A
Frequency Bands in MHz	Footnote No.	Maximum DC input power (see A and B overleaf)	SSB Operation	F1B
1,240·0 – 1,260·0	1, 10, 17 and 18	150 watts	26 dBW	
1,260·0 – 1,270·0	1, 14, 15, 17 and 18			F2A
1,270·0 – 1,325·0	1, 10, 17 and 18			
2,300·0 – 2,400·0	1, 10, 17 and 18			F2B
2,400·0 – 2,450·0	1, 10, 13, 14, 17 and 18			
3,400·0 – 3,475·0	1, 17 and 18			F3E
5,650·0 – 5,670·0	1, 10, 13, 14, 15, 17 and 18			G1A
5,670·0 – 5,680·0	1, 10, 17 and 18			
5,755·0 – 5,765·0	1, 10, 17 and 18			G1B
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			G2A
10,000 –10,450	1, 10, 17 and 18			
10,450 –10,500	1, 10, 13, 14, 17 and 18			G2B
24,000 –24,050	8, 10, 12, 17 and 18			
24,050 –24,250	1, 8, 10, 17 and 18			G3E
2,350·0 – 2,400·0	1, 5, 13, 17 and 18	25 watts mean power and 2·5 kilowatts peak power		K1A L2A K2A L3E K3E M2A Q2A V2A
10,050 –10,450	1, 5, 17 and 18			
5,755·0 – 5,765·0 5,820·0 – 5,850·0	1, 5, 13, 17 and 18			

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

Phase Modulation

G1A	Telegraphy by phase shift keying without the use of a modulating audio frequency.
G1B	Automatic telegraphy by phase shift keying without the use of a modulating audio frequency.
G2A	Telegraphy by on-off keying of a phase-modulating audio frequency or frequencies, or by on-off keying of the phase-modulated emission.
G2B	Automatic telegraphy by on-off keying of a phase-modulating audio frequency or frequencies, or by on-off keying of the phase-modulated emission.
G3E	Telephony.
G3C	Facsimile Transmission.
G3F	Slow Scan television and high definition 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.
K3E	Telephony, amplitude modulated pulses.
L3E	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 pulsed carrier —the audio frequency or frequencies modulating the angle of the carrier during the pulses.
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.

CLASSIFICATION 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.

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 (e.r.p.)* (in a given direction): The product of the power supplied to the antenna and its gain relative to a half-wave dipole in a given direction.

EXCEPTING THAT HOLDERS OF AMATEUR (B) LICENCES ARE NOT PERMITTED THE USE OF RADIO FREQUENCIES BELOW 144 MHz OR THE USE OF A1A, A1B, A2A, A2B, F1A, F1B, F2A, F2B, G1A, G1B, G2A, G2B, K1A, K2A, L2A, M2A, Q2A and V2A TRANSMISSIONS.

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

Dated this 19th Day of March 1982.

The April 16 Schedule Revision

~An Analysis by G3GSR

The above schedule replaces that published in the *London Gazette* of 12 February, 1982. Comparing this latest schedule with the UK Amateur Licence as it existed prior to February 12, the following appear to be the main changes:

1. Power limitations on most bands are now stated in terms of Carrier Power and Peak Envelope Power, and given in dBW, that is level in decibels relative to a watt. Approximate conversions from dBW to watts are as follows:

9dBW = 8W	20dBW = 100W
15dBW = 32W	22dBW = 160W
16dBW = 40W	26dBW = 400W

2. Classes of Emission are given in the new international code. See *All Change!,* page 24 of our August 1981 issue for full details.

3. The spot aeronautical frequencies in the 144·0–146·0MHz band have been deleted.

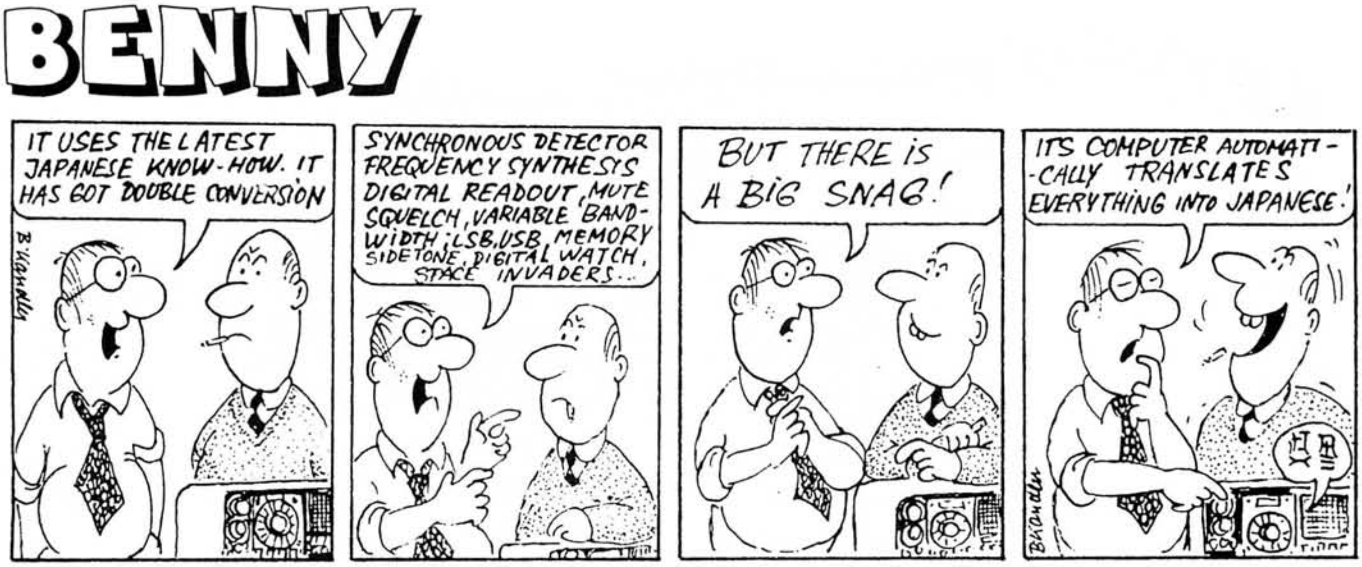
4. Facsimile transmission now has a bandwidth limit of 6kHz imposed.

5. The band 1·8–1·81MHz has been lost to amateurs, but 1·81–2·0MHz is now shared on an equal footing with other users, rather than the amateurs being secondary users as before.

6. A new band 10·1–10·15MHz has been allocated to amateurs on a *secondary-user* basis.

7. Amateur satellite communications have new frequency allocations under certain restrictions in the 1260·0–1270·0, 2400·0–2450·0, 5650·0–5670·0, 5830·0–5850·0 and 10450–10500MHz bands.

Continued opposite ▶



TRANSMITTER PARAMETERS—3

▶▶▶continued from page 28

amplifiers are not very common these days, and this is perhaps a better thing than many people realise, in view of the ability of a simple tunnel diode amplifier to oscillate at five frequencies at once, all the way from 25Hz to 3·5GHz!

Transverters

Spurious outputs are problems that are generally avoided by the average amateur. The occasional transverter design has problems which are caused purely by ignorance. For example, consider a transverter from 3·5MHz to 1·8MHz. If a 5·5MHz crystal is used, then an input frequency of 3·5MHz will produce an output frequency of 2MHz and an input of 3·7MHz will produce an output of 1·8MHz. Simultaneously, the mixing process will produce an output from (2 × 3·5) − 5·5, which is 1·5MHz, becoming (2 × 3·7) − 5·5, which is 1·9MHz. Thus a signal is produced which moves in the opposite direction to the wanted signal as the input frequency is varied, and cannot be removed by means of tuned circuits. A similar effect appears on 144MHz transverters from 28MHz, wherein (2 × 116) − (3 × 29) gives an output on 145MHz for the spurious, and 145MHz for the wanted signal.

Fortunately, because of the high order of the spurious, provided the mixer is not overdriven, it is possible to keep the spurious at a suitably low level. Nevertheless, the well sited high power 144MHz station may well put out one or two spurii of this nature which are detectable for some distance, and it should be realised that such do exist and can cause trouble.

Ideally, a station running full legal power on 144MHz should have such spurii attenuated by a minimum of 70dB, and even this will mean the spurii are at a power of 40 microwatts. Naturally, there is no point in suppressing such spurii below the wide-band noise floor of the transmitter, but they should be as low as possible if they are not to cause annoyance to other local operators.

This article may seem to be over-critical of the solid-state p.a., and no apology is made for this. Wide-band solid-state p.a. stages are generally less efficient in converting d.c. to r.f., and can be much more difficult to tame and keep clean than valved p.a. stages. They have their own difficulties in design, but provided the problems are realised and taken note of, very good transmitters are possible. The lengths necessary to obtain really good i.m.d. performance are justified in terms of pollution of the r.f. spectrum, but generally lead to too high a cost to be attractive to the amateur. The advent of power m.o.s. devices capable of handling r.f. powers produces a different set of problems, but generally show promise of performance better than that available from present-day bipolar techniques. The Polar Loop system of s.s.b. generation promises solid-state transmitters of a cleanliness not previously thought possible, and this is all to the good.

The aim has been to bring home to the average reader some of the parameters of h.f. and v.h.f. transmitters that are important in minimising interference to other users, and to give some idea of how the measurements are made, and the levels that should be looked for. ●

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8. The upper limit of the 70MHz band has been lowered to 70·5MHz. Other conditions remain unchanged.

9. The various s.s.b. modes of emission can now be used in the 430·0–432·0MHz band, as well as in the remainder of this band from 432·0 up to 440·0MHz.

10. The former band 1215·0–1325·0MHz is now limited to 1240·0–1325·0MHz. The sections in which high-definition television can be used are changed.

11. Two segments of the band 5650·0–5680·0MHz are no longer available to the amateur service.

12. A footnote on safety precautions at microwaves has been added.

Discussions between the Home Office and the RSGB are continuing, in an effort to produce a simplified and more easily understood form of schedule, and to overcome certain problems relating to the Amateur (B) Licence. Because of the way in which the new emission codes are drawn up (there is no distinction between Morse code and other telegraph codes), the wording of the final paragraph of the *Gazette* announcement precludes (B) Licensees from using RTTY or data transmission. We understand that this was not the intention of the Home Office.

Rather more esoteric is the lack of any emission code permitting the amateur to transmit composite vision and sound signals when using high-definition television.

It is hoped that the simplified schedule may be ready later in 1982, possibly as part of a revised amateur licence.

Radio SPECIAL PRODUCT REPORT

TRIO/KENWOOD TS-530S HF TRANSCEIVER

I. H. Crowther G3KLF

The TS-530S was purchased to be the author's main h.f. rig after much consideration of all the alternative equipments and their relative prices and capabilities.

The 530 is a single-conversion transceiver. In transmission, an s.s.b. signal generated at 8·83MHz is mixed with the phase-locked-loop local oscillator output to produce the final transmission frequency. The circuitry is hybrid, using valves in the driver (12BY7A) and final stage power amplifier (6146Bs). The p.l.l. circuit generates a heterodyne frequency for each band and a counter reference signal from a single crystal oscillator (10MHz). The 530 incorporates an i.f. shift circuit, VOX, c.w. with semi-break-in and sidetone, speech processing, noise blanker, crystal calibrator, etc.

At a current price of around £530 including VAT, it appears to be good value for a transceiver covering all the amateur bands from 1·8 to 28MHz including the three new WARC bands, requiring only the purchase of a microphone, and a suitable antenna to go straight on the air.

The accessories provided with the rig are as follows: Instruction manual, speaker jack-plug, 7-pin DIN plug, spare 4A fuse and two plastics extension feet, which can be fitted to tilt the front panel upwards. It is highly recommended that owners contemplating their own servicing, or modifications, when the warranty has expired, should purchase a copy of the TS-530 Workshop Manual at £10 including VAT and postage, as the instruction manual mainly refers to the operation of the transceiver rather than to detailed descriptions of the circuits involved.

Optional accessories available include analogue v.f.o., digital v.f.o., a.t.u. with s.w.r./power meter and antenna selector switch, external speaker with built-in audio filter, linear amplifier, 1·8kHz s.s.b. filter and 500Hz and 270Hz c.w. filters.

The 530 is finished in two-tone silver grey, with a light cabinet and dark front panel. The cabinet can be removed in two halves, i.e. upper and lower, to provide access to the internal wiring above and below chassis level. A carrying handle is fitted at one end with additional feet at the opposite end so that the rig can be safely stood on one end for tests, servicing, etc. A speaker is built in to the top of the cabinet, and a very quiet fan is used to cool the r.f. output stage.

The photographs show that the front panel controls are neatly laid out and are easy to use. The operating frequency is indicated on a digital display with a resolution to 100Hz, and an analogue scale on the main tuning knob is graduated at 1kHz intervals. The internal v.f.o. allows the main tuning to cover 500kHz sections with an additional 50kHz both above and below obtainable by tuning to the extremes of the dial.

A multi-function meter is fitted which has the following capabilities: 1. "S" units to 40dB over S9 on receive. 2. ALC—monitors r.f. feedback from TX final. 3. IP—monitors anode current in TX final. 4. RF—monitors relative r.f. output power. 5. HV—monitors d.c. volts on TX final.

The i.f. shift is noteworthy, being Trio's method of tuning out interfering signals close to the wanted signal by moving the i.f. bandpass about the centre frequency by ±1·2kHz. This is controlled from the front panel. An r.f. attenuator (20dB) is also controlled from the front panel as is the built-in VOX and a.f. speech processor. RIT and XIT (Receiver and Transmitter Incremental Tune) are provided, as is a variable noise blanker.

The rear panel carries the cooling fan for the TX final 6146Bs, the r.f. volts control (to set relative readings on the meter), and the bias control to adjust the standing current through the TX final valves. A switch is provided to turn off the screen grid d.c. volts during neutralisation of the TX final, required whenever the 6146s are changed. A key jack socket, anti-VOX control, speaker jack, external v.f.o. connector, a remote connector for control of a linear amplifier, and finally a mains voltage selector giving options of 220 or 240V a.c. complete the rear panel features. Other supply voltages are catered for by internal straps on the mains transformer. Certain adjustments are accessible through small holes in the bottom of the cabinet. These are side-tone level adjust, standard oscillator adjust, carrier adjust (USB, LSB, CWT), i.f. shift adjust. The CWT control is used to adjust an 800Hz c.w. offset.

Transmitter Tests

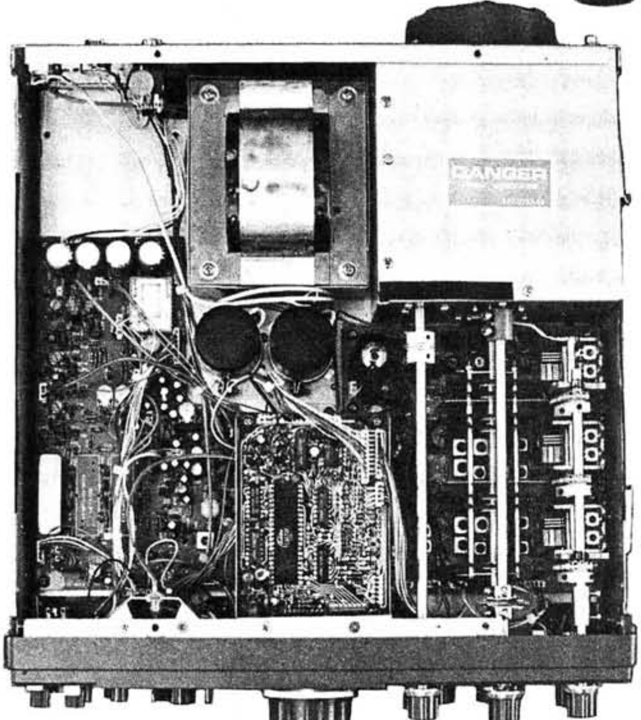
The r.f. output power obtained on each band, using the test set-up shown in Fig. 1, is given in the table. The d.c. to r.f. conversion efficiency of the output pair of 6146Bs was typically 69 per cent. The final stage h.t. supply, measured on the front panel meter, was 900V at switch-on, before the valves warmed up. After warm-up, with 60mA standing current, the supply was 850V, falling to 775V on c.w. full power key down (250mA). This represents a 9 per cent drop, which is extremely good from a relatively small power transformer, which is also used to supply 100V a.c. to the cooling fan.

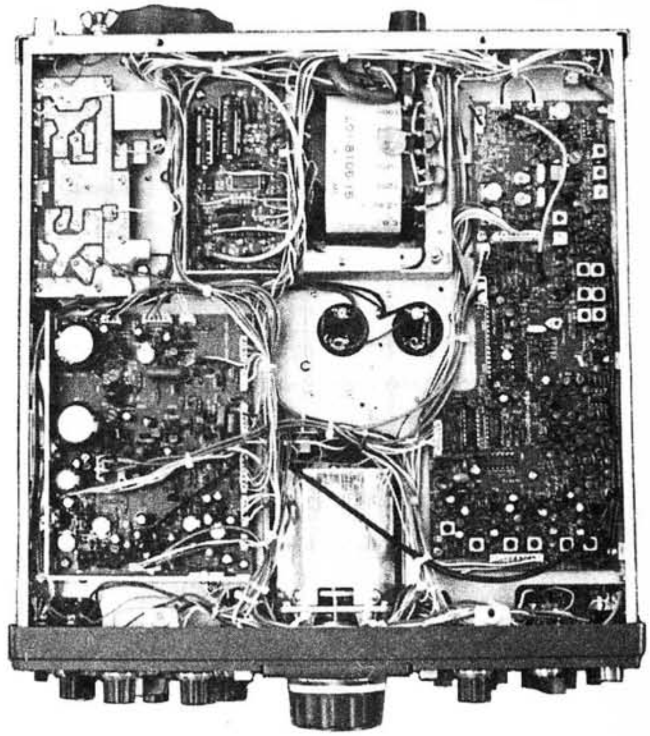
Using the same test set-up, a check was made on the accuracy with which the transmit frequency could be set, using the TS-530's digital display. Because the least significant digit is 100Hz, this is in some ways only a test of the operator's ability to judge the mid-point of the range over which each final digit is lit. However, it was found that a repeatable reset accuracy of at worst about 50Hz could be achieved.

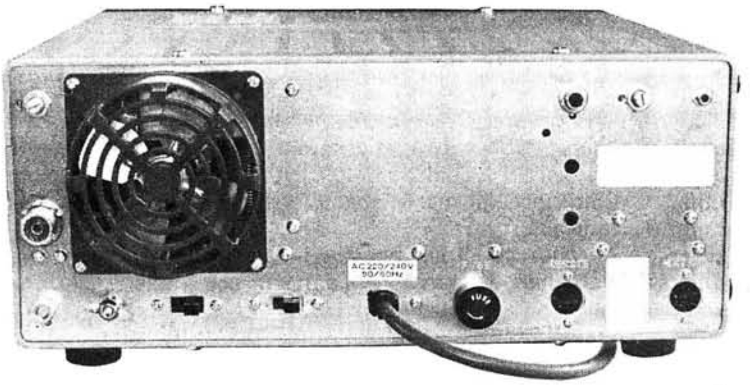
Replacing the frequency counter in Fig. 1 by a spectrum analyser, checks were made for harmonic and spurious outputs, and again the results are shown in the table. No spurii were observed above 70MHz.

Radio SPECIAL PRODUCT REPORT

TRIO/KENWOOD TS-530S







The photographs above show the internal layout of the transceiver, viewed from above (left) and below (right)

Receiver Tests

The test set-up of Fig. 2 was used to produce the sensitivity figures shown in the table. As an interesting test, the signal generator level was reduced until the carrier was just copyable above the basic receiver noise to simulate a very weak c.w. station (on 21·2MHz). The level was found to be 0·035μV, i.e. −136·3dBm, indicating exceptional sensitivity. Selectivity measurements at 3·7MHz using the same arrangement, tuning the generator across the receiver passband, produced a figure significantly narrower than that specified by the manufacturer, possibly due to different measurement techniques.

The workshop manual describes the adjustment procedure for the "S" meter circuit, involving two pre-set potentiometers. It specifies that S9 should be achieved with

Radio SPECIAL PRODUCT REPORT

★ specifications

Frequency coverage:	1·8–2·0MHz (160m) 3·5–4·0MHz (80m) 7·0–7·3MHz (40m) 10·1–10·15MHz (30m) 14·0–14·35MHz (20m) 18·068–18·168MHz (17m) 21·0–21·45MHz (15m) 24·89–24·99MHz (12m) 28·0–29·7MHz (10m)
Types of emission:	A1A (c.w.) J3E (u.s.b./l.s.b.)
Power input:	A1A 180W d.c. J3E 220W p.i.p.
Carrier suppression:	Better than 40dB
Unwanted sideband suppression:	Better than 50dB
Spurious output:	Better than −60dB
Harmonic output:	Better than −40dB
Frequency stability:	Within 1kHz during the first hour after 1 minute of warm-up. Within 100Hz during any 30-minute period after warm-up
Antenna impedance:	50Ω, unbalanced
Receiver sensitivity:	0·25µV for 10dB (S + N)/N
Receiver selectivity:	2·4kHz at −6dB, 4·2kHz at −60dB with standard filter
Receiver i.f.:	8·83MHz
Image rejection:	Better than 60dB
I.F. rejection:	Better than 70dB
Audio output:	1·5W into 8Ω
Power requirements:	120/220/240V a.c. 50/60Hz 27W receive (heaters off) 295W transmit
Dimensions:	133 × 333 × 333mm
Weight:	12·8kg

a signal generator input of 40dBµV, i.e. 100µV. The actual value measured of 94µV is very close, and at 14·175MHz the "S" meter reading was only 2dB high.

A useful check for owners not having access to an accurate signal generator, but nevertheless wishing to form an idea of the continuing performance of their receiver, is to use the internal calibration oscillator as a generator, keeping a note of the "S" meter readings for each band. The r.f. gain control should be set to maximum, the DRIVE control peaked, and the r.f. attenuator switched out. Using this technique, readings between 7 and 9 were obtained on the various bands.

The residual noise level was measured with the antenna socket terminated in 50Ω, and the r.f. and a.f. gain controls at maximum. This was found to be 200mW at the rear-panel loudspeaker jack, and 50µW at the headphone socket (a series limiting resistor is included in the wiring to the headphone socket). Investigation revealed this noise to be coming from the r.f. stage of the receiver, though it should be borne in mind that it is a relative thing, since a c.w. signal of 0·035µV can be copied at maximum gain settings.

Using a similar test set-up (i.e. input terminated in 50Ω), the TS-530 was slowly tuned through the full frequency range covered, keeping the DRIVE control peaked at all times. No internal spurii capable of moving the "S" meter needle were found. Very weak signals were heard at 10, 20 and 30MHz, just above the noise level, obviously originating from the 10MHz standard oscillator used in the p.l.l. circuit. These signals correspond to an input signal level around 0·05µV, and were not considered detrimental as they all lay outside amateur bands.

Impressions

The TX-530S is mechanically strong, with no trace of cabinet flexing. The front panel is diecast and is extremely rigid, the rear panel is of heavier gauge than the main cabinet and is also very strong for its purpose. The cooling fan runs slowly and quietly.

On removing the top cover, the first impression was that it looked a bit untidy and cluttered, with connecting wires everywhere. This may be because the writer has become used to seeing vertical plug-in boards with interconnecting cables running beneath them, generally out of sight. Having said that, it is felt that more thought could have gone into tidying up the connecting cables by greater use of lacing, cable-ties or spiral plastics cable-wrap.

The plug and socket connections however do make a very solid connection, and it is thought that very little trouble should stem from them once a check has been made that they are all firmly seated.

The front panel controls all function easily, smoothly and well. The noise blanker is effective on ignition type noise but excessive setting of the threshold level control should be avoided as this causes severe cross-modulation problems at night on frequency bands up to 7MHz.

The VOX and the associated anti-trip work well, the only criticism being that the antenna change-over relay is a bit noisy in operation. The a.g.c. is completely satisfactory, with well-chosen time constants for the fast and slow alternatives. It is also useful to have the option of switching off the a.g.c. entirely if required, e.g. on very weak signals.

The c.w. sidetone level is affected by the setting of the AF GAIN control. This is annoying as the positions of RF and AF GAIN controls vary a lot according to the band in use, time of day, etc. It would be better if the sidetone level remained fixed once the associated pre-set has been adjusted to a satisfactory level.

When good-quality headphones, such as stereo types with their extended bass response, are used, a low-level mains hum is discernible. This is not apparent on the built-in speaker.

The a.f. speech processing seems to have little effect on the lower bands, although DX stations on the higher frequencies seem to prefer its use. Speech quality reports are very good, and checks made with G4LQO, also using a TS-530S, yielded useful information regarding operation with different types of microphone, which generally seemed to favour the use of fairly high-impedance mics (around 15kΩ) rather than low-impedance (around 500Ω). Microphones tested included a Shure 444D (switchable high/low), Shure 401A (low) and Trio MC30S (low). The

★ test measurements

TRANSMITTER

Output power in A1A (c.w.) mode:

Band (MHz)	Max. output (W)	Band (MHz)	Max. output (W)
1·8	125	21·0	125
3·5	140	24·5	130
7·0	130	28·0	125
10·0	135	28·5	125
14·0	135	29·0	125
18·0	125	29·5	130

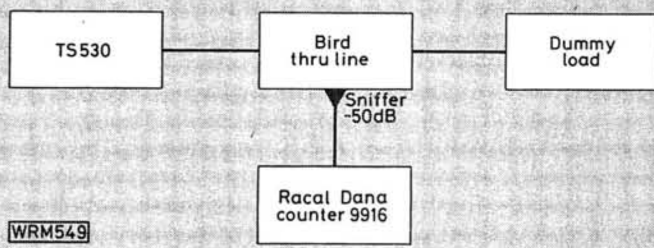


Fig. 1: Transmitter test set-up. For checks on harmonic and spurious outputs, and on carrier and sideband suppression, the counter was replaced by a Hewlett Packard 8565A spectrum analyser

Harmonic & spurious outputs: (Transmitter operating on 10MHz band)

Frequency (MHz)	dB down "Tune" (25W)	dB down A1A (135W)
10	0	0
20	46	45
30	68	69
40	—	—
50	75	75
60	—	—
70	—	76

Carrier suppression: 56dB
Unwanted sideband suppression: 50dB

—Nothing visible on analyser display

RECEIVER

Sensitivity: μV p.d. input for 10dB (S+N)/N

Frequency (MHz)	Input	Frequency (MHz)	Input
1·8	0·15	21·2	0·19
3·75	0·17	24·9	0·11
7·05	0·14	28·25	0·17
10·125	0·23	28·75	0·16
14·2	0·19	29·25	0·16
18·1	0·19	29·75	0·17

I.F. rejection: 84dB
Image rejection: 69dB on the 21MHz band
Frequency drift: +500Hz max. over 3 hours after 4-minute warm-up. (21·48MHz)
A.G.C.: Threshold 1·58μV p.d. Output change for 80dB input change relative to 1μV: 3·3dB

Selectivity: 1·2kHz at −3dB, 1·9kHz at −6dB, passband ripple less than 0·5dB

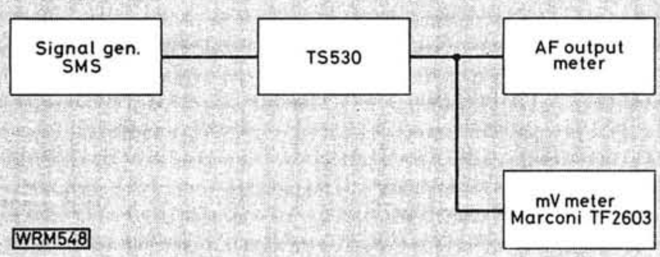


Fig. 2: Receiver test set-up. The signal generator was by Rohde & Schwarz, the a.f. output meter was a Marconi TF1065

"S" meter calibration: Checked at 21·2MHz

Meter reading	Input (μV p.d.)	Meter reading	Input (μV p.d.)
1	1·8	8	33·0
2	2·1	9	94·0
3	2·5	+10dB	369·0
4	3·1	+20dB	1·57mV
5	4·4	+30dB	6·28mV
6	7·2	+40dB	19·80mV
7	14·7		

Audio output: 2W max. undistorted. Over 3W for 10% distortion (3 Ω loudspeaker) 30mW into 3Ω (headphones)

MC30S is the type normally supplied for use with the TS-530S, though the handbook specifies that any input impedance from 500Ω to 50kΩ will suit this transceiver. It does stress that microphones having an output level greater than −50dB to −60dB should be attenuated to allow correct operation of the a.l.c. and compression. All the above tests were carried out at the recommended half-way position of the mic gain control, with the processor off.

Reports on the c.w. note and keying characteristics are also good, as one would expect from a transceiver in this price range, but it should be noted that the keying line is at −65V, which could damage some electronic keyers.

continued on page 60▶▶▶

NEWS NEWS NEWS

Computer Experiment—Phase II

Jonathan Marks, producer of Radio Nederland *Media Network,* has provided further details of their on-going "on-air" computer experiments.

Results of the second test, on 28 January 1982, are still being processed but data from the first test has revealed useful information. Over 76% of successful participants are located within a "single hop" of one of the three transmitter station sites (main centre Lopik in the Netherlands, relays are located on the islands of Madagascar and Bonaire, Dutch Antilles).

The traditional "simple" theory of the ionosphere acting as a mirror for broadcast s.w. signals is shown to be inappropriate (inadequate) when digital information is being passed. Phase changes of the signal occur due to reflection from different layers within the ionosphere, resulting in corrupted data and the failure of the computer to load the received information.

Radio Nederland has developed, in conjunction with contributors to their HOBBYSCOOP programme, a standard code for use with machines using BASIC.

The user first loads a translation program into his home computer and can then compile programs using the HOBBYSCOOP BASIC-CODE, storing on cassette or floppy disc in the usual manner. At the time of writing, 13 machines can use this code system, including Apple, NASCOM, PET, TRS-80 model 1, Level II or III and VIC-20. Unfortunately, the ZX-81 is not compatible because of insufficient capacity.

The HOBBYSCOOP CODE is designed so that the computer will read the entire program without aborting should it fail to read a portion of the data being fed in. In most cases the result will be the printing of an incorrect character in the listing, which generally can be corrected by the user.

Further details of the HOBBYSCOPE CODE and information on future broadcast experiments are available, in return for 1 IRC (obtainable from main post offices), from: *Jonathan Marks, Producer Media Network, English Section, Radio Nederland Wereldomroep, P.O. Box 222, 1200JG Hilversum, Netherlands.*

New Microwave Beacon

A new microwave beacon GB3NWK, transmitting on 1296·81MHz, became operational on 7 March, 1982. Located at Chelsfield, near Orpington, Kent, it is located on the site previously occupied by the 432MHz (70cm) repeater GB3NK, which is 160m above sea level. GB3NK moved to Wrotham in 1980.

General specifications of GB3NWK are as follows: the beacon emits 80W e.r.p. (4W drive) using a single 15 over 15 slot-fed Yagi mounted 6·1m above ground level and beaming WNW. It is planned to reposition the antenna 11m a.g.l., together with an additional antenna beamed in another direction. The beacon keyer generates the following call "GB3NWK AL51B Chelsfield" every 40 seconds; further plans exist to upgrade the keyer unit, employing a microprocessor system which will allow varied sending sequence and the possibility of RTTY information to be sent.

The beacon keeper Alan Grove G8BJG, QTHR, would welcome all reception reports and would like to thank Wood and Douglas, Quartslab Marketing Ltd., G8CIU, G4GLN, G8CTT, G4EGU, G3TAA, G8JNZ and G8GGP for their invaluable support and also many thanks to Jerry Wing for his generous help in supplying the group with accommodation for the beacon.

Vintage Servicing

Douglas Byrne G3KPO of the National Wireless Museum at Arlington House, Ryde, IOW, has informed me that he has now available a very large collection of old service sheets, manuals and technical literature. The gen also deals with tape recorders and TV sets going back to the days before the arrival of transistors and i.c.s. Should any reader be searching for information on a piece of antique equipment they may contact Douglas by ringing him on Ryde 62513. This service is absolutely free.

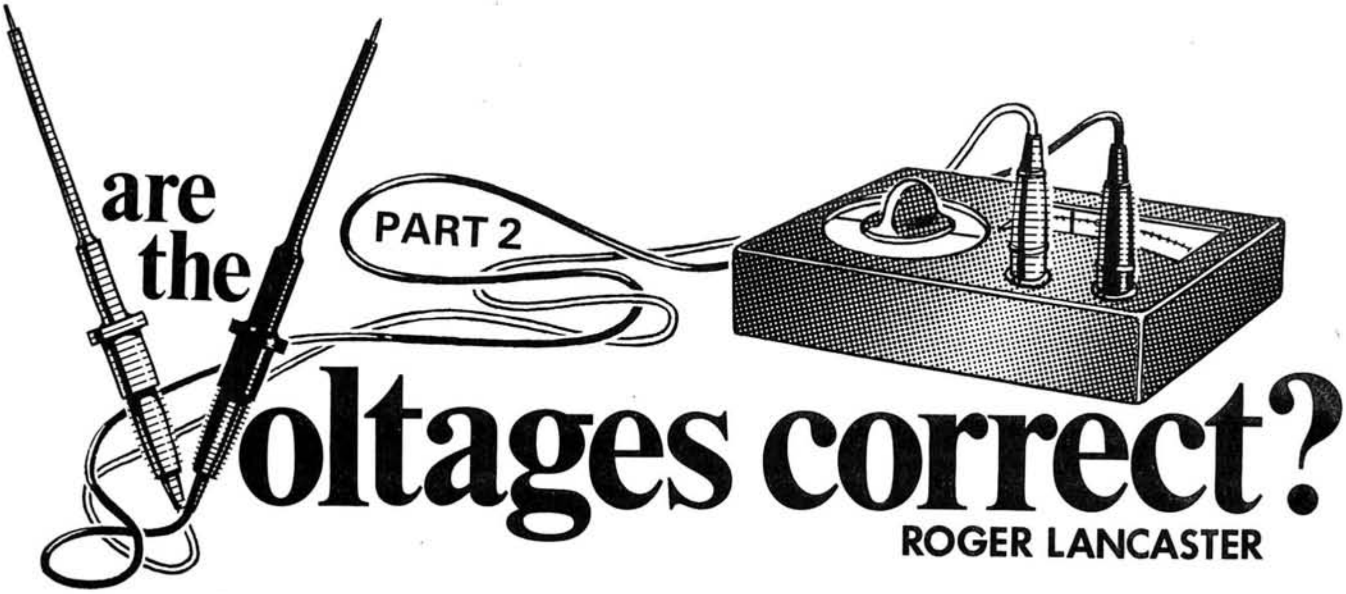
Equipment Stolen from Gemini Communications

Last month in News I mentioned the burglary at Gemini Communications, below is a list of serial numbers and other details of the stolen equipment.

MAKE	MODEL	SER. No.	COMMENTS
Yaesu	FRG-7	G330405	No mic. No power lead. No instructions.
Sommerkamp	FT-780	1E020256	No mic. No power lead. No instructions.
,,	FT-207	01093626	No cover for box. No instructions.
,,	FT-208	1H032693	No cover for box. No instructions.
,,	FT-708	1F020906	No cover for box.
,,	FT-725	09050079	No box/mic/lead/mobile mount.
,,	FRT-7700	1K041686	No box.
,,	FT-277ZD	OD100826	FM Mk III. No mic. No mains lead.
,,	FT-227RA	IF250131	No mic. No d.c. lead.
,,	FT-202	???	No NiCads. 3 channels only.
,,	FP-12	???	Complete.
,,	MT-155	???	Marine transceiver, 2 channels fitted. No box. No manual. No mobile mount.
,,	TS-788DX	???	Complete.
,,	FT-207	???	No manual. Faulty internal mic. Very dim l.e.d. display. No charger.
,,	FT-767DX	???	No power lead.
,,	FT-902DM	???	No mains lead/box/manual/d.c. lead.
Sun	402	???	CB transceiver. No mic.
Sensound	Auto-scanning receiver. VHF, 10 channels. No charger/xtals.		

Any information should be sent to Bolton CID at Middle Hulton station or to Gemini Communications.

More News on page 57



are the Voltages correct?

PART 2

ROGER LANCASTER

In all the examples of calculating potentials in series resistance circuits in last month's issue, the "0V" reference point was always part of the circuit in which we were interested. This will not always be the case. See Fig. 2.1 for an example of this.

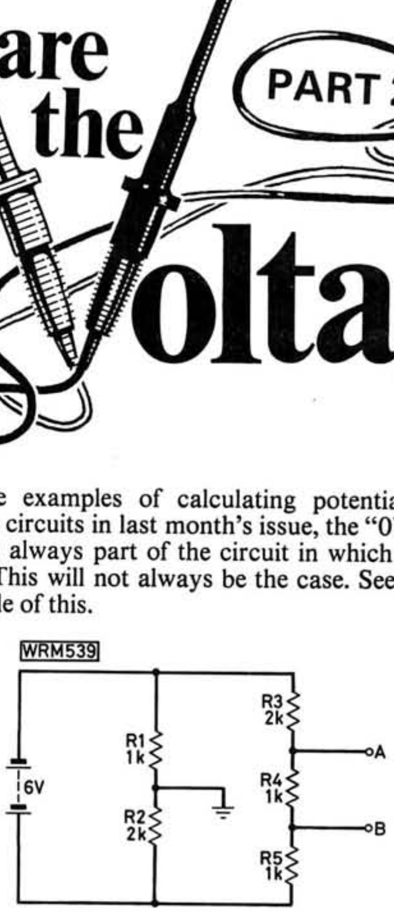


Fig. 2.1

Suppose we wish to know the potentials at "A" and "B" (with respect to earth, as this is the obvious reference point). The series circuit R3, R4 and R5 does not include the reference point. We know that there is 6V across this circuit so we can work out the voltages across each of the resistors:

$$V_{R3} = \frac{2}{4} \times 6 = 3V$$

$$V_{R5} = V_{R4} = \frac{1}{4} \times 6 = 1{\cdot}5V$$

To find the potentials at "A" and "B" we first have to find the potential at the top end of R3 and the potential at the bottom of R5. We can do this by looking at the series circuit which does include the reference point. The voltage across the circuit is the same 6V as before. Voltages across R1 and R2 can be calculated:

$$V_{R1} = \frac{1}{3} \times 6 = 2V$$

$$V_{R2} = \frac{2}{3} \times 6 = 4V$$

So the **potential** of the top line of the whole circuit is −2V and the potential of the bottom line is +4V.
Using this information:
Potential at "A" $= -2 + V_{R3} = -2 + 3 = \mathbf{+1V}$
Potential at "B" $= +4 - V_{R5} = +4 - 1{\cdot}5 = \mathbf{+2{\cdot}5V}$

Fortunately, we are not usually faced with such a problem in practice. The 6V battery and the R1, R2, earth part of the circuit would be incorporated in the equipment's power supply and the top and bottom lines of the circuit would normally be **labelled** −2V and +4V respectively, but this example has shown how to proceed if things are not so straightforward.

Resistors in Parallel

As any text book on basic electricity will tell you, the general formula for the total resistance (Rt) of *n* resistors connected in parallel is:

$$\frac{1}{Rt} = \frac{1}{R1} + \frac{1}{R2} + \frac{1}{R3} + \ldots \frac{1}{Rn}$$

This is a rather cumbersome formula to use if you do not possess one of the better types of calculator and it is well worth knowing the two cases in which its use can be avoided:

(i) When all the resistors are of the same value say (Rx), the formula simplifies to $Rt = \frac{Rx}{n}$

(ii) When there are **only two** resistors in parallel (say R1 and R2), the formula simplifies to

$Rt = \frac{R1 \times R2}{R1 + R2}$ usually remembered as "product over sum".

Another hint which is useful to remember as a quick check on your working is that the total resistance will always be lower than that of the lowest value resistor in the parallel network.

In a circuit comprising resistors all connected in parallel, there can only be one voltage to measure. See Fig. 2.2. Whatever source of e.m.f. is connected to "X" and "Y", the potential at the top ends of all the resistors will be

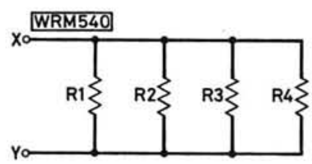


Fig. 2.2

the same (that of "X") and the potential at the bottom ends will also be the same (that of "Y"). It is only where such an arrangement of resistors is part of a more complex circuit that calculation of this single voltage needs to be considered.

Resistors in Series/Parallel Arrangements

If we wish to calculate the potentials at "A" and "B" of Fig. 2.3, we must first reduce the parallel networks (R2, R3) and (R4, R5, R6) to **equivalent** single resistors and so produce an **equivalent** circuit comprising only resistors in series.

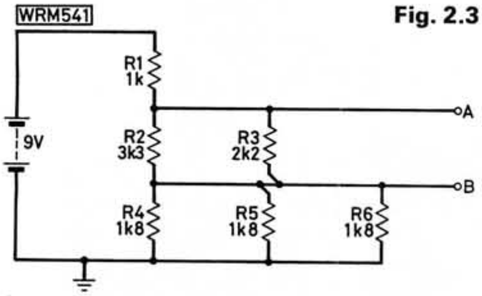


Fig. 2.3

Resistor R2 in parallel with R3, using the simplified formula of case (ii), reduces to:

$Rx = \frac{R2 \times R3}{R2 + R3} = \frac{3{\cdot}3 \times 2{\cdot}2}{5{\cdot}5} = 1{\cdot}32k\Omega$ (n.b. this is less than the $2{\cdot}2k\Omega$, so it looks reasonable.)

Resistors R4, R5 and R6 in parallel, using the simplified formula of case (i), reduces to:

$$Ry = \frac{1{\cdot}8}{3} = 0{\cdot}6k\Omega = 600\Omega$$

Now we can use the equivalent circuit of Fig. 2.4:

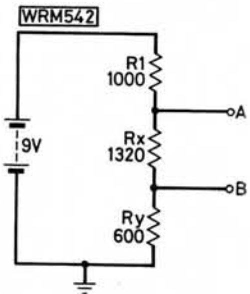


Fig. 2.4

Total resistance = 1000 + 1320 + 600 = 2920Ω

$$V_{R1} = \frac{1000}{2920} \times 9 = 3{\cdot}08V$$

The top end of R1 is at a potential of +9V (the battery voltage), so the potential at "A" = +9 − 3·08 = **5·92V**

$$V_{Ry} = \frac{600}{2920} \times 9 = 1{\cdot}85V$$

So the potential at "B" = 0 + 1·85 = **+1·85V**

The example of Fig. 2.5 is more difficult. Point "D" is not one of the main junctions of the parallel networks. However, we can find the potentials at "A", "B" and "C" using the method of the previous example, then find the potential at "D" by considering the series sub-circuit between "C" and earth (R8, R9).

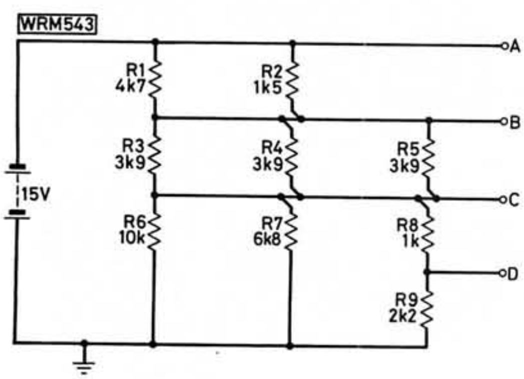


Fig. 2.5

Resistor R1 in parallel with R2 reduces to:

$$Rx = \frac{R1 \times R2}{R1 + R2} = \frac{4{\cdot}7 \times 1{\cdot}5}{6{\cdot}2} = 1{\cdot}137k\Omega = 1137\Omega$$

$$R3, R4, R5 \text{ in parallel} = Ry = \frac{3{\cdot}9}{3} = 1{\cdot}3k\Omega = 1300\Omega$$

Between "C" and earth, we have R6, R7 and (R8 + R9) in parallel = Rz. This time we have to use the big general formula:

$$\frac{1}{Rz} = \frac{1}{10} + \frac{1}{6{\cdot}8} + \frac{1}{3{\cdot}2} = 0{\cdot}1 + 0{\cdot}147 + 0{\cdot}3125 = 0{\cdot}5595$$

$$\text{Therefore, } Rz = \frac{1}{0{\cdot}5595} = 1{\cdot}787k\Omega = 1787\Omega$$

(n.b. The value of Rz is less than the 3·2kΩ, so it looks reasonable.)

The equivalent circuit is now that of Fig. 2.6.

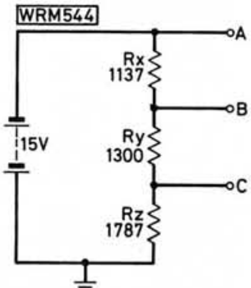


Fig. 2.6

Potential at "A" = **−15V** (battery voltage)

Total resistance = Rx + Ry + Rz
= 1137 − 1300 + 1787
= 4224Ω

$$V_{Rx} = \frac{1137}{4224} \times 15 = 4{\cdot}04V$$

Therefore, potential at "B" = −15 + 4·04 = **−10·96V**

$$V_{Rz} = \frac{1787}{4224} \times 15 = 6{\cdot}35V$$

Therefore, potential at "C" = 0 −6·35 = **−6·35V**

To find the potential at "D", see the sub-circuit of R8 and R9 in Fig. 2.7:

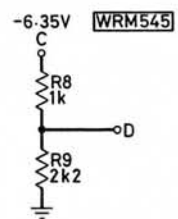


Fig. 2.7

Total resistance between "C" and earth = 3·2kΩ

$$V_{R9} = \frac{2{\cdot}2}{3{\cdot}2} \times 6{\cdot}35 = 4{\cdot}37V$$

Therefore, potential at "D" = 0 −4·37 = **−4·37V**

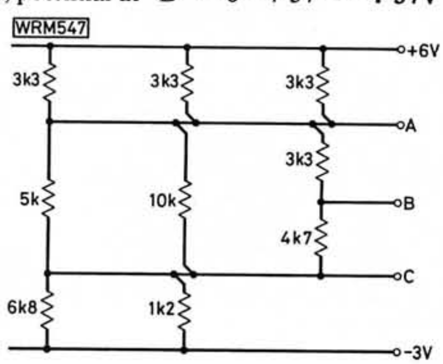


Fig. 2.8

Now here is an example for you to try for yourself. In Fig. 2.8, the top and bottom line potentials are quoted with respect to chassis (earth) as is usual. Calculate the potentials of points "A", "B" and "C" with respect to chassis. A full solution will be given in next month's issue.

Effects of Meter Resistance

When we connect a meter to a circuit to make our voltage measurements, we immediately modify the circuit because our meter itself is a resistor and we may have to take this into account in estimating our voltages.

So if you did the experiment suggested last month and obtained results you didn't expect, meter resistance could be the reason. Another explanation might be the **tolerance** of resistor marked values. A resistor without a fourth colour band has a tolerance of only ±20 per cent. This means a "good" 1kΩ resistor could have an actual resistance of anything between 800 and 1200 ohms.

The resistance of a moving-coil type meter can be calculated from the formula:

meter resistance = sensitivity × full-scale deflection, where full-scale deflection means the maximum voltage on the scale for the range in use.

The sensitivity is a constant for any particular meter and should be quoted on the meter scale. Its units are ohms-per-volt. A good meter will have a sensitivity of 20 000 ohms-per-volt or more. A cheap meter will probably have a sensitivity of 2000Ω/V or less.

If the sensitivity is not quoted on your meter, it can be calculated. Generally the reciprocal of the lowest d.c. current range gives you the ohms-per-volt. For example, the writer's personal meter has a lowest current range of 500μA. The reciprocal of this is $\frac{1}{500 \times 10^{-6}} = \frac{10^6}{500} =$ 2000Ω/V. This is no doubt why it was such a cheap instrument when I bought it over 20 years ago, but it continues to serve me well and I can get accurate readings as long as I remain aware of its relatively low resistance.

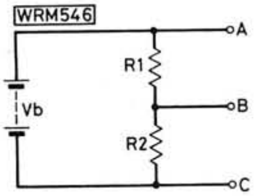


Fig. 2.9

As an example of the effects of meter resistance, try wiring up the circuit of Fig. 2.9 with a battery of some 6 or 9V and resistor values **in excess** of 220kΩ for both R1 and R2. With your meter, measure the voltage across "AB" (V_{R1}), then the voltage across "BC" (V_{R2}), then the voltage across "AC" (the battery voltage).

According to Kirchhoff's Second Law (don't throw your hands up in horror—it is a very useful practical law of which we shall be glad when things become more difficult), which states that in any series circuit the sum of the p.d.s equals the e.m.f. applied, the first two voltages you measure should add up to the third. In other words:

$V_{R1} + V_{R2} = V_b$

You may find this very far from the case. But before you curse the hallowed name of Kirchhoff or throw your meter into the dustbin in disgust, wait until you have read next month's article, in which we shall look further into this question of meter resistance.

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MMS1	The Morse Talker	115.00

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MORSE EQUIPMENT continued

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BY3	Keyer Paddle (gold plated)	£92.00

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DM81Trio Dip Meter	63.25
AT145 Packer VHF wavemeter	£19.95
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THE PW MORSE SHOW

Steve DAMON G8PYP

PART 1

Having held an amateur class B licence for the past four years the author decided to have yet another attempt at "cracking the code".

Because of other commitments the only time available for Morse lessons occurred when prospective teachers were not! For this reason electronic Morse tutors were reviewed, and it soon became apparent that there was a need for a relatively cheap alternative to the £100 plus commercially available units.

The following article describes the *PW* Morse Show, a very comprehensive Morse tutor, suitable for both the beginner and the advanced c.w. operator. The *PW* Morse Show will play one minute of random Morse code at a selected speed, in a five letter code group format or, alternatively, a delay of 0·5 to 2 seconds may be introduced between each individual character. The complete randomly generated sequence may then be played back during which time each character will be displayed in turn on a 7 × 5 l.e.d. dot matrix.

To achieve the necessary flexibility an MPU based control system is employed using the Intel 8085.

Microprocessor Basics

When microprocessors are mentioned a lot of people seem to develop the "ostrich syndrome", they bury their heads in the sand and hope it will go away! In reality microprocessor basics can be easily understood, so we will start this project with an introduction to the microprocessor itself.

The "micro-chip" consists of a large number of transistors on a single slice of silicon, arranged in such a way that its internal circuitry can perform a large number of functions, but only one at a time.

The functions available are decided by the chip designer and cannot be changed by the user. Each individual function is represented by a defined binary code applied to the microprocessor's DATA pins. The binary codes required to produce given functions are called collectively the INSTRUCTION SET and are unfortunately different for each type of microprocessor.

The microprocessor is capable of executing a single instruction very quickly (1·6µs, with a 3MHz clock, for the 8085A) and a program consists of a series of instructions which make the microprocessor perform the task you have set it.

As there are eight DATA pins on the 8085 each instruction must consist of binary numbers 8 bits long and known in computing terms as a BYTE. However, in practice binary numbers are very long and cumbersome, making them difficult to work with and consequently error prone. To overcome this, a method of instructing the microprocessor called Assembly Language is often used. In this system a mnemonic for the actual function is written i.e.: JMP=Jump to the place in the program next specified. The complete Assembly Language program is subsequently converted to binary code by means of a standard program called an ASSEMBLER.

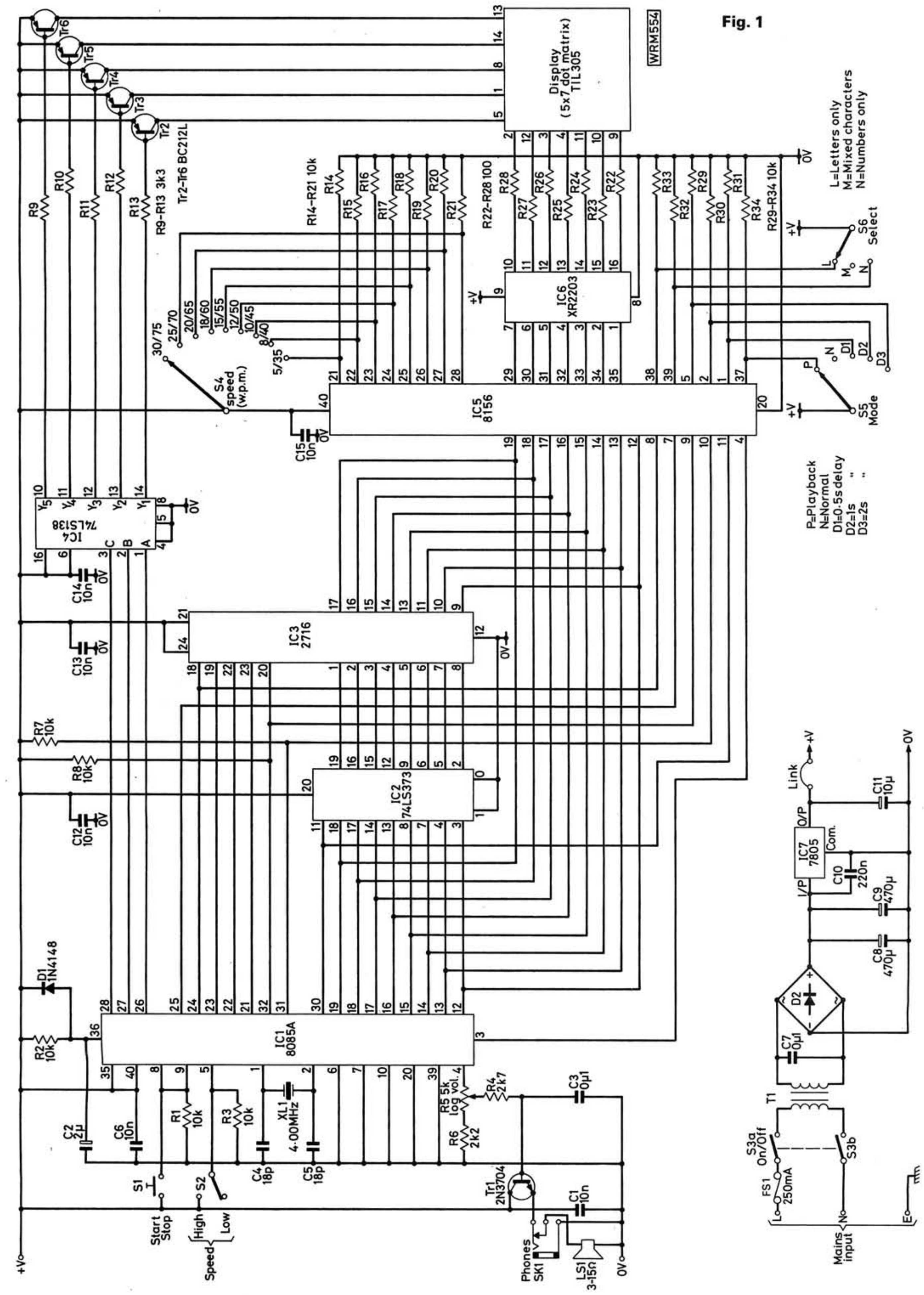
CONSTRUCTION RATING Intermediate

BUYING GUIDE

A kit of parts, with the exception of the case and control knobs, is available from Heritage Communications Limited, Lloyds Bank Chambers, 4 The Square, Wimborne Minster, Dorset BH21 1JA. Tel: 0202 888402, at the VAT inclusive price of £65·99. Alternatively a drilled p.c.b. and ready-loaded EPROM is available at £22·54.

For those constructors with access to suitable EPROM loading equipment the 12-page software listing is available from the *PW* Editorial Offices at £1·00 inclusive of VAT and postage. The attractive case used for the prototype was kindly supplied by BICC Vero from their HI Style Desk Top Console range.

APPROXIMATE COST £76



Display (5x7 dot matrix) TIL305
WRM554
IC1 8085A
IC2 74LS373
IC3 2716
IC4 74LS138
IC5 8156
IC6 XR2203
IC7 7805
Tr2-Tr6 BC212L
R9-R13 3k3
R14-R21 10k
R22-R28 100
R29-R34 10k
D1 1N4148
Tr1 2N3704
XL1 4·00MHz
R5 5k log vol.
R4 2k7
R6 2k2
C1 10n
C2 2µ
C3 0µ1
C4 18p
C5 18p
C6 10n
C7 0µ1
C8 470µ
C9 470µ
C10 220n
C11 10µ
C12 10n
C13 10n
C14 10n
C15 10n
R1 10k
R2 10k
R3 10k
R7 10k
R8 10k
S1 Start Stop
S2 Speed High Low
S3a On/Off
S3b
FS1 250mA
T1
Mains input
Phones SK1
LS1 3-15Ω
Link
+V
0V
S4 speed (w.p.m.)
30/75
25/70
20/65
18/60
15/55
12/50
10/45
8/40
5/35
S5 Mode
S6 Select
P=Playback
N=Normal
D1=0.5s delay
D2=1s "
D3=2s "
L=Letters only
M=Mixed characters
N=Numbers only

Fig. 1

Assembly Language programs are much quicker to implement, being less tedious to write and de-bug (fault find) than binary coded programs. The software (program) for the *PW* Morse Show was written in this way although, due to space restrictions, it has not been printed here. It is available from the *PW* Editorial Offices (see buying guide box) on request.

The program, in its binary coded form, is placed in a ROM, Read Only Memory, in the order in which it is to be executed. Inside the microprocessor there is a counter, called the PROGRAM COUNTER, which counts each program step. The output of this counter is connected to 16 pins on the microprocessor called the ADDRESS pins, some of which are connected to the ROM in order to select the correct step in the program. The output of this counter can also be affected by certain program instructions.

On the 8085 microprocessor the lower order BYTE (eight least significant bits) of the ADDRESS share the same pins as the DATA. To specify whether the information on the BUS is ADDRESS or DATA the microprocessor generates an Address Latch Enable signal (ALE) whenever the BUS has ADDRESS information on it. BUS is a shortened form of busbar, and another name for highway. The MPU system uses buses to carry DATA to ADDRESSES within its structure.

The ADDRESS and DATA pins are also connected to the RAM (Random Access Memory), which is a memory device where the microprocessor may store data in order to allow its retrieval for use later in the program. The ADDRESS and DATA pins are also connected to the IO (Input/Output) ports, which are used to connect the microprocessor system to the outside world. On the *PW* Morse Show the RAM and IO ports are contained within the same i.c., but this is not always the case.

From the previous paragraph it can be seen that the DATA can either be coming from, or going to, the microprocessor. So that other devices within the system know whether they should be sending or receiving DATA, the microprocessor sends RD (Read), and WR (Write), signals at appropriate times during the execution of the program.

The foregoing description is by no means comprehensive, but is intended as a brief outline introduction, to enable readers unfamiliar with microprocessor based systems to follow the circuit operation.

Circuit Description

The complete circuit diagram of the *PW* Morse Show is shown in Fig. 1.

Integrated circuit IC1 is the 8085 microprocessor which contains its own internal clock generator, driven by the 4MHz crystal XL1; the actual clock frequency is in fact half the crystal frequency, in this case 2MHz.

When the unit is first turned on capacitor C2 will start to charge via R2, giving a low level on the 8085 RESET pin for about 20ms. This pulse is used to reset the microprocessor, which sets the program counter to zero. Diode D1 is used to ensure that C2 discharges quickly when the unit is turned off.

When C2 has fully charged and the RESET pin is at a high level, the microprocessor outputs the contents of the program counter onto the ADDRESS BUS and generates an ALE signal which is used to latch the outputs of IC2. This device is necessary because the 2716 ROM, IC3, is not designed specifically for use with the 8085 and does not have internal ADDRESS latches, unlike the 8156 IO/RAM, IC5.

The type of ROM used in the *PW* Morse Show is an EPROM (Erasable Programmable Read Only Memory), and this means that its contents (the program) can be erased by exposing the window on the top of the i.c. package to ultra-violet light; if required a new program may then be "blown" into it.

After the ADDRESS has been latched, the microprocessor transmits an $\overline{RD}$ signal which allows the ROM to put the DATA it contains, at the first ADDRESS, onto the DATA BUS. This DATA is the first program step which the microprocessor reads and then executes before placing the next instruction ADDRESS onto the BUS, in the same way as before.

The first few instructions initialise the IO section of IC5, setting the ports as follows: PA=Input port, PB=Output port and PC=Input port; this is achieved by placing the control ADDRESS of IC5 onto the ADDRESS BUS and then transmitting the required DATA to this ADDRESS. The microprocessor then instructs the IO to place the MODE switch S5 reading onto the DATA BUS and then acts on this information to decide if the unit is in the NORMAL or PLAYBACK mode; it then sets the relevant pattern onto the l.e.d. matrix display and "loops", repeating these instructions, until the START/STOP switch S1 is pressed. This switch is connected to the 8085 RESTART inputs; these inputs, when high and enabled, cause the program counter to be set to a specific value causing the microprocessor to "jump" to a particular program location. Two of these inputs are used: RST 5·5 (pin 9) for START and RST 6·5 (pin 8) for STOP, the program allowing only one of these inputs to be accepted at any one time. When S1 is pressed the microprocessor jumps to the start of the main program and allows only the STOP input to be recognised.

The main program instructs the 8085 to read, via the IO ports, the HIGH/LOW switch S2 and the SPEED switch S4, to obtain the length of the dots (and hence the dashes) before it generates the Morse "start of message" character $\overline{CT}$. The program also instructs the microprocessor to store a binary number representing this character in the RAM section of IC5. Depending on the setting of S5 it either waits for 0·5, 1 or 2 seconds, or for the length of a dash (=three dots), before generating the next character at random and storing a number corresponding to this character in the next RAM location. When it has counted five characters the microprocessor waits for the length of a further four dots before generating the first character of the next group.

Characters generated by the *PW* Morse Show are not truly random but pseudo-random; the microprocessor mathematically derives one sequence from 6885 possible sequences. The sequence chosen depends upon the setting of the MODE and SPEED switches and the time taken (measured in microseconds) between the end of a sequence and the user pressing the START/STOP switch to start the next sequence.

TABLE 1

Inputs			Outputs								
C	B	A	Y_0	Y_1	Y_2	Y_3	Y_4	Y_5	Y_6	Y_7	
0	0	0	1	0	0	0	0	0	0	0	Not used
0	0	1	0	1	0	0	0	0	0	0	Tr2
0	1	0	0	0	1	0	0	0	0	0	Tr3
0	1	1	0	0	0	1	0	0	0	0	Tr4
1	0	0	0	0	0	0	1	0	0	0	Tr5
1	0	1	0	0	0	0	0	1	0	0	Tr6
1	1	0	0	0	0	0	0	0	1	0	Not used
1	1	1	0	0	0	0	0	0	0	1	Not used

★ components

Resistors

$\frac{1}{4}$W 5% Carbon Film

100Ω	7	R22–28
2·2kΩ	1	R6
2·7kΩ	1	R4
3·3kΩ	5	R9–13
10kΩ	19	R1–3, 7, 8, 14–21, 29–34

Potentiometer

$\frac{1}{2}$W log law, $\frac{1}{4}$in Spindle

5kΩ	1	R5

Capacitors

Ceramic Plate, 100V

18pF	2	C4, 5
10nF	6	C1, 6, 12–15

Polyester 100V

220nF	1	C10
0·1μF	2	C3, 7

Electrolytic, 63V double-ended

2μF	1	C2
10μF	1	C11

Electrolytic, 63V single-ended

470μF	2	C8, 9

Semiconductors

Diodes

1N4148	1	D1

Diode Bridge

200V 1·6A	1	D2 (RS Components 261–491)

Dot Matrix

TIL 305	1	D3 (7 × 5 array)

Integrated Circuits

8085	1	IC1
8156	1	IC5
74LS373	1	IC2
74LS138	1	IC4
XR2203	1	IC6
2716	1	IC3 (refer to buying guide box)
7805	1	IC7

Transistors

2N3704	1	Tr1
BC212L	5	Tr2–6

Switches

Miniature Toggle

S2 s.p.d.t.
S3 d.p.d.t.
S6 s.p.d.t. with centre "off"

Miniature momentary action push-button

S1

Single-pole rotary, 12-way

S4, 5 (see text)

Miscellaneous

Mains Transformer T1, 10V 6VA secondary. Fuse FS1, 250mA, 20mm with holder. Crystal XL1, 4MHz parallel resonance 30pF wire ended. Pointer knobs (3) for $\frac{1}{4}$in shafts. Loudspeaker LS1, 3–15Ω. 3·5mm min. jack socket, SK1. IC sockets: 40 way (2), 24 way (1); 20 way (1), 14 way (1), 16 way (2). Printed Circuit Board. Case (see buying guide box). Software program listing (refer to buying guide box).

If the START/STOP switch is now pressed, or a minute's worth of Morse code has been sent, the microprocessor generates the Morse "end of message" character $\overline{AR}$ before returning to "looping" around the standby display section of the program, after re-enabling the START input. With S2 set to HIGH only 30s of Morse is sent.

Audio output is derived from the SOD pin (not a slip with the soldering iron, this is the Serial Output Data pin) on the 8085, which is turned on and off at a frequency of 1kHz by the program. The 1kHz note is taken from the potential divider formed by R5 and R6 to a simple *CR* filter, R4/C3, before being fed to the loudspeaker, via the emitter follower transistor Tr1.

Replay Function

When the MODE switch S5 is in the PLAYBACK position the microprocessor executes the PLAYBACK section of the program which causes it to recall the characters from the RAM, playing and displaying them one at a time.

The character display is formed by a 7 × 5 dot matrix providing five columns of seven l.e.d.s, interconnected as shown in Fig. 4. Although relatively expensive this type of display was chosen in order to give a clear, easily read, readout of the complete character set. The l.e.d. rows are driven via IC6 from the B ports of IC5. The XR2203 integrated circuit IC6 consists of seven separate drivers and is required in order to "sink" the 20mA drawn by each l.e.d. The l.e.d. columns are selected by decoding the upper three ADDRESS bits in IC4, an 8 of 3 decoder, and using the outputs to turn on Tr2-Tr6 in turn, as shown in Table 1.

The power supply follows standard design practice and consists of a 10V transformer T1 feeding a full-wave bridge rectifier pack D2, which supplies a three-terminal 5V regulator IC7. Smoothing of the rectified voltage is accomplished by a reservoir capacitor formed by C8 and C9. Two parallel capacitors are used in this position because of the rather high ripple current.

Next Month

The concluding part of this article will provide full constructional details necessary for you to build this fascinating project

NEW BOOKS

OBTAINABLE FROM BOOKSHOPS

GUIDE TO WORLD-WIDE TELEVISION TEST CARDS
by Keith Hamer and Gary Smith
Published by HS Publications
Price £2.85

Late in 1936, the BBC began the first national television service from the now famous transmitter at Alexandra Palace. Unfortunately the war ended this in 1939 and transmissions did not recommence until 1946 and now, 35 years later there are only a few countries without a network of TV stations. Obviously, for many reasons, television stations do not transmit programmes all the time their transmitters are on the air, so for these periods a test card, often with station identification is used so that engineers can adjust or carry out repairs to TV receivers.

Like all other aspects of communication, television has its DXers and the object of the book is to assist such people. The authors, both TV DXers, have included 240 well captioned photographs of test cards, station clocks and idents. The book includes a table of world TV transmission standards, a page of electronic test patterns and about seven pages of useful additional information about the TV networks in Africa, the Middle East, Americas and the Caribbean, Australasia, Europe, Asia and the Far East.

In my view, this book, available from HS Publications, 7 Epping Close, Derby, DE3 4HR is excellent value and a must for the DXer, especially during the Sporadic-E season when many test cards are seen.

Air mail to Europe is £3·25 and the rest of the world £3·60 and there are discount rates for bookshops and world-wide DX clubs.

R. Ham

THE THEORY & SERVICING OF AM, FM & FM STEREO RECEIVERS
by Clarence R. Green and Robert M. Bourque
Published by Prentice-Hall
583 pages, 234 × 174mm. Price £19.45

This hardback book is intended to assist the transition from fundamental concepts to the servicing and trouble shooting of a.m., f.m. and f.m. stereo receivers.

EARLY WIRELESS
by Anthony Constable
Published by Midas Books
160 pages, 232 × 154mm. Price £8.50

Although this book deals with a technical subject it is fascinating to read and should complement the bookshelf of any modern historian. Basically it deals, in three well researched chapters, with wireless from its humble beginnings to 1930. This includes a list, occupying some 33 pages, of wireless sets, their prices, some technical information and details of their manufacturers who were around in 1926. Such gen, compiled with over 130 pictures of historic sets, loudspeakers, valves and crystal set novelties, is an asset to any collector.

For the student or newcomer to wireless some 30 drawings have been used in conjunction with several pages of easy-to-read text, to explain the workings of a spark transmitter, coherer and crystal detectors and bright emitter valves.

I found this book to be a sheer delight, attractively presented in hard back, with something for everyone.

R. Ham

ELECTRONICS FOR THE SERVICE ENGINEER PART 2
by Ian R. Sinclair
Published by Technical Press
271 pages, 243 × 187mm. Price £4.95

An introduction to electronic circuit operation and fault finding procedure for the service technician and the interested amateur.

AMATEUR TELEVISION HANDBOOK
by Trevor Brown G8CJS and John Wood G3YQC
Published by British Amateur Television Club
94 pages. Price £2·35 including postage

However knowledgeable you are it is always good to have a gen book on a specialised part of a technical subject, and this book does just that.

This is a book full of text and diagrams, with additional contributions from G6NR on principles, G8PTH on antennas, F3YX and G8CGK on receivers, G4BAU on vision sources, C. Brownbridge on video processing and J. Goode, GW8PBX and GW3JGA on colour television.

Apart from explaining the technical and operating side of Amateur Television, the chapters get down to the facts about setting up a system and warning the reader of the technical and mechanical pitfalls that a constructor could drop into.

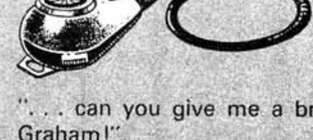
What impressed me was the "do this", "don't do that" attitude of the authors which can be found throughout the book. "To do this because" is valuable to the expert as well as the beginner.

The reader is assured in the preface that, "Almost all of the projects in the volume have never before been published and indeed some were designed especially for this book.", or that, "The video projects are all compatible with each other and the p.c.b.s have been made to a standard size."

In short, this book, available from BATC Publications, 14 Lilac Avenue, Leicester LE5 1FN, is full of interest and will help the ATV constructor.

R. Ham

the things people say



". . . can you give me a break on the name please, Graham!"

. . . heard by G8NVZ

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

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.

Letters

US Experience

Sir: I can comment from experience in America on the Government's attempt to re-establish order on the airwaves once the public has "voted with its feet" and acquired the habit of operating unauthorised transmitters with impunity. AM/CB has long been lawful here, and is proving immensely valuable. I operate for REACT, and have seen it in action in all kinds of emergencies in co-operation with Police, fire and other services. But in spite of the fact that anyone who wants to own a transmitter legally can do so, and "legitimate" operators police their own system, we are seeing a complete breakdown of the long-preserved control over private transmission which has made orderly band allocation meaningful.

There is constant QRM from non-linear "linear amplifiers"—operated, to judge from the content of their transmissions, by close relatives of the Talking Mule, who yell, whistle and deliver monologues audible in California from sites in the Deep South. Many of these give "unit numbers" and transmit their location. The amateur bands are full of unauthorised s.s.b.—rather better conducted, and with fewer psychiatric cases on the air, but still illegal and operating with impunity. The FCC, which has far too few staff to deal with pirates, or even with a citizen who uses CB to broadcast recordings of Hitler's speeches in the San Diego area, seems to limit itself to coming down hard on licensed hams whose signals are picked up on poorly-screened hi-fi equipment.

In the past, a radio hobbyist who was consumed with the desire to transmit had to construct his own gear, which required some knowledge and perseverance, and such people were usually motivated to become licensed amateurs. With Morse obligatory here for a novice licence, and solid-state transmitters available which are inexpensive, smugglable and impossible to control, it looks very much as if band allocation will break down altogether, and, as with firearms, which are now available in such numbers that there is little chance of recalling them or stopping them at the frontier, there are so many unlicensed transmitters around that the FCC will almost certainly come in time to legitimise them *faute de mieux*.

The best hope here might be to create an amateur category which did not require a Morse test, and attempt to integrate the offenders into the responsible tradition of amateur radio. One sees signs of this type of peer pressure in the magazines for (illegal) s.s.b. owners. Unfortunately, some of the noisiest and most persistent lawbreakers are not made of the stuff of responsible behaviour. I cannot see the station somewhere in the South which calls itself "Big Thunder, No Numbers", and intrudes on the emergency channel with a 500W signal, slightly off frequency on both sides, acquiring that kind of civic decency, or being very welcome in the ARRL under any terms.

I think that the changed situation, which will get worse as high wattage r.f. output transistors get cheaper, calls for some very serious contingency planning between the FCC and legitimate amateurs, as to what can be done to prevent a general pandemonium of haphazard transmission and interference with services.

Britain had much stricter enforcement (it is smaller, after all) but the stupidity of the Government in resisting licensed CB, and giving the appearance of perversity when compelled to let it in, may have thrown away the advantage. Just how valuable licensed CB can be in extending the range and reducing the response time of services has to be experienced. If no other kind of discipline can be enforced, one must hope that at least interference with the emergency channel can be policed out. Ironically, in a major emergency in Britain, it is quite likely to be the illegal a.m. broadcasters who come to the aid of the community, as legal amateurs have so often done.

If I knew the answers to these problems, I would propose them. The subject merits very serious discussion among hams and responsible CBers, with a view to working some agreed conclusions down the throat of officialdom.

Alex Comfort MB DSc
Santa Barbara USA

ATC

Sir: To most people the Air Training Corps probably means young men in uniform, interested in aircraft and flying. Whilst this is true, the ATC is involved in many more subjects: shooting, adventure training, sports and radio communications.

One of those subjects that I am actively engaged in is radio communications. The ATC has a number of frequencies at its sole disposal within the h.f., v.h.f., and u.h.f. bands.

Regular contact is made between Squadrons throughout both London and the United Kingdom. A number of cadets sit examinations to become competent Radio Operators both in RT and WT operations. To qualify for the Air Cadet Radio Operators Certificate a cadet must show that not only does he know how to operate the various radios, but must have a good working knowledge of the theory of radio communications.

In the past training was given by qualified staff (usually ex-servicemen) on equipment supplied to the Squadrons from the RAF. In recent years there has been a great reduction in service personnel joining the ATC, and a reduction in radio equipment available to the Corps. This is because radio equipment within the Air Force has become very advanced and of a type which is not suitable for cadet use.

These reductions have meant that Squadrons within the London area now have to purchase from local sources suitable transmitters/receivers or transceivers. Because of the frequencies allocated, should a Squadron wish to operate on a number of frequencies then it is obliged to obtain one transceiver per frequency. As costs have to be borne by individual Squadrons, at times it proves too costly and necessitates a limitation to the training scheme.

To try to overcome this problem, Headquarters London Wing are forming a central communications centre to carry out the servicing, repair and allocation of radio communication equipment to the 23 Squadrons within the area.

At the centre, staff and senior cadets will be trained to become qualified operators/instructors, returning to their Squadron to train their cadets. It is at this point I would ask you to, if possible, consider assisting us in this task.

continued on page 53▶▶▶

TROPOSPHERIC PROPAGATION

J.GLANVILLE G3TZG

Tropospheric propagation is a phenomenon which affects almost all the radio waves used by man. The troposphere consists of the region stretching from the surface of the earth to an altitude of about 10 kilometres. Even radio waves from distant space probes have to pass through it to reach tracking stations located on the earth's surface. In composition it consists of a mixture of gases (mainly nitrogen and oxygen), with water in the form of water vapour, water droplets or ice crystals. On the geophysical scale the troposphere is a huge thermodynamic engine within which the manifestations we call weather take place.

The troposphere can attenuate, scatter and refract electromagnetic waves. It can also produce electromagnetic waves in the form of radiation from lightning discharges, these may be detected as visible light or as wideband transients in the radio spectrum. At frequencies below about 30 megahertz the main mode of distance propagation is ionospheric, but above frequencies of about 50 or 60 megahertz tropospheric propagation plays a more important part in distance working.

Since visible light consists of electrodynamic waves it is instructive to examine the passage of light through the troposphere. Primarily light waves are scattered. The blue, shorter wavelengths are the most scattered, and in consequence, in the absence of cloud, predominantly blue light reaches us from all directions. This gives the sky its characteristic blue colour. When the sun is low in the sky we view it through a longer segment of the troposphere. Under such conditions the longer red wavelengths are attenuated to a lesser degree, and this leads to red tinged sunsets.

Refraction or bending of the rays is another property of tropospheric propagation. Refraction may be considered as a result of the electromagnetic wave traversing a region where the medium consists of layers exhibiting differing propagation velocities. The traditional analogy is that of a line of soldiers marching shoulder to shoulder. To change direction the line must wheel round, with the inner part moving at a lower velocity than the outer part.

Rainbows are formed by the path of the sun's rays being bent when passing through raindrops. In this sense the troposphere is acting as a spectrum analyser with a panoramic display. Refraction is also the mechanism whereby ice crystals high in the atmosphere can bend sunlight reflected from the moon into the form of a halo.

A measure of the bending properties of a particular medium is the refractive index. Generally in cold, dense air the index is high, leading to a low velocity of propagation. In the troposphere the refractive index gradually reduces with altitude from the surface of the earth. The velocity of propagation therefore increases with height. This causes rays travelling over the surface of the earth to have a tendency to follow the curvature of the earth. In consequence one can see stars that are really below the geometric horizon. Under abnormal conditions the refraction can be so great as to cause a phenomenon known in optics as total internal reflection. The ray path may thus be bent through a considerable angle. Optical mirages are caused in this manner.

A diagram of a mirage, showing bending towards the surface of the earth, appears in Fig. 1. The observer sees an inverted image of the object which is over the geometric horizon. A layer of hot air lying over a layer of cool air causes this type of refraction. Such phenomena are uncommon in England. A type of tropospheric refraction more commonly observed in this country is depicted in Fig. 2. This is caused by solar radiation heating the surface of a road, and a layer of hot air lies a metre or so above the surface. Above this lies cooler, denser air with a lower propagation velocity. The observer sees patches of bluish/white light scattered from the sky and refracted upwards into his eye. This produces an illusion of a layer of water on the road. An observer so placed is experiencing both scattering and refraction of some of the sun's electromagnetic radiation.

Although they are of longer wavelength, radio waves behave in a broadly similar manner to visible light waves when propagating through the troposphere. Tropospheric scattering is an important method of commercial radio communication. Fig. 3 illustrates the basic principles of "troposcatter". A powerful narrow radio beam is directed over the horizon, and a high-gain receiving antenna is accurately directed onto a volume of space occupied by the projected beam. Tropospheric scattering enables the receiver to capture signals at distances far beyond the normal range. This technique is little used by amateurs, because of the high transmitted powers necessary.

From geometric considerations alone the distance to the horizon for a v.h.f. antenna would be approximately $\sqrt{2ah}$ where "a" is the radius of the earth, and "h" is the height of the antenna above the surface. Restricted to such condi-

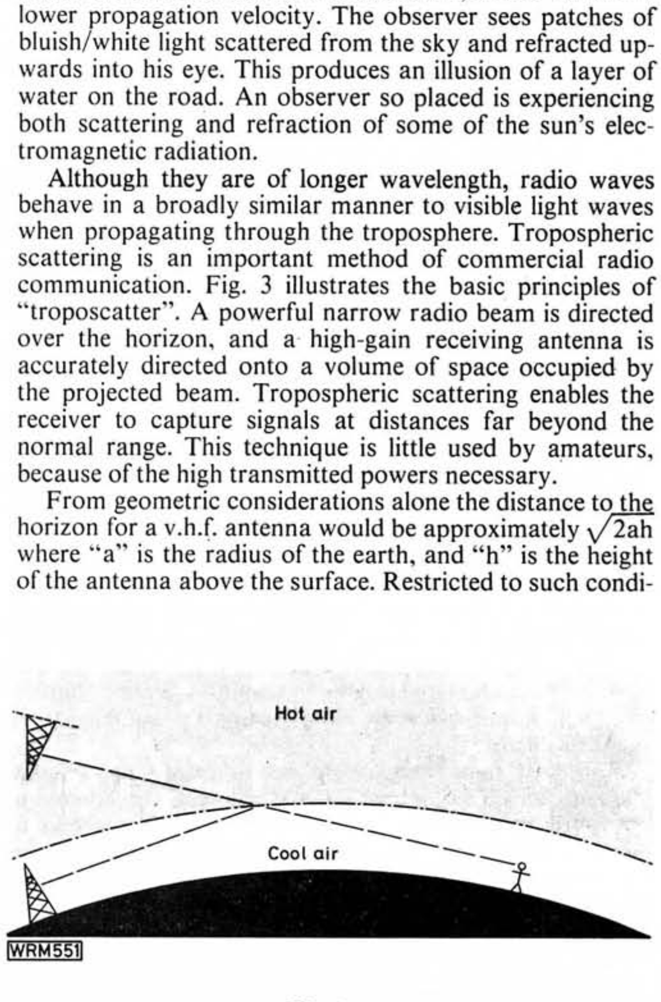


Fig. 1

tions a ray directed at the horizon would graze the surface at a tangent and continue on, drawing away from the earth at an ever-increasing altitude. It would seem therefore that the limit of v.h.f. communication would be the geometric horizon.

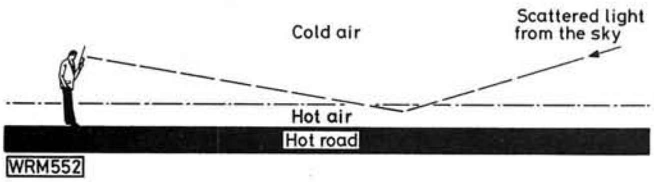


Fig. 2

However, due to tropospheric refraction the radio wave tends to be bent towards the surface and the effective range is increased. The expression for the radio horizon then becomes $\sqrt{2kah}$, where "k" is a factor which increases the apparent radius of the earth. Refraction causes the earth to appear rather flatter than it actually is. Shades of Christopher Columbus! For a standard atmosphere of 1013·25 millibars, "k" is 1·33 or 4/3. Hence the v.h.f. buffs speak of the "standard four thirds earth".

Since radio waves bend in this manner due to a gradual increase of propagation velocity with height in the troposphere, an obvious question is — what is the cause of this variation?

The velocity of a radio wave in a transmission line is given as: $c = \frac{1}{\sqrt{LC}}$ where L is the distributed inductance in henrys per metre, and C is the distributed capacitance in farads per metre. A similar expression exists for the propagation of radio waves in the troposphere. This is given by $c = \frac{1}{\sqrt{\mu\varepsilon}}$ where μ (mu) is the magnetic constant in henrys per metre and ε (epsilon) is the dielectric constant in farads per metre.

The fact that this expression has the nature of a velocity was one of the logical steps that led Clarke-Maxwell in 1865 to predict that under the right conditions a circuit containing inductance and capacitance would radiate waves. This conclusion was brilliantly deduced from purely mathematical reasoning, and Maxwell's equations form the basis of all radio communication.

Obviously if μ or ε are changed then the velocity changes. The troposphere consists of a mixture of gases, mainly nitrogen and oxygen. For most gases the magnetic constant is invariable, being similar to that of free space. It is therefore changes in the dielectric constant which cause propagation velocity changes in the troposphere. A feature of the dielectric constant is that it is hardly ever constant! It depends upon such factors as pressure, temperature and the amount of water vapour present. In the thermodynamic churnings of the troposphere these parameters are continually changing. The standard atmosphere rarely occurs of course, but in general v.h.f. waves abide by the four thirds earth formula.

Fig. 3

From time to time the troposphere produces conditions where there is a very sharp change in the dielectric constant a few hundred metres above the surface of the earth. Such conditions usually only last for periods measured in hours, or at most a day or so. A dielectric discontinuity of this nature may be caused by dry air descending to low altitudes where it lies over cool moist air relatively near the surface. Descending dry air of this nature sometimes occurs when pressure is high and a period of settled weather is about to change.

Under such conditions v.h.f. waves are transmitted over much greater distances than those predicted by the four thirds earth formula, and there is said to be a "lift" in conditions. The wave may be refracted to earth at some point well over the radio horizon, or it may be trapped in a tropospheric duct, and be returned to earth hundreds of kilometres from the transmitter. During these periods long-distance working by amateur v.h.f. stations is possible. Co-channel interference between television transmitters may also occur, even when the stations sharing the same channel are considerable distances apart. Amateur v.h.f. repeaters may also suffer co-channel interference.

These v.h.f. lifts are difficult to forecast, but watching TV may be a help! If a herringbone pattern appears on the raster of a u.h.f. TV receiver then one possible cause is co-channel interference from continental stations, thereby indicating a lift. Also, since lifts are associated with areas of high barometric pressure, some attention to the TV weather charts may be useful. It must be pointed out that v.h.f. lifts are not regular occurrences. Indeed it is fortunate that this is so! Otherwise co-channel operation of radio, TV and repeater stations would be impossible. ●

LETTERS

▸▸▸*continued from page 51*

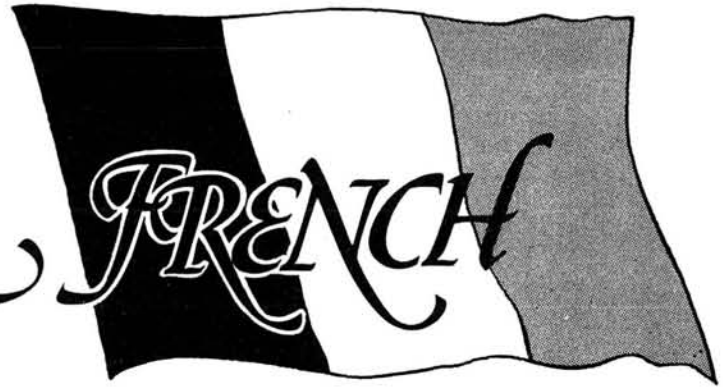
To train personnel adequately at the centre and to get Squadrons operational and keep them that way will require 100 transceivers within the h.f., v.h.f., and u.h.f. bands. Help in solving this extremely costly problem will mean success or failure of the centre. Even one set donated to the Wing is one set less to find money for.

Should your organisation or Company be one that uses radio transceivers within any of these bands, and be considering changing them now or in the future, perhaps you will think of London Wing. A gift or donation of your old set would greatly assist us. Should some financial consideration be necessary, then perhaps we could be approached.

Any gift or agreed sale of equipment to the Wing would be put to a very good and worthwhile use. The centre which is to be staffed by qualified radio technicians will carry out the re-crystalling and re-alignment of the sets before issue to Squadrons. I also give an undertaking that any equipment will not be used for any other purpose than Radio Communications training, on authorised frequencies and according to the regulations of the ATC as laid down by MOD (Air). Your assistance is most urgently required in order to keep this aspect of training alive. Should you not be in a position to help us at present perhaps you may consider our needs in the future. Please contact me at: London Wing ATC, Block D, Duke of Yorks Barracks, Kings Road, Chelsea, London.

B. B. S. Dowley
Flight Lieutenant RAFVR(T)
Communications Officer
London Wing Air Training Corps

BASIC QSOs in



PART 2

G.W. Roberts GW4JXN

In the concluding part of this article we deal with the remainder of the useful sentences and phrases as well as some useful tables

Technical		
I have a new rig/linear/antenna which I am testing.	Je suis en train de tester mon nouvel équipement/amplificateur linéaire/ma nouvelle antenne.	Zhe swi on trang de testay mon noovel ekipmong/amplificateur linayayr/ma noovell anten.
Is my modulation OK. Your modulation is good/bad.	Est-ce que ma modulation est bonne? Votre modulation est bonne/mauvaise.	Es se ke ma modulasion ay bon? Votr modulasion ay bon/movayz.
What is my exact frequency?	Quelle est ma fréquence exacte?	Kel ay ma fraykins ecsact?
I'm using a speech compressor.	Je me sers d'un speech compresseur.	Zhe me ser dung speech compresseur.
Does this make any difference?	Est-ce que cela change quelque chose?	Es se ke sela shon kel ke shoz?
Thank you for the test.	Merci d'avoir fait ce test.	Maresee davwahr fay se test.
Social		
From the shack I can see mountains/sea/moors.	De ma cabine de transmission je vois des montagnes/la mer/des collines.	De ma kabin de transmission je vwa day montain/la mer/day colin.
I have a friend/wife/children in the shack with me.	J'ai un ami/ma femme/mes enfants dans ma cabine avec moi.	Zhay un ami/ma fam/mays onfon don ma kabin aveck mwa.
He is a visitor/a short wave listener.	C'est un visiteur/amateur récepteur d'ondes courtes.	Set un visitor/amateur reseptoeur dond coort.
She is a visitor.	C'est une visiteuse.	Set une visiteuse.
He intends to sit his radio exam.	Il a l'intention de passer son examen de radio amateur.	Il a lantonsion de pasay son ecsomon de radio amateur.
I am at home/at work/at a friend's house.	Je suis chez moi/à mon travail/chez un ami.	Zhe swi shay mwa/a mon travai/shayz un ami.
This is a demonstration/special station.	C'est une station de démonstration/une station spéciale.	Set une stasion de demonstasion/une stasion spesial.
I have visited your country.	J'ai visité votre pays.	Zhay visitay votr pay.
I hope to visit your country.	J'espère visiter votre pays un jour.	Zhespair visitay votr pay un zjour.
We had a nice time.	Nous nous sommes bien amusés.	Noo noo somm bian amusay.
Excuse my French.	Excusez mon français.	Ecskusay mon fronsay.
I wish I could speak your language as well as you speak mine.	Je voudrais bien savoir parler votre langue aussi bien que vous parlez la mienne.	Zhe voodray bian savwar parlay votr long awsi bian ke voo parlay le mien.
Can we continue in English?	Pouvons nous continuer en anglaise?	Poovon noo continoo-ay on aonglay?
May I say it in English?	Puis je le dire en anglais?	Pwi zhe le deer on onglay?
May I explain it in English?	Puis je l'expliquer en anglais?	Pwi zhe lecsplikay on onglay?
QSL		
Could you please send me your QSL card?	Veuillez m'envoyer votre carte QSL?	Vayay monvwa-ay votr cart key es el?
I would be very pleased to get a QSL card from you.	Je serais très content de recevoir votre carte QSL.	Zhe seray tray conton de resevwar votr kart key es el.
I shall send you my QSL card via the bureau/direct.	Je vous enverrai ma carte QSL par le bureau/directement.	Zhe voo onveray ma kart key es el par le beoro/dirctemon.
My name is in the American/British call book.	Mon nom est dans le registre d'appel Américain/Britannique.	Mon nom ay don le rezhistr dappell amayricain/britanik.

Is your name and address in the call book?	Est-ce que votre nom et votre adresse sont dans le registre d'appel?	Es ce ke votr nom ay votr adres son dans le rezhistr dappell?
Can you give me your address and telephone number over the air?	Pourriez-vous me donner votre adresse et votre numéro de téléphone par radio?	Pooray voo me donnay votr adres ay notr numayro de telephone par radio?
What is your postal code/telephone code?	Quel est votre numéro de téléphone/code postal?	Kel ay votr noomayro de telephone/kod postal?
This is my address and my telephone number.	Voici mon adresse et mon numéro de téléphone.	Vwasi mon adres ay mon noomero de telephone.

Concluding Remarks

May I thank you once more for this call?	Puis je vous remercier une fois de plus de cet appel?	Pwi zhe voo remayrsay un fwa de plu de set appell?
I wish you a very good morning/afternoon/evening/good weekend.	Je vous souhaite une bonne journée/bonne nuit/un bon weekend.	Zhe voo soo-ate un bon zhornay/bon nwi/un bon weekend.
Merry Christmas and a Happy New Year.	Joyeux Noel et Bonne Année.	Zhoyoe noel et bon anay.
I send you my best regards.	Je vous envoie mes meilleurs souhaits.	Zhe voo onvwa may mayor soohay.
All the best to you and yours.	Meilleurs souhaits pour vous et les vôtres.	Mayor soohay poor voos ay lay votr.
I look forward to working you again.	Je serai content de vous contacter de nouveau.	Zhe seray conton de voo kontactay be noovoh.
May I wish you 73, 55, 88 and make this my final?	Puis-je vous souhaiter soixante-treize, cinquante-cinque, quatre-vingt-huit et j'en ferai ma transmission finale.	Pwi zhe voo soohaytay swasont trayz, sankont sank, katrvan wheat ay zhon feray ma transmission feenal.
Back to . . . from . . . who is waiting for any concluding remarks from you.	Je passe le micro à . . . de . . . qui attend vos eventuels commentaires finaux.	Zhe pass le micro a . . . de . . . ki aton voh ayvontoo-el com-ontair finoh.
So best wishes and good DX.	Meilleurs voeux donc et bon DX.	Mayor voe donk ay bon day ics.
Goodbye until next time/until the pleasure of seeing you again.	Au revoir à la prochaine/au plaisir de vous revoir.	Ohrevwar a la proshane/oh playzir de voo revwar.

Stating Future Intentions

This is . . . signing off and clear with . . . and now standing by for a call on this frequency.	Ici . . . qui signe avec . . . et qui est prêt à recevoir un appel sur cette fréquence.	Isi . . . ki seen aveck . . . ay ki pret a resevwar un appell sir set fraykons.
. . . now monitoring this frequency and waiting for any call.	. . . qui écoute maintenant cette fréquence et qui contrôle un appel.	. . . ki acoot mannon set fraykons ay ki kontrol un appell.
. . . now changing frequency to . . .	. . . qui change maintenant de fréquence à . . .	. . . ki shonzhe mannon de fraykons a . . .
. . . now returning to the calling channel.	. . . qui revient à la chaine d'appel.	. . . ki reviang a la shane dappell.
. . . now going QRT.	. . . qui devient QRT cesse transmission/quitte l'écoute.	. . . ki devian key er tay/ses transmission/keet latcoot.

For those who have some French already here is a list of the most common radio technical words and phrases. The pronunciation is not given here.

amplifier—l'amplificateur (m)
power supply—la source de courant
transmitter—l'émetteur (m)
transceiver—le récepteur-émetteur
rig—l'équipement (m)
receiver—le récepteur
operator—l'opérateur/opératrice (f)
antenna—L'antenne (f)
vertical antenna—une antenne verticale
vertical rod—une tige verticale
rotating antenna—une antenne rotative
Frequency modulation—la modulation de fréquence
amplitude modulation—la modulation d'amplitude
sideband—la bande latérale
upper sideband—la bande latérale supérieure
lower sideband—la bande latérale inférieure
wavelength—la longeur d'onde

a meter—un compteur
a digital frequency meter—un compteur à fréquence digitale
continuous wave—l'onde entretenue (f)
modulated wave—l'onde modulée
pulse modulation—une onde modulée par impulsion
lightning protection—la protection contre la foudre
feeder—la ligne de connection
coaxial cable—un cable coaxial
shielded braiding—le tressage blindé
omnidirectional antenna—une antenne omnidirectionelle
directional antenna—une antenne directionelle
antenna tuning unit—un filtre d'antenne
indoor antenna—une antenne d'intérieur
sound frequency—la fréquence de tonalité
carrier frequency—la fréquence porteuse
absorption wavemeter—un compteur d'ondes d'absorption
log book—le carnet d'écoute
calibrator—le calibreur
disturbance—le perturbation
cross modulation—la transmodulation

antenna matching—l'adaptation d'antenne
single sideband—une emission à bande latérale unique
to radiate—rayonner
to tune up—regler
RF amplifier—l'amplificateur de haute fréquence
skip zone—la zone de silence
troposphere—la troposphère
final stage—l'étage final (m)
switch—le commutateur
standing wave—l'onde stationnaire (f)
speech processor—compresseur de tonalité
aurora—l'aurora
auroral—auroral
low pass filter—filtre passe-bas (f)
high pass filter—filtre passe-haut
band pass filter—filtre passe-bande (f)
earth—terre
to earth—relier à la terre
earthed—relié à la terre
deviation—la déviation

line of sight—ayant une connection de visibilité
balun—le dispositif d'équilibrage
ionosphere—l'ionosphère
repeater—le relais/réemetteur
satellite—le satellite
coil—la bobine
valve—le lampe/le tube
insulator—un isolateur

metal case—le carter metallique
dial—le cadran
jack—la douille
plug—la prise
dummy load—la fausse charge
parasitics—les modulations parasitiques
ground wave—une onde de surface
sky wave—une onde ionesphérique

fading—la chute d'intensité
condensor—le condensateur
variable—variable
fixed—fixé
preset—reglé
transistor—le transistor
the range—la portée
rotator—un rotateur

The French alphabet—used for stating Q code and also for stating callsigns.

letter	French name	pronunciation
A	ah	ah
B	be	bay
C	ce	say
D	de	day
E	eux	yh
F	effe	ef
G	ge	zhay
H	hache	ash
I	i	ee
J	gi	zhi
K	ca	ka
L	elle	el
M	emme	em
N	enne	en
O	o	oh
P	pe	pay
Q	cu	kay
R	erre	er
S	esse	es
T	te	tay
U	u	i/u
V	ve	vay
W	doubleve	dooblvay
X	icse	ics
Y	igrec	eegrec
Z	zède	zed

Common French Christian names of operators—it's easier to recognise them in the QRM if you have seen them before.

Bernard	Luc
Charles	Leon
Claude	Marc
Christophe	Max
Daniel	Marcel
David	Mathieu
Etienne	Nicholas
Florent	Pascal
Francois	Pierre
Guillaume	Philippe
Jean	Regis
Jean-Paul	Roger
Jean-Claude etc	Serge

Numbers together with their pronunciation.

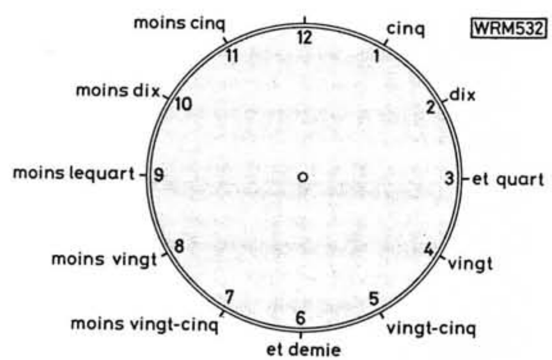
1	un	un
2	deux	dyh
3	trois	trwa
4	quatre	catr
5	cinq	sank
6	six	sease
7	sept	set
8	huit	weat
9	neuf	nough
10	dix	dis
11	onze	onz
12	douze	dooz
13	treize	traiz
14	quatorze	catorz
15	quinze	kanz
16	seize	says
17	dix-sept	dis-set
18	dixhuit	disweat
19	dix-neuf	disnough
20	vingt	vant
21	vingt et un	vant ay un
22	vingt-deux	vant dyh
30	trente	tront
31	trente et un	tront ay un
40	quarante	karont
50	cinquante	sankonte
60	soixante	swasont
70	soixante-dix	swasont dis
80	quatre-vingt	katr van
90	quatre-vingt-dix	katr van dis
100	cent	son
200	deux cent	dyh son
1000	mille	mil
2000	deux mille	dyh mil

Days of the week.

Sunday	dimanche	dimonsh
Monday	lundi	lyndy
Tuesday	mardi	mardee
Wednesday	mercredi	mercredee
Thursday	jeudi	jydee
Friday	vendredi	vondredee
Saturday	samedi	samdee

On Sunday—dimanche
On Sundays—le dimanche
Next Sunday—dimanche prochain
Last Sunday—dimanche dernier

Time
1 o'clock—il est une heure—il ay une oeur
2 o'clock—il est deux heure—il ay dyh oeur
2.05—il est deux heures cinq—il ay dyh oeur sank
2.55—il est trois heures moins cinq—il ay trwa oeur mwan sank



The last appendix shows some of the former French colonies which might count as your rarer countries. The feminine adjective in brackets used after e.g. la station.

Country	Adjective
Le Tahiti	tahitien(ne)
Le Gabon	gabonaise(e)
Le Martinique	martiniquais(e)
Le Madagascar	malagache
L'Algérie	algérien(ne)
Le Maroc	maroccain(ne)
La Tunisie	tunisien(ne)
L'Indochine	indochinois(e)
La Guyane	guyanais(e)

NEWS NEWS NEWS

Marconi in Ireland

To commemorate the establishment of the first transatlantic radio station in Ireland, the Connemara Radio Experimenters Club will be operating a special event station from the original site. This station will be situated at Clifden, Co. Galway, the site of Marconi's first transmission from Ireland. The callsign will be EIMFT and the dates are 25–27 June. The station will be on h.f., v.h.f. and u.h.f. covering all modes including RTTY and operating 24 hours a day.

Aligning the FT-101

Owners of the popular FT-101 h.f. transceiver will be aware that the alignment instructions contained in the manual involve quite a major operation. For those owners who wish to "touch up" a unit which is just a little off tune, Holdings Photo Audio Centre has produced a free leaflet containing instructions on how users may "peak up" their set.

The leaflet also includes notes on aligning the band pass filter, and is obtainable, in return for a large s.a.e., from: *Holdings Photo Audio Centre, Mincing Lane, Darwen Street, Blackburn BB2 2AF. Tel.: (0254) 59595.*

New Catalogues

Greenweld, the Southampton based component suppliers, announce the availability of their new 1982/83 catalogue.

This 60-page catalogue lists hundreds of useful items for the electronics enthusiast, plus discount vouchers, bargain list, wholesale list, order form and 1st class reply paid envelope.

Costing 50p plus 25p p&p, the catalogue is available from: *Greenweld Electronic Components, 443 Millbrook Road, Southampton SO1 0HX. Tel: (0703) 772501.*

Ambit International's latest "Concise Parts Catalogue" is now available. Its 96 pages contain a host of interesting items plus three £1.00 vouchers and order forms.

The catalogue costs 70p, which includes p&p, and is obtainable from: *Ambit International, 200 North Service Road, Brentwood, Essex CM14 4SG. Tel: (0277) 230909.*

UOSAT-OSCAR 9

The following telex message has been received from Ron Broadbent G3AAJ, Secretary of AMSAT-UK:—*"During the course of altitude control to UOSAT-OSCAR 9 by the University of Surrey command, a control malfunction occurred causing both data beacon transmitters to be switched on. This has resulted in some desensing of the command receivers making difficulty in controlling the space craft excepting during direct overhead passes.*

This problem is expected to be with us for several weeks and future spacecraft programmes will contain a fail safe device."

RAE News

Readers may be interested in some figures recently supplied by the City and Guilds concerning the RAE Examination 765-01 and 02.

For the May 1981 examination 5334 candidates sat part 01 and 5543 sat part 02, of these 3961 passed both parts and "qualified for the award." Similarly, in December 1981, 5340 candidates sat part 01 and 5332 sat part 02 and a similar pass rate is expected.

However, registrations for the May 1982 examination reveal that 8146 candidates will be sitting part 01 and 8181 sitting part 02.

Rally Date

Nunsfield House Community Association Amateur Radio Group has organised the Elvaston Castle Radio Rally for Sunday 13 June 1982.

Opening at 1000 hrs, talk-in will be available from 0930 on both 144 and 432MHz. All the usual attractions will be present including trade stands, Grand Bring-n-Buy Sale, a flea market, full on-site catering, together with many displays and events throughout the day.

Further details from: *Hon. Sec.: Ian M. Cage G4CTZ, 27 Long Row, Shardlow, Derby. DE7 2HE. Tel.: (0332) 799452.*

Expedition to XJ

Readers interested in QTH location square awards will be pleased to learn that an expedition to the rarely active square XJ has been organised by members of Liverpool University Amateur Radio Society.

Dates for the expedition to Lizard Point, Cornwall, are 14 to 21 July 1982. The Society are hoping to be active on the following bands:—1·8, 3·5, 7, 14, 21, 28, 144 and 432MHz plus 1·3, 5·6 and 10GHz.

Skeds and further information may be obtained from: *Club Secretary, G3OUL, QTHR.*

VHF Repeater News

The two Borders repeater units GB3BT and GB3SB should be operational shortly after you read this announcement.

The Eire v.h.f. repeater network continues to expand, with the formation of a group intent on establishing a 144MHz repeater to cover the mountainous terrain of Connemara. I look forward to publishing a complete up-to-date list of all Eire repeaters in the near future.

UHF Repeater News

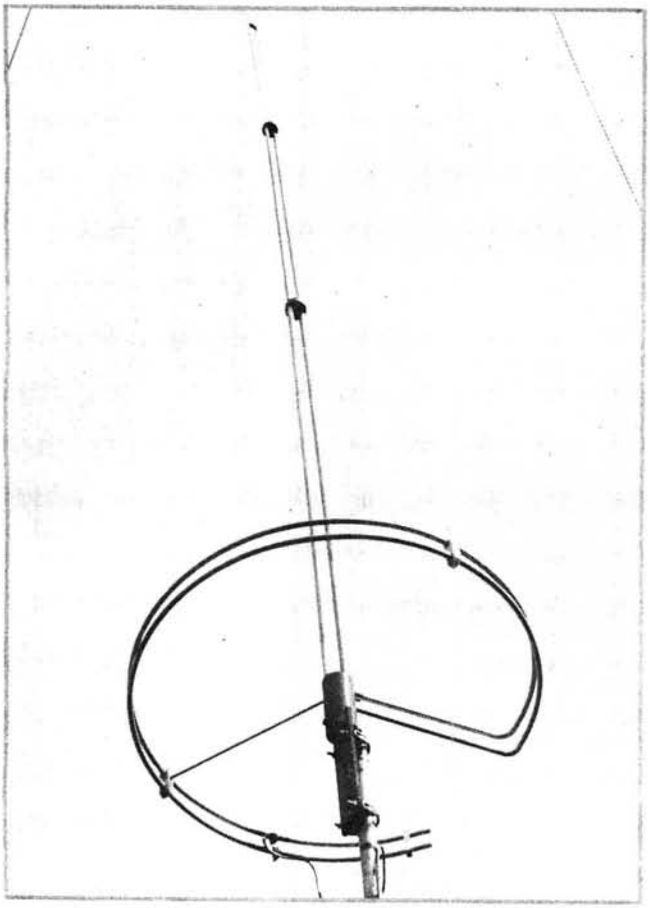
A meeting of the RSGB Repeater Working Group on 3 April 1982, determined the extent of proposals for the u.h.f. Phase 7 repeaters. A total of 15 complete proposals were received by the deadline date, and after final evaluation, by the RWG, will be passed to the Home Office later this year. The list is as follows, all channel allocations remain provisional:

GB3CA	Carlisle	RB13
GB3CY	York	RB13
GB3DS	Worksop	RB13
GB3GD	Leicester	RB12 RTTY/data
GB3GH	Gainsborough	RB15 (still under discussion)
GB3GU	Guernsey	RB13
GB3HK	Hawick	RB14 (Borders)
GB3KB	Biggin Hill	RB0
GB3KR	Kidderminster	RB4
GB3LA	Leeds	RB11
GB3PP	Preston	RB13
GB3SU	Sudbury	RB15
GB3SZ	Bournemouth	RB15
GB3VE	Bury-St-Edmunds	RB6
GB3YS	Yeovil	RB2 (still under discussion)

You'll be pleased to know Phase 8 u.h.f. is now under consideration!

The 27MHz CB Radio Antenna ②

F.C. JUDD G2BCX



The first part of this article dealt with the various antenna designs that could be used to meet the 27MHz CB licence Schedule 3 requirements and also some that, although efficient, would not comply with the regulations laid down. We deal now with the efficiency of the antenna design specified by the Home Office for 27MHz CB operation.

Antenna Efficiency

Some of the power entering the antenna from the transmitter is wasted in heat owing to the resistance of the conductor used and also insulation loss, but in all antennas long enough to be *fully resonant* these losses are quite small compared with the power actually radiated. It is, however, convenient to represent the power actually radiated in terms of a fictitious resistance called the radiation resistance and say that if this has a value R_r with a current I flowing into it, then the power radiated is I^2R_r.

When an antenna has a length that makes it naturally resonant at the frequency of operation, the *radiation resistance* is very nearly equal to its own input impedance. It should be remembered, however, that the impedance and radiation resistance of antennas operating in the lower (h.f.) frequency ranges can change as the height of the antenna above natural ground is increased but that need not concern us here since we are dealing with ground-plane type antennas. The important factor is *radiation resistance* which, incidentally, should not be confused with the purely resistive property of a non-resonant antenna.

As the length, or what is more usually called the *effective height* of a vertical antenna is made shorter than a natural resonant length, the radiation resistance becomes smaller and the power actually radiated is reduced. The addition of a loading coil to provide the requisite inductive reactance to obtain resonance also introduces considerable resistive loss. This and insulation loss, etc. can be combined and denoted as R_{dc}. There is also ground loss, the amount of which depends on the conductivity of either real ground beneath the antenna or any artificial ground-plane that may be used and which can be denoted as R_g. It is when the antenna radiation resistance R_r becomes small that losses due to R_{dc} and R_g begin to assume larger proportions by comparison. The radiating efficiency of the antenna then becomes:

$$\frac{R_r}{R_r + R_{dc} + R_g} \times 100\%$$

The chart (Fig. 6) shows the radiation resistance for various antenna lengths in terms of wavelength. In using this chart remember that the wavelength taken at the middle frequency of the UK f.m. CB allocation (27·6 to 27·99HMz) is 10·79 metres. The HO specified length of radiator for this band is 1·5 metres which is approximately 0·139 of the wavelength and the radiation resistance for this is about 6 ohms (from Fig. 6(a)). Note that for a full quarter-wave (Fig. 6(b)) the radiation resistance is 36 ohms.

With a really well designed antenna we can take the overall ohmic loss (R_{dc}) due to the loading coil and other d.c. losses as approximately 30 ohms and the ground loss (R_g) with a relatively small ground-plane as at least 20 ohms. The radiation efficiency will be:

$$\frac{R_r}{R_r + R_{dc} + R_g} = \frac{6}{6 + 30 + 20} = \frac{6}{56} \text{ or } 10{\cdot}7\%$$

which means that if 4 watts of power is supplied to the antenna only 10·7 per cent or 0·43 watts will be radiated and this incidentally ignores any coaxial cable loss and any loss due to antenna mismatch. *Some commercial CB antennas designed to meet the HO specification have an efficiency as low as around 5 per cent largely due to the use of loading coils with high r.f. resistance, metal fittings in close proximity to the loading coil that cause power loss due to heating, whip type radiating sections made of very thin, hardened steel and also poor quality insulating materials.*

It was mentioned in Part 1 that the loading coil plays no part in radiation and serves only to maintain resonance. It is the straight portion of the antenna only that produces radiation by virtue of the current flowing in it and its

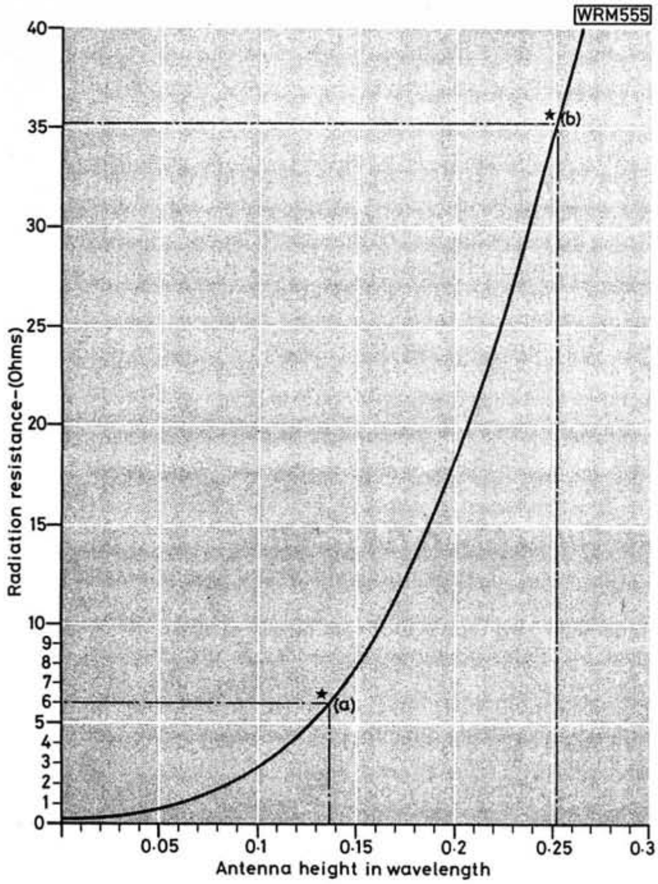


Fig. 6: Radiation resistance against height of short antennas operating above a ground-plane. Example marked *(a) is for the specified 27MHz CB antenna. Example marked *(b) is for a quarter-wave of full length

radiation resistance (R_r). However, the power from the transmitter is dissipated into what it sees as a total resistance equal to the impedance of the antenna input. For CB radio this impedance is standardised on 50 ohms so with a perfectly accurate match and consequently a v.s.w.r. of 1 to 1 the current flowing into the antenna will be $I = \sqrt{4 \div 50} = 0{\cdot}28$ Amps (this also ignores cable loss). The radiated power will therefore be I^2R_r or $0{\cdot}28^2 \times 6 = 0{\cdot}47$ watts which is close enough to the previously calculated radiation efficiency figure of 0·43 watts.

Other Accountable Losses

So far we have ignored losses due to the coaxial cable between the antenna and transmitter and also the angle of maximum radiation of a typical short length antenna operating above a ground plane as specified by the CB licence. Reflected power due to even a small mismatch between the transmitter and antenna is also lost power. Power loss due to coaxial cable of the commonly used RG58U with an average run of 10 metres and using PL259 connectors will be about 1·5dB which means that out of the 4 watts leaving the transmitter approximately 2·828 watts actually arrives at the antenna. Let us now assume that reflected power due to mismatch gives a v.s.w.r. of 1·2 to 1 (an average low figure), the power lost will be 0·035 watts. The power now arriving at the antenna will be 2·828–0·035 = 2·793 watts. This represents a current into the antenna of 0·236 amps but since the radiation resistance is only 6 ohms the radiated power will be $0{\cdot}236^2 \times 6 = 0{\cdot}334$ watts which is a lot less than even the 2 watts e.r.p. allowed by the CB licence.

Loss Due to High Angle Radiation

Some examples of vertical angle radiation from vertically polarised ground-plane antennas were given in Part 1. Since CB radio is intended for point-to-point ground path communication the antenna should ideally have maximum radiation at right angles to it, i.e. along a path parallel to ground. If the angle of maximum radiation is in the region of 35 degrees as shown in Fig. 8 then the power loss in the direction most needed along a ground path, can be as much as 6dB. So taking the last figure of power actually radiated from a typical "specified" 27MHz antenna, i.e. 0·334 watts, the loss of 6dB due to high angle radiation would bring the real ground path radiation down to 0·083 watts or 83 milliwatts.

Field Trials Give the Answer

Long before CB radio was actually licensed in the UK the writer was carrying out field trials with various antenna designs for both 27MHz and 934MHz under a special Home Office licence issued with the callsigns G9BTM and G9BTN. The second chart (Fig. 7) may

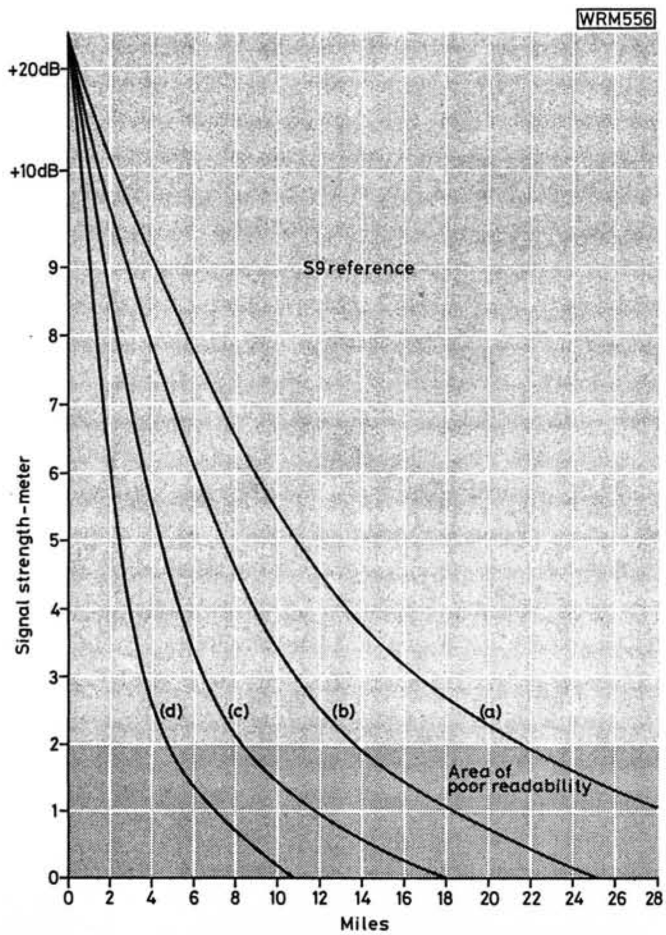


Fig. 7: Results of field trials with various antennas operating on 28·8MHz. (a) Fully resonant end-fed folded dipole—length 5·18m. (b) Centre-loaded end-fed resonant half-wave about 2·9m in length. (c) Centre-loaded end-fed resonant half-wave 1·5 metres long. (d) 1·5 metre base loaded to CB licence Schedule 3 with four 2·44m long ground-plane radials

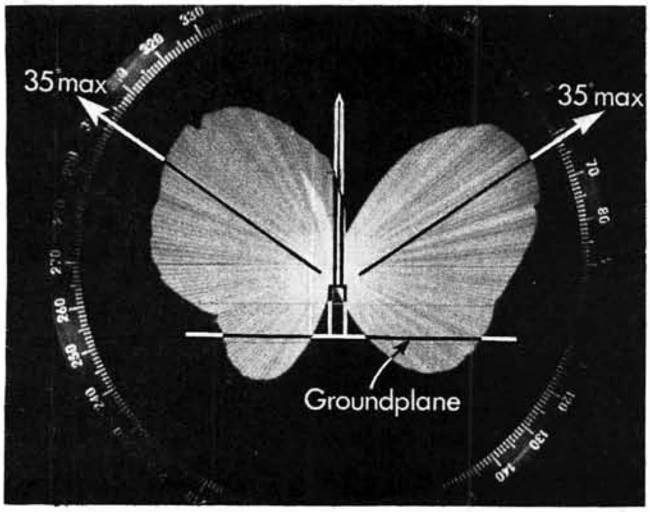


Fig. 8: Vertical angle radiation pattern of a legal omni-directional ground-plane antenna

prove interesting and shows the results obtained with four different antenna designs, one of which (d) was as specified in the CB licence Schedule 3. Each antenna trial was carried out along the same course over flat country and during normal daylight hours. Each antenna was separately tested in the same position and at the same height of 7 metres. The same coaxial cable was used for each and with v.s.w.r. set and checked with a Bird Thru-Line meter to a ratio of 1:1 for the frequency of operation, namely 27·8MHz. The power supplied in each case was 4 watts. The captions denote the different antennas a, b, c and d. The largest and most efficient antenna used (a) was the vertical folded half-wave shown on page 58. Readers may realise that this is a 27MHz version of the Slim Jim originally designed for v.h.f. 144MHz operation, but with the lower quarter-wave matching stub set horizontally in the form of a circle at the base.

The bottom part of the chart marked "area of poor readability" is where signals below the S2 level were rather too difficult to copy through general noise or other interference. Each antenna was of course capable of receiving signals from continental countries due to short skip conditions and at times such signals were so strong that trials had to be abandoned for obvious reasons. Even the most inefficient ground-plane type antenna seems incapable of keeping out what CB operators and radio amateurs refer to as "spaghetti" QRM.

Finally, a note about various CB antennas that are being sold but which do not meet the HO specification. It is up to CB operators as to whether they use full half-wave antennas or beams of one kind or another but **beware of false claims that are being made for gain.** If the antenna is 5·2 or 5·5m long it will be a half-wave (usually end fed) and will have no gain. Some half-waves are advertised as having a gain of 4 or 5dB which is, of course, impossible. Even a 2-element colinear for 27MHz, which would be in the region of 10·4 metres long, could not have a gain of more than 2·8dB. Three-element beams and two-element quads are being sold with claims of gain up to 14dB. Neither of these antennas can have a gain of more than 5 to 6dB. ●

Further Reading

Antennas—J. D. Kraus—McGraw Hill Publications.
ARRL Antenna Handbook—ARRL Staff.

Clang!

In the caption to Fig. 3(b) infinite should read finite. In Fig. 5 the average length should read 1·5m.

TS-530S REVIEW

▶▶▶ *continued from page 39*

The r.f. attenuator is useful on the 1·8, 3·5 and 7MHz bands to reduce cross-modulation at night, whilst still retaining meaningful "S" meter readings. The 25kHz marker serves little function as a calibrator, bearing in mind the accuracy of the digital display, but is useful as a built-in signal generator for alignment and "S" meter tests, etc.

The IF SHIFT control is very nice to use, not only to "drop out" QRM from the passband, but also as a tone control on incoming signals. The RIT and XIT are essential for DX or local working, and both work extremely well.

Band switching is easy, and the final stage seems quite tolerant of dubious antennas.

Enabling the WARC Bands

This is not as straightforward as the manual would have one believe. Diodes are installed to prevent accidental transmission on unauthorised bands. The removal of individual diodes to allow transmission on, say, 10·1MHz whilst leaving 18 and 24MHz inhibited is a tricky job requiring dexterity and very delicate tools. Unsoldering the diode would be especially difficult, probably requiring the board to be lifted from the chassis. Cutting the diodes out would be the preferred method, provided they were never required to be replaced.

Easier by far is to enable transmission on all three WARC bands by cutting the blue wire just behind the v.f.o. screening box, which joins Pin 1 of connector (6) on the r.f. unit to Pin 4 of connector (7) on the a.f. unit. This is not only easier, but also essential in the writer's view to check the TS-530S in all its functions, so that warranty claims can be made if the WARC bands are faulty in any way.

A station with the call of an old timer QRT and dead was heard on a London repeater. When told of this the voice became all heavenly, "Yes I am he, calling from the world beyond". Another voice says, "God, some lift on to-night".

. . . heard by G2DRT

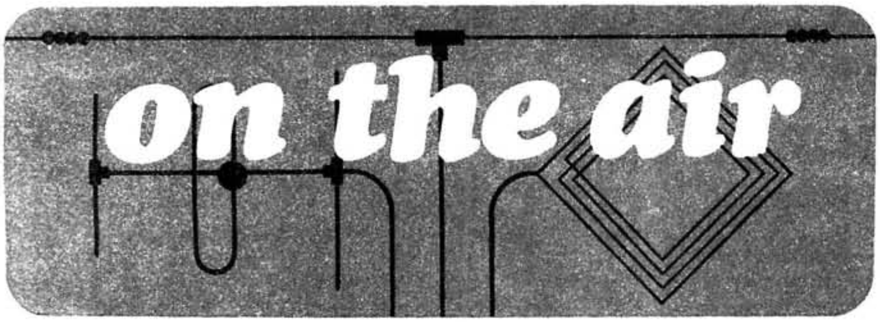
"I was thinking of buying a 5/8 λ mobile whip for 2m and see there is a choice of stainless-steel or glass fibre."
"OK on the steel, but how can you make an antenna out of glass fibre when it is an insulator?"

. . . heard by GM8OWX

"Nice to work you for the first time, again!"

. . . heard by G8KEN

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



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.

One type of receiver that has received a lot of attention in recent years is the direct conversion design in which the r.f. signal is converted directly to an audio signal without the intervening i.f. stages of a superhet receiver. The design in the Oct 1980 issue of *PW* proved very popular indeed, bringing in long lists of DX heard from readers who had built it. It does make an ideal first receiver project for the constructor.

Its main defects are lack of selectivity and the fact that most of the gain has to be achieved in the audio amplifier stages where noise is a big problem at the best of times.

To understand the idea behind the d.c. receiver (an unfortunate appellation) one needs to go back to the valve era and the straight receiver with designations such as 0-v-1, 1-v-2, etc., meaning no r.f. stage plus detector plus one audio stage, and r.f. stage, detector, plus two stages of audio respectively. A typical detector stage of this period is shown in Fig. 1 with a reaction or feedback winding L2 wound on or close to the main tuned circuit L1/C1 in such a way that energy could be fed back from the anode to the grid circuit, controlled by the reaction capacitor C2.

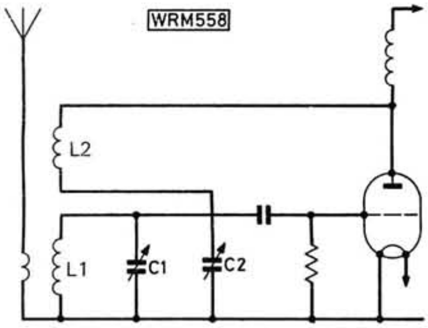


Fig. 1: Basic circuit of a valve detector circuit where the feedback from the anode to the grid via L2 to L1 is controlled by the reaction capacitor C2

When the degree of feedback was sufficient to overcome the losses of the circuit the detector would oscillate of its own accord at a frequency principally determined by the tuned circuit L1/C1. Then the oscillation could beat with any carrier to produce an audio tone so it was eminently suitable for detecting Morse code signals. For telephony reception the reaction would be backed off so that self-oscillation just ceased, at which point sensitivity and selectivity would be at their greatest.

The c.w. condition of such a detector can be used today for demodulating s.s.b. signals, the locally generated carrier replacing the suppressed carrier as does the b.f.o. or carrier insertion oscillator in a superhet receiver.

Coming to the d.c. receiver, Fig. 2, the detector circuit remains but the inserted carrier, for c.w. or s.s.b. reception, is generated in a separate stage and fed into the detector stage under controlled conditions, enabling better stability to be obtained. An important factor in the detector stage is that it should be as linear as possible, the product detector usually being employed using special diodes in a balanced configuration.

The signal is amplified before reaching the detector and an audio filter added after the detector. The selectivity of the d.c. receiver is determined in the audio stages with appropriate filters for c.w. or s.s.b. reception. In effect the d.c. set is a superhet with an i.f. frequency of zero with the input carrier and local oscillator on the same frequency. The audio contained on the input signal forms the difference signal which is detected and passed through to the audio stages.

The d.c. receiver will receive a.m. signals, as distinct from s.s.b., by tuning the signal to zero beat, but it is not entirely satisfactory. Other names for the direct conversion receiver are homodyne or synchrodyne but these are seldom encountered these days.

Reporting the DX

Must tell you first of all of our DXer **Kelvin Weaver** BRS46864 of Blackwood in Gwent who, at 16, has passed the RAE, not to mention his father who also passed! Both await calls (who doesn't!) but both intend getting the code test over before long. An FT-101ZD is used with a short wire antenna for receiving at the moment, but a trapped dipole is being constructed in the interim. Resisting the temptation to press the microphone button Kelvin logged FR0FLO, J28DP, VS6CT, 8P6OR and 8Q7BN on 28MHz (10m) plus CO2HQ, KL7IB, VP2AO, VP2MDG, ZD8DZ, 5H3LM on 21MHz (15m) and then C31WW, D68AM, JW0P, J73PP, VP8QI and ZI4BC on 14MHz (20m), a goodie in DF3NZ/ST2 on 7MHz (40m) and down to 3·5MHz (80m) for ZL1BQD, 5Z4YV, 7X4AN and 9H1FN plus several PYs.

From Edinburgh **Anne Edmondson** BRS47285 queries the QSL address of W6QL/8R1 which I quoted as being via W6RGG. She reckons it is the Yasme Foundation. Anne's DX-200 seems to be sick around the dial mechanism, the bandspread dial that is, but she's hoping to persuade a GM4 at her club to perform the necessary. Doubt whether she will have any problems in that direction! Before the string went ping Anne copied SV0AU on 28MHz, then K6GXO/V2A (QSL home call), and YC1BZ on 21MHz followed by plenty of JYs, VP2EC and EM0C on 14MHz. That last one looks like an EA in disguise for a contest. Interesting on 7MHz was SM0GMG/CT3 probably on holiday, and F0DYM/FS7, VP2EC again, with good catches on 3·5MHz in C6ADV, EA9IE, VP9AB and HK, and 7Z2AP who wants cards to POB2537, Ryadh, Saudi Arabia. Anne queries ED3VM which, I'm afraid, is probably just a novice EA3.

Stephen Evans BRS50397 (Hornchurch, Essex) took my advice and built an a.t.u. in about four hours and costing around £12 altogether. The result, a great improvement all round. Included in his log are J6LTZ, TL8CK, 4K1A and 5N8PBN plus OE1EB/P on the Golan Heights all on 14MHz (20m). On 21MHz

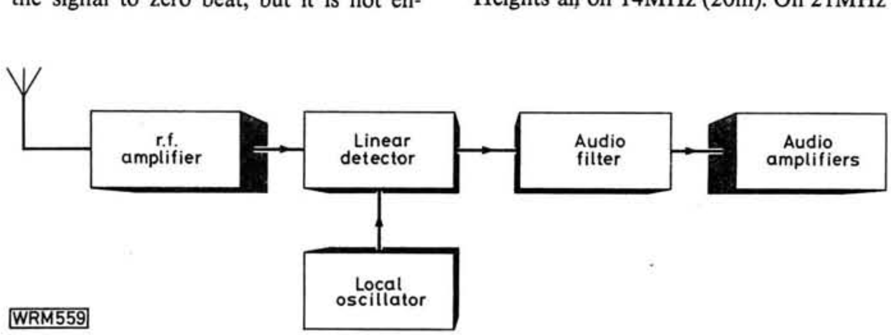


Fig. 2: Block diagram of a practical direct conversion receiver. The r.f. stage is a virtual necessity since almost all the following gain occurs in the audio stages

(15m) he got FK8DD and JX5VAA, while on 28MHz it was Z21GL, 5H3AA, 9J2TJ, all on s.s.b.

The FRG-7700 plus matching a.t.u. plus VK2ABQ beam for 28MHz, also used on the other h.f. bands, brought in HK0FBF on San Andres Is, H44PT, KG4QQ, VK9ZH on Wallis Is, AH8AA on US Samoa who wants QSLs to W4FGX, JT1BG, KB7IJ/KH2, ST2FF, VK9NNF on Norfolk Is, and 6E5RN on 28MHz for **Dave Coggins** (Knutsford, Cheshire). On 14MHz AH2L on Guam turned up, plus T32AB on Christmas Is with cards to N7YL, and VE8RCS at Alert close to the North Pole. Down to 7MHz and CO2HS, VK3XI, HK0FBF again, VK9NS on Norfolk Is, ZL4BO and ZL4OY/A an excellent catch on Campbell Is.

In Ramsgate, Kent, **Archie Magrath** remains BRS48064 having boobed with the last RAE, but after only four months of study for the exam he agrees it was just a bit too soon. Contrary to most people he is quite happy with his QSL returns. His solution—a good card that catches the eye. Archie's R-1000 plus Global AT1000 a.t.u. fetched VP2ED, VP2VA on 28MHz then YB8AEG, VP9KQ, and VP2MGQ on 21MHz s.s.b. among many others. In Hamilton, Scotland, **Donald Stewart** has been doing some sterling work with a Ferguson receiver plus an Eagle RAD30 which seems to be used as a b.f.o., and a short wire for an antenna. On 14MHz he managed SV5SW on Rhodes, DU1RFU, HC2HX, 5V7HL, DF3NZ/ST2, KH6GDR, ZL3SO and HC6MN.

An interesting note from **Radio Officer Guiney** EI2EF at the Valentia marine radio station reports that a distress signal put out by a Spanish ship on 2182kHz at 2200GMT on March 11 was copied by Perth marine radio in VK-land, subsequently confirmed by telex. The report was 3 × 3 so Top Band users trying to make that VK QSO should not give up hope.

Another who believes in taking the hard way is **D. J. Ackrill** of West Heath, Birmingham, who uses a Grundig Melody Boy 600 plus a Masteradio receiver as the external oscillator, and the telescopic antenna on the Melody Boy, pulling in mostly Euro stuff on the 7MHz (40m) band. Then an HAC Triple-T receiver was obtained which with a short wire did a bit better on 14MHz (20m) copying lots of Ws and VEs. Eventually the RAE is on the cards. **Robert Roberts** of 3 Caefron, Upper Llandwrog, Carnarvon, Gwynedd, has bought a JR599 but wonders if anyone has an operating manual to spare (not a service manual). For a beginner he has not done so bad with 5H3DM, S21GM, FR7SN and TL8MX on 20m.

Our regular DXer **Allan Stevens** has moved QTH to East Grinstead, W. Sussex, and is still waiting for his G6, with an FT-290 already to hand. However a G4 is still in mind before long. Newcomer to the column **Stephen Evans** BRS50397 of Hornchurch, Essex is also new to the hobby and managed to get an old KW77 quite cheaply and to get it going with over 70 countries in the log already. A wire 11 metres long brought in C53AD on 28MHz, YS1SA and OA4JR on 21MHz, plus DU3MC, 3D6ZQ, VP2EX, VP9VQ and J3AUT all on 14MHz s.s.b. Next job is an a.t.u.

A few c.w. entries from **Paul Williams** of Whitehaven, Cumbria who it turns out trained as a merchant navy op but went into the Army. Back home with his Realistic DX100 and a 15 metre wire he found 6Y5SG on 21MHz c.w. and then 7Z2AP, FY7YE, VP8QE, BP2MMP, FG7AS and 8P6QA also on c.w. on 14MHz with VP2EX on s.s.b. A fan dipole for 28 and 21MHz in the roof restricts **Rob Gibson** (Wadhurst, E. Sussex) to those two bands being unable to get anything up outside. While still QRX for his G6 he copied 5H3BH, 9L1TH and 9X5PP on 28MHz, HP1XKZ and PZ5AA on 21MHz, then 9X5SL, AP2P, CP6JX, DL2VK/ST2, HL1SF, KH6IJ, P29GO, TYA11, VS6CT and YB6ADZ on 14MHz.

Stephen Bowler (Wakefield) managed to get his G4MH Minibeam up at last with good effect it seems. A colour photo of his shack is unsuitable for reproduction, unfortunately. Remember they should be clear, and black and white of reasonable size. A Datong Morse tutor should help towards that G4 before long. In the meantime it was JR6OJD, 5H3BH, EM0C and 4K1A on 28MHz, JR6VNJ and HK5BCZ on 21MHz ending with CU5UA (CT-land), KG6DX and V3WS on 14MHz. From Thurnscoe, near Rotherham, **John Gwynn** sends a log for 14MHz s.s.b. heard with his Unica receiver and a 40 metre long end-fed wire, like A71AO (POB4747, Doha, Qatar), TA1CT (Box 902 Istanbul), SU1ER, VK0AN, VK9NS, 7Z2AP, KC4XJ, FK8DR, KG6RN and ZD7AL.

A new one on 1·8MHz (160m) on s.s.b. was LX1PD for **Philip Morris,** near Swansea, plus JW0P on 3·5MHz (80m), then on 14MHz (20m) it was KC6IN, ZD8TC, T32AB, ZL4OY/A, 7P8CG, TR8GM, TN8AJ, 9U5WR and VQ9CW, all with a CR-100 and 40 metre long wire. An FRG-7700 plus a.t.u. and long wire plus Datong FL2 audio filter has done well for **John Hayes** of London N9 with DU1RD (QSL POB2041 Manila), P29MF, VP2MCK, XT2AU, and YB0AC (QSL WA4RRB) on 28MHz, TL8CK, ZD8TC, 6E5MX, JE2HCJ/P/8N2, 9U5WR all on 21MHz, with 14MHz coming up with SV9PR, V3MER, ZD7AL, and ZD8TC. For 7MHz John logged FR7CE, HK0EHM and 8P6OR ending with FY7AN and 6D5M on 3·5MHz, a good use of a multiband receiver!

Jim Dunnett of Prestatyn, Clwyd, says he got fed up with DXing which is just as well or he would have wanted the whole column for his log! So here goes for c.w., s.s.b. and RTTY. Taking c.w. first it was OY7ML and UK9FER on 1·8MHz, C6ABA, DL2GG/YV5, VK3MR, VP8ANT and ZS1QN on the new 10MHz band, C53AP, FY7BC, SV5SW (POB349 Rhodes), V2AU, 6W8FJ on 14MHz followed by OZ-OY-HB-OE on the newly-released, for some, 18MHz band. Then the 21MHz provided C53AP, FR0GGL, HP1XEK, J28CI, M1C, SV5SW, 6W8EX with s.s.b. stations C32MJ, 9J2TJ and 9U5WR on the side. That other new band on 24MHz produced LA-HB-DJ and other Euros on c.w. For 28MHz c.w. it was A92CE (?), CE0AE on Easter Is, J3ABA, VK9XM, Z23JO, 3X1Z with s.s.b. catches C53AP, S79MC, TYA11 (QSL ON5NT), V2AO, VP5WJR, VP8ZV, 8P6OR. Now to RTTY with FG7BG and PY2QV on 14MHz, then CE3CEW, SV1MO, V2AW on 21MHz and finally FY7BC, V2AW, YB2BLI and 5N9FDR on 28MHz. Phew!

Jon Kempster BRS45205 deserted his FRG-7 for a walking tour in the Peak District, after trying unsuccessfully to get it in his rucksack. Much excitement when local G3VRY brought round an FT-902DM to try on Jon's G5RV antenna as /A with a JA on 21MHz to start the ball rolling. Back to the FRG-7 though with J28DL and VP2EC on 28MHz (10m), with 4N6HN, CE3NR and OA4AWD on 21MHz (15m) and lonely FP0FSZ on 14MHz (20m) who wants cards via VO1FB. The last was logged on a recently acquired FRDX-400.

In General

Vast quantities of information pouring in this month so individual mentions must be short. Bitter comment by **Clive Cowan** of Rugeley, Staffs, who, having passed the RAE, reckons he will now have enough time to save for a new rig before his new callsign arrives! In the meantime it's code practice for the G4+3.

Those who support the RAIBC will be interested in a sponsored walk being organised by **Hans Field** G8WXW (6 Llandovery Close, Winsford, Cheshire) over 10 miles starting at 10am on Sunday June 6, on behalf of the Mid-Cheshire ARS. Anyone interested in walking or sponsoring drop a line to Hans.

Wanted, circuit diagram and/or manual for the CR300 by **Chris Reed,** 5 Waverley Drive, Chertsey, Surrey with all expenses reimbursed. Seems Dad worked the DX with an 1154 and AR88 in days gone by, so it's rubbing off. **Neville Moore,** aged 14, from East Kilbride, Glasgow, reports success in the RAE but very bravely is carrying on with the code practice in order to get his G4 straight away, but "O" level studies don't help.

In order to get his 1155A receiver going **Bill Piper** of 2 Church Road, Dunton, Brentwood, Essex, would appreciate details of a suitable power unit and audio stage. Bill, an o.a.p., returns to the hobby after some 50 years in other fields. The code was learned during the war so a G4 ticket could be in the offing.

The RAFARS is mounting a scientific expedition to the Scilly Isles, roughly June 11 to 25, to investigate DX paths at u.h.f. and v.h.f. although h.f. equipment will also be carried. Calls to be G3RAF/P and G8RAF/P located on St Mary's Island under canvas with maximum of 12 operators. Interested in going along? Then send details of RAFARS membership and operating experience and RAF details to Admin Sec, RAFARS, RAF Locking, Weston-Super-Mare, Avon BS24 7AA.

Coming from computers **Iolo Davidson** of Hawling in Glos seems to have become entirely devoted to amateur radio. His valved KT320 is now working after some faultfinding and logs are promised. First venture into the hobby by **John Hargreaves** of Lancaster is with a DX302 and, having just retired, John will have plenty of time for the DX, with a short wire in the loft, although he does not like the look of the RAE papers!

Dave Shirley BRS46900 says he has given up prodding the HO for his licence and taken to prodding rice puddings as the result is the same, no reaction! His pleas to the RSGB seem to have fallen on deaf ears, he says. An FT-101DFM is on the way to connect to the G5RV antenna already up.

Club Spot

If you are looking for a local club but can't find it in this month's issue then look back over past issues, or write for information to the RSGB to which most clubs are affiliated.

Greater Peterborough ARC Fourth Thursday at Southfields Junior School, Stanground, at 7.30. June and July are visits to the local police HQ and to Hereward Radio respectively. Contact is Frank G8ZVW, 27 Lady Lodge Drive, Orton Longueville, Peterborough or 231848.

Aylesbury Vale RS Meets "ever four weeks" at Stone Village Hall, near Aylesbury at 8pm. However next one is on Tuesday June 15 when G3KLT speaks on the exploitation of natural phenomena. More precise details from M. J. Marsden G8BQH, "Hunters Moon", Buckingham Road, Hardwick, Aylesbury or 641783.

North Bristol ARC Normally last Friday of the month except for June, July and August because of outside activities like the League of Friends fund-raising fete on June 5, and GB2LOF, probably. Also NFD day so resources pretty strained by all accounts. It's Ted Bidmead G4EUV, 4 Pine Grove, Northville, Bristol or 691685 and, before I forget, normal meeting place is the Self-Help Enterprise, 7 Braemar Crescent, Northville, Bristol.

Copeland ARC New one for the column I think, meeting first and third Weds at 7.30 in the Market Hall, Egremont, West Cumbria, with everyone most welcome. Contact Bill Duddle G4EDV, 28 Rannerdale Drive, Whitehaven, Cumbria or W'haven 3458.

Radio Amateur Invalid and Blind Club Notice of AGM on Sunday June 20 during the mobile rally of the Denby Dale ARS at Shelley High School near to Denby Dale, a venue which will be appreciated by all those more northern members of RAIBC. Francis Wooley G3LWY, 9 Rannoch Court, Adelaide Road, Surbiton, Surrey, will fill in the details of the a.g.m. or the club's activities.

Stevenage & District ARS Meetings in the Staff Canteen, British Aerospace Dynamics, Site B, Argyll Way, Stevenage, at 8pm with June 17 devoted to a rig test evening. It is hoped that a beginners' night to be held in Welwyn Garden City in July will lead to frequent gatherings in that QTH. Publicity sec is Les Mather G8OKI, 63 Woodhall Lane, Welwyn Garden City, Herts.

Thames Valley ARTS Meets first Tuesday at 8pm at the Thames Ditton Library meeting room, Watts Road, Giggshill, Thames Ditton where on July 6 well-known John Pegler G3ENI will address the assembled multitude. Afraid the June date was too early for this issue of *PW*. Contact is Julian Axe G4EHN, 65 Ridgway Place, Wimbledon, London SW19 or try 01-946 5669.

Norfolk ARC Wednesdays, 7.45, Crome Centre, Telegraph Lane East, Norwich, with informal meeting plus code practice on June 9, and G4LDG describing a simple h.f. bands QRP rig and a.t.u. on the 16th. The 23rd is informal and code again with the 30th devoted to final plans for VHF FD. Sec is P. Gunther G8XBT, 6 Malvern Road, Norwich, also N'wich 610247.

Winchester ARC Meets on third Saturdays (unusual!) at 8pm at the Log Cabin, Stockbridge Road, W'chester, visitors and new members most welcome says PRO Graham Middleton G6EEJ, 33 Main Road, Littleton, Winchester, Hants, or try W'chester 880986.

Bromsgrove & District ARC Second Friday of the month at the Avoncroft Art Centre, Bromsgrove with a QRP group also meeting there on fourth Fridays, plus a club net on 144·850 at 8pm on Wednesdays. Big date is the Bromsgrove Carnival on June 26 with special event station but Alan Kelly G4LVK, new sec of the club, at 021-445 2088 will supply the details.

Southgate ARC Coming events include a multi-club darts and social evening in the summer plus a v.h.f. d.f. hunt on August Bank holiday but more of that anon. The June 10 meeting will deal with Marconi the Man by an historian from the Marconi Co. It's at 7.30 at St Thomas' Church Hall, Prince George Avenue, Oakwood, London N14, as are all meetings. John Fitch G8EWG, 16 Kent Drive, Cockfosters, Barnet, Herts is the man to contact.

Salop ARS Handsome newsletter available to all and sundry for an s.a.e. to Edwin Arnold G6AKE, 30 Leamore Crescent, Belle Vue, Shrewsbury, Shropshire who will also be glad to answer your queries on the club. Venue is the Albert Hotel, Smithfield Road, S'bury on Thursdays at 8pm. June 10 is natternite but special date is the 12th at the West Mid Show Ground with radio and ATV display at the scout camp from around 10am. On June 17 Mike Wilde demonstrates SSTV while the GM of the RSGB Dave Evans G3OUF visits to talk about the society, and hopefully members of other local clubs will rally round for the occasion.

Yeovil ARC Briefly, 7.30 Thursdays, Building 101, Houndstone Camp, Yeovil, with G3KSK threatening to double your code speed on June 10 while G3MYM discusses a club propagation research project a week later. RAE and code tuition available to members plus weekly club nets on 3·5MHz and 144MHz. Don McLean G3NOF, 9 Cedar Grove, Yeovil, Somerset also answers on Yeovil 24956.

Watford RC First and third Wednesdays in the Small Hall, Christ's Church, St Albans Road, N. Watford, which happens to be opposite a Kentucky takeaway! 8pm is OK for an 8.30 start. Details of events from D. J. Baxter G8KBV, 3 Old Farm Cottages, Langley Bury School, Hunton Bridge, King's Langley, Herts, the club's PRO.

British Rail ARS Seems the congress is to be held in October and not November as previously stated. In the meantime 3·7MHz on Wednesdays at 8pm will keep the members in touch. Sec Geoff Sims G4GNQ has been busy on 10MHz working Euros and the odd VK3, with 50W. He can tell you more of the club's activities if you write to him at 85 Surrey Street, Glossop, Derbys.

Midland ARS Just to get things straight the meeting time is the third Tuesday of the month, rather than "last but one". On June 15 it's experiences on 10GHz with the *PW* Exe project, with G3KPT and G8ASW. (I'm sure the Editor would also like to know how they made out.) What a pity that the club mag *Probe* doesn't say where the club meets! Is it a state secret? However, a word with T. B. Brady G8GAZ, 57 Green Lane, Great Barr, Birmingham or a call to 021-357 1924 should get you all the answers.

Honestly, the number of club mags and letters that give no hint of meeting place or secretary information is quite remarkable!

Wirral ARS Now here is a nicely produced mag, list of committee, list of events to come, and little space wasted on past events, plus wide variety of topics to suit everyone. Meetings first and third Weds 7.45, at Minto House School, Birkenhead Road, Hoylake, Wirral. June 16 is a DF foxhunt on the 144MHz band and I'd better tell you of the July 7 demo of v.h.f. equipment by G3LEQ who, it seems, always brings a wide range of the latest equipment. Your contact is Gordon Lee G3UJX, 30 Manor Drive, Upton or 677 1518.

Rolls Royce ARC All set for the big rally on June 27 at the RR Sports and Social Club, Barnoldswick, with talk-in on S22 and ample facilities of all kinds, for all the family. Normal meetings on first Wednesday at the Sports and Social Club with pie and peas after the lecture, so what else could one ask for? Morse classes at the shack on the sports ground on Monday nights at 7.30 with two instructors plus a third for the raw beginners. So far not a single failure has been recorded when it came to the crunch. Want to know more? Then try Les Logan G4ILG, 19 Fenton Avenue, Barnoldswick, Colne, Lancs or (0282) 812288.

Hastings Electronics and RC The club journal *Vital Spark* tells me the club meets on the third Wednesday at West Hill Community Centre, Hastings for its main meetings, with the Club Room at 479 Bexhill Road, St Leonards-on-Sea open for the computer mob on Monday evenings and the socialites on Fridays.

On Tuesdays it's an RAE course at the William Parker School at 7.30pm. What do they do in their spare time, one asks? On June 16 it's the Summer Social but if you contact George North G2LL of 7 Fontwell Avenue, Little Common, Bexhill-on-Sea he will enlarge on this. Or try Cooden 4645.

Derby & District ARS Member Bill Mead G5YY reaches 50 years in amateur radio and gets a surprise presentation from the members. Wednesdays at 7.30 at the clubroom at 119 Green Lane, Derby, with tea, coffee and other light refreshments for the work-weary. June 9 is a technical quiz but on the 16th G3XER will demonstrate Robot slow-scan TV equipment which ought to be exciting. Quite different is the barbecue at Drum Hill, Little Eaton, on June 23, with a night on the air on the 30th. I think that it is still Jenny Shardlow G4EYM at 19 Portreath Drive, Darley Abbey, Derby that you should contact for more info.

Edgware & District RS Much contest conversation these days with NFD and VHF FD coming along in June and July with the club aiming at operating on all bands from 70 to 1296MHz at the latter event. Editor of the *Edgware Ham News* G3MNO has started something by sponsoring a constructional contest for the best design for constructing high-voltage variable capacitors with ordinary workshop tools. Seems the real ones are just a bit expensive these days. So second and fourth Thursdays at 8pm at 145 Orange Hill Road, Burnt Oak, Edgware, Middx, with club net on 1875kHz Mondays at 10pm plus code practice at meetings and over the air from RSGB keybasher G3ASR on 1·8 and 144MHz. June 10 sees a quiz evening conducted by Alan G3PSP with the 24th devoted to informal matters and discussion of plans for VHF FD. If there are any more details get them from sec Howard Drury G4HMD, 39 Wemborough Road, Stanmore, Middx, also 01-952 6462.

Bournemouth RS New *BRS* newsletter could be confused with ditto from the British Rail group previously mentioned! Anyway the mag is well produced (it ought to be!) especially the circuits and diagrams, the downfall of most magazines. Meetings on second and fourth Fridays of the month but Elaine Howard G4LFM of the *PW* staff will be delighted to tell you all.

Southdown ARS It is the Chaseley Home for Disabled Ex-servicemen, Southcliff, Eastbourne, E. Sussex at 7.30 on the first Monday with an open forum plus demonstration of amateur equipment on June 7, venturing forth for an open-air meeting on July 5 at Butts Row. Drop a line to sec J. S. Pitt G6BGT, 18 Kingsmere Court, Hurst Lane, Eastbourne or ring 643463.

Acton, Brentford & Chiswick ARC Interesting discussion on the new amateur radio licence schedule on Tuesday June 15 at the Chiswick Town Hall, High Road, Chiswick, London W4 at 7.30pm, for which a big attendance is anticipated, and from which neither the Home Office nor the RSGB can expect to escape unscathed. More on the club activities from W. G. Dyer G3GEH, 188 Gunnersbury Avenue, Acton, London W3.

Cornish Radio Amateur Club First Thursdays at the SWEB clubroom in Pool (not Poole) twixt Camborne and Redruth says "newly promoted" secretary Simon Rodda G6DFE of Cliff Hotel, Penzance, Cornwall (0736) 3524 or on 144MHz. Go and meet everybody at the club's mobile rally on July 18 at the Camborne Tech College with various trade stands and a DF foxhunt to boot.

Biggin Hill ARC An RSGB film on microwaves features in the club calendar for June 22 at the usual meeting place, the Biggin Hill Memorial Library at 8pm. Call Ian Mitchell G6EMW on Biggin Hill 75785.

Radio Society of Harrow Said to be one of the largest and best attended clubs in Greater London, the club is making a special effort to cope with the influx of new members and visitors by organising talks and demonstrations for these beginners to amateur radio. In contests two stations are operated, one seriously by experienced members and the other for the newcomers to get the feel of amateur radio. Meetings every Friday in the Roxeth Room of the Harrow Arts Centre which just happens to be opposite the Alma pub in the High Road, Harrow Weald, Middx, at 8pm. Enquiries to Chris Friel G4AUF on 01-868 5002 please.

Torbay ARS Eagerly awaiting the rally on August 29 at the ITT Social Centre with talk-in on S22 plus hot meals and bar at lunch time. Says PRO L. G. Mays G2CWR, "if it rains we are all under cover and if it's sunny the beaches are just down the road." He lives at Atlantis, Clennon Avenue, Paignton, and the club meets at Bath Lane, rear of 94 Belgrave Road, Torquay. More details of the rally direct from G4DZH on (0803) 523063. Thought you'd like to get this date in your diaries in good time!

Verulam ARC June 22 has G3LXP discoursing on operating techniques on the h.f. bands, at the usual meeting spot, the Charles Morris Memorial Hall, Tyttenhanger Green, near to St Albans, Herts, at 7.30. If you'd prefer an informal meeting to start with then it's the RAFA HQ in New Kent Road, St Albans on the second Tuesday of the month, around 7.30 also, I'd imagine. Hon publicity sec Peter Hildebrand G3VJO of Hobbits, 31 Crouch Hall Gardens, Redbourn, St Albans is the fellow to contact, also Redbourn 2761.

Wolverhampton ARS Well-printed newsletter giving club events into August; very helpful. Like surplus equipment sale on June 7, natter-nite on the 14th, general question time and solving of problems on the 21st, ending with a treasure hunt on the 28th. From which you may deduct that meetings are held on Mondays, at the W'hampton Chamber of Commerce and Industry, 93 Tettenhall Road, W'hampton, and if you want to know more it is John Cook G8EDG, 75 Windmill Lane, Castlecroft, Wolverhampton.

Reminder that the deadline for copy is the 15th of the month for inclusion in this column. Other correspondence any time, of course.

Medium Wave Broadcast Band DX

by Charles Molloy G8BUS

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

Every now and again I am asked by a reader if it is possible to predict what reception will be like on the medium waves. There are really two questions. Some DXers would like to know, before going to bed, if it is worthwhile getting up during the night to scan the band. Others look for longer term forecasts. Before examining the subject it might be worthwhile clearing up any misconceptions that may exist about propagation on the medium waves.

I took part in some tests organised by the European DX Council several years ago which consisted of monitoring at a set time every night, three frequencies in different parts of the m.w. band. When the results were collated it seemed quite clear that when reception of North America was poor then reception from South America peaked. It was not simply a lack of North American QRM. The signals from South America were enhanced and a theory to account for this has been advanced by at least one DXer in the United States.

Instead of periods of poor reception, as experienced on the short waves, reception on the medium waves seems to favour one direction on one night and another direction on another occasion. Complete fadeouts do occur but not nearly as often as on the short waves so it is always worth having a look round the m.w. band. In fact some of my best catches have occurred during periods of unsettled reception. I logged WIVI (now WUWI) 1MHz located in the American Virgin Islands when there was not a single North American to be heard. I hope we are never able to forecast precisely what will be heard on the medium waves as a lot of the fun of DXing would then disappear. This is a personal view not likely to be shared by everyone.

Pointers

Attempts have been made to relate reception during the evening with reception later the same night. If some stations in Northern Europe are audible then the path is probably OK for North America later on. Similarly for reception to the south and the pointers, of course, are the

The Transmitter site of WIVI

stations to look for during the evening. Has anyone experience of forecasting by this method? I'm sure readers would be interested. There is also the related method of looking for stations in North America, Newfoundland for example, which are the first to fade-in but as this can only be tried in winter we will have a look at it in a later issue.

In answer to reader **Michael H. Thomas** of Gateshead who is interested in DXing local radio stations at sunrise. There ought to be a relationship between conditions at sunset and again at sunrise the following morning so it might be worthwhile listening during the evening to see if this is the case.

There is another method of prediction, based on the ionospheric data broadcast over the Time Signal and Frequency Standard station WWV which is located in Boulder, Colorado in the USA. The broadcasts are continuous throughout the day and night on 2·5 MHz, 5MHz, 10MHz, 15MHz and 20MHz. The higher frequencies are usually audible in the UK in the evening. WWV is easy to identify as it gives a voice time check every minute as well as the one second pulses.

Ionospheric Forecasting

At 18 minutes past each hour WWV gives, by voice, the latest value for the "K" index and values for the previous day for the Solar Flux and the "A" index, plus a short comment on them.

Solar Flux is a measure of the degree of ionisation of the ionosphere and is measured on a scale going up to 200. A low value means low ionisation. A high value means high ionisation and increased absorption of lower frequencies. For the medium waves, but not necessarily for the short waves, a low value for the solar flux should indicate good DX from North America and a medium value should indicate good reception from South America. Unfortunately, the values of solar flux that come over WWV are one day out of date so m.w. DXers go for the geometric indices instead.

The "K" index and the "A" index are simply different ways of expressing the value of the earth's magnetic field which is affected by particles such as electrons and protons, coming from the sun. These particles also affect the ionosphere, so the two indices give a measure of the state of the ionosphere and its effect on radio reception.

The "K" index is up-dated every three hours (every six hours over WWV) and is on a scale from 0 to 9. The "A" index is the average of the previous day and is on a scale from 0 to 400. The "K" index is of interest to us since it is the more recent. Very roughly, a value of 2 or less means good reception of North America on the medium waves. Middle values mean poor reception of North America but good reception of South America. High values for the "K" index indicate disturbed conditions and you probably won't be able to hear WWV in this event.

To make real use of the WWV information it is desirable to relate it to your DXing. Not everyone is prepared to do this but the method does work. A record in your log of "K" index values from WWV at selected times could be a valuable guide for future listening. Next time we will have a look at the 11-year sunspot cycle and the 27-day solar rotation period, both of which have an effect on radio reception.

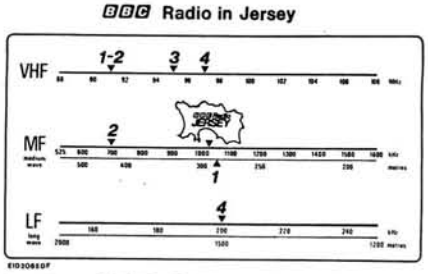
Local Radio

A Sony TFM C660W (Clock Radio) pulled in Manx Radio on 1368kHz for **Keith Nockels** of Ipswich which must rank as a very nice catch from that QTH. **Ian Kelly** (Reading) is another local radio enthusiast. He has a Pye 9015 portable radio cassette. "I have received 28 local radio stations within England, Wales and Northern Ireland, the great majority in daytime." Stations heard occasionally at night include Radio Forth 1548kHz, Radio Cleveland 1548kHz, Radio Lincolnshire 1368 and Manx Radio also on 1368. Ian says it is a pity that many of the local radio stations occupy the same frequency. Making use of the directional properties of the ferrite rod antenna by rotating the receiver is one way to overcome the problem. Another is to try sunset/sunrise DXing.

African DX

Summer is a good time for DXing the African continent. The time zones are near to our own which means that we can start at sunset which is always a good time for DXing. This year Ramadan begins on the 23rd of June which means that for some four weeks from that date, Arab countries will continue broadcasting all night.

Stations in Algeria, Tunisia and Morocco are to be found all over the band and should become conspicuous once Europeans sign off for the night. Listen on 531, 585, 594, 612, 629, 891, 936, 980, 1233 and 1566kHz. There are also two on the long waves, Tipaza in Algeria on 251kHz and Azilal in



Radio JERSEY 1026KHz

Sent by reader John Parry of St Saviour, Jersey, CI

Morocco on 209. Less obvious are Libyans on 1125 and 1251 and Egypt on 621 and 819kHz. There is also the Spanish enclave in Morocco which has Radio Ceuta on 990kHz but this is really a difficult one.

Moving south from the Mediterranean there are a number of interesting broadcasts to be heard, some of them quite frequently in the UK. Radio Dakar in Senegal is on 765kHz in French and local languages, Ougadougou in Upper Volta is weak but consistent on 747kHz, the Canary Islands are on 621kHz and 1341kHz in Spanish, Nouakchott in Mauretania has been heard in French on 1521kHz, Abijan in the Ivory Coast also in French is on 1494 while Freetown in Sierra Leone can be found, in English, on 1206kHz.

Readers' Letters

Duncan Fraser has recently come to London from New Zealand and his experience with a loop pre-amplifier designed by the New Zealand DX League and widely used by DXers in that country, is interesting. He tried it with a loop in daylight and it worked great on several Europeans between the top and bottom of the band. After dark the pre-amplifier overloaded in the presence of strong European signals over the entire band. The pre-amplifier has a gain control but "surprisingly, reducing the amplification makes no difference to the overloading though it worked OK on the signal." It is the non-linearity of the amplifying device, presumably a transistor, that is causing the overloading. You won't get away with high gain pre-amps on the medium waves in this part of the world. There is at least 100 megawatts of broadcasting in Western Europe on the medium waves.

Duncan goes on to say: "It seems most sets are more sensitive on the short waves than medium waves. Just tune to 1600kHz on m.w. and on s.w. (bands) and see the difference". It is not accidental. Many receivers are deliberately desensitised on the medium waves to prevent overloading. Damping resistors across tuned circuits is one popular method. Finding a really good receiver for m.w. DXing is not easy. Reader **J. C. Thompson** of Havant regrets parting with his old CR-100. Join the club, I did the same a few years ago.

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Short Wave Broadcast Bands

by Charles Molloy G8BUS

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

Regular readers of this column will be aware that radio receivers, especially the simpler ones, are able to generate unwanted signals which are usually called spurious responses or simply, spurios. They can be images, which cause a station to appear at two different places on the dial, or the receiver's internal oscillator may generate unwanted frequencies, usually multiples of the correct one, which make stations appear at unexpected places and prompt some of us to reach for our pocket calculators to come up with ingenious explanations to account for what is happening. There is also overloading, caused by applying very strong signals, perhaps from a long wire, to the receiver. Spurios are the result. One thing these unwanted signals have in common is that they are not real signals coming in from the antenna but are produced inside the receiver itself. They can be designed-out or reduced by careful use of the receiver's controls and choice of antenna.

There is another type of signal though called a harmonic, which is quite different. The harmonic is a real but unwanted frequency generated at the transmitting station. So far as the listener is concerned the harmonic is a real broadcast appearing at an unexpected place on the frequency spectrum. What are these harmonics, where do they appear and is there any way we can identify them for what they are.

Harmonics

When a radio signal is generated, there is a tendency to produce additional signals on multiples of the wanted frequency. For example, if the correct signal is 1MHz then there will be much weaker signals on 2MHz, 3MHz, 4MHz etc. These unwanted signals are called harmonics, the one on 2MHz being the second harmonic, the one on 3MHz the third and so on. There is no first harmonic as the main signal on 1MHz is called the fundamental.

Transmitting stations do their best to suppress harmonics and are usually very successful. Still, when a power of 500kW is being pumped into a transmitting antenna it is difficult to prevent a few watts of harmonics from going with it. Normally, this does not matter too much. Short Wave broadcasters try to operate near the maximum useable frequency (m.u.f.) for any path and harmonics just pass through the ionosphere off into space. At the moment, at a time of high solar activity, the m.u.f. is much higher than normal and harmonics do come back from the ionosphere, often at a considerable distance from the transmitter.

Harmonic DXing

Where can we find harmonics? The most likely place is between the 21MHz band (13m) and the 26MHz band (11m). The second harmonics of stations in the 11MHz band (25m), including the unofficial spread at the ends, appear between 23MHz and 24MHz. Second harmonics from the 9MHz (31m) band are to be found between 18·9MHz and 19·9MHz while 4th harmonics from the 6MHz (49m) band are located between 24MHz and 25MHz with 5th harmonics coming up near 30MHz.

If you suspect you are listening to a harmonic then try to find its frequency as accurately as possible and divide it by 2, 3, 4 or 5 and see if this lines up with a known station. You may even be able to hear the original broadcast on the correct frequency but this is not always possible as the path might not be open on both frequencies. Harmonics that may be audible are Cairo on 24·1MHz (2 × 12·05), Budapest 23·82 (2 × 11·91), Baghdad 28·635 (3 × 9·545), Turkey 19·03 (2 × 9·515). This is real DX as the transmitting power may only be a few watts!

A few DXers specialise in hunting down harmonics though I doubt if they have much success with QSLs. Who is going to admit sending out a harmonic? It should not be thought that harmonics are only to be found on the higher frequencies. Second harmonics of medium wave stations do occasionally appear in the 2·3MHz (120m) and 3·2MHz (90m) tropical bands. A couple of years ago I really thought I was on to something on the 2·3MHz band until I realised I was listening to the second harmonic of BBC Radio 3 on 1215kHz.

DXing Latin America

The amount of high power international broadcasting and the jamming that exists on the short wave broadcasting bands discourages many DXers who eventually turn to the tropical bands in search of DX. It is not generally realised that there are times when some bands, although quiet, still hold DX. The higher frequencies are used during the daytime and after dark in the UK they appear dead while even the 11MHz (25m) band quietens down. The path to Central and South America is still open though, as it is still in daylight and this is the time to go looking for DX. A good outdoor antenna and even a preselector can be used at this time without danger of overloading the receiver, but a good portable with its whip is capable of pulling in some interesting signals.

There is some international broadcasting in English from this area, noticeably Radio Bras in Brazil on 15·125MHz and 17·805MHz at 1900UTC, and RAE Argentina on 11·71MHz at 2200, while HCJB in Ecuador can hardly be missed. The main interest though is in local broadcasting. The 15MHz and 11MHz bands are used for domestic broadcasting on a non-seasonal basis by a number of countries in this part of the world and there are a number that come in regularly in the UK throughout the year.

Brazil is the most prominent and the easiest to identify since the language is Portuguese. Listen for Radio Globo in Rio de Janeiro on 11·785MHz and Radio Amazonia on 11·78MHz. Spanish is the main language of Latin America though its pronunciation is quite different in the south and the north of the continent and the two can easily be distinguished with a little experience. Listen for Radio Nacional de Chile on 15·14 and 15·15MHz, Radio Nacional Asuncion in Paraguay on 11·915, Radio el Espectador in Uruguay on 11·835, Radio el Mundo in Buenos Aires on 15·29, Radio Nacional Bogota in Colombia on 15·335.

In the Caribbean/Central America area XERMX in Mexico is on 15·43MHz, Radio Clarin Dominican Republic 11·70MHz, Radio Habana Cuba 11·76MHz and Radio Free Grenada is in English on 15·045 and 15·105MHz. The above are only a selection of what can be heard but it should be remembered that these DX signals are a lot weaker than the normal daytime broadcasters on these bands and they can be missed easily if you tune quickly across the band.

Readers' Letters

Scottish DXers will be interested to learn that **John McCarra** has been holding meetings for radio enthusiasts in Glasgow since 1974. They are held once every two months and the type of interests represented are medium wave, short wave, f.m. and TVDXing. Further information is available from John at 47 Sunnybank Drive, Clarkston, Glasgow, G76 7SS.

"I am a new short wave listener" writes **Graham Coles** from Clapton, who is currently using a Bush DAC 41 of 1954 vintage along with a one metre length of wire as an antenna. Graham would like to join a DX club and I suggest a letter of enquiry and SAE to the World DX Club, 17 Motspur Drive, Northampton, NN2 6LY.

Reader **Paul Hutchison** (Billingham) has been active on 5MHz (60m), which is his favourite DX band, using an FRG-7700 and 15MHz (19m) band dipole. He reports hearing Radio Nigeria in English

A recent QSL card from Radio Sofia

on 4·77MHz at 2150, Radio Mundial Bolivar in Venezuela also on 4·77MHz, this time at 1214. Radio Guatapuri in Colombia was heard on 4·816 at 0358, Radio Sante Fé also in Colombia on 4·965 at 0730. Paul finds the extra selectivity of the FRG-7700 a great help in DXing.

"I am 19 years old and at present doing my military service" writes **Mikael Andersson** from Heby in Sweden. His receiver is a Grundig Satellit 1400 which was used with its own antenna to pull in four Brazilians on the 11MHz band. These were Radio Globo on 11·805MHz, R.Bandeirantes on 11·925, R.Club Paranaense on 11·935 and R.Guacha on 11·915 plus some DX on the 2MHz band (120m). Stations heard here, all in China, were Gansu on 2·49MHz, Fujan 2·34, Zheijang 2·475 and Yunnan 2·46—a very good log.

A report from *SWL Digest* (Radio Canada International) mentions that the new WRNO in New Orleans has a programme called *The World of Radio*, presented by the well known DXer **Glen Hauser**. It is on 15·42MHz from 1900 to 1930 UTC on Tuesdays.

"I would be grateful if you could ask any readers if they could give me some help in increasing the frequency range and boosting the power of my newly acquired AT&E Reception Set" writes *PW* reader **A. C. Crowhurst** of 5 Arthur Wright Road, Fich Hoek 7975, RSA.

VHF Bands

by Ron Ham BRS15744

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

A certain amount of DX, especially when conditions are above average, is concealed by normal day-time traffic and extra strong signals. Therefore if you are about after midnight, have a tune around Band II, when most of the BBC stations will have closed down, and the 144MHz band repeater frequencies for co-channel identification signals and 14·090MHz for the weaker RTTY stations.

Solar

A fully steerable, home-brew, 9m dish antenna is being used by **John Smith** at his home in Rudgewick, Sussex, for a special study of the sun at 182MHz, looking for rapidly pulsating bursts. At the centre of the dish is an inward facing 5-element Yagi which feeds the solar signals to a 3N140 transistor amplifier in the focus box. The signals are amplified again by another 3N140 at the end of a 10 metre coaxial line before entering the main receiver, which has 3N140s in the front end followed by a 29MHz i.f. amplifier. At this point the signals are detected and then separated to feed an audio monitor, a d.c. amplifier to drive a pen recorder and an analogue digital converter for a microcomputer. The overall system gain is 140dB and is calibrated with a noise diode in the focus box. While these observations are in progress, mainly at weekends, John uses 10mm of chart per second and the computer not only stores 10-second samples but can feed the results back at a slower chart speed for analysis and supply information for a moving display on an oscilloscope.

Both **Peter Bushby** G8FNV, Worthing and **Ted Waring,** Bristol, use optical telescopes to project the sun's image on to a card for noting the presence of sunspots, and during Ted's observations he counted 25 spots on March 20, 30 on the 23rd, 55 on the 28th, 25 on April 6 and 36 on the 11th.

Several strong bursts of solar radio noise were recorded by **Cmdr Henry Hatfield,** Sevenoaks, on 136MHz and by me on 143MHz on March 21, 22 and 24, with noise storm conditions, Fig. 1, on March 18, 19, 20, 23, 24, 26 and 27. A similar report for 151MHz observations came from **Reg Taylor** in Shillington. Around 1850 on the 30th, **George Grzebieniak** G6GGE, London, recorded solar noise varying in strength at 144MHz, and between 1630 and 1725 on April 1 he heard auroral signals from G4LAA in Cumbria and GM8TSI in Midlothian.

The noise storm on the 27th and a series of bursts between 1700 and 1800 on the 26th, 28th, 29th and 30th were observed at 144·4MHz by Peter Bushby who uses an 8-element Yagi feeding a pre-amplified Pye Cambridge receiver with an output meter to measure the solar noise.

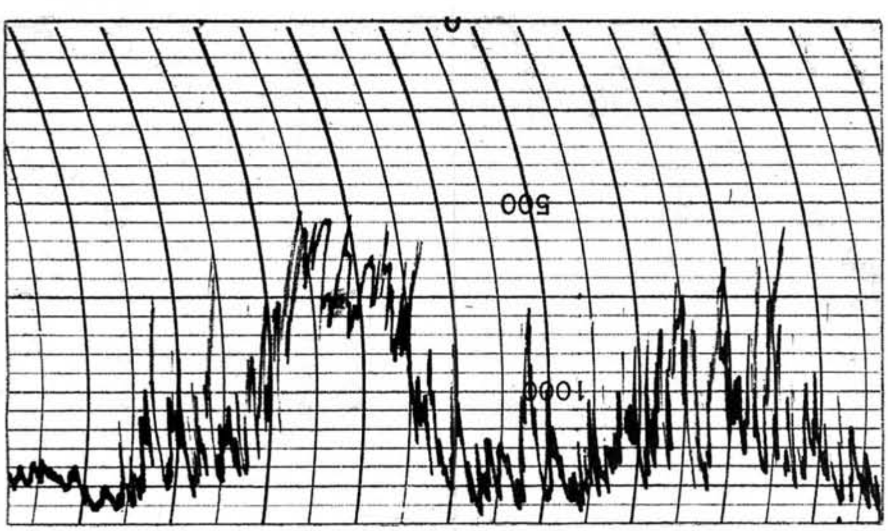

Fig. 1: Solar burst within a noise storm recorded by the author

Although very little radio noise was recorded from the sun during the first three weeks of April, Peter reported seeing several small sunspots on the 14th. For those readers who keep statistics, my log shows that the sun was active on 51 of the first 90 days of 1982 compared with 38 for the same period in 1981.

The 28MHz Band

Although conditions on the 28MHz band appeared variable and generally down between March 18 and April 17, **Harold Brodribb,** St Leonards-on-Sea, periodically logged stations in Australia, Canada, India, Russia and South Africa. On April 9 the band "opened up to magnificent reception" said Harold, who then logged very strong signals from Canada and most call areas in the USA. At 0957 I heard a strong VK which, apart from signals from Japan on only 5 days, was my best DX for the period.

During March, **David Heale,** Bolton, using a Realistic DC-100L receiver added Japan and many stations in the USA to his 28MHz DX list, and **Ken Dines,** Horsham, is using a Sony 2001 receiver and long wire antenna while studying for the RAE. Ken is delighted with the set's performance, especially the accuracy of the computer-controlled tuning.

28MHz Beacons

My thanks to **David Newman** G4GLT, Fig. 2, Leicester, for clarifying a few points about the 28MHz beacons and writes "U2ABJ, which has been assumed by many to be a Russian beacon on 28·272MHz is in fact TU2ABJ at Abidjan, Ivory Coast and people made this mistake because of the long initial 'T' ". David became interested in beacons in June 1980 and since then, with his large antenna, Fig. 3, has logged 39 different beacons, many of which did not last too long. Like **John Coulter,** Winchester and Ted Waring, David points out that the Hong Kong beacon VS6HK has changed its callsign to VS6TEN. In April 1981, David made a special study of the signals from the Australian beacons VK2WI and VK5WI and offers the following useful tips on beacon monitoring. "Daily observations are much better than occasional loggings and when one is QRT it is possible to leave a tape recorder, with a C120 cassette, running which gives an extra 60 minutes of monitoring. Alternatively, if the recorder has an electrical pause button this could be switched on

Fig. 2: David Newman G4GLT and Snuffles

and off at regular intervals, say every 5 or 10 minutes for 20 or 30 seconds, thus sampling a small section of the propagation every so often and giving a complete day's results on a short piece of tape."

Information to complete the beacon chart, Fig. 4, was supplied by John Coulter, Henry Hatfield, Ted Waring and by me.

Both Henry and Ted made a special effort to log the signals from the Capetown beacon ZS1CTB around 28·247MHz. Ted also logged the Gough Island beacon ZD9GI on several days.

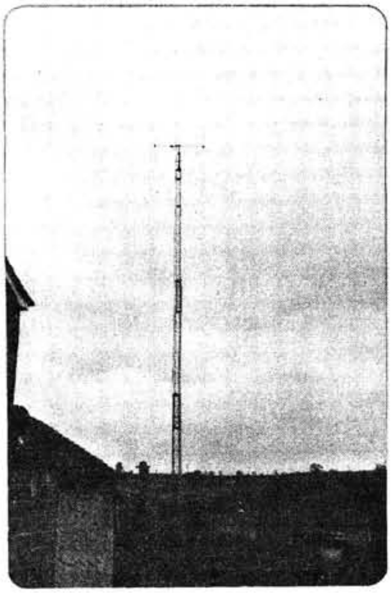

Fig. 3: Antenna mast of G4GLT

The 50MHz (6m) Band

Readers wishing to join the "UK 6m Group" should write to David Newman G4GLT, QTHR, and get all the gen before the band opens up again this coming winter. David has been interested in 50MHz propagation since last October when he borrowed a friend's converter and was excited to hear signals from Canada, the Caribbean and both north and south America coming through. "I suggest that anyone interested should purchase a 50MHz converter and put up a resonant antenna for 50MHz" writes David and further suggests that "those amateurs who wish to attempt 50/28MHz crossband QSOs should use a separate receiver with the converter to eliminate the need to turn numerous dials and switches to get back to the station. Remember how easy it is to blow up the front end of the converter if one forgets to operate the antenna switch in the excitement". Originally David used a loft dipole for 50MHz but now he has a 5-element Yagi made by Tonna (available from Randam Electronics) on top of his mast.

"The 50MHz path to ZS was incredibly good on April 12" writes **David Newman** who heard the South African beacons, ZS1STB 50·010MHz, ZS3E 50·075MHz, ZS6DN and ZS6PW 50·030MHz, between 1016 and 1650. At 1305 the signals from the two latter beacons were peaking 599 and during the day crossband QSOs were made with ZS3E, ZS5TR ZS6BT, ZS2FM, ZS6BMS, ZS6BUF and ZS6XJ. David feels sure that this will almost certainly be the best 50MHz ZS opening of the 1982 spring season.

RTTY

When all seemed quiet around 0100 on March 30, I found a crop of RTTY DX on 14MHz and in about 15 minutes I logged signals from Japan, Nicaragua, Puerto Rico and the USA. My normal band checks last for about 20 minutes around 0900 and 1330 each day and between March 18 and April 17, I copied, as usual, about 200 RTTY stations spread over 32 countries, CN, CT, DJ, EA, F, G, HA, HB9, HT, I, IT9, KA, KP4, LA, LX, OE, OH, OK, OY, OZ, PY, SM, SV, UA, VE, VK, W, YO, YU, YV, 3A and 9H. Most of these stations were calling CQ or in contact with another who was impossible to read. However, some interesting two-way QSOs I received were between DJ0SD and SM6KIN at 0848 on March 23; DJ2AG and LX1PA at 0909 and F6HKL and OE6KCG at 0915 on the 24th; HA7TS and I8PSX around 1425 and EA9KQ and IT9LXF at 1648 on the 25th; LA3SU and Y82ZN at 1427 on the 27th; DK2KV and W9OBI and IN3GNV and W2PN both around 0930 on the 28th; OZ1GHQ and W3AE at 0912 on the 30th; EA9JZ and SV1MO at 1730 on April 6; YV5AMH/OH and YV5ANE around 0850 on the 7th; OE6KCG and VK1RY at 0834 and HB9BXY and SM6KIN at 1752 on the 8th; EA9JZ and EA9KQ at 1025 on the 9th and OY5T and OZ1GHQ at 1415 on the 16th.

Fig. 5: Band II QSL card received by Ian Kelly

Readers thinking about a RTTY to TV converter will see from this and previous lists that there is a great deal of pleasure to be had from this mode of operation, and although the majority of these signals were on 14MHz, around 14·090MHz, about 15 were copied on 21MHz around 21·090MHz.

I am looking forward to reports from **Bernard Dowley,** London, who hopes to add a RTTY converter to his Realistic DX300 receiver fed by an AV3 trapped vertical antenna. Between March 20 and April 5, **Henry Winter** BRS40276, Bristol, copied RTTY signals from 20 countries from Europe and the USA. Most of Henry's operating time is during the afternoon when he uses a FT-901 and a dipole antenna to drive his RTTY to TV converter. During the period Henry logged two-way QSOs on both the 21MHz and 14MHz bands.

Tropospheric

Having been down to 29·5in (998mb) on March 16, the atmospheric pressure, measured at my QTH, began to rise rapidly from 29·8 (1009mb) at midday on the 20th to 30·5 (1032mb) at 1600 on the 24th, when it began a steady fall reaching 30·0 (1051mb) around 0400 on the 28th. The pressure then hovered around 30·0 from 1400 on the 30th until 2200 on April 11 when it rose to 30·15 (1020mb) and was still around that level on the 17th.

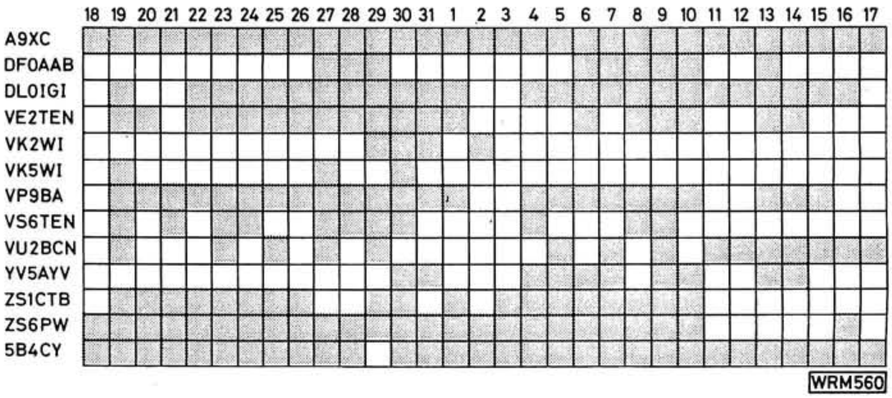

Fig. 4: Daily observation of 28MHz beacons

During the period of the main rise and fall, March 23 to 28, a mild tropospheric opening took place causing many extra repeaters to come up on local channels as well as disturbing signals in Band II and the v.h.f. and u.h.f. amateur bands.

"Tropo seems to have been up on the 24th" writes George Grzebieniak, who worked many stations in Holland and a German station at 710km who was running 10W to a 10-element Yagi on 144MHz. During the 25th and 26th George worked G3VXY, Merseyside and several stations in Belgium and Holland. "The thing that I found interesting was that stations 60km west of London were not working the lift" says George who added that although G3JXN found 144MHz conditions poor on the 26th, they were good on 1296MHz. This often happens George, tropo disturbances are sometimes very directional and limited in frequency range.

Conditions peaked again in early April and on the 4th, George worked into ON and PE0 and G8VES in West Yorkshire and on the 6th he contacted GI6DCQ in Co. Down.

Jon Kempster BRS45205, Berkhamsted, has purchased a second-hand Yaesu FRDX-400 which includes a converter for both the 144MHz and 50MHz bands. At 2235 on March 25 he heard ON7TN working through the Kent repeater GB3KN on R4, and at 0016 on the 26th he received EI9BD via the north London repeater GB3NL on R7 and noted a marked increase in the signal strength of the Leicester repeater GB3CF on R0. At 0910 on the 24th and 0038 on the 25th PD0LJR and ON1RL respectively were working through the Kent repeater.

During the March 144/432MHz contest, **Adrian Grover,** G6DBX, Burgess Hill, worked into France and the Midlands on 144MHz s.s.b. with his Yaesu 290R and a 5-element loft Yagi.

For most of March 24 I heard several French broadcast stations in Band II. At 1800 on the 23rd, Harold Brodribb counted 1 Belgian and 12 French stations between 87–100MHz and early on the 25th he received 5 editions of BBC Radios 2, 3 and 4 and noted 26 French stations in the band.

"The best time of the opening was between 0630 and 0830 on the 26th, when signals from broadcast stations in Belgium, France and Holland were strong and numerous" writes **Ian Kelly** from Reading who received a fine QSL card, Fig. 5, from Belgische Radio en Televisie (BRT) for a reception report on their 98·6MHz signals which he sent them earlier this year.

During the evenings of March 24 and 25, **Simon Hamer** heard a "phone-in" programme from LBC. *Stranger on the Shore* by Acker Bilk from ILR's Piccadilly Radio, strong signals from BBC Radios Manchester and Solent, ILR Chiltern, a good stereo signal from BRT Belgium and very good signals from TDF-Frequenque-Nord and TDF-France Cultur from both Lille and Brest.

"BBC local radio stations were swamped" said Harold Brodribb who again found 21 French stations at 1800 on the 28th and Simon Hamer received 9 editions of BBC Radio 4 during the evening of April 4. All of these reports should interest hi-fi enthusiast **Ian Goodwin** of Pontefract, who uses a Quad FM4 stereo with a 6-element rotatable Yagi for Band II and is looking for some extra gear for long distance reception.

On the subject of local radio, I learnt that BBC Radio Brighton has two amateurs on their production team, **Piers Bishop** G6CJS who presents the morning programme *Coast-Wise* and **Ian Collington** G6DTS who produces a variety of programmes and is often heard working 144MHz mobile with his IC240.

Microwaves

During the tropo opening on March 24 and 25 conditions on 10GHz were very good and the 10GHz beacon at Martlesham, with 1mW output, presented a strong signal in PA0. "G3LQR near Woodbridge worked a number of PA0s on 10GHz and PA0s were calling on 432·2MHz for 10GHz QSOs" writes **John Tye** G4BYV, Dereham, who worked DL3NI at 450km, with 59 reports both ways, on 2·32GHz on March 24. "We have now moved to 2·32GHz as both DL and PA0 no longer have 2·304GHz" said John who now has a receiver working on 5·76GHz (6cm).

News Items

Since the Rowner and District Amateur Radio Society was formed in January they have concentrated their efforts on constructional projects and getting some members through the RAE. Readers in the Gosport/Portsmouth area wishing to know more about the club should contact "Mac" McKeever, 108 Greenaway Lane, Warsash, SO3 6HS.

The Brownlow family from Brighton were active at the Chalk Pits Museum, Amberley, on April 15 and 18 and while Gerry G3WMU, was explaining the techniques of amateur radio to the museum's visitors, Richard G4LCV entertained them by working stations in Finland, Germany, Italy and the USSR on the key. During the afternoon of the 18th, Margaret G4LCU, worked a husband and wife team VE1ATU and VE1BQF on s.s.b. giving the Canadians their first YL contact in the UK. Gerry has spent some time building a quad antenna for the h.f. bands which now looks very impressive at the top of the museum's new antenna mast.

TV

by Ron Ham BRS15744

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

With the advent of a wide variety of compact, battery-powered television receivers, most of which tune through bands III, IV and V, DXing from a temporary location on high ground has become relatively easy. Although television signals are polarised, the telescopic rod antenna fitted to the sets will usually suffice. However, antenna polarisation is an important factor in our search for DX so it is well worth the time to tune through the bands, first with the rod vertical and then again with it horizontal, not forgetting that when the antenna is horizontal it also becomes directional.

Acknowledgment

A good reception report to a broadcast station can be worthwhile because in reply to information that **Brian Renforth,** Chippenham, sent to Swedish Television he received an impressive QSL card, Fig. 1, a large postcard in colour of their TV1-Sverige test card and a booklet containing maps and details of Swedish broadcasting sent by Hans Ekman, their international co-ordinator.

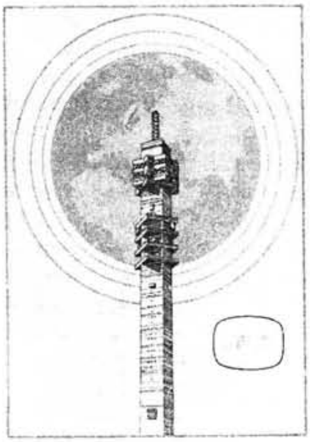

Fig. 1: QSL card received by Brian Renforth

Sporadic-E

Often a considerable amount of information can be obtained from the many random bursts of picture which appear on Ch. R1 49·75MHz, either via meteor trail reflection or pre-season sporadic-E. Obviously one cannot watch the screen the whole time therefore it is advantageous to run a radio receiver, tuned to 49·75MHz, alongside the television set so that the sound of synchronising pulses from the loudspeaker will draw one's attention to the associated picture on the screen. For this particular purpose and a quick tune around the Band I sound channels, **Roger Bunney** uses a wartime Hallicrafters SX21, **Harold Brodribb** an ex-military RL85, I use an ex-army R216 and **George Grzebieniak** has purchased a Tandy Patrolman 50 for monitoring Ch. R1 and as a 38MHz i.f. amplifier for a v.h.f./u.h.f. television tuner.

Strong bursts of test card were seen around 0900 on Ch. E2 48·25MHz from Austria ORF FS1 on March 25 and on Ch. R1 from Czechoslovakia RS-KH on March 22 and April 5 and 7 and Poland on March 18, 20, 23 and 27 and April 1,

Fig. 2: SSTV colour picture received by Richard Thurlow

Fig. 3: SSTV colour picture received by Richard Thurlow

Fig. 4: SSTV colour picture received by Richard Thurlow

Fig. 5: Picture from G3NOX via I3XQW

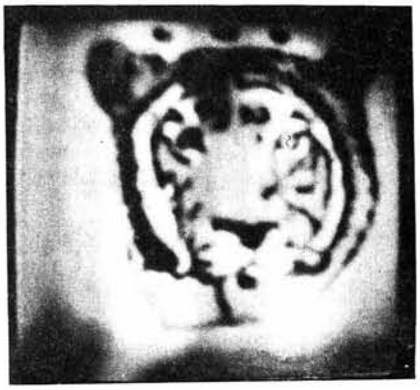

Fig. 6: Camera test by G3WW

Fig. 7: Camera test by G3WW

6, 7 and 16. Longer bursts of picture of a mathematics programme were seen at 0810 on March 25, clowns dancing at 0934 on April 11 and the Polish insignia "dt" at 0901 on the 14th. At 1400 on March 30, Brian Renforth received pictures of what looked like a classroom on Chs. E2 or R1, bursts of an entertainment show with stand-up comedian in front of a studio audience on Ch. E3 55·25MHz at 2100 on April 10 and a children's programme at 1430 on the 11th.

Keith Hamer and **Garry Smith** of Derby saw the first real sporadic-E opening of the 1982 season at midday on March 31 when they received strong pictures and good quality sound from the USSR on Chs. R1 and R2 and a test card from Poland on Ch. R1. Checking the band again at 1820 they had a bonus when a bit of trans-equatorial propagation put an African test signal on their screen.

Tropospheric

During the spell of good conditions between March 23 and 27, Harold Brodribb, St Leonards-on-Sea, received pictures from France TDF on Chs. 21 and 34 and George Grzebieniak, London, using an 18in Pye colour receiver and a 9-element Yagi received pictures from Holland NOS 1 and 2 on Chs. 28 and 31 and German stations WDR on Ch. 46 and possible ZDF on Chs. 31 and 34. For long periods between 0845 on the 24th and 1000 on the 26th, I received strong pictures from the IBA transmitter at Lichfield, Central TV, on Ch. B8, with only a dipole feeding my Marconiphone, Band III 405-line receiver as did Brian Renforth using a 405-line receiver and a Telerection double 8 antenna. At 0810 on the 25th, I received a test card from Holland PTT NED 1 on Ch. E5 and around 1600 I took my Plustron TVR5D to a nearby high spot and with its own telescopic antenna and by adjusting the line hold control, a strong test card TDR TV1 from France appeared on Ch. 21. Periodically between the 24th and 26th, both the BBC and IBA warned their viewers about the prevailing interference. On the 25th, Brian received pictures from TDF and between 0700 and 0900 on the 26th, both Brian and **Ian Kelly**, Reading, received the Dutch test cards PTT NED 1 and PTT NED 2. "At least 3 Dutch stations were seen in Band IV, one of them was on an adjacent channel to BBC2 and the Dutch picture was chopped into four quadrants and travelled at 1 frame approximately every 2 seconds horizontally across the screen," writes Ian who also noticed that before 0800 the stations NOS Nederland 1 and 2 carried a card scribed AUUC HUS, "there's nothing like this in my Dutch dictionary" says Ian.

"On March 25, TV DXing was a bit on the disappointing side" writes **Simon Hamer** from Presteigne, whose only DX was a fair picture from Anglia TV at Sandy Heath despite the warnings of interference. This suggests that the opening did not reach Wales which adds weight to the point raised by George Grzebieniak that the event was in limited areas (see *VHF Bands*).

At 1735 on the 28th, Harold Brodribb received clear, negative pictures from France on Chs. 21 and 34 as I did again on one of my hilltop expeditions at 1700 on April 15 and 1600 on the 16th.

SSTV

At 2036 on March 22, **Richard Thurlow** G3WW, March, had a two-way slow-scan television contact with G3LUI on 144·230MHz and learnt that the Essex 144MHz SSTV f.m. net is active on 144·5MHz every Wednesday at 2000 BST and among the net members that Richard has worked are G4IMO Rochford, G4KXN Chelmsford and G4MYQ Clacton-on-Sea. During the good 144MHz conditions on March 24, Richard made first-time SSTV QSOs with PA2JSL and PE1GNF and G3RED, Peterborough, BARTG's crack RTTY news sender. On the 25th he exchanged pictures with G8ASI in Hemel Hempstead and ON4VF.

Colour SSTV

The QSO between G4IMO and Richard on 144·5MHz around 2119 on March 31 began with monochrome and then they spent some 30 minutes sending colour pictures back and forth. "We both use black and white cameras and three coloured filters into a Robot 400s plus two home-brew memories" writes Richard, who adds: "new two-way QSOs in colour continue to increase on the 28MHz and 14MHz bands". The SSTV signals received off-air and from his own camera tests are displayed on a 14in Ferguson colour portable and Figs. 2, 3 and 4 are pictures he received during experiments with an Italian station, I3XQW, Fig. 5 originated from G3NOX and was received via I3XQW who replayed it, and Figs. 6 and 7 are the results of Richard's own camera tests. The tiger's head is from a knitting pattern in a woman's magazine stood in front of his Robot 80a camera. The Italian station is now using two of the colour pictures he received from Richard in his colour demonstration tape.

I note from a circular that I received from Aero and General Supplies that "New FCC regulation permits USA general class operators to use slow-scan television from 22nd February 1982" and this could double SSTV operation from the USA.

Amateur Television

The Worthing and District Video Repeater Group hope soon to have their television repeater GB3VR, operational in the Worthing area to cover the coast between Bognor and Shoreham. For further information and offers of help, contact Martin Newell G8KOE QTHR.

Get Together

"I now have a Plustron TVR5D with antennas for Bands I, III, IV and V on a rotator, on the roof" writes Tim Anderson from Stroud who would be pleased to hear from other TVDXers in his part of the world: 24 Highfield Rd, Bowbridge, Stroud, Glos.

Warning

Please bear in mind that the early valved v.h.f. receivers such as the Eddystone 770R, Hallicrafters SX21, S27 and S36 and ex-government RL85 and R216, often mentioned in this column, are between 25 and 40 years old and when found on the second-hand market may require considerable repair work to bring them up to their original performance. If you do see one and are not sure about it, do get some expert advice, because, although old, they are still useful receivers.

---

swap spot

Have stock album mainly mint British stamps and mint Commonwealth. SEM-18–144MHz convertor, new. LAR 7MHz traps, brand new. Would exchange for general coverage receiver, 144Mhz gear, v.h.f. RX, high impedance desk mike. XTAL calibrator/wave meter. J. Randall G3OAZ QTHR, or 0256 65126 (Basingstoke) *N.430*

Have general coverage/amateur bands RX 9R-59DS, internal XTAL cal. Would exchange for 70cm transceiver, 3 or more channels. G3DSV, 036 27 324 (Crediton, Devon) *N.446*

Have 317 1926-1950 valves, "Grid Leaks" pocket phone, Bulgin VT17 i.f. liner, "Ardron" 2-valver about 1932, 2 Amplion Corvette M2V eliminators and a General Radio Co. Standard 603A signal generator. Would exchange for radio/TV test gear. A. Keys, Mill Lane Farm, South Somercotes, Louth, Lincs. *N.463*

Have BIM mains p.c.b. drill kit, boxed, with all tools, collets etc., almost as new. Also Verowire prototyping kit with plenty of additional wiring combs. Would exchange for quality radio, electronics or computer text books, magazines considered. David Millne, Bedlington (0670) 829215. *N.483*

Have telephone exchanges (ex-military). Would exchange for any GPO subs equipment (HES 1 & 2 especially sought) or exchange equipment (auto or m anual), also require some GPO "N" series diagrams. John Hein, 13 Blane Avenue, Blanefield, Glasgow G63 9HU. Tel. 0360 70403 ext 25 (evening) 0855 2450 ext 20 (day). *N.498*

Have Telequipment 3in 6MHz scope, probes, Tandy 0–50MHz frequency meter, precision Taylormeter 100A, logic probe, CV power supply 0–38V 1·5 amp. Would exchange for FRG-7 digital, Trio 1000, Bearcat or good similar. C. Makin 051 526 7884. *N.510*

Have SX200 scanner receiver 26MHz to 512MHz. Would part exchange for Grundig Satellit 3400 or similar. H. Tobias, 108 Baysdale Road, Scunthorpe, South Humberside, DN16 2QG. Tel. 0746 841586. *N.519*

Have Cannon camera AE1 as new, zoom lens 100–175, enlarger, dark-room equipment. Would exchange for Trio R600. J. Adams, Burton-on-Trent 221870. *N.568*

Have Binatone 5-star f.m. CB transceiver with slidemounting, antenna loft ground plane and coaxial cable, 13·8V 3 amp power supply, v.s.w.r. meter, extension speaker, p.a. horn, spare microphone, patch leads, antenna matcher and coaxial switch. Would exchange for Icom IC2E, charger unit and microphone. M. A. Williams 01-237 4581 ext 100 (office hours) 01-698 4392 (home). *N.579*

Have 1951 Defiant Band I TV, no picture but all tubes light. Would exchange for a dead oscilloscope or w.h.y. V. Halsall, 50 Sunfield Road, Oldham, Lancs. *N.593*

Have 24GHz Rank precision slotted line s.w.r. meter including dial gauge, new, crated with instructions. Would exchange for Eddystone 880 receiver. M. Mann G4FFO, 45 Old School Lane, Milton, Cambridge, CB4 4BS. Tel. 0223 860150. *N.601*

Have JVC 3040UKC, CR100, R107 and Pathfinder. Would exchange for SX200 or APR9. D. Everall, 36 Eleanor Road, Waltham Cross, Herts. EN8 7DL. *N.628*

Have two 20W 4Ω stereo speakers and Ferguson stereo cassette tape recorder (not compatible with speakers). Would exchange for decent short-wave portable receiver. T. Graham, 44 Watermead, Bolton-on-Dearne, Rotherham, South Yorks, S63 8NF. Tel. Rotherham 898374. *N.629*

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EABC80	0.56
EAF42	1.40
EB91	0.52
EBC81	0.85
EBC89	0.85
EBF80	0.50
EC90	0.60
ECC81	0.55
ECC82	0.55
ECC83 Philips	1.10
ECC83	0.60
ECC83 Philips	1.10
ECC85	0.60
ECC88	0.65
ECC91	0.65
ECC804	0.40
ECC807	1.30
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ECF82	0.60
ECF86	1.50
ECF812	1.20
ECH3	2.50
ECH35	1.50
ECH42	1.00
ECH81	0.58
ECH84	0.93
ECL80	0.66
ECL82	0.58
ECL84	0.74
ECL86	0.74
EF37A	2.95
EF39	1.25
EF42	2.50
EF55	2.25
EF80	0.48
EF83	3.50
EF85	0.48
EF86	0.70
EF89	0.75
EF91	1.50
EF92	2.50
EF93	0.65
EF94	0.55
EF183	0.65
EF184	0.65
EH90	0.72
EK90	0.72
EL33	4.00
EL34	1.98
EL36	1.60
EL37	5.00
EL38	4.50
EL82	0.58
EL84	0.66
EL85	3.85
EL86	0.80
EL90	0.82
EL360	8.35
EL519	4.50
EM80	0.70
EM81	0.70
EM84	0.70
EM85	0.85
EM87	1.10
EMM803	2.50
EN91	0.95
EN92	4.00
EY84	8.00
EY86/87	0.50
EY88	0.60

EZ80	0.75
EZ81	0.56
EZ90	0.96
G1/371K	30.00
G55/1K	8.00
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GS10C	12.00
GXU50	12.50
GY501	1.20
GZ30	1.00
GZ32	1.00
GZ33	4.50
GZ34	2.00
GZ37	4.50
KT61	4.00
KT66 USA	6.00
KT66 UK	9.00
KT77	5.00
KT88 USA	7.00
KT88 UK	11.50
KTW61	1.50
M8079	6.00
M8083	3.25
M8100	2.85
M8137	5.50
M8162	5.50
M8225	1.20
ME1400	4.00
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OA2	0.60
OB2	0.65
PC86	0.80
PC88	0.80
PC92	0.85
PC97	1.10
PC900	0.95
PCF80	0.65
PCF82	0.60
PCF86	1.20
PCF200	1.35
PCF201	1.35
PCF801	1.35
PCF802	0.72
PCF805	1.48
PCF808	1.48
PCH200	1.10
PCL82	0.80
PCL83	2.00
PCL84	0.80

PCL85	0.90
PCL86	0.80
PCL200	1.60
PCL805	0.90
PD500	3.50
PFL200	1.13
PL36	1.05
PL81A	0.75
PL84	0.85
PL500	1.12
PL504	1.20
PL508	1.75
PL509	3.50
PL519	3.50
PL802	2.95
PY88	0.74
PY500A	1.75
PY800	0.70
PY801	0.70
QQV02-6	12.75
QQV03-10	4.50
QQV03-20A	17.00
QQV06-40A	18.00
QS150/45	7.00
QS1200	3.95
QS1209	2.00
QS1212	3.20
QV03-12	3.50
TY2-125A	45.00
U19	11.95
UCH81	0.65
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UF80	0.80
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5Z4G	0.85

6AB7	0.60
6AB8	0.66
6AC7	1.00
6AF4A	1.20
6AG7	1.20
6AH6	1.00
6AJ7	1.00
6AK6	2.00
6AL5	0.52
6AM4	2.50
6AM5	6.00
6AM6	1.30
6AN5	2.00
6AN8A	2.50
6AQ5	0.82
6AS5	1.50
6AS6	2.50
6AS7G	6.00
6AT6	0.80
6AU6	0.55
6AV6	0.72
6AW8A	2.50
6BA6	0.50
6BA7	3.75
6BA8A	3.50
6BE6	0.72
6BD6	1.10
6BH6	1.60
6BJ6	1.05
6BN7	3.50
6BN8	2.00
6BR7	3.75
6BR8A	1.20
6BS7	3.30
6BW6	4.50
6BZ6	2.00
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6EA8	1.80
6F6G	2.00
6F28	1.25
6GH8A	0.80
6GK6	2.00
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6J6	0.55
6J7GT	1.25
6JB6	3.95
6JS6C	2.55
6K7	0.70
6KD6	4.50
6L6GC	1.90
6L6GT	1.20
6L7	0.55
6U8	0.60
6V6GT	0.90

7B7	1.40
7S7	3.00
7027A	4.65
7591A	2.35
11E2	16.50
12AC6	0.80
12AD6	0.80
12AE6	0.85
12AG8	1.50
12AH8	5.50
12AT6	0.59
12AT7	0.55
12AT7WA	2.50
12AU6	0.60
12AU7	0.55
12AV6	0.80
12AX7	0.55
12AX7WA	2.50
12AY7	4.00
12AZ7A	1.50
12BA6	0.75
12BE6	1.05
12BH7	0.95
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12GN7	3.95
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BC108	0.10
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BC141	0.25
BC142	0.21
BC143	0.24
BC147	0.09
BC148	0.09
BC149	0.09
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BC158	0.09
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BC170B	0.10
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BC183	0.12
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BC213L	0.09
BC237	0.09
BC238	0.09
BC307	0.09
BC327	0.10
BC337	0.10
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BC478	0.20
BC547	0.10
BC548	0.10
BC549A	0.08
BC557	0.08
BC558	0.08
BD131	0.32
BD132	0.35
BD133	0.40
BD135	0.30
BD136	0.30
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BD140	0.30
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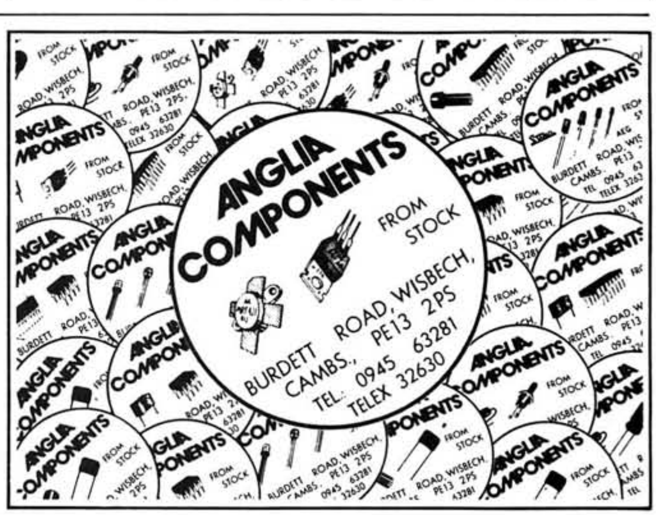

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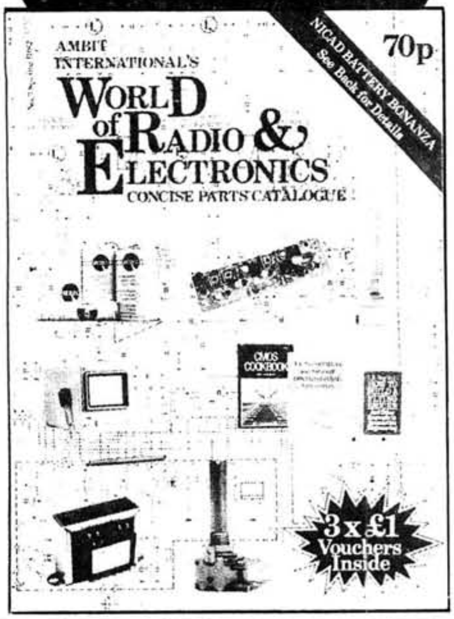

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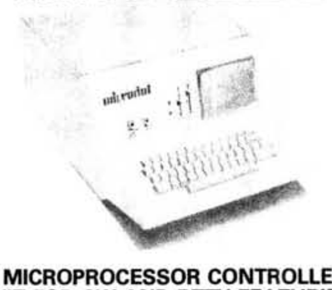

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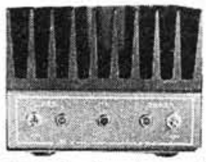

Further to our announcement in previous advertisements to produce 2 meter linear amplifiers, we have finally designed and manufactured a 80 watt version to suit the most popular QRP transceiver – the Yaesu FT290R, but is also suitable for any other transceiver having an output power of 2-3 watts. (And the price is right too.)
This decision was made after a survey amongst our customers who were owners of QRP transceivers their requirements were for a 80 to 100 watt basic amp. with no gimmicks such as receive pre-amp which only adds to costs and degrades the noise performance of the receiver.
Features: Quiescent current (no drive) 300 m/A. Minimum output power with 2½ watts drive – 80 watts with 13.8v. Suitable for FM and SSB. Fully RF switched or can be used via transceivers PTT line. Straight through operation when switched off. Provision for fitting "T" attenuator for higher RF inputs. Separate Led indicators to show "power" and "SSB" selected plus "ON AIR" indicator. Manufactured to high industrial standards. SO239 sockets fitted as standard. Finished in hard stove enamel colour storm grey semi gloss with matt black heat sink. Size 105 × 210 mm long. SPECIAL INTRODUCTORY PRICE OF ONLY **£98.00.**
Yaesu FT290R – £249.00. Mobile mounting bracket – **£22.25.** Set 2.2a nicads – **£21.50.**
SPECIAL OFFER: We can supply you with one of our linear amps and a FT290R for an all in price of only **£330.00.** (FT290 accessories extra.)
3SK88 MOSFET super low noise 1.1db @ 150 MHz with 26db gain. 16db gain @ 900 MHz with only 3.5db noise. Still a good device for 70cms approx 22db gain with 2.2db noise. Supplied with data sheet – new REDUCED PRICE ONLY **£1.20** ea. or two for **£2.20.**
RECEIVER PRE-AMP for 27-30MHz. Suitable for any receiver or transceiver covering these frequencies, circuit is designed around a dual gate mosfet giving a gain of 25db with only 1db noise. Gain is adjustable on PCB. 50 ohm imp. in & out & requires 9-15 volt supply. Ready built on board size 60 × 40mm. PRICE **£8.00.**
We still produce our NBFM adapter for the FT101 up to "E" model. No holes to drill or PCBs to fit, small free standing unit which just plugs into the sockets at rear of FT101 still the best & reduced to **£70.00.** Data sheet available.
SEMICONDUCTORS:– VHF RF POWER 2N6083 30 watt @ 2 mtrs over 7db gain 12v OK FM/SSB. With data sheet **£6.50** (the cheapest you will find). 2N3866 **75p,** BFW16A **75p,** PT4236A (2N4427) **75p,** 2N2631 (2N3553) **75p,** SD1212-6 3 watt @ 2 mtrs 12v 10db gain **£2.50.**
HF POWER – 2N5070 25w pep 24v 30MHz **£4.00,** 2SC1909 5w to 50MHz 13db @ 30MHz 12v **£2.00,** 2SC1307 15w AM 25w pep @ 30MHz 13db gain 12v **£3.00** (data sheet with 2SC1909 & 1307).
MOSFETS 3SK88 **£1,** two for **£2.20,** 3SK45 **50p,** 3SK60 (3N204) **80p,** BFR84 (41673) **60p. FETs** 2N3819 **40p,** TIS88A **43p.**
FILM TRIMMERS 2-25pf 10mm dia ten for **75p,** 10pf 7mm sq. 2 pin **10p ea.,** 2-18pf 9mm sq. 3 pin **15p ea.**
PLUGS/SOCKETS PL259 **45p,** reducer for UR76 etc. **15p,** PL259 right angle plug for UR76 etc. **70p,** SO239 socket flange type **45p,** 50 ohm BNC flange socket **70p,** 50 ohm BNC female plug **50p.**

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Type	P/out	Gain	Volts	Freq.	Price
2N3866	1w	10dB	28	175MHz	£1.01
2N4427	1w	10dB	12	175MHz	£1.22
2N3553	2.5w	9dB	28	175MHz	£1.34
2N5913	2w	7dB	12	470MHz	£1.95
SD1127	4w	12dB	12	175MHz	£2.75
2N6080	4w	12dB	12	175MHz	£5.97
SD1143	10w	10dB	12	175MHz	£7.75
2N6081	15w	6.3dB	12	175MHz	£8.86
2N6082	25w	5.7dB	12	175MHz	£9.49
2N6084	40w	4.5dB	12	175MHz	£13.90
SD1428	45w	6.5dB	12	175MHz	£17.65
SD1416	70w	6.7dB	12	175MHz	£26.75
SD1477	100w	6.0dB+	12	175MHz	£31.50
2N5590	10w	5.2dB	13.6	175MHz	£7.10
2N5591	25w	4.4dB	13.6	175MHz	£9.15
2N5944	2w	9dB	12	470MHz	£7.47
2N5945	4w	8dB	12	470MHz	£9.65
SD1135	5w	7.5dB	12	470MHz	£6.99
SD1136	10w	8dB	12	470MHz	£9.50
2N5946	10w	6dB	12	470MHz	£12.02
SD1088	25w	6.8dB	12	470MHz	£21.50
SD1089	40w	4.3dB	12	470MHz	£31.25
SD1434	50w	6.0dB	12	470MHz	£28.33

Ex Equip 2N5070 2-30MHz 25wPEP — £2.88
2N5645 Mot. 12v 470MHz 4W out. — £4.50
2N5914 RCA 12v 470MHz 2w 7dB — £4.60
218BLY Mul Studless BLY38 2w 470MHz — £3.45
61387 RCA Studless Sim C1-12 CTC — £3.45
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BF900 UHF MOSFET Equiv 3SK88 — £1.30

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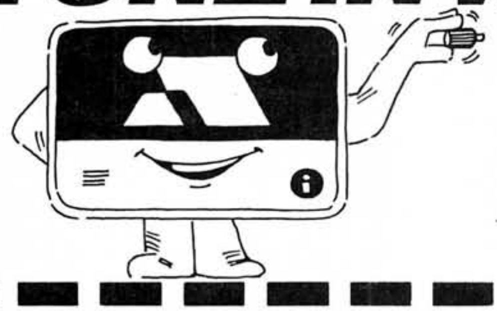

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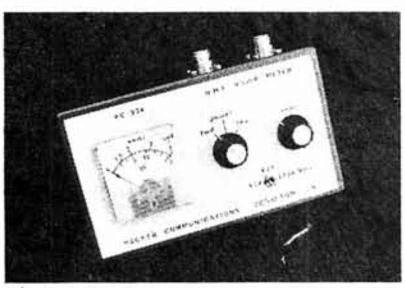

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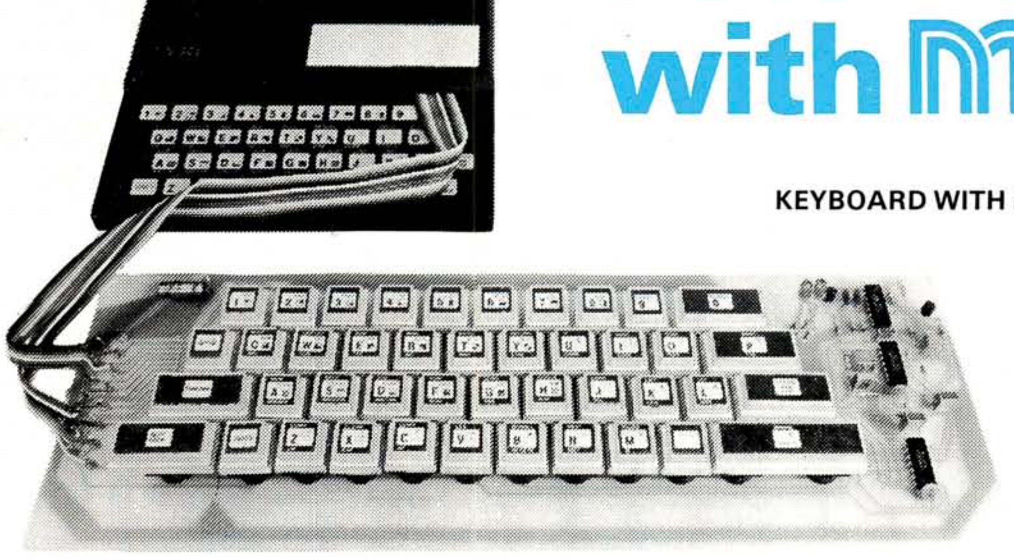

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