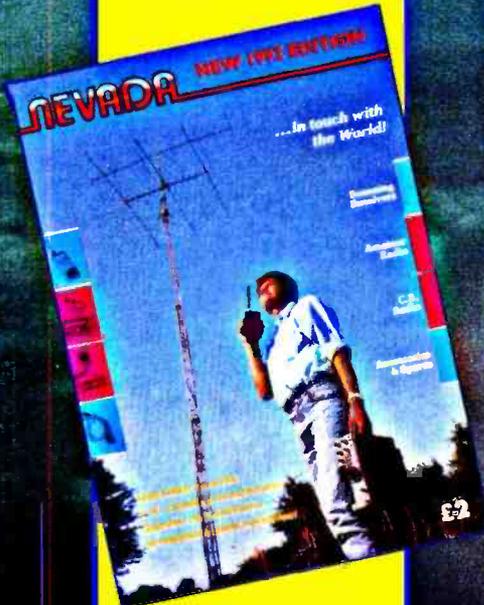


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Same Again Sir?

In the battle of the stations, the FT-990 all-mode HF transceiver is the clear winner. Based on the same remarkable performance, ease of operation and the features of the FT-1000. The FT-990 is an extraordinary achievement, compare the advantages yourself. Feel the silky smooth tuning, hear the dual digital SCF (Switch Capacitance Filter) provide unsurpassed reception quality never before obtained. Be heard with the CPU-controlled RF FSP (RF Frequency-Shifted Speech Processor) for the extra pile-up "PUNCH". See the lightweight and compact FT-990 with built-in AC switching power supply. The FT-990 is a true champion HF rig without compromise. Leave it only to Yaesu to offer powerhouse performance that leaves the rest far behind.



FT-990
HF All-Mode Transceiver

- ✓ **Dual VFOs With Direct Digital Synthesis (DDS):**
Two ten-bit DDS plus three eight-bit DDS.
- ✓ **High Dynamic Range:**
108dB. RF circuit design with quad FET first mixer similar to the FT-1000 as only Yaesu's unsurpassed tradition can provide.
- ✓ **CW 500Hz Crystal Filter (Included).**
- ✓ **Dual Digital SCF Filter and IF Shift, IF Notch:**
Superior interference reduction.
- ✓ **Automatic Mode-Dependant AGC Selection.**
- ✓ **Full and Semi-Break In CW Operation!**
With built-in latching memory keyer with BFO offset and CW spot. Key jacks on both front and rear panels.
- ✓ **6 Function Multimeter.**
- ✓ **Adjustable RF Power Output:**
With internal heatsink and whisper-quiet temperature-switched squirrel cage blower.
- ✓ **Adjustable Level Noise Blanker:**
For a wide variety of noises and woodpecker.
- ✓ **CPU Controlled RF FSP (RF Frequency-Shifted Speech Processor):**
For better intelligibility and pile-up "PUNCH" for competitive situations.
- ✓ **High Speed Automatic Antenna Tuner:**
With 39 memories.
- ✓ **50 Memories:**
Independent ATU and mode/IF filter memory.
- ✓ **Multimode Selection on Packet/RTTY:**
Switchable FSK tone, RTTY shift and CW pitch.
- ✓ **Front Panel EX Antenna Selection:**
Allows quick switching.
- ✓ **Digital Voice Storage (DVS-2):**
Option provides instant playback of 16-second receive memory, plus two 8-second or 4-second "CQ contest" messages on transmit.
- ✓ **Built-In Switching AC Power Supply:**
Reliable performance with significantly reduced size and weight.
- ✓ **Band-Stacking VFO System:**
Each VFO register memorises your most recent operating frequency, mode, bandwidth and clarifier information for instant return to your favourite frequency and mode.
- ✓ **Accessories/Options:**
TCXO-2 (Temperature Compensated Crystal Oscillator), XF-10.9M, 202-01 (2nd IF SSB Narrow 2.1kHz), XF-445C-251-01 (3rd IF CW Narrow 250Hz), SP-3 (External Speaker), MD-1CR (Desk Microphone), YH-77ST (Headphones).

Performance without compromise

practical Wireless

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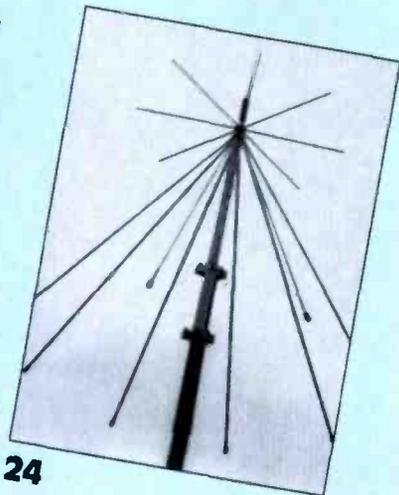
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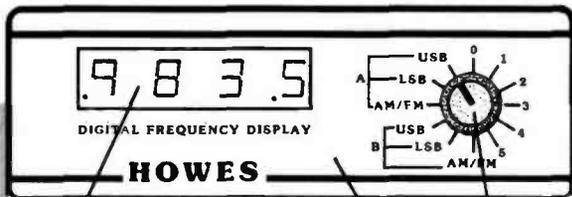
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The **HOWES DFD4** is an add-on Digital Readout for analogue receivers and transceivers. If you have an FRG7, an analogue FT101 or a similar type of rig, then the DFD4 has been designed with you in mind. The DFD4 is a frequency counter that can be programmed for any IF offset so it can be used with almost any radio, including the old Government surplus sets. It can also count down as well as up, so it is suitable for "reverse tuning" rigs too.

To make the DFD4 even more versatile, we now offer the **PMB4** Programmable Matrix as an optional kit. This enables you to switch between six different programmed offsets, so the DFD4 can be used with more than one radio, and to compensate for IF frequency differences when switching modes. Also new is the **CA4M** "hardware package". This contains a custom made case with pre-punched anodised aluminium front panel (see drawing above), plus switch, knob, BNC socket, nuts and bolts etc. to enable you to achieve a high standard of finish for your project.

DFD4 Kit: **£39-90**
PMB4 Kit: **£9-90**

Assembled PCBs: **£59-90**
CA4M Hardware: **£19-90**

HOWES QRP CW Transceiver



BUILD A QRP TRANSCEIVER!

To build a transceiver with our kits is a simple modular, step by step approach. You can start with the receiver, and then add on the transmitter at a later date if you wish. Various accessory kits are available to increase the facilities, these range from a simple signal meter for the receiver to extra filtering and of course, digital readout. We offer a matching range of "hardware packs" (case, knobs etc.) to enable your station to look as good as factory equipment! Whether you fancy a single band CW transceiver, or more complex dual band SSB/CW rig, all these kits are designed to be within the scope of the ordinary home constructor. The well thought out designs and the backing of professional RF test facilities mean you can build with confidence!

Single band 40 or 80M CW transceiver:

	Kit	Assembled
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CVF40 or 80 VFO for TX or TX/RX	£10-90	£18-40
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You will also need two 50pF tuning caps (£1-60 each) plus a slow motion dial (£6-90).
Total price of transceiver in kit form (including caps and dial): **£101-30**.

PLEASE ADD **£1-20 P&P** for kits or **£3-00** if ordering hardware.

HOWES KITS are produced by a professional RF design and manufacturing company. They contain good quality printed circuit boards with screen printed parts locations, full clear instructions and all board mounted components. Sales and technical advice are available by phone during office hours. Please send an SAE for our free catalogue or specific product data sheets. Normally all items are in stock and delivery is within seven days.

72 & 73 from Dave G4KQH, Technical Manager.

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Frequency coverage: 30kHz - 30MHz
Modes: USB/LSB/AM/Sync. AM (Selectable S'band)
IF Bandwidths: 2.5kHz & 7kHz
Tuning: 8Hz steps with variable speed
Memories: 60 holding frequency & mode



Aerial inputs: 600 ohms, 50 ohms & Hi-Z Whip
Power: 12Vdc from mains adaptor (supplied)
Case: All-metal light alloy case
Size: 185mm(W) x 80mm(H) x 160mm(D)
Weight: 1.3kg (less batteries)



HF-235 The Professionals' Choice

£1116 inc VAT

Frequency coverage: 30kHz - 30MHz
Modes: AM/LSB/USB/CW/NBFM (Sync AM optional)
Filters: 6 Input bandpass filters
Tuning steps: 8Hz - 125Hz (stepped by mode)
Construction: Fully floating chassis

Remote control: RS232C Computer interface (optional)
Memories: 30 holding a host of data
Tuning: Spin-wheel, keypad & MHz button freq. entry
Power supply: 110-120 or 220-240Vac 50Hz
Size: 483mm(W) x 88mm(H) x 320mm(D)

HF-225 Gateway to the World

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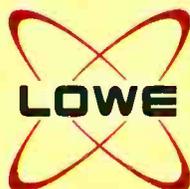
Frequencies: 30kHz - 30Mhz
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Filters: IF filters for all modes fitted
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Practical Wireless, May 1992



2m & 70cms Dual Bander DJ-580E

£369

inc VAT

The DJ-580E hand-held is the most advanced design ever offered to the radio amateur. Building on the winning formula of the DJ-560E, ALINCO have now reduced the size dramatically and introduced a combination of innovative features that will make your operating even more fun and certainly more versatile.

It goes without saying that ALINCO offer you all the standard features you expect from a hand-held including dual watch, dual controls, scanning, searching, priority, etc. Of course ALINCO's standard of engineering and reliability is now becoming the envy of its competitors. (They're also pretty envious of ALINCO's prices!) Naturally you get a full 12 month warranty including parts and labour. It's the extra features that really make this a winner.

For example you now have ALINCO's patented circuit that retains full operation with dry cells even when battery voltage falls by 50%. Great for emergency applications. You get a programmable auto power off feature, battery saver, digital telephone dialler and three output power levels. And we've only just started! Key in a special code on the keypad and your rig will turn into a fully operational automatic crossband repeater. Key in another code and you will open up the receiver for a.m. airband reception and frequency segments up to 995MHz! You can even use the DTMF feature to send and receive two digit code messages.

To learn more about the transceiver that has already taken the Japanese and American markets by storm, phone or write for a full colour brochure.



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Specification

Tx	144-146MHz 430-440MHz
Rx	AM 108-143MHz FM 130-174MHz FM 400-470MHz FM 810-995MHz
Steps	5, 10, 12.5, 20, 25kHz
Memories	42
Power Output	2.5/1.0/0.3 Watts 5 Watts with 12V DC
Scan	8 Modes
Tones	1750Hz plus DTMF Optional CTSS
Sensitivity	12dB SINAD -15dBu
Size	140x58x33mm
Weight	410g
Accessories Supplied	Ni-Cad pack, AC charger, belt clip, carry strap, dual band antenna.

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The FT890 is an exciting new all band multimode HF mobile/base transceiver from Yaesu. Designed to replace the very popular FT757GX and FT757GXII, the FT890 is a worthy successor.

Direct digital synthesis combined with a magnetic encoder provides silky smooth tuning, pure signals and as the digital synthesisers are driven from a single master oscillator both frequency accuracy and stability are guaranteed.

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- ATU2 Internal automatic ATU
- FC800 External automatic ATU
- DVS2 Digital voice storage system
- SP6 External speaker (base).
- SP7 External speaker (mobile).
- TCX03 Temperature compensated oscillator unit.
- MMB20 Mobile mounting bracket.
- XF455K 250Hz CW filter.
- YF100 500Hz CW filter
- YF101 2kHz SSB filter.

RAVE REVIEWS



FT990

- * Amateur bands Tx 160-10m
- * General coverage Rx
- * Power output up to 100W P.E.P.
- * Auto ATU and internal P.S.U.
- * 50 memories

Since its arrival in the UK the Yaesu FT990 has been hailed as a resounding success in both performance and ergonomics.

Central to the success of the FT990 is the many hours of extensive development by the engineering team at the Yaesu factory which ensures that all the very latest in circuit techniques are employed to benefit the operator. By the use of more sophisticated designs the actual operation of the transceiver can be made very easy and logical, whilst retaining the superb electronic performance expected from modern transceivers.

Almost all the people who have reviewed the FT990 agree that it is hard to beat at the price and they all suggest you try one.

A large number of amateurs are already enjoying the pleasure of operating a transceiver in a class of its own.

So why not join this group of happy people by trying one today at your local dealer!

See December 91 edition of P.W. for Rob Mannion's review
April edition of Radcomm for Peter Harts review

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The Daiwa range of power supplies is proving very popular for all types of applications, both for the professional user and the hobbyist alike.

From the smallest 9A continuous PS120MkII, via the extremely popular 24A PS304, to the top of the range 32A continuous RS40X. All the Daiwa range of PSUs feature variable voltage from at least 3-15V and switchable voltage 1 current metering. Both the PS304 and RS40X have a cigar lighter socket, convenient for powering your handheld.

Also available from Daiwa are some good quality SWR/PWR meters and coax switches.



POWER SUPPLIES

PS120 M2	3-15v Variable	9A/12A max.	£69.95	C
PS304	1-15v Variable	24A/30A max.	£129.95	D
RS40X	1-15v Variable	32A/40A max.	£189.00	D

COAX SWITCHES

CS201	2 Way SO239	DC-600MHz 1kW	£13.95	A
CS201G2	2 Way N	DC-2GHz 1kW	£27.50	A

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CN101	1.8-150 MHz	15/150/1500W	£59.95	B
CN103N	150-525MHz	20/200W N	£69.95	B

LINEAR AMPLIFIER

LA208H	2m 1.5-5W in	30-80W out	£159.95	C
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The CV730-1 'V' dipole is the latest in a line of dipoles from Creative Design. The use of the 'V' shape reduces the area needed for mounting the antenna which is insensitive to changes in height above ground and surrounding metallic objects.

All this for only £152.00D

6M BEAMS

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CL6DX 6 ele 13dB	£117.50D
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CL6DXZ 8 ele 14.5dB	£235.00D

*Manufacturers figures.

ROTATORS

The RC5 series of rotators from Creative Design are built to meet the exacting standards required by both professional and amateur users. A range of models is available designed to cater for medium to large sized antennas. All the rotators are manufactured with high quality components allowing continued and reliable operations.

RC5-1	£223.75C
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RC5B-3	£689.00C
CK46 Rotary bearing	£35.75B

A=£1.95 B=£4.75 C=£6.60 D=£11.00 E=£16.50

The CREATE company has, for the past twenty years, been the leading manufacturer of amateur and commercial antennas (mainly HF) in Japan.

Now available to customers in the UK through South Midlands Communications, the appointed distributor are the popular CREATE HF beams to cover the 10/15/20 metre bands, HF baluns up to 10kW PEP and to exciting 10/15/40V dipole which has elements of only 19ft and is designed in such a way that it can be mounted in particularly awkward places. SMC also stock what must be one of the largest amateur antennas available, the 40 metre full sized beam, as well as 6 and 7 element and six metre yagis and professional quality log periodic antennas for 50-1300 and 105-13000MHz. CREATE also manufacture rotators to exacting levels of precision and these have virtually no back lash, quiet gears, variable speed and large torque. All are now available from SMC stock. Please contact us NOW for full details.

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CD318B 5 ele 10-15-20M 2kW PEP Gain 7:5:9:9:5dB F/B 20:18:20dB	£459.00D
CLA0B-4 3 ele Yag 40m 4kW PEP Gain 8dB F/B 22:18dB	£1120.00E
CL10 5 ele 10m 2kW PEP Gain 120dB F/B 24dB	£219.00D
CL15 5 ele 15m 3kW PEP Gain 125dB F/B 24dB	£325.00D
AFA40 2 ele 40m 2kW PEP gain 60dB F/B 20dB	£383.00D
714X-3 3/4 ele 15-20-40m 3kW PEP gain 7:9:10dB F/B 20:23:20dB	£815.00E
CV48 40M vertical 2kW PEP 500W PEP Radial wvts included	£214.50D
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AD385 matching network 40780M for CV48 remote switchable	£50.00B
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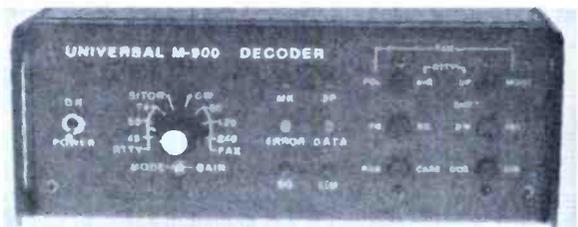
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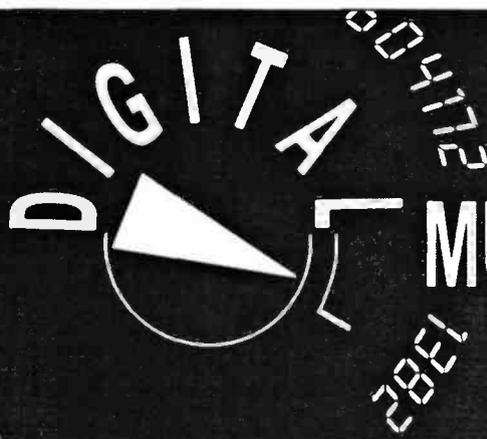
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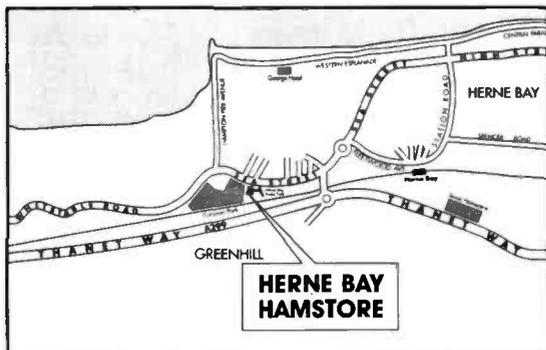
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73's, Chris G8GKC, Gordon G3LEQ and John G8VIQ.

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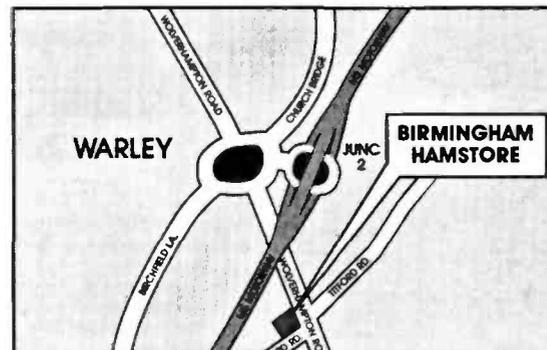
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73 DE Rob Mannion G3XFD

Practical Wireless readers, it seems, are caring people if the response to my recent 'safety in the shack' theme to 'Keylines' is anything to go by. I say this, because the response to my request for a replacement i.f. transformer for my damaged Electroniques front-end, was overwhelming!

Thank you all very much for your help. I'm extremely grateful indeed for the various bits and pieces that arrived in the post and via Rev. George Dobbs G3RJV's car at the London Amateur Radio Show! (Thanks George).

Unknown Reader

In the latter case, I'm anxious to hear from the unknown reader who 'phoned me, and then took the trouble to take equipment to Rochdale, which George G3RJV then delivered to me at the LARS. Unfortunately, I don't have a callsign or address to write to, so please let me know your name. I'd like to write to say thanks for the Electronique front ends that came wrapped in some unusual cabinets, and beautiful Eddystone dials!

Some of you were kind enough to take the trouble to 'phone to suggest where I could obtain replacement parts, and then sent them on to me! I even had a call from 'Mr Electroniques' himself, who I'm pleased to say is very much with us and active in the hobby although officially 'retired'.

You're all a wonderful group of people, and thanks to your generosity, I can get my transmitter going, and at least two school radio clubs will benefit, by having ready-built front ends for their amateur band receivers.

The effect of my editorial makes me think that there are a

lot of very useful, potential home-brew bits and pieces lying around in readers' shacks. This sort of gear, sounds like real 'Bargain Basement' material to me. I'd be very pleased to see more of this sort of item for sale in *PW* to help and encourage constructors. So how about it all you hoarders?

Constructional Bias

Although *PW* has a constructional bias, I fully realise that home-brewing equipment doesn't appeal to everyone. It's also true that even the keenest constructor will usually have some commercial equipment in the shack.

A glance through the pages of the magazine, will show that there's a very good variety of new commercially-made equipment available. This supply of sparkling, high-quality new equipment, along with a very healthy second-hand market, is an essential aspect of amateur radio.

Without advertising, and without readily available equipment, the radio hobby (and *PW* for that matter) would find it difficult to survive. However, I think that the time has arrived when we desperately need an 'injection' of cheaper new gear, to boost the amateur radio equipment market.

Expensive Pastime

Amateur radio equipment has never been cheap. Our hobby has always been known as an expensive pastime. The newcomer, if they aren't interested in kit-building or cannot obtain equipment on the second-hand market, needs a rather deep pocket.

What the hobby needs, is a

range of ready-made basic 'no frills' receivers and transceivers for h.f. operation. Surely it can be done? You only need to look at the equipment produced for the CB market to see that it is possible to produce simple, but reliable equipment for a much cheaper price than we're used to seeing.

To a certain extent, the v.h.f. and u.h.f. equipment market is quite well catered for. It's relatively easy for the v.h.f. operator to get on the air for less than £200. Nowadays, we've got several British designed and built v.h.f. rigs, and an h.f. receiver on the market. But what about the h.f. transmitting operator, who cannot afford to buy one of the many more expensive rigs on offer? What do they do?

Relatively Cheap

I would like to see a range of relatively cheap, easily serviced h.f. rigs on sale in this country. If amateur radio is to encourage new blood, we must have a plentiful supply of budget-priced, basic equipment.

There's no real objection (as far as I'm concerned) to having valves in equipment in this price range, and they can be very cheap to replace. Another factor, which most people know anyway, is that you can get away with 'murder' when it comes to mis-matching a valved 'final' amplifier. How many operators are there who can say (hand on heart!) that they've never endangered a p.a. stage?

Here in the *PW* office, despite our 'Bargain Basement' page, we still receive complaints from readers. They're not complaining about the service we offer, but they are complaining about the fact that they get 'killed in the rush', every time they try to chase the bargains.

The basic problem is that

everyone is trying to buy from what is, in reality, a very limited market. The supply of KW2000, 'As' and 'Bs' and the popular early Yaesu FT transceivers and other equipment is very limited. So, we really do need that 'injection' of budget-priced gear.

Privileged

As editor of *PW*, I'm in a very privileged position. It means that I have the opportunity to try out some really excellent equipment. Despite this, I'm very conscious that many of our readers, although they'd like to, cannot afford some of the equipment we review.

So, I'd like to take advantage of my privileged position and ask all the mainstream manufacturers and importers to consider the 'bottom end' of the market. I feel sure that, bearing in mind the expertise available, it is possible to produce more equipment to suit very limited purses.

Hopefully, I'll get a response to my suggestion. You never know, I may even be able to review some budget equipment in *PW*.

Any manufacturer or importer, who is prepared to support the lower end of the market, can count on my support. Don't forget, that the radio amateur who starts off with a basic rig, may well 'trade up' later! This will be to everyone's advantage.

The budget-priced equipment will enter the equipment chain, and will continue to circulate. The addition of such equipment will complement the secondhand market, the quality kit trade and the high-performance stables.

In my opinion, the radio amateur will then be catered for in the best way possible. I think it's the only way forward for our hobby.

Receiving You



Send your letters to the editorial offices in Poole. They must be original, and not duplicated in any other magazine. We reserve the right to edit or shorten any letter. The views expressed in letters are not necessarily those of *Practical Wireless*. The Star Letter will receive a voucher worth £10 to spend on items from our Book, PCB or other services offered by *Practical Wireless*. All other letters will receive a £5 voucher.

Dear Sir

Can I bring to the attention of those attending radio rallies, that some unscrupulous dealers are messing about with the junk on offer. I have noticed this particularly with computer motherboards and peripherals, but it no doubt happens in other areas.

The modern motherboard is fairly reliable, and lasts a long time. The average service organisation does not waste time over these, replacement AT boards cost about £60, so if the repair looks as if it will take longer than an hour, the board is scrapped and a replacement fitted.

If a dealer gets a couple of faulty boards, he has two options. He can sell them at the next show for £10 each, which is a reasonable deal for all parties concerned. The other option is that he can spend an hour or so, swapping chips between boards, and may get one of them to work, in the process identifying the faulty chips.

He can now sell the working board for much more, say £45. And what does he do with the faulty chips? The unscrupulous will plug them back in to the faulty board, hence giving the impression that the board is merely faulty, not full of 'duff' components. This also happens with hard disc drives.

I was caught at the recent show in the National Motor Cycle Museum. I was after some i.c.s and saw a board with what I was after.

At this time the board was virtually complete with only one missing chip. The dealer wanted too much, so I came back later and did a deal. I didn't check the board the second time, and it was only when I got home that I discovered that the processor and all the PAL chips had been removed since I last saw it.

A programmed PAL i.c. is no good to anybody without the board it came from. So the person who removed them, is left with some useless components and has totally sabotaged any chance I may have had of repairing it. There is no easy way of spotting this. You can sometimes tell if a board has been 'got at' by signs of screwdrivers use around the corners of the chip sockets, but there is no way of checking hard drives.

Let the buyer beware!

**Kenneth S. Termie
Oadby
Leicester**

Editor's comment: Sorry to hear about your problems Kenneth. I've no doubt that there are other comments waiting to be made on this subject. It would be interesting to hear something from a 'dealer' on this point, and I hope we get a response.

PW October 1992 Issue

We particularly need reader's letters with memories of *PW* for the Diamond Jubilee issue. Get writing - it's your special celebration too!

Dear Sir

Thank you for a really excellent magazine, I have been a subscriber since 1956. I noted with great interest the Revex s.w.r. and power meter on the front cover of the March issue. The meter is particularly interesting, as

it's a p.e.p. type, covering 144 and 430MHz, and has a 400W capability.

I looked through the article for the UK supplier but in vain, can you help please? (How about a review of this one please).

Secondly, I am building a 4CX250B linear amp

THIS MONTHS STAR LETTER

Dear Sir

In reply to your request as to what readers wish to see in *PW*, I can only agree with what Mr R. Morrall says in his letter (*PW* March 1992).

Briefly, I also would like to see more detailed explanations, with necessary mathematics, concerning all aspects of radio reception and transmission design. So many current electronics magazines appear to be little more than providers of reports on consumer electronics.

Let me add, that *PW* has no serious competitor here in France.

**Robert Duncan
Chasseneuil, France**

Editor's reply: Thanks for your letter and comments Robert. The *PW* team would be most interested to hear more from readers on the subject area Robert has mentioned. Would YOU like to see an article or articles discussing the entire design process (considering both practical and theoretical) considerations? Let's be hearing from you!

Dear Sir

Should I have read the small print more carefully? I note on re-reading 'Radio Diary' in the March issue of *PW*, that the entry for the Northern Cross rally didn't mention radio. It was right not to. Craft stands, computers and broadcast satellite gear yes, but no radio.

I travelled a long way to get there, as had a few radio traders, and I don't know who looked more 'brassed off'.

In fairness, the event was well run, well attended and I hope it did well for the club. But next time, can we have the radio stalls in a small room of their own, or tell them and us that its going to a computer fair!

**M. Hodgkins G4HCC
Colne, Lancs**

Editor's reply: It's best to get 'both sides of the story', so we contacted the organisers and here's their comments:

A reply from the Northern Cross Rally organisers.

Thanks for the opportunity to comment on Mike Hodgkin's letter. We were interested in his comments as Northern Cross '92 was our first rally organised by the Wakefield & District Radio Society, and we have learned lessons for the future.

Regarding Mike Hodgkin's particular criticism, it's also one that concerned us at the planning stage, noting the trend at other rallies. As radio amateurs, we certainly wanted as many radio traders as we could get, 178 were invited and only 30 came. Two ceased trading between accepting and the day, which is a sign of the times.

The equivalent figures for computer dealers were 30 invited, with 16 attending. The radio traders who did come told us that business was good. Let's hope the news of this spreads.

Dave Gray G0FLX and Bob Firth G3WWF on behalf of the Wakefield & District Radio Society.

Practical Wireless, May 1992

for 430MHz I can manage the mechanical construction, but lack knowledge of the high voltage power supply construction. I am fully aware the high voltages and currents can kill, so please, no advice on that side!

I would be very pleased to see a *PW* project on this subject. I can follow the circuits okay, it's producing a p.c.b. design that causes me some difficulty. Clear details and diagrams would be a great help. Good sharp photos are a bonus, so how about it? Keep up the excellent standard of the magazine.

Paul Beaumont
Harrogate, North Yorks

Editor's reply:
Sorry Paul, the meter was from Waters & Stanton.

Dear Sir

I received my copy of the March issue of *PW*, and saw John Cushing G3KHC's item on a simple capacitor tester, on page 41. It's a very simple and useful device, and not too expensive if one is into salvage.

I tackled mine in a very similar way to John, except that I used a t.t.l. logic chip, an SN7400 with the last gate used as a buffer. It is voltage sensitive, and I opted for a regulator at 5V from a 9V battery to cover that problem.

The meter was a former 300V movement, less multiplier, so the design was fixed in one regard, with a 300pF basic scale. The case is a former wardrobe and hence is a nice shade of Walnut. The front panel is of Formica, with the lettering done with Indian ink pens and stencils.

The boxes were made by glueing and pinning it together as a complete affair, and then cutting the lid portion off, with a power-saw.

The merit of this method of testing modern components, is that the voltage applied to the capacitor under test, is almost certainly going to be within range. None of the foregoing should be taken as criticism of John's article, but as an endorsement of the usefulness and the ease of DIY.

Dennis Lisney G3MNO
Harrow, Middlesex

Editor's comment: Nice to hear from you Dennis, and I'm sorry we had to shorten your long and interesting letter, so that we could publish it. I found your tip about making a box complete, and then sawing the top off, to be so simple. I've never been able to make a decent lid to a box, but I'll be able to now!

Queries

We will always try to help readers having difficulties with a *Practical Wireless* project, but please note the following simple rules:

- 1: We cannot give advice on modifications to our designs, nor on commercial radio, TV or electronic equipment.
- 2: We cannot deal with technical queries over the telephone.
- 3: All letters asking for advice must be accompanied by a stamped, self-addressed envelope (or envelope plus IRCs for overseas readers).
- 4: Make sure you describe the query adequately.
- 5: Only one query per letter please.

Back Numbers & Binders

Limited stocks of many issues of *PW* for past years are available at £1.80 each including post and packing. Binders, each holding one volume of *PW* are available price £5.50 each (£1 P&P for one, £2 for two or more). Send all orders to the Post Sales Department.

Subscriptions

Subscriptions are available both for the UK and overseas. Please see current issues for the latest prices.

Constructional Projects

Each constructional project is 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.

Intermediate: A fair degree of experience in building electronic or radio projects is assumed, but only basic test equipment is needed to complete any tests and adjustments.

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. Definitely not recommended for a beginner to tackle on their own.

Components for our projects are usually available from advertisers. For more difficult items a source will be suggested in the article.

The printed circuit boards are available, mail order, from the Post Sales Department.

Mail Order

All *PW* services are available Mail Order, either by post or using the 24hr Mail Order Hotline (0202) 665524. Payment should be by cheque (overseas orders must be drawn on a London Clearing Bank). Access, Mastercard or Visa please.

Spot The Rig!

Our art bod Steve Hunt has manipulated a pic of a rather famous piece of amateur radio equipment. Can you work out what model and make it is?



Name.....
Address.....
.....
.....
.....

I think that this rig is a...

Subscription Voucher

Send your entry (photocopies acceptable with coupon) to: May Spot The Rig Competition, *PW* Publishing Ltd., Enefco House, The Quay, Poole, Dorset BH15 1PP. Editor's decision on the winner is final and no correspondence will be entered into. Entries to reach us by May 22nd.

First Prize: One year subscription or £20 book voucher.
Two runners-up: Six months subscription or £10 book voucher.

Competition Services

Competition Corner
May '92

New Catalogue

Alpha Electronics plc now have available their new T & M Catalogue and price list for 1992. Nearly 200 test and measuring instruments are featured in 16 colour pages, together with their BS 5750 Repair and Calibration Service.

Products include insulation, continuity, earth loop, RCD and portable appliance testers, high and low voltage indicators and proving units, clamp meters, cable location and fault indicators, earth testers and milliohmmeters. A complete range of analogue and digital multimeters, oscilloscopes and power supplies are enhanced by many recorders and data loggers. Energy metering, monitoring and management equipment is also featured.

This free catalogue contains many 'standard' names, such as Megger, Robin, Clare, Avo, Rustrak, Edgcombe, Global, Northern Design, Seaward, Intek and Fluke.

For further information, please contact **Fred Hutchinson of Quiswood Ltd. on (0756) 799737.**



Adam Leisure Sponsor Scout Badge

Harrogate-based activity toys and electronic games company, Adam Leisure Group plc, are forging closer links with their consumers by sponsoring a new Scout badge.

The Scouts Radio Technicians' Badge is aimed at introducing Scouts to radio technology, and as part of the six week course, Scouts build radio equipment and learn how to communicate with it.

Six Northampton Scouts, who were the first to gain the new Badge, visited Adam Leisure's warehouse, service and distribution facilities at Wellesbourne, Warwickshire, and were given a tour of the facilities and a demonstration of the latest Grandstand Walkie-Talkie radio communicators.

The successful Scouts, who come from the Northampton Amateur Radio Group, are aged between 13 and 15 years old.

Ibrar Sheikh, Adam Leisure's quality manager, presented each of the Scouts with their Badge and a pair of Grandstand Walkie-Talkies. He also presented the group with a Morse tutor learning aid, which generates Morse code messages at different speeds.

**Adam Leisure Group plc.
Adam House
Ripon Way
Harrogate
North Yorks HG1 2AU.
Tel: (0423) 501151.**

Martlesham Radio Society

On 12 April 1992, Martlesham Radio Society are again holding a VHF Roundtable, which has become an established event in the v.h.f. operative's calendar, as has the Microwave Roundtable, organised by the same society.

The event is to be held at BT Laboratories, Martlesham Heath, Ipswich, Suffolk. Facilities offered include noise figure measurements for all v.h.f. bands; SINAD measurements for complete receivers; power measurement to several kW; measurement of isolation, cross talk, insertion loss of relays and attenuators, etc. All measurements will be performed using high performance test equipment. There will also be technical workshops and talks.

The VHF Roundtable provides an opportunity for a friendly get-together with fellow v.h.f. enthusiasts in amicable surroundings, with refreshments available and excellent car parking.

Admission is by ticket only, available by sending a s.s.a.e. to **Roy Smith G6GAU, 'Lykkebo', The Street, Burstall, Ipswich IP8 3DN.** When applying for tickets, please remember to supply the names of all applicants (BT Laboratories Security requirement).

Overseas visitors very welcome; the venue is close to the ports of Felixstowe and Harwich, approximately 70km from Stansted airport.

South Dublin Radio Club

The South Dublin Radio Club are interested in twinning with other interested clubs with a view to having regular skeds on the air during their club night, which takes place most Tuesdays between 8 and 10pm. Any clubs interested, can write to **Pat Murray EI7HK, South Dublin Radio Club, Ballyroan Community Centre, Marion Road, Rathfarnham, Dublin 14, Ireland.** They welcome all replies!

The Greenweld Newsline

Because of the ever increasing amount of surplus stock being purchased, Greenweld are instigating a new service for all their customers - the Greenweld Newsline. By calling **(0891) 505121***, you'll get a recorded message giving details of stocks purchased during the last week. This will include items not advertised elsewhere because the quantity is too small. Every caller who places an order will be entitled to a Free Gift - details on line.

***Calls charged at 36p/min cheap rate, 48p/min other times.**

RNLI Appeal

During 1992, 1993 and 1994, The Worked All Britain Awards Group will be raising money in support of the Royal National Lifeboat Institution. The target being to raise enough money to buy a 'D' class 5m Inshore Lifeboat at a cost of £10 000. Once this figure has been achieved v.h.f. radio equipment will be aimed for at a cost of £865. This means that WAB will be hoping to raise £305 per month over the next three years. Any help you may offer will be gratefully appreciated.

Steve Bryan G1SGB will be organising yet another DXpedition, this time to the Orkney Islands. He shall be sailing from Stromness on 12 April 1992 on the Lighthouse maintenance vessel *MV POLE STAR*, where he shall be operating Maritime Mobile for the duration of the trip. He will be lifted by helicopter to some of the more remote lighthouses where he shall endeavour to operate as many bands as possible in the h.f. spectrum (using WAB Net frequencies). Some of the Islands where lighthouses are located have never before been activated and may not be again for quite a while.

Another group of WAB enthusiasts will be doing a mobile operation from John O'Groats to Lands End, and they will be looking for sponsorship and donations along the route. The WAB group hope you will take some part in their fund-raising, even if it's only a contact with the station.

If you or your club would like to take an active part in raising money for this event, please contact **Adrian Keeble G4HPU on (0206) 230860.**

Waters & Stanton Open Day

Waters & Stanton will be holding their annual open day on Sunday 10 May, from 10am to 5pm. Last year was so successful they are aiming for something even bigger this year. There will be free food and free drink for everyone, plus a prize draw. Those needing talk-in should initially call G0PEP on 145.55MHz.

They will be offering some fantastic bargains and clearance lines on a wide variety of amateur radio equipment covering two floors of their premises. When they say bargains, they really mean it! But you will have to call in person to snap them up. Make it a date, Sunday 10 May for their crazy 'May Madness Sale'.

Solway Radio Club

During the month of April, the Solway Radio Club will be 20 years old. The G4BBX licence was issued on 11 April 1972. During the weekend of April 11 & 12, GX4BBX will be on the air on all bands and most modes. They will be issuing a special card and a diploma will be issued to those stations who work a given number of GX4BBX members during April.

Throughout 1992, G4BBX will be on the air on Wednesdays, which is their club night.

The Solway Radio Club actively promotes and encourages the novice licence. They have a number of novices training in the club, and if you hear them on the air, please call and say hello. For more details, please contact their secretary, **Marion Dockray G1PEN at 54 Kelsick Park, Seaton, Workington, Cumbria CA14 1PY.**



Marathon Runner Hopes For Wings On His Heels

Licensed radio amateur, Clive Dunnico G4YEN, of Leigh-on-Sea, Essex, is to run in the London Marathon on 12 April 1992, on behalf of the Winged Fellowship.

Clive will be raising money for the Winged Fellowship Trust, which provides holidays and respite care for over 5000 physically disabled people and their carers each year in five holiday centres in Essex, Redhill, Southport, Nottingham and Southampton.

As a member of the ADT-London Marathon team, Clive who is now 50-years old, has run several marathons raising tens of thousands for charity and is hoping to raise a substantial sum for Winged Fellowship. Sponsorship forms can be obtained from **Mrs Joan Brander, 58 College Road, Dulwich, London SE21 2LY**, where donations marked 'Dunnico Sponsorship' will be most gratefully received.

For further information, contact **Jane Popplewell on 071-833 2594.**

The Winged Fellowship Trust was established in 1963 with the aim of providing holidays for disabled people and respite care for their carers. There are currently five centres: Crabhill House in Surrey, Jubilee Lodge in Essex, Skylarks in Nottingham, Sandpipers in Southport and Netley Waterside House in Southampton. The Trust provides over 44 000 bed nights per year to disabled people and their spouse/carers. Apart from the permanent staff, the Trust also needs 4000 volunteers per year to help care for and entertain the guests. Winged Fellowship also organises overseas holidays (again with one to one care), for groups of nine or so, and Discovery Holidays which include UK camping and touring.

Making Waves On Thinking Day

Radio amateurs Richard Pearce G0PNY aged 15 (left), and John Williams G6GSV aged 16 (second left), explain radio communication to Crosland Hill, Huddersfield Guides and Brownies.

Richard and John are members of Denby Dale Radio Club, which helped the 10th Crosland Hill Methodist company to celebrate Thinking Day.

The day is celebrated annually by Guides, Brownies and Rangers across the world, as it marks the joint birthday of the movement's founders Lord and Lady Baden-Powell.

The Crosland Hill girls celebrated by getting in touch with other Guides across the country via the radio waves. They invited girls from other packs in the district to join them.

Thinking Day was also marked locally with a party attended by Rainbows, Brownies, Guides and Rangers from the Huddersfield Central South District.

The party, at Crosland Hill Methodist Sunday School rooms, had an international theme and included games, songs and crafts.

Time On Your Hands?

Volunteers are needed in many parts of the country to repair the RNIB's Talking Books for the Blind. **No, please don't skip this item - read on!**

These talking books are simple cassette players, and are a lifeline to 70 000 blind 'readers' throughout the country. From time to time, these players go out of adjustment and need simple repairs: simple to you, but not to a blind person.

The work is occa-

sional and seldom amounts to more than a couple of evenings in a week. You need basic electronic skills and circuit diagrams and full technical details are provided. If you would be prepared to do this rewarding task, please ring **David Finlay-Maxwell on (0484) 450982** work or **(0484) 604546** home. Or write for info to him at **D.F. Maxwell & Co., Prospect House, Huddersfield, Yorkshire HD1 2NU.**

Swindon & District ARC Telethon '92

The ITV Telethon will soon be upon us once again, and in support of the HTV Regional Appeal, Swindon & District ARC members are to spend 48 hours coaxing the World's radio amateurs out of the woodwork to make as many contacts with the station as possible over the period.

The special event station, GB4SRC, will be on the air, promotionally, from 14 May 1992, the main event starting at 1800hrs on Friday 29 May, until 1800hrs on Sunday 31st.

The station will be located at the Club shack at South Marston, Swindon and a Telethon QSL card will be sent to all contacts.

Sponsorship will be on a 'per call' basis, or by donation. There will be an opportunity to help swell the funds at the Swindon Rally on Saturday 16 May, at the Oasis Centre, Swindon. Just call in at the club stand and have your arm twisted!!!

The same call will be on the air again during June 5th to 7th, from the Lydiard Park Nostalgia weekend, where a great collection of steam engines, both stationary and mobile, classic vehicles and many other artifacts of bygone days will be gathered together. This is well worth a family visit if you can make it. Talk-in on 144MHz, if required. Details of the above event can be obtained from **Geoff GODMZ QTHR, 1990-on.**

Newsdesk '92

Please send in all of your 'Club News' items to Sharon George at the editorial offices in Poole.

Axe Vale ARC meet 1st Fridays, 7.30pm in the 'New Commercial', Trinity Square, Axminster, Devon. Further details from Pat Cross G0GHH on (0297) 33756.

Aylesbury Vale RS meet 1st & 3rd Wednesdays, 8pm in the Village Hall at Hardwick. April 15 is Peter Chadwick G3RZP on 'Linear Amplifiers'. Further details about the club from Martin G4XZJ on (0296) 81097.

Barr Beacon RC meet 1st Mondays and 3rd Wednesdays, 7.30pm at 112 Walsall Road, Aldridge, West Midlands. For further details, ring (0922) 36162.

Barnsley & District ARC meet Mondays in the radio club room and shack, at the rear of the Darton Hotel, Station Road, Darton, Barnsley. April 13 is a talk on 'Theatre Lighting' by Keith G8SVX, the 27th is a talk by G4JJ on 'Getting Started On Satellites'. May 4 is an open talk on 1992 rally and the 11th is a talk on the RSGB by G4EJP Zone A council. For further information, ring Ernie G4LUE on (0226) 716339.

Basingstoke ARC meet 1st Mondays, 7.30pm at the Forest Ring Community Centre, Sycamore Way, Winklebury, Basingstoke. April 26 is a 2m Fox Hunt - OS185 - Fox: Spencer Naylor G0NQU and May 4 is a social evening & Junk Sale. For further details, phone (0256) 25517.

Bedford & District ARC meet Thursdays, 8pm in the Allen Club, Hurst Road, Bedford. More details from Gavin Carmichael, 15 Evesham Court, Avon Drive, Bedford MK41 7AJ. Tel: (0234) 365660.

Blyth ARC meet Wednesdays, 7pm at Newsham Community Centre, Elliott Street, Blyth, Northumberland. All welcome. Details from Keith Ritson G0PKR on 091-237 1963.

Bradford ARC meet 2nd & 4th Thursdays, 8pm at the Polish Ex-Service Club, Shearbridge Road, Bradford, West Yorkshire. April 9 is a natter night, the 23rd is a discussion on the use of computers in amateur radio and May 14 is a committee meeting, plus arrangements for working G3NN portable during the summer. Charles Bolt G0AEX on (0247) 494694.

Braintree & District ARC meet 1st & 3rd Mondays, 8pm at the Community Centre, Victoria Street, Braintree. M. Andrews, 22 Arnhem Grove, Braintree, Essex CM7 5UQ. Tel: (0376) 27431.

Brighton & District ARC meet 1st & 3rd Wednesdays, 7.45pm at the Roast Beef Bar, Brighton Racecourse, Elm Grove, Brighton. More details from Harold Lunson G3WR, 17 Tongdean Rise, Brighton, East Sussex BN1 5JG. Tel: (0273) 501100.

Bromsgrove & District ARC meet Fridays at Avoncroft Arts Centre, South Bromsgrove, Worcester. April 10 is Home-brew Constructors Comp. More details from Joe Poole G3MRC on (0562) 710010.

Bromsgrove ARC meet at Lickey End Social Club, Alcester Road, Burcot, Bromsgrove. April 14 is a night on the air, the 28th is Oscilloscopes (practical) and May 12 is their AGM. Mr D. Edwards G4ZWR, 2 Mason Close, Headless Cross, Redditch, Worcs B97 5DF. Tel: (0527) 546075.

Bury St. Edmunds ARC meet 3rd Tuesdays, 7.30pm in Room ED-40 of West Suffolk College, Out Risbygate, Bury St. Edmunds. April 14 is 'Digital Speech Generation' by Bob Price G8DTF and May 12 is 'The Sun' by L. M. Dougherty. For more details, contact Ien G0KRL on (0359) 70527.

Bury RS meet Tuesdays, 8pm in The Mosses Community Centre, Cecil Street, Bury, Lancashire. 2nd Tuesdays are Lecture/Talk nights and other Tuesdays are general natter nights with the club's 'new' rigs on the air. More

details from Colin Fox G3HH, The Lair', 5 Pinewood Crescent, Holcombe Brook, Rensbottom, Bury BL0 9XE. Tel: (0204) 883212.

Buxton Radio Amateurs meet at the Lee Wood Hotel, Buxton at 8pm. April 14 is Aerial Topics, the 28th is a QSL night and May 12 is a Video Show. For further details, contact Derek Carson G4IHO on (0298) 25506.

Charmwood Amateur Radio Contest Club meet Saturday lunch-time at The Priory Hotel, Loughborough. Dedicated to operating and demonstrating the joys of amateur radio and furthering the hobby. Listen on S17 or contact Phil on (0509) 232927.

Chelmsford ARC meet 1st Tuesdays, 7.30pm at Marconi College, Arbour Lane, Chelmsford, Essex. April 12 is Martesham RS Round Table, tickets G6GAU. More details from Roy & Eile Mertyr G3PMX & G6HKM, 1 High Houses, Meshbury Road, Great Waltham, Essex CM3 1EL. Tel: (0245) 360545.

Colwyn Valley RC meet 1st Thursdays, 7.15pm at The Studio, Penrhos Road, Colwyn Bay, Clwyd. May 7 is a talk by Dr. David Last and the 14th is a Visit to Pentir National Power Switching Station. For further details, contact Meryl Jones GW4NLL, 72b Princes Drive, Colwyn Bay, Clwyd LL29 8PW. Tel: (0492) 530725.

Cornish RAC meet at the Memorial Hall, Perranwell Station, Perranwell, nr. Truro, 7.30pm. For further information, please contact Mr G. Bate, 9 Tresithney Road, Carharrack, Redruth, Cornwall TR16 5QZ. Tel: (0209) 820836.

Coulsdon ATS meet 2nd Mondays, 7.45pm at St. Swithun's Church Hall, Grovelands Road, Purley, Surrey. April 13 is a Surplus Equipment Sale and May 11 is 'Packet Radio For Beginners' by Peter Burton G3ZPB. Andy Briers G0KZT on (0737) 557198.

Coventry ARC meet Fridays, 8pm at Baden Powell House, 121 St. Nicholas Street, Radford, Coventry. For further details phone Jon on (0203) 610408.

Decorum AR & TS meet 1st (informal) & 3rd (formal) Tuesdays, 8pm at The Heath Park, Cottrells, Hemel Hempstead. Further details from Dennis Boast G1AOK on (0442) 259620.

Denby Dale & District ARC meet at Pie Hall, Denby Dale, nr. Huddersfield, 8pm. More details from Ivan Lee, Clayton Lodge, Sunnyside, Edgerton, Huddersfield HD3 3AD.

Derby & District ARC meet Wednesdays, 7.30pm at 119 Green Lane, Derby. April 15 is 'Radar' - the early years by Denis Godfrey G0KIU, the 22nd is a Video Show, the 29th is a Cheese & Wine Party, May 6 is a Junk Sale and the 13th is 144MHz OF practice - Allestree Park, Derby. More details from Richard Buckley G3VGR, 20 Eden Bank, Ambergate, Derby DE5 2GG. Tel: (0773) 852475.

Derwentside ARC meet Wednesdays, 7.30pm in the Steel Club, 36 Medomsley Road, Consett, County Durham. Regular talks by amateurs and non-amateurs. Construction work overseen by Don G4LGA. Further details from Geoff Darby G7GJU, 60 Pine Street, Grange Villa, Chester-le-Street, County Durham DH2 3XL. Tel: 091-370 2022.

Dorking & District RS meet at The Friends Meeting House, South Street, Dorking, 7.45pm. April 28 is 'Polar Comms' by Laurence Howell G3ADM. More details from John Greenwell G3AEZ on (0306) 77236.

Dorset Police ARC. A new radio society. Membership open to anyone connected with Dorset police, such as all regular police officers, all special constables, civilian staff employed by Dorset police, immediate families of all the above and retired police officers resident in Dorset. Further details about membership from Richard Newton, Ferndown Police Station, Ringwood Road, Ferndown BH22 9AF. Tel: (0202) 552099 ext. 3198.

Dragon ARC meet 1st & 3rd Mondays, 7.30pm at the Four Crosses Hall, Menai Bridge. April 20 is a general discussion and May 4 is Sale of Surplus Equipment. Tony Rees GW0FMQ on (0248) 600963.

Dronfield & District ARC meet 1st & 3rd Mondays, 7.30pm in Room 3 of Gladys Buxton School, Dakhill Road, Dronfield. On other Mondays, members meet socially, by arrangement at the Fleur-de-Lys Public House, Main Road, Unstone. More details from Piers Oldham G7HRW, 110 Green Lane, Dronfield, Nr. Sheffield S18 6FU. Tel: (0246) 290444.

Dundee ARC meet Tuesdays, 7pm in the College of Further Education, Graham Street, Dundee. April 21 is a Construction night, the 28th is a lecture on 'HF Propagation' by John Braneagan G4AIHJ, May 5 is a construction night and the 12th is a lecture by George Allan G4MHYF, member of MEGS, the Morse Enthusiasts Group, Scotland. Further details from George Millar GM4FSB, 30 Albert Crescent, Newport-on-Tay, File DD6 8DT.

Dunstable Downs RC meet Fridays, 8pm at The Old Mill, West Street, Dunstable, Beds. April

24 is a talk on the 'Novice Licence', May 1 is Studio Lighting and the 8th is an informal. Further details from Wendy Jefferson on (0582) 451057.

Easington ARC (Co. Durham) meet Thursdays, 7.45pm at Southside Social Club, Easington Village. Further details from Mr H. Walker G3CBW, 20 Birchfield Drive, Eaglescliffe, Stockton-on-Tees, Cleveland TS16 0ER. Tel: (0642) 788280.

Echalford ARC meet in the Community Hall, St. Martin's Court, Kinston Crescent, Ashford, Middlesex, 7.30pm. April 9 is their AGM, the 23rd is 'Worked All Britain' by J. Fitzgerald G8XTJ and May 14 is a natter night. Further details from P. Townshend G6PMT on (0344) 843472.

Edgeware & District RS meet at the Watling Community Centre, 145 Orange Hill Road, Burnt Oak, 8pm. April 9 is 'AMTOR & SSTV' by Hank Kay G0FAB, the 23rd is an informal, G3XASR on air and May 14 is 'Advances In RF Power Semiconductors' by Graham Morris G3SGC. More details from Howard Drury G4HMD, 11 Batchworth Lane, Northwood. Tel: (0923) 822776.

Fareham & District ARC meet Wednesdays, 7.30pm in Portchester Community Centre, Westlands Grove, Portchester, Fareham, Hants. Details from Rod Smith G0ERS on (0705) 373572.

Farnborough & District RS meet 2nd & 4th Wednesdays, 7.30pm at Farnborough Community Centre, Meudon Avenue, Farnborough, Hants. April 22 is Your Radio Problems Solved night. More details from Tommy Tomlinson G3UHW on (0252) 515041.

Fyde ARC meet 2nd & 4th Thursdays, 7.45pm at South Shore Lawn Tennis Club, Midgeland Road, Blackpool. April 12 is an Equipment sale, the 23rd is an informal and May 14 is a DX Foxhunt. Eric Fielding G4IHF on (0253) 726685.

Glenrothes & District ARC meet in their clubrooms, Provosts Land, Leslie, Fife, 8pm. Further details from John Hardwick GM4ALA on (0592) 742763.

Gloucester ARC meet Wednesdays, 7.30pm at St. John Ambulance HQ, Heathville Road (off London Road), Gloucester at 7.30pm. April 15 is Packet Self-Help Group, the 22nd is Construction Group and the 29th is Home-brew Clinic. Further details from Jenny Beckingham G7JUP on (0452) 529533 Ext. 2731.

Grafton RS meet 2nd & 4th Wednesdays, 8pm in Holy Trinity Club Hall at the rear of Holy Trinity Church, Granville Road, London N4. Further details from Rod G0JUZ on 081-368 8154.

Grantham RC meet 1st & 3rd Tuesdays at the Kontak Social Club, Barrowby Road, Grantham. Further details from John Kirton G8WWW, 'Treetops', 13 Saltersford Road, Grantham, Lincolnshire NG31 7HH. Tel: Grantham 65743.

Great Lumley AR&ES meet Wednesdays, 8pm at Great Lumley Community Centre, Great Lumley, Nr. Chester-le-Street, Co. Durham. For more details, contact Barry G1JDP on 091-388 5836.

Halifax & District ARC meet 1st & 3rd Tuesdays, 7.30pm at the Running Man Public House, Pellon Lane, Halifax. April 21 is 'Marconi - The Vision Realised' by H. C. Scott MBE. For further details, contact David Moss G0DLM, Beechwood Lodge, Leeds Road, Lightcliffe, Halifax, West Yorkshire HX3 8NU. Tel: (0422) 202306.

Hambleton ARC meet in Room A5 of Northallerton Grammar School at 7.30pm. For more details, contact Nigel Robertshaw G0NHM on (0609) 776608.

Hoddesdon RC meet 1st & 3rd Thursdays, 8pm at the (Service) Club, Rye Road, Hoddesdon (side entrance). April 19 is a talk by Mark Francis, author of *The Secret Of Learning Morse* and new products from Waters & Stanton, the 30th is a social evening and so is May 14. Details from Peter Fairhurst G0KLU on (0992) 33036.

Hordean & District ARC meet 1st Thursdays, 7.30pm at Hordean Community School, Barton Cross (off Catherington Lane), Hordean, Hants. May 7 is EMC Update. For more information, contact Stuart Swain, 35 Mevis Crescent, Havant, Hampshire PO9 2AE. Tel: (0705) 472846.

Horseshoe ARC meet Wednesdays, 8pm at the Mill, Atwick Road, Hornsea. April 15 is RSGB Videos, the 22nd is 'Personal Computers' by Rick G1YVL, the 29th is a natter night, May 6 is an Open night and the 13th is Rig Check. Further information from Jeff G4IGY on (0964) 533331.

Horsham ARC meet at the Guide Hall, Denne Road, Horsham, West Sussex, 8pm. May 7 is a talk on 'Miniature Antennas' by G3LDD. Further details from Peter Stevens G8SUI, 11 Nutwood Avenue, Brockham, Betchworth, Surrey RH3 7LT. Tel: (0737) 842150.

Ilford Group RSGB meet Thursdays at 7pm. They do not teach, but will fully answer any questions that members ask. They offer training and guidance on how to build and test electronic

equipment, training on the safe use of tools, and how to solder, with full use of all test equipment. Members are encouraged to build equipment, which they can do in the workshop. The club takes part in NFD each year. For further details, please contact J. Hooper on 081-478 3741.

Ipswich RC. Contact Mrs S. Elden G8HYE, 124 Larchcroft Road, Ipswich IP1 6PQ.

Keighley ARC meet at The Cricket Club, Ingrow, Keighley, 8pm. April 9 is a Junk Sale. Further details from Kathy Conlon G1IGH on (0274) 496222.

Kettering ARC meet Tuesdays, 7.30pm at the Electricity Sports & Social Club, Ekedale Street, Kettering. April 14 is a talk by a speaker from 10th Tactical Reconnaissance Wing (USAF), aircraft-to-ground communication, possibly some exhibits. Further details from Ian G0RDU (but OTHR as G7EHM) on (0536) 514544.

Kidderminster & District ARC meet alternate Tuesdays, 8pm at The Queens Head, Wolverley, Worcestershire. For more details contact Geoff Philipotts G7JIR, 62 Erneley Close, Stourport-on-Severn, Worcs DY13 0AH. Tel: (0299) 379229.

King's Lynn ARC meet Thursdays, 7.30pm at the 19th King's Lynn Scout HQ, North Runcton. Further details from Derek Franklin G0MQL on (0553) 841189.

Lothians RS meet on the 2nd & 4th Wednesdays, 7.45pm in the Orwell Lodge Hotel, Polwarth Terrace, Edinburgh. Further details from Mel Evans at 56 Southhouse Road, Edinburgh EH17 8EU or telephone 031-664 5403.

Loughton & District ARC meet in Room 14 of Loughton Hall, 7.45pm. For more details contact Mike Pilsbury G4KCK on 081-504 4581.

Louth & District ARC meet 3rd Tuesdays, 7.30pm at the Kings Head, Louth. More details from Neil Bartholomew G0JKY, The Bungalow, Main Road, Grainthorpe, Lincs LN11 7HX.

Maidenhead & District ARC meet at The Red Cross Hall, The Crescent, Maidenhead, 7.30pm. Details from Neil G8XYN on (0628) 25952.

Manchester & District ARS meet Tuesdays, 7pm at Simpson Memorial Community Association, Moston Lane, Manchester M10 9NB. Further details from Roger Farnley G0KTR, 6 Cardigan Road, Hollinwood, Oldham OL8 4SF.

Mansfield ARC meet at the Polish Catholic Club, off Windmill Lane, Woodhouse Road, Mansfield. May 7 is their AGM. Further information from Mary G0NZA on (0623) 755288.

Midland ARS meet in Unit 22, 60 Regent Place, off Caroline Street, Birmingham B1 3NJ. Wednesdays are RAE classes and Thursdays are natter nights. April 21 is an RSGB talk, the 24th is an Atari night, the 27th is a computer night and May 10 is MARS Drayton Rally. For further details, contact John Crane G0LAI on 021-628 7632 evenings.

Milton Keynes & District ARC meet 2nd Mondays at North Bucks Youth Sports Hall, Haversham Road, Wolverhampton, Milton Keynes. On April 13 they have a Junk Sale and May 11 is 'Fighter Aircraft and Aces' by Stuart Lightfoot G0G0F. For more information, please contact Julian Winson G3FGB on (0908) 611005.

Morecambe Bay ARS meet every other Tuesday, 7.30pm at the Trimpall Sports & Social Club, with Morse instruction each Tuesday during club meetings. For more details, please contact J. Burrow G0NYD, 36 Longfield Drive, Cragbank, Barnforth, Lancashire LA5 9EJ. Tel: (0524) 733212.

Nelson & District ARC meet Wednesdays, 7pm at Llancaich School Nelson. They also run a c.w. class at their meetings. Anyone wishing to find out further information is welcome to call in, or otherwise contact Leighton Smart GW0LBI at 33 Nant Gwyn, Trelewis, Mid-Glamorgan, Wales CF46 60B. Tel: (0443) 411736.

Norfolk ARC meet Wednesdays, 7.30pm at 'The Norfolk Dumpling', The Livestock Market, Harford, Norwich. April 15 is an informal & committee meeting, the 22nd is a construction contest, the 29th is First HF NFD briefing, May 6 is a 'Real Radio' evening and the 13th is G3NB repeater AGM. Jack Simpson G3NJO on (0603) 747992.

North Bristol ARC meet Fridays, 7pm at Self Help Enterprise, 7 Braemar Crescent, Northville, Bristol. RAE and Morse tuition is available for members. More details from Tony G4RDX on (0272) 513573.

North Ferraby United ARS meet Fridays, 8pm at the North Ferraby Utd. FC Social Club, Church Road, North Ferraby, East Yorkshire. April 17 is club station on the air, the 24th is Packet Nodes, Chris G6KIA, May 1 is 'Way ahead meeting', Ken G4VKK and the 8th is QF or QFH - what are they talking about? Ken G4VKK. Further details from Frank Lee G3YCC on (0482) 650410.

North Wakefield RC meet Thursdays at The White Horse PH, Fall Ings Lane, East Ardsley, Nr. Wakefield. More classes start at 7.30pm and all are welcome, with the Novice class on Friday evening. More details from John Hoban G0EVT

on (0924) 825443.

Nottingham ARC meet Thursdays, 7.30pm at the Sherwood Community Centre, Mansfield Road, Nottingham. April 16 is a talk 'Operators Guide to 2m' by Alan G7DII, the 23rd is VAB Activity & Construction evening, the 30th is a talk 'Electromagnetic Compatibility' by Bob Peace G8SQZ, May 7 is Forum to discuss this summer fox hunts and the 14th is a talk by the Regional Liaison Officer, Mary ONZA. Further details from Rex Beestall G0REX on (0602) 733740.

Pontefract & District ARS have Morse classes on Mondays, Novice classes on Tuesdays and normal meetings on Thursdays, all at the Carleton Community Centre, 8pm, May 11 is their Annual Junk Sale. Details from Colin Wilkinson on (0977) 677006.

Poole RAS meet 2nd & last Fridays, 7pm at Lady Russell-Coates House, Lower Constitution Hill Site, Bournemouth and Poole College of FE. April 10 is their AGM. More details from Vernon Cotton G3BCI, 45 Branksome Hill Road, Bournemouth, Dorset BH14 9LF. Tel: (0202) 760231.

Preston ARS have a talk by Mr Green G8HLZ 'Decoding Systems' on April 16, a talk by Mr Duncker 'Windmill Land' on the 30th and a talk by Mrs Tomlinson 'Pageant Of Lancaster Priory' on May 14. Details of their meeting place and time from Eric Eastwood G1WCO, 56 The Mede, Freckleton, Preston, Lancashire PR4 1JB. Tel: (0772) 686708.

Prudential ARS is open to all employees and ex-employees of the Prudential companies. All those interested in PARS should contact David Oyer G4DNX at 'Highbank Cottage', Underhill, Moulford, Oxon DX10 9JH.

Reading & District ARC meet 2nd & 4th Thursdays, 8pm at The Woodley Pavilion, Woodford Park, Haddon Drive, Woodley, Reading. April 9 is 'Understanding Transceiver Specs' by Gary Clark G0BRK, the 23rd is 'G5RV and other Antennas' by John Crabbe G3WFM, May 9 is Support Christian Aid Walk and the 14th is HF NFD Planning, John Linfood G3WGV & Don Field G3KTT. More details from Vin Robinson G4JTR, 4 Hilltop Road, Caversham, Reading RG4 7HR.

Rochdale & District ARS meet Mondays at T. S. Froisher, Greenbank Road, Rochdale. Further details from Brian on 061-653 8316 or Dave (0706) 32502.

Rhyl & District ARC meet 1st & 3rd Mondays. For more details, contact Ken Padley GW7IAR, 67 Rosehill Road, Rhyl, Clwyd LL18 4TS. Tel: (0745) 338276.

Salisbury Radio & Electronics Society meet Tuesdays, 7.30pm at Grosvenor House Centre, Churchfields Road, Salisbury. April 14 is a natter night/Morse class/RAE class/committee meeting, the 21st is '10GHz For Beginners' or how to convert a Pye Cambridge by Martin Cranage G8DFA, the 25th is International Marconi Day, club stn at the Roving Kennels in Salisbury, May 5 is 'DX Packet Cluster' by Neil G4LDR and the 12th is a natter night/Morse class/RAE class. For further details, contact Bert Newman G2FIX on (0722) 743837.

Salop ARS meet Thursdays, 8pm at the Old Buck's Head, Shrewsbury. April 9 is a construction competition, the 23rd is 1st Fox hunt and May 7 is a Visit to RAF Cosford. Further details from Glenda G1YJB on (0939) 232090.

Sevenoaks & District ARS. On April 27, they have Colin Merry G4COM of the Dartford Direction-Finding Club, to talk about direction-finding. Details from The Secretary, c/o Sevenoaks District Council, Council Offices, Argyle Road, Sevenoaks, Kent TN13 1HG. Shefford & District ARS meet Thursdays,

8pm at the Church Hall, Amphil Road, Shefford, Bedfordshire. For further information, contact Nigel G1JKF on (0908) 274473.

Silverthorn RC meet Fridays, 7.30pm at The Chingford Community & Adult Education Centre, Friday Hill House, Simmons Lane, Chingford, London E4 6JH. More details from Andrew Mowbray G0LWS on 081-529 4489 between 5.30 and 6.30pm weekdays only.

Solihull ARS meet 3rd Thursdays in The Shirley Centre, 274 Stratford Road, Shirley, Solihull, West Midlands. For more details, contact Colin Taylor G3USA, 231 Robin Hood Lane, Hall Green, Birmingham B28 0DH. Tel: 021-777 9965 evenings or (0827) 53344 daytime.

South Dartmoor ARC meet Mondays, 8pm at South Dartmoor School, Balland Lane, Ashburton, Devon. This radio club has a committee of only one adult - the rest being school-age youngsters! Although anyone wishing to join in is welcome. For more details on this Novice-run radio club, contact Peter Thornhill G6ZKQ, 21 Elmbank, Buckfastleigh, Devon TQ11 0DX. Tel: (0364) 43433.

South Dorset RS meet 1st Tuesdays, 7.30pm in the Wessex Lounge of Weymouth Football Club. May 5 is club meeting and the 10th is the Yeovil ARC 8th QRP Convention. Geoff Gwilliam G4FJO, 13 Overlands Road, Wyke Regis, Weymouth DT4 9HS. Tel: (0305) 781164.

South Notts ARC meet at Highbank Community Centre, Farnborough Road, Clifton Estate, Nottingham, or Fairham Community College, Farnborough Road, Clifton Estate. April 10 is Construction (Fairham College), the 17th is talk-in (S22) and a talk on 'Organising Contests' by Richard G4LPD, the 24th is on air, May 1 is a talk-in (S22) and open forum and the 8th is Construction (Fairham College). For further details contact Ray G7ENK on (0602) 841940.

Southgate ARC meet at Winchmore Hill Cricket Club Pavilion, Firs Lane, Winchmore Hill, London N21. April 9 is a Grand Surplus Equipment Sale, the 23rd is club construction project and May 14 is a lecture by Stan Woods, Marconi Historian, on 'Early Radar, part 2'. Brian Shelton G0MEE, 22 Berkeley Gardens, Winchmore Hill, London N21 2BA. Tel: 081-360 2453.

Spalding & District ARS meet Fridays, 8pm at The Riverside Centre, The Old Fire Station, Double Street, Spalding, Lincolnshire. Further details from David Johnson, 65 West Street, Bourne, Lincolnshire PE10 9PA. Tel: (0778) 425367 (6-7pm).

Spun Valley ARS meet Thursdays, 8pm in Old Bank Working Men's Club, Mirfield. Alternate Thursdays are 'Noggin & Natter nights'. Further details from Ian Berraclough G7DWY on (0484) 716453, early evening.

Stevenage & District ARS meet in Ground Floor Rear Suite, Sitec Building, Ridgeman Park, 7.30pm. April 14 is HF Packet primer and demonstration by Peter G0GTE, the 28th is D/F Antenna assessment by Alf G7KPV (outside activity), May 5 is a v.h.f. & h.f. night on the air and the 12th is Computer modification & enhancement (IBM clones, etc.). More details from Pete Daly G0GTE, 48 Lincoln Road, Stevenage, Herts SG1 4PJ. Tel: (0438) 724991.

Stirling ARS meet Thursdays, 7.30pm at premises near Throsk, Stirling. Details from Brian Muleady G6MKWL, QTHR or on (0324) 36235.

Stockport RS meet 2nd & 4th Wednesdays, 7.45pm in Room 14 of the Dialstone Centre, Lisburne Lane, Offerton, Stockport, Cheshire. April 22 is Captain Thompson, Ex Queen Mary Captain and May 13 is 'Computers As Was/Today' by P. Stanley. Further details from John Verity G4ECI, 7 Adelaide Road, Bramhad,

Stockport, Cheshire SK7 1NR. Tel: 061-439 3831.

Stourbridge & District ARS meet 1st & 3rd Mondays, 8pm at Robin Woods Community Centre, Scotts Road, Stourbridge. Details from Dennis Bode G0HTJ at 53 Grove Road, Wollescote, Stourbridge, West Midlands DY9 9AE.

Stratford-Upon-Avon & District RS meet 2nd & 4th Mondays, 7.30pm at the Home Guard Club, Main Road, Tiddington, Stratford-Upon-Avon, Warwickshire. April 13 is AGM & Surplus Sale, the 27th is 'What's On 80m' by John Allen G4PDP and May 11 is 'Computers In Amateur Radio' by John Price G4QIL. Further details from Alan Beasley G0CXJ, 2 Ilmington Road, Blackwell, Shipston-on-Stour, Warwickshire CV36 4PE. Tel: (0608) 82495.

Stroud & District ARS meet fortnightly in the Minchinhampton Youth Centre. For more details, please contact Dave Stallon on (0453) 886964.

Sutton & Cheam RS meet 3rd Thursdays, 7.30pm at Downs Lawn Tennis Club, Holland Avenue, Cheam, Surrey with natter nights on 1st Mondays, in the Downs Bar. Meeting from beginning of May will be at Sutton United Football Club, The Borough Sports Ground, Gander Green Lane, Sutton, Surrey, with natter nights on 1st Thursdays. April 16 is a Junk Sale, the 28th is a committee meeting and May 7 is a natter night. More details from John Puttock G0BWW, 53 Alexandra Avenue, Sutton SM1 2PA.

Taunton & District ARC meet 1st & 3rd Fridays, 7.30pm in 'The Basement', County Hall, The Crescent, Taunton. Other Fridays informally for a natter and station operation, Morse code classes, etc. For further details, contact Mr W. Lindsay-Smith G3WNI, Way Close, Madford, Hemyock, Cullompton, Devon EX15 3QY. Tel: (0823) 680778.

The GB3XZ Repeater Group meet at Chiltern Communications, Lincoln Road, Cressex Industrial Estate, High Wycombe, Bucks, 8pm. Details from Francis Rose G2DRT on (0494) 814240.

The Submarine ARC submerge on Thursdays, 7pm at HMS Dolphin, Gosport, Hants. For more details contact K. Fisher G0LXX on (0329) 281174.

The Three Counties ARC meet every other Wednesday, 8pm at the Railway Hotel, Liphook Hampshire. April 22 is their AGM and May 6 is British Nuclear Fuels Ltd. their operations and the environment, speaker from BNFL. Kevin Roche G8GOS on (0420) 83091.

Thornbury & District ARC meet at the United Reform Church, Chapel Street, Thornbury, 7.30pm, talks start at 8pm. Morse practice sessions are held between 7.30 and 8pm. More details from H. Cromack G0FGI at Rose Cottage, The Naitie, Oldbury-on-Savern, Bristol, Avon BS12 1RU. Tel: Thornbury 411096.

Tor ARA meet Tuesdays, 7.30pm at the Ernest Bailey Community Centre, New Street, Matlock, Derbyshire. April 21 is their AGM, the 28th is a talk & demonstration by Derek Pearson G3ZOM of Jandek, on their range of kits for QRP operation and novice use and May 7 is a Buffet & Get-together at the Duke of Wellington, Chesterfield Road, Matlock. More details from Vince Shirley G0ORC on (0773) 826747.

Torrey ARS meet Fridays, 7.30pm at the ECC Social Club, Highweek, Newton Abbot. April 10 is a club night, the 24th is monthly meeting, talk by SWEB and May 1 & 8th are club nights. More details from Andy Stafford G4VPM on (0803) 329055.

Trowbridge & District ARC meet at 8pm, in the Territorial Army Centre, Bythesea Road, Trowbridge, Wiltshire, 8pm. More details from Ian Carter G0GRI on (0380) 830383.

Verulam ARC meet 2nd & 4th Tuesdays, 7.30pm at the RAF Association Headquarters, New Kent Road (off Malborough Road), St. Albans, Hertfordshire. 2nd Tuesdays are their activity evenings and 4th Tuesdays are their main monthly meetings. More details from Walter Crane G3PMF, 5 The Crescent, Abbots Langley, Watford, Hertfordshire WD5 0DR.

Wakefield & District RS meet Tuesdays, 8pm in First Floor Rooms, Ossett Community Centre, Prospect Road, Ossett. John Bailes G0MVA on (0924) 260048.

West of Scotland ARS meet Fridays, 7.30pm at the Scout HQ, 21 Elmbank Street, Glasgow. For further details, please contact John Power G6MKT0, PO Box 599, Glasgow G3 6DH. Whitton ARG meet Fridays, 8pm at the Whitton Community Centre, Percy Road, Whitton, Twickenham. April 17 is new & used equipment advice from Alan Brackley of ARE Communications and the 24th is an AGM report from all officers and election of a committee for coming year. More details from Ian G0DFN on 081-894 9131.

Wiesbaden ARC - DA1WA - is a club mainly for US military personnel stationed anywhere near Wiesbaden, Germany. For more details, contact Robert Kipp G3JPU, Hugelstr. 25, D-6070 Langen, Germany.

Wigtownshire ARC have meetings and RAE classes every Thursday, 7.30pm at the Community Education Office, Stranraer Academy. More details from Ellis Gaston G6MHPK, 3 Victoria Buildings, Cairnryan, Stranraer, Dumfries & Galloway DG9 8RA. Tel: (0581) 2202.

Wimbledon & District ARS meet 2nd & last Fridays in St. Andrews Church Hall, Herbert Road, Wimbledon SW19. April 10 is a general activity evening, the 24th is 'Discillators' by George Cripps G3DWW and May 8 is a general activity evening. Chris Frost G0KEB, 61 Selbourne Avenue, Tolworth, Surrey KT6 7NR. Tel: 081-357 0427.

Winchester ARC meet 3rd Fridays, 7.30pm at the Red Cross Centre, Durgate House. Further details from Malcolm Butler G0LMD, 44 East Stratton, Nr. Winchester, Hants SD21 3DU. Tel: (0962) 89550.

Wirral ARS meet 1st & 3rd Wednesdays, 7.45pm at Ivy Farm, Arrowe Park Road, Birkenhead, Wirral. More details from Alec Saed G3FDD on 051-644 6094.

Woodpecker Radio Group meet Mondays, 8.30pm at Richmond Place Club, Edgar Street, Hereford. More details from Chris, PO Box 39, Hereford HR1 2YL. Tel: (0432) 352441.

Yeovil ARC meet Thursdays at Red Cross HQ, Grove Avenue, Yeovil, Somerset. April 9 is Construction & Operating, the 23rd is their 48th AGM, the 30th is Construction & Operating and May 7 is open discussion and preparation for QRP Convention, the 9/10th is Annual QRP Convention at Preston School and the 14th is 'An 80m Superhet Receiver' by G3PCJ. Further details from Mike Woodford G0JVG, Holm Wood, 5 Orchard Close, South Petherton, Somerset TA13 5DX.

club
News

Radio Diary continued on page 41

April 12: Cambridgeshire Repeater Group will be holding their Amateur Radio Rally at Philips Communications Systems - Catering Centre, St. Andrews Road, Chesterton, Cambridge. Doors open 10.30am. There will be a Junk sale, Bring & Buy, Auction. Further details from Mike G6CDD on (0223) 440373.

April 19: Centre of England Easter Sunday Radio & Electronics Rally will be held at the National Motorcycle Museum, Bickenhill, near the NEC (Jct. 6 M42). Doors open 10.30am, 10am for disabled visitors. Admission £1 (concession for RAIBC members and senior citizens). Over 60 traders, ample free parking, bar & restaurant facilities. Talk-in S22. Easter special: 'Spot The Egg' on many of the trade stands to win an easter egg. Details from Frank Martin G4UMF on (0952) 598173.

April 26: The Bury Radio Society are holding their Annual Rally/Hamfest at 'The Castle Leisure Centre', Bolton Street, Bury, Lancashire. More details from Laurence Jones G4KLT on 061-762 9308.

April 26: Lough Erne ARC have their 11th Annual Mobile Rally in The Killyhevlin Hotel, Enniskillen. Talk-in on S21. Contact Alwyn G10BFD, 15 Glenwood Gardens, Sligo Road, Enniskillen, County Fermanagh, Northern Ireland BT74 5LT. Tel: (0365) 323802.

April 26: Swansea ARS will be holding their 11th Annual Rally in the Swansea Leisure Centre on the Swansea-Mumbles Coast Road, the A4067, from 10.30am to 5pm. Usual attractions include trade stands, bookstall, Bring & Buy, operational h.f./v.h.f. stations, full catering. Talk-in on S22 via GB2SWR. Further

details from Roger Williams GW4HSH on (0792) 404422.

May 4: Dartmoor Radio Club Rally is to be held at St. Pauls Church Hall, Yelverton. Doors open at 10.30am. Free parking, usual traders, refreshments, Bring & Buy. Details from George Spray on (0822) 853885.

May 10: The 8th Yeovil QRP Convention will be held at The Preston Centre, Monks Dale, Yeovil, Somerset (via Preston Road and Larkhill Road, maps available from G3CQR, QTHR). Doors open 9am, entrance fee is £1.50 which includes program with lucky-draw number. GB2LDW 144MHz talk-in from 8.30am on channel S22. Further details of the QRP Funrun and Challenge from Peter Burridge G3CQR, QTHR or tel: (0935) 813054.

May 16: All Formats Computer Fair will be held at Sandown Exhibition Centre, close to M25, three miles from Esher railway station, parking for 6000 cars. This is intended to be the regular future venue for the London fair. Further details from John Riding on (0225) 868100.

May 17: The 35th Northern Mobile Rally will take place in the Flower Show Hall at the Great Yorkshire Showground, Harrogate, north Yorkshire. Showground opens 10am, doors open 10.45am. Talk-in on S22. Bring & Buy, bar & cafeteria. Free parking and loads of stands. Entry and parking of Wetherby to Harrogate Road. Separate arrangements for disabled visitors off Hookstone Wood Road. Details from Mike G0MKK on (0423) 564353/507653 or FAX (0423) 520992 or @GB7CYM.

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The Manson EP-925

High Current Power Supply

Normally I use a customised version of the ubiquitous PW 'Marchwood' power supply design, which has variable output and current limiting. In this form, it provides me with a useful general bench supply when I'm in a home-brew mode.

The 'Marchwood' becomes a real 'work-horse' when higher power mobile transceivers are being reviewed. Obviously, this is the type of rig that Manson had in mind, when they produced their p.s.u.

The first thing that struck me when I unpacked the EP-925, were the two moving-coil panel meters which gave the unit an air of quality. The first meter is scaled 0-15V with a red marker at 13.8V. This is the terminal voltage of a fully charged 12V lead-acid car battery.

The second meter is scaled 0-30A. The EP-925 can supply 25A continuous at 15V and peak maximum of 30A.

Steel Case

The power unit is housed in a two-part steel case, which is finished in very respectable black satin finish paint. Judging by the durability of the surface, I'd say that the metalwork had been well primed before painting.

The front panel of the p.s.u., is the only section of the chassis constructed from plastics. Besides housing the two panel meters, the front panel has a pair of fairly heavy duty screw-down type terminal posts.

I felt that the terminals looked a bit on the light duty side for handling 25A continuous current. However, I need not have worried, as they proved adequate in operation.

In addition to the 'high current' output terminals, the power supply is fitted with two pairs of 3A quick-release clip fastening outlets. I know from experience with my own p.s.u., that this feature is useful.

Although it only appears to be a minor refinement, it can save a great deal of frustration. There's a finite limit to how many pairs of light duty wires can be twisted together, and trapped under one terminal post!

Voltage Control

Next to the panel meters is a voltage control potentiometer. This control gave me an uneasy feeling as I adjusted it, and I felt it was a little too easy to adjust.

Fortunately, the p.s.u. can only supply a maximum of 15V. This voltage level could be a bit tough on 6V equipment, but most mobile gear should survive an accidental brush of this control.

In my opinion, because this p.s.u. has no pre-settable current control, it has rather limited scope as a general bench supply. A screwdriver access type of control, to permit adjustment, would have been useful. After all, most operators are going to use this unit as a substitute mobile power supply, especially with all that current on tap at 13.8V.

The two l.e.d.s mounted just below the voltage control, operate as a power-on indicator in



conjunction with a rocker type mains on-off switch. They also act as a visual warning that the p.s.u. has folded-back into its over-current state.

Amazingly Quiet

The mains input lead (approximately 1.5m length) plugs into the rear. There's also a well guarded and amazingly quiet 70mm instrument fan.

The fan, I later discovered, is a brushless d.c. type, and it must be under-run for such a hushed performance. The fan's operation is governed by an internal temperature sensor. The sensor switches on the fan in at 70°C and off at 40°C.

The fan provides forced cooling in conjunction with a reasonably sized grill, set back a little from the front panel. Using this method of cooling, obviously helps to keep the size down.

The overall sizes and weight of the p.s.u. are 150 x 150 x 305mm and 9kg. I felt that this power supply wouldn't be out of place in anyone's radio shack, as it has modest dimensions, for such a heavyweight specification.

Proportional Current Limit

Although there's not much information on the accompanying data sheet, the p.s.u. has a proportionally adjusted current limit facility. This, in simple terms, winds down the amount of current available with respect to the unit's voltage output level.

This, I can only guess, is done in preference to a fully adjustable limit. This is because there's little or no headroom for extra dissipation in the regulating devices, and as the manufacturers say, it helps to keep costs down.

To help the end-user, the makers provide a graphic representation of the facility. You'll find it on the A4-sized information sheet.

Value For Money

The EP-925 has obviously been built to a price. But that's not a criticism in itself, as the unit represents good value for money.

Despite this, I felt that the addition of some manual current control would have given the unit a much wider appeal, particularly in the small electronic business sector. The lack of this control, relegates the EP-925 to a (very good) 13.8V high current d.c. supply, with the added luxury of a variable voltage output.

There is by the looks of the front panel, a

Review

Power supplies are often something of an afterthought in most shacks, but if you're going to use any of the higher power mobile equipment outside of the car, a good p.s.u. is essential. With this in mind, Richard Ayley G6AKG, has tried the Manson p.s.u., to see if it's up to this demanding task.



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IC-725	HF all band, general coverage RX, 12V	779.00
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FT890TU	All mode transceiver, general coverage RX, c/w internal ATU	1250.00
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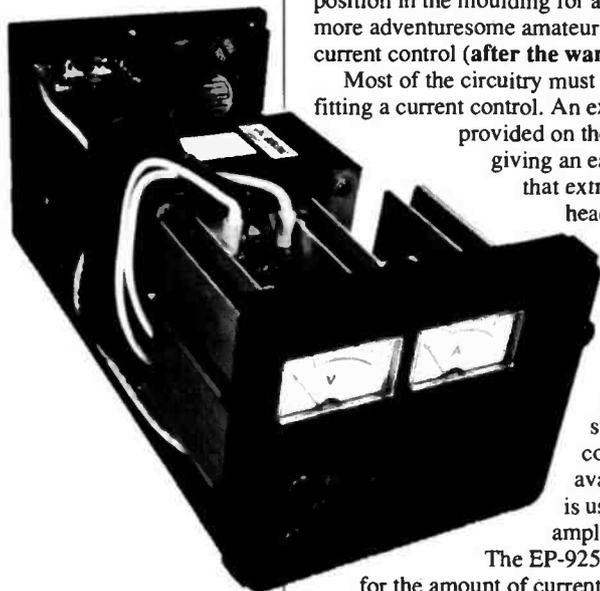
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position in the moulding for an extra control. The more adventuresome amateur might fit his own current control (after the warranty has expired!).

Most of the circuitry must already be in place for fitting a current control. An extra set of holes is provided on the regulator heatsink, giving an easy route to adding that extra dissipation headroom I mentioned earlier.

High Standard

The interior of the unit reveals a high standard of construction. Every available inch of chassis is used to house the amply-rated components.

The EP-925 is a very compact unit for the amount of current that it can provide. The fact that the mains transformer occupied at least 50% of the chassis, came as no surprise.

The transformer is of the standard laminated design, and it's well finished. Knowing how much a transformer like this costs to make, I wondered how Manson managed to budget for such a high quality component.

I found the main smoothing capacitor sandwiched between the chassis and the transformer. This component raised an eyebrow, as it didn't look like a high ripple current device.

It's physical size is not large for the capacity, 47000 μ F, and the capacitor is terminated in large soldered tags. However, I may be doubting the component unnecessarily, as it is not marked that clearly.

Screw Terminations

Capacitors normally used for high-power applications, are almost always fitted with screw terminations to provide the necessary current handling. If electrolytic capacitors are used above their ripple current rating, they get hot and produce gas.

In time, they can 'dry out', causing them to lose capacity. Despite this, the capacitor is mounted near the main air flow from the fan, and it should be relatively free of this problem.

The diode bridge is mounted along with five 2N3055 'pass' transistors. Comprising of two sections of aluminium, the heatsink is mounted one section above the other.

This idea makes maximum use of the space left on the chassis. Rectification is provided by an integrated type, high current diode bridge and it's fitted with 'Lucar' spade terminations.

Good Practice

A capacitor is fitted across each diode in the bridge, and this is a good r.f.i. reduction method. In practice, the capacitor filters out the diode switching noise generated when the device is working hard.

In my line of work (e.m.c.), you often find that high current diodes produce a significant level of both radiated and conducted low frequency interference. This can be a real bind if you're a 1.8MHz DX fanatic!

The internal wiring is reasonably neat. All the heavy current connections are crimped, rather than soldered, with the exception of those to the smoothing capacitor.

The main control p.c.b is attached to the rear of

the front panel. The quality of the board is good, and the soldering is up to standard with no dry joints. Unfortunately, due to the way the p.c.b. is fixed to the front panel, I couldn't see what active devices are used to control the p.s.u.

Electromagnetic Compatibility

Nowadays, I work for an Electromagnetic Compatibility (e.m.c.) testing company. So, I thought I'd look for any vices the EP-925 might have, with regards to it being effected by high r.f. field strengths. Exploring this avenue, is not unjustified, especially as the unit is to power some fairly powerful r.f. equipment.

I must tell you immediately, that the field strengths used to conduct the following test, represent an almost worst case scenario. Unless you intend running the full legal limit on each of the bands mentioned, into in-shack antennas, the EP-925 should not deviate from its normal mode of operation.

Most of the effects I noted during the testing, caused the unit to fail safe. In other words the output voltage went down rather than up.

Only one amateur band provided different results. On 70MHz, with a signal level at 70V/m of a.m. modulated field, the unit lost all regulation and supplied around 16.5V.

Bad Practice

There's no need to worry though, as my test equates to running approximately 20W into a mag-mount antenna, stuck to the case of the p.s.u.! This would be bad practice anyway, as the unit represents a terrible groundplane at this frequency.

But speaking seriously now, I did notice some other minor effects at 50MHz. On this band, 50V/m caused a 2V drop in output, while 20V/m and 50V/m at 70MHz caused volts drop of 3V and 6V respectively.

On 144MHz, there was only a minor twitch at 100V/m, and no effects at all were noted at 430MHz. The h.f. bands (1 to 30MHz) were also clear of any effects. So, from my tests, it would appear that the EP-925 is an extremely tolerant piece of equipment when it comes to fairly high r.f. field strengths.

Full Load Performance

During my tests, the unit was run under full load (25A) for a period of 30 minutes. It coped very well, with no signs of overheating.

Towards the end of the test period, the ripple level was checked at 30A output and proved too low to measure. The regulation from no load, to full load, gave a very temporary 'droop' in output voltage in the region of 100mV.

The information sheet advises that the load is removed from the p.s.u., before switch on. So, I conducted a test to see the effect of the opposite course of action.

No ill effects were noted. Although, if the unit were to be switched on during a peak in the a.c. mains cycle, while under load, the mains input fuse could blow. This is because the EP-925 does not appear to be fitted with a soft-start circuit. Despite this, and providing the manufacturer's advice is followed, the need for such a circuit is unnecessary.

The front panel meters were checked against an AVO Model 8 test meter. Measured accuracy can only be described as more than adequate, as only small errors were noted across each meter's range. The errors were non-linear in nature, and impossible to quantify.

Summary

In my opinion, the EP-925 is a compact and unassuming power-house. It has enough capacity to deal with the majority of high power mobile amplifiers, as well as mobile 100W+ h.f. rigs. That's what I think this p.s.u. was designed for, and no doubt it's what people are queuing to buy for.

The only thing that worried me was the seeming lack of an overvoltage crowbar circuit. This would operate if for some reason the output should go higher than 15V.

Most mobile equipment will cope with 15V, as this can easily be experienced in a car. This is the only real short-coming I can see with the EP-925. Anyone who is of a nervous disposition might think about building an extra unit to do provide over-voltage protection.

I think the EP-925 represents a good quality p.s.u., which is sensibly priced at £99.00

including VAT. My thanks go to AQL EMC Ltd., for the use of their test facilities. Thanks also to Lowe Electronics headquarters at Matlock, Derbyshire and their Bournemouth branch (for the loan of the review unit) and Richard G7HIP for his helpful comments.

Specification

Output voltage	3-15V (adjustable)
Output current	25A @ 15V
Max output current	30A
Output ripple and noise	(5 minutes max.)
Cooling	<10mV r.m.s.
Input Fuse Rating	Forced air
Dimensions	250V @ 5A
Weight	150 x 150 x 305mm
	Approximately
	9kg

Review

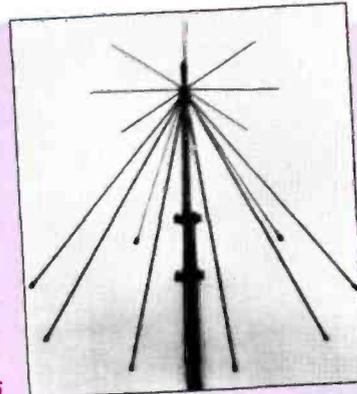
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The coaxial feeder cable, which is not supplied, is connected to the antenna with an N-Type connector. This connection is well shielded as it is made at the base of the antenna inside the mounting tube. Of course, for the best results the feeder should be of the highest grade coaxial cable with minimum loss. The WB 1300 antenna can also be used on transmit on the 50, 144 and 900MHz and 1.2GHz bands.

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A Simple Inductance And Capacitance Bridge

Part 2



Construction

The power supply for the simple bridge, is itself uncomplicated. The circuit is shown in Fig. 2.1, and as you can see, it's a basic, Zener diode stabilised unit. The associated p.c.b. is shown in Fig. 2.5, with the other boards.

Now it's time to start on the next stage, the building of the bridge board. You'll find that this section of the project is slightly more involved.

This board eventually stands off, and is mounted behind the front panel. It's wise to mark out the two fixing holes and the holes for the main controls, S1 and R9 directly on to the panel before mounting any components. The photograph of the complete unit will help in this respect.

The Lorlin 12-way miniature switch (S1) mounts directly on to the board. The switch's tag-ended connectors have the tags neatly snipped off,

to leave the longest possible 'stumps'. A suitable design for the switch labels is provided in Fig. 2.3.

The small metal stop ring should also be removed from beneath the fixing nut. This allows the switch the full 12-position travel.

The board holes for the switch fitting should be accurately drilled out with a 2mm or a 1/16in drill. The control R9 is fitted to the board on the opposite side to the switch. Wire connections are then made to the three pads, which fall immediately below the potentiometer tags.

I advise that you use Veropins, inserted at the pads for the switching terminal lugs, and at each pad of the link position P1-P2. Use double-ended types for the off-board connections.

This is recommended because soldering to external positions from both sides of the board is

This month Stephen Knight Bsc., describes the final stages of construction of his simple bridge design, and tells us how to complete the simplified calibration.

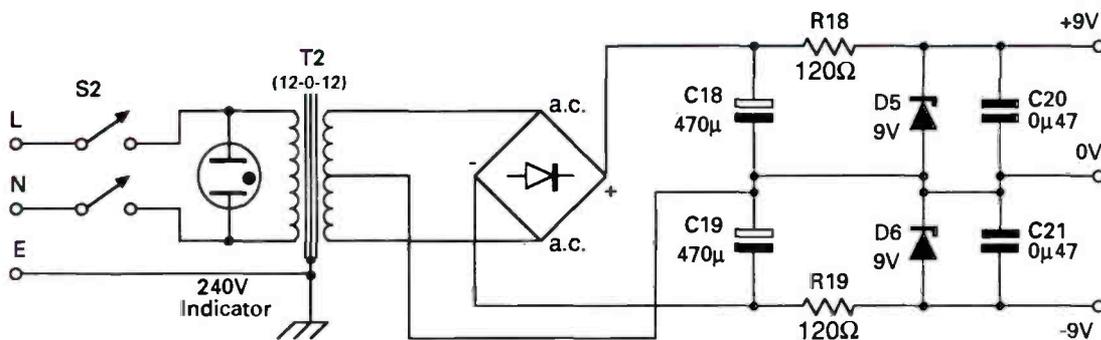


Fig. 2.1: The circuit diagram of the Zener diode-stabilised power supply for the Simple Inductance Bridge. The associated p.c.b. design appears in Fig. 2.5.

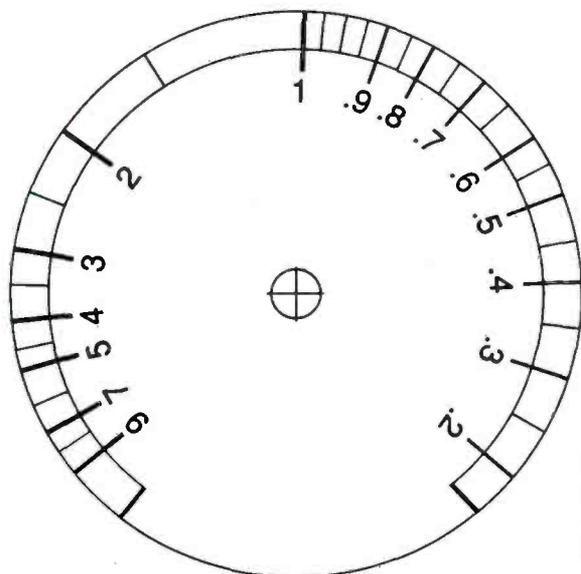


Fig. 2.2: The instrument's dial template design. See text for details on how to reproduce the design, as scale is important, as calibration accuracy is dependent on size-for-size reproduction.

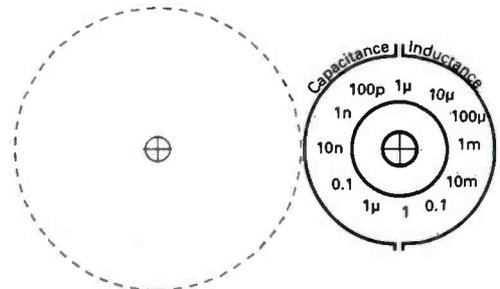


Fig. 2.3: Suggested design for the S1 switch panel. See text for switch mounting details.

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made at these points. The link P1-P2 (see main circuit, Fig. 1.4 in Part 1) should be left open for the time being.

Maplin Case

The case I used was a Maplin two-part unit measuring 200 x 100 x 125mm. The front panel drilling requirements can be gauged from the photographs.

The front panel legends can be done in rub-off lettering or stencil. The spacing of the two 9.5mm holes for the shafts of S1 and R9 is critical, as are the two fixing holes for the bridge board.

I suggest you use the board itself as a template as mentioned earlier. Before fitting any of the boards, attach the three input terminals, which should be spring-loaded types.

The off-board wires that go to the respective input terminal tags, should be kept as short as possible. **They must not be twisted together!**

Board Mounted

The bridge board can then be mounted behind the panel using 6BA screws and 30mm spacers, checking that the control shafts pass centrally through their respective holes. By using grommets with a 6.5mm centres in these holes, they will act as soft bearings for the shafts.

A touch of non-mineral oil is useful here, for making smooth-turning controls. You will, incidentally, need a shaft extender for potentiometer R9.

The remainder of the front panel components can now be fitted, including the on-off switch S2, and the 50µA meter M.

The oscillator and null-detector boards are mounted on short spacers on the base of the box, the positions being in no way critical, while the power board (see the photograph in Fig. 2.4) is mounted, again using two screws and spacers on the back wall of the case.

Oscillator Check

When all the internal interconnections have been made, the first thing to be done is to check that the oscillator IC1 is working. This is done by adjusting preset R3.

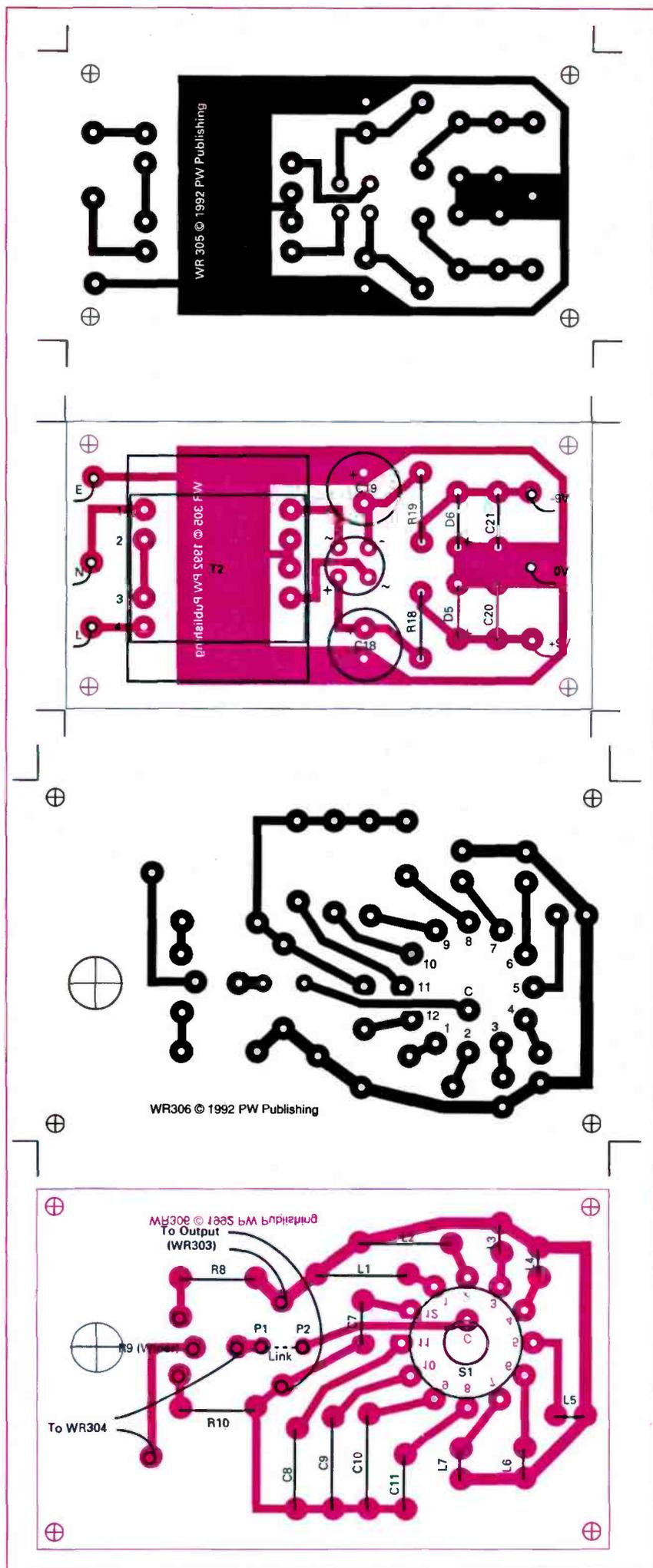
An oscilloscope is the best way to test the oscillator. The oscilloscope will also check the impedance matching transistors Tr1 and Tr2, by displaying the waveform across the primary of T1.

Start off the tests with R3 at its mid position, and you should get a sinewave output at pin 6 of the i.c., of about 6V peak-to-peak amplitude. The frequency is not important, but adjustment of R3 should enable a stable sinewave without visible distortion to be obtained.

The setting of R3 is not critical. For those without a 'scope, setting it to mid-position should give you a suitable output.

What is important, of course, is that the oscillator is working. The instrument will work with a distorted waveform, but it won't work at all if the oscillator isn't performing!

Fig. 2.5: The p.c.b. designs for the Simple Inductance Bridge, showing power supply, and bridge unit p.c.b. designs, copper track lay-outs and associated component over-lays.



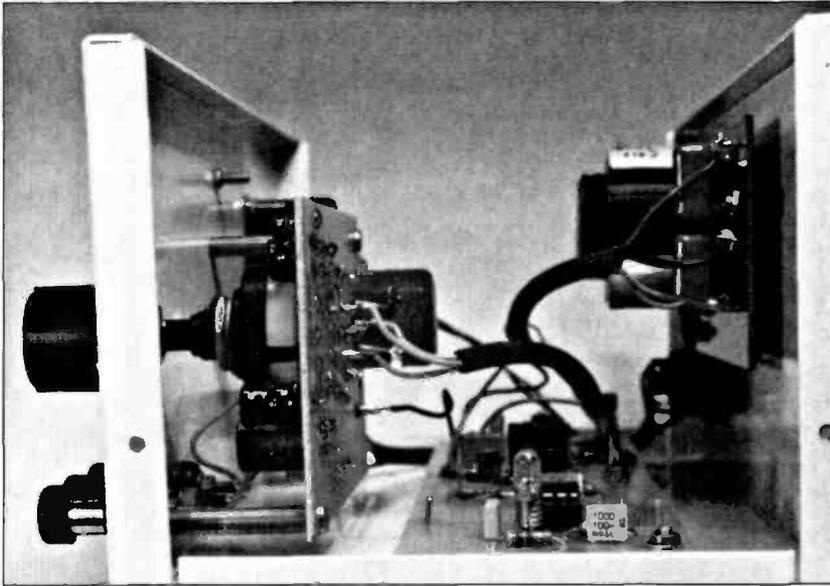


Fig. 2.4: Photograph showing method of mounting bridge-board, stand-off mounts, inter-wiring and the power supply panel which is fixed on the rear casing.

The Calibration

Turning now to the calibration, you might be pleased to know that this has been done for you! Unless you are a purist, you need no further equipment to see things through.

First of all, fit a suitable knob to the range switch shaft, so that with the switch turned fully anti-clockwise, the knob pointer indicates the $1\mu\text{H}$ position on the range selection. It should then turn correctly through the other 11 positions, stopping fully clockwise on the 100PF capacitor position.

The main control scale design, which you'll eventually fit on to the shaft of the potentiometer R9, is given in Fig. 2.2. After a number of experiments on prototypes, I found that this scale gave consistent results within an estimated error of about 3%, provided that the specified potentiometer is used.

The scale cannot be guaranteed to match any alternative potentiometer. This control was chosen because it has a 2% linearity tolerance, and wide mechanical and electrical rotation angles.

So, if you use the same potentiometer, the calibration is already done. By doing it this way, the rather tedious marking of a scale against external standards is avoided!

The Scale

Next, photocopy the scale (or reproduce it in some way) and glue it on to a 75mm diameter disc of thin aluminium, say 18-20s.w.g., with the centre point accurately marked. You can use card, but this does tend to buckle in time, and aluminium (or thin Perspex) seems the best bet.

Now, having got the disc prepared in this way, glue or screw to it, perfectly centrally, an instrument knob of about 28-35mm diameter. The complete dial can then be fitted, when required, to the extension shaft (cut to a suitable length) of R9.

You now need two resistors of 1% tolerance or better. The actual value of these resistors doesn't matter, but 100Ω is suitable and the closer they are matched the better.

Turn the shaft of R9 to about mid-position (no dial yet fitted) and connect one of the resistors across Cx terminals (shown as 'Capacitance' in the circuit Fig. 1.4 in Part 1) and the other across the Lx terminals (shown as 'Inductance' in Fig. 1.4 in Part 1). The range switch position is immaterial at this stage.

Now turn the shaft of R9 very carefully, to produce a minimum reading on the meter. Without disturbing the shaft position, slip on the scale and then fix it in position using the knob grub screw(s) or collet clamp.

Ensure that the central figure 1 on the scale, is exactly in line with the indicating mark on the panel. Then re-check. This is a tricky part of the procedure, but a steady hand is all that is basically needed.

If everything seems to be okay up to this point, the work is completed. Next, switch the unit off, remove the test resistors and solder a link of wire across the Veropins at P1-P2 (see main circuit in Fig. 1.4 in Part 1) on the bridge board. The instrument is now ready for use.

Making A Measurement

All that has to be done in making a measurement, is to connect the inductor (or capacitor) to the appropriate pair of terminals (Cx or Lx). Then set the range switch to a suitable position, and turn the main control knob until a minimum reading is obtained on the meter.

You may have to search through the range switch positions if you don't have a clue as to the probable inductance value of your inductor. Don't be deceived by what looks like a minimum reading coming up, but which reaches the end stop of the control without actually reversing its direction.

There must be a definite reversal of direction by the meter pointer. The best accuracy is obtained when the 'balance' occurs within the central 50% or so of the scale calibration, say, within the range 0.3 to 4.0.

All you have to do is to multiply the range switch scale by the factor on the main scale. For example, if you find a 'balance' at 0.75 with the range at 10mH, the inductance being measured is $10 \times 0.75 = 7.5\text{mH}$.

Theory And Practice

In theory, this bridge should measure inductors from $1\mu\text{H}$ to 10H, and capacitors from 1pF to $10\mu\text{F}$. In practice, the range of inductance measurement is about $5\mu\text{H}$ to 5H, and of capacitance from 10pF to $5\mu\text{F}$.

There's not much point in taking any measurement below $5\mu\text{H}$ or 10pF at its face value. This is because of stray inductance and capacitance, which is bound to vary from model to model.

In my prototype these quantities measured at $1.7\mu\text{H}$ and 2.3pF respectively (on a high precision laboratory instrument!). At the other end, the 1H standard coil used is stated to have an accuracy of 10%, (it was actually under 4% on test) and a $1\mu\text{F}$ capacitor with an accuracy better than 5% is not easy to get hold of.

PW

Anyone willing to have a go at calibrating their own scale from external standards, can get the information from me, if they'd like to write via the PW office. I hope that your bridge will make inductance and capacitance identification easy for you in the future!

Getting Started - The Practical Way

The first radio set I built had the following 'ingredients': a toilet roll former for the coil, a diode made from a scratched blue Gillette razor blade, and a single wartime surplus headphone. The toilet roll was the hardest bit to find because most people, at least the ones I knew, used neatly cut squares of newspaper on a nail!

However, I really did begin the hobby by winding a coil, although nowadays many projects use ready-made coils or inductors. I suspect that this may be because writers of articles know, like me, that readers often come unstuck when attempting to wind their own coils. I don't know why this should be, as it really is easy, and I even find it quite therapeutic.

Using The Dip-Meter

Last month, I described the building of a dip-meter to check the frequency of a tuned circuit. Now it's time for you to learn how to use this most useful instrument.

Assuming that the tuned circuit consists of a coil (inductor) and a capacitor, the diagram Fig. 1, shows the method of using the dip-meter to check the resonant frequency. There are three types of inductor in common use in amateur radio, and these are shown in the photograph on page 32 (the 'screened can' type is shown with the can in place and removed).

If the inductor is a coil wound on a cylindrical former, the method in Fig. 1(a) is used. The tuned circuit is made up from the inductor (L) and a capacitor (C).

The frequency can be measured with the inductor and capacitor in place on a circuit board. It can be done this way, but I usually find it easier to check the inductor before it's placed in the circuit board. I do this by soldering in the appropriate value of capacitor for the circuit.

The Method

The method used, is to switch the dip-meter on, and bring its coil close to the inductor which is to be measured. Aligning the instrument and the inductor 'end on', as shown in the diagram, aids good coupling.

The object of the exercise, is to make the inductor (the one we're checking) absorb energy from the dip-meter coil as it oscillates. When the windings on both coils are placed as shown, and as you tune over the dip-meter range, you should notice a distinct 'dip' on the instrument's meter. This should occur when the frequency of the oscillator in the dip-meter matches the frequency of the tuned circuit being measured.

Some care may be required in placing the dip-meter, and taking readings. If the windings are too close, the coils might be 'over-coupled', and you might get a 'double dip', which would give an inaccurate measurement.

If the windings are too far apart, the coupling will not be enough, and you'll get a poor dip, or no dip at all. In practice, it's worth moving the dip-meter coil around a little, until one clear dip is obtained.

The frequency reading obtained, will depend upon the accuracy of the dip-meter's tuning scale. Even the expensive commercially-made dip-meters, are often only crudely checked when it comes to frequency calibration.

Care And Time

The home-brewed dip-meter's frequency accuracy, depends upon the amount of care and time taken in its calibration. Despite this, a far better indication can be had if the dip-meter is connected to a digital frequency meter.

Many enthusiasts have frequency meters nowadays. If you use this method, all you do is use the frequency reading from the frequency meter.

The diagram, Fig. 1(b), shows the technique used when the inductor is a toroidal coil. This is the type of inductor wound on a toroid-shaped core.

Toroids are 'doughnut' (or 'Polo Mint') shaped formers. The advantage of this type of former, is that the Practical Wireless, May 1992

inductance field is kept within the circle of the core. The disadvantage is that it's not really possible to take measurements, just by probing with the dip-meter near to the coil. In this case, the dip-meter must be coupled to the inductor.

The easiest method is to couple the toroidal winding to the dip-meter coil, using link windings. Energy can be put into, or taken out of a coil winding, by means of a link winding (a smaller winding placed over, or alongside the main winding).

The diagram, Fig.1(b) shows how this done. A couple of turns are added over the toroidal winding, and this is connected by a pair of wires, which ends in several turns wound loosely over the dip-meter coil.

Energy Transferred

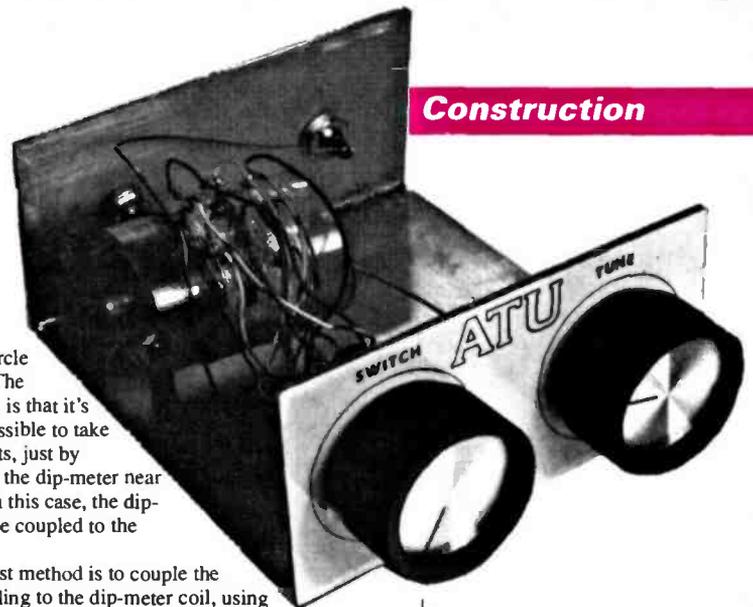
Using the link-windings, the energy can then be transferred from the dip-meter coil to the toroidal inductor. Again, it's possible to 'over couple' the windings, and in some cases only a single turn may be required. It may only need the wire passing through the centre of the toroid, to achieve the coupling necessary.

A special case is shown in Fig. 1(c), but it's one which is common to modern radio projects. It arises because some designs make use of the convenient Toko range of inductors, which are mounted in aluminium screening cans. These are difficult to measure on a dip-meter because the former and windings are contained within the screening can.

Many of these inductors have a link winding already built into the 'canned' coil. Usually the main winding has a tap, in the form of a take-off point on part of the winding. Fortunately, this allows us to identify the main winding because there are three pins on that side of the can. The side of the can with two pins is the link winding.

A pair of wires are then attached to these pins, and they are connected to a two-turn coil on the dip-meter oscillating winding. This follows the procedure for the toroidal inductor, only using an existing link winding.

Editorial note: Many manufacturers produce 'canned' inductors. The method G3RJV describes can be used to identify the resonant frequency of any inductors of this type, provided the connections to the 'coupling' winding can be discovered. In practice, this is not difficult and the 'coupling' winding can soon be found.



This month, as a follow-on to the dip-meter project, the Rev. George Dobbs G3RJV tells us how to use the 'dipper', talks about coils, 'dips' and windings, and finishes off with a practical project.

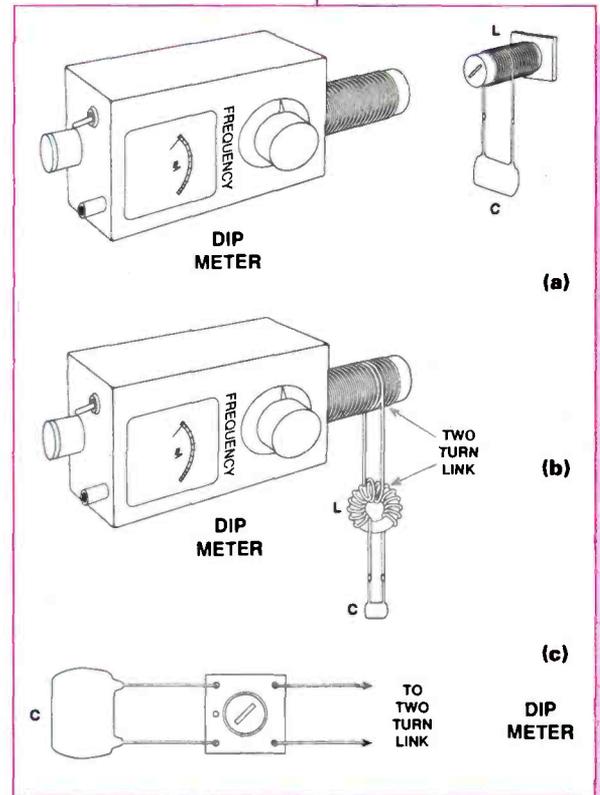


Fig. 1: The dip-meter in use. See text for special method used in Fig. 1(c).

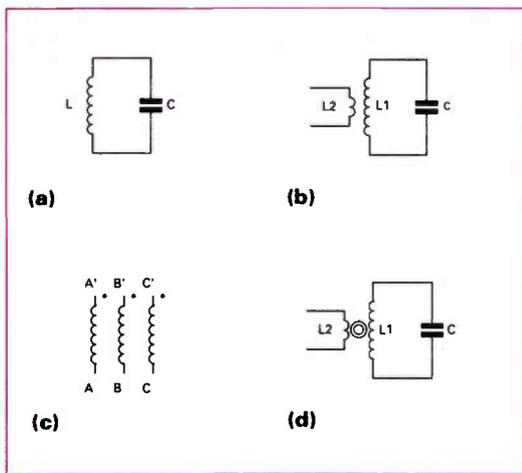


Fig. 2: The main types of circuit representations of inductors.

lower the frequency and the higher the value of capacitor, the lower the frequency. Close winding the coil lowers the frequency, spacing the turns increases the frequency.

Other factors can influence the inductance of a coil winding. Usually coils with only a few turns are wound with thicker wire, and the length of the winding also influences inductance. Such coils may also be 'air-spaced'. This means that they're wound on a cylinder which is then removed, and the coil left in a free air-space form.

Some coil formers have cores (sometimes called slugs). For this purpose, there are several types of material that can be used. The most common type being iron dust (or powder) or ferrite (a ferro-magnetic compound).

These materials increase the inductance of the coil winding. Often they're arranged so that you can screw them in and out of a coil former, and this effectively provides adjustment, by varying the inductance of a coil winding.

Circuit Representations

In Fig. 2, the main types of circuit representation of inductors are shown. The example in Fig. 2(a), is a simple tuned circuit with an inductor and a single capacitor.

The circuit in Fig. 2(b) is a tuned circuit with a link winding, which is an additional, smaller, winding to couple the tuned circuit to another part of the circuit. The diagram, Fig. 2(c), shows a trifilar wound inductor.

The trifilar type is so called, because three wires are twisted together, and then wound on the former or core. The dots mark the beginning of each winding, and in this case, the beginning of one winding is connected to the end of another. Multi-wire windings will be used, and explained in detail later in this series.

The diagram, Fig. 2(d), shows a tuned circuit, which has in this case an extra winding, wound on a toroidal core. Often these cores will be indicated on the circuit diagram by the addition of lines running alongside the coil symbol.

Not Difficult

Winding a coil is not difficult. The correct gauge or diameter of wire is selected, and using a cylindrical former, begin near the base of the former. The beginning of the winding must be anchored firmly. There may be a fixing tag to which this can be soldered, if not a little pvc tape will often do the job.

Simple Instrument

The dip-meter is a simple instrument to use. The best way to become familiar with its use, is to make up some tuned circuits and check their frequency.

The photograph (page 32), show the mains types of inductor found in radio circuits. There are a few simple principles to remember about inductors in tuned circuits and I think it's time to discuss them now!

To start with, the frequency of the tuned circuit depends upon the inductance of the coil and the value of the capacitor.

The more turns on the coil, the

Wind the wire around the former, keeping the wire taut, and make clean turns which don't overlap or cross each other. Close winding (side-by-side turns) is the commonest, and easiest, for coil winding.

When the correct number of turns have been made, secure the end of the winding with another piece of tape. Place this tape on the unused section of the former, rather than over the winding.

The wound turns must now be secured. Some constructors use dope or modelling adhesive, but I think the 'secret weapon' is bee's wax!

Excellent Stuff

Bee's wax is excellent stuff for securing almost anything in electronic construction. It melts on the tip of a soldering iron without messing up the tip.

To use this method, melt some bee's wax with the tip of a soldering iron, and then let it drip onto the winding. Next, carefully stroke the soldering iron tip along the winding.

The wax will flow and cover up the winding, holding the turns in place. It's even possible to remove turns from the winding later, by gently pulling the wire out of the wax coating.

I also use bee's wax to hold cores firmly in formers. Melt a little into the thread of the core and it binds the core to the inside of the former. The core can still be adjusted, but it will remain securely in place after 'trimming'.

Some inductors have link windings. These are often used to couple the windings to another part of the circuit. The commonest way to add a link winding, is to wind it over one end of the main coil.

Link windings are usually smaller than the main winding. It is also usual to add the link coil over the end of the main winding that goes to ground, or earth, in the circuit. Unless the instructions say otherwise, add a link winding by carefully winding it over the bottom end of the main windings.

Toroid Cores

Many construction projects in amateur radio publications make use of inductors wound on toroid cores. These are the little doughnut (or 'Polo Mint') shaped formers with the coil wound around the circumference, looping in and out of the hole.

Toroids aren't complex. They're only formers made of magnetic material, either ferrite or powdered iron.

They have two main advantages, in that the core material provides higher inductance with a smaller number of turns and coil is self-shielding. This means that no metal can or other enclosure is needed to keep the magnetic field away from other parts of the circuit.

Broadband Transformers

Usually, the ferrite cores are used for broadband transformers and inductors. The powdered iron cores are used for tuned circuits.

Take care when using surplus toroids, as many are seen on radio rally and junk sale stalls. Unfortunately, these are almost always ferrite and most amateur radio applications are for powdered iron cores. To be on the safe side, it's better to get the correct cores from a reliable source.

Most amateur radio applications use toroid cores made by Micrometals. They're distributed by Amidon Associates, both are United States-based companies, and either names may appear in articles.

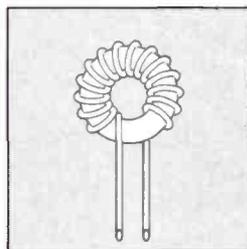


Fig. 3.

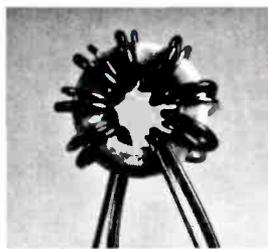


Fig. 4(a).

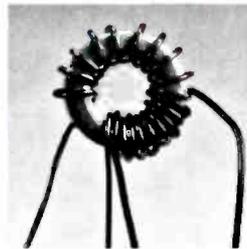


Fig. 4(b).

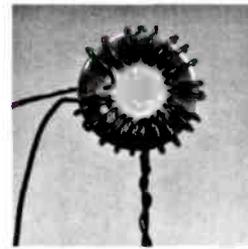


Fig. 5.



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Coded Designation

These cores have a coded designation to indicate a particular core. The T or FT says if the core is a Toroid (powdered iron) or Ferrite Toroid.

The next number states the outer diameter in hundredths of an inch. The last number, following a hyphen, indicates the mix of the material and its appropriate frequency range.

Material mix will affect the magnetic characteristics of the core. The mix is also colour coded, in the case of the powdered iron cores.

A common example is the T50-2. Following the coded designation, this a powdered iron core, with an outer diameter of 0.5in, using '2' mix material, with the core sprayed red. This may seem complex, but amateur radio articles in magazines and books usually state the exact toroid core required for each inductor.

Winding Easy

Winding toroidal inductors is easy. Every time the wire passes through the centre of the core counts as one turn.

Despite the simple process, there are correct and incorrect ways to put the required number of turns on the core. For example, it's recommended that a gap of some 30° be left between the beginning and the end of the winding, see Fig. 3.

Adding a link winding to a toroid inductor is shown in Fig. 4 (a) and (b). In the case of broadband transformers, it's common to space the link winding over the whole of the main winding coil.

Sometimes, it's possible to add the winding in the gaps between turns on the main winding. Small link windings on tuned circuits, are usually added at the grounded end of the main winding.

This is sometimes called the 'cold end'. These can sometimes also be added between the turns on the main winding.

How Long?

A piece of wire has to be cut to go through the hole of the core but how long should it be? Take heed, it's easy to waste a lot of wire in the process!

The easiest way to work the required length out, is to try a couple of turns, and measure the length of wire used. Then from the total number of turns, you work out how much wire will be needed for the coil. (Add a little to be safe!).

Toroidal cores can break if they're dropped or misused. But never fear, if it's a clean break, and you have no spare cores, glue it back together with modellers cement. The core makes no electrical connection.

Making A Tapping

Some circuits involve making a tapping in a coil winding. A tap is a take-off point, between the beginning and end of the winding. The diagram in Fig. 5, shows how this is can be achieved. The usual method is the twisted loop shown in Fig. 5.

Begin winding the coil in the usual way. When you reach the required number of turns where the tap is to be made, hold the last turn firmly with the thumb and pull out

about 10mm of wire.

This length of wire is pulled out at right angles to the former, looped back on itself and a few twists are added to make the wire tight against the former. The winding is then completed.

The end of the twisted lead is scraped clean of enamel using a hobby knife, and it should then be tinned with the soldering iron. This provides the tapping point.

Alternative Method

There is an alternative method and this uses a single loop, which is made at the tapping point (just one twist). This is also scraped clean and tinned. The photograph of the a.t.u. on page 33 shows this method.

The loop then requires a connecting wire to be soldered in place. This method is useful when several tapings are required on a coil and space is at a premium.

Warning! It's vital not to scrape too much enamel off the wire, because the lack of insulation could cause shorted turns on the coil.

Simple Calculations

Generally, this series does not deal with the mathematics of electronics. Despite this, I'm going to describe a very simple calculation, which can work out the number of turns required on a toroid, to produce a required inductance.

Some circuits quote the value of inductance required for a particular application. This is simple to translate to a winding on a toroid.

The chart, Table 1, shows the inductance obtained for 10 turns on some common toroids. I have only quoted the '2' and '6' mix for the common sizes. These are the usual ones used for tuned circuits on the h.f. amateur radio bands. The table shows core mix, colour code and the value in μH (micro-Henries) per 10 turns for four sizes of toroids.

The Formula

The formula is shown below Table 1 (page 33), and if the required inductance, L , is known and the value of inductance for 10 turns, L_{10} , for a particular core, the number of turns required can be derived.

Don't worry, it really is very easy to use the formula. To find out, let's follow it in calculator key-strokes.

Let's say that an inductance of $0.75\mu\text{H}$ is required and it's to be wound on a T37-6 core.

Take up thy calculator, follow these steps and we'll start!

- Step 1: Enter 0.75
(0.75 displayed)
- Step 2: Press divide
(0.75 displayed)
- Step 3: Enter 0.3 (Value 10t on T37-6)
(0.3 displayed)
- Step 4: Press = sign
(2.5 displayed)
- Step 5: Press Square root key ($\sqrt{\quad}$)
(1.5811388 displayed)
- Step 6: Press \times and enter 10 (multiply by 10)
(15.811388 displayed)

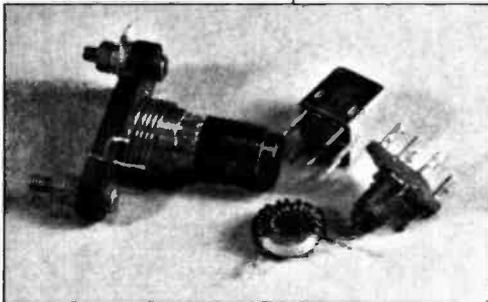
Answer: The core requires a coil of 16 turns to give $0.75\mu\text{H}$ (we round-up the 15.811388 to 16).

What Gauge?

What wire gauge is required? Often articles or projects state the number of turns, without the gauge of wire being given.

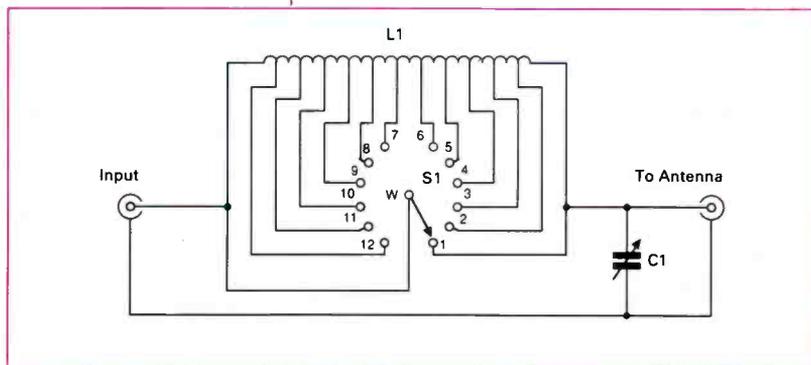
The best guide is to use the thickest gauge of wire that will nicely fill the core giving the 30° gap I mentioned earlier. The chart, Table 2 (page 33), gives the maximum number of turns of a range of wire gauges which will fill particular cores.

This chart refers to a full core. Use the gauge lower than the full core value, to obtain the required gap in the winding. To be really safe, two gauges smaller can be used. The higher the gauge number, the smaller the wire size.



The three main types of inductor found in radio circuits.

Fig. 6: The circuit of the a.t.u., C1 can be any 250-500pf variable capacitor.



Simple Project

Now it's time for a simple project. This month we're going to build an L-Match antenna tuning unit (a.t.u.).

An a.t.u. is a vital part of any amateur radio set-up. The a.t.u. matches the impedance of an antenna to the input impedance of a receiver, or the input and output impedance of a transceiver.

Most receivers and transceivers have an input impedance of 50Ω, the a.t.u., using a combination of inductance and capacitance, makes the antenna appear to be 50Ω.

For many people an antenna is simply a 'piece of wire stuck in the back'. This a.t.u. will help the receiver or transceiver to accept an end-fed piece of wire and provide a good match.

The L-Match requires a good range of inductance and capacitance. In the circuit, Fig. 6, a variable capacitor is used and a tapped coil provides a range of inductance. A single pole 12-way wafer switch, allows 12 values of inductance to be provided by one coil winding with tapings.

The Coil Former

The coil is wound on a 25mm former. Any good insulated material will serve as a former. I used a piece of plastics tube.

The tapings were made using the single loop method, because there are 11 of them to fit along the winding. I also offset the placing of the tapings along the length of the coil to allow more space.

The capacitor is a Polyvaricon type with all sections used, this is fine for a receiver a.t.u. It can also be used for a transmitter with power up to about 5W. Any 200 to 500pf variable can be used.

In fact, the a.t.u. is ideal for QRP (low power) or novice operation on the amateur bands. However, at higher power levels above 5W, a better insulated, air-spaced variable capacitor will be required.

The photograph shows the layout of my prototype. I used three pieces of scrap p.c.b. blank sheet to make a base, and a front and back panel. The wiring is simple and direct.

Table 1.

Inductance for 10 turns on Micrometals Toroids

Core Mix Number	Colour Code	Core Size Prefix (μH/10t)				Frequency Range
		T37	T44	T50	T68	
-2	Red	0.40	0.52	0.49	0.57	1 to 10MHz
-6	Yellow	0.30	0.42	0.40	0.47	10MHz upwards

Formula for number of turns: $N = 10\sqrt{L/L_{10}}$. Where N = number of turns, L = required inductance, L₁₀ = inductance at 10 turns (from Table 1 above). All values of inductance are in μH.

Table 2.

Maximum Number Close Wound Turns On Core

Core Type Number	Internal diameter in inches	Wire Size In s.w.g.					
		20	22	24	26	28	30
T37	0.20	13	17	22	28	35	42
T44	0.224	15	20	26	32	39	47
T50	0.298	21	27	35	43	53	64
T68	0.360	26	34	43	53	65	78

Simple To Use

The a.t.u. is simple to use. It's placed, between the receiver and the antenna. The receiver is then tuned to the desired frequency.

Next, with the capacitor set about half way, rotate the switch until you think the signal is at its loudest. Fine adjustment can then be made with the capacitor for the best reception. It's also good idea to make a scale on the control knobs so that settings for favourite bands or frequencies can be marked.

Well, that's the lot for this time. But keep building, learning and having fun!

Shopping List

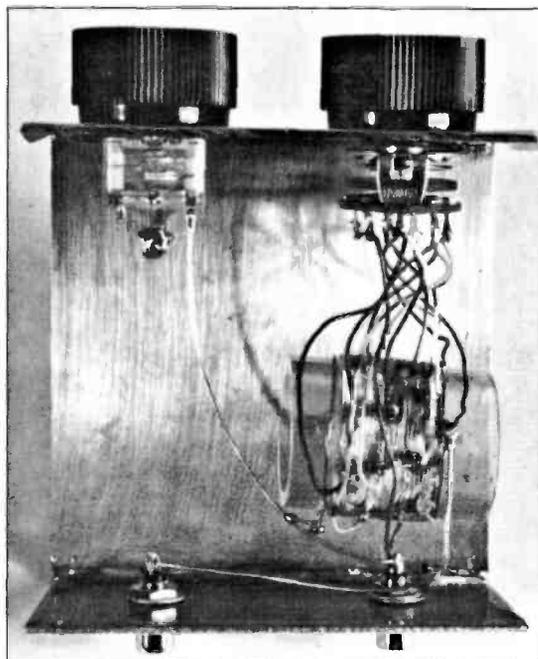
Former (25mm see text) for coil, 22s.w.g. enamelled copper wire for inductance winding, Polyvaricon variable capacitor for C1 (Maplin Electronics FT78K or similar). One single-pole, 12-way wafer switch for S1. (Maplin Electronics 7773Q or similar type suitable). Plugs, sockets and control knobs to suit.

Toroid cores are available from: CirKit Distribution Ltd, Park Lane, Broxbourne, Herts EN10 7NQ. Tel: (0992) 444111 catalogue from W. H. Smith Ltd.

CirKit also supply the Micrometals full RF Toroid Catalogue Stock: 02-55003.

Bonex, 12 Elder way, Langley Business Park, Slough, Berkshire SL3 6EP. Tel: (0753) 49502 also supply the Micrometals range of toroids.

A useful Catalogue of Micrometals toroids can be obtained from: Ferromagnetics, PO Box 577, Mold, Clwyd CH7 1AH.



Photograph showing the layout for the a.t.u. project, by G3RJV.

Errors & Updates

A Simple Capacitor Checker March 1992 (p41-43)

In the circuit diagram of Fig. 1 the junction of capacitors C1-5 should be connected to pin 11, the gate output pin, of IC1b. In the photograph of the overlay Fig. 2 the lead marked 'To junction C1-C5' must be connected one hole to the right, in position N19 (and not position N18 as shown).

The integrated circuit IC1 is mounted with pin one at the bottom left as shown in the photograph. If this is marked with a notch, then this notch is to the left. We apologise for the indistinct reproduction of this area around IC1 in the photograph.

Going abroad this year? Want to take your rig and perhaps become one of those 'exotic' calls? To help you in your vacation plans, the PW team have compiled a list from the basic information available, to help you on the way to that reciprocal licence.

On Holiday? How

To start off, the following countries either offer reciprocal licences, in other words a bilateral agreement, or visitors' licences (unilaterally), or have implemented CEPT TR61-01 to radio amateurs from the United Kingdom.

The UK Licence

The current UK licence conforms to the CEPT Recommendation TR61-01. This makes it much easier for British amateurs, who visit other European countries which have also implemented this recommendation.

Those countries which have implemented the agreement, have the letters CEPT against them in the list. At present not all CEPT countries have implemented the recommendation. However, the list given below was correct at the time we were preparing to go to press.

Mobile Or Portable

If you are visiting a CEPT country, and intend to operate only a mobile or portable station (which includes station powered from mains electricity at a temporary fixed location, such as a hotel), or the station of another amateur, then you should apply to the address given for a copy of their licensing conditions.

You should then take these conditions, your UK licence and current licence

validation document (if it has been renewed) with you to be permitted to operate. You must comply with the foreign regulations and your UK licence, whichever is the more restrictive.

For example, the UK licence permits operation on 70MHz, but most foreign countries do not. In this case the foreign regulations prevail, and you may not operate on 70MHz in these countries.

Kilowatt Operation

Some countries permit operation at 1kW, but the UK licence (at the time of writing) doesn't. In this case, your UK licence prevails and you may not operate at this power level.

Please also note that the CEPT agreement, limits a UK Class B licensee to operation on 144MHz and above.

If you are staying longer, intend to stay in something other than a hotel or similar, or wish to gain the privileges of a host licence, you will still need to apply for a reciprocal licence.

Reciprocal And Visitors' Licences

Applications should be made to the addresses provided, but please allow plenty of time (between one and six months depending on the country).

Country & Contact address

Andorra
Delegation Permanente pour l'Andorre,
Prefecture des Pyrennes Orientales,
66 000 PERPIGNAN, France.

Australia +VK9
Assistant Secretary,
Licensing Policy & Operations,
RF Management Division, PO Box 6444,
St Kilda Road Central, Melbourne, Victoria
3004. Tel: 010 61 03 266 8921. Telex 37503.
High Commissioner,
Australian High Commission,
Australia House,
Strand, London WC2B 4LA.
Tel: 071-379 4334.

Austria (CEPT)
P & T Direktion,
Als Femmeldebehorde I. Instanz, DE1, 3, 4
(Wien Vienna), Nierosterreich (Lower
Austria and Burgenland respectively,
A-1011 Wien, Dr Darl
Lueger Platz 5. DE2, 5 (Saltzburg and
Oberosterreich (Upper Austria)
A-4010 Linz, ZollamtstraÙe 1. DE7,
9 (Tirol and Vorarlberg in Innsbruck).
Austrian Embassy,
18 Belgrave Mews West,
London SW1X 8HU. Tel: 071-235 3731.

Barbados
The Telecomms Engineer,
Ministry of Transport,
Works and Telecomms.,
East-West Boulevard,
Pine Bridgetown, Barbados.
Tel: 010 1 809 42 62669.
Class A only.
High Commissioner,
Barbados High Commission,
1 Great Russell Street, London
WC1B 3NH.
Tel: 071-631 4975.

Bahama Islands
Telecommunications Corporation,
PO Box 3048, Nasseu.
High Commissioner,
Bahamas High Commission,

Bahamas House,
10 Chesterfield Street,
London W1X 8AH. Tel: 071-408 4488.

Belgium (CEPT)
Rigiedes Telegraphes et des Telephones,
Service National de Controle,
du Spectre des frequencys,
Tour TBR (7eme etage),
Boulevard E Jacquain 186,
1210 Brussels.
Belgian Embassy,
103 Eaton Square,
London SW1W 9AB. Tel: 071-235 5422.

Brunei
Controller of Telecommunications,
Telecommunications Headquarters,
Bandar Seri Begawan, Brunei.
Class A only.
High Commissioner,
Brunei Darussalam High Commission,
49 Cromwell Road,
London SW7 2ED. Tel: 071-581 0521.

Bolivia
Radio Club Boliviano, PO Box 2111, La Paz.
Class A only.
Bolivian Embassy, 106 Eaton Square,
London SW1W 9AD.
Tel: 071-235 2257/4248.

Botswana
Botswana Telecomms Corporation,
The Mall, Gaborone.
Telex: 2252 Botswana.
Class A only.
High Commissioner,
Botswana High Commission,
6 Stratford Place,
London W1N 9AE. Tel: 071-499 0031.

Bulgaria
Bulgarian Federation of Radio Amateurs,
PO Box 830, Sofia-C.
Class A only.
Embassy of the Republic of Bulgaria,
186-188 Queen's Gate,
London SW7 5HL. Tel: 071-584 9400/9433.

Canada
Head Office: 300 Slater St,

Ottawa, Ontario K1A 0C8.
High Commissioner,
Canadian High Commission,
Macdonald House,
1 Grosvenor House,
London W1X 0AB. Tel: 071-629 9492.

Chile
Radio Club de Chile,
Casilla 13630, Correo,
Santiago, Chile.
Class A only.
Embassy of Chile,
12 Devonshire Street,
London W1N 2DS. Tel: 071-580 6392/7.

Columbia
Ministerio de comunicacoaes,
Bogota DE1.
Class A only.
Colombian Embassy,
3 Hans Crescent,
London SW1X 0LR. Tel: 071-589 9177.

Costa Rica
Radio Club de Costa Rica,
TIORC, Apartado 2412,
Edificio Crystal,
Cly3a, Ctl,
San Jose, 1000 Costa Rica.
Tel: 010 506 21-69-03.
Class A only.
Costa Rican Embassy,
Flat 1, 14 Lancaster Gate,
London W2 3LH.
Tel: 071-723 1772/9630.

Cyprus
Senior Telecomms Officer,
Ministry of Comms & Works,
Nicosia, Cyprus.
Tel: 010 357 24 02268.
High Commissioner,
Cyprus High Commission,
93 Park Street,
London W1Y 4ET. Tel: 071-499 2810.

Denmark (CEPT)
Post-og Telegrafvaesnet,
Radioteknisk Tjeneste,
Tilddelsessektionen,
Islands Brygge 83C,

DK-2300 Copenhagen S.
Class A only.
Royal Danish Embassy,
55 Sloane Street,
London SW1X 9SR. Tel: 071-333 0200.

Dominican Republic
Direccion General de
Telecomunicaciones,
Santo Domingo, Dominican Republic.
Class A only.
Honorary Consul-General,
Honorary Consulate General,
539 Martins Building,
Water Street, Liverpool L2 3TE.
Tel: 051-236 0722.

Falklands Islands
The Postmaster,
General Post Office,
Port Stanley, Falkland Islands,
South Atlantic.
Government Representative,
Falkland Islands Government Office,
Falkland House,
14 The Broadway,
London SW1N 0BH. Tel: 071-222 2542.

Finland (CEPT)
General Directorate of Post & Telecoms,
PO Box 529,
SF-00101 Helsinki, Finland.
Finnish Embassy and Consulate,
38 Chesham Place,
London SW1X 8HW. Tel: 071-235 9531.

France (CEPT)
Direction des Telecommunications des
Reseaux Exterieurs,
Centre de Gestion des
Radiocommunications,
Boite Postale 75,
F-94002 CRETEIL, CEDEX.
Tel: 010 33 14 595 33 00.
French Embassy,
58 Knightsbridge,
London SW1X 7JT. Tel: 071-235 8080.

The Gambia
GAMTEL (Licensing Authority),
Banjul, The Gambia. Attn: M M Cham,
Licensing Officer.

To Get Your Reciprocal Licence



**High Commissioner,
Gambia High Commission,
57 Kensington Court,
London W8 5DG. Tel: 071-937 6316.**

Gibraltar
The Wireless Officer,
General Post Office,
104 Main Street, Gibraltar.

Germany (CEPT)
Deutscher Amateur Radio Club,
International Affairs,
Postfach 1155, D-3507 Baunatal 1.
**Embassy of the Federal Republic of
Germany,
23 Belgrave Square,
London SW1X 8PZ. Tel: 071-235 5033.**

Greece (CEPT)
Ministry of Telecoms.,
Directorate of Communications Technology,
49 Syngrou Avenue,
GR-11780 Athens, Greece.
**Embassy of Greece,
1A Holland Park,
London W11 3TP. Tel: 071-727 8040.**

Grenada
Wireless Officer,
Ministry of Communications & Works,
St George's, Grenada, West Indies.
**High Commissioner,
Grenada High Commission,
1 Collingham Gardens,
London SW5 0HW. Tel: 071-373 7808.**

Guatemala
Direccion General de Radio Sub Director,
General del la Direccion,
General de Radiodifusion y Television
Nacional,
5a Avenida 13-18 Zona 1,
Guatemala City, Guatemala.

**Class A only,
Embassy of Guatemala,
13 Fawcett Street,
London SW10 9HN. Tel: 071-351 3042.**

Hong Kong
Officer in Charge,
Telecommunications Branch,
19th Floor, Sincere Building,
173 Des Voeux Road,
Central, Hong Kong.
**Commissioner, London Office,
Hong Kong Government Office,
6 Grafton Street,
London W1X 3LB. Tel: 071-499 9821.**

Honduras
Direccion de Radio Nacional, Hondutel,
Tegucigalpa,
Honduras.
**Class A only,
Embassy of Honduras,
115 Gloucester Place,
London W1H 3PJ. Tel: 071-486 4880.**

Hungary
Frekvencia Gazdalkodasi Intezet,
Ostrom U, 23/25, H/1012 Budapest.
**Class A only,
Embassy of the Republic of Hungary,
35 Eaton Place,
London SW1X 8BY. Tel: 071-235 4048/7191.**

Iceland
The Icelandic Post & Telecommunication
Administration,
Amateur Guest licensing,
Attn: Mr Gustav Amar,
Landssimahusinu vid Austurvoll,
101 Reykjavik, Iceland.
Tel: 010 354 1 26000.
**Embassy of Iceland,
1 Eaton Terrace,
London SW1W 8EY. Tel: 071-730 5131.**

India
Ministry of Comms,
Sanchar Bhavan,
20 Ashoka Road,
New Delhi 110001, India.
**Class A only,
High Commissioner,
Indian High Commission,
India House, Aldwych,
London WC2B 4NA. Tel: 071-836 8484.**

Indonesia
Organissai Amatir Radio Indonesia,
Jalan Pecenongan No 69,
Jakarta.
**Class A only,
Indonesian Embassy,
38 Grosvenor Square,
London W1X 9AD. Tel: 071-499 7661.**

Ireland (Eire)
Radio & Broadcasting Division,
Dept of Communications,
Scotch House, Hawkins Street,
Dublin 2. Tel: 0001 718211.
**Irish Embassy,
17 Grosvenor Place,
London SW1X 7HR. Tel: 071-235 2171.**

Israel
Ministry of Communications,
PO Box 29107, Tel-Aviv 61290,
Israel.
**Embassy of Israel,
2 Palace Green,
Kensington,
London W8 4QB. Tel: 071-937 8050.**

Italy
Either:
ARI, Reciprocal Licensing Department,
Via Giorgione 16, I - 40133 Bologna,
Italy. Tel: 010 39 51 389502 (English spoken
after 8pm GMT);

or
Ministero Delle Poste E Delle
Telecomunicazioni,
Direzione Centrale del Servizi Radioelettrici,
Divisione 6 - Sezione 4,
Viale Europa 160,
I-00100 Roma/Eur RM.
**Italian Embassy,
14 Three Kings Yard,
Davies Street,
London W1Y 2EH. Tel: 071-629 8200.**

Jamaica
Headquarters,
Posts and Telegraphs Dept,
South Camp Road,
Kingston, Jamaica.
**Class A only,
High Commissioner,
Jamaican High Commission,
1-2 Prince Consort Road,
London SW7 2BZ. Tel: 071-823 9911.**

Jordan
The Director General, Telecommunications
Corporation,
PO Box 1689,
Amman, Jordan.
**Embassy of the Hashemite Kingdom of
Jordan,
6 Upper Phillimore Gardens,
London W8 7HB. Tel: 071-937 3685/7.**

Kenya
Kenya Posts and Telecommunications,
PO Box 30301,
Nairobi, Kenya.
**Class A only,
High Commissioner,
Kenya High Commission,
45 Portland Place,
London W1N 4AS. Tel: 071-636 2371.**

Liechtenstein
(CEPT)
Regierung des Fürstentums Liechtenstein,
FL 9490 Vaduz, Liechtenstein.

Lebanon
Ministere des PTT,
Direction generale des telegraphes et
telephones,
Bir Hassan, Beirut,
Lebanon.
**Class A only,
Lebanese Embassy in London,
21 Kensington Palace Gardens,
London W8 4QM. Tel: 071-229 7265/6.**

Liberia
Ministry of Post & Telecommunications,
Monrovia, Liberia.
**Class A only,
Charge d'Affaires,
Embassy of The Republic of Liberia,
2 Pembridge Place,
London W2 4XB. Tel: 071-221 1036.**

Luxembourg (CEPT)
Administration des Postes et Telecoms,
Boite Postale 999,
Luxembourg-ville,
Luxembourg.
**Class A only,
Embassy of Luxembourg,
27 Wilton Crescent,
London SW1X 8SD. Tel: 071-235 6961.**

Malagasy
Ministere des postes et
telecommunications,
Antanarenina,
Tananarive, Malagasy.

Malta
Inspector of Wireless Telegraphy,
Wireless Telegraphy Branch,
Castille, Valetta, Malta.
Tel: 010 356 225231/224901.
**High Commissioner,
Malta High Commission,
16 Kensington Square,
London W8 5HH. Tel: 071-938 1712.**

Mauritius
The Director, Telecommunications Dept,
Edith Cavell Street,
Port Louis, Mauritius.

Class A only.
**High Commissioner,
Mauritius High Commission,
32-33 Elvaston Place,
London SW7 5NW. Tel: 071-581 0294.**

Monaco (CEPT)
Direction generale des telecommunications,
16 Boulevard de Suisse,
Monte Carlo.
**Consulate General of Monaco,
4 Audley Square,
London W1Y 5DR. Tel: 071-629 0734.**

Morocco
Ministere des PTT,
Division des telecommunications,
Rabat, Morocco. Class A only.
**Embassy of The Kingdom of Morocco,
49 Queens Gate Gardens,
London SW7 5NE. Tel: 071-581 5001/4.**

Montserrat
The Ministry of Communications and
Works, General Turning Road,
Plymouth, Montserrat, West Indies.
Class A only.

Netherlands (CEPT)
PTT Centrale Directie,
Radio Control Service,
PO Box 570, NL-9700 AN Groningen,
The Netherlands.
Tel: 010 31 506 02514. Telex: 77154.
**Royal Netherlands Embassy,
38 Hyde Park Gate,
London SW7 5DP. Tel: 071-584 5040.**

**Netherlands
Antilles**
Radio Controle Dienst,
Landsradio, Schouwburgweg,
Apna-gebouw, Curacao,
Netherlands Antilles.
Tel: 010 31 631111.

New Zealand
In advance:
Telecommunications Division (Radio),
Post Office Headquarters,
Wellington, New Zealand.
**High Commissioner,
New Zealand High Commission,
New Zealand House,
Haymarket,
London SW7 4TL. Tel: 071-930 8422.**

Nicaragua
Jefatura de Comunicaciones,
Managua, DN, Nicaragua.
Class A only.
**Embassy of Nicaragua,
8 Gloucester Road,
London SW7 4PP. Tel: 071-584 4365.**

Nigeria
Nigerian Amateur Radio Society,
PO Box 2873, Lagos,
Nigeria.
Class A only.
**High Commissioner,
Nigeria High Commission,
56-57 Fleet Street,
London EC4Y 1JU. Tel: 071-353 3776.**

Norway (CEPT)
Norwegian Telecommunications Admin,
Radio Inspection Office,
Boks 6701, St Olavs Plass, Oslo 1,
Norway. Class A only.
**Royal Norwegian Embassy,
25 Belgrave Square,
London, SW1X 8QD. Tel: 071-235 7151.**

Oman
Royal Omani Amateur Radio Society,
PO Box 981, Muscat, Oman.
Class A only.
**Embassy of The Sultanate of Oman,
44A/B Montpelier Square,
London SW7 1JJ. Tel: 071-584 6782/3/4.**

Panama
Ministerio de Gobierno y Justicia,
Direccion Nacional de Medio de
Comunicacion Social,
Apartado Postal 1628, Zona 1,
PANAMA, Republic de Panama.
**Embassy of The Republic of Panama,
119 Crawford Street,
London W1H 1AF. Tel: 071-487 5633.**

Paraguay
Radio Club Paraguayo,
Casilla Postal 512,

Asuncion, Paraguay.
Class A only.
**Embassy of Paraguay,
Braemar Lodge,
Cornwall Gardens,
London SW7 4AQ. Tel: 071-937 1253.**

Peru
Ministerio de Transportes y
Comunicaciones,
Av 28 de Julio 800,
Lima, Peru.
Class A only.
**Peruvian Embassy,
52 Sloane Street,
London SW1X 9SP. Tel: 071-235 1917/2545.**

Philippines
Planning Division,
Telecommunication Control Bureau,
5th Floor, Delos Santos Building,
Quezon Avenue, Quezon City,
Philippines.
**Embassy of the Philippines,
9a Palace Green,
London W8 4QE. Tel: 071-937 1600/9.**

Pitcairn & Henderson
Amateur Radio Section,
Radio Regulatory Div.,
Department of Trade & Industry,
Waterloo Bridge House,
London SE1 8UA.

Poland
Główny Inspektorat Państwowej Inspekcji
Radiowej via the national society - Polski
Związek Krotkofalowcow,
Zerząd Główny, PO Box 320, 00-950
Warszawa 1.
**Embassy of The Republic of Poland,
47 Portland Place,
London W1N 3AG. Tel: 071-580 4324.**

Portugal
Direccao dos Servicos de
Radiocomunicacoes,
Rua do Conde Redondo 79-1,
1189 Lisboa, Portugal.
Telex: 12595 RACTEX P.
**Portuguese Embassy,
11 Belgrave Square,
London SW1X 8PP. Tel: 071-235 5331.**

Romania
The Ministry of Transport and
Telecommunications,
Bd Dinicu Golescu nr 38R-7,
Bucharest, Romania.
Class A only.
**Embassy of Romania,
4 Palace Green,
London W8 4QD. Tel: 071-937 9666.**

St. Lucia
Police HQ, Castries,
St Lucia.
**High Commissioner,
St Lucia High Commission,
10 Kensington Court,
London W8 5DL. Tel: 071-937 9522.**

Seychelles
Telecommunications Dept.,
Ministry of Education,
Information and Youth,
Mont Fleur, PO Box 48,
Republic of Seychelles.
Class A only.
**High Commissioner,
Seychelles High Commission,
Box No. 4PE,
111 Baker Street,
2nd Floor, Eros House,
London W1M 1FE. Tel: 071-224 1660.**

Singapore
Telecom Authority of Singapore,
PO Box 399,
Killiney Road PO, Singapore 9123.
Class A only.
**High Commissioner,
Singapore High Commission,
9 Wilton Crescent,
London SW1X 8SA. Tel: 071-235 8315.**

Solomon Islands
The Controller of Posts and
Telecommunications,
GPO, Honiara, Solomon Islands.
Class A only.
**Honorary Consulate,
19 Springfield Road,
London SW19 7AL.
Tel: 081-946 5552.**

South Africa
Postmaster General, Private Bag X74,
0001 Pretoria,
South Africa.
Tel: 010 27 12293-1171.
Class A only. **Embassy of The Republic of
South Africa,
South Africa House,
Trafalgar Square,
London WC2N 5DP. Tel: 071-930 4488.**

Spain (CEPT)
Sr Ing Jefe de los Servicios de
Telecomunicacion,
Direccion General de Correos y
Telecomunicacion,
Subdireccion General de
Telecomunicacion,
DCHA, Madrid-14, Spain.
**Spanish Embassy,
24 Belgrave Square,
London SW1X 8SA. Tel: 071-235 5555.**

Sri Lanka
Office of the Director of Telecomms,
5th Floor, Telecomms HQ,
Lotus Road, Fort, PO Box 503, Colombo 1,
Sn Lanka.
Class A only.
**High Commissioner,
High Commission for the Democratic
Socialist Republic of Sri Lanka,
13 Hyde Park Gardens,
London W2 2LU. Tel: 071-262 1841.**

Suriname
Vereniging van Radioamateurs in Suriname,
PO Box 1153,
Paramaribo, Suriname.
Class A only. (All correspondence direct to
this address)

Swaziland
The Director of Posts and
Telecommunications,
PO Box 125,
Mbabane, Swaziland.
Class A only.
**High Commissioner,
Kingdom of Swaziland High Commission,
58 Pont Street,
London SW1X 8AE. Tel: 071-581 4976/8.**

Sweden (CEPT)
Televerkets Radiodivision,
Tillstanskontoret, S123 88 Farsta, Sweden.
**Swedish Embassy,
11 Montagu Place,
London W1H 2AL. Tel: 071-724 2101.**

Switzerland (CEPT)
Generaldirektion der PTT,
Radio und Fernseh Abteilung,
CH-3000 Berne, Switzerland.
**Embassy of Switzerland,
16-18 Montagu Place,
London W1H 2BQ. Tel: 071-723 0701.**

Syria
Direction generale de L'establissement des
postes et des telecommunications,
Damascus, Syria.
**Embassy of The Syrian Arab Republic,
8 Belgrave Square,
London SW1X 8PH. Tel: 071-245 9012.**

Tonga
The Superintendent,
Telegraph & Telephone Department,
PO Box 46, Nuku'alofa, Tonga.
Class A only.
**High Commissioner,
Tonga High Commission,
36 Molyneux Street,
London W1H 6AB. Tel: 071-724 5828.**

Turkey CEPT only.
**Turkish Embassy,
43 Belgrave Square,
London SW1X 8PA. Tel: 071-235 5252.**

United Nations
Station Manager IARC,
International Amateur Radio Club,
Box 6, Place des Nations,
CH-1211 Geneva 20, Switzerland.

Uruguay
Radio Club Uruguayo,
PO Box 37, Montevideo, Uruguay.
Class A only.
**Embassy of The Oriental Republic of
Uruguay,
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your trip. Bon voyage!**

In last month's column I dealt with the safety aspect of 27MHz mobile antennas. So, this time I thought perhaps it would be a good idea to look at a few notes about coaxial cables and the old, old problem of s.w.r.

Did you know for instance, that if the s.w.r., measured between the transceiver and the coaxial cable to the antenna, is only a fraction higher than 1:1 (unity) it will always be higher at the antenna! Why? (think about it but don't worry about it!)

Coaxial Cable

A suitable and commonly used coaxial cable for 27MHz mobile, or base station antennas is (M)UR43, or an equivalent. The length of cable used for 27MHz, even for base station operation, will normally be too short to offer much attenuation.

Attenuation is a form of resistive loss inherent in all coaxial cables. In fact, even with a cable run of 10 to 15 metres, the loss factor will be a little more than 0.5dB, which we can virtually ignore. *(M)UR43 and (M)UR67, or equivalents, are NOT suitable for 934MHz. More on this next month.*

Wise Buy

By the way, it's always wise to buy a little more cable than you need anyway, say an extra two or three metres. Although it may be a little too long, don't cut it!

I'm giving you this advice because a change in base station antenna and height, or a change in vehicle at some time, may require a little more cable. If the cable used to feed your base station antenna is too long, it can be coiled up as shown in the photo, Fig. 1.

It can then be hung on the wall outside, or indoors. For a mobile installation, you can coil the cable up and stow it away inside the 'boot' or under a seat.

If a length of coaxial cable is too short, you can join the required extra length by using suitable r.f. plugs and a dual (socket) coupler.

Do not make a join in coaxial cable by soldering inner and outer conductors, or by using electrical block connectors and covering with insulating tape. Oh yes, people do use methods like that, and then they wonder why the s.w.r. won't come down!

Standing Wave Ratio

Standing wave ratio, and its measurement, is a controversial subject especially with radio amateurs! And now it's time for you to see how easy it is to lose nearly half the precious 4W of r.f. power from your rig!

First, let's assume that your coaxial cable has no loss. In that case none of the power going to the antenna would be lost and neither would the level of received signals be reduced.

What follows now, assumes that you have a s.w.r. meter connected between the transceiver and the coaxial cable. The meter may be a Practical Wireless, May 1992

CB HIGH & LOW

By 'Quaynotes'

This month 'Quaynotes' looks at the thorny old (and much misunderstood) problem of s.w.r. and how to tackle it successfully, and reminds readers that he welcomes your letters.

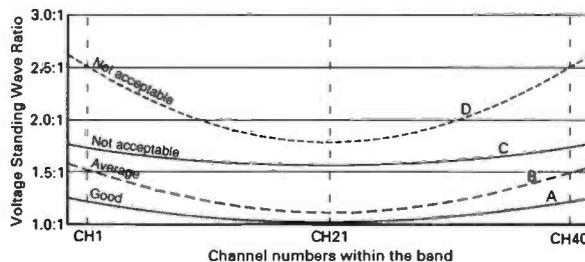


Fig. 2: Some examples of s.w.r. versus bandwidth responses. The example marked 'good' means exactly that. The 'average' is acceptable, but those marked NOT acceptable are to be avoided (see text).

dual movement type, with 'Forward' for your 4W of power on one meter, and the actual s.w.r. reading on the other.

If it's a single meter, dual pointer type, one pointer should be 'reading' the power and the other the s.w.r. The other common type is the single meter, switched selection instrument. In this case, the same meter movement reads both the forward power (when it's selected) and then the 'reflected' power, which is given as a ration on the pointer scale.

Antenna Adjustments

If you have made the necessary adjustment(s) to the antenna, and have obtained a s.w.r. ratio of 1:1, or unity, or very close to it at the mid-band frequency (channel 21), you have done well! All your rig's 4W will then be reaching the antenna. If this also has no self-loss, then all 4W will be radiated.

However, perhaps you can't get that magical 1:1 reading. (If anyone tells you it doesn't

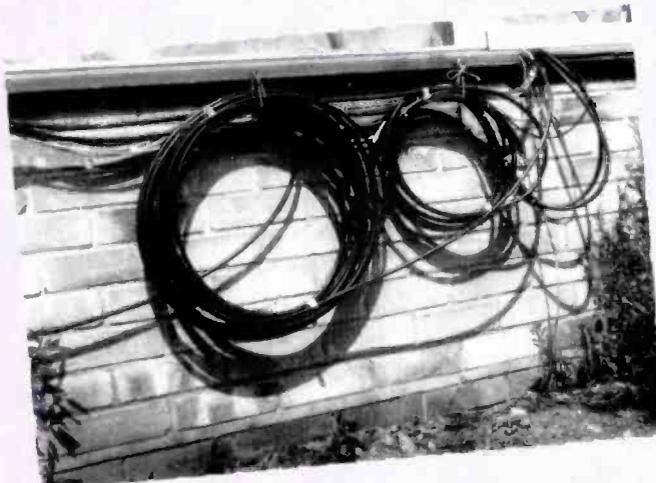


Fig. 1: Do not cut coaxial cable if it's slightly over length (see text). The extra cable should be coiled up, as shown in the illustration. It won't cause any appreciable loss and that extra metre or so, may be required later.

matter, ignore their comment!). What reading have you got?

Firstly, I suggest that you take a look at Fig. 2, which shows different s.w.r. versus bandwidth read-outs. You can plot your own 'curve' on a similar graph format (copy that from Fig. 2). You can also use the same graph for the CEPT 27MHz CB band. All you do, is just change the frequencies.

Curve Close

The curve marked 'good' on the graph in Fig. 2, is about as close as you will get across the whole band. The reason for this is simple, and it's because the antenna tends to exhibit a small mismatch, as the frequency is changed from 'mid-band' to one higher or lower. The curve marked 'average' is acceptable, but the other two shown on the graph aren't!

Let's take a closer look at the lower 'not acceptable' curve. This plot is indicative of a fairly flat antenna bandwidth response, but the mid-band s.w.r. is about 1.6 to 1 higher at each end of the band. This means, (we're still assuming there's NO cable loss), that the r.f. power arriving at the antenna will be in the region of 3.3W. Think about that!

Now, we'll take a look at the upper 'not acceptable' curve. This shows it's nearly 1.8 to 1 at band centre but each 'end' is over 2.5 to 1!

At mid-band, the power at the antenna is a fraction over 3W and at the band ends a little under 3W. A quarter of your power is lost!

Do Something!

Don't just think about that unnecessary loss of power, it's time to do something! To help you, here's a checklist:

- Have you properly carried out the required adjustments to the antenna to obtain minimum s.w.r.?
- Perhaps the antenna is poorly designed and adjustment for a minimum s.w.r. reading is not effective.
- The coaxial cable, although new, may be of poor quality.
- The cable may be of the wrong impedance in other words, it may not be 50Ω.

(e) You may be using old cable that has seen better days.

Incidentally, this approach applies to operating on 934MHz. At this frequency, the coaxial cable MUST be a good quality, VERY LOW LOSS grade.

What next? There's been a lot of grumbling about those who jam up the conscientious 4W output limit f.m. operators, with single sideband and amplitude modulation (s.s.b. and a.m.). These operators often use high power linear amplifiers (the so-called 'after burners'). Can we do anything about it? Unfortunately, there's no more space this time, so I'll talk about it next month. Cheerio for now.

Quaynotes

Mathematics For The RAE

This month Ray Fautley G3ASG takes a look at the complex world of mathematics associated with sinewaves, and the relationship between sinewaves and their frequency.

First this month, we'll take a look at the relationships which exist between the different ways of expressing the amplitude of a sinewave. The diagram, Fig. 19(b), shows a sinewave (it could represent a voltage or a current waveform) with the relative levels of peak, r.m.s., and peak-to-peak indicated.

If we were to look at the waveform of the ordinary domestic electricity supply on an oscilloscope, the shape we'd see on the screen, would be just like the curves shown in Fig. 1.

Warning note! Please don't try this, as the voltage involved is dangerous!

After the warning, it's back to our example! The maximum swing from + (positive) through zero to - (negative) is known as the peak-to-peak amplitude of the wave. It's quite logical to call it that, isn't it?

It would be easy to measure the peak-to-peak amplitude of such a voltage on an oscilloscope. But it's **not so easy** on a meter.

An a.c. voltmeter is normally calibrated to read the r.m.s. value of the voltage, and it's this value which is most commonly used. I think that a word or two about r.m.s. is necessary here, so we'll take a quick look.

The term r.m.s. stands for the phrase Root Mean Square. Not much wiser? Don't worry, forget the theory here, and just try to remember the following: that the r.m.s. value of a voltage or current, is equivalent to that value of direct voltage or current (d.c) which has the same heating effect if connected to a resistive load.

As always, an example is the best way to understand the problem. We'll take our domestic mains as a convenient example.

Our domestic electricity supply is quoted as being 240V r.m.s. This means that its heating effect, when applied to a resistive load, is the same as that of a 240V battery, or a 240V d.c supply.

What really concerns us, is the relationship between the **peak**, **r.m.s.** and **peak-to-peak** values of the alternating wave, and this is not very difficult to understand.

Peak-To-Peak

The peak-to-peak amplitude of an a.c signal is twice the **peak amplitude**, this is shown clearly in Fig.1(a). The r.m.s. amplitude of an a.c. signal is 0.707 times the peak amplitude also shown in Fig. 1.

It's not necessary here to prove this statement

theoretically, although it can be shown mathematically to be true. You'll probably be pleased to know, that for RAE purposes, you only need to learn the following relationships:

$$(i) V_{r.m.s.} = 0.707 * V_{peak}$$

$$(ii) V_{peak-peak} = 2 * V_{peak}$$

and so we can see;

$$V_{peak} = \frac{V_{rms}}{0.707}$$

From (i) above $V_{r.m.s.} = 0.707 * V_{peak}$, it follows that:

(iii) $V_{peak} = V_{r.m.s.} * 1.414$ (as 1.414 is the reciprocal of 0.707).

Practical Example

As a practical example, we'll take the 240V r.m.s. mains voltage again.

$$V_{peak} = 1.414 * 240 = 339.4 \text{ or near enough}$$

$$340V_{peak}$$

$$V_{peak-to-peak} = 2 * V_{peak} = 2 * 340 = 680V_{peak-to-peak}.$$

If that bit has sunk in, the following worked example should be easy!

On an oscilloscope, a sinewave measures 75mV peak-to-peak. What is its r.m.s. value?

$$\text{From (ii) above } V_{peak} = 0.5 * V_{peak-peak}$$

$$\text{and from (i) } V_{r.m.s.} = 0.707 * V_{peak}$$

$$\text{and so } V_{r.m.s.} = 0.707 * 0.5 * V_{peak-peak} \text{ or } 0.707 * 0.5 * 75mV = 26.5mV.$$

Let's look at just just one more example. What is the peak value of a 17V r.m.s. sinewave?

From (iii), we have $V_{peak} = V_{r.m.s.} * 1.414$, so the answer is

$$V_{peak} = 17 * 1.414 = 24V$$

Sinewaves And Frequency

Another feature of a sinewave is its frequency. The frequency of a sinewave is the number of whole cycles of the waveform, that occur in a time period of one second.

Again, for convenience we'll take the mains supply as an example. The supply frequency is given as 50Hz. Now 1Hz means **one complete cycle occurring during a time period of one second**. So, 50Hz means **50 complete cycles occurring during a time period of one second**.

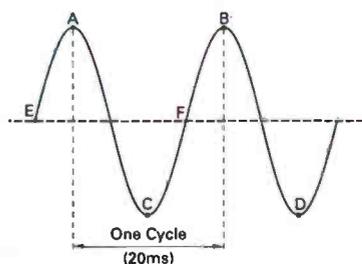


Fig.1(a): A sinewave, with relative levels of peak, r.m.s. and peak-to-peak indicated.

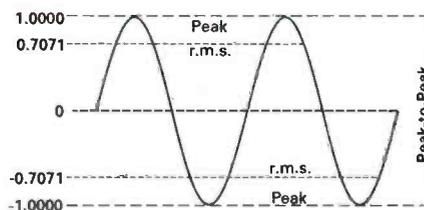


Fig. 1(b): The British 'mains' supply standard of 50Hz, provides a convenient example of a sinewave. The term 1Hz means that one complete cycle takes place during a time period of one second. So, the term 50Hz means that 50 complete cycles occur during a time period of one second.

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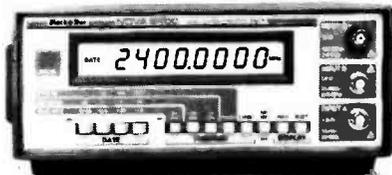
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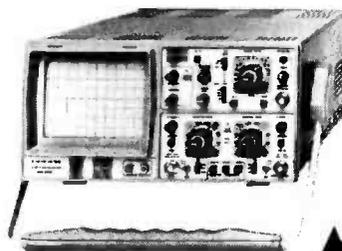
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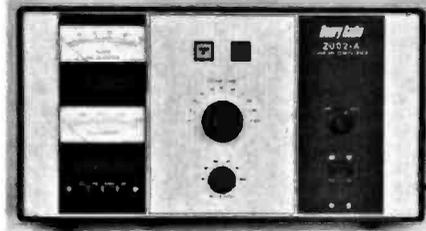
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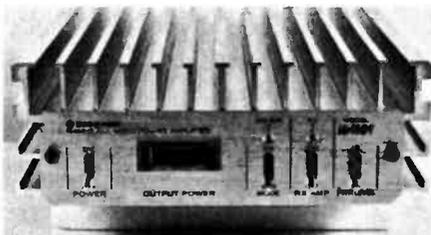
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HL63U	70cm 10/25W in 50W out pre amp	£220.00	C
HL130U	70cm 3/10/25W in 120W out pre amp	£397.00	C
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One complete cycle is shown on Fig. 1(a), between points A and B, C and D, or E and F.

The relationship between frequency and time is:

$$\text{frequency (Hz)} = \frac{1}{\text{time}(t)}$$

Where f is the frequency of the waveform in Hertz (Hertz) and t is the time period for one complete cycle in s (seconds). Transposing gives us a time/frequency relationship of:

$$\text{time}(t) = \frac{1}{\text{frequency (Hz)}}$$

Taking the 50Hz mains supply again, the time

period is $1/50\text{Hz}$, which is 20 milliseconds (20ms).

A different example; what is the frequency of a waveform having a time period of one microsecond (1 μs) for one complete cycle?

From the frequency/time relationship we have frequency is $1\text{sec}/\text{time period}$. This gives

$$f = \frac{1}{1\mu\text{sec}} = 1\text{MHz}$$

That's all for this time, I hope I've taken some of the mystery out of sinewaves for you!

Radio Diary continued from page 19

May 17: The 'Parkanaur' Rally will be held at the Silverwood Hotel, Lurgan, Co. Armagh. Doors open from 12 noon. There will be the usual trade stands, Bring & Buy, bookstall, QSL bureau, etc. Talk-in on S22 145.550. The proceeds of this rally will go to the Stanley Eakins Memorial Fund, at Parkanaur, near Dungannon. This is a very worthy charity, and they hope to see a really good turn out of everyone interested in all aspects of radio and electronics. Details from **Jim Lappin** on (0762) 851179.

May 24: The Plymouth Radio & Electronics Fair by the Plymouth Radio Club will be held at Plymouth Comprehensive School, Church Road, Plymouth. Over 25 stalls selling electronic, computer and radio components. Many second-hand bargains for the enthusiast. Free parking, Bring & Buy, club station on the air, bookstall, hot & cold buffet and grand reffé. Doors open 11am, admission is £1 at door. For further information, phone **Plymouth 787181**.

May 24: The 16th East Suffolk Wireless Revival 1992 is to be held at the Maidenhill Sports Centre, Ipswich, Suffolk. Among the main attractions this year will be Bring & Buy, car boot sale, book stall for RSGB books and vintage radio display, Suffolk Data Group, satellite/e.m.e. prediction service, antenna measurements, BYLARA, RAI/BC, Scout Radio, RAYNET stands and Ipswich Area Novice and RAE Exam bookings. All the usual traders, plus non-radio stalls and children's play area. Refreshments and bar available. Lots of other attractions, providing an enjoyable day out for all the family. The price of admission (including ample car parking) is £1. Talk-in on S22 (GB4SWR), listening out on GB3PD (R2) and GB3IH (RB4). Send an s.a.e. for free maps. Doors open 10am. **Bob Baal G7HZV, 14 Gainsborough Road, Felixstowe, Suffolk IP11 7HS, or via packet, G4YQC @ GB7MXM. Trader enquiries only to Syd Mason G0JMY, 367 Norwich Road, Ipswich IP1 4HA, tel: (0473) 748515.**

***May 30/31:** The RSGB will be holding their eighth National Amateur Radio Show at the National Exhibition Centre, Birmingham.

June 7: The Northampton Radio Club will be holding their Radio Computer & Electronics Rally at the rear of the 'Red Lion' public house, (500 yards from junction 16 of the M1 motorway). This year there will be room for four times more stalls, as they have booked an extra field just for parking. Doors open 10am. Pub and cafe will be open all day. Talk-in on S22 and on GB3NH (RB3) and 1.933MHz. All enquiries to **Paul Young** on (0327) 41267.

June 7: Bury St. Edmunds ARS Car Boot Sale will be held at the Scout Pavilion, Stanton. Doors open 10am until 4pm. Admission free. Light refreshments available. £3 per car boot. Talk-in on S22. Send an s.a.e. for a free map. Details from **G0MEV QTHR, Tel: (0359) 50271.**

***June 14:** Royal Naval ARS have their Annual Mobile Rally at HMS Mercury, nr. Petersfield, Hants. There will be dozens of trade stands; a Bring & Buy; flea market; radio-controlled power boats and trains; local radio clubs and repeater groups; children's rides and amusements; vintage fire engine; TV detector van; ices and refreshments; arts and crafts' exhibition; two Grand raffles; spectacular arena displays and other attractions, making this a great day out for all the family. Talk-in on 144 and 430MHz, free parking and picnicking, free admission for children, adults £1.50, no dogs except guide dogs. For full details, contact **G1HF Harper G4UJR, 34 Nave Road, Bitterne Park, Southampton SO2 4FJ, Tel: (0703) 557469.**

June 20/21: Preston 'Guild' Hobbies Fayre is to be held in and around the grounds of Tulketh High School, off Tag Lane, Preston. One of the largest local exhibitions of crafts, hobbies, pastimes and sports, staged in the north-west. The fayre runs for two days, with the Preston ARS flying the flag for 'amateur radio' and 'amateur electronics'. Any profits from this event will be split between local charities and Tulketh High School. Trade stands and activities cover everything from armchair hobbies to the super-adventurous, with something for everyone, whatever age group. **Eric Eastwood G1WQC, 56 The Meds, Freckleton, Preston, Lancashire PR4 1JB, Tel: (0772) 586708.**

June 21: Derby Dale & District ARS will be holding their Rally at Salendine Nook High School, Huddersfield. Easy access from M62, junction 23 eastbound, junction 24 westbound. Doors open 11am. Usual traders, craft stalls, etc. Bar, catering, car boot sale, Bring & Buy, ample parking. Talk-in S22 and SU22. Details from **Philip G4FSD on (0484) 648827.**

June 27: The Brentwood International Amateur Radio & Computer Rally will be held at Brentwood International Centre, Dodinghurst Road, Brentwood, Essex. Major suppliers and manufacturers of radio equipment, computers, accessories, antennas, computer software and second-hand gear. Easy access from M25 motorway junction 28, and A12 trunk road. Fully signposted by the AA. Bar and cafe serving hot meals and drinks all day. Bring & Buy area. Massive car park, easy access for the disabled. Rally information centre on site. Talk-in on S22 and SU22. Doors open 10.30am to 6pm. Details from **CLPK, 18 Litchfield Close, Clacton-on-Sea, Essex CO15 3SZ.**

June 28: The 35th Longleat Amateur Radio Rally (follow the brown signs for 'Longleat House' from Warminster, Wiltshire). An extensive trade exhibition, featuring over 140 companies. A large craft fair, RSGB bookstall and membership services stand. Over 20 national and local amateur radio clubs. Bring & Buy. Bear tent and plenty of on-site catering. Free parking right by the rally. Camping and caravanning facilities by the rally all weekend. All the attractions of the Longleat Estate available. Details from **Shaun G6VPG on (0225) 873098.**

June 28: The Bromsgrove ARS will be holding their second Mobile Radio Ham Rally & Car Boot Sale at the Lower Wick Country Fair, the location being on the Worcester to Malvern Road, rear of Bennetts Dairy. Doors open 9am to 6pm. Tables for Boot Sale are £4. Entry to fair & rally is £1 per person. Details from **Dave Edwards G4ZWR on (0527) 546075.**

July 5: King's Lynn ARC will be holding their Rally at The Corn Exchange, King's Lynn, Tuesday Market Place. Doors open 10am. Further details from **Derek Franklin G0MQL on (0553) 841189.**

July 5: The York Radio Rally will be held in the Tattersall Building, York Racecourse, Knavesmire, York. Doors open 11am (10.30am for disabled visitors). Entrance fee £1. Ample free parking. Amateur radio, electronics and computers, arts and crafts. Morse tests. Licensed bar and cafe. Talk-in on S22. Further details from **Dave Moreland G7FGA on (0904) 790079.**

July 5: The 1992 Newport ARS Junk & Boot Sale will take place at the usual venue - Brynglas House in Newport. Opening time is 10.30am (10am for disabled), and there will be a talk-in on S22 by G0INRS. Light refreshments will be available. There will also be a raffle, with various prizes. Entry is by ticket, cost 25p. Further information, and applications for pitches from **Kevin Snelling GW7BSC, QTHR on (0633) 262488, please phone between 6 and 7pm weekdays only.**

July 11: The Cornish Rally will be held at Penair School, St. Clement, Truro. Further details from **Mr B. Thomas G0NNR, 'Creekside', Greenbank Road, Devoran, Nr. Truro, Cornwall, Tel: (0872) 862046.**

July 12: The Horncastle Amateur Radio, Electronics & Computer Fair will be held in the Sports Hall of Queen Elizabeth's Grammar School, as last year. There will facilities for a flea market outside, a talking station on 2m and there is lots of free parking. If anyone would like to bring things to sell from the boot of your car (electronics/radio only please), you will be able to, for a small fee. Any information can be obtained from **Tony Nightingale on (0507) 522482, or send an s.a.e. to The Area Youth Office, Horncastle Youth Centre, Cagthorpe Building, Cagthorpe, Horncastle, Lincs LN9 6HW.**

July 19: The 9th McMichael Rally and Car Boot Sale will be held at the Haymill Youth and Community Centre, Burnham Lane, Slough (near Burnham Railway Station). For more details, contact **Neil G8XNY on Maidenhead (0628) 25952.**

July 25/26: Norfolk ARS are planning a 2-day event. Details from **Sheila G0KWP, Tel: (0603) 618810.**

July 28: The Rugby ATS 4th Annual Amateur Radio Car Boot Sale will be held at the BP Truckstop on the A5, three miles east of Rugby and just two-and-a-half miles north-west from junction 18 of the M1 motorway. Open from 10am, admission is £1 per car and facilities include a good cafeteria and toilets. Talk-in on S22 by G86CBS. Pitches are £7 pre-booked or £9 on the day. Further details from **Peter on (0455) 552449 or for bookings ring Kevin on (0203) 441590.**

July 28: Scarborough Amateur Radio Society will hold their Radio, Electronics and Computer Rally at the Spa, South Forshore, Scarborough. Doors open 11am. Many traders, Bring & Buy, refreshments and bar. Details from **Ian Hunter G4UQP on (0723) 376847.**

August 23: The West Manchester Radio Club's 'Red Rose Rally' will be held at the Bolton Sports & Exhibition Centre, Silverwell Street, Bolton (town centre). All the usual trade stands, societies, Bring & Buy, etc. All at pavement level. Refreshments available all day and bar. Doors open at 10.30am for disabled and 11am for general public. Admission £1, children free. Further details from **Dave G1100 on (0204) 24104 evening only.**

September 6: Preston ARS will be holding their 25th Annual Rally at the University of Lancaster, as in previous years. The university is located south of Lancaster and the entrance is on the A6 trunk road. From the M6 leave at junction 33 on to the A6 and proceed north for approximately three miles. Trade stands, club/repeater stands, large Bring & Buy, snack bar, lunchtime restaurant, licensed bar, free prize draw and free parking on campus. Doors open 11am (10.30am for disabled). Details from **George Earnshaw on (0772) 718175.**

September 8: Vange Amateur Radio Society will be holding their Annual Rally at The Laindon Community Centre, Laindon High Road/Aston Road, Laindon, Basildon, Essex. The centre is only a short walk from Laindon Railway Station on the Fenchurch Street to Showburyess Line. Doors open from 10.30am to 4.30pm. Admission 75p. Featuring many traders, Bring & Buy, refreshments and a free raffle. Talk-in on S22. Approach roads will be signposted. For further details contact **Mike Musgrave G4NVT on (0268) 543025 or Doris Thompson on (0268) 552606.**

September 8: Milton Keynes & DARS will be holding their 8th Car Boot Rally at Cranfield Airfield (south side), Cranfield, Bedfordshire MK43 0AL (off J13 or J14 of the M1). Talk-in on S22, G8MKC. For further details, contact either **Ray G1LRU on (0908) 660798, Tony G6WXM on (0908) 316435 or Dave G3ZPA on (0908) 501310.**

September 13: BARTG's 1992 Rally will be held in Sandown Park Exhibition Centre, Esher, Surrey. More details from **Peter Nicol G8VXY, 38 Mitten Avenue, Rubery, Rednal, Birmingham B45 0JB, Tel: 021-453 2676.**

September 13: Telford Amateur Radio Rally will be held in The Telford Exhibition Centre, Telford, Shropshire. Doors open 10.30am. Admission £1. Traders' stands, flea market, restaurants, bars, free parking. More details from **John Burford G0GTN, 19 Bowdley Avenue, Telford Estate, Shrewsbury SY2 5UD.**

*** Practical Wireless & Short Wave Magazine in Attendance.**

Reflections

Ron Ham 'reflects' on the old days when valves were commonplace in TV and radio equipment, takes a look at the well-known '18' set, and winds up with your reports.

Let's forget the low-consumption semi-conductors which make up the high-tech equipment that we enjoy using today, and think back to a couple of periods in time, when radio and television, of the valve era, played an important role. Forty years ago our Queen came to the throne, and 50 years ago the British and Commonwealth armies were fighting in several theatres of war.

However, in those days, the heart of all radio equipment was a number of current hungry, glass envelope valves. For instance, in the late 1940s, many televisions, like the 9in PYE in Fig. 1, were only single channel (on 45MHz) and used about 15 ex-wartime EF50 valves. Some were still scribed with 'AM' (Air Ministry) labels and their service number (VR91).

Briefly, 'V' alve 'R' eceiving (type) 91 was an indirectly heated, state-of-the-art, v.h.f. amplifier which required 6.3V at 0.3A to heat its cathode and up to 250V, at 10mA, for its anode. In my opinion, had the government not released huge quantities of such valves at the end of the war, the manufacture of television receivers would not have been as fast as it was.

Coronation Day

Because we were there at the time, Joan and I were among those interviewed by South Coast Radio in February, for a programme celebrating the 40th year of the Queen's reign, and we were asked to recall our memories of coronation day in June 1953. Like many TV and radio engineers, I was busy installing sets during the run-up period ready for the big day and in some cases fitting magnifiers to the 9in sets!

Not many people had a television receiver at that time and most of those who did, invited neighbours into their homes to watch the event. We spent the day with my parents where the dining room had been 'modified' to seat about 17 people. A 9in Mullard console, similar in style to Fig. 1, was elevated on a box at one end of the room, and a table at the other

end carried a multitude of sandwiches that Joan and mother had made early that morning.

The room was darkened so as to get the maximum brilliance from the small black and white picture. Food was still partially rationed then, so the visitors previously contributed various ingredients towards the sandwich pile. Around 0900 I had a call to adjust a set that, like ours, had been moved for the day and when I had finished the customer was so pleased that she gave me a 2lb packet of sugar. You can imagine how delighted mother was when I arrived home with this 'bonus' to add to the festivities.

Several of our guests had not seen television before, and they were amazed to think that they were actually watching something that was taking place, "in London", 96km away. A grand account of this outside broadcast is given from page 75 to 88 in the BBC publication *Richard Dimbleby Broadcaster*. Although this was published in 1966, you may still find a copy in a second-hand book shop or in your public library.

The '18' Set

In every battle from the deserts of North Africa to the jungles of Burma, wireless communications between the infantry, artillery and their mobile support units was essential. The largest of the 'portable' transmitter/receivers was WS.18 (Wireless-Set. 18), which could be stood down on its flat base, Fig. 2, or carried as a back-pack.

The webbing for the shoulder straps and the waist band was attached to the carrying handle (top centre Fig. 2) and the 'back' shaped metal at the bottom of the case (Fig. 2) respectively. Provision was made, for practical reasons, to change the angle of the antenna by 'clicking' around a socket on the side of the set (centre right Fig. 2).

One ex-soldier from a Far East campaign told me, "I used to carry the B—— thing" and "the aerial was always getting caught up in the trees", another said, it was very heavy and awkward, "especially if

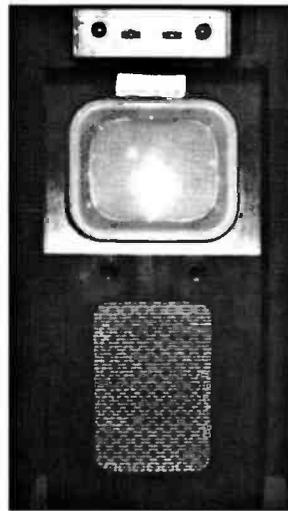


Fig. 1: Pye TV.

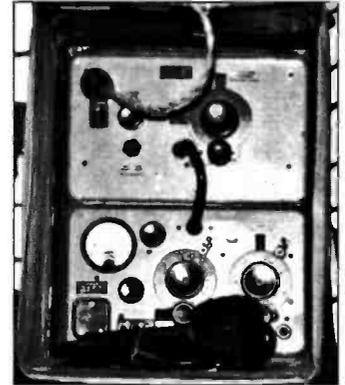


Fig. 3: WS.18 front view.

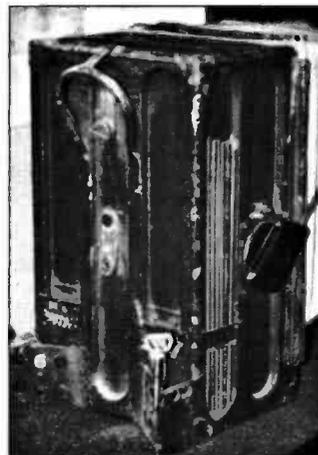


Fig. 2: WS.18 rear view.

you had a BREN-gun as well." The electrical length of the antenna was adjusted by adding short sections of interlocking copper rod, drawn from a store on the sides of the casework (centre Fig. 2).

The main framework, measuring around 18 x 10in had a canvas hood fitted to the front, (far right, Fig. 2) to act as a weather shield. The separate receiver and sender units (behind the hood in Fig. 3) are each secured by a large 'coin' slotted screw (centre rear panel, Fig. 2) for easy removal.

A specifically designed 'all-dry' battery giving about 160V high-tension and 3V low-tension, was

housed in the base of the cabinet which meant removing the sender chassis to replace the battery. This entails detaching the small 4-pin plug at the top of the panel which provides the power for the receiver (centre lead, Fig. 3), a large 4-pin plug (bottom, Fig. 5), which connects, via a socket in the cabinet, to the battery and, of course, undoing the securing screw.

Imagine doing this under battle conditions, or perhaps replacing a faulty or broken valve when either chassis had to be removed by the same process.

A padded metal case of spare valves, like Fig. 4, with instructions in the lid, was supplied in the 'signals satchel' for emergency repairs. The WS.18 has a limited frequency coverage of 6 to 9MHz, clearly scribed on the receiver and the sender's (master oscillator) slow-motion tuning dials (Fig. 3). The transmit frequency of the two valve sender, is selected on the right hand dial. The r.f. output, measured on the meter, is matched to the number of rods by selecting a position on the antenna switch, (right of the meter, Fig. 3) and peaked up by rotating the left hand sender dial.

In addition to a spare battery and valves, the signals satchel contained the headphones, microphone and Morse key. These were plugged-in at the top left of the receiver and the



Fig. 4: Spare valves for WS.18.

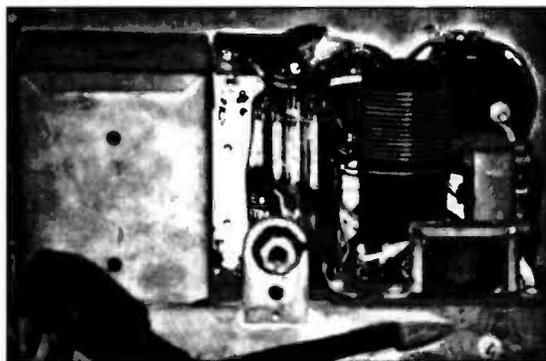


Fig. 5: WS.18 TX chassis.

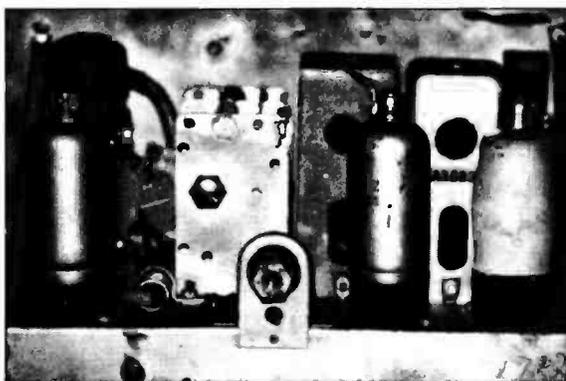


Fig. 6: WS.18 RX chassis.

bottom left and right hand sides of the sender (Fig. 3) respectively. The receiver is a simple superheterodyne, Fig. 6, (upper unit, Fig. 3) using four directly-heated valves, each requiring 2.0V at 0.05A for its low-tension and about 120V at 1.0mA high-tension. The filament in the sender's p.a. valve (ATP4) wanted 2.6V at 0.3A and its anode required 150V at 32mA high-tension. The specially designed 'A'rmy 'T'ransmitting 'P'entode four valve is prominent at the rear of Fig. 4 and the centre of Fig. 5.

When in use, the WS.18 had a range of between eight and 16km and the operator could communicate with the infantryman's WS.38 and/or Canadian WS.58, the WS.46 commando set, and the more powerful WS.19 fitted in armoured cars and tanks. Signals from all of these sets, could be monitored at a base station on the army communications receivers type R103, R107 and R109.

Although at the end of hostilities a large number of '18' sets were retained by the military and used for many years by the TA and the cadet forces, an equally large number

were sold on the surplus market and operated by amateurs on the 7MHz band.

Information

Not all the information that I gather for my columns in *PW* and *SWM* comes verbally or via your letters. There are times when I need to make reference in a public library or to write text away from home, especially if I am working with Joan in the County Records Office.

Therefore I required a portable word-processor that was user-friendly and would easily transfer my 'outside' work to the Amstrad PC2286 when I got home.

My choice was the Tandy WP-2, Fig. 7, with its IBM/PC transfer software and connecting cable. In the Tandy catalogue, it's the WP-2 at £229.95, the transfer program at £14.95 and the cable at £9.95. Although the machine runs on four 'AA' type batteries, a special a.c. adapter is available from them at £9.95. The built-in 100 000 word spell-checker and the 200 000 word thesaurus attracted me to the WP-2, and its 32k (expandable) RAM is

adequate for my needs. I immediately found the full-size 62-key 'QWERTY' keyboard a joy to use, and being about the size of an 'A4' pad, it easily fits my brief-case. Serial and parallel input/output ports and a DIN socket for a cassette tape-recorder are fitted to the rear panel.

Although on-screen help is provided by pressing a specified key, more detailed instructions are given in the 150 page *Owner's Manual* supplied with the WP-2.

This, like the two page *Transfer User Guide* is well thought-out and easy-to-follow.

In my case the transfer software is loaded on the Amstrad's hard-disk, in a directory entitled 'WP2', which I call up, when required, by typing CDWP2 (ENTER) at the 'C' prompt followed by WP2LINK (ENTER) at the next 'C' prompt.

Auto Saved

Once the text is written it is automatically saved when the WP-2 is switched off and is retained in the memory by a CR2430 lithium battery, which has an approximate three year life. On arrival home and before switching either computer on, I connect Tandy's link-lead (back left, Fig. 7) to the RS232 ports on the Amstrad and the WP-2.

Next, after booting-up both machines I call up the transfer software on the PC and select item 1 "UPLOAD FROM WP-2" from the menu. Briefly, I then command the WP-2 to make an ASCII file of the wanted text and by following a sequence of key-codes the data transfer is quickly carried out.

Between ourselves readers, I make a crib-card to remind me of the codes and, as a precaution against 'sods-law', I do not erase the text from the WP-2 until it is safely filed and backed-up on the PC.

Observations

Now it's time for observations. In January, Ron Livesey (Edinburgh), using a 2.5in refractor and 4in projection screen, located five active areas on the sun's disc on days 4, 5, 7, 9, 22, 25 and 26, six on the 11th, 12th and 28th and seven on the 10th and 31st. From his observatory in Sevenoaks, Cmdr Henry Hatfield, using his spectrohelioscope, observed four sunspot groups, 17 filaments and nine small quiescent prominences at 1240 on February 3 and his 136MHz radio telescope recorded large individual bursts of solar noise on the 2nd and a continuous noise storm on the 3rd.

Auroral

It's auroral time next, and Ron Livesey, the auroral co-ordinator for the British Astronomical Association, received reports of 'glows' overnight on January 1, 3, 4, 7 and 8, 'quiet arc or band' on the 13th, 'ray bundles' on the 11th, 29th and 30th and 'active, moving, pulsating' on the 3rd, 13th and 26th, from observers mainly in Scotland and on the Ocean Weather Ship 'Cumulus'. Doug Smillie (Wishaw) heard weak auroral reflected radio signals on the 144MHz band on the 8th, 29th and 30th.

Magnetic

On the magnetic side, the variety of magnetometers used by Tony Hopwood, Ron Livesey, Karl Lewis (Saltash), David Pettitt (Carlisle) and Doug Smillie between them recorded some magnetic activity on January 1, 3, 4, 5, 10 to 16 inc. and 26 to 30 inc. Doug has an interesting article, with constructional details, about his magnetometer and auroral observations on pages 16 to 20 inclusive in the February *Journal of the British Astronomical Association*.



Fig. 7: The Tandy WP-2.

PACKET PANORAMA

Roger Cooke G3LDI takes a look at a new magazine for packet radio fans, provides an insight on the Canadian packet scene, and gives you news of an important date for your diary.

I've got news of a relatively new magazine this time. The magazine has the delightful (and very apt) title of *Cluster Duster*, following on from the instigation and licensing of the now well established DX Clusters.

The *Cluster Duster* is edited by Maurice King G3XKD, and the first issue was in March 1991. Produced on a laser printer, it has a very acceptable appearance, with articles from amateurs from home and abroad.

This is yet another DX-orientated magazine for the avid DXer, complemented by the *Cluster*, it makes working DX a fine art in comparison to what it was some 30 years ago!

Basic Guide

There is another basic guide to packet radio, entitled *Packet Radio Primer*, which is written by Dave Coomber G8UYZ, and Martyn Croft G8NZU. It's written in such a way as to encourage the beginner, and give them the confidence needed to dive into what seems a most complex subject.

It's almost an 'Enid Blyton' style of book, which tends to encourage the reader along in a humorous way. This is done without thrusting too much jargon at them all at once.

Almost without realising it, the reader is learning all the basics needed to connect their TNC, computer and radio together, and have fun on the air. The basic connection is discussed, together with the settings of TNC parameters, using both a PMS and a BBS and how to read and leave messages.

Then, the structure of a packet, with some basic protocol information follows. This is so that an understanding of how packet works can be easily grasped. This is closely followed by a discussion of Nodes, Packet Clusters and how to use them.

Final Selection

The final section is given to BBS commands, although not all are covered. It covers RS232 connections and provides a glossary

of TNC commands, plus some commonly-used terminal software. The last two pages are taken up by the 'Packet Guidelines', which should be read by everyone.

The title says it's a primer. As such, it is a very useful book for the raw beginner to read, before they become embroiled in what is, after all, a very complex subject.

It depends how deep a hole you want to dig for yourself! The old rule still applies though: 'If you find yourself in too deep, stop digging!'

The primer is not intended as a reference book. But if you are thinking of getting into packet radio and have been frightened off so far, reading this book will allay all your fears. Go on, buy it, read it and do it!

News From Canada

News comes from Canada, sent by Barry Winch VE3NAV, of the 56kbaud links that I saw in action during my visit. Watching data move at 56kbaud is very impressive, especially when it's full duplex, and it seems to be catching on.

Some experimental links are operating in the UK, but not quite to the extent that seems to be happening elsewhere. However, given time and dedication, plus a fair amount of money, I feel sure that it won't be too long before we have a similar operational capability.

I must thank Barry McLarnon VE3JF, of the Ottawa ARC Packet Working Group, who wrote the information on the Canadian scene. Barry comments on the Canadian 144MHz bandwidth, comparing it to the UK. He also says that most of the packet channels are busy!

Canadian Comments

Barry says "the 144MHz band over here is 4MHz wide, so we have a few more packet channels available. Packet channels tend to start at 144.91MHz and go at 20kHz steps up to 145.11MHz (I think). 145.01 is THE packet channel. It is still the primary v.h.f. frequency for inter-city forwarding, and as such is ridiculously congested.

"Progress is being made in

moving the intercity forwarding to 220MHz and 440MHz, where higher speeds, typically 9600 and 19.2kbps can be used. These links are usually restricted access".

Ottawa Area

"The Ottawa area is served by one major node site, plus a number of subsidiary nodes. The major 'hub' site, at Carleton University, is the home of the Hydra packet switch.

Hydra actually consists of two separate systems. The switch itself ('hydra-gw'), which is a PC AT running KA9Q NOS, currently has four ports.

Two of these are 9600bps serial interfaces into the 144MHz NET/ROM nodes OTTAWA (145.07 LAN) and CAPITL (145.01). The third port, uses an Ottawa PI board* (see details below), to interface into the 56kbps LAN, which is served by a full-duplex cross-band repeater (220.55MHz in, 433.55MHz out) at the same site.

Finally, there is an 'ethernet' port which is connected to the Carleton campus 'ethernet'. Also on the 'ethernet' is the second part of Hydra, a Sun-2 workstation, which is a Unix system with a large amount of disk storage.

This system will be the platform for developing various services for the amateur packet community. In addition to various servers such as on-line call-book look-up, the possibilities include a gateway into the Internet itself.

Full Duplex

"The 56kbps full-duplex network is, as far as we know, the only one of its kind in the world. It began as a high-speed LAN for the 'power users', but it has evolved to a combination LAN/local backbone network.

This goes against the conventional wisdom of keeping LANs and backbones separate, but it is successful because there are no hidden transmitters, and the capacity is more than sufficient to handle both functions. When the 56kbps network begins to get congested, our

plan is to 'twin' the cross-band repeater with a second one, using additional 100kHz channels in the same bands.

It is remarkably simple to add a second repeater in this way. The antennas and r.f. gear can be shared between the two repeaters, with power combining/splitting done at the 28-30MHz i.f. of the 56kbps modem."

Hydra Switch

"The 56kbps network provides the link from the Hydra switch to the three Ottawa area BBS stations (VE3JF, VE3NAV and VE3KYT), to users on two additional LAN frequencies (144.91 and 145.03MHz), and to a conference node. This network offers an easy means of 'spreading out' the 1200bps 144MHz traffic, so that low-speed users can continue to get adequate access to the network.

A user on the 56kbps network can attach a two metre port to his station, and open up a network access port on a new frequency for users in his area. This is what you might call a 'cellular LAN' approach.

In a traditional LAN with a wide-coverage node, modelled after voice repeaters, you have too many users, too many hidden transmitters, and therefore many collisions and terrible 'throughput'.

In a cellular LAN with more limited coverage, you have fewer users, and since they are located in a smaller area, less chance that they are hidden from each other. An additional benefit comes from the fact that the cellular nodes are located at home stations, and therefore are easier to maintain".

Basic Model

"The basic model for network development in the Ottawa area therefore is:

1: A central switch with expandable capabilities, and offering access to various services for network users.

2: One or more high-speed, full-duplex repeaters which link the

J. BIRKETT

SUPPLIERS OF ELECTRONIC COMPONENTS

SMALL 3 GANG POLYCON VARIABLE CAPACITOR. 340-340-340pf @ £1.95.
P.C. BOARD with 4 Variable Voltage Regulators LM317T, 1-LM340KC-12, 1-10,000uf 16v.w., 1-Heat Sink, 4-LEDS @ £1.00 (p&p £1.20).

P.C. BOARD with 2-MJ10006, 2-Heat Sinks, 2-Thyristors (S.C.R.s), 2-Heavy Current Diodes, 2-Heavy Currency Chokes @ £1.00 (p&p £1.50).

SEALED LEAD ACID BATTERIES YUASA Type NP106 6 volt 10A.H. @ £4.50 (p&p £3.30) Dry Fit Type A200 208-305 6 volt 3A.H. @ £2.95 (p&p £3.30), Dry Fit A200 A212-305 12 volt 3A.H. @ £4.50 (p&p £3.30) Nicads Varta 2500K Stack of 5 (6 volt), will fit in C Type Battery Holder @ 75p. All batteries tested.

SCREW TERMINAL ELECTROLYTICS. 10,000uf 25v.w. @ 50p, 15,000uf 40v.w. @ 75p.

BRIDGE RECTIFIER 100 PIV 25 amps @ £1.30.

MAJOR COMPONENTS FOR SHORT WAVE CRYSTAL SET as described in December Short Wave Mag. with info. @ £3.80.

PHILLIPS R.F. POWER FET, 400MHz, 15 watt, 24 volt, BLF244 with data and circuit @ £9.95. Two for £15.50.

NUT FIXING FEED THRU'S 500v.w 500pf, 1000pf, 4700pf. All at 65p each.

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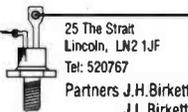
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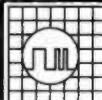
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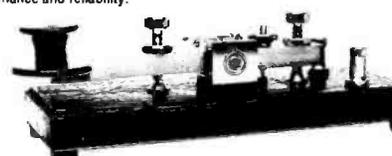
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PACKET PANORAMA

switch to the other area nodes, as well as to some individual users.

3: A number of low-speed, limited-coverage network access nodes, on different frequencies, with the frequencies re-used as appropriate. Each frequency has one, (and only one) node for a given 'cell', so that there is no node-to-node traffic on these frequencies".

Main Departure

"The main departure from this model at the moment, is on 145.07MHz. This is where the OTTSAT node, which serves as the access point to the Calgary-Ottawa 'wormhole', resides in addition to the OTTAWA node.

The OTTSAT node is expected to be removed from this frequency sometime in the near future, and it will either be added to the 56kbps LAN, or provided with a dedicated point-to-point link from Hydra".

High Priority

"Improving the links to other areas, is a high priority for the Packet Working Group. Other than the Calgary link, all out-of-town linking remains dependent on the grossly overloaded 145.01MHz network.

One reason we have been slow to upgrade these links, other than our pre-occupation with the local high-speed network and switch developments, was the possibility of obtaining additional satellite links, from the OTTSAT gateway to Montreal, Toronto, and possibly other points.

This has failed to materialise, and although chances are still good that something may happen, it is clear that we can no longer afford to wait. Furthermore, we should not let the possibility of using commercial satellite channels for some of our links, divert us from the goal of building an autonomous fully-connected amateur network".

Backbone Links

"We are anxious to work with neighbouring groups to install backbone links for trunking packet traffic between Ottawa and the surrounding areas. We do recognise that any collision-free backbone link, even if only 1200bps, would be Practical Wireless, May 1992

** The PI board is an IBM PC compatible, synchronous interface card for high-speed packet radio interfacing. It was designed by Dave Perry VE3IFB, and is good for operation up to 57600 bits-per-second. The PI card offers the following features: Dual channel operation, one high-speed d.m.a., one low-speed non-d.m.a., IBM PC, PC-XT and PC/AT compatibility. Low-speed driver socketed to allow for RS-232 or TL levels. Available driver for KA9Q NOS.*

a vast improvement over using 145.01MHz, and would do a reasonable job of handling the current volume of BBS mail.

However, we also feel that we should aim for much higher performance. Not only will the amount of mail and bulletin traffic increase quickly as the link capabilities improve, but users will require more throughput for applications such as file transfers and logging into remote servers.

We feel that 9600bps should be regarded as a minimum standard for a trunk linking two major network nodes, and our preference would be to have 56kbps on these links before long. We would therefore urge that network planners who feel that it is not feasible to go to the higher speed immediately, at least give serious consideration to providing an easy upgrade path".

Upgrade Path

"Providing an upgrade path involves two key issues:

1: Selecting a band (or bands) in which at least 100kHz bandwidth channels are available. This means putting the link on a frequency above the two metre band!

2: Designing sufficient margin into the link, such that it can be upgraded to 56kbps without changing the antennas and feeds.

With regard to the second point, there is a convenient rule of thumb. In order to work adequately at 56kbps, the link will require approximately 10dB more margin than is needed for 1200bps a.f.s.k.

For example, if a link works okay at 1200bps with low-gain omni-directional antennas at each end, then replacement of the antennas with small Yagis, should provide sufficient margin for upgrading to 56kbps, assuming the same power

"There are a number of reasons

that the Ottawa working group has a strong preference for using the WA4DSY 56kbps modem in linking projects. After working with the modem for nearly three years, we have a good deal of experience with it, and a high degree of confidence in its capabilities and reliability.

It offers much higher value in terms of bits-per-second per dollar of investment than the lower-speed modems, and its higher throughput means a longer lifetime before obsolescence. It's very easy to deploy, since it is a self-contained r.f. modem, which does not have to be interfaced to standard radios.

Its 28MHz i.f. is simply converted to v.h.f. or u.h.f. using a standard transverter, or separate receive and transmit converters, in the case of full duplex. And it will run full duplex with no difficulty, unlike some lower-speed modems.

The use of speeds of 56kbps or more necessitates the upgrading of nodes with more capable packet switch hardware than the TNC-2. Like the Ottawa Hydra switch, a multiport node can be configured fairly inexpensively around a PC AT-class machine.

The TNCs can be retained to handle the low-speed nodes. For major node sites with multiple 56kbps (or higher speed) ports, a more attractive proposition is the Grace PackeTen packet switch board. The latter board can make use of the PC as a host, so again there is a clear upgrade path if a PC is used for the switch".

So, that's what's going on across the Atlantic! Thanks for the interesting news from Canada Barry, and we look forward to hearing more from you.

Norfolk Barbecue

Now it's time to return to more domestic matters! Once again the Norfolk AX25 Group are organising

their annual barbeque, purely as a fun day for the family, with a slight leaning toward the hobby (grilled p.c.b. and 'chips' perhaps? Editor).

This year it is being held on June 28th, starting 11am until late pm. The Maitre de Cuisine au Jardin is Paul G4VLS. There's loads of food, ice-cream and drinks, all for £5 per adult. However, children between 7 and 12 years will cost £3 ('un-cooked'), and the under seven's can come for free but we don't guarantee they won't end up on the menu!

'Uncle Pat' Gowen G3IOR, is in charge of games for the children. As a special treat, Geoff 'Biggles' G4ODC, will be performing daring aerobatics with his competition standard radio-controlled aircraft. Bookings by the end of May, at the LATEST please!

The barbeque will be held at my QTH, at Swardeston, Norfolk (QTHR). There's talk-in available on S22, or on u.h.f., 433MHz, via GB3NR. Lots of parking, and it's off the main road.

We're looking forward to seeing some of you at the great Swardeston 'Cooke-in', but please do book early!

Swapping Programs

There's just enough space left to mention that David G0JVF @ GB7SDN, would be interested in swapping programs for the BBC Electron. There does not seem to be many of these machines about, although a local here in Norwich has one. There seems to be even less in the way of software for this machine. If anybody can help David, please send him a packet message.

I'd also like to see a few more photographs with information for the 'Sysop of The Month' spot. Please send them to G3LDI QTHR.

Before I close, I'm sorry that we don't have room for the detailed 'Clive' commands in the column. However, if you send a large s.a.e. to Tex Swann G1TEX at the Poole office, he'll send you a photocopy. So, that's it for another month, 73 and happy packeting de Roger, G3LDI @ GB7LDI QTHR, tel: (0508) 70278, or FAX on (0603) 787534.

UoSAT Operations

From Jeff Ward G0/K8KA, of the University of Surrey Spacecraft Engineering Research Unit team, comes news that amateur radio operations have now moved from UoSAT-3 (OSCAR-14) to UoSAT-5 (OSCAR-22).

Amateurs will now have 512Kbytes of program memory permitting 800 message capacity, two amateur-radio uplinks (145.900 and 145.975MHz), no downlink frequency switching, and more directory entries. This means that messages will be longer lived, as the default lifetime of these can be increased to seven days for bulletins, while recommending shorter lifetimes for other forms of mail.

What is more, if uplink activity is concentrated on what was the old UO-14 uplink, e.g. 145.975MHz, and 145.900MHz is just used for overflow, interference on 145.900 to AO-13 users and the microsats is reduced. Geoff says: "I think that the best way to divide uplink activity is to have broadcast requests and other PB operations on 145.900, while uploaders use 145.975MHz. I know that this would be difficult for automated stations, and don't expect everyone to comply, but if manned stations try to do it, then it will improve performance for everyone".

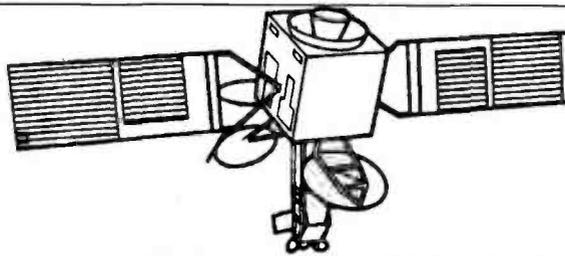
Price To Pay

As Geoff points out, there is a price to pay for this transition. Most notable is the conflict between c.c.d. users who want to download large c.c.d. image files and BBS users who just want to get their mail. University of Surrey (UoS) are looking into on-board JPEG compression for the images, and this potential disadvantage will be balanced by the advantages outlined above.

Discernible Difference?

Dave Hulatt G4WFO, a regular UoSAT user, has yet to find that the change has done anything about easing the QRM uplink troubles, as he has yet to be able to notice any discernible difference at all. He remains convinced that the main problems are brought about by 'alligators' and undisciplined operators.

He writes: "UoSAT-5 has other hidden problems, which give difficulties to myself and many other users. The problem is that decoding the downlink is a degree more difficult. The reasons behind this are apparently transmitter design. The UoSAT-3 employs a crystal controlled transmitter which



Satellite Scene

by Pat Gowen G3IOR

This month Pat Gowen G3IOR, covers the UoSAT changeover, and the reasons behind it. Pat also gives some bad news on band intrusion and the bleak 'RS' satellite future, balanced by some good news of RS-12's amazing DX possibilities.

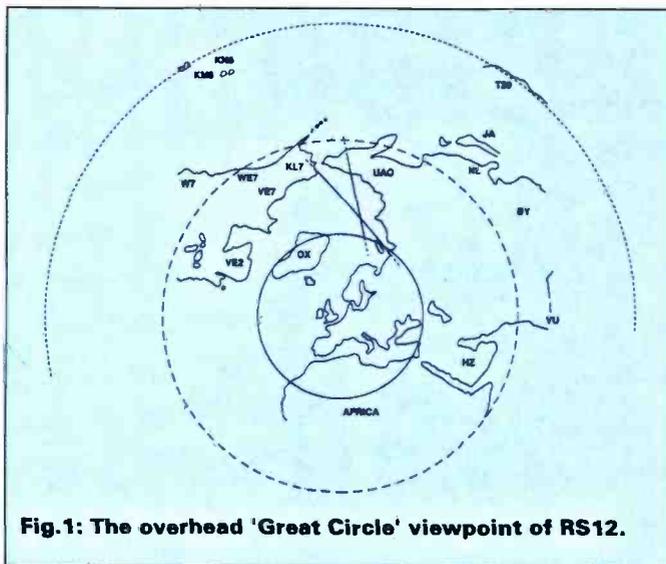


Fig.1: The overhead 'Great Circle' viewpoint of RS12.

generates a far better 'eye' on the downlink beacon. On the other hand, the quality of UoSAT-5, which employs a p.l.l. transmitter, does not generate the desirable characteristics users have become accustomed to with UoSAT-3. Ultimately, this resulted in further 'butchering' of my FT-736R to try and compensate for this inferiority".

Marked Improvement

Dave recommends that a marked improvement can be made on the FT-736R (which transceiver the vast majority of users employ) by simply removing C82, which resides on the receiver unit, and that a further improvement results when C25 on the G3RUH 9K6 Modem is changed to 1µF.

The Bad News

There's bad news from Andy Mirinov, who controls the RS-10/11 and RS-12/13 satellites from the RS3A command station, who tells

us that due to the loss the of DOSAAF funding, he is now employed on alternate weeks. Leo RA3AT, earlier head of RS3A has already left.

The residual remaining funds will run out by May. If no satellite command control is possible, RS-10/11, RS-12/13 and the new single satellite transponder planned for launch in late April, with the six others in the pipeline, will cease.

French Decision

The French administrative decision to give the exclusive use of 144.000-144.050 and 145.950-146.000MHz to Olympic Team communications, and the ban on the use of it to radio amateurs over wide areas for the duration of the games was unprecedented. Whilst any administration has this power over its own nationals, this is normally only applied in times of emergency, and then with discretion.

To allow the use by non-amateurs of both the highly

sensitive 144MHz e.m.e. band, and the international Amateur Satellite Service at the time of the WARC meetings, shows the vulnerability of some of our most important parts of the amateur radio spectrum. Indeed, the Olympic traffic has been heard causing QRM on FO-20 by G3CAG.

Sub-Horizon Tests

When the m.u.f. at our latitude was up to 50MHz earlier this year, Roger Cooke G3LDI, David Johnson G3MPN and myself, all near Norwich at 52.700N 358.750W, carried out a series of RS-12 'K' mode sub-horizon tests that provided some fascinating satellite propagational findings. We were all armed with high gain low angle h.f. beams on 21MHz and 29MHz giving e.r.p.s of some 1kW, and we used c.w. to aid identification and measure the tonal degradation. Using 21.214MHz as an uplink and 29.415MHz for a downlink, we kept in touch with each other on 145.425MHz voice f.m., so phasing our calls and relaying our downlinks to each other for comparison.

Early Passes

We first took early morning passes from 80° to 34° azimuth and found that there was little or no audible pre-acquisition of signal (pre-AOS) audibility of the beacon or our transponded signals. It was AOS plus two minutes before the beacon, with severe tonal degradation, came above the noise. Our own downlinks did not appear until three minutes after calculated AOS, and only then as very rough hissing notes.

As the satellite elevated above our horizon, our signal returns improved to about T6, then degraded again, disappearing with the beacon one minute prior to the calculated loss of signal (LOS) time. Four minutes after the calculated LOS the beacon re-appeared simultaneously to our own downlinks, with the tone improving rapidly all the time.

We all copied each others signals perfectly, and found the strongest and cleanest signal returns up to 17 minutes post horizon, when the satellite was on the opposite side of the pole heading down the Bering Sea between Alaska and Kamchatka toward British Columbia.

After this peak the signals then gently weakened to go below the noise. Following south to north passes were equally good, but with the excellent transponded returns always slowly fading out as RS-12 went over the far tip of Sakhalin Island.

Fig. 2: Side view of RS-12 orbit track.

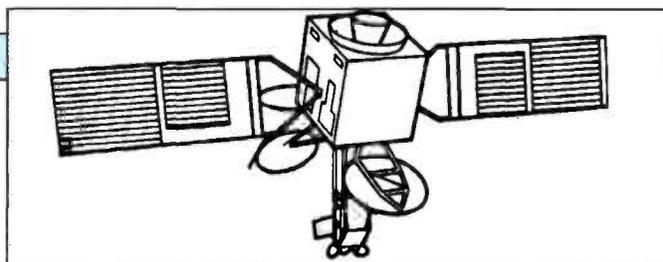
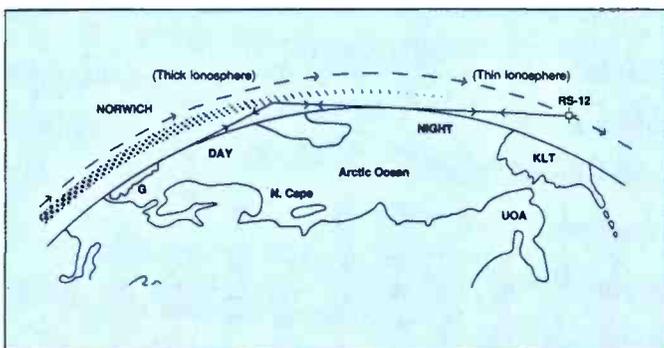


Fig. 3: Showing the terminator at 2142-2152UTC.

Auroral Hiss

Over a series of days, we found that our signals were invariably and consistently a rough 'auroral' hiss at low angles. Improving to typical h.f. auroral and polar flutter returns as the satellite approached the northern LOS horizon, where it usually disappeared before returning well post horizon, with improving strength and tone. We noted that stations located in southern England such as John G3FBN and Don G3BGM tonally degraded first, whilst GM stations and those to our north, such as Gordon G3DDG in Durham, remained almost T.9, far less tonally effected, when David, Roger and I had very rough notes indeed.

It was also very noticeable that our 21MHz signals transponded to the downlink on 29MHz, were far more tonally degraded than the 29.407MHz beacon or the 29.453MHz ROBOT. Sadly, although we were often within range of JA, KL7, W7, VE and UA0, no-one was on the satellite from the other side of the pole apart from a few stations using the uplink band for local u.s.b. contacts, who were not listening for transponded signals on 28MHz.

Late Passes

Late afternoon and early evening passes could just as well have been via u.h.f. or v.h.f. satellites, as they demonstrated the more typical true AOS and LOS times, showing no sub-horizon activity whatsoever, and very little tonal degradation. However, later in the evenings after 2200UTC, when both 28 and 21MHz were totally dead, we were able to work W1, 2, 8 and 9 stations, who were using the self-same propagation as we had been earlier in the day.

Results Sent

The results of our findings were sent to **John Branegan GM4IHJ**, who calculated the F_2 ion density decrease as the satellite and the reflective layer approached the dark polar and opposite areas, and so explained the phenomena of the path that we were using. John provided, as computer graphics, the UK overhead great circle viewpoint of the tracks shown in Fig. 1 and the side view of the orbit tracks as seen in Fig. 2. In Fig. 1 the inner circle around the UK is the normal horizon, and the outer circle that of the first refraction zone. The two tracks show that we had sub-horizon access first when the satellite was over Novaya Zemlya, and until it was out over Alaska for the first pass of 1155 AOS and beyond eastern Siberia for the second of 1334UTC AOS. Note that this puts both Hawaii and Papua New Guinea within range!

If we now look at Fig. 2, we see the side view of the signal track at the last moment of access. The dense solar illuminated ionosphere as far as the northern Russian Federation was able to re-angulate our signals, so that they then went through the far thinner ionosphere in darkness further north to the satellite over Alaska.

The reverse was true also, as the satellite signal was able to penetrate downward through the low attenuating thin ionosphere over Alaska. It was then, by earth skimming chordal hop, able to produce refraction from the underside of the more dense ionosphere between Norway's north cape and the UK.

Late Evening Paths

Late evening DX paths to the west were achieved when the satellite was over eastern Europe, a long way below the American

horizon, but within normal line-of-sight of the Norfolk stations. At this time both 21 and 28MHz were devoid of ionospherically propagated signals, and the band was dead.

As Fig. 3 shows, the terminator at 2142 - 2152UTC when W's were worked was well across the other side of the Atlantic, new with the dense ionosphere new over the USA, and absent over Europe. Whilst the American stations would have been able to work stations direct on 21 or 28MHz in mid-Atlantic, they would not have been able to make QSOs with Europe at that time.

At this time the 21MHz uplink signal leaves America, refracts from the sunlit ionosphere over the eastern seaboard, propagates downwards towards earth, skims the surface, and then rises to penetrate the very thin ionisation layer to 'see' the satellite over eastern Europe. The satellite 29MHz downlink return then follows the reverse path, going through the thin ionosphere to the ionised F2 layer off the USA and Canada, then to refract down to the north American stations.

DX Possibilities

John pointed out that in fact, had they only been active, the DX possibilities were good. We could have worked right across to W0, W6 and W7 at that time.

He explains: "Contacts of this type take place when one station and the satellite are on the night side of the world, whilst the other station is across the terminator under a daytime ionosphere. With this alignment, provided the satellite is above a thin night time ionosphere either one or both of the two stations in QSO can be on the daytime side of the world. Several ionospheric hops beyond the terminator, on the simple proviso

that 21 and 29MHz propagation exists for both of them along the full length of the path along the terminator and that the satellite is near enough to the terminator to 'see' across into the daylight dense ionospheric zone. There is therefore no reason as to why more distant stations should join in QSOs of this type. Operators should therefore concentrate on two patterns:

- 1 Listening for distant stations beyond and on their own side of the terminator, when they are in daylight and the satellite is just over the night side of the terminator.

- 2 Listening for distant stations located on the day side of the terminator, when the operators station is inside the satellite footprint, above the station horizon and the satellite is on the night side of the terminator, but no more than some 3000km from the day-night terminator."

From Proof To Practice

So, GM4IHJ's calculated path theories were put to the test and proved! Within a week I worked a UA0 in zone 19 and WA6BDA in California. VE7DFW is hearing Europe, LA4XC Harry Jansen worked JA, and short wave listener Jan Andersen OZ-DR2197 of Skagen, Denmark has been hearing JA, VE7, W7, VK5, VU and YS as well as many European signals sub-horizon. As the summer brings extended illuminated paths, contacts with the far east and the west should become easier still.

Regularly updated sets of Keplerian elements for all OSCAR's, the 'RS' satellites, MIR, UARS, and all of the weather satellites are freely available to readers who send a large s.a.s.e. to Donna at the *Practical Wireless* editorial offices in Poole, Dorset.

Bye for now, more *Satellite Scene* next month.

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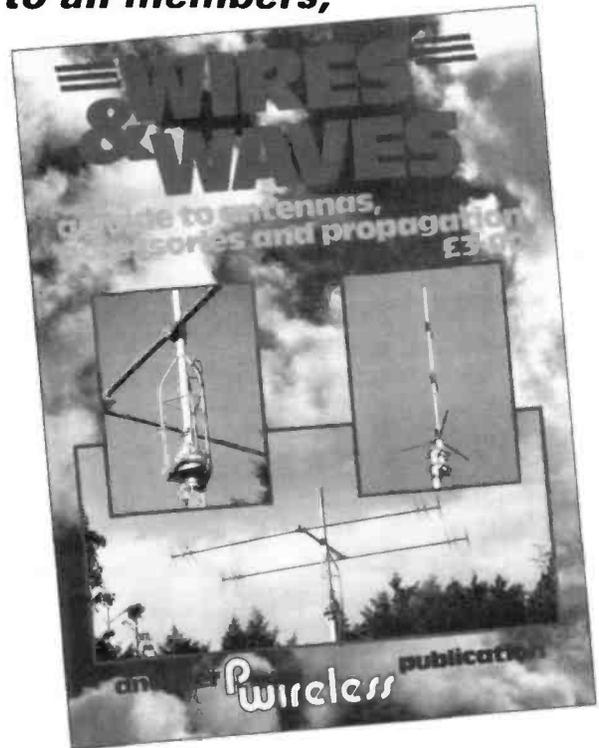
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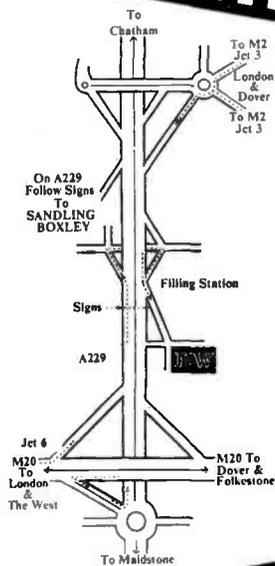
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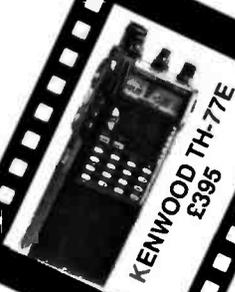


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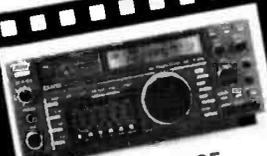
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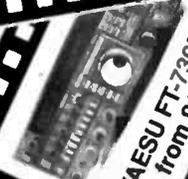
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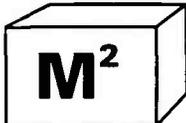
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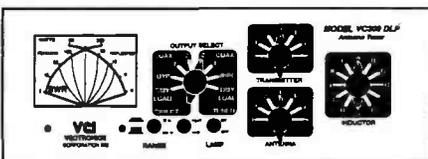
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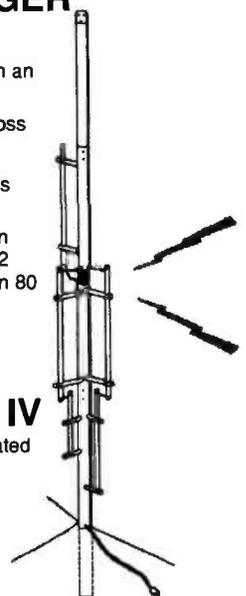
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Back-Scatter

HF Bands

Reports to
Paul Essery GW3KFE

287 Heol-y-Coleg, Vaynor, Newtown, Powys SY16 1RA

Except for some working on my long wire specimen of the genus Best Bent Wire, I've been QRT this month, still awaiting parts for the beam. However on the very morning I started this offering the first bits surfaced...so, there is hope yet!

Conditions

Conditions on the bands have been anything between superb and awful depending on the chosen date and time! However, when the 'awful' befalls, you can progress the rebuild of the station a.t.u., or look on the computer to see what the dimensions ought to be for a Yagi array; I fed in '23 elements at 1.8MHz' at one stage - enough raw material for a lifetime of dreams!

At this very moment, the sun is shining and a deckchair in the garden seems the best option. But as the locals say 'If you can see the hills, it's going to rain, but if you can't see 'em it IS raining!'

Alex UA6LHB

Further to my note last time about Alex UA6LHB, GODAS writes to say he has just had a long letter from him in Rostov-on-Don. Alex seems to be having a bit of a time of it. The rig has a problem he can't cure, the computer has crashed swallowing all his address-book file, and to crown it all his car was bumped by a military truck so no compensation! A few letters from his friends in UK wouldn't come amiss!

Hospital Tests Ted

Another one in the wars is Ted G2HKU; there's no firm news pending the result of hospital tests, but Ted says his daughter's suggestion of an 18-year-old Swedish au pair to cheer him up left him cold - he didn't, he says, feel up to it! That definitely sounds ominous!

The 28MHz Band

Despite the hospital tests, Ted G2HKU in Sheppey can go in the shack and so on 28MHz c.w. Ted booked in W5XJ, K4XU/0, W1RAN, K8NW, K2LE, K5ZD/3, ZP6CW, K2VUI, K1NA, OY3QN, N2KW, G6DC, K2SX/1, N3RS, K1JKS, W3VT, N5TP, K8EJ, K8ZH, N9SW, K5MA, K3Z0, WD8AUB, N3RD, K1RH, K4EFZ, W2GW, EA8Q0, 4X1FC, 4X4NJ, W2BA, N3RS, W3LPL, K5NA, KC9T, K4FU, ZP6CW, W6JNX, N3JF, W6OV, K8ZH and W4DHZ.

Up in Auckengill, Wick, Don

GM3JDR keyed with ZS6BID, BY8AC, T14CF, PY1BYK, Z21FN, VS6BG, VU2R0I, ZA1TAC, YV5DTA, JAs and Ws.

Next Angie G0HGA from Stevenage, who mentions K2QIL, K1WJB, K2MFY, WF1W, WF3T, W3DKT, WD8QBP, WX8Q, W41F, W4FOA, WB4LOU, W4/G4ILW, KM9PK, W9AND, W9ACU, YN/SM00IG, J37M, UA9FXW, UA9KW, and the usual smaller fry.

Now a new reporter by way of Alan GORCI in Grantham; Alan has 10W to a 5/8l vertical at 11m, with which he managed UV1AD, UV9UBE, 4J1700JJ, W2PPG, WF1F, HK3MAE, SV1BJT, U05GQ, UJ8JCO, PT7WX, CN8EC, WA4WTG, W11DP, UL7PLJ, IT9KDA, CP6RW, ES1WW, WP4VU, 9H1DE, 4Z4DX, 4X4JU, W3DKT, W7OF, EA6ST/7, EA9IB, LY1DR, C56/G3RZ, UZ9CWA, K2PS, VU2JJQ, CU2DW, P43FM, 4U1UN, H18MTL, N1FOJ/T, W6KKT, AP2MYC, JY3ZH, 7X2VZK, KC4TLK, UH8EA, JA7OWD, YL3FW, N3HBT, 9K2ZZ, C6A/G4AMLK1YUB, 5B4ES, PJ2WG, J69BB, VP5JM, YS1EJ, UF6VBZ, UD6DFR, VY2OH, C08LY, HZ1AB, HL1XP, P43TAT, ZS1UW, VE3EFP, VE3DTV, K8SWZ, JA1SGX, BV2BT, KA0SMR, WP4EPA, JA7SN, JH8BOE, JH0BBS, LU8XW, 8P6BL, T77M, PZ1DY, J73VE, K3AQH, P30JE, UH7E/P/UA9SMG, 7X2DG, K2P0F, PT7WZ and of course the smaller fry as well.

Over the water to Pat ON7PQ (Kortrijk) who is all c.w. and offers YS/K8LA, AA4NC/KP1, AP/WA2WYR, 3D2UU, 7Q7XX, WL7E, JA1NUT, ZD8OK, J88AQ, J7/DL6LAU, ZF2HM, FG1/K3HAQ, 8P9CP/TU4SR, V73AZ, VK9XM, AC8W/AHO, KL7QR, ZY0FX and VC8DR.

Operation on sideband is Don G3NOFs mode from Yeovil, and he used this band for C56/G3RZ, CP6RP, JE3TXA, KA2IMX/KH2, OD5SK, SV0IL (Crete), V31KX/VOA, W7CFL (Utah), W7XY (Arizona), XX9AW, YV5DUW, 4K2CC, YV5DUW, 4K2CC and 9K2ZZ.

Leighton Smart GW0LBI sticks to his last, and this time reports OK2HMA, HA7JHF, WA80A, UA6YX, K20NP and WE1F, all on the low power. Antennas by the way are a 62m end-fed, a trap dipole, and on the h.f. bands monoband dipoles.

John Heys G3BDQ in Hastings, notes what a super month it has been on 28MHz (naturally, that's why my beam came down!) s.s.b.; stations worked included CN8NS, 9K2ZZ, BZ9AAA/5, B5YRT, BY8AL, RH2E/RA3AQK, 6Y5PF, TI2DX, C56/G3RZ, FH3AS (Mayotte), 9K2TC, 3DA0AY, 9K2TC, UI8DAA, UJ8KAA, AP2MYC, HZ1MM, ZD7CW, 7Q7JL,

HL1XP, 4K2CC (Franz Josef), many S9-plus JAs, VKs and ZLs.

The WARC Bands

On the WARC bands, again Ted G2HKU leads off and again its all c.w. On 18MHz we find SP5EXA, while on 24MHz the tally was LZ1NK, W1HT and 4Z4DX.

Don GM3JDR found U0AL, 7P8RQ, N6QR, OY1H, ZL1UB, VQ9QM, RY0U, 4J7GWB, ZA1TAC, 4X4DK on 10MHz while 18MHz gave 4K3BB, JW5NM, RC9WAZ, JA and W. Turning to 24MHz he logged KN4UG/C6A, A430JF, VP2EST, FS4PL, V47UY, JA and Ws.

At Vince 9H11P's (M'Scala, Malta) QTH, operation on 24MHz yielded IT9EUT for a bit of real short-skip, 3X0HNU, A22AA, 4N7Zz (Croatia), VP2V/KB5GL, VP2V/W5ZPA, VP5WA2B0T, WA4DAN/KP1 and KW2P/KP1 (both Navassa), Y11RM, YN/SM00IG and J8/G0GPX; dropping down to 18MHz found 7P8EN, 8P6EM, WP4JOE, A22AA, ZD7AY, 8P6QY, 5N0CEP, 5V7JG, VP2V/W5ZPA, Z21HJ, KW2P/KP1 (Navassa) and TA1AL.

Now to Don G3NOF and s.s.b.; on 18MHz he noted 3A2LF, and on 24MHz C07JC, FG5BG, FM5CD, FM5WD, FS/JE2HCJ, FY5FA, HZ1AB, JA7JH, KP2A, NL7JZ/AM/HZ, RL7PEO, R05DP, SV0VOA, UI8DX, UJ8KA, VP2MR, VS6CT, XX9AW, Y11RM, YV2BYT, ZA1TAH, ZB2AZ, 3C1EA, 4K2CC, 5N0AIP, 5U7M, 5V7JG, 6Y5EW, 7Q7MM, 9K2WR and 9X5NH.

The best-kept secret of amateur radio is 10MHz' says GOKDZ in Thirsk, who stuck on this band only and keyed with 9M2AX, 4J4GC, 5B40G, 4K2CC, PZ1DY, JJ1TEA, JA0AWF, ZL4HB, VK3MR, ZL2AGY, VP2V/W5ZPA, OY2H, ZA1TAH, KL7U, JJ1VKL/4S7, JA8GQZ and 9K2MU.

On again to ON7PQ: Pat sticks to his key and this method netted him P4/K1MD, 5U7M, 5T5CJ, T77C, 5V7JG, 8Q7XX, TA4/OK7PE, 4K2CC, UJ8KA, 4K3BB, TR8GL, VK9XM, AC8W/AHO, KL7QR, ZY0FX, VC8DR, VP2E/DK2UY and FR5GL.

This call leaves John G3BDQ to wrap up with the following s.s.b. contacts on 24MHz: AP2JZB, 6Y5EW, Z21HJ, KP4DAL, A92BE, XE/DJ6OV, plus a couple on the key in 7N1ULX and JR0BAQ.

The 1.8MHz Band

On 1.8MHz, it's John G3BDQ first; who notes all Europe, plus TA1KA/2, TA4/DK7PE, OH0AM, T77C, HX1LVL from the Winter Games, 5U7M for a

band new one, 4X4NJ, VO1A, OY8JD, N2RM, WB2Q, K2KIR, W3BGN, W3LPL, N4AR, K4TEA, K5UR (Arkansas), W8AH and KD9SV.

The QRP from Leighton GW0LBI in Trelewis, went out to G13LFH, SM6CTQ, EA3KU, GD4BEG, all c.w., while the sideband signal got to G13PDN, EI9FK and DL7UCW.

Angie G0HGA found eight new countries in the CQ WW 1.8MHz contest, and heard her first VK while listening to the FOC Marathon.

Finally for this band, Ted G2HKU mentions no contacts but wonders if it is his imagination...is the noise level on the band getting higher these days? Ted rarely gets a night when the noise level is tolerable.

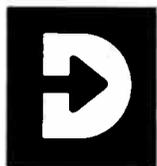
The 3.5 and 7MHz Bands

Now it's time to look at 3.5 and 7MHz. Ted G2HKU notes U05N and 4X4NJ on 3.5MHz, while on 7MHz K1JKS, N3RS, FY0EK, ZA1KF and UZ9XOU were netted. All c.w.

Again all-c.w. at GM3JDR. Don netted QSOs on 3.5MHz with JA7IUJ, JA1CGM by long path, J79DX, W5QN, WB4FDT/5, PJ2AM, C08DY and OX3CS. The 7MHz band got a bashing though: ZL2RA, ZL3ABV, ZL2UV, ZL1AZE, VK3YD, VK3BVE, VK7RG, J37M, H18A, JWOC, 3X0HNU, CX1BBL, UW1ZC/JW, EM3W, C08RCD, CM2AF, C02MA, C02VG, GW3INW/HK3, UZ0AB, UA0JB, UA9JX, J79DX, VP2EY, LU1EPO, LU2BRG, YV4AU, T14CF, O4A4MM, 4K4/UA1ZFO, K6GGUN, K7LJ, N7MC, K7ABV, K6DC, K6RK, W6JZH, WA6BMB, K6RG, K6DT, K7RO, N6TV - the Ws between 1400-1500UTC via long path.

Angie G0HGA is all but QRT again on 3.5MHz, due to complaints of computer r.f.i., but she did work all around Europe; the W7IW/10 must have been a bit of an anti-climax though! On Forty W03Z, K1VMI, WA1IWD, WR10, W4GCW, KA2DEV, K1JD, W2QM/4, UA0SPB twice, UA0ALQ, UA9GE, UV9AAA, 4K3/UW10G, UL8LWA, UL8GAK, RH2/RA3QA and EA8BUJ who is ex-G3BNF.

All 7MHz is the game at Eric GOKRT in Worcester Park, Surrey; 1W of c.w. from a Lake DTR7 does the business, with two-way QRP to three Gs, IK1DHA, ON5UP, DJ8TA; other contacts included DJ8TA again, DK8ND, DL4XQ, DL7LX, EA1DDX, IK2ERA, IV3HRO, OE1PRB,



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SP5JJR, UV6LSX, ON4KEP, ON5RR, OK1FPS, LA3JHA, PA3FPP, YT3KO, YU4IEF and YU3CCD, so the countries worked tally continues to rise. Eric's antenna is a 26m top with a quarter-wave counterpoise.

Now it's back to GW0LBI; Leighton keyed with 2W0AAI, OK1VOY, OK1PVA, and used the mike for G0JMF. This was on 3.5MHz; but on 7MHz there was just ON4NO on c.w.

Over to Pat ON7PQ, and this time 7MHz first: 7P8EN, FS4PL, BV2TA, VU/HA5BUS, JJ1VKL/4S7, WA4DAN/KP1, 7Q7XX, 9K2ZZ, OA4AWE, 3X0HNU, DU1COO, KL7U, AA5K/AH0, V2/WJ20P, JW5NM, ZD80K, HS0ZAI, KH6CD, KO7P/NH7 and TR8XX. Turning to 3.5MHz he logged 7P8EN, JH1RES, 4Z4DX, V85FC, VS6WV, ZS3VC, CN8T, SV9BGH, VY2SS, TI4SU, N6ND, K6NA, ZL4KX, KB2S/6Y5, SU1HV, CZ2SS, TI2PZ, PJ2AM, TA4/OK7PE, YK1CW, JW0E, 4K3OQL, K7EG, ZY0FX, ZD8Z, 8P9CP, ZF2KE, VQ9QM, 9M2AX, XE3ARV, HF0POL, CO8LY, V2/WJ20, 4K2MAL, FM5BH and OA4MM.

The 14 & 21MHz Bands

Don GM3JDR starts off on 14 and 21MHz. He keyed with DU3HF, 4K3/UW10G and VK6VK on 14MHz while on 21MHz he logged ZL1CH, UA0QE, UA0FJ, 4K3/UW10G, 4K3/JA10L, BZ10K, 4K2CC, 4K30LL and ZL30E.

Next it's G2HKU who again stuck to his key; 14MHz saw Ted work W1RAN, K4LTA, K8ZH, W2XN, N2KW, W8EBG, K4XU/0, EA6ZY and 3A2LF; for 21MHz it was K10T, N4LS, W4YE, K3ZO, W1RAN, N4XR and KA4IFF.

At Angie G0HGA the key supplied WA1FXB, N2IF (an ex-local), WB3EPC, W4ZO, W2QM/4, AA4GQ, N5VV (New Mexico), K9UIY, K9QVB, W9FST, KM9W, K9CLO (Indiana), N5FB, KA9ZZT, AB4UM, K7RIE, K0HB, W9GXR, VE2XCT, JW0C, J37ZR, YV1NX, EA6ZY, and lots of smaller fry, with BV4CT at 1530UTC for a 'gotaway'. Turning to 21MHz we find W4HT, K1RM, K2DXE, WA2SON, N3FOP, W9NTM, KB7SO (Arizona), JA1QSS, JA1CQC, ZD8LI, UA9TQ, UA9XJV, UA9XBH, RA9AAV, and a

short-skip GW.

Now it's time for s.s.b., driven by G3NOF; Don used 14MHz for A22BW, A41JR, AL7S, AP2AU, BV2CR, CU2AX, CU2YA, FK8CP, J28GG, JT1BV, KH6WU, P29UV, SV0VOA, TK5FF, TU2ZB, VC8CB, VU2DVP, VU2JQJ, XW1QL, ZL2AAI, ZS1DZ, 3A/F9UW, 4K3/RZ10A, 5H3DC, 8Q7DV, 8Q7PV, 9J2EG and 9J2SZ; all between 1500 and 1900. As for 21MHz, here the scalps included AA7FV, BZ4RBV, C6/G4AML, EG7BVI, HF0POL (S. Shetland), KL7GLS, NI6H, T30A, TR8GL, VP2E/DK7UY, XW1QL, 3D2AG (Rotuma), 4K3/RZ10A, 5N0AIP and 9Q5TE.

Leighton GW0LBI tried s.s.b. on 14MHz QRP to raise K1RU WA2YVA; the c.w. KF8QE, N4DN and GM3XUW.

It was mostly sideband on 21MHz for John G3BDQ, by way of UI8TAA, 7X2VXX, UA9QCP, RH2E/RA3QAK, BV5AP, BV5BG, LU8XW; but VK7RY, BV3BI, VU/HA5BUS and RL7PJI were on c.w.

Finally ON7PQ: Pat tried 14MHz c.w. for 3O2UU, NOTG/KP1, 3D2WZ, OD5/LA4GHA, KD7P/NH7,

WA2C/WP4, NH0/N8CC, HS0ZAA, VS6WV, 7P8FE, F05JR, V63AX, 9M2FR, FK8FG, T32BW. As for 21MHz, it turned up 9K2TK, A350X, DF2UU/KH8, AA4NC/KP1, 3D2UU, VK9XM, J77UY, KH0/K8AQM, JE7LHT/JD1, 5R8GW, ZD8Z and A22GH.

Contests

Just a couple of contests to mention this time; March 28/29 for the CQ WW SSB WPX Contest; April 18/19 for the SARTG WW AMTOR contest, and then the CQ WW SSB WPX Contest weekend May 30-31. Not of course to forget NFD on the first weekend in June.

That's the lot for this time. Send your lists to reach me by April 1, May 3, and June 1 at the address given at the head of the piece. Thanks.

Solar Data For February 1992

During the last week of January there were a number of significant flares, the largest being an X1/3B on the 26th and an M4.9/2B on the 30th. Major solar storms were reported on January 26 and February 2 and between February 3-9, 11 M-type flares were recorded. An impressive long duration M4.3/2B flare also erupted in a favourable position on the Sun at approximately 1052UTC on February 6.

Magnetic storms occurred on February 3 and February 8, and in the period between February 10-16, 10 M-type and one X-type flares were reported. More magnetic disturbances occurred between February 17-23 with 14 M-type flares during the period. It was therefore hardly surprising that a number of auroral events took place on the v.h.f. bands during February! Propagation on the 50MHz band was also exceptional, especially during the first three weeks of the month.

Solar flux levels increased from a low of 152 units on January 18 to 303 units on January 31, declining to 198 units by February 14, but picking up again to 255 units on February 25. The geomagnetic A index, measured at Boulder, was at sub-storm levels during the first week of February, reaching 48 units on February 3, 45 units on February 8-9 and 46 units on February 10.

It then remained generally quiet for most of the month but became

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Reports to
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active again reaching 40 units on February 20, 64 units on the 21st and 20 units on February 22. Between February 26-29, it measured 38, 42, 41 and 28 units respectively, certainly a very magnetically disturbed period.

Auroral Events

As predicted, activity via auroral modes of propagation was very prevalent during February. In central England, events were recorded on February 1, 2, 3, 8, 9, 20, 23, 24, 25, 26, 27 and 29th. Some of the openings were fairly large scale, allowing contacts up to 2000km to be made on the 144MHz band.

Martin Andrews GM6VXB (I097) thought that the aurora on February 1 was quite good, and from 1550UTC he made s.s.b. contacts on the 50MHz band with stations in DL LA, OY, OZ and SM. He passes on the news that he expects to have a 50MHz station operational from an oil rig in locator JD18, and that he will be active during alternate two week periods.

During the aurora on February 1,

Ela Martyr G6HKM (J001) worked GM3XOQ (I099) on the Shetland Islands plus three other GM stations. More 50MHz QSOs were made on February 8 with LA4TE (J059), SM3EQY (JP81), SM6BZC (J067), SM6HYG (J058) and G, GD, GM, GW, DL, ON and PA.

An event on February 9 found GI7FOD (I074), GM4IGS (I075) and GM4OGI (I085) on the 50MHz band and GM0GDL (I086) on the 144MHz band. Ela made many 50MHz contacts during the widespread opening on February 20 including OL6NF (J033), EI2EFB (I064), OZ7JV (J045), SM7FJE (J065) and stations in G, GM, GI, GW, ON and PA. Up on the 144MHz band s.s.b. contacts were made with EI3GE, GM7IKA, GM7JED, GM7KDW and GM0HSU.

On February 1, I made c.w. QSOs with GM3WTA (I087) and SM5MIX (J078) on the 144MHz band and s.s.b. contacts with GM6VXB (I097) on both the 50MHz and 70MHz bands. A weak event, on February 2, found EI4DQ (I051) and G8RZ (I084) on the 144MHz band but conditions were very much better on February 8, with c.w. contacts being made

with HB9DFG (JN37), HG0HO (KN07), LX2PA (JN39), OE2UKL (JN69), OE3XHF (JN76), OE5KE (JN78), RB5PA at 1900km, SP20FW (J093), SP7JSG (K001), YU2EZA (JN86) and YU3ZW (JN86). QSOs were also made from my QTH (I081) with DL, F, ON and PA stations. An event on February 9 produced GM4AFF (I087) and GM4DIJ (I085) on the 70MHz band, GM4ISM (I085) on the 50MHz band and OZ1AZZ (J057), SM4IVE (J079), DL, EI, G, GM and PA on the 144MHz band. This band also gave me c.w. contacts with GM4OJS (I085) and LA6VBA (J048) on February 24 and in a much better event on February 26, between 1845-2045UTC, c.w. contacts with I1DMP (JN35), OE3JPC (JN88), RB5PA, SP20FW, YU2EZA and many DL stations.

John Regnault G4SWX (J002) also made the most of the opening on February 26 and between 1955-2057UTC he worked many 144MHz stations including HB90BM, HB9DFG, HG8CE, I1DMP, I1JTQ, IK10DO, OK3KMY, OK3LQ, SP20FW, SP4MPB and YU1WP. John caught an excellent widespread opening on February 29, (why do these good events always occur when I'm at an RSGB v.h.f. committee meeting?) the best of the bunch being ES2XM (K029), OH3EX (KP20), OH5LK (KP30), RB5PA (K021) and UZ2FWA (K004).

Meteor Scatter

Conrad Farlow G6ZTU is now active on meteor scatter using both

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c.w. and s.s.b. His 144MHz station consists of an FT707, LT2S, 4CX1000A amplifier, a mast-head l.n.a. with 0.5dB n.f. and four 9-element Yagis. During the Geminids shower in December, he worked DL5MAE, EA3BTZ, HA7AJP, HG7ULP, OK1IBL and YU7EF. He also heard EA2LY, EA3JH, IK0SMG and OH2AV.

The Quadrantids shower in early January was even better and Conrad contacted EA3FLN, EA6FB, FC10DA, HA5PT, HA7P, HG8CE, IW1AZJ, IK2DDR, IV3HWT, IK4DCO, IW5AVM, IS5JUX, IK0BZY, OE3JPC, SM3BIU, SP9EWA, SP9EWU, YU2PT, YU3XY, YT3ET and UV1AS at 2048km.

The following data, concerning meteor showers occurring during April-May, will help you determine in which direction to beam at specific times and when the shower is below the horizon.

The Lyrids meteor shower will be encountered between April 18-25, peaking on Tuesday 21st around 2130UTC. Between 0200-0400UTC beam north-east or south-west, 0400-0700UTC beam east or west, 0700-0800UTC beam south-east or north-west, 0800-1000UTC beam north or south. The shower radiant is low between the hours of 1400-0200UTC and is therefore not usable for meteor scatter.

The Eta Aquarids meteor shower will be encountered between April 21 and May 12 peaking on Monday May 4 around 2030UTC. The actual peak is rather broad with several sub-peaks. This is a very complex meteor stream and prediction of maximum activity is difficult. However, between 0400-0600UTC you should beam south-west or north-east, 0600-1000UTC beam west or east, 1000-1200UTC beam north-west or south-east. This shower does not give very good results on the north-south path. The stream is below the horizon between 1700-0400UTC.

Moonbounce

Apologies for giving the wrong date, last month, of the REF e.m.e. 'moonbounce' contest, but the details given in a Scandinavian magazine were totally inaccurate. Hopefully, the information in *Radio* the REF Revue des Radioamateurs Francais, should be correct and although you've missed the first leg, held on March 14-15, there is time to prepare for the second leg on May 9-10. The chart, Fig. 1, gives details of moon rise and moon set when you may hear DX signals with your conventionally mounted antenna system.

Despite running a modest e.m.e. set-up of four 9-element Yagis, G6ZTU has worked over 40 stations and heard three two-Yagi stations in three months of operation. Contacts made in December included IW5AVM, OE3UP, OH5YI, OH7PI, OK1MS, OZ4MM, SM2CEW, SM5MIX, N1BUG, K2GAL, KA5AIH, WB5LBT, W5UN, W7HAH, KB8RQ, AF9Y, K9MRI and KO1FL. New stations worked, or initials as the e.m.e. brigade call them, in January, were DL3BWW, DL8DAT, HB9CRQ,

I1ANP, I1KTC, IK2DDR, K13W, N5BLZ, K6MYC, K7CA, LA9NEA, OE5EYM, ON7RB, PA3DZL, PA3FSA, PA0JMV, RB5AL, SM3PWM, SM5FRH, SM7BAE, VE1BVL, VE7BQH and ZB0T. It is interesting to note that four of the stations, IK2DDR, PA0JMV, RB5AL and VE1BVL were using only two Yagis.

The G4SWX reports that European e.m.e. is booming, and that at least five new stations are appearing each month on the 144MHz band. During January, e.m.e. contacts were made with DK1KO, DL5MAE, DK9ZY, Y23RD, EA3DXU, F3VS, HG1YA, IK2EAD, IK3MAC, IV5AVM, LA6HL, OE3UP, OK1MS, PE1DAB, PA3FJY, SM2CKR, SM5FRH, SM5MIX, SK7AX, SM7BAE, N5BLZ, W5UN, WA6MGZ, N8AM, K9MRI, RB5PA, UA4NM, UA4NX, RA6HHT, UG6AD, UA9SL and ZB0T.

Results were equally good during February, and to give you a picture of the real activity that presently exists in Europe, I have included both worked and heard reports from G4SWX. Note also that much activity now occurs during the week, and not just at the weekend as used to be the case.

On February 8, despite an intense aurora, QSOs were made with IT90WA/2 and W5UN. American WA6MGZ was called on random, but got John's call sign as G4IWX! February 14 found KB5IUA for initial 162 followed, on February 15, by HB9DBM, I2FAK, IS5JUX, LA9NEA, RB5AL, UA9XEA and VK3AMZ. Stations heard on the 15th included HB9CRQ, I1KTC, OE5EYM, OK1MS, OZ4MM, PA3FSA, UA4NX, RA6HHT, UA9FAD and UA9SL.

On February 16, contacts were made with GM4AFF, HG1YA, IK2DDR and SM0PYP with the following being heard, DJ6CA, F3VS, I2FAK, LA8YB, LA9NEA, LA0BY, OZ4MM, K1WHS, K2GAL, N5BLZ, W5UN, KB8RQ, AF9Y, RB5AL and UA9XEA. The 17th got IK2EAD and W2UHI in the log book with DK1KO, HB9CRQ, HB9SV, IK1MTZ, I2FAK, K3HZO and LA9NEA being heard.

Contacts on February 18 included DL3BWW, IK2EAD and RA6HHT with G3IMV, LA9NEA, OE3UP, SM7BAE and UA9XEA being heard. IK1MTZ was worked on the 19th with VK3AUA being heard for 30 minutes with a pile up of 10 stations. Not bad for a Wednesday

evening! Other stations heard included LA8YB, LA9NEA, PA3BXH, RA6HHT, RB5AL and RB5PA.

One QSO was made on February 20, with DF8LC for initial 170, the stations being passed over being DK9ZY, G3IMV, G3LQR, IK2EAD and RA6HHT. Since 1988, G4SWX has attempted 573 e.m.e. QSOs of which 453 were completed, a 79% success rate. A total of 170 stations have been worked on the 144MHz band, with 110 being worked without any prior scheduling. So far, two single-Yagi and nine two-Yagi stations have been worked. As John mentions, the 1990s are the decade of everyman's e.m.e.!

The 50MHz Band

Propagation during the first few months of 1992 on 50MHz were tremendous, with a number of stations hearing or working all continents in under 30 minutes! On many days the band opened up to Australasia, allowing numerous low power stations to work the ultimate in DX with comparative ease.

Mark Trotman G1FYC (IO81), picked up a number of new countries during January by working YV5ZZ on the 2nd, CN8ST on the 3rd, OK1DIG on January 4 and K8EFS on the 6th. During this US opening he also made s.s.b. QSOs with KA2RDO, WA3DJG, K3QMX, N8MLE and K9HMB.

Terry Chaplin G1UGH (JD02) made his best DX so far, VK6PA (OG89) at 16624km, during an opening on February 16. Other good contacts included PT7NK (HI06) on February 20 and TR8CA (JJ40), ZS6PJS (KG46) and 4X1IF (KM72) on February 22.

Jim Smith G00FE (IO90) thought February was a very interesting month making many

contacts via F2, Sp-E and aurora. He heard TU4DH on February 2 and some W8s on February 6 but was unable to work them. On February 7 he managed to catch K1DZS, K1TOL, VE1MQ and VE1XDX before the band closed at 1650UTC. Conditions on February 8 were very good with Jim hearing KG6UH/DU1, VK5BC and many VK6s in the morning and HC1BI, KP4A and P43AS at midday. At 1410UTC he worked H8A after which the Caribbean signals faded and a large scale aurora commenced. Conditions on February 15 were described as 'spotty', but KG6UH/DU1 was eventually worked for a new one and UL7GCC was also heard but he disappeared under the pile-up! Towards the end of the month a number of new countries were worked including ZD8LII and 4X1IF on February 22, UL7GCC on February 23 and E15FK via aurora on February 26 for country no. 80.

At my QTH, events on January 6 and February 8 were the highlights of a very interesting winter season. On January 6, following a day of intense European Sp-E activity, the band opened up to North America. What made this opening particularly interesting was the fact that propagation was most definitely via Sp-E at the UK end of the path.

In a westerly direction this propagation mode is preferred at my QTH, as the Black Mountains are located only a few kilometres away and received signals are very much stronger if they arrive via the E-layer, rather than the corresponding F-layer path. Between 1708-1856UTC I made 42 QSOs with stations located in all US call areas apart for W6 and W7. The ARRL locator map, Fig. 2, shows the extent of the opening stretching over as far as K5FF and W5FF (DM64) in New Mexico at a distance of 8000km.

The second opening worthy of note occurred on February 8 when, between 1135-1210UTC, contacts were made with VK6AKT, VK6HK, VK6JJ, VK6KRC, VK6KZ, VK6RO, VK6SQ,

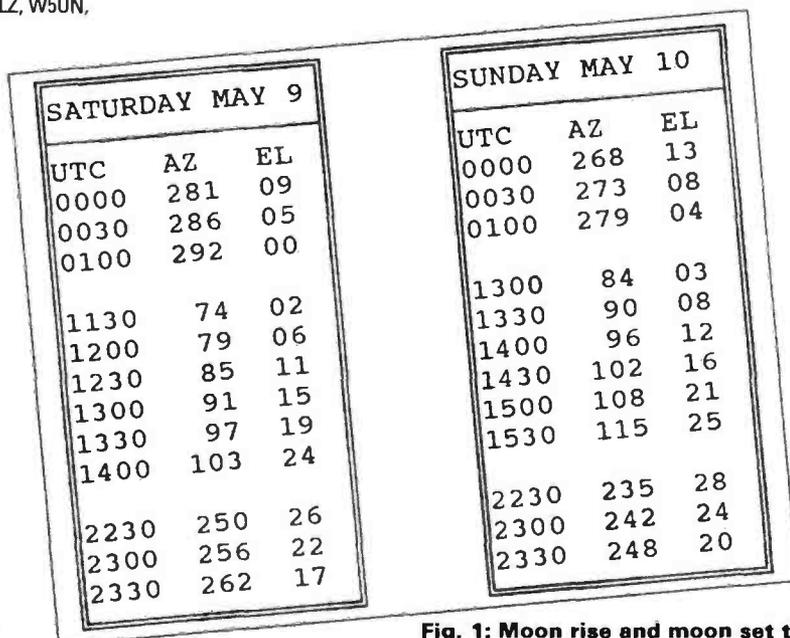


Fig. 1: Moon rise and moon set times during the REF e.m.e. contest.

Back-Scatter

VK6WD and VK6YU, all stations being located in the area DF77, DF78 and DF88. Incidentally, I found VK6RO up on 50.250MHz calling CQ on f.m., as the QSL card in Fig. 3 shows.

This leads very conveniently to a letter from the man himself, **Graham Rogers VK6RO**. He reports that this opening lasted over five hours, from 0814-1330UTC and that contacts were made with 12 countries and 71 stations, 40 on s.s.b. 23 on c.w. and eight on f.m. He claims that a QSO with GQJHC at 1154UTC on February 8 was the first Australia to UK f.m. contact on the 50MHz band. Graham mentions that Perth is the most remote capital city in the world, and that the opening was the biggest he had experienced in over 40 years!

The 144MHz Band

Tropo conditions on the 144MHz v.h.f. and u.h.f. bands, were remarkably good during January and February, with an extended opening to the northern coast of Spain covering a large area of the UK and excellent propagation into central Europe lasting for many days.

On February 6, **GW6TEO (IO71)** heard a number of very strong s.s.b. stations situated on the north coast of Spain and managed to work **EA1YV (IN52)** and **EB1EFC**. On February 7 he worked **EA1DAV (IN63)** and **EA1DKV (IN53)**. He then went on to work, from 1330UTC, 48 stations in DL, PA and SP, the best DX being **SP1HLE (JO73)** at 1357km. Gordon mentions that it was very difficult to work stations to the east because of the very strong signals from Spain on the side of the beam!

Terry G1UGH (JO02), made the most of the good conditions by working **DL6HCE** and **OJ9YE** on January 31, **EA1TA (IN53)**, **EA1TJ (IN83)** and **F1CYB (JN17)** on February 5, **EA1CJT (IN63)** on the 6th and **DK1MG (JN39)** and **EB1DSD (IN63)** on February 8.

The tropo duct from the northern coast of Spain continued through the UK up to IO93, enabling **John Hill G7CLY** in Humberside to work, on February 6, **EA1CJT**, **EA1DKV** and **EA1TA**.

Mary Lowe G0NZA (IO93), had just finished working a local mobile station on February 6

around 1815UTC, when she was surprised to hear **EA1CFF (IN53)** and by moving to 145.325MHz, an f.m. contact was made with station located in La Coruna. Mary uses a Trio TR751E running 25W into a 5/8 over 5/8 colinear antenna.

Derek Moore G1THG (IO80) mentions that his QTH in Dorset is not very good to the south because of local hills rising to 280m, and therefore he couldn't work any of the EA stations. However, in other directions he was able to work **G04XTT (IO74)**, **GM0PMW/P (IO85)**, **DK0OG (JN68)**, **DLOWAE (JO42)**, **F6IPR/P (JN27)** and **HB9RCJ (JN37)**.

Ralph Sachs G2CZS (JO01) missed the good conditions on January 31, but did catch **DG1BCU (JO42)**, **DG1JL/P (JO31)**, **DJ5PG (JO33)**, **DL6IC (JO43)** and **DG9BDV (JO33)** on February 1, **DLOWU (JO31)** on February 2 and **DJ9YE (JO43)** and **DG0KW (JO64)** on February 7.

Paul Bradbeer GM7GUC, reports that the 144MHz band has been very quiet at his QTH in Fife. Not only that, but on a recent portable outing, the high winds got the better of his mast! Paul can often be found on s.s.b. at the weekends operating from one of the local high points. He uses an Icom IC275H, 100W and a 12-element ZL beam antenna. He is hoping to get active on either the 430MHz or 1296MHz band and is looking at sources of transverter kits for these bands. Can anyone help him please?

Alex Younger G1WNH, is a newcomer both to the v.h.f. bands and to this column. He suggests that it would be useful if a chart could be published in *PW* giving details of radio gear, power output and antenna systems used by readers of this column, so that others could judge which is the best combination to use for working DX stations on the v.h.f. bands. In principle, this may sound a good idea but in practice it's not quite as simple as that!

To work consistent DX on the v.h.f. and

u.h.f. bands, you will require a good antenna, a reasonable amount of power and experience. A good QTH is also very useful but not essential. Experience is probably the major component of successful DX working, but it takes a number of years and you never stop learning!

The 430MHz Band

Richard Girling G4FCD (IO91) reckons that 1992 has got off to a tremendous start having, by the end of February, worked as many countries on the 144, 430 and 1296MHz bands as in 1991! The 430MHz band was open to Spain on February 5, 6, 8 and 22 allowing contacts to be made with stations located in IN53, 63 and 73.

The best tropo conditions occurred on January 31-February 1 with over a 100 stations in DL, OZ and SM worked on the 430MHz band and **OZ1GEH** and **SM7ECM** worked on the 1296MHz band. Conditions were also good into northern Germany on February 7, the best DX being **DL1SUN (JO53)** on both the 430 and 1296MHz bands.

Geoff Brown GJ4ICD, reports that on January 30 he copied the Manchester repeater **GB3MA** at S9 and then went on to work **G0MOK** on f.m. using a simple colinear antenna. The beacons **GB3MLY** and **GB3ANG** were S9+ for most of the day, but there was very little to work on the band. However, during the evening, activity increased and contacts were made with **DC7MH (JO62)**, **DF8LC (JO53)**, **Y21TC (JO63)** and **OZ1BJF (JO75)**. The band remained open on January 31 and over 300 s.s.b. contacts were made with stations in OZ and SM.

The Microwave Bands

Tropo conditions on the s.h.f. bands were especially good during the periods of foggy weather at the beginning of 1992. On January 31, **G6HKM** made 23 QSOs on the 1296MHz band, working many stations in Germany and the Netherlands. Ela also contacted **OZ1GEH (JO65)** and **G6YXT** in Devon. Propagation was still good on the following day allowing s.s.b. QSOs to be made with **DK5WO (JO30)** and **PE1MII**, who was only running 100mW.

Rik Royall G8ESB (IO94) reports that his most interesting contact recently on the 1296MHz band was with **Alice Blackwell 2E1AIZ**. She is the daughter of **G4PMK** and can regularly be heard on the band. Rik

also mentions reports that he has a regular schedule with **G6JQV (IO92)** at 1900 hours on Monday, Wednesday and Friday and at 1830 hours on Tuesday and Thursday. They start on 432.210MHz and then **QSY** to 1296.190MHz and although **G6JQV** has only a few watts on the 1296MHz band, they can normally make a QSO.

Do any other readers have regular schedules on these bands? Write in and let me know and I'll publish details in this column.

VHF News

Details have been received of the 1992 Scandinavian v.h.f. meeting being held in Angelholm, (JO66KG) Sweden, between June 5-8. The radio club **SK70L** is set in a forest alongside a sandy beach, where self-catering coastal chalets are available at special rates. If you fancy a short holiday, maybe taking the family, send me a s.a.e. and I will provide full details.

If you can't make it to Sweden, why not try the **Weinheim v.h.f.** meeting later in the year? It is located near Heidelberg (JN49) and will be held between September 18-20. Contact me if you want further information.

Expedition Update

Steve Bryan G1SGB, is hoping to be active from the **Sule Skerry lighthouse** during April. He will be active on the 144MHz band, concentrating mainly on WAB.

The expedition to Georgetown, Guyana (GJ06) by **G3JVL**, **G3SED**, **G4CCZ** and **G4CVI** is taking place between April 20 to May 22. The group will be very active on the 50MHz band.

Beacon And Repeater News

A new v.h.f. repeater **GB3LG**, located at **Lochgilphead, Argyll**, is now operational on channel R3. Contact **A.Fraser GM3AXX** for further details.

QRZ Contest!

The leading stations in the RSGB 144MHz fixed station and AFS contest held in December were **G4HUP (1st)**, **G4DHF**, **G3XDY** and **G1LSB** in the single operator section and **G4ANT (1st)**, **G4KUX**, **G4DSP** and **G0LIP** in the multi-operator section. Winners of the affiliated societies section were **Spalding and District**, followed by the **Martlesham DX and Contest Group**, **Sutton and Cheam Radio Society** and the **Rugby Amateur Transmitting Society**.

An RSGB contest covering all bands from 430MHz to 24GHz is being held on May 2-3 between 1400-1400UTC. There are sections for single operator, multi-operator and listeners. The contest exchange consists of callsigns, RST, serial number and locator. The 430MHz Trophy contest will run during the first eight hours, 1400-2200UTC on May 2. There are sections for the single operator fixed station, single

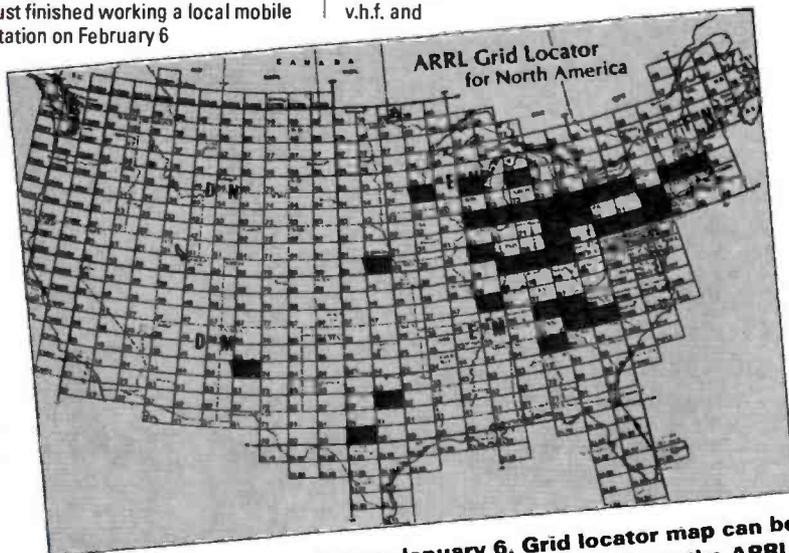


Fig. 2: 50MHz opening on January 6. Grid locator map can be obtained from the ARRL.

RSGB'92

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**Saturday 30 May &
Sunday 31 May**

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Organised by the RSGB Exhibition and Rally Committee.

Trade stand enquiries welcome to E and R Chairman,
Norman Miller, G3MVV, 178 Warley Hill, Brentwood,
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operator portable, all others and listeners.

On May 16-17 between 1400-1400UTC, an RSGB 144MHz contest is being held for single operator fixed stations, single operator portable, all others and listeners. An interesting departure is that there will be a separate, six hour duration event, for single operator fixed stations. Operation may take place, without any breaks, for any continuous period of six hours starting on the full hour, for example, 0200-0800UTC. Especially useful if you have TVII The contest exchange consists of callsigns, RST, serial number, locator and county.

Whilst on the subject of contest exchanges, it is good practice to give the information in the following way. "G9XYZ, you're five seven, zero twenty-two, in italy oscar eight one mike x-ray, seventeen kilometres north-east of Abergavenny, from G9ZYX over." In this way you follow the format of the standard v.h.f. log sheets. It can get a little confusing

Back-Scatter



Fig. 3: Australia to England on 50MHz f.m.!

when you receive, "G9XYZ, you're a good signal, five and nine on my meter. The location here is three miles north of Epping, in the county of Essex. I don't know my QRA but the WAB is tango lima five zero. I hope you've got that OK. Oh! By the

way you're zero zero one. Is that a roger!"

Summer microwave contests have been scheduled by the RSGB microwave committee to take place between 0900-2100UTC on the following Sundays, April 26, May 24, June 14, July 19, August 16, September 13, October 3-4, the latter to coincide with the IARU

contest arranged for the same weekend.

Scandinavian activity contests will be held between 1800-2200UTC on the following dates, 50MHz on April 28 and May 26, 144MHz on May 5 and June 2, 430MHz on April 14

and May 12, Microwaves on April 21 and May 19. A full set of rules can be obtained from myself on receipt of a s.a.e.

Deadlines

Please send your letters to reach me by the end of the month. I always write up the column in the first week of the following month. Don't forget that I can also receive messages via packet radio at my mailbox GB7TCM and I can also be contacted at my DX cluster GB7DXC.

Photographs of your shack, antennas or any v.h.f. activity are especially welcome. Other pictorial items such as QSL cards, awards, certificates, etc., are also required. They will all be returned to you.

144MHz QRB Table

Top distances (km)

Tropo 3160	GM4YXI
Aurora 2143	G4YTL
Sp-E 3080	GOEVT
Meteor3100	GW4CQT

Back-Scatter

Broadcast Round-up

Reports to Peter Shore via the PW Editorial Office

I have reported about Esperanto and Latin broadcasts in this column over the last year. Now comes news from the Head of Radio Finland's External Service that YLE, Finnish Broadcasting, is to publish a book of the Latin news broadcast by the station since it started in 1989. The book, called *Nuntii Latini* will be available from YLE in Helsinki. However, Swiss Radio International in Berne is to stop Esperanto broadcasts at the end of March, since the station believes that English is now more widely spoken in the eastern part of Europe, where the largest following of the language was.

Satellite continues to increase its role in international radio here in Europe. Radio Sweden will be on Astra 1A by the end of March, and anyone who can pick up Tele-X at 5° east, which carries Scandinavian television services, will also be able to receive Radio Sweden. There's a new line-up of times for European listeners from March 30, and details are in the European Stations section. Meanwhile Swiss Radio International is pressing ahead with its plans to use Astra 1A so if you have a dish, keeping scanning the audio sub-carriers.

The changes in the former Soviet Union are still having knock-on effects to the external services of the Republics. There are more and more disputes over who should pay for the use of transmitters. Stations such as Radio Vilnius are suffering particularly badly at present, as they cannot afford the huge rates being demanded by the Ukrainians and others for use of transmitters on their territories. Some of the latest frequency news for Vilnius and Kiev is carried in the European Stations section.

A new relay station for Radio Exterior de Espana is nearing completion in Costa Rica to serve

the Americas. Meanwhile old transmitters used by Radio Independent Spain, which operated during the Spanish Civil War, may be used soon by REE for European services. The four transmitters are in Romania, and are rather antiquated but believed to be serviceable. More details soon.

If you like to keep an eye on propagation conditions on the short wave bands you might like to know what the predicted sunspot numbers are for the first part of 1992. February to July's predictions are: 129, 126, 123, 121, 119 and 117. The margin of error is ± 31 . The actual average for January 1992 was 149.

If you've been wondering what the new Sony ICF-SW77 receiver is like, here's your answer! The new set, retailing at around £330, is the replacement for the ICF-2001D which has been around since the mid 1980s. The new set is similar in size and offers continuous coverage on a.m. from 1560kHz to 30MHz, as well as v.h.f.-f.m. with stereo through personal headphones.

The synchronous detector mode first seen on the 2001D, is also on this set but is easier to use. There is an annoying feature associated with it, though, for every time the synchronous detector circuit locks, the bass of the audio is cut, leaving a very difficult signal to listen to. There are 162 memory channels, 82 of which are pre-programmed with

the frequencies and operating times of the major international stations. A sophisticated clock and timer facility allows the set to be switched on automatically, and if a cassette recorder with a remote start socket is connected, will start recording for you. The new Sony is a reasonable performer, although sensitivity is not all it could be. A more detailed report will appear in a future edition of *PW's* sister magazine, *Short Wave Magazine*.

European Stations all times GMT(=UTC)

Radio Austria has been carrying out s.s.b. tests on 9.875MHz to North America between 0000 and 0300. These are heard clearly in the UK in German, English and French.

Croatian Radio continues to air short English newscasts on 9.83 and 7.24MHz noted by Roy Merrill at 0902 and 1303. Later broadcasts are inaudible because of heavy QRM.

Radio Vilnius wants listeners to FAX reception reports to them on Vilnius 660526.

Radio Ala, the Russian station which predominantly broadcasts folk music, has moved to 6.015, noted in parallel with 5.04MHz at 2200.

Radio Sweden makes changes to its English programme times on March 30. The first broadcast will now be at 1330 and the evening one hour English block will move from 1930 to 2030GMT to take account of

the time change in Europe. The English service will also be carried on Astra advises George Wood, presenter of *Mediascan*, which is heard on Tuesdays.

Radio Kiev in the Ukraine has English transmissions at 2200 on 9.785, 7.38, 6.02 and 5.96MHz and again at 0100 on 17.69, 17.605, 9.86, 7.40, 7.24 and 4.825MHz.

African And Middle Eastern Stations

Roy Merrill has been hearing the Angolan clandestine station, 'The Voice Of The Resistance Of The Black Cockerel'. It signs on 9.70MHz at 0440 with poor signals in the UK. Much better reception is offered at 1754 on 7.10MHz. The station identifies in Portuguese as A Voz da Resistencia do Galo Negro, often abbreviated to VORGAN. The identification comprises a cock-crow repeated twice, followed by a nine note organ phrase and Portuguese id, repeated until a brass band interlude at 1758 with a YL announcer and a further chorale. The evening transmission can rate up to SIO 333 with BBC QRM from 7.105MHz. Since the beginning of the year the schedule has run from 1645 to 2300, and is more difficult to detect. Signals tend to disappear by 2000 at the latest.

The RDN Tchadienne in N'djamena can often be heard on 6.165MHz in parallel with 4.9047MHz from 0426. A four second chord on the balafon, repeated twice at 10 second intervals, precedes the National Anthem and id in French at 0430. The channel is marred by the Breda carillon of Radio Netherlands from Bonaire, reports Roy Merrill.

Radio Ghana's External Service has been heard weakly by Roy Merrill signing on in English at 0644 on cluttered 6.135MHz.

Radio Kuwait is back on short

wave. There's a relay of the Arabic domestic service heard:

0400-1305 on 6.055MHz
1315-2345 on 11.99MHz

A broadcast to North America is on the air daily at 1700 for an hour on the old Radio Kuwait faithful frequency of 15.505MHz. An interview with the Head of the External Service of Radio Kuwait broadcast on Radio Netherland's *Media Network*, revealed that at the moment the station has only very limited capacity. It hopes to be back with a 24 hour-a-day schedule by the end of March, and to start the English service again by Independence Day on February 21. More news next month, but do let us have any reports to the *PW* Editorial Office in Poole.

Radio Nigeria in Kaduna is often heard with Hausa language programmes on 6.09MHz at 0530 with SIO up to 434. There are commercials for businesses such as the Universal Bank of Nigeria.

Radio Suid Afrika and R Orion have been regularly and clearly heard on 4.81MHz in Afrikaans initially from as early as 1715. Later R Orion rates up to SIO 332 in English until well after midnight.

Asian and Pacific Stations

Radio Alma Ata has increased English coverage with a new

Back-Scatter

transmission at 2030 to 2100, on many of its domestic second channel frequencies including 5.035, 5.26, 5.96, 5.97 and 9.505MHz. The station has been heard by Roy Merrall identifying as Radio Alma Ata World Service.

Despite the cutbacks of relays by transmitters in the former Soviet Union used by countries such as Afghanistan, Laos still has a French service relay apparently coming from Russia. Try at 1100 on 15.19 or 17.86MHz. Radio Afghanistan, meanwhile, is just about audible on 9.535MHz.

New Zealand will be heard on 11.735 between 1700 and 2200 from the end of March.

Radio Pakistan has English to Europe:

0800-0845 on 21.52 and 17.9025MHz
1100-1120 on 21.52 and 17.9025MHz
1700-1800 on 15.55 and 11.57MHz

The station was also noted by Roy Merrall on January 4 at 1015 on 21.52 and 17.9025MHz with commentary of the 3rd test between Pakistan and Sri Lanka with frequent mentions of the sponsors the Pakistan Tobacco Company

(who make Wills cigarettes).

The FEBC Manila service has English at 1530 on 11.995MHz offering European reception up to SIO 323.

American Stations

Radio Havana Cuba's English to Europe service has been noted: 2000-2100 on 17.705 and 9.76MHz

2200-2300 on 7.215MHz
Some frequencies would appear to come from the former Soviet Union, so it seems that relays of Moscow continue from transmitters in Cuba.

The HCJB service in Quito now uses a slightly lower frequency for its single sideband transmissions from an old Swiss PTT transmitter operating with 30kW, and it's possible to hear it in Europe throughout most of the day, with an SIO of 232 noted at around 1100. It's on the air 24 hours on 21.455 upper sideband, with English heard:

0030-0430 on 21.455-u.s.b., 15.155 and 9.745MHz
0500-0700 on 21.455-u.s.b., 11.925MHz
0700-0830* on 21.455-u.s.b., 11.73 and 9.585MHz
0730-1130 on 21.455-u.s.b.,

11.925 and 9.745MHz
1130-1600 on 21.455-u.s.b., 17.89 and 11.925MHz
1900-2000* on 21.455-u.s.b., 17.79 and 15.27MHz
2130-2200* on 21.455-u.s.b., 7.79 and 15.27MHz

Frequencies noted with an asterisk are beamed to Europe. Station WCSN is noted on new 13.615MHz from 0800. Station WWCR can be heard on 7.435MHz in the early morning with a DX programme at 0435 on Sundays and 0705 on Mondays, with a Sunday evening repeat at 1605 on 15.69MHz.

QSL card from WSHB.

A card promoting Radio Finland's latin news.

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E881	1.50	EY800A	3.00	QOY02-B	10.00	8B47	5.00	8V1	3.80
E8F80	1.00	EZ800	1.80	QOY03-10	8.00	8BE6	1.80	8X5GT	2.50
E8F89	1.50	EZ81	1.80	QOY03-10 Mult	15.00	8BH6	2.50	12A17	2.25
E8L31	12.50	GY501	3.00	QOY03-20A	28.00	8B16	2.25	12A17	2.25
E8D1	6.00	GZ82	6.00	QOY06-40A Mult	40.00	8B86	2.00	12A17	2.25
E8D33	1.50	GZ83	4.50	QOY06-12	10.00	8BZ7A	3.00	12BY7A GE.	7.00
E8C35	7.80	GZ84 GE	7.80	R18	4.00	8BR7	6.00	12BA6	2.80
E8C81	2.25	GZ87	4.00	R19	3.00	8BR8A	4.80	12BE6	2.80
E8C82	2.25	KT81	7.80	SP41	6.00	8BS7	6.00	12BY7A GE	6.00
E8C83 Siemens	1.20	KT88	28.00	SP41	4.00	8BV6	4.80	12BY7A GE	7.00
E8C85	3.80	KT88 GEC	38.00	U19	10.00	8BW7	1.80	12E1	20.00
E8C88	4.70	KT77 Gold Lion	P.O.A.	U25	2.50	8BZ6	2.50	12HG7 12GM7	6.50
E8C91	2.80	KT88	18.80	U26	2.50	8C4	1.80	30P11/2	1.50
E8C90	1.80	KT8	9.50	U37	7.50	8C6	3.50	30P14	2.50
E8C95	3.30	DA2	2.70	U4BC80	1.50	8C86A	3.80	30P19	2.80
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E8H81	3.00	OC3	4.00	UCH42	4.00	8CL5	3.75	30P14	1.80
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E8F7A	3.50	PC17	2.80	UL41	10.00	8D05 GE	12.80	811A	10.80
E8F80	2.70	PC800	2.80	UL84	2.20	8D08	9.80	812A	52.50
E8F40	5.00	PCF80	2.00	UY41	4.00	8E48	3.80	813	27.50
E8F41	3.80	PCF82	2.25	UY85	2.25	8E45	1.85	866A	25.00
E8F42	4.80	PCF88	2.50	VR105/30	2.50	8F5	3.00	872A	20.00
E8F50	2.50	PCF801	2.50	VR150/30	2.50	8G48	4.00	821A	25.00
E8F54	4.80	PCF802	2.50	Z759	35.00	8H6	3.00	2060A GE	10.00
E8F55	3.50	PCF805	1.70	Z8C3U	25.00	8H56	4.50	5763	10.00
E8F80	1.80	PCF808	1.70	ZD21	3.50	8J5	3.00	5814A	4.00
E8F85	1.80	PCF200	1.80	3828	20.00	8J6	3.00	5842	12.50
E8F86	5.00	PCJ82	2.00	4C4-2506 EIMAC	82.00	8J7	4.00	6080	6.50
E8F91	1.80	PCL83	3.00	5R4G3	6.00	8J8A GE	16.00	6148E GE	15.00
E8F92	2.15	PCL84	2.00	5U4G	5.25	8JF8C	12.80	6550A GE	15.00
E8F93	2.00	PCL85	2.50	5V4G	4.00	8JSG GE	11.25	6638E GE	10.80
E8F94	1.80	PCL86	2.50	5Y8GT	3.00	8K5GT	6.00	6973	11.00
E8H00	1.70	PCL805	2.80	5Z3	4.00	8K7	4.00	7025 GE	7.80
EL22	2.80	PDS00	6.00	5Z4GT	2.50	8K8	4.00	7027A GE	12.50
EL30	2.80	PFL200	2.50	630L2	1.75	8K06 GE	11.95	7199	10.00
EL34 Philips	1.80	PL85	2.50	6A07	3.00	8L8G	8.50	7581A	12.80
EL34 Siemens	4.80	PL81	1.75	6A8E	4.50	8L8GCSYL	9.50	7586	10.00
EL38	4.00	PL82	1.50	6A85	4.50	8L8G Siemens	4.50	7587	23.00
EL380	25.00	PL83	2.80	6A85	2.80	8A85 GE	9.50	7868	10.80
EL31	1.80	PL84	2.80	6A86	1.85	8L1	3.50	8058	16.80
EL34	2.25	PL504	2.50	6A85	5.00	8L06	12.50	8417GE	11.80
EL88	2.25	PL508	6.50	6A86A	4.80	807	4.00		
EL91	4.00	PL509	6.00	6A05	3.25	8RH8/6K8B	12.00		
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Antennas

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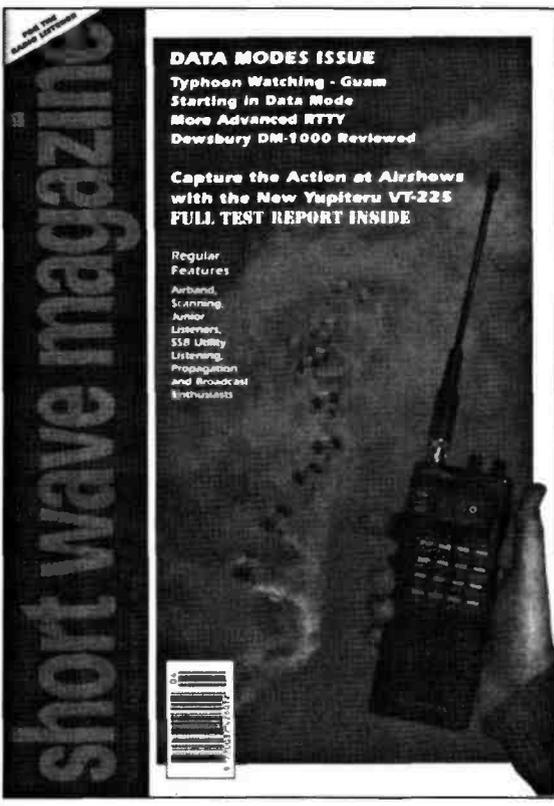


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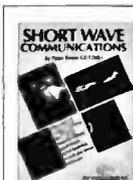
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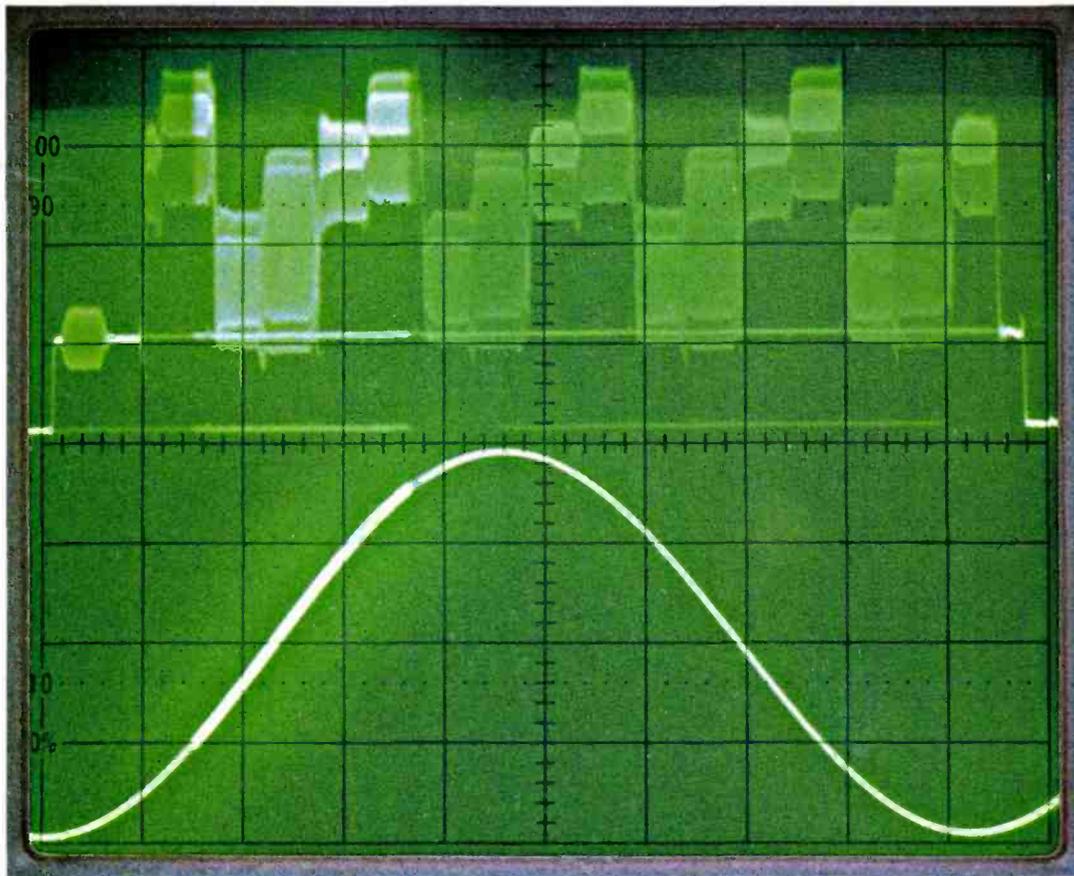
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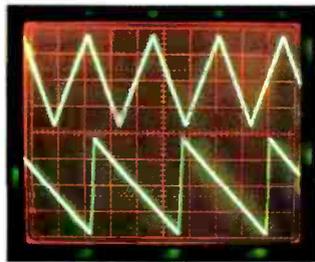


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