

practical Wireless

OCTOBER 1994 £1.90

TEST EQUIPMENT SPECIAL

Featuring

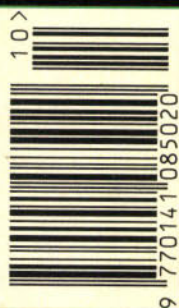
Extending The PW Robin Frequency Counter

A Solid State Crystal Oven For The Robin

A Beginner's RF Probe

**SPECIAL
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OFFER INSIDE**

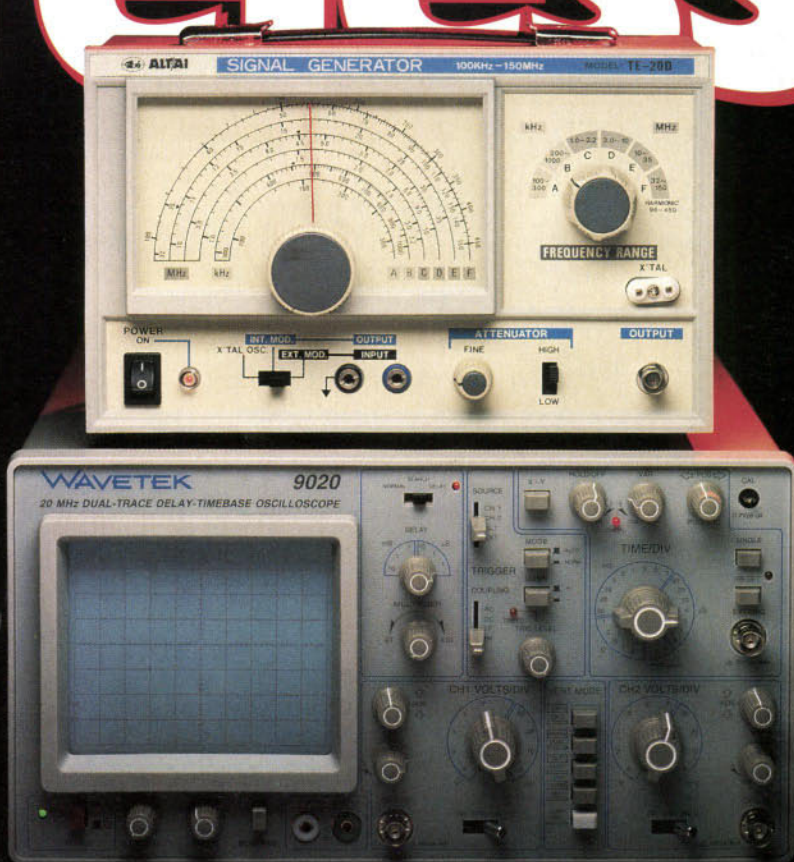
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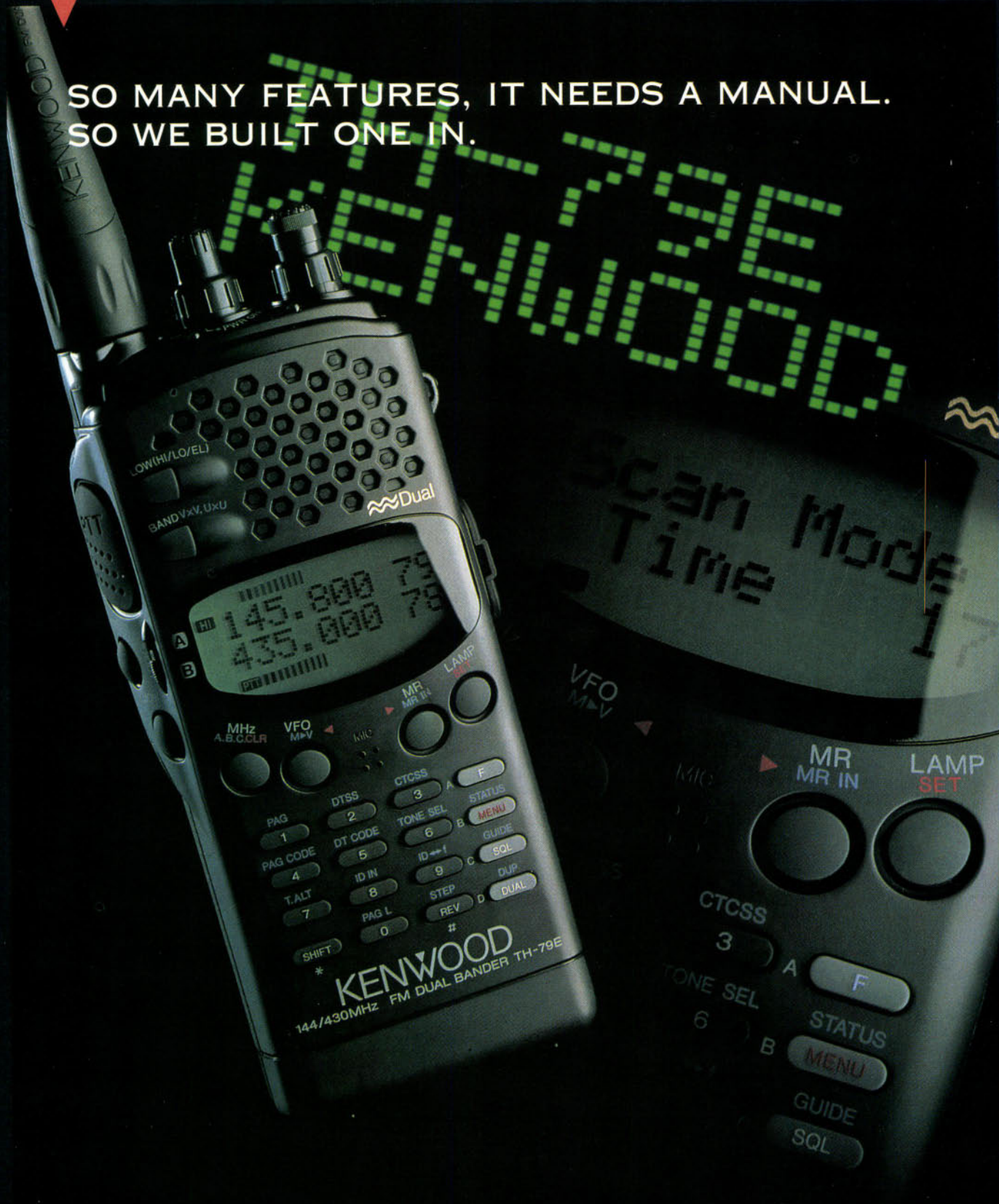


FROM MULTIMETER TO OSCILLOSCOPE

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KENWOOD

practical Wireless

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Practical Wireless
Arrowsmith Court
Station Approach
Broadstone
Dorset BH18 8PW
☎ (0202) 659910
(Out-of-hours service by answering machine)
FAX (0202) 659950

Editor

Rob Mannion G3XFD

Art Editor

Steve Hunt

Layouts Richard Gale

Technical Projects Sub-Editor

NG ("Tex") Swann G1TEX

Production/News

Donna Vincent

Editorial Assistant

Zoë Shortland

Advertisement Manager

Roger Hall G4TNT

PO Box 948

London SW6 2DS

☎ 071-731 6222

Cellphone (0850) 382666

FAX 071-384 1031

Advert Sales and Production

(Broadstone Office)

Lynn Smith (Sales),

Ailsa Turbett (Production)

☎ (0202) 659920

FAX (0202) 659950

CREDIT CARD ORDERS

☎ (0202) 659930

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COMING NEXT MONTH

Join *Practical Wireless* as we explore the world of long distance radio communications with a special on DX operating practices and procedures.

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Carriage: HF Base TCVR - E, HF Mobile & VHF Base

TOKYO HY-POWER

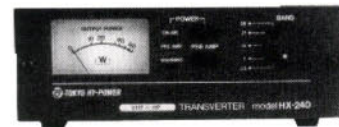
LINEARS

	£ Carr
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HL66V 6M Linear, 10W in 50-60W out Rx Preamp	169 C
HL166V 6M Linear, 3/10W in Auto select 80/160W out Rx Preamp	299 C
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HL62VSX 2M Linear, 5/10/25W in 50W out preamp	235 C
HL36U 70cm Linear, 6/10W in 25/30W GaAs FET Preamp	155 B
HL63U 70cms Linear, 10/25W in 50W out GaAs FET Preamp	259 C
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HL130U 70cms Linear, 3/10/25W i/p auto select 120W out Rx Preamp	485 C
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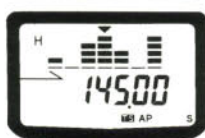
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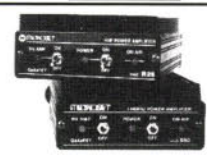


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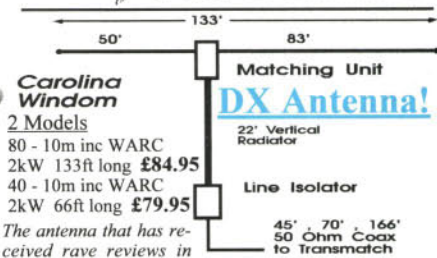
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EDITOR'S Keylines

Unfortunately, the Science Museum doesn't agree with G0JJQ. In fact, they consider amateur radio communication to be outdated. They think that the future lies only in fibre optics, computers and data communications, and as a result GB2SM is soon to be lost.

So, on Monday August 8 I was really busy! Along with my letters to Sir Neill Cossons, Director of the Science Museum, I wrote to HRH Prince Charles (who actively sponsors and encourages interest in science and technology) and the Prime Minister, the Right. Hon. John Major.

My efforts on behalf of GB2SM led to an article in *The Daily Telegraph* on Tuesday August 9. There was also a broadcast on BBC radio the same day.

In *The Daily Telegraph* article Graham Farnelo (Head of Programmes in the Science Museum) was reported as saying the GB2SM closure would not be reversed and: "We were expecting opposition from the radio people. They are a dedicated bunch. But the decision has been made!"

So, now you can see what we're up against. Your letters can help too! Write and tell your MP, complain to Sir Neill Cossons and tell them that without active demonstration and encouragement, there'll be fewer engineers to design and make those fibre optics, computers and 'electronic super highways' in the future! Keep the Science Museum on the air, save GB2SM!

Bureaucratic Vandalism

Dick Ganderton G8VFH, the Editor of our sister publication *Short Wave Magazine*, commenting in his editorial on the news of GB2SM's closure said it was "Bureaucratic Vandalism". I agree wholeheartedly with Dick's comments and wish that I'd said it first!

Like many others, I've spent many hours over the years visiting the scientific world's version of the 'Aladdin's cave'. In the past it's always been a place where anyone interested in science, engineering, physics, medicine and many other wonders, could be enthralled for days on end.

Although I had been interested in radio for a long time before my first visit to the Science Museum, it was there in 1958 that I watched and listened in fascination as GB2SM was put on the air by Geoff Voller G3JUL. From that moment on, my spare time was taken over completely by radio, electronics and the ambition to become a transmitting amateur myself.

How many others have been encouraged by GB2SM to take up a hobby which, for many, can lead to full time careers? How many school parties have returned home, and then started up their own clubs, directly due to watching and hearing GB2SM in operation? Additionally, GB2SM is an amateur radio 'Ambassador' to the world, representing the UK in the best possible way.

In his August PW article 'This Is GB2SM' Wayne Dillon G0JJQ (himself one of the many volunteer operators) neatly sums up GB2SM by saying that "GB2SM has continued to evolve along with technology. It has moved with the times which has made it one of the most enduring and popular exhibits at the museum".

In the August PW we featured an article about GB2SM, the internationally famous amateur radio station at the Science Museum in South Kensington, London. The article, written by Wayne Dillon G0JJQ, reflected on the almost four decades of service during which the station has promoted amateur radio and engineering science.

Less than a month later, the Science Museum announced the closure of GB2SM, to be effective from November 7 1994! The news of the impending closure of this most important permanent exhibition station, was given to me by Geoff Voller G3JUL at the RSGB Rally at Woburn Abbey on August 7. Geoff, now retired from the Science Museum, was associated with GB2SM from the very early days in 1955.

Geoff Voller is still very much involved with GB2SM. And, as it has done for almost 40 years, the station provides almost the only example of easily attainable 'hands on' involvement with science and engineering technology available to people of all ages.

Subscribers' Club

Recently, I've discovered that quite a few regular subscribers don't realise that we run a 'Subs Club'. This 'club' is our way of saying 'thank you' to readers who pay 'up front' for their magazines, whether it be for one, two, three year or joint subscriptions.

Subscribers' Club members get the chance to save money on special offers, while other regular readers can also get a discount. So, look out for the 'Subs Club' offer this and every month which can be found towards the front of the magazine. For this month's offer see page 17. You can save money on your favourite read, special offers and get the magazine delivered direct to your door!

Rob Mannion G3XFD

COMPETITION CORNER - Wordsearch

Wordsearch rules:

Twelve different words have been hidden in the letter grid. They have been printed across (forwards or backwards), up and down, diagonally, but they are always in a straight line without odd letters between. You can use the letters in the grid more than once for different words. Once you have found all 12 words, mark them on the grid and send it,

along with your name and address (photocopies accepted with the corner flash) to our editorial address, marked 'Competition Corner' Wordsearch October 1994.

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Morse Test & RSGB

Dear Sir

Either it's the 'silly season' in journalism or have I completely mis-read the arguments which two of your correspondents are trying to make in your August issue of *PW*. They certainly seem worthy of comment in the interests of veracity.

Whilst one regrets that Mr Dick could not, or would not, pass the Morse test for many years, I do not see how the RSGB can be blamed for this, nor why is he still complaining even after he has a licence to operate of h.f.

If this gentleman read *Radcom* he would know that the Society canvassed its members on this subject, and the replies received were in the ratio 2:1 in favour of keeping the Morse requirement. Surely other representations were made, including those of *PW*, but why blame the RSGB if their arguments were deemed the most effective by the authorities?

Also, is the Society obliged to publish letters from non-members anyway? Mr Arnold's case is almost similar. I can appreciate his wishes, but one either joins a club under its existing constitution and then tries to make any desired changes within, in a democratic manner. My hackles always rise when people plead poverty, because in my experience, the opposite is usually the case.

As an OAP existing on a very small occupational pension in addition to the DHSS one, I find no difficulty in paying the subscription, in fact, I did not commence paying the concessionary rate until some years after I actually retired. Perhaps some of us 'smart Ales' (his words, not mine) could give him a few tips H! because things come no cheaper here than in Avon.

I'm surprised that some of 'em don't blame the RSGB for the weather! What a nation of moaners we are!!

E. G. Allen G3DRN
London

Club News

Dear Sir

I read your Keylines in the August *Practical Wireless*. The 'Club News' section of *PW* is very popular with readers, so why change something that is popular?

When I started getting interested in amateur radio I bought *Practical Wireless* and looked for my nearest club and got details of club nights. If we are to get more people interested in amateur radio, we must get them to join their local club.

If we have to send for details of club news every month, it will cost two envelopes and two stamps. Leave the club news pages, they are very popular.

The idea of a spotlight on clubs is a good idea and a small space could be found for it in the magazine.

K. J. Dennis G7PHT
Norfolk

Newcomers Poorly Served?

Dear Sir

In reply to T. R. Rennie, Hertfordshire (July *PW*) about newcomers being poorly served, what a load of rubbish that is!

There are lots of good clubs to join and lots of very good amateur radio shops where information is happily given free of charge.

There are plenty of rallies to go to and if you are careful, you don't get ripped off!

Keith Goodchild
Hertfordshire

German transmitter DKN calling W2XAD and asking for a national hook-up. After some time, having received no reply from W2XAD, the German station announced that they would go ahead anyway. Then over came the announcement that "Early this morning German troops crossed the Polish border".

To hear one national transmitter calling that of another country for an unscheduled relay was an unprecedented occurrence and I have never seen reference to this broadcast. For a number of hours I must have been one of the few members of the general public in the UK aware of the event which was to change our lives so dramatically.

My advice to short wave listeners is to keep listening, preferably on home-made receivers. The biggest surprise may come when you least expect it.

T. R. Rennie
Hertfordshire

Editor's comment: Thank you for your fascinating story Mr Rennie. I feel sure there are many more stories to come from our readers.

Component Suppliers

Dear Sir

As a regular reader of your magazine, I notice that no component suppliers advertise lists of basic components in your pages.

I'm sure I speak for a large majority of readers who would find it useful to be able to obtain the standard components, for example: transistors, resistors, etc. direct from your magazine and not through a catalogue, which are full of do's and don'ts on how to order these days.

I'm sure you could spare half a page or so to a supplier, like you used to years ago.

Aled Lewis
Dyfed

Editor's reply: Quite frankly Aled, I don't think your suggestion is possible for advertisers nowadays. Even regular advertiser

John Birkett (Lincoln) only mentions the larger components he supplies. However, although I get most of my small components from rallies and the various shows, catalogue shopping is not that difficult. Have any readers got any advice on this aspect of home-brewing?

Fifty Year Morse Test?

Dear Sir

Re: GM0IRZs letters in the August issue. Have I read it correctly or have I got my wires crossed. Did it take 50 years to pass the Morse test? Is it such a beast?

A. F. Sephton G3JIL
London

Absorption Wavemeters & Harmonics

Dear Sir

The letter from Glenn Loake G0GBI about using an absorption wavemeter to measure harmonics in the June *PW* aroused my interest: this is a question I have asked several times, admittedly somewhat tongue in cheek! I do not see how an absorption wavemeter is any good at all for checking the harmonics produced in the output of even a semi reasonable transmitter.

How has the fallacy arisen? Simply because in the 'good old days' of transmitters with multiplier chains, an absorption wavemeter was a pretty near infallible method of ensuring that the multiplier chain was tuned up to the correct frequencies. There may well be people in Chelmsford who remember the occasion that a local amateur didn't use an absorption wavemeter when tuning up his crystal oscillator multiplier type 144MHz rig. It's possibly a jaundiced view that suggests a 'CQ Two metres' all over 'Sunday Night at the London Palladium' was an improvement!

But for looking for the levels of unwanted harmonics, if an absorption wavemeter really detects harmonics in the transmitter output, my advice is to adjust the transmitter - with a sledge hammer! A normal absorption wavemeter will detect signals at a level of 1 milliwatt - certainly not at the microwatt levels that modern v.h.f. equipments produce.

Even modern h.f. rigs at 100W output will typically produce harmonics 50 or 60dB down - at best, just detectable. But the loading of the tuned circuit, with the detector and the coupling to the source of r.f. energy, the Q is damped so far down as to make the rejection of the fundamental by the wavemeter very poor.

A few sums show that for a working Q of 50 (which is very difficult to get, because of damping), the second harmonic response of the wavemeter is only about 40dB. So a 100W TX could well suggest it had harmonics only 40dB down when they were 20dB better - because of the faults in the wavemeter! Cavity wavemeters at 1296MHz and above are another story, of course....

My suggestion is to build a directional coupler (as used in the wattmeters and s.w.r. bridges), calibrate it with a signal generator, and feed the TX through it to a dummy load. Off the coupled port, feed via a high pass filter with 40 or 50dB attenuation of the fundamental, and use a receiver, or a spectrum analyser connected at that point.

I would class as one of the great fallacies in amateur circles this current idea that harmonics can be 'measured' or even satisfactorily 'indicated' with an absorption wavemeter - at least, below 1296MHz. Professionally, of course, spectrum analysers are used - machines which, given the ghost of a chance, will not only lie like a politician, but occasionally tell you truthful things you'd rather not know!

Peter E. Chadwick G3RZP
Wiltshire

Incoming QSL Cards For G0 'S' Series

Dear Sir

As the new Sub-Manager for the G0 'S' Series I am somewhat dismayed to find so many of the G0 'S' series call signs with hundreds of QSL cards form all parts of the compass but with no envelopes, with me as Sub-Manager to collect them.

If you would be so kind as to print a reminder to all amateurs that they do not need to be members of the RSGB to receive cards, it would certainly alleviate some of the burden that QSL Sub-Managers have to contend with.

A further point

would be that they submit s.a.e.s with their respective managers so as to avoid QSL cards being destroyed or returned to sender.

Many in my series are obviously very active and receive excessive amounts of cards from the same country, if they do not want cards, they should at least have the courtesy to let their contacts know so as to avoid congestion to the QSL system and expense to fellow amateurs.

Most of the guilty parties are 'Particulars Withheld' in the callbook so

obviously other than via the amateur radio media of via direct 'On Air' Contact there is no way of letting them know that cards are being held by Sub-Managers.

Any message that you can pass on via *Practical Wireless* would be gratefully appreciated as I am very loathe to destroy cards that someone has obviously gone to the trouble of sending in the spirit of amateur radio.

I was of the belief that a QSL is the final courtesy of a QSO?

Steve G. Bryan
G0SZGB
South Yorkshire

★ ★ ★ ★ STAR LETTER ★ ★ ★ ★

Leicester Repeater GB3CF

Dear Sir

Leicester's repeater GB3CF is back on the air again and is being used and misused in the usual way. Isn't it a pity though that we amateurs rise to the bait?

Why is it that we always try to gainsay or shame these shameless people into silence? It never seems to work and usually stimulates even more nauseating banter.

We ought to resist the temptation even when a clever put-down comes straight to the mind.

It's hard though, and I wish I could always practice what I preach! I feel better now I've said it!

A. R. Mikolajczyk G4ZRE
Nottinghamshire

Help Needed

Dear Sir

Many thanks for your personal reply of information about the Codar 10W TX when I needed to get mine going as a spare rig. I don't know where I have been for the last 25 years as far as the Codar company is concerned. I have been active using other equipment, using a TX model DX100U and a RX Yaesu FRG DX400.

I only use Morse, but it has been a good means of getting QSOs. I still think that the faintest QSOs in Morse can always be heard!

I now have problems with my DX100U and FRG DX400. I'm over 80 years old and would gladly welcome some help to repair my rigs as my friend who helped is now a silent key. Do you think any reader could help?

Harold Davies
Powys

Editor's reply: I replied to Harold's original letter about Codar, and he replied telling me that his other equipment had now failed. Any offers of help from readers will be passed directly on to him.

Ideas For PW

Dear Sir

I have been receiving amateur radio for some time, after a gap of thirty years. The variety of areas of interest that amateurs can now take up has greatly increased as has the variety of equipment and the cost!

In the last year I have provided tuition for a Novice group. As a result of my experience and the big question - what to provide next - I am writing to you to ask if you would provide in your magazine, articles on the following.

- 1) Oscillators and a detailed explanation on the current flow. What about a computer program with program supplied on disk!
- 2) More information on those TX/RX reviews - what about the third order intercept?
- 3) Test equipment, its use and the second-hand market - millivolt meters, frequency counters, modulation meters, distortion meters, a.m./f.m. signal generators, pulse generators and oscilloscopes.

The above should give you enough material to keep your readers happy for some time.

Pascal McDonald
Londonderry

Editor's reply: The *PW* team hope you find this month's 'Test Equipment' special of interest Pascal. Your suggestions will help us, and comments are also being passed to Ian Poole for 'Specifications...The Mysteries Explained'.

Science Museum Station GB2SM To Close

Just before this issue of *PW* went to press, a shock announcement was made by the Science Museum as to its intention to close GB2SM, the museum's amateur radio station. The closure will take effect from November 7 1994 and will mark the end of an era spanning nearly 40 years.

Graham Farmelow, Head of Education Interpretation speaking on behalf of the Science Museum said, "The station exhibit no longer reflects the contemporary image of modern communications required by the broader audience attending the museum".

The space that is currently occupied by GB2SM will be given over to a display that will relate to data communication superhighways, which when you think about it would not have been possible without the continuing development of data communications by radio amateurs!

If you wish to add your comments to the decision to close GB2SM and join the fight in keeping it open you should write to **The Director, Sir Neil Cossons, The Science Museum, Exhibition Road, London SW7.**

Twenty One And Still Going Strong

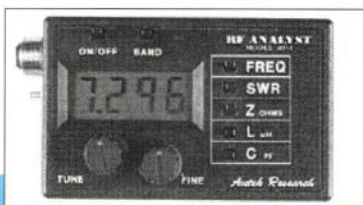
On July 23 1994 Waters & Stanton Electronics celebrated 21 years of trading. On their first day of trading in 1973 a Mr Tony Croft of Rayleigh purchased a radio from them and 21 years later to the day he purchased another, a new AR8000 scanner.

Jeff Stanton G6XYU reported that the birthday celebrations bought the best ever day's trading for Waters & Stanton for the time of year and that the day was an all-round success.



Tony Croft collects his scanner from Jeff Stanton (Right).

NEWS '94



The new pocket-sized RF Analyst, the RF1 has recently been launched by Autek Research from the USA. The RF1 has been designed with the intention of being used to check and adjust antennas, feedlines and r.f. networks.

Features of the RF1 include a microprocessor, A/D converters, sine-wave generator and is adjustable from 1.2 to 35MHz in five bands. It is capable of measuring r.f. values of impedance 0-2000Ω; s.w.r. 1 to 15:1; capacitance 0-9999PF and inductance <0.04 to 300μH.

The manufacturers, Autek Research say that the accuracy of the RF1 is 2.5 to 5% over most of its range, that it will fit into a shirt pocket and that it is powered from a standard 9V battery. The price of the RF1 is £139.95 including delivery within Europe.

Eastern Communications of Norfolk have recently been appointed as European agents for Autek Research of Florida USA. **Eastern Communications** can be contacted at **Cavendish House, Happisburgh, Norfolk NR12 0RU. Tel: (0692) 650925.**

Autek Analyst

Send in your news, photographs and product information to Donna Vincent at the editorial offices in Broadstone.

Congratulations

The staff of *Practical Wireless* would like to pass on their congratulations to all this year's newly licensed Radio Amateurs. Well done to all those who achieved passes in both papers and to those who got part passes. In particular *PW* would like to say well done to **Ailsa Turbett** who works on *PW*'s Advert Production for passing the RAE and who will soon be a G7.

To those who unfortunately failed we would like to say don't give up, keep going and you'll soon be on the air!

Radio Amateurs Examination Course News

As the *PW* Newsdesk has been swamped with news of all the Radio Amateurs Examination courses that are due to start in the coming weeks, we've kept the details as brief as possible to enable us to publish as many as possible.

Venue/Club	Course Details	Start Date	Enrolment	Time/Day	Contact
Balwearie High School, Kirkcaldy, Scotland	RAE Morse	late Sept late Sept	mid Sept mid Sept	Mon, 7 - 9pm Tues, 7 - 9pm	Ken Horne GM3YBQ Tel: (0592) 265789 or Mr T. McGill Tel: (0592) 640335
Bideford Arts College, The Quay, Bideford	RAE	29 Sept		6.15 - 9.15pm	Tel: (0237) 474462
Flight Refuelling ARS, (venue to be confirmed)	RAE Course	Oct 4		Tues	Doug G0TUC Tel: (0202) 570894
International House, 963 Wolverhampton Road, Oldbury, Birmingham	RAE	15 Sept		Thurs	Jill Tel: 061-485 5036 Gordon G3LEQ Tel: 021-544 0771
John Bunyan Community College, Bedford	RAE	30 Sept		Fri, 1 - 3pm	Eric Elsley G3YUQ Tel: (0234) 768120
Lagoon Leisure Centre, Vicargae Lane, Hailsham	RAE	7 Oct		Fri, 8pm	John G3DQY Tel: (0323) 485704 or Vic G0THX Tel: (0323) 846774
Mid Sussex ARS	RAE, Morse, Novice	Sept			John G0010 Tel: (0444) 450957
Morley Green Club, Morley Green, Wilmslow, Cheshire	RAE	11 Sept		Sun, 7pm	Jill Tel: 061-485 5036 Gordon G3LEQ FAX: (0585) 634560
North West Kent College of Technology, Dartford	RAE	29 Sept		Thurs	Tel: (0732) 823483.
North West College of Technology, Gravesend	RAE	Sept			Tel: (0474) 352049
Stroud/ Rochester Adult Education Centre	RAE	Sept			Tel: (0634) 845359
Redbourne Community College, Amptill, Beds	RAE	26 Sept		Mon, 7.30 - 9.30pm	Eric Elsley G3YUQ Tel: (0234) 768120
Royal Forest of Dean College, College Road, Cinderford, Gloucestershire	RAE	Sept			Tel: (0594) 822191
Rugeley Adult Education Centre	RAE	20 Sept		Tues, 7pm	Mr B. Golemboski Tel: (0889) 578738
Twyford House, Shirehampton, Bristol	RAE	19 Sept		Mon, 7.15 - 9.15pm	Liz Tel: (0272) 683112 or Chris Tel: (0454) 616267

Refund Winner And Subscribers Club

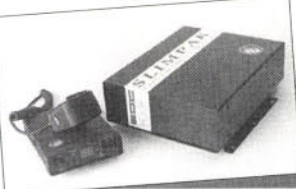
The lucky *PW* reader who has had his money refunded as a result of taking advantage of the June 1994 issue Subscribers Club Offer is **Mr R. Ritch** from Orkney. Mr Ritch's name was the first one pulled out of the hat after the closing date for the MFJ-209 antenna analyser offer. Our congratulations go to him.

Don't forget that by becoming a subscriber to *Practical Wireless* you are eligible to take up the Subs Club offers, which also means you qualify for money off and extra benefits on other reader offers. See 'Editor's Keylines' and page 17 of this issue for more details.

Importing Mirage

South Midlands Communications Ltd., have recently announced that they are currently importing a new range of goods from the USA. The Mirage KLM range consists of linear amplifiers, masthead preamps and power meters.

Prices for the linear amplifiers start at £189, £149 for the masthead preamps and £189 for the power meters. Full details on the Mirage KLM range can be obtained from **South Midlands Communications Ltd., S.M. House, School Close, Chandlers Ford Industrial Estate, Eastleigh, Hampshire SO5 3BY. Tel: (0703) 255111.**



New From SGC

The *PW* Newsdesk has received news from SGC Inc. of two new products that they have recently added to their range of equipment. The first of these is the SG-2000SP Slimpak h.f. s.s.b. radio which has been designed with the same technology and design as the SG-2000.

The Slimpak is of slim profile and has several operating head options. The manufacturers claim that the Slimpak is the ideal radio for small spaces and for installations in boats, aircraft and mobile situations.

Features include SITOR telex channels, 100 user programmable frequencies and easy weather FAX connection. The Slimpak produces 150W and has a full frequency range of 1.6 to 30MHz.

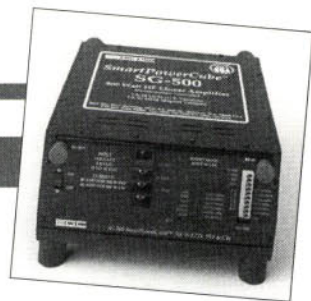
The price of the Slimpak transceiver complete with mobile head is \$2395 and a version with reduced specifications (2-22MHz with 100W output) is also available. Other head options are an aviation or the standard SG-2000 programming head.

The second new product from SGC is the SG-500 SmartPowerCube linear amplifier. This unit is controlled by a microprocessor and is claimed to boost power to 500W.

The SmartPowerCube allows the operator to quickly determine any faults by use of a bank of I.e.d.s on the front panel, which function as built-in test equipment. The Cube constantly monitors h.f. s.s.b. activities, power needs and antenna conditions and can quickly select the right broadband filter.

In the event of a fault in the microprocessor the unit shuts down automatically. The SG-500 has been designed to be used in fixed, mobile and marine environments and is fully compatible with most h.f. equipment.

The introductory price of the SG-500 SmartPowerCube is \$845 and additional information on this or the SG-2000SP Slimpak is available from **SGC Inc., SGC Building, 13737 S.E., 26th Street, PO Box 3526, Bellevue, WA 98009, USA. Tel: 1-800 259 7331.**



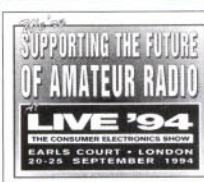
International HF & IOTA Convention

The 1994 Radio Society of Great Britain's International HF and IOTA Convention is being held over the weekend of October 7 - 9 at the Beaumont Conference Centre, Old Windsor, Berkshire. This year's convention also coincides with the celebrations of the Islands On The Air (IOTA) 30th Birthday.

The Convention is being sponsored by Martin Lynch and Kenwood. More information on the International HF & IOTA Convention is available from **E. Cheadle G3NUG, Further Felden, Long Croft Lane, Felden, Hemel Hempstead, Herts HP3 0BN. Tel: (0442) 62929.**

LIVE '94

Roger Hall G4TNT tells you how you could win a major prize in a free, easy to enter competition to be held at the Live '94 consumer electronics show.



Live '94 (Earls Court, September 20 to 25 1994) is going to be an enormous show that will cover almost every aspect of consumer electronics.

However, one stand that will be of special interest to readers of *PW* is the Amateur Radio Village.

The Village will be a joint venture between Icom UK, Lowe Electronics, Martin Lynch, PW Publishing, The Radio Society of Great Britain, Trio-Kenwood, Waters & Stanton and Yaesu and its aim is to promote radio as a hobby.

Major Prizes Every Day

A feature of the Amateur Radio Village will be two demonstration Special Event Stations - GB3RS & GB2VHF. That's why a competition is running for the duration of the show with major prizes to encourage you to take part.

All you have to do to enter is to make contact with one of the Special Event Stations or call in at the stand and leave your QSL card. At the end of each day, all the names will be entered into a draw and three prizes will be given away.

The first one drawn will be given one of the

radio prizes and the following two will receive a subscription to the RSGB (or book vouchers to the same value) or to *Practical Wireless* or *Short Wave Magazine*. A computer logging system kindly supplied by Lambda Electronics will be used for the draw.

The Rules

The rules for the prize draws are as follows: **1.** Only one contact per band, per day, per person, per mode will be entered in the draw; **2.** The winners will be randomly selected at the end of each day and will be notified by post no later than October 30 1994. The first selected will be awarded one of the radios and the following two will receive the RSGB prize and the *PW* prize in that order. However, we regret that the radios can **only** be won by amateurs resident in the UK. If a non-resident is selected first, they will receive one of the other prizes; **3.** The names of the prize winners will be published in *RadCom* and *Practical Wireless*; **4.** A full list of the prize winners can be obtained by sending an s.a.e. to RSGB HQ six weeks after the show ends; **5.** The organiser's decision is final and no correspondence will be entered into; **6.** There will be no cash alternative for any of the prizes.

See you there! Roger Hall G4TNT

Prizes

- ★ **IC281H 144MHz 50W mobile transceiver** - donated by Icom (UK) Ltd.
- ★ **HF150 short wave receiver** - donated by Lowe Electronics Ltd.
- ★ **Kantronics KPC3 packet controller** - donated by Martin Lynch The Electronics Hobbies Exchange Centre.
- ★ **Six subscriptions to either *Practical Wireless* or *Short Wave Magazine*** - donated by PW Publishing Ltd.
- ★ **Six full corporate memberships of the RSGB or book tokens to the same value** - donated by the Radio Society of Great Britain.
- ★ **The choice of either a TH-22E (144MHz) or TH-42E (430MHz) hand-held transceiver with optical keypad** - donated by Trio-Kenwood UK Ltd.
- ★ **Alinco DJ580E dual-band (144/430MHz) hand-held transceiver** - donated by Waters & Stanton.
- ★ **FT-416 144MHz hand-held and accessories** - donated by Yaesu (UK) Ltd.

Don't forget you still have just enough time to nominate someone for the Novice Natter Elmer Award. I've got all these logbooks just waiting to be sent out, so get writing.

I want to know who's fault it is that you took up radio as a hobby? Perhaps they gave you lots of technical help, perhaps they inspired you with their enthusiasm or perhaps they just encouraged you to learn for yourself. Anyway, I want to hear about them.

The first 50 entries will win a **Kenwood** station logbook just for entering the competition and the overall winner will receive their prize of a **hand-held transceiver kindly donated by Yaesu (UK) Ltd.**, at the Leicester Amateur Radio Show in October.

Anyone could win.

So drop me a line telling how they got you started in the hobby and what help or encouragement they gave or just tell me why you are blaming them for getting you involved. Send your entries to the address at the top of the page - Good Luck.

NOVICE Natter

For Radio Beginners of all Ages.

This month Elaine Richards G4LFM looks at readers' letters, competition winners and 'jargon busting'. Elaine starts off with a reminder about the Novice Natter PW 'Elmer' Award.

**Elaine Richards G4LFM, PO Box 1863,
Ringwood, Hants BH24 3XD.**

The Winner

While talking about competitions, I must announce the winner of the JVFX, Hamcom and Pervisell Interface technical teaser competition. I had quite a few entries, some of which were only half right. So,

I've decided to award two first prizes.

I picked **Keith Burrows** from Stockport and **R. T. Irish** from Totnes out of the Richards' household biscuit tin. There are also three runners-up prizes going to **Martin Reed, B. Pace** and **Noel**

Moore as they were the next three out of the tin. Many thanks to all those who entered, I wish I could make more of you winners.

Just to clear up a query, anyone who reads this column can enter the competitions, if I decide to hold a 'Novice' only competition, I'll make it clear so don't worry. There's no competition this month as I'm hoping you'll enter someone for the Elmer Award.

Readers' Letters

Let me say thank you for all your letters. I do read every one and I will get around to replying to each and everyone of you - eventually.

I must confess that with three small children and the school summer holidays, letter writing has been knocked off the top of the priority list. Hopefully, normality will be resumed in September - assuming I'm still sane!

Mr W. Atkinson has written following a clear out. He's got a few items that may be of use to an Amstrad CPC 464

Special Event Station GB4NWC

A couple of months ago I mentioned the Special Event Station GB4NWC and **Robert Aley** who was organising it. I am pleased to be able to tell you that the day was a great success.

The public showed a lot of interest and several people expressed an interest in attending the local Novice course. Contacts made included stations in: 144MHz Band - G (England), EI (Eire), PA (The Netherlands), ON (Belgium) and FT (one of the French Islands), 430MHz Band - G and 2E (UK Novice), 7MHz Band - GM (Scotland), G, GU (Guernsey), DJ (Germany), DK (Germany), F (France), LA (Norway), PA, PI (The Netherlands) and SM (Sweden).

Robert agrees that I was correct in saying that organising a special event station is a lot of work. As the station

manager, his duties included organising operators, equipment (including all the connectors so that the rig matched the antennas) and power supplies, etc.

Other responsibilities included checking that the licences had arrived, liaising with the schools PTA, choosing a suitable room, organising leaflets to hand out, publicising the station and sorting out QSL cards. Fortunately, Robert concludes that the satisfaction and enjoyment he gained from it was worth every moment.

It's also nice to know that Robert

learnt something that day. It's best to ensure that the coaxial cable is attached firmly to the antenna **before** you hoist it up on a 7m pole and tie off all the guy ropes, otherwise you have to take it down and start again!

Robert would like to thank **Bill G0BXJ**, **Andy G6OHM**, **John G0FLP**, **Dave 2E1CYK**, **Shaun 2E1DBV** and **Les G6SXB** for all their help in running the station and for providing equipment, without which it wouldn't have been possible.

Fig. 1: The GB4NWC Special Event Team (L-R) Andy G3OHM, Shaun 2E1DBV, Dave 2E1CYK, Robert 2E1AXZ and Bill G0BXJ.



Fig. 2: Bill G0BXJ on the h.f. rig after the crowds had died down!



Fig. 3: The GB4NWC QSL card.

SPECIAL EVENT STATION						
GB4NWC						
Neale-Wade Community College March, Cambs JD 82 BN						
Parent Teacher Association Summer Fayre and Family Fun Day 3rd July 1994						
Station	From	Until	Freq	Mode	RST	Operator

Please QSL via RSGB

user. These are *Remote Control Handbook BP240* by Owen Bishop. It contains details for the construction of interfaces for the CPC 464, 644 and 6128, the BBC, Commodore 64 and Spectrum 48 and 128K. Also available is a RTTY interface (built) for use with the 464, boxed with full instructions, it just requires a switch knob to complete it.

Mr Atkinson also has available the following books: *Amateur Radio Software* by Morris. RSGB. *Test Equipment for the Radio Amateur* 2nd Edition by Gibson. RSGB. *Amateur Radio Techniques* 5th Edition by Pat Hawker. RSGB. *Weekend Projects for the Radio Amateur*. ARRL. *Specialised Communications Techniques for the Radio Amateur*. ARRL. *Introducing RTTY*. Practical Wireless Reprint. *Introducing QRP*. Practical Wireless Reprint. *Practical Power Supplies*. Practical Wireless Reprint. *Out of Thin Air*. Practical Wireless Reprint. *Radio Amateurs Examination Manual*, 10th Edition. RSGB.

If you would like any of these books, please drop me a line and I'll pass on all the

requests. Many thanks to Mr Atkinson for his kind offer.

Ron Wilson also has a copy of *Out of Thin Air* available. Again drop me a line and I'll pass your name and address onto Ron - thanks.

Peter Pickering G3ORP has let me know about the activities of the Maidstone YMCA Amateur Radio Society. Novice classes are on Wednesdays from 7.30 to 9.30pm with three instructors - Martyn G0LCH, Phil G0RVU and Howard G0RJN. They also conduct RSGB Morse tests, with the next test date being January 15. Dummy Morse tests are to be held on December 13 and January 10 free of charge. These include 1 hour's coaching to help overcome any problems such as nerves, etc.

On the air training is also part of their course. A Novice station, s.w.l. station plus CB2781FM and CEPT CB rigs are all provided for pupils use. The shack also houses GX3TRF, GX3YSC and GX8TRF and Peter reckons it sounds like an aviary at times!

The cost for all the facilities offered is £6.50 a year plus

Jargon

If you have problems with some of the jargon and technical language used in our hobby you might be interested in two new books from Babani. The titles, rather confusingly, are: *A Reference Guide to Basic Electronics Terms* and *A Reference Guide to Practical Electronics Terms*. So what's the difference I hear you ask!

In *Basic Electronics Terms* the author, F. A. Wilson deals with the theoretical side of the hobby and explains items such as attenuation, capacitance, power factor, etc. The scope of the coverage is very detailed and most of the entries have quite comprehensive explanations.

There are also plenty of diagrams to illustrate some of the more complex subjects. As the book stretches to some 472 pages you can see that it is packed with plenty of information.

The sister book, *Practical Electronics Terms*, uses a similar style but concentrates on terms associated with practical applications rather than theory. Examples here are baluns, circulator, frequency divider, padder capacitor and shunt. In fact the two books went together so well they should be bought as a set. This would then provide a very comprehensive reference.

Both books are available from the PW Book Service priced at £5.95 each plus £1 P & P for one, £2 for two or more (UK), £1.75 P & P for one, £3.50 for two or more (overseas).

Sorry, but space has run out again, if I haven't mentioned your letter this month, I'll try in the next column. Please keep writing, I'm always interested in your news and views.

Elaine G4LFM

£1.20 per week, although the first two visits are free. They also have things like free 'lucky' dip component draws for keen constructors. So if

you are in the Maidstone area and are interested in finding out more, contact **John Belling G0RHO on (0622) 832259**.

September 11: The 1994 BARTG Rally will be held at Sandown Exhibition Centre, Sandown Park Racecourse, Esher, Surrey. Doors open at 10.30am. Admission £1.50, OAPs £1.00, under 14s free if accompanied by an adult. On-site catering including hot and cold meals, snacks and beverages and a licensed bar. Over 250 tables, see the latest in radios, computers, software, books, equipment and much more. **Peter Nichol, 38 Mitten Avenue, Rubery, Rednal, Birmingham B45 0JB. Tel/FAX: 021-453 2676.**

***September 11:** The 13th Lincoln Hamfest will be held on the Lincolnshire Showground and Exhibition Centre, four miles north of Lincoln on the A15 Lincoln to Scunthorpe/Humber Bridge Road. Doors open 10.30am. All the usual attractions, Bring & Buy, refreshments available, free parking, caravans welcome by prior arrangement. Entry fee £1, children under 14 free. **Sue Middleton (XYL G8VGF, QTHR) on (0522) 525431.**

September 17: The Scottish Amateur Radio Convention & Computer Show (SARCON) are holding their rally at Cults Community Centre, Aberdeen. This event is sponsored by the Aberdeen Amateur Radio Society. Further details available from **Mike GMDJCN on (0569) 731177.**

***September 20-25:** The Live '94 Consumer Electronics Show is being held at London's Earls Court One - all levels. Doors open 9.30am to 7.30pm on Tuesday, Wednesday & Sunday and on Thursday, Friday & Saturday doors open 9.30am to 8pm. There will be many exhibitors from the various sectors of electronics, covering access-

sories, computers, photography, security, software and much, much more. For the latest information and to pre-book tickets, their hotline number is **(0891) 500103.**

September 25: The 36th Harlow Amateur Radio Rally is being staged at the usual venue of the Harlow Sports Centre, easy access of M11, Jn. 7 A414, the fully signposted route will be complemented by a talk-in on 144MHz S22 and 430MHz SU22 by G6UT, the club's own station. Doors open at 10.30am, all on site parking is free, catering and licensed bar facilities are in the complex. Further information from **Mike G7BNF on (0850) 487863.**

September 25: The Three Counties Rally are holding their rally at Three Counties Show Ground, Malvern, Worcestershire. There will be a large

* Practical Wireless & Short Wave Magazine in attendance

If you're travelling a long distance to a rally, it could be worth 'phoning the contact number to check all is well, before setting off.

The Editorial staff of PW cannot be held responsible for information on Rallies, as this is supplied by the organisers and is published in good faith as a service to readers. If you have any queries about a particular event, please contact the organisers direct.

section of trade stands, usual Bring & Buy and probably some lectures on amateur radio topics. There will also be on site catering facilities and other events at the show ground on the day. Further details from **G4PQZ on (0905) 773181.**

September 25: Peterborough Radio and Electronics Society East of England Rally will be held at the Peterborough Showground, easy access from A1, A605, A47. There will be trade stands, radio car boot, plus other local attractions, acres of free parking, full catering and bar, etc. Doors open 10.30am, 10am for disabled. Admission £1. Talk-in on S22 via G3DQW. **Ted GOREM, QTHR on (0733) 66471**

October 2: Blackwood and DARS Rally will be held at the Community College, Oakdale, near Blackwood, Gwent.

Doors open at 10am. There will be traders, raffles, a Bring & Buy, £1 per item or job-lot. There will also be a talk-in on S22. Further details from **Norman GW0MAW on (0495) 227550.**

***October 2:** The Great Lumley Amateur Radio & Electronics Society will take place in the Community Centre. Doors open 10.30am for disabled visitors and 11am for others. There will be trade stands, Bring & Buy and refreshments available. Talk-in on S22. **Barry G1JDP on 091-388 5936.**

October 7-8: The All Ireland International Radio & Hobbies Exhibition will take place at St. Patrick Hall, Cathedral Road, Armagh. **R. Ashe G18RL on (0762) 870423** or mobile **(0374) 122213.**

October 9: The Computercations 1994 Amateur Radio & Computer Rally will be held at Hillhead Campsite, Kingswear Road, Brixham, Devon. Trade stands for computer and radio, Bring & Buy, raffle and refreshments. Unlimited free parking with overnight camping available. Talk-in on S22. **Bill Trezise G6ZRM on (0803) 522216.**

October 9: The Kidderminster & District ARS Rally is being held at Stourport-on-Severn High School, Minster Road, Stourport-on-Severn, Worcestershire. Usual traders, Bring & Buy, refreshments and Talk-in on S22. Admission £1 per person. **Jeff G0RJP on (0299) 822206.**

***October 21 & 22:** Leicester ARS at Granby Halls, Leicester. Doors open at 10am each day (9.30am for disabled visitors) All the usual facilities. **Please note the date. Frank G4PDZ on (0533) 871086.**

RADIO Diary

Don't forget, a full 'Club News' listing is available from the PW Editorial Offices for a stamped, self addressed envelope, marked 'Club News' Sheet.

CLUB Spotlight

Orkney Wireless Museum - GB2OWM

It's intended to activate the Orkney Wireless Museum's amateur radio station GB2OWM on a daily basis during the Fourth Orkney Science Festival between September 9-15.

The station is situated at the Museum, which is in St. Margaret's Hope on the Island of South Ronaldsay - WAB ND49. Operation will be on the h.f. bands. Further details can be obtained from **Bill GM3IBU, QTHR.**

Moved into a new club room ? Won a contest? Got a funny story or news of a special event? Send your information to the 'Club Spotlight' newshounds Donna Vincent and Zoë Shortland at the PW Editorial Offices.

Radio On The Ben

A few months ago, **The Bishop Auckland Radio Amateur Club** attempted to scale Ben Nevis, the highest mountain in the British Isles, and set-up a radio station at the top!

However, from the start, it seemed that the weather was against them. One obstacle they did not expect on the climb were the swollen waterfalls, sometimes knee-deep, which became torrents during the journey.

Within 200ft of the summit one of the club's party had to turn back due to exhaustion. The rest pressed on, only to find that from there to the summit was a stretch of blank, featureless and very icy snow and low cloud.

Had the group taken crampons and ice axes, they would have probably made it, but it would have been dangerous to go any further. The risk of slipping or injuring themselves (or their equipment!) was just too great to set up a station which would have been on air only for a very short time.

So, the group headed back down the mountain, defeated but not downcast, promising the smug-looking mountain 'We'll be back...'

Despite not being able to complete the climb, they managed to raise a four figure sum for a local childrens' ward at Bishop Auckland Hospital.



Dundee Discovery

Amateurs will have the opportunity to make contact with a famous ship of the past on September 24-25 when members of the **Dundee Amateur Radio Club** mount a station in the original radio cabin of **Royal Research Ship Discovery** now berthed in Dundee, the city where she was built. The Dundee ARC are hoping to help with the restoration of the wireless cabin and battery room.

The **RRS Discovery** was the ship used by Captain Scott on his Antarctic expedition in 1901-1904. The ship was trapped in ice in the Antarctic for two years before, being dynamited free to allow her to return to the UK.

This Special Event Station will operate on 7, 14, 21 and 144MHz.

To find out more about the Dundee Amateur Radio Club and its activities, contact **George Millar GM4FSB, 30 Albert Crescent, Newport on Tay, Fife DD6 8DT.**

Marconi Dragon

The Welsh based **Dragon Amateur Radio Club** will be operating a Special Event Station GB2VK on September 22 from the site of the old Marconi Station at Waunfawr, Caernarfon. The event will mark the 76th anniversary of the first direct wireless message transmitted from the long wave Marconi Wireless Station at Waunfawr, Caernarfon, North Wales and received at the Experimental Wireless Receiving Station at Wahroonga, New South Wales, Australia New South Wales on

September 22 1918.

Members of the Dragon Club will operate GB2VK from 0100 to 2359 hours UTC. The equipment will be housed in the old Wireless Station Buildings and the antennas will be put close to some of the bases of the original 400ft masts.

In conjunction with the Wahroonga Amateur Historical Radio Society VK2WAH in Australia it's hoped to re-establish contact between the two sites. Depending on the conditions the frequencies being

used will be 14.175, 14.020, 21.175 and 21.020MHz. There will also be activity on 3.5 and 7MHz from time to time.

It's hoped that a local 144MHz link will be operated and that a 1296MHz ATV station will work through the local repeater GB3TM, which may mean the pictures will be received on the North West Coast of England.

If you would like to be involved with GB2VK or would like to know more about the Dragon ARC contact **Dewi Roberts GW0ABL**.

GB2VK





Operators of GB6OL (L to R): Peter G7RPG, Brian GOJEZ (Station Manager, Dick GORPX, Dave s.w.l., Ken GOJWL (Club Chairman), Fred G1TDQ and Mike GOSWY.

Horndean Overlord

The members from the **Horndean & District Amateur Radio Club** recently activated GB6OL (Overlord) to coincide with the D-Day commemorations. The h.f. Special Event Station was operational from June 1 - 6 and was situated inside the specially constructed Veterans Centre on Southsea Common, Portsmouth.

The event was a prestigious operation for the Horndean club and the members feel that it achieved the ultimate aim of showing the general public what Amateur Radio is all about.

Horndean & District Amateur Radio Club meet on the 1st Thursday of every month at 7.30pm at the Horndean Community School, Barton Cross, Horndean, Hants. **Stuart Swain G0FYX**, Club Secretary can be contacted on **(0705) 472846** for further details.

Wakefield Jamboree

The *PW* Club Newsdesk has recently received news of the **Wakefield & District Radio Society's** involvement with Jamboree On The Air (JOTA). Members of the Wakefield & District Radio Society will be putting on a Special Event Station over the JOTA weekend of October 15 & 16th to enable Scouts and Guides to send messages all over the world.

Roy Harvey G0TBY, Secretary of the Wakefield club has told *PW* that the club likes to involve themselves with the Scout movement whenever possible. Recently they set-up a radio station during a weekend camp that was attended by 150 Scouts and Guides.

If you live in the Wakefield area and are interested in joining in with the activities of the Wakefield & District Radio Society, they meet on Tuesdays, 8pm at the First Floor Rooms, Ossett Community Centre, Prospect Road, Ossett. More details can be obtained from **Roy Harvey G0TBY**.

Thanet Electronics Club

The **Thanet Electronics Club** will be holding their enrolment meeting and discussions about future club programmes and activities on Monday September 19 1994. The meeting will be held at the Quarterdeck Centre, Zion Place, Margate at 7.30pm. There will also be a follow-up meeting for prospective Novices on October 10.

If you have an interest in electronic project building, models and amateur radio, as well as outdoor activities such as cycling and youth hostelling, the club are also looking for sponsors for projects.

If you're interested in becoming part of the Thanet Electronic Club or can help with sponsorship then please call **(0304) 812723** to find out more.

SUBS CLUB/READER OFFER

Be sure of your copy of Practical Wireless every month and qualify for our Subscribers' Club as well. Special offers and discounts are normally available to members, including those abroad.



This month, in keeping with our test equipment theme we've come up with a digital multimeter at a very special price. The portable Metex M3800 DMM has the following features:

- High Surge Voltage protection 1.5-3kV.
- High a.c. frequency range 40Hz - 1kHz.
- 7 current ranges 20µA - 20A.
- 3½ digit display.
- Automatic polarity indication.
- 12mm high contrast l.c.d.
- Transistor h_{FE} test.
- Diode Test.
- Audible continuity Test.

The sturdy Metex M3800 DMM normally sells for £39.95 plus P&P but **PW Subscriber Club Members can get theirs for just £33.95** including P&P (UK, overseas P&P rates available on application).

Readers who are not subscribers can also save on this offer. The Metex M3800 is available to **non-subscribers for £36.45** including P&P (UK, overseas P&P rates available on application).

So, don't miss out take heed of Clive Hardy G4SLU's advice in his article on page 18 of this issue, where he says that a multimeter is the piece of test equipment to put on the top of your shopping list. Order your Metex M3800 DMM today!

Isn't it time you became a member of the Practical Wireless Subscribers' Club and had your favourite magazine delivered direct to your door?

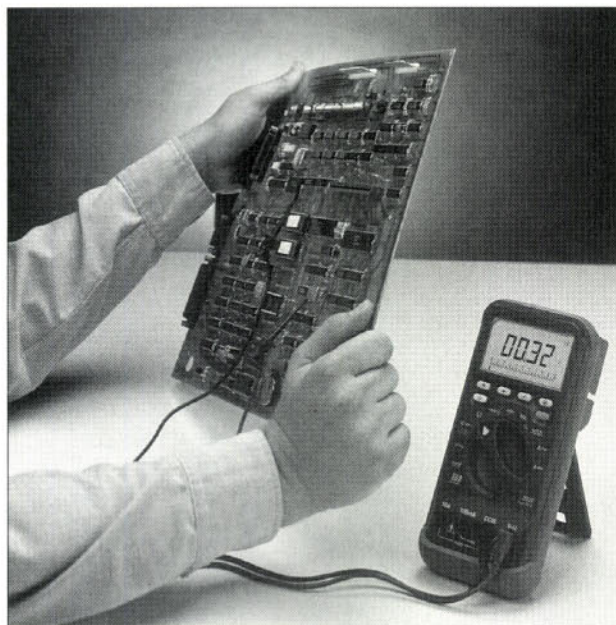
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Offer open until 13 October 1994 (UK), 10 November 1994 (overseas).

From Multimeter



Clive Hardy G4SLU guides you through the maze of test equipment to help you choose what is needed in your shack.

When you're considering test equipment for the shack, the big questions are - How much do you need and where do you start? What item should be bought first? What is essential and what isn't? And, of course, slightly useful gear rapidly becomes essential with use.

There's a great deal of satisfaction to be gained from locating and repairing faults in equipment, and from home construction. All of these operations require test gear.

There are those who would have you believe that hardly any radio amateurs touch a soldering iron from one year to the next. Yet every year the range of test gear seems to grow and grow.

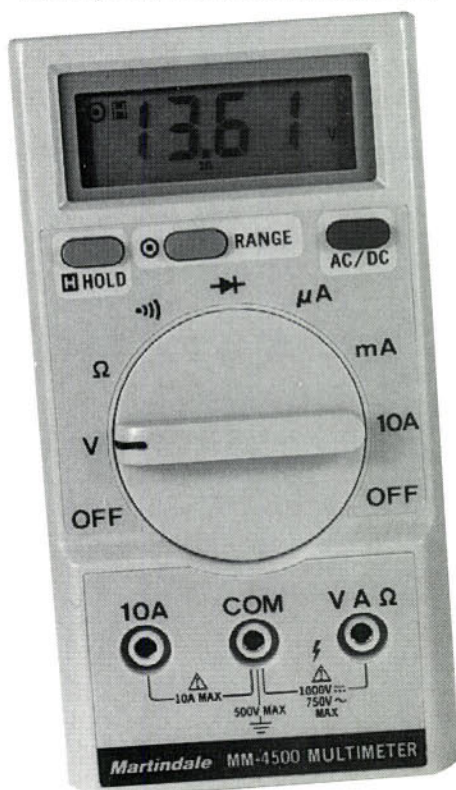
Some items can be 'ever so' humble, others extremely sophisticated. From the r.f. probe to the spectrum analyser, each addition to the shack is a benefit and I always encourage radio amateurs to build equipment.

Many items of test gear lend themselves to home-brewing or are available in kit form. So start building!

You Need A Multimeter

If someone starting in the hobby has no test gear whatsoever, you need a multimeter and it has to be the item to put on the top of the shopping list. It's the tape measure of electronics.

In my shack I have two multimeters, both analogue. One is an old AVO8 which, due to its size, usually only appears on the bench to measure currents larger than my main multimeter can cope with.



The other one is an inexpensive 20k Ω per volt analogue multimeter. It was bought many years ago and it still works perfectly. My preference is for analogue multimeters over digital multimeters, although both types have advantages.

All the digital meters I've owned have died, whilst the 'steam age' analogues live on. For measurements of fixed voltages a digital meter is excellent, giving very precise readings. Some have an auto-ranging feature, which eliminates manual range selection.

Analogue meters are easier to use when the voltage being measured changes as adjustments are made to a circuit. When adjusting for minimum or maximum readings, the swing of a needle is much easier to follow than changing digits.

Designers of multimeters have cottoned on to this recently, which is why some digital meters now have an analogue indicator as well as the numerical display. The best of both worlds?

The **Fluke 70** series multimeter is one meter offering the best of both worlds. As well as the digital display it has a 31 segment bar display below the digital display.

The Fluke 70 measures a.c. and d.c. volts, plus resistance. It also has auto-ranging. Different multimeters have different functions. Some multimeters



A good example of an analogue meter is the AM-900 from Instrotech Ltd.

have transistor testers. Others have I.f. frequency counters.

For example, the **Martindale MM-4500** digital meter does not have the analogue display of the Fluke, but has a three range ammeter covering from 0.1mA to 10A. Whereas the **Martindale AM-900** is an analogue meter with a transistor tester circuit.

Look around for the multimeter that most suits your needs. There is a large variety of instruments available with many combinations of features. The right meter will give you years of service.

At this point, it's worth mentioning

The Martindale MM-4500 digital multimeter has a three range ammeter from 0.1mA to 10A.

To Oscilloscope

An SWR Bridge

I didn't instantly think of a standing wave ratio (s.w.r.) bridge as a piece of test gear in the usual sense. Even though the multimeter maybe the first item on most people's list of test gear, the s.w.r. bridge is probably the first item most people actually get.

An s.w.r. bridge is fitted at the transmitter output in the antenna feed line. It gives an indication of what percentage of r.f. power leaving the transmitter is getting to the antenna system. It does this by sampling the r.f. present in the feed line.

If an antenna system does not present the correct impedance to the transmitter a mis-match situation occurs. This may damage the output devices if the mis-match is too high, and that could be very expensive!

Today, fortunately, most amateur transmitters are fitted with circuitry to reduce output in the case of serious mis-match. Two measurements are necessary to give the required indication.

The two measurements are often referred to as forward and reflected power. Reflected power is a term that often causes much confusion. This is not the article for a discussion about what reflected power is, or where it does or doesn't go. Suffice to say that, the less of it there is, the better.

Some s.w.r. bridges have two meters, one for each measurement. Others have one meter which is switchable to indicate either measurement. Some twin meter bridges indicate s.w.r. by the point at which two needles cross.

The crossing needle type of s.w.r. bridges, which I've seen also indicate the actual r.f. power going through them. The other types indicate only the relative proportions of forward and reflected power.

The **Lake TUA1** s.w.r. meter is a single meter s.w.r. bridge supplied in kit form. A switch selects the required measurement.

The TUA1 is supplied as a kit and it uses a toroid transformer in the measuring circuit. This is less frequency sensitive than the capacitive coupling used in cheaper bridges.

The kit comes complete with all the components, box, and stick-on front panel. It took me only a few hours to build. As usual, cutting the holes in the box took the longest time.

Calibrating the meter is quite straight forward. It appeared to work well. I didn't use it beyond the testing stage as it has Belling Lee sockets for the input and output. These may be cheap and OK for low power operation, but more conventional sockets such as BNCs or SO239s would be better.

A word of caution regarding the use of s.w.r. bridges. The diodes in the meters used to rectify the r.f. could generate harmonics. Unless you are sure that the problem does not exist at your shack, don't leave a meter permanently in line. Only put it in line for tests.



The Lake TUA1 is a single meter s.w.r. bridge, which is available in kit form from Lake Electronics.

Dummy Loads

Calibrating the s.w.r. bridge brought to mind another useful item of test equipment, the dummy load. This is simply a non-inductive resistor used to replace the antenna system and presenting the correct load to a transmitter under test, usually 50Ω.

Dummy loads can be purchased which will handle considerable power outputs. The mechanical design of the dummy load becomes more critical at v.h.f. and above, but for h.f. this is certainly an item of test gear to consider building yourself.

For very low power h.f. transmitters, two 100Ω resistors in parallel will suffice. For higher powers, 20 two watt 1000Ω resistors can be used. This type of configuration is used in the design of the *PW* 'treacle tin' dummy load published in *PW* January 1983 and was one of the first pieces of amateur radio equipment that I built.

With the addition of a diode to rectify the r.f. across a dummy load, the power output of a transmitter can be measured. Using a multimeter, of course, to measure the d.c. voltage. Simple mathematics will translate the d.c. voltage reading to an r.f. power reading.

The **Hands PMT3** power meter kit uses a more sophisticated means of measuring r.f. power from two watts down to the micro watt region. The example supplied for this review was a ready built demo model in need of re-calibration. It was as accurate as an elastic tape measure!

Other r.f. power meters are also available, either ready made or as kits. They are mostly combined power meter and s.w.r. bridges.

Field Strength Meters

The field strength meter is an item for checking that r.f. is being output from the antenna. It's almost the simplest piece of test gear, consisting of little more than a pick-up wire, diode, and moving coil meter.

The meter gives an indication of the relative field strength around an antenna, which is helpful when making antenna adjustments. A one or two stage transistor amplifier can be added to increase the sensitivity.

The Wavemeter

Back in the days when every shack needed equipment 'capable of verifying that the sending apparatus ... is operating with emissions within authorised frequency band' the wavemeter was a must. The wavemeter is really just a glorified field strength meter. It has a variable tuned circuit instead of the pick-up wire.

that all test equipment has an affect on the circuit being tested, and this will introduce a degree of error into any reading. The greater the input impedance of the piece of test equipment the less the effect, and so the less the error.

Apart from the cheapest types of multimeter, which should be avoided as serious test equipment, most analogue multimeters have an input impedance of

20kΩ per volt. This means that the resistance across the probes is 20kΩ for each volt of the range selected. At the 10V range therefore the meter has an input impedance of 200kΩ.

This is fine for most situations. But digital meters score much higher in the impedance department. They have much higher input impedances, typically 10MΩ.

Unlike an untuned field strength meter, which responds to any r.f., the wavemeter should only respond to r.f. to which it's tuned. Its main purpose is to detect harmonics on the main transmitted signal.

To satisfy the 'men from the ministry', wavemeters for checking transmissions had to cover the second, and preferably also the third harmonic of the signal. To ensure adequate coverage, wavemeters use a selection of plug-in coils for different frequency bands.

Crystal Calibrators

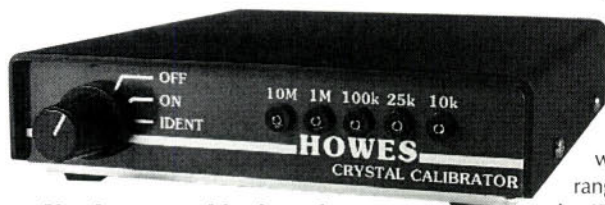
Crystal calibrators are still useful. In the days before digital read-outs and phase locked loops it was difficult to be certain that the frequency shown on the dial was the one to which the receiver was tuned.

Dials needed to be checked, or calibrated, against known frequencies. Crystal oscillators often served this function.

There are still plenty of receivers about today that do not have accurate frequency indicators. Today's crystal calibrator provides far more frequencies than just the one of the single crystal.

Microchip technology is used to divide the crystal frequency and create harmonics to provide markers at regular intervals up to v.h.f. A typical modern crystal calibrator is made by C. M. Howes Communications.

The **XM1** provides signals as 10, 25, and 100kHz spacings, and also at 1 and 10MHz spacings. The signals can be switched between continuous or pulsed. This is to identify the calibration marker from on air signals or other spurious signals.



Northamptonshire based C. M. Howes Communications produce a typical crystal calibrator in the form of the XM1.

Aligning Noise Comparator

The noise comparator is another piece of test gear used in aligning receivers. Its purpose is to aid tuning a receiver for best noise performance.

A noise comparator works by comparing the noise level from the receiver without a signal present to the level with a signal present. A meter indicates the relative difference.

The signal is supplied by a wide band noise generator which is switched on and off several times a second. This allows rapid comparisons to be made as adjustments to the receiver are carried out. When adjustments to the receiver cause an improvement in the receiver's noise performance the meter reading on the comparator increases.

It's a simple item to use, and very effective. Only two connections to the receiver are required. One is to the antenna socket, the other to the loudspeaker socket.

The receiver's automatic gain control (a.g.c.) circuit must be switched off and a noise comparator isn't suitable for aligning f.m. receivers. The **Hands Electronics NCM1** noise comparator covers up to 1.2GHz and is available in kit form.

Signal Generators

On to signal generators now. To align a receiver it's necessary to have an r.f. input to the antenna socket at the required strength and frequency. As the receiver is brought to alignment the lower the strength of the signal likely to be needed at the input.

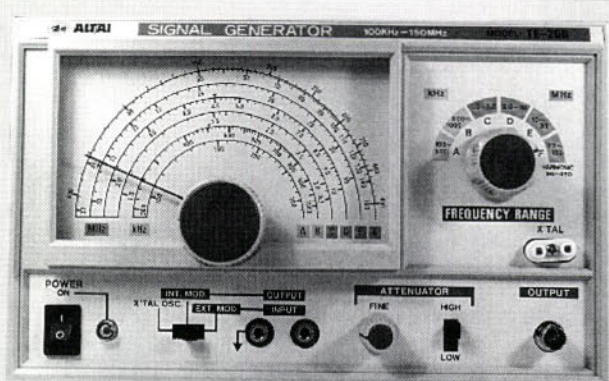
It might be possible to get the signal from another station's transmitter, but this presents all sorts of difficulties. Life is so much easier if you have your own very low power multi-frequency transmitter, which can be connected directly to the receiver's antenna socket.

A signal generator is the name given to such a low power transmitter. It has a v.f.o. with switched inductors or capacitors. This gives a wide frequency range, usually from v.l.f. to v.h.f.

There's also usually a facility for external connection of a crystal if a precise frequency is required. More sophisticated signal generators have digital readout and phase locked loop oscillator circuitry. There is a facility on most, if not all, for the signal to be modulated. Output power into 50Ω is in the tens of mW range.

So that the signal is at the correct level, it can usually be continuously varied from the maximum to practically zero. The **Altai TE-20D signal generator** covers from 100kHz to 150MHz in six ranges, with the harmonics detectable to 450MHz.

The Altai has a free running v.f.o. and a fairly imprecise analogue frequency indication. With such a signal generator some means is required to ensure that the receiver is being tuned to the correct frequency.



The Altai TE-20D signal generator covers from 100kHz to 150MHz in six ranges.

Frequency Counters

The usefulness of a frequency counter is self evident. The ability to see the frequency of any oscillator or transmitter displayed, often to tens of Hz of accuracy, is a great help to any constructor.

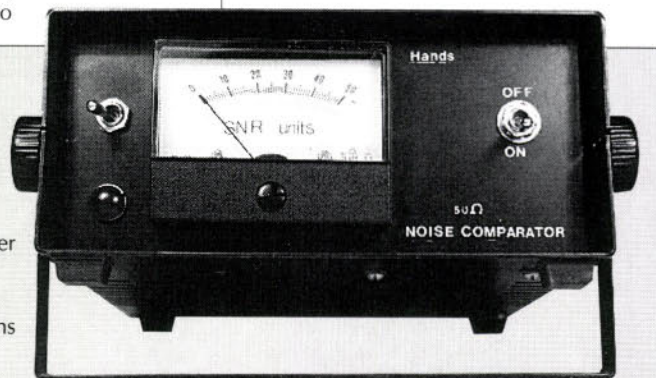
For this article I was loaned a **Startek ATH-30** counter to play with. This small item has a very large range, from 1 to 2800MHz, although the ATH-30 isn't really made as test equipment. Why not?

Well, bench frequency counters usually have two

inputs. One at low impedance, typically 50Ω the other at high impedance, say 1MHz. The higher input impedance is for direct connection to a circuit. This is because the higher impedance has less effect on the circuit under test.

The ATH-30 only has a 50Ω input. Other features also indicate it's designed with covert frequency hunting in mind. It has one shot count and hold, plus an antenna with a pen clip, which is ideal for sidling up to a radio user, waiting for him or her to operate the

Continued on Page 23



A useful piece of test gear for aligning receivers is the noise comparator. Hands Electronics produce the NCM1, available as a kit.

WOULD THEY CREDIT IT?

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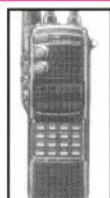
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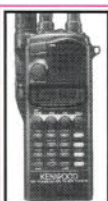


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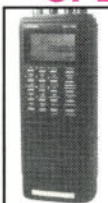
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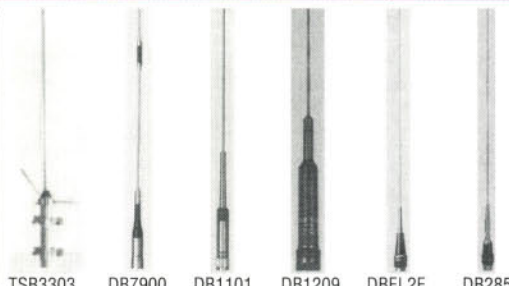
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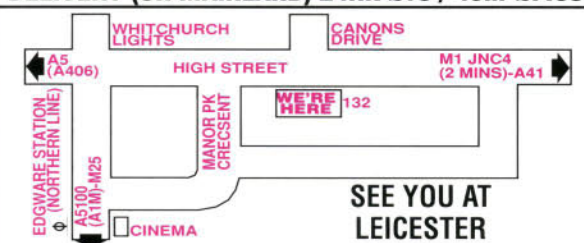
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From Multimeter To Oscilloscope

Continued from Page 20

radio, then checking the frequency of the transmission at a more convenient time and place.

This is a frequency counter for scanner enthusiasts, although it does have amateur radio uses as well. It proved useful when used together with the Altai signal generator to check the frequency, although it did have some effect on the wave form.

That was only discernible on the oscilloscope, but it did illustrate the effect of test equipment on a circuit. So unless you have a specific need for a hand-held frequency counter covering almost up to 3GHz, a bench counter with a high impedance input would be my recommendation.

My thanks go to the following companies for supplying the various pieces of equipment used in compiling this article.

RF Signal Generator TE-20D

Cirkit, Park Lane, Broxbourne,
Herts EN10 7NQ.
Tel: (0992) 444111

Crystal Calibrator XM1

C. M. Howes Communications, Eydon,
Daventry, Northants NN11 3PT.
Tel: (0327) 60178

Noise Comparator NCM Power Meter PMT3

Hands Electronics, Tegryn,
Llanfyrnach, Dyfed SA35 0BL.
Tel: (0239) 77427

MM-4500, AM900, Fluke 70 Multimeters

Instrotech Limited, 129 St. Albans Road,
Watford, Herts WD1 1RA.
Tel: (0923) 247641

TUA1 s.w.r meter kit

Lake Electronics, 7 Middleton Close,
Nuthall, Nottingham NG16 1BX.
Tel: (0602) 382509

Bench p.s.u. 2A 30V XG89

Maplin Electronics, PO Box3,
Rayleigh, Essex SS6 8LR.
Tel: (0702) 554161

Sartek Frequency Counter ATH-30

Nevada Communications, 189 London
Road, North End, Portsmouth,
Hants PO2 9AE.
Tel: (0705) 662145

Oscilloscope 9020E

Wavetek Ltd., Hurricane Way,
Norwich, Norfolk NR6 6JB.
Tel: (0603) 404824

Further details on any of the equipment mentioned above or indeed others in the range can be obtained by contacting the companies direct.

Power Supplies

A bench power supply unit (p.s.u.) can be distinguished from an ordinary power supply by its ability to vary the output voltage. It also has meters to indicate the output voltage and the current.

While a bench p.s.u. with variable voltage has to be useful, I have managed without one so far in my amateur radio constructing activities. This

is because most of the time amateur radio equipment is powered by 13.8V.

Apart from valve gear it's safe to say that most equipment requires a 13.8V supply, whatever voltages it uses inside. If not, it needs less.

On the few occasions when I'm using or working on equipment requiring a lower voltage I use a universal mains adaptor of the type sold by high street electrical dealers. A 1.2A version with seven voltages from 1.5 to 12V usually retails for just under £10. The voltage regulation is reasonable too, within 0.25V of the stated voltage off load.

For the amateur I would say that the ammeter on the bench power supply is the most useful feature. Often, however, the maximum current supplied by a bench p.s.u. is only a couple of amps. This precludes its use as the station supply unless QRP operation is the order of the day.

The Maplin XG89 power supply has a maximum output of 2A available in two voltage ranges, 0-15 and 15-30. Having a maximum of 15V available on one range offers a degree of protection to the attached equipment. It does limit the possibility of squirting too high a voltage into 13.8V equipment by injudicious operation of the voltage control.



A bench power supply unit can be distinguished from an ordinary p.s.u. by its ability to vary the output voltage.

The Oscilloscope

I am now moving into the luxury end of amateur radio test equipment with the oscilloscope. The price of an oscilloscope keeps it out of most shacks, although the cheapest cost less than the more expensive multimeters.

The oscilloscope such as the Wavetek 9020E is the sort of piece of equipment that a club could consider buying. Most of us are familiar with the sort of displays seen on an oscilloscope screen.

For the radio amateur the ability to look at a wave form is very useful. The effect of modulation on a signal can be seen. Measurements can be taken by means of the on-screen grid or graticule.

The dual traces means that two signals can be displayed. For example, at the input and output of a stage. If you are seriously into home-brew and design access to an oscilloscope is essential to gain an accurate picture of what is going on inside a radio.

Summing Up

In summing, up there are various other items of test equipment that I could have mentioned, but I think I've covered the ones most people are likely to consider buying or building. Like all tools, it pays to get the best you can for your needs.

Best doesn't have to mean expensive. Kits are a good source of some excellent inexpensive test gear.

PW

Further Reading

To compliment Clive Hardy G4SLU's article, the Editor Rob Mannion G3XFD, has selected some interesting titles from the PW Book Service on the theme of test equipment.

In his further reading article 'Books - The Essential Tool' on page 33, Rob aims to help you select suitable titles by providing some of his personal choices.

A Solid State Crystal Oven For The PW Robin

Following the success of the 'Robin' counter in *Practical Wireless*, I found that especially for u.h.f. operation, the very slight frequency drift of the clock oscillator was responsible for an error in the frequency displayed as the counter warmed up.

After some experimentation, I came up with a suitable crystal heater. Once incorporated into the Robin, this 'solid state oven' holds the crystal temperature within approximately 1°C after warm-up.

Circuit Description

The circuit for the crystal oven is shown in Fig. 1. The actual 'heater' for the crystal is Tr2. The crystal and thermistor R2 are all in thermal contact with Tr2 (see Fig. 2).

At switch on, R2 has a high resistance, Tr1 is turned on and Tr2 conducts and warms up. As Tr2 warms up, so does the crystal and thermistor and the resistance of the thermistor drops. This reduces the drive to Tr1 and 2 reducing the current and thus the heat that's developed.

Thermal equilibrium is soon reached

and the temperature remains virtually constant. The variable resistor, R1, adjusts the drive to Tr1 and governs the final temperature.

Construction And Fitting

Let's now turn to the construction and fitting of the oven. Start by carefully removing the crystal from the Robin and fitting a couple of Veropins into the two holes.

Next, fit all the components to the board. When mounting the crystal, smear heatsink compound to the metal face of Tr2 and both sides of the crystal.

Carefully mount a mica washer between Tr2 collector and the crystal to prevent short circuits. Mount the thermistor in contact with the crystal and slip a small piece of heat shrink sleeving over the whole assembly (see Fig. 2). Then carefully warm the whole assembly and shrink the unit tightly together.

You should then allow the assembly to cool. When it's cool, you can fit on the rear panel of the Robin, with the pins on the sub-board opposite to the pins on the main board.

The Calibration

To begin the calibration, set R1 fully counter clockwise and connect a milliammeter in series with the supply lead and switch on. The current should be set to approximately 75mA using R1, and should fall and reach a fairly stable value after a few minutes.

Monitor the current being drawn, and by adjustment of R1 (a small step at a time) adjust it until the meter reads about 40mA and remains at approximately that value. If a temperature probe is available, the case temperature of the crystal should now read about 30°C and remain constant.

PW

The PW Robin frequency counter designed by Mike Rowe G8JVE has proved to be a very popular project. Mike's now come up with a modification to increase stability and reduce drift on the Robin.

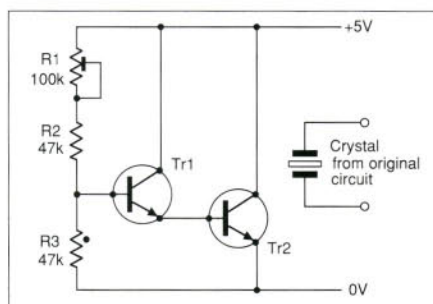
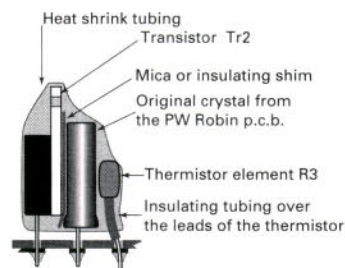


Fig. 1: Circuit of the crystal 'oven' unit for the PW Robin frequency counter, as built by the original designer Mike Rowe G8JVE.



A cross section through the oven with the Crystal sandwiched between Tr2 and R3.

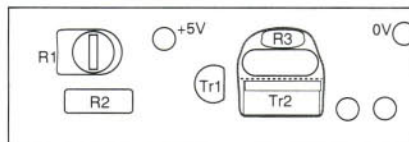
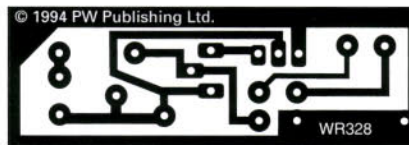


Fig. 2: The p.c.b. and associated overlay for the crystal oven project on the Robin frequency counter. The overlay also illustrates the technique used to mount the components together to provide a constant temperature (see text) for the crystal 'oven'.

Shopping List

Resistors

Metal film 0.25W 5%

47kΩ 1 R2

Miniature p.c.b. mount trimmer

100kΩ 1 R1 (Cermet preset
Maplin WR44X)

Thermistor

47kΩ 1 (Maplin FX42V)

Semiconductors

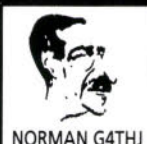
Transistors

BC337 1 Tr1

TIP31 1 Tr2

Miscellaneous

Heat sink compound, p.c.b. (from PW
PCB Service). Veropins.



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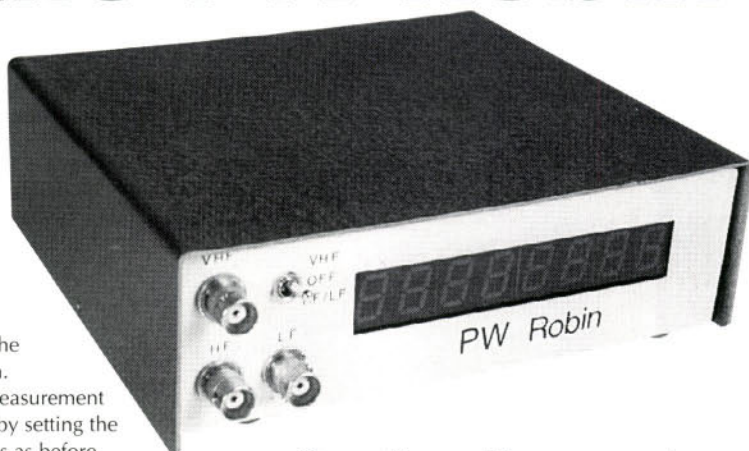
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	1.3mtrs long	82.50	70.00	RH900	2m/70cms flexible 49.5cms	39.95	33.00
X200	2m/70cms vertical 6/8dB						
	2.5mtrs long	109.95	92.50				
Mobile (all PL259 bases)				HF			
NR77	2m/70cms 2.15/5.3dB			CP5	10-15-20-40-80mtr rigid radials	275.00	230.00
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NR770	2m/70cms 3/5.5dB						
	99cms long	41.95	35.00				
NR790	2m/70cms 4.5/7.2dB						
	1.45cms long	69.95	59.50				

Lee Electronics

Extending the PW Robin

George Fidler G3TDV has found his PW Robin frequency counter very useful. In the second of our special articles on this popular project, George describes his modifications allowing the Robin to measure time and capacitance.



The additions I'm describing in this article extend the facilities on the PW Robin frequency meter, originally published in PW July 1991. My modifications add the facilities to measure both time and capacitance.

With eight decades of display on the PW Robin, it's possible (in theory) to indicate capacitance values for 1pF to 99.999999µF, in a single range.

In terms of time measurement the same readings could indicate time intervals of 100ns to 9.9999999 seconds, or multiples of these. Three ranges of time measurement are catered for in this unit to extend time measurement up to just under 1000 seconds.

A DIN plug is used to connect the extension to the counter, and handles both data and power.

To interface the extra unit with the existing Robin, it's necessary to cut three lines feeding the counter/display section on the counter. These are the latch, reset, and count input lines.

If the input lines are cut, and fed back to the counter via a three-pole change-over switch, then in one position they are as normal. However, in the other position these three inputs may be accessed by external equipment (see Figs. 1a and 1b).

On my prototype, the DIN plug mentioned earlier carries these signals, as well as d.c. power to the Robin. The existing regular, and protection diode are removed, and +5V from the extension unit connected directly to the +5V 'bus' on the frequency counter.

The Modifications

Let's now take a look at the modifications I'm suggesting, in some detail:

1: Timer section. Three link selectable ranges are available. These are (a) 100 nanoseconds to 9.99 seconds (b) 1 microseconds to 99.99 seconds and (c) 10 microseconds to 99 seconds.

Triggering assumes logic levels between 0 and +5V e.g., TTL and CMOS, or relay contacts, providing one contact can be grounded to give a logic 0 when closed.

The period between any two edges of a pulsed wave may be selected for measurement using the **edge select** switches as shown in Fig. 2. Once the edges have been selected and the incoming wave applied, measurement is

initiated by using the **Timer Reset** button.

Single pulse measurement may also be done by setting the start and stop edges as before. Next, press **Reset** to clear the counter, then apply the pulse to be measured.

Manual timing is also possible using negative to positive transitions of the edge select switches, although switch bounce may often make these work in both directions. **2: Capacitance measurement section.** Most capacitors except electrolytics may be measured. Some tantalums and low leakage electrolytics measure satisfactorily, but readings were found to be a little high, although within the tolerance of the capacitor.

A pair of test terminals are provided to hold the test capacitor and a double-pole centre-off, biased change over switch is used, on one side to discharge the capacitor and reset the counter whilst the other side initiates measurement.

The Circuitry

Time to look at the circuitry now, and I'll start off with the oscillator/frequency divider. This uses a 74HC4060 (IC4) as 10MHz crystal oscillator. It has a buffered output at pin 9.

The 10MHz clock is used for timing measurements on the 100 nanoseconds to 9.99 seconds range. It's also used to derive 1MHz and 100kHz clocks via IC6 (a, b) dual decade counter, wired to give a square wave output at these frequencies.

These clocks may be used for timing on the slower ranges, by link selection (or switch if used). The capacitance sections uses only the 1MHz clock.

Timing circuitry is provided by IC1 which is a 74HC86 Quad exclusive OR gate type. Two gates are wired as conditional complimentors. This allows us to select either a positive or negative edge of an incoming wave to trigger IC2.

The resistors R1 and 4 in conjunction the two 5.1V zener diodes limit the input levels. The pull up resistors R3 and 6 hold the inputs at logic 1 under no signal conditions. This makes it possible to measure mechanical makes and breaks (for example) relay contacts with one side to ground.

And finally, there are the gating functions. These are provided by the IC2a and 2b.

Capacitance Measurement

Let's now turn to the capacitance measurement circuitry. This operates on the basic principle of time constant, $t=CR$ when a capacitor is charged from a constant voltage via a resistor; t =time in seconds, C =capacitance in Farads, and R =resistance in ohms. This time 't' is the time taken for the charge on the capacitor to reach 63.2% of maximum.

Now, if R is held constant, then as C increases in value, so will 't'. A '555 timer when connected in monostable mode switches when the charge on its timing capacitor reaches about 66% of maximum value, but this can be changed to 63.2% (equal to 't') by applying a control voltage to pin 5: the output pulse width from the '555 will then be equal to 't' for any capacitor with negligible leakage.

If this output pulse is now used to gate the existing counter on, and off, then with a 1MHz clock, the counter will display 't' in microseconds, and with a 1MΩ charging resistor, and C in picofarads.

For example, assume a capacitor of 100pF:

$$t=CR = 100 \times 10^{-12} \times 10^6 = 100 \times 10^{-6} = 100\mu s$$

So, the display should show 00.000100, indicating 100pF.

The variable resistor, R8 is a calibrated control used to set the switching point of the IC5 to 63.3% of 5V. This is about 3.16V, and the adjustment is described later.

The resistor R11 removes any residual charge in a capacitor when the **Discharge** control is pressed. This action also resets the Robin's counter.

The network C2, 3 and R12 and 14 apply a short trigger pulse to IC5. This initiates the timing cycle.

When the biased switch, S3, is pushed to **Measure**, the output of IC5 immediately goes to logic 1 which enables the AND gate (IC3b) to allow the 1µs clock pulses through to the Robin's counter. Then a time 't' later, the output of IC5 drops back to logic 0, disables IC3b and stops the counter.

The counter should then display the elapsed time in microseconds. This, as I've

mentioned before, is equal to the capacitance in picofarads. I don't make any claims for super accuracy, but despite this, results are adequate for normal use in the shack.

When measuring unmarked tantalum capacitors or those with confusing colour codes, it's possible to hook them up in the wrong polarity. If this happens, the counter will not stop counting because of the leakage. Try reversing the polarity, when a reading should be obtained.

I found that most tantalum capacitors were measuring high. But they were within the tolerance of the capacitor, and some with more than negligible leakage would not measure at all.

Single Sided Board

My prototype was built using a single-sided printed circuit board with wire links on the top side. Two of these links are under IC6, so it's a good idea to solder all the links in first, then follow up with the i.c. sockets and other components.

Note: In order to keep stray capacitance low, I recommend that you use a single solid wire from the p.c.b. to the capacitor terminal on the front panel. Keep it well clear of the board and any earthy points.

Note: The latch input to the Robin is grounded at the DIN plug. This is done so you will be able to see the count progressing on large capacitors, and on long time delays.

Initial Testing

Before starting the initial testing **do not** insert any i.c.s, and **do not** connect the unit to the Robin. And, before switching on, don't forget to measure the resistance between the +5V rail, and ground on the board, to ensure that no short circuits exist.

If everything is in order, switch on. Check for +5V d.c. between the V_{CC} and ground pins at each socket.

Then make sure that the correct supply polarity for the Robin is wired to the DIN plug. And don't forget to do the same for the socket to the Robin!

Providing all is well, switch off and plug the unit into the Robin. Now switch on and set the new switch at the rear of the Robin to **External**.

Next, set the **Capacitance/Time (C/T)** switch on the front panel of the new unit to C, and press Discharge. The display should clear.

Now press **Measure** and a number greater than '0' should be displayed. If not, alter the setting of R8 and try again.

If everything checks out, switch to **measure time (S5)**, set the start and stop edge select switches to **-ve edge**, and press **Reset**. The display should clear.

Next, set the start edge switch to **-ve edge** and counting should commence, set the **stop edge** switch to **-ve edge**, and counting should stop. If these tests are okay, the next step is fine tuning the crystal to precisely 10MHz, and calibration of R8.

Crystal Frequency Adjustment

You should now be ready to start the crystal frequency adjustment. Begin by setting the new **Internal/External** switch at the rear of the Robin to **Internal**.

For the next stage you use the Robin frequency meter to align the crystal to exactly 10MHz. This can be done by coupling the 10MHz link on the p.c.b. to the h.f. input on the Robin via a 100pF capacitor. You can then adjust the crystal trimmer capacitor.

Variable Resistor

The variable resistor, R8, adjustment is done by using two 1% silver mica capacitors. One capacitor should be fairly large, say 2200pF to set the high value end of the range, and the other should be quite small, say 5pF to set the low value end of the range.

Proceed as follows: (1) Fit the 2200pF to the measurement terminal, and take successive readings using the **Discharge** and **Measure** switch, until a correct reading is obtained. This will of course include stray circuit capacitance of 25 to 30pF, but the 1% tolerance of 2200pF is 22pF, so you won't be too far out on the first try.

(2) Next, remove the 2200pF, and measure the stray capacitance. This should be somewhere near the 25 to 30pF value mentioned above.

Now fit the 5pF capacitor to the test terminals and take successive readings whilst re-adjusting variable resistor R8 slightly, until a correct reading of 5pF plus strays is obtained. Therefore assuming the strays measurement was 25pF, you would be adjusting for 30pF (5 + 25).

If necessary, repeat these steps until the high value end is fairly accurate and the low value end is quite accurate.

Timer Section

On the timer section, the maximum input pulse repetition rate (p.r.r.) is 5MHz, using the 10MHz clock. The minimum pulse width measurable is 200 nanoseconds plus or minus less than 100 nanoseconds.

The p.r.r. and minimum width limit is because the clock is free running and after a pulse is applied, the next positive edge of the clock initiates measurement. However, when comparing this measurement with the display of a cathode ray oscilloscope it's difficult to detect any difference.

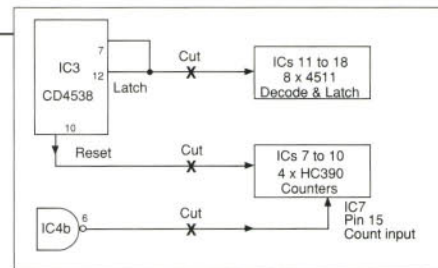


Fig. 1a: Part of the circuit diagram of the original Robin frequency counter, indicating where p.c.b. tracks are to be cut (see text) for the additional unit.

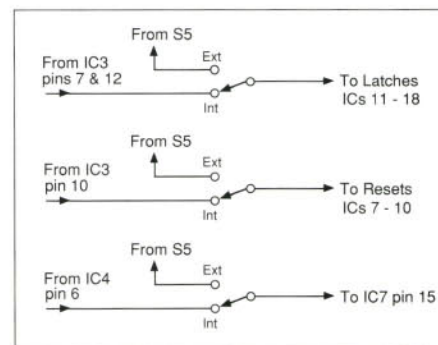


Fig. 1b: The additional switching circuit required for the modifications suggested by G3TDV (see text).

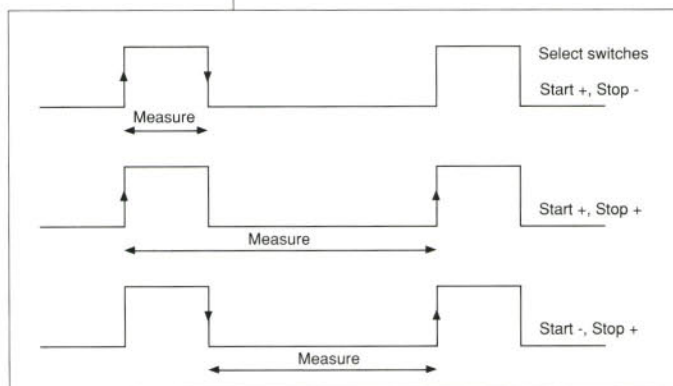


Fig. 2: Timing diagram showing variations of start and stop triggers (see text).

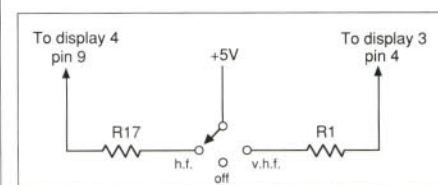


Fig. 3: Part of original Robin circuit for decimal point switching (see text).

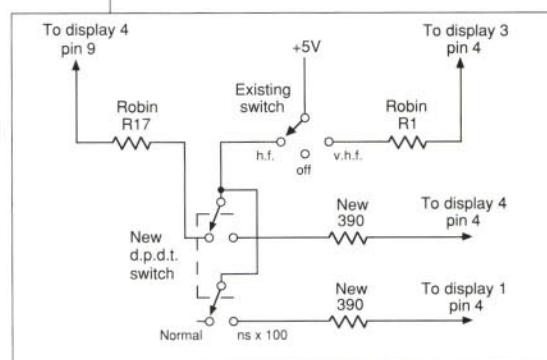


Fig. 4: Modified decimal point switching.

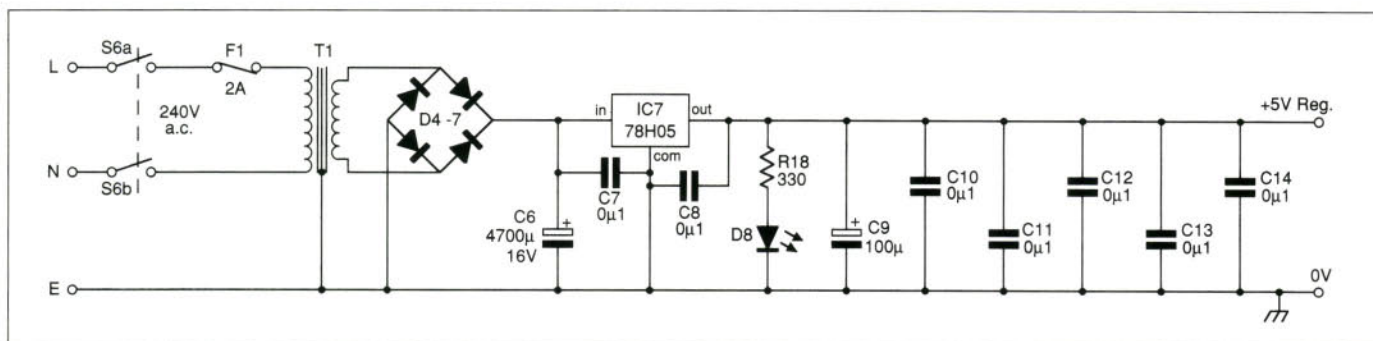


Fig. 5: The new power supply unit for the combined units.

Fig. 6: Circuit diagram of the G3TDV modifications for the Robin frequency counter.

Repetitive Pulse Width

To measure pulse width (repetitive pulses) assume +ve pulses are at logic levels. Begin by setting the **start edge** switch to **+ve edge** and the **stop edge** to **-ve edge** then apply the input pulse train, and press **Reset**. The pulse width of the first pulse encountered will then be displayed.

Single Pulse Width

To measure a single pulse width (monostables, etc.) you should set the start and stop switch as before. Next, start off by pressing (for this operation) the **Reset** first. Then apply the single pulse. For negative going pulses reverse the polarities of the start and stop edges selected.

Mark Plus Space

For the measurement of periodic time of a repetitive wave (mark plus space) you should set both start and stop edges to the same polarity. Then apply the pulse train and press **Reset**.

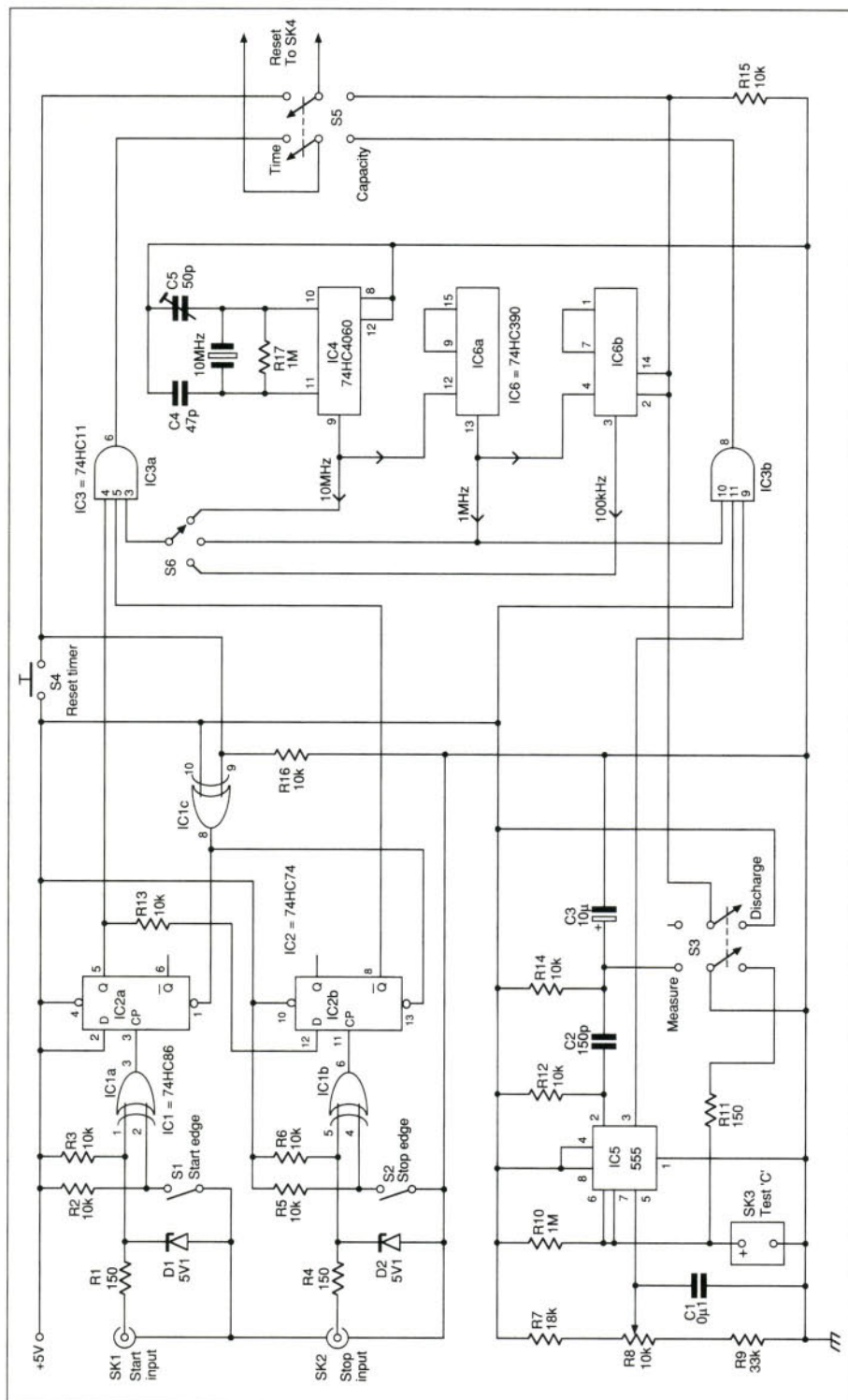
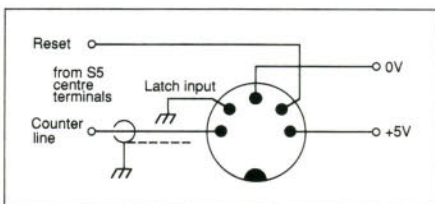
Obviously, the mark-space-ratio may be obtained by measuring the mark, then the space, then calculating the ratio.

Capacitance Measurement

The stray circuit capacitance of the measurement circuit in the prototype was about 25pF. So, when measuring capacitors below about 10 times this (250pF) the stray capacitance is measured first.

The stray capacitance is then deducted from the reading obtained with the test capacitor in circuit. In this manner, capacitance down to about 2pF can be measured.

Fig. 7: Suggested interconnecting cable connections for interfacing the additional unit to the Robin.



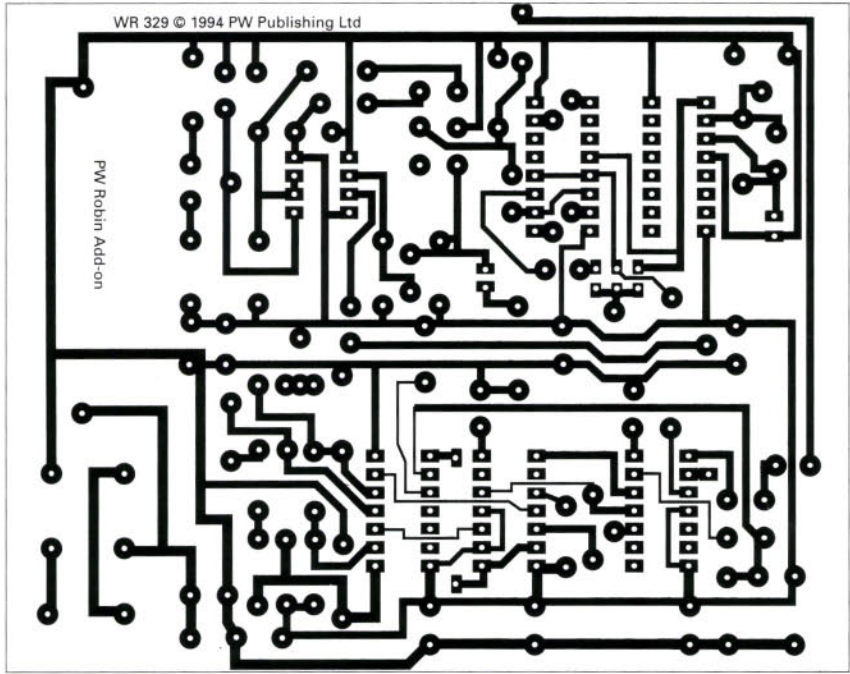


Fig. 8: The printed circuit board and associated overlay for the G3TDV project.

Resistors

Metal film miniature 5%

150Ω	3	R1, 4, 11
330Ω	1	R18
390Ω	2	As per Fig. 4
10kΩ	8	R2, 3, 5, 6, 12, 13, 14, 16
18kΩ	1	R7
33kΩ	1	R9
1MΩ	2	R10, 17

Miniature trimmer

10k Ω 1 R8 Cermet type

Capacitors

Miniature disc ceramic

47pF	1	C4
150pF	1	C2

Miniature polyester

100nF	8	C1, 7, 8, 10, 11, 12, 13, 14
-------	---	---------------------------------

Miniature electrolytic 16V

10 μ F	1	C3
100 μ F	1	C9
4700 μ F	1	C16

Miniature trimmer capacitor

10 to 50pF	1	C5
------------	---	----

Semiconductors

Zener diodes

5.1V	2	D1, 2
------	---	-------

Rectifier

2A bridge	1	D4-7
-----------	---	------

Integrated circuits

7555	1	IC5 (CMOS 555 type)
78H05	1	IC7 (Any 5V, 2A or more type)
74HC86	1	IC1
74HC74	1	IC2
74HC11	1	IC3
74HC4060	1	IC4
74HC390	1	IC6

Miscellaneous

Switches: Small double-pole change-over (centre off) non latching (both ways) for **Measure/Discharge**. Small double-pole change-over for **Select Time/Capacitance**. Small double-pole toggle (mains switch). Small three-pole change-over (for rear of Robin). Two small single pole toggle switches (for **Edge Select** switches). Press button switch (normally open). Mains transformer 6V 25VA, 10MHz crystal, Maplin 160B case, five pin DIN plug and socket (interface to Robin), two BNC sockets (wave/pulse inputs), one i.e.d., two terminals (capacitor test terminals).

Invaluable For Checking

I found my add-on unit for the PW Robin to be invaluable for checking those 'bargain' capacitors as bought in the £1 bags at mobile rallies. Some of the capacitors had the wrong colour code on them and others measured as high value resistors (1 to 10M Ω , etc.).

One packet of supposedly 100pF disc capacitors turned out to be 10pF. So, it certainly paid to have the extra facilities on my Robin!

PW

With larger values, say 1000pF and 5% tolerance, which means 1000pF \pm 50pF, the stray capacitance can in most cases be ignored.

When measuring (for example) the range of a tuning capacitor or trimmer capacitor, remember that the wires used to connect it have some capacitance. This depends on their length and spacing.

The capacitance of the connecting leads should be taken into account. They should be measured to get the total stray capacitance before actually connecting them to the circuit to be measured. This value is then deducted from the final measurements.

THE UK's No. 1 SUPP

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FT-736R

Still the only Base Station that can take all four VHF/UHF bands at once, the FT736 for 6/2/70 & 23CM is out on its own. No other offers you a built in PSU. No other offers satellite operation at the press of a button and is so convenient for packet operation. Its SSB facility allows true DX when the local FM chat becomes a bore. A Turbo front end, courtesy of messers muTek has been available for almost two years enhancing the receiver performance even more on 2 & 70.

FT-990

More and more customers are realising the high quality offered by Yaesu and the 'Nineties' series of H.F. communications transceivers. The FT990 is probably the most 'commercial grade' transceiver available to the Amateur. For example, no other has

plug in boards interfacing to a mother board, giving you low servicing times in the unlikely event of a break down. No other has digital filters fitted as standard, giving you razor sharp selectivity. No other has a front panel layout that allows the operator to take full advantage of all the features available - without referring to the handbook every time. The list goes on. Visitors to the store always comment on how solid the FT990 feels to the hand. The performance has been underlined by Peter Hart and Rob Marion. Test drive one today!

FT-840

With the FT747 now finished, the FT840 takes over. The reports from the "big boys" on H.F. constantly remind me how good the FT840 is. (see our newsletter, FT840 - First Impressions by Henry Lewis G3GIQ). I'm so confident that you'll agree, the FT840 really has performance to match the big rigs. I'm offering a TEN DAY money back guarantee.

IC-820H

This one's so new that we still get asked what is it? It's the latest Dual Band Multimode Base Station from Icom. 35/45 watts on two & seventy, it's the neatest package around for the VHF operator. Once again, the men at Icom have priced this very sensibly.

IC-736

It's funny that only a year ago you were all asking me when a manufacturer was going to bring out an HF rig with six, that offered 100 watts across the whole range. Icom's ears must of been wagging, presto! the new IC-736. It didn't stop there however. Whilst they were busy giving you a world first,

somehow they've squeezed in a mains PSU and an auto tuner in the smallest space possible! Don't forget what Peter Hart said about its brother, the IC-737 (without 6m), "amongst the best receive performance of any rig I've tested".

IC-737A

If you're not enthused about the NEW IC736, or simply don't want 6M or possibly a power supply, then take a special look at the IC737. It's been a favourite of mine since its introduction last year. Voted one of Peter Hart's favourite rigs, his comment "amongst the best receivers I've ever tested" is absolutely true. They're in stock at a special price to suit you.

FT-900

On July the fifteenth, 1994, Yaesu Musen Co. of Japan unveiled their exciting (and world first), FT-900. For those of you who "preferred" to use the features of the FT-890 for mobile use, but found it a little too large, Yaesu engineers have "split" part of the front panel, enabling full feature HF mobile, with base station facilities from your car, in the new FT-900. For mobile operation, the new lightweight detachable sub-panel permits separating the transceiver and mounting the main unit in a remote location. This makes the FT-900 convenient for mobile and maritime amateur operation, or wherever space is at a premium. With similar features to the FT-890, the new FT-900 incorporates an option ATU-2 Auto Antenna Tuner and many more newly introduced features, not yet seen on such a small and compact package.

Operating frequency and other important settings are displayed on a high-contrast back-lit LCD. The new three-mode bargraph meter display features delayed "peak hold" circuitry for the tuning

bargraph segments that simplifies tuning stations with rapidly varying signal strength.

FT-747GX - ONLY 5 LEFT

Now in its final stages of production, the FT747GX allowed thousands of operators to get on the H.F. bands for the cost of a dual bander mobile rig! It's simple in operation and Yaesu's brief was to give the user 100 watts on all Amateur Bands, include a General Coverage Receiver and the option of all modes. The biggest crunch was the price. I've managed to secure the very last production from Yaesu Japan and I'm offering them to you at cost. Last chance - there are no more!

FT-530

Hands up all those who thought they had bought the right dual band handle, only to find their mates bought the correct one first - the FT530. The new FT530 from Yaesu is in our opinion the easiest to

LEICESTER SHOW STOPPERS!!!

For all customers spending over £100 on the **LYNCHY STAND** at the Leicester show, your entrance fee will be returned - in cash!! How's that for a fair deal?

REMEMBER REMEMBER the 26th of NOVEMBER

Last year was the opening of the new shop, this year we're celebrating the first anniversary and what a day that will be! More news next month, but make a note in your diary NOW. Nearly a thousand people poured through the door and grabbed tens of thousands of pounds worth equipment at virtually trade prices. Further more, they were fed and watered for free. ARE YOU SURE YOU'RE BUSY THAT DAY? What ever you've got on - cancel it and come to **MARTIN LYNCH**. Make him sweat and give yourself a big grin - grab a bargain! More details next month.

TS-50S

I've been using one mobile for nearly a year. For all those skeptics, it hasn't gone wrong, even running 100 watts output. I remember other manufacturers scoffing at the fact "I wonder how long it takes to burst into flames?" Well let me tell you, they don't. The TS-50S is the most reliable HF transceiver we probably sell. It only begs the question why are the other H.F. transceivers so large?

SUPER SLIM TH-79E

The TH-79E is a new very slim and lightweight DualBander, offering features exclusive to this new design. Despite its compactness, the radio can operate full duplex and monitor two frequencies at once, within the same band. Monitoring both input and output of repeaters simultaneously are therefore possible.

80 non-volatile memory channels with ID
The TH-79E has 80 multifunction channels - all capable of storing TX/RX frequencies, CTCSS and split channel operation. Each channel can be assigned with letters (upto 7 characters) to identify each one

individually. All memories are stored in EPROM, so no more worries about lithium backup! **Multiple scan Modes, DTMF Memory & DTSS & pager functions are all present in this tiny well constructed package.**
★ Power on call sign display ★ Selectable dual & single band operation ★ A.B.C. (auto band change) ★ CTCSS operation (with optional TSU8) ★ Tone alert system ★ Auto repeater offset (VHF) ★ 3 position power, High/Low/Economy low ★ Over voltage display and audible warning ★ Auto power off ★ 10 minute time out timer ★

Dot-Matrix LCD & menu/guide system

Making its debut on handheld transceivers, the dot matrix display greatly improves user friendliness since there are no limitations on the variety of messages that it can handle. In addition to frequency data, this can be used to access a menu system with full alphanumeric display of functions and settings. The operator can also scroll through a summary of current operational status. What really sets this system apart is the "on-line" guide - simple operating instructions appear in the display whenever needed.

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LIER FOR

EGOTIATION

ICW-21E/ET

The alternative Icom Dual Bander is available with or without keypad. They are great value and still offer all the extended receive features that is so important today. Why I don't know, but there it is. What ever happened to AM on 2 and tuning "low to high?"



ICOM

use, most feature packed, only one to offer CTCSS as standard, super-wide extended coverage Handie available. Like other Yaesu products, once you've read the manual, we doubt you'll need to read it again.

FT-11R/41R

I know you probably think the Japanese have gone bonkers building VHF portables, but you've just got to see what Yaesu have done with these two. No larger than a packet of cigarettes, the NEW FT-11/41R handies are full-feature machines with all the "trick" facilities built in. The volume & squelch are controlled by up & down buttons, leaving the top panels with only one knob - the channel change knob. See one today!



YAESU

TS850S

The TS850 set the standard for sub £2K radio's and judging by how many we get through every month, you obviously appreciate the machine as well! Rather like a popular car, you either know someone with one, had one and wish you never sold it, or haven't yet got round to investing in the best HF base station since Trio launched their TS530 all those years ago. I'm here and I'm ready to take your money!

TH78E - LAST FEW ONLY

The TH78E still has the most features per pound offered on a dual bander. It's the smallest shape with the most buttons on it.

TH22/42E

The latest in slim-line single band FM handies. If you're fed up with the bits you'll never use, but just want a good 2 or 70 radio then look no further. They are sensibly priced too!



KENWOOD

Martin Lynch?

MARTIN LYNCH

G4HKS

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AA&A 'CAPCO LOOPS'

Whether you're using a FT747 or a top flight FT1000, if the space is limited, try the new range of CAPCO LOOPS for yourself.

Magnetic Loops

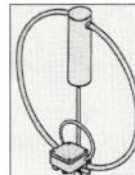
AMA-3 200W 13.9 - 30 Mhz	£249.95
AMA-4 100W 1.8 - 4.2Mhz	£399.50
AMA-5 150W 3.5 - 11Mhz	£299.95
AMA-6 150W 6.9 - 24Mhz	£279.95

(£20 Carriage on these items)

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SPC-300D Roller Coaster 300W RMS, 1kW pep	£299.95
SPC-3000D Roller Coaster 1kW RMS, 3Kw pep	£399.95
CFA: Variable frequency antenna	£99.95

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A3S 3 ele Beam, almost as above!.....	£349.00
A3WS 18/24MHz 3 ele beam	£275.00
D3W 10/18/24 MHz rotary dipole	£179.00

DON'T FORGET, I'VE GOT A HUGE ARRAY OF ANTENNAS AVAILABLE.
COBWEBB, OUTBACKER, VARGARDA, VALOR & SERENE to name but a few!

MyDel MiniMag 270

After six months of trials, the new MiniMag 270 is offered as the real alternative for fixing a dual band antenna to your new vehicle, without drilling holes or using ugly trunk clip mounts. Under twenty inches high, the antenna offers dual band operation on 2 & 70, incorporates an extremely powerful magnetic base just over an inch in diameter and comes complete with 4M of miniature coax, terminated with a BNC plug. I've driven at high speeds and it won't fall off unless knocked hard!

Introductory offer of only £29.95 plus £3.00 p&p.
Also available at other retailers - just ask!

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PHF-40 The muts nuts on 40m, at a mere	£22.95
PHF-20 The way to DX, [safely] on 20m	£19.95
PHF-15 You guessed it, the same but on 15m	£19.95
PHF-10 I'll give you one guess	£19.95
AB-5 5 bander 10-80 in one antenna. It works!	£89.95
BB-2 Massive Spring mount for L.F. Whips	£49.95
116-NP gutter mount with 3/8 thread	£6.95
142-ADP Body mount with 3/8 to SO239	£9.95

NEW ANTENNA ANALYSER MFJ 259

If you've never bought a piece of test gear in your life, then now's the time. This hand held device instantly allows you to view the resonance of any antenna upto 170MHz. Not only ideal for those of you who home brew but checking out that multiband vertical or HF beam, dipole and so on. An ideal birthday present - to yourself!

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SUMMER NEWSLETTER NOW AVAILABLE!

It's been a long time coming, but the Lynchy newsletter has arrived. If you like reading my twaddle, (you've read this far!), then phone or write in today. Packed with new products I'm not even allowed to mention here, there's money saving offers and clearance items listed. News reviews and First Impression tests from Henry Lewis are all there. It's totally free so call today.

FREE AMATEUR RADIO CAR STICKER WITH EVERY REQUEST!



VISIT THE AMATEUR RADIO VILLAGE AT LIVE'94
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A Beginner

Steve Ortmyer G4RAW has come up with another one of his delightfully simple projects, and as usual, it's practical as well as being useful around the shack.

Technology advances at an alarming rate, how often have we heard that statement! However, I was pleased to see that when my lads started with bikes, puncture repairs had not changed since my own youth!

Repairing punctures still involved rubber glue and small sticky patches. But, what has all this got to do with amateur radio? I hear you ask.

Well, the puncture kit came in a small tin which I quickly acquired as a suitable housing for a radio project. 'Waste not, want not'....is the Ortmyer motto.

Unfortunately, cases for projects are often the most costly item. Because of this I'm always on the lookout for tins and boxes that can be used to house projects.

All my interest started with the famous Doug DeMaw W1FB who described a 'Sardine Sender' in *QST* magazine. It was (surprise!) a transmitter housed in a sardine tin.

The Probe

The probe I'm describing measures root mean square (r.f.s.) r.f. voltage when used with a f.e.t. voltmeter of 10M Ω input impedance. It can be housed in any small metal case (for screening), but a puncture kit container is ideal.

This circuit has appeared for many years in the *ARRL Handbook*. It will only work with an f.e.t. voltmeter with an impedance of 10M Ω .

If you want to make your own f.e.t. voltmeter, you can certainly do so. The book *Solid State Design for the Radio Amateur* provides details of simple f.e.t. meters.

If your meter does not have a 10M Ω input, then the book *The Joy of QRP* can help you. It explains how to change the 4.7M Ω resistor to suit different values of input to match your meter.

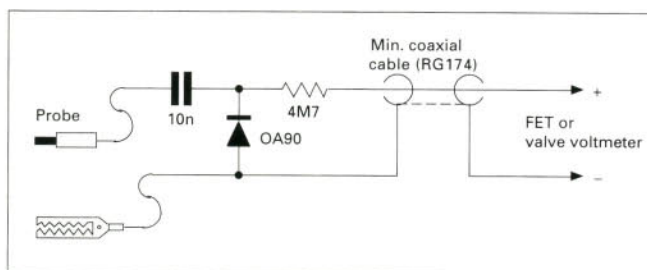


Fig. 1: Circuit of the simple r.f. probe described by G4RAW.

provide an earthing clip.

Measure Voltages

Once you've built it, the probe can be used to measure (r.m.s.) r.f. voltages in a circuit. The probe can also be used to

measure low power outputs from a transmitter across a dummy load.

The Novice Licence permits a power output of 3W. Some transmitters are calibrated for output, but your new probe can be used as a check.

The dummy load should be 50 Ω . It should be made up of carbon resistors (not wire wound types).

You can make a dummy load with three 150 Ω resistors, each with a 2W rating. These, in parallel give a 6W load for short bursts only. Keep the leads as short as possible on the resistors to prevent stray inductance affecting the circuit.

The power can be worked out from

$$\text{Power} = \frac{E^2}{R} \text{ or rearranging it}$$

$$E = \sqrt{R * \text{Power}}$$

So for 3W into 50 Ω the voltage should be:

$$E = \sqrt{50 * 3} = \sqrt{150} = 12.25V$$

Building The Probe

Building the probe is simple. I constructed mine on a small piece of printed circuit board.

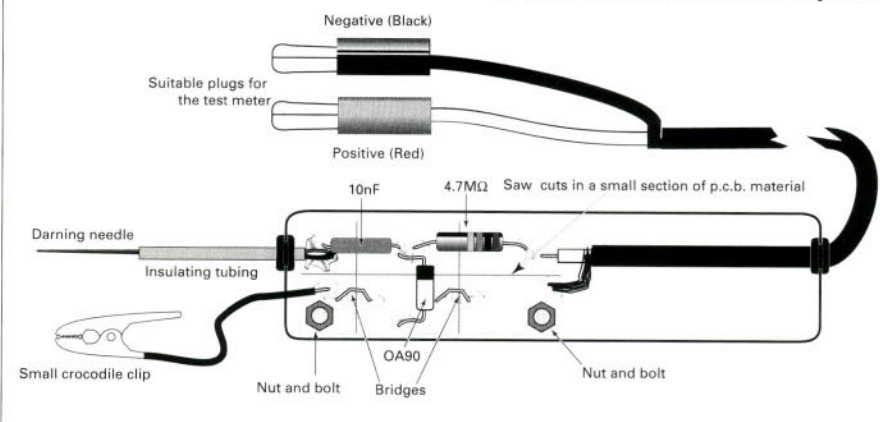
The copper foil on the p.c.b. is removed to make six isolated squares. This is done by carefully drawing a small saw across the foil.

Take care not to go too deep into the board. When you've finished the cutting (not too deep now!) the copper can be cleaned up with wire wool.

Next, solder the components as shown, not forgetting the to create a single earth line. The probe itself can then be made from stiff wire (or a darning or large sewing needle) with some sleeving to insulate it from the tin.

The completed project on the p.c.b. is then bolted into the tin as shown the bolts in this position will provide earthing for the tin. A crocodile clip can then be attached to a short length of wire to

Fig. 2: Diagram showing the constructional method adopted by G4RAW (see text) for the r.f. probe.



's RF Probe

Radio frequency energy is not easy stuff to measure and this simple probe cannot be expected to be very accurate. But for most amateur applications, it should give good service and you can build it yourself!

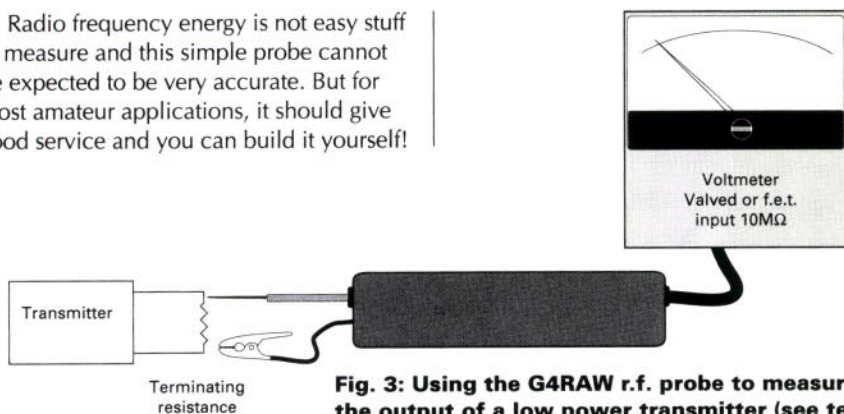


Fig. 3: Using the G4RAW r.f. probe to measure the output of a low power transmitter (see text).

Shopping List

Resistor

Metal film 0.25W miniature
4.7MΩ 1 R1

Capacitor

Miniature disc ceramic
10nF 1 C1

Semiconductor

Diode

OA90 1 D1

Miscellaneous

Suitable metal case (puncture repair outfit tin, see text), section of p.c.b. material, bolts, suitable probe (large darning needle), suitable insulating sleeving, crocodile clips, miniature coaxial cable, wander plugs.

Books - The Essential Extra Tool

Rob Mannion G3XFD enjoys working on his test bench when he's not busy on PW. To help you get the best from your workshop he's compiled a selection of further reading on test equipment and ancillary items. All the books are available from the PW Book Service.

Our hobby is extremely well served when it comes to 'further reading'. In fact, the choice is so great that even the experienced radio enthusiast can be overwhelmed by the choice of books to read. So, I've compiled a list of books which are either in my library or will soon be included.

In his article 'From Multimeter To Oscilloscope' this month, Clive Hardy G4SLU sums up the importance of the multimeter very neatly. It's essential!

However, many enthusiasts don't get the best from their meters and lose much of the instrument's potential. The Babani books *Getting The Most From Your Multimeter*, £2.95 and *More Advanced Uses Of The Multimeter*, £2.95 by R. A. Penfold provides excellent help for anyone wishing to get the best out of their meter. The first book provides an introduction to multimeters (every meter should have one in my opinion!) and their use. The second provides a

complimentary, advanced guide (including i.c. work and logic fault finding). Highly recommended.

Babani's Mr Penfold is a busy chap! His *Test Equipment Construction*, £3.50 and *More Advanced Test Equipment Construction*, £3.50 are both packed with ideas for test equipment projects and how to use them. Everything from signal generators to meters and test probes onto digital test gear is covered and you can equip your workshop completely with ideas from the second book!

I think these books, like the many other Babani publications, don't give themselves any justice. Hidden behind those modest, simple covers, budget printing and bindings, you'll find a range of excellent publications at reasonable prices.

For many radio enthusiasts, an oscilloscope in the workshop is a dream. But if you do buy a 'scope, Ian Hickman's well-established *Oscilloscopes How To Use Them - How They Work* £15.95 (Third Edition), published by Newnes, will help a great deal.

Along with 'showing you around' this most versatile test instrument, I think that the book provides an essential 'guide before you buy' service. An excellent book which is highly recommended.

If you've already got an oscilloscope, the more advanced *Troubleshooting With Your Triggered-Sweep Oscilloscope*, £17.50 by Robert Goodman will prove very useful. This American

book comprehensively covers more advanced 'scope techniques and also provides prospective users with a guide on trigger-sweep working. A very readable book, packed with information and well illustrated.

All the books I've mentioned here are available from the PW Book Service. Please remember to add £1 P&P for one, £2 P&P for two or more (UK) and £1.75 P&P for one, £3.50 for two or more (overseas).

Don't forget that your reference library is open at any time you want it to be! I hope you find my suggestions helpful, and I'm always willing to talk about books if you bump into me at shows and rallies. Cheerio for now and good reading!

G3XFD

ERRORS AND UPDATES

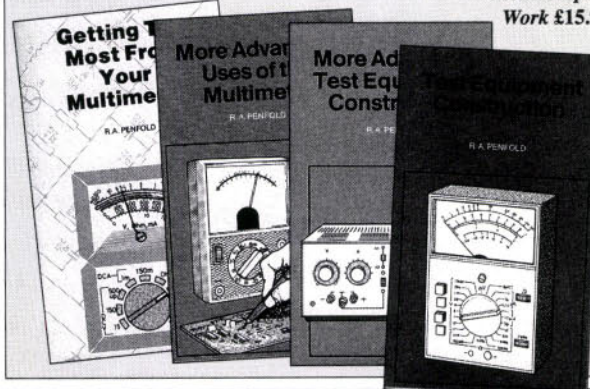
'A Case Of TVI' pages 32 -33 PW August 1994

In the separate panel on page 33 of Ray Petri's article 'A Case Of TVI' in the August '94 issue of PW, an error crept into the formula. Unfortunately the multiplying figure of 7.02 was missed out when printed.

The full formula appears below:

$$e (V/m) = \frac{7.02 \sqrt{e.r.p.}}{d}$$

Our apologies for this mistake. Ed.



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HP8556A	Spectrum Analyser plug-in 300kHz	£200
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HP3406A	Broadband sampling voltmeter	£150
HP5150A	Thermal printer	£150
HP3400A	RMS voltmeter 10MHz	£115
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HP491C	Microwave amplifier 2-4GHz	£275
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HP8755	Sweep amplitude analyser c/w heads	£750
HP8565A	Spectrum analyser 0.1-23GHz	£90A
HP Spectrum analyser 1827 main frame/8558B plug-in		
100kHz-1.5GHz c/w HP 8750A storage normaliser		£2000
Marconi TF2163S UHF attenuator DC-1GHz		£100
Marconi TF2162 step attenuator DC-1MHz		£60
Marconi signal source 6059A 12-18GHz c/w levelling amp. 6587		£215
Marconi signal source 6058B 8-12.5GHz c/w levelling amp. 6587		£215
Marconi TF2015 AM/FM signal generator 10MHz-520MHz		£165
Marconi TF2016A AM/FM signal generator 10kHz-120MHz		£165
Marconi TF2700 universal bridge (battery op.)		£125
Marconi TF2008 AM/FM signal generator 10kHz-510MHz		£300
Marconi TF2370 Spectrum analyser 30Hz-110MHz		£800
Marconi 2955 Radio Comm. test set c/w results printer		£3250
Racal 9301A RF Millivolt meter 10kHz-100MHz		£225
Racal 9009 modulation meter		£200
Racal MA1720 drive unit		£600
Racal 9082 Synthesised signal generator 1.5-520MHz		£480
Racal linear amplifier 10Kw		£1500
Racal Dana 9932 instrument interface		£120
Racal Dana 9915M frequency meter 10Hz-520MHz (fitted FX standard)		£125

Racal Dana 9904 universal counter/timer 50MHz	£100
Racal Dana 9300 RMS voltmeter	£250
Racal Dana 5001 digital multimeter	£250
Racal Dana 202 logic state analyser	£300
Racal Dana 205 logic state analyser	£300
Phillips PM5520 monochrome test generator	£65
Phillips PM7832 SWR meter	£175
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Specifications

- The Mysteries Explained

Ian Poole G3YWX delves into the internally generated spurious signals, which are often present in many of today's receivers.

Many receivers can pick up signals that are generated within the receiver itself. These internally generated spurious signals can be heard on many of today's general coverage communications receivers. However, by good design and the use of sufficient filtering, it's possible to reduce most of them to a level where they are no longer a problem.

It is quite easy to check whether any spurious signals are present. The antenna can be removed and preferably replaced with a 50Ω load to ensure that the input is properly terminated. By doing this, no signals should enter the receiver if the case is a sufficient screen. Then any spurious signals can be located by tuning the receiver over the whole of its coverage.

Number Of Oscillators

Most of today's receivers and transceivers have a large number of internal oscillators. Many sets have up to three frequency conversions, each with its own local oscillator.

Signals from the oscillators can find their way through into the receiver in a variety of ways and mix with one another to give small but significant signals. Small amounts of leakage through the circuitry can mean that low levels of oscillator signals can appear in unwanted parts of the receiver. The diagram **Fig. 1** shows a very simple example of how spurious signals can be generated.

The signals from the first local oscillator will appear at the output of the mixer, pass through the filter or find their way via stray coupling to the input of the stage. At the mixer they will combine with the second oscillator to give a signal which is in the pass-band of the fixed i.f.

The problem I've mentioned is a very simple example which would be avoided in any well designed receiver. Unfortunately the picture is not as easy as this in a real receiver!

Wide Variety

A fact not widely known, is that mixers can generate a wide variety of signals. Normally it's expected that they will only generate the sum and difference frequencies. But whilst they do this they generate other products as well.

Harmonics of the first frequency will then mix with harmonics of the second. This will then give a variety of other signals.

The mechanism behind each spurious signal may not be immediately obvious. Even when the mechanism has been discovered then it may not be easy to cure. In fact, reducing spurious signals to an acceptable level can be one of the biggest headaches for receiver designers.

A typical example of a spurious signal generated in the way mentioned is shown in **Fig. 2**. Here the signal from the first oscillator leaks through onto the input of the second mixer.

It happens that the sixth harmonic of the second oscillator tuned to 5.5833333MHz appears at 33.5MHz and beats with the first oscillator at 33MHz to give a signal at 0.5MHz - the intermediate frequency. Unfortunately there are a whole string of other frequencies where this type of action can take place.

Fortunately however, it's possible to reduce the levels of stray signals around the receiver to surprisingly low levels. Also the levels of the mix products are low when high grade mixers are used. This makes the receiver designer's job a little easier. Even so there are bound to be some spurious signals somewhere!

Certain Level

Normally manufacturers will specify that all spurious signals are below a certain level. Usually this is related to the noise level of the receiver.

As the noise is proportional

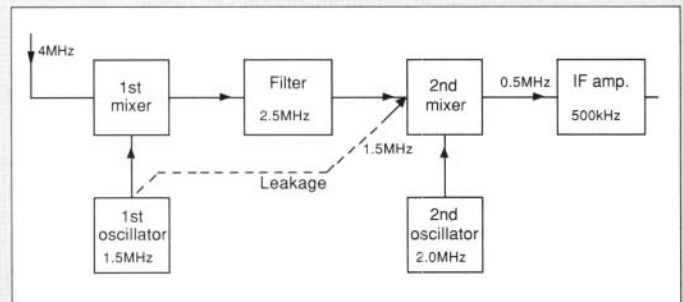


Fig. 1: A simple example of spurious signal generation in a receiver.

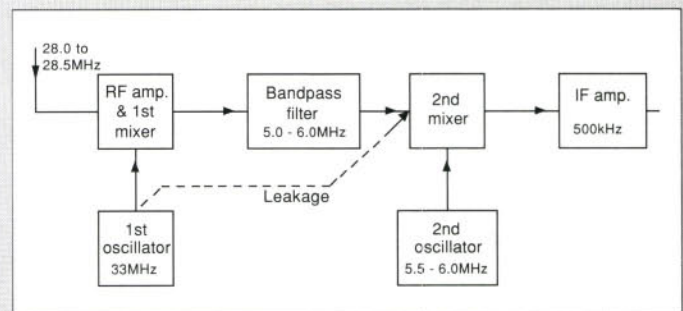


Fig. 2: A more realistic example of spurious signal generation.

to the bandwidth, i.e. the wider the bandwidth the more white noise will be allowed through the filters, a bandwidth is also specified. Typically these signals should not be more than 3dB above the noise in a 3kHz bandwidth.

Sometimes it is not possible to reduce all the signals to an acceptable level. Often there may be one or two which remain. In this case many manufacturers will admit to this and state it in the specification.

One example of the manufacturer 'coming clean' appears in the Ten Tec Argosy specification. It's where a small but audible spurious signal appears on the receiver at 29.980MHz when the set is on the 28.5 - 29.0MHz band.

By tuning the set to the bottom of the 29.0 - 29.5MHz band the signal is not present. Although the spurious is quite low in level and it's not a problem, it's reassuring to know that the manufacturer is being honest!

Clock Oscillators

In addition to the signals produced by oscillators used directly in the receiver path, many of today's receivers use processors which require clock oscillators. These can be a problem, and care has to be taken when designing the radio. Clock oscillators can often be detected at frequencies such as 5MHz or other popular clock frequencies.

That's all I've got room for this month so cheerio for now. Don't forget if you have any queries regarding specifications please drop me a line via the PW Editorial Offices.

PW

Antenna Wo

Many years ago, Jim Fisk W1HR, the editor of the now defunct *American HAM RADIO* magazine gave the definitive piece of antenna advice. That advice was, "There is no doubt that the most efficient (and simplest) multi-band antenna is a half wave dipole cut to resonate at the lowest operating frequency, centre fed with open wire transmission line through an antenna tuner".

The W1HR advice was echoed by my own amateur radio 'Elmer'. He advised me to get out as much wire as I could, as high as I could, split it in the middle and use open wire feed for all bands.

Lots of radio amateurs seem to have some funny reasons for not using open wire feeders. 'My transceiver is designed for a 50Ω load', 'Open Feeder is difficult to get and difficult to use', 'I would have to use an Antenna Tuner' ...and so on. All poor reasons! 50Ω coaxial feeder is commonly used because **it is common**.

Not so long ago all transmitters had output matching to a whole range of impedances. A considerable amount of technical

fiddling is often required to get a solid state power amplifier to match 50Ω coaxial cable. I think this is a case of the tail wagging the dog!

The cheapest 300Ω twin feeder is less lossy at short wave frequencies than the most expensive hard-line 'plumbers delight' coaxial cable. Open wire feeder is easy to make, and commercial versions can be bought at prices that undercut even medium grade coaxial cable.

A commonly held idea, is that a commercial antenna, possibly designed for several bands, can simply be hung onto a transceiver with 50Ω coaxial cable. It's a compromise to say the least. If you do not use an a.t.u. for that reason alone, one should be added for r.f. hygiene to reduce harmonic radiation.

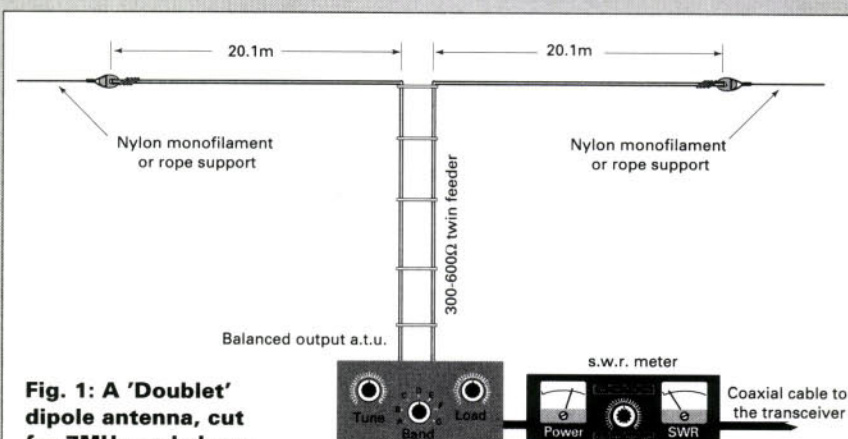


Fig. 1: A 'Doublet' dipole antenna, cut for 7MHz and above.

Open Wire

So what is open wire feeder? An open wire feeder consists of two parallel wires held a constant width apart by a series of spreaders.

The classical insulating material spreaders of yesteryear were beautifully worked in wood. They were often soaked for days in paraffin. However, nowadays any good lightweight insulating material will do the job.

I have seen spreaders made from strips cut from washing up liquid bottles and ice-cream cartons. Plastics plant labels have often been used.

I once made a temporary feed line by using drinking straws used for children's parties. The straws were very strong when cut into short lengths and the wires were stapled on each end. This was done to get an antenna up quickly but the feeder line was still in use three years later.

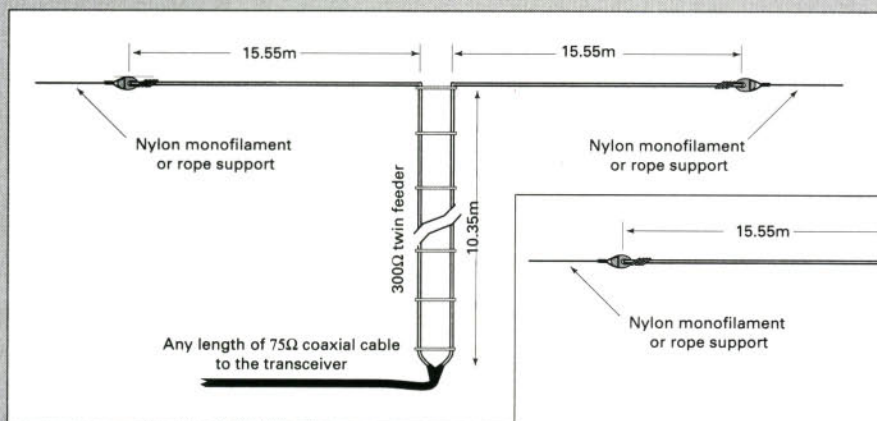


Fig. 2: The G5RV antenna in its traditional guise.

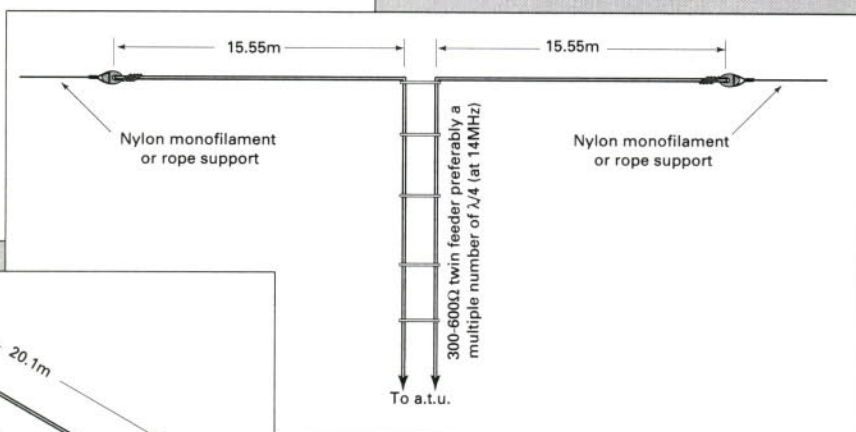


Fig. 3: George Dobbs says that by modifying the G5RV like this, it should be more efficient.

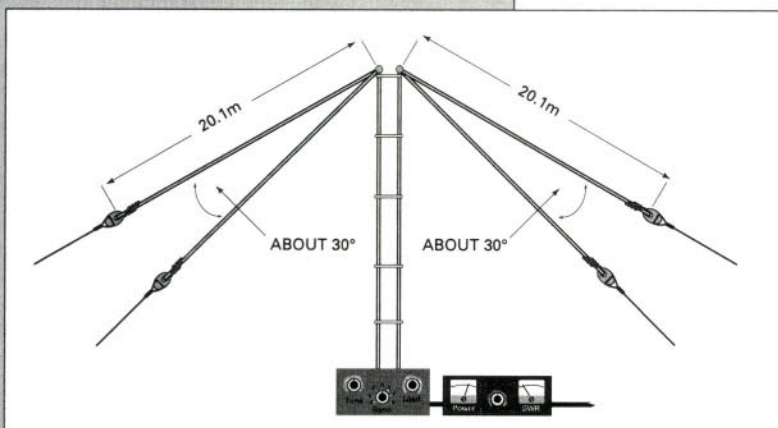


Fig. 4: This is the form of the Skelton Cone antenna (see text for more details).

rkshop

Our well known author, the Rev. George Dobbs G3RJV, leaves his work bench to offer some simple practical advice on feeders and antennas by posing, then answering the question 'open feeders - yes or no'?

Opinions vary as to the correct spacing for feeder wires. Common wisdom seems to infer about 50mm, but I've used a spacing of about 25mm for most of my open feeder lines.

The usual impedances of open feeders range from about 3-600Ω. Commercial spreaders are available from W. H. Westlake (see footnote).

The number of spreaders required depends upon the length of the feeder. I have found that placing spreaders roughly 5-600mm apart seems to keep the lines parallel but this will need adjustment if the feeder line is curved or twisted in its path to the shack.

The only wire I have ever used is the cheapest PVC covered stranded wire, usually bought in inexpensive reels at radio rallies. Firms, such as W. H. Westlake, among other companies, have a large range of suitable wire often sold as light duty antenna wire.

Several years ago it was possible to buy a commercial ladder line feeder with two wires and plastic spreaders welded onto the wires. In more recent time 'slotted feeder' has become the only commercial alternative.

Slotted feeder consists of two parallel wires spaced with a plastics 'web', like the skin between a duck's toes. The cheap 300Ω ribbon feeder is not a good choice as the web gathers dirt and moisture.

The slotted version is heavy duty and has slots which gives it the effect of looking like ladder line. W. H. Westlake sell heavy duty 300 and 450Ω slotted feeder.

Doublet Dipole

The term Doublet is often used for a dipole, fed with open feeder and used on several bands. The commonly found variant, shown in Fig. 1, works very well from 3.5MHz and up. I've also had good results from this antenna on 1.8MHz.

'But I haven't got space for a 40m run', some will say. Well - most radio amateurs have restricted space, the better ones manage to get a lot of wire into it! I've never had a 40m 'straight run' but I've used this format many times usually by making it in the Inverted V arrangement.

A pole on the chimney or gable end of a house gives one high point for the centre of the antenna. The two legs then slope down to form an inverted V, the

ends being just off the ground. It is surprising how much extra length can be found by this method.

The ends can also be bent under at the ends or form a 'dogleg' to make it fit. It may look horrible but it usually works!

Famous G5RV

Most radio amateurs know the famous G5RV antenna, with the usual arrangement, Fig. 2, using 10.35m of open feeder to match into 75Ω coaxial cable. Explanations appear all over the amateur radio literature.

My usual approach with a G5RV is shown in Fig. 3, and that is to use open feeder the whole way to an a.t.u. This gives a better match and makes it useable on all bands. Ideally the feeder line length should be a multiple of a quarter wave lengths on 14MHz.

My single favourite antenna is the Skelton Cone : a sort of 'double G5RV'. I was introduced to this antenna by the late Bob Spidell W6SKQ, a considerable QRP DXer.

The Skelton Cone has four 15.5m legs joined in pairs to open feeder line which ought to be 14 or 21.35m. The pairs of legs should be spaced apart at 30° if possible, Fig. 4.

I use the Skelton antenna in the most restricted garden space I have had. The top was held at about 18m high on a pole from a chimney, and the ends were only about 1.3m above ground.

The angles were certainly not 30° and the feeder length was neither of the recommended

lengths. But it worked very well and was especially potent on 7MHz.

Simple Slanter

A little out of fashion these days, the simple Slanter (or sloper) antenna is a good way to use limited space. Have a look at Fig. 5, which shows a slanter cut for 7MHz and above. The antenna may look as if it requires a 10m metal pole. Ideally that is so, but it can be made from wire hung from trees or mounted up the side of a house.

The bottom leg splays out at an angle and is guyed about a metre off the ground. Like all the other ideas - fit it and try it!

A Classic ATU

The Z-Match a.t.u. is among the classics of amateur radio. I have tried many other types of tuner for open feeder antennas but still use my several versions of the Z Match. It is easy to make. The basic circuit of the Z Match is shown in Fig. 6.

For low r.f. power, twin gang variable capacitors from old broadcast band receivers work very well. The best ones are those culled from old valve receivers.

If you use high powers, special large spaced capacitors will be required. But that is your own fault for wanting so much power!

The Z-match tuner is easy to build but remember that C1 must be insulated from ground. Some clever people have managed to cover all the h.f. bands with one

set of coils for L1 and L2 but I can only do it with two sets.

I normally use home-made plug-in coils but others switch pairs of coils. The coils may be wound to taste by experimentation.

I find the best test is to put a 12V/5W car bulb across the output and attempt, using the tuner, to get the brightest light with a few watts of r.f. My favourite pair of coils are wound on plastics water piping of about 60mm diameter.

For the higher bands, L1 and L2 are both 6 turns of PVC covered stranded wire. For the lower bands, L1 has 14 turns and L2 is 6 turns. The coils are close wound, with the L1 and L2 turns wound side by side (interleaved). I have sometimes done this by using 5A twin electrical wire to produce the side by side windings.

I found these windings very uncritical. My best ever 1.8MHz coil for a Z-Match was made using twin lighting flex wound around my fist and fastened with PVC tape, the number of turns being right when I could light a bulb. Isn't amateur radio fun!

My 'Antenna Workshop' has been a rapid 'Cook's Tour' of some antenna ideas. Next time PW allow me to grace this space, I'll expand upon suitable tuners for open feeders with other antennas and simple measuring equipment.

Slotted feeder, spreaders along with suitable wire for making your own twin feeder is available from W. H. Westlake, West Park, Clawton, Holsworthy, Devon EX22 6QN. Tel: (0409) 253758.

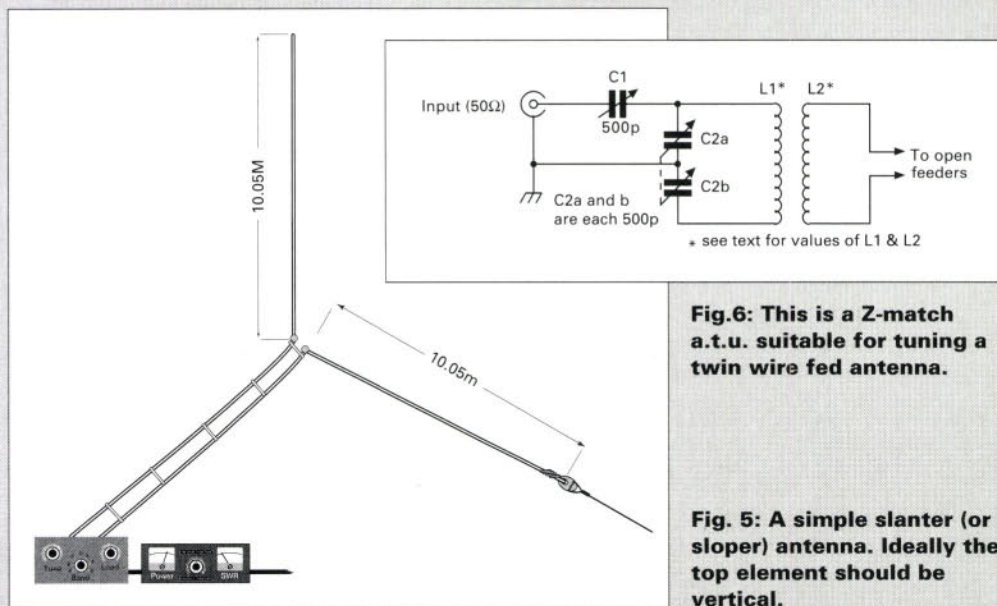


Fig. 6: This is a Z-match a.t.u. suitable for tuning a twin wire fed antenna.

Fig. 5: A simple slanter (or sloper) antenna. Ideally the top element should be vertical.

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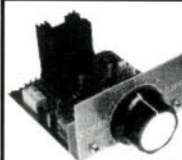
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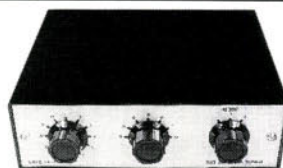
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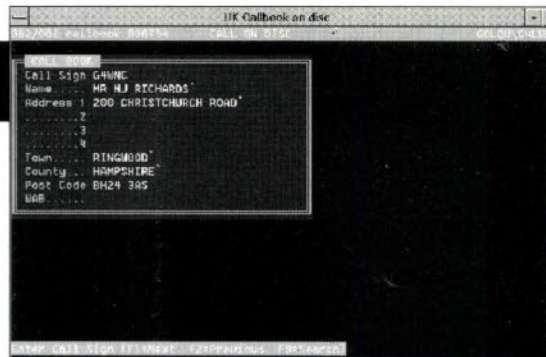
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The Computer
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Mike Richards
G4WNC brings you news
of a Windows callbook program
and an update on HamComm in
his first 'Bits & Bytes' column.



A screen from C & E Computers UK callbook.

It's great to be back! My last commission with *PW* was the old 'RTTY' column so you can imagine how pleased I was when Rob asked me to take over from Peter Hunter G0GSZ.

I shall attempt to keep up the high standards set by Peter, but please write and let me know what you would like to see in the column. Whilst there is bound to be a heavy accent toward PCs and compatibles, if you hear of any interesting software or hardware for other systems, please write and let me know.

Windows Call Book

Following on from Peter's mention last month of the C & E Computers Callbook, I've just been sent the latest Windows based Callbook from G0LOV and G4LUE. This is based on the spring UK Callbook but includes a number of continental repeaters, nodes and mailboxes. The package is delivered as four disks with two A4 pages of information to help get you started.

Although the presentation doesn't compare with modern software houses, the value-for-money packaging has been chosen to keep the price as low possible - I won't argue with that philosophy! Loading the software was extremely simple thanks to the provision of a self installation program on the first disk.

The installation program expanded all the relevant files onto a drive and directory of your choice and automatically called for disk changes as the installation progressed. The whole installation process took around three to five minutes with the only problem being the 18.7Mb of disk space occupied by the database and program. If your hard disk is anything like mine, finding that much disk space means some hasty, but worthwhile, housekeeping!

When running the program you are presented with a simple drop down menu where you can choose callbook, repeaters,

mailboxes or nodes. The callbook option takes you into the main part of the program with the callsign entry screen. At this point you can enter the required callsign or use wild card characters for unknown elements.

For example, if you want to see all the G4ABs you just type G4AB* or G4AB? The search routines in this section are extremely fast with most simple single call searches being completed in less than one second when using a 486SX computer.

For more general information there are options to search by address, postcode or surname and each of these searches can use wild card characters to make them really useful. As with the main callsign search, the response times were very good.

As a form of benchmark comparison, I tried searching for all the amateurs in Dorset. I used two computers, a 486SX and a 486DX with both machines using a 33MHz clock. The DX machine searched and sorted all 815 entries in just three seconds whilst the SX machine took around thirteen seconds.

In addition to holding the basic UK callsign information, the G0LOV and G4LUE package includes details of repeaters, beacons, mailboxes and nodes. Although primarily UK based, there are a number of continental stations included in this section. These modes include search facilities and you can also list all the stations in short form with just callsign and locator displayed.

My only criticism of the program lays with its slightly clumsy Windows interface. Though you cannot really grumble when a four disk program costs just £12.50 plus £1.50 post & packing!

Overall then, this is certainly a very fast and effective package that should satisfy the basic needs of most amateurs. To order your copy, contact **J. Bailey, 8 Hilde Avenue, Cudworth, Barnsley, South Yorkshire S72 8RN.**

HamComm Latest

Wilhelm Schroder has just sent me the latest release of his amazingly popular RTTY/c.w. program for IBM PCs. The most significant change for version 3 is that AMTOR transceiver has now been included. This is a big step forward and will, I'm sure, appeal to many.

As with the earlier versions, HamComm 3 is supplied as a single self-extracting file (HAMCOM30.EXE) that you move to the required drive and directory before you run it. Once expanded, there's a comprehensive 38-page manual on disk as well as all the essential sample configuration files.

By the way, the simple way to print the manual is to set your printer up to use 12 characters per inch and just type copy HC.DOC PRN. As the file contains standard page feeds, you should find you get a properly formatted manual.

One of the problems with synchronous modes such as AMTOR is the need for very accurate reference clocks at both ends of the link. Although all PCs operate with crystal oscillators the absolute frequency is not always that accurate. To compensate for this, the new HamComm includes a very simple adjustment system that involves receiving a good quality signal ideally from a commercial SITOR station and noting the displayed timing correction factor.

The computed correction value is then incorporated in the main configuration file. This is the only change required to use the AMTOR modes as all the interface connections remain the same as the earlier versions. For your evaluation copy of HamComm 3 just send me a formatted disk, a sticky self-addressed label and 50p.

Interfacing Books

Bernard Babani (Publishing) Ltd. have just sent in review copies of two books aimed at those that would like to do a little more with their PCs. The

first, titled *Interfacing PCs and Compatibles* aims to provide a grounding in some of the basics of dealing with PCs. It's important to note that the book does not cover the interfacing of conventional peripheral devices such as printers, CD ROMs, etc., but concentrates on more basic electronic interfacing.

The book starts with an introduction to the PCs main bus and covers the functions of all the bus connections along with a few mechanical details. This is supplemented with some very simple Basic programs to demonstrate how to communicate to the outside world via the expansion bus. The final sections provided good coverage of address decoding and interface electronics including analogue to digital converter and the 8255 parallel interface controller.

The second book, *Electronic Projects for PCs*, continues the line set by the first book and starts with a review of address decoding and common interface devices. However, the main subject areas are real electronic circuits that enable the PC to start interfacing with the outside world. These start with simple measurement systems such as voltage and capacitance meters and work-up to control systems including a stepper motor driver.

I thought that these two books went well together and provided a good starting point for those that would like to link their PC to the outside world. Both books are available from the *PW* Book Service priced £3.95 each plus £1 P&P for one, £2 for two or more (UK), £1.75 P&P for one, £3.50 for two or more (overseas).

That's all I've got room for this month. Don't forget to send your letters to me Mike Richards G4WNC at 'Bits & Bytes', PO Box 1863, Ringwood Hants, BH24 3XD or CompuServe Mail 100411,3444.

E N D

Valve &

Once again, Ron Ham welcomes you into the PW vintage 'wireless shop' where you can rediscover the delights of 'steam radio', even though you can't actually buy anything!

Welcome to the world of valve and vintage equipment where in recent months I've looked at the ex-RAF receivers R1116 and R1224A respectively. Both these sets were designed in the late 1930s using the large envelope two-volt battery valves.

During the Second World War, sets like the Canadian 58 transmitter and receiver and the clandestine operations MCR1 receiver were produced using the 1.4V filament miniature glass valves. The change from large to small envelope valves meant a big saving in space because of the dramatic reduction in the size of the glass and the valve holder.

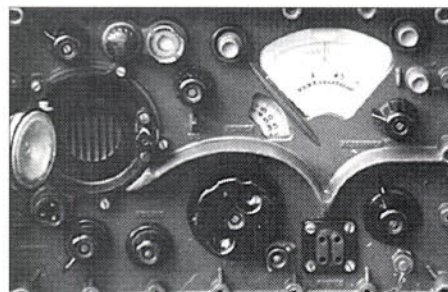
Post War Portables

Manufacturers began using the miniature valves in their immediate post war portables. The military did the same in the late 1940s in their new 'peace-time' communications equipment.

Among post war equipment were such receivers as the R209, **Fig. 1**, R216, **Fig. 2** and the 'pouch' sized transmitter-receiver WS88. Briefly, the R209 and the R216 provided between them continuous coverage from 1 to 157MHz in the a.m., c.w. and f.m. modes.

The R209 has an internal vibrator power pack, the right hand 'box'

Fig. 1: The R209 receiver (see text).



in **Figs. 3** and **4**. The R216 has the option of an external vibrator power supply unit which plugs into the multi-pin socket on the left of the front panel, **Fig. 2**.

Dedicated Modules

I believe that the R209 was the first post-war military set to use dedicated plug-in modules. Four of the modules occupy the centre of the chassis, **Fig. 3**, and are held in position by a plate along the top, centre of **Fig. 4**.

The fifth module, the b.f.o., is situated horizontally at the rear of the other units. Like them, its position is identified on the securing plate, **Fig. 4**.

Sockets for the modules are shown at the bottom of **Fig. 5**. Looking from left to right, the first three modules are i.f. amplifiers and

the fourth is the discriminator.

The b.f.o. and discriminator units have differing locating pins, **Figs. 5** and **6**. These are to prevent them being fitted in each others, or any of the i.f. sockets.

Components in each module are screened by a metal can which is held by a centre bolt, **Figs. 3** and **4**. I removed the cans from the b.f.o., one i.f. and the discriminator modules, left to right respectively **Fig. 7**, to show their internal construction.

The b.f.o. and discriminator valves are type 1S5 and the i.f. amplifiers use the 1T4. A large 'soft' pad, inside each metal cover, keeps the valve secure in its base.

When you check a set of this age, make sure that all those pins in **Fig. 6** and their sockets, **Fig. 5**, are really clean and making good connection. If not, the valve inside the module will not get its correct voltage resulting in a weak or sudden fall off in performance. Additionally any unwanted 'crackles' developing in these stages will be amplified through the system.

Front Panel

Apart from the large tuning knob in the lower centre of the front panel, **Figs. 1** and **8**, the other controls fitted to the R209 are wave-change, bottom right **Figs. 1** and **8** and the mode-switch.

At the bottom left of **Fig. 8**, is the volume control. And, at bottom left **Figs. 1** and **8**, is the b.f.o. adjustment and antenna trimmer,

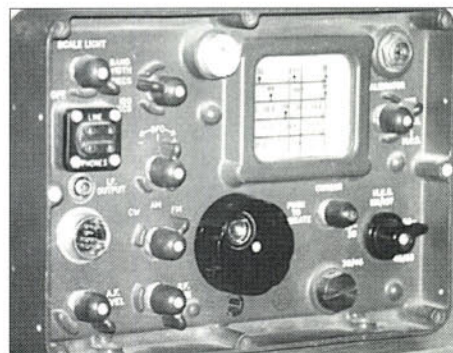


Fig. 2: The R216 receiver (see text).

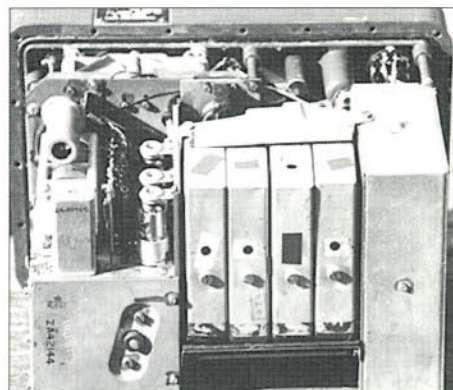


Fig. 3: The R209 receiver has an internal vibrator power supply unit, which can be seen on the far right (see text).

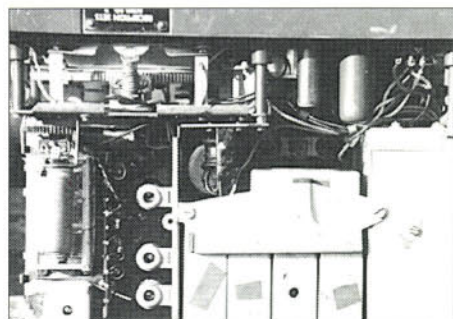


Fig. 4: The R209 uses dedicated modules which are kept in place by a special plate (see text).

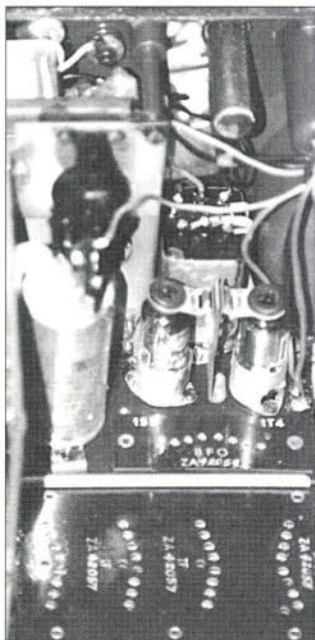


Fig. 5: Photograph showing the special sockets for the individual modules, which can be seen marked with their appropriate title.

Vintage

By Ron Ham

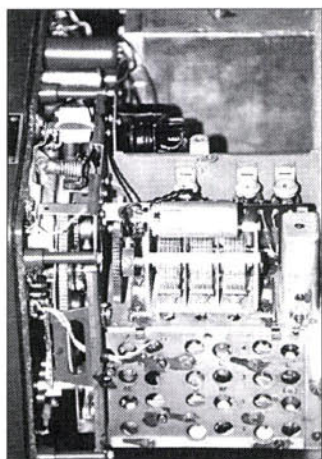


Fig. 9: Tuning mechanism, three-gang tuning capacitor and Philips type 'Beehive' tuning capacitors on the R209 (see text).

left and right of dial respectively. There's also the on/off and pilot light switch, upper left Fig. 1.

The power lead enters via the socket just below the speaker. The line and headset outputs are on the 4-pin block at the bottom right, Fig. 1.

Feeders from a dipole are coupled to the terminals at the right of the dial. Additionally, a single wire antenna can be connected to the terminal at the upper left of the dial, Figs. 1 and 8.

Each time the wave-change switch is moved, the appropriate scale comes into view behind the glass. The photographs in Figs. 1 and 8 shows that range 3, 2.3 to 5.6MHz has been selected.

Other ranges available are: (1) 12 to 20MHz. (2) 5.5 to 12.5MHz and (4) 1 to 2.3MHz. Each using the same wide-spread calibrated scale.

The loud-speaker, shown in Fig. 1, has its cover flap open. And the vernier scale can be seen almost in the middle of Figs. 1 and 8.

A small-envelope voltage regulator (CV284) is fitted horizontally, in a can, immediately above the main 3-gang tuning capacitor, left Figs. 1 and 4 and the centre of Fig. 9.

'Lift-top' spring flaps, with rubber grommets, secure the three valves to the right of the tuning

capacitor, Figs. 3 and 4. The same method is used on the two hidden by the b.f.o. module in the centre of Fig. 5.

Outer Case

Both the R209 and R216 sets have an outer metal case that slides off the framework of the chassis. A rubber gasket seals the joint between the two when a 'ring' of nuts and bolts are tightened to hold them together.

Chemical dessicator indicators are fitted at the top-centre of both sets. These enable the operator to see if the seal has been broken and if any moisture has entered.

Philips 'bee-hive' trimmers are used to align the coil-pack and are visible through the holes at the bottom of Fig. 9. But beware - you shouldn't attempt to adjust these without the special insulated tool made for this type of pre-set capacitor.

Finally, if you're servicing a receiver - don't forget to lubricate the tuning mechanism. Some of its complex gearing can be seen at the lower left of Fig. 9.

Fine Adjustment

There's a row of 'bee-hive' trimmers, centre Fig. 10, which are used for fine adjustment on each of the four variable capacitors making up the tuning gang on the R216. The special tool for setting these fits snugly over the 'shape' at the top of the moving part.

Four separate coil assemblies, banked in a turret, right Fig. 10, are employed on each of the five ranges covered by the receiver. They're selected by the switch at the lower right of Fig. 2.

The i.f. and a.f. chassis is on the left of Fig. 10. And, in addition to the usual controls, labelled in Fig. 10, this set has a 30/120kHz bandwidth selector, a 1 and 5MHz crystal calibrator and a 4.86MHz i.f. output terminal (centre left Fig. 10).

Among its many features, the R216 has a lengthy 'film-strip' scale which gives a super band-spreading on all ranges. These are (1), 19 to

30MHz, (2) 30 to 46MHz, (3), 46 to 68MHz, (4) 68 to 101MHz and (5) 101 to 157MHz.

Finally on the R216, it's essential that the shaft-ends and gearing on the turret and the ball-races on each variable capacitor, are kept lubricated and running free.

Fig. 6: Ron Ham believes it is possible that the R209 receiver was the first post Second World War military set to use dedicated plug-in modules (see text).

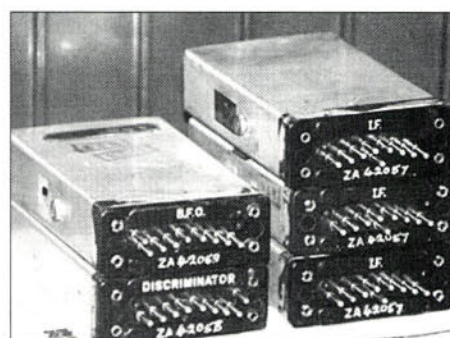


Fig. 7: Individual R209 modules opened up to demonstrate the compact techniques adopted. The receiver used the 1.5V filament range of glass-based B7G valves (see text).

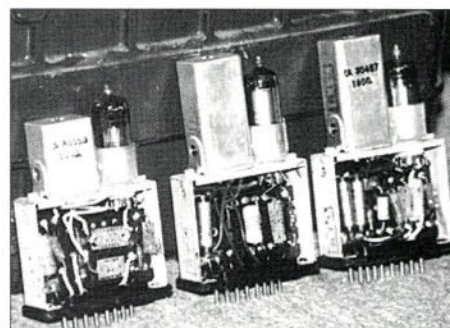


Fig. 8: Range scale and tuning dial of the R209 receiver. The 'fine tuning' vernier dial scale is on the left.

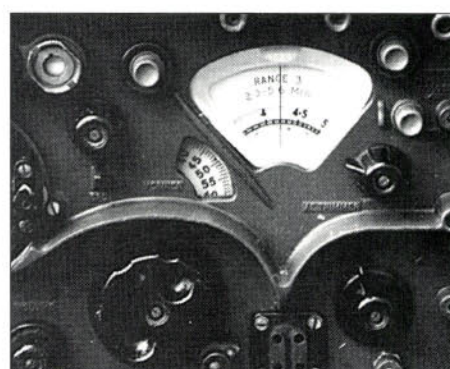
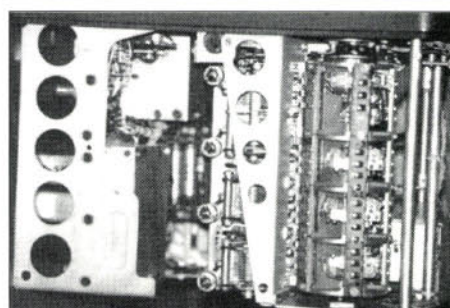


Fig. 10: Part of the tuning mechanism, trimmer capacitors ('Beehives') and tuning turret on the R216 receiver (see text).



Also, don't forget to keep the coil contact pads clean.

Well, I've run out of space again so, it's time to 'shut up the shop' until next month. However, don't forget you can write to me at 'Faraday', Greyfriars, Storrington, West Sussex RH20 2HE.



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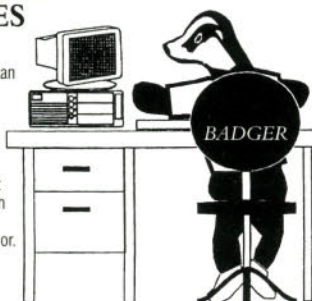
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73 from Dave G4KQH, Technical Manager.

Packet Panorama

PACKET

This month Roger Cooke G3LDI, has news of an advanced group in Kent and has some information on some new books.

Due to protests from readers on both sides of the Atlantic, Packet Panorama is a monthly column again, as from this issue. This will allow me to give a more topical and up-to-date page each month. Please keep the news and photographs coming in, it's nice to feel wanted!

My backlog is large and this information was kindly sent to me by **Steve Morton G8SFR**, Kent IP Group's publicity officer, in January! Steve's group, KIPG, produce a very nicely printed newsletter. It's only eight pages, but there's a lot of useful information in it.

The Kent group have set up a Hub, or a central data repeater, which started in January 1993. **Keith G4LZV** is the network guru, **Chris G6AHK** built the computer from a load of parts and **Dave G7APE** built the TNC.

Suitable Site

A suitable site was provided by the Royal Engineers Society on the same site as the GB3RE repeater. Problems appeared, Murphy's rule again, but were overcome. As a result a structured TCP/IP network has now been formed as follows:

The Hub is licensed as GB7CRE. The Sub-hubs are: GB7SEA in Seasalter covering the Thanet area, run by John G0GCQ; GB7RTW in Royal Tunbridge Wells, run by Chris G6AHK; GB7ZHR in Crayford, covering SE London and NW Kent. G0TMH run by Chris in Gravesend. G1DVU, Martin, provides links to the south of Hastings and Eastbourne.

Mail and bulletins from the AX25 BBS Network are provided by **Kurt G7NCV** using his own BBS GB7EZB. He also, together with **Bob G6CKK** set up G7RGL, a dumb router on a hill-top site near Maidstone. From this site links go to: The Lonny link in London, linking direct to the USA, and a station at Martlesham Heath linking into Europe.

It's possible for stations to converse with all continents in real time. Users communicating via local hubs on 144.625 MHz. Inter-hub links are on 50 and 430MHz.

Thanks to Steve G8SFR of the KIPC for this news; keep it coming Steve! Has your data group set up anything similar? Let me have the details.

New Books

Let's now have a look at some new packet books. The first one has been written by Mike Mansfield G6AWD who also wrote the *Practical Guide to Packet in the UK*.

Mike's new book is entitled *High Speed Packet Radio Transceiver Connections*. It's published by Compaed Graphics of Warrington, Cheshire.

Printed on both sides of A4, G6AWD's book runs to 85 pages. The index at the beginning of the book clearly shows that there is information on more than 80 different transceivers. Mike also invites comments, suggestions and undocumented transceivers, presumably so he can add these to a future reprint.

There are 18 pages of general principles of operation at 9600Baud. There's particular reference to the Tiny-2 TNC, together with some information on which satellites can be used at 9600Baud. There follows a few pages discussing types of modulation. The main reason for the book is the modifications which can be made to the various transceivers.

Modifications described by G6AWD are a collection of bulletins from various amateurs who have got their transceivers working. They have then publicised the details for the benefit of others.

Mike seems to have imported these from the BBS 'as seen' and doesn't seem to have edited them. My thoughts are that the details should have been edited first and the grammar and spelling

corrected. This is a minor criticism however.

Within the book there is also some information on 56kBaud working. This is mostly from America, but including some comments from Barry McLarnon VE3JF from Ottawa.

Barry VE3JF, featured in this column around a year ago. To finish off the book there's a section devoted to deviation measurement, and a series of circuit diagrams showing the connection points.

I think Mike G6AWD's new book is undoubtedly a very useful addition to any packet user's bookshelf and will hopefully encourage a lot of end users on to the higher speeds. We seem to have been stuck on 1200Baud now for far too long!

Bargain Price

There are still quite a few BBC B computers about and they can be bought at a bargain price and used on packet very successfully. I first bought my BBC-B computer some 13 years ago.

I used the BBC on RTTY first, then later on packet. I then changed over to the PC (IBM clone) and have stayed with it ever since.

However, I've recently received some information from a 'Beeb' enthusiast, **Stan G3XON**. This is what he has to say: "If you shop around for a BBC-B, you can pick one up for around £30, but check that it has the Disk Filing System (DFS) installed.

I use my BBC-B for packet even though I have an IBM PC. Used in conjunction with the PacComm Tiny-2 and the easy to use 'TNCV303' PD disk program you have all you need. The word processor 'Wordwise Plus' makes the Beeb indispensable.

With messages coming through daily from all parts of the world, some even direct, I have full control for recording onto disk, spooling messages for forwarding and printing out hard copy.

The TNCV303 program is unique because it has at a

touch the commands: Converse, MH, Status, Directory, TX File, RX File, Monitor on/off, Printer, Data Flow, Disconnect etc. It also has the ability to set up text for various commands, background colours and together with Wordwise Plus, I can pre-write all messages for rapid transmission."

I don't know if there is still a BBC enthusiasts' club around, but there certainly was in the early 1980s. (Perhaps Stan ought to start one on packet) It would be useful for swapping ideas etc. Let me know if you use one and I will publish a list. In the meantime, if you want to write to Stan, his address is **G3XON @ GB7GFD.#42.gbr.eu**

The RTTY Guide

Although packet seems to have taken over some of the older RTTY operators, me included, there is still a considerable interest in RTTY. A book called *The BARTG Guide to RTTY*, produced by John Barber G4SKA has just released by BARTG. This has obviously replaced the booklet that I remember, *RTTY The Easy Way*, published around 1959 I believe!

This newest BARTG guide describes how RTTY works, discusses baud rates, equipment needed, receivers transmitters and the terminal unit. This is followed by a brief mention of the use of computers and the 'Toni-tuner'.

The guide concludes with a resumé of how to operate RTTY on the air and an invitation to join BARTG, which is dedicated to all Data modes and not just RTTY. This small guide with useful RTTY information, costs 75p. It's ideal for the beginner, is fully illustrated and can be obtained from the BARTG Publications Manager; **Mark Ashby G6WRB, 47 Close, Luton, Beds LU1 5SR.**

E N D

Report

S BANDS HF

Paul Essery has news of the DX News Sheet, reports from your letters and news of DXpeditions in his monthly up-date on the h.f. bands.

With the death of Geoff Watts, it was thought his famous lists would also become history. Rumour has it, though, that the lists will live on. I hope so.

The *DX News Sheet* was Geoff Watts' idea originally but the present editor is G4DYO. Enquiries go to **RSGB, Lambda House, Cranborne Road, Potters Bar, Hertfordshire EN6 3JE**, and not, please **not**, to G4DYO, lest he wring my neck!

And, while talking of DX information, don't forget the propagation forecast on the RSGB's GB2RS broadcasts on the various bands on Sunday mornings. For details of frequencies and times for your area, contact the RSGB direct or use the information in the callbook.

South Georgia Activity

South Georgia activity is planned from Grytviken, for January 1995 by WA3YVN, WA4VQD and another. The intent is for three complete stations with beams and verticals.

Any QSLs for the South Georgia station should go via John Parrott W4FRU, PO Box 5127, Suffolk VA 23435. The cost of this one is estimated as 50-60 000 US\$!

Funny Noises

Up in the north of Scotland **GM0EXN** says both 7 and 14MHz are plagued with odd 'funny' noises. These seem to be double-sideband suppressed (or maybe reduced) carrier indecipherable signals that occasionally turn into resolvable sideband and give apparently amateur calls of Eastern European origin.

In the north of GM the signals are enormously strong - more than you would expect from amateurs. On occasion a strong one appears to be in contact with something much weaker. Around 14.2MHz is one area; 7.037 and 7.047 are others.

Reports, and any useful information please, to me and I'll pass 'em on to the right quarter. Also noted up there is a broadcaster who is aiming at Oriental listeners, whose lower sideband splatters well into the 7MHz band. Again, reports and information are welcomed.

Your Letters

Time to look at your letters now. And, we're really in the summer doldrums, so complains **John Heys G3BDQ** from Hastings.

Like me, John G3BDQ doesn't enjoy heat-waves much! However, afternoons on 21MHz yielded Y11AA, TT8PS, ET3YU, AP2MMN and HZ0ZAZ, and 18MHz produced Mike Devereux G3SED and his group as JY8ED, plus G3RFX doing his thing as ZB2FX.

On the other hand, John says he hasn't worked USA on 21MHz for weeks. Like myself, John doesn't go much on evening operating, but at this time of year it's frequently noticed that the daily peak is anywhere but around noon!

The Isle of Sheppey in Kent is home to **Ted G2HKU**; On 3.5MHz c.w. Ted hooked the Goodwin Sands group, and on 7MHz he clicked with VE10R, both on the G5RV antenna.

On 10MHz, with G2HKU on low power and using the vertical antenna, HB0/DL7UBA and 3Z0EMC went into the net. The same combination on 14MHz accounted for 4X/OK1FMR, ZA1C, ES2RW/2 (Kappa Island) before a change to 18MHz and again the low power struck, this time KZ1H.

Ted's 28MHz operation saw a couple of contacts in I3JSS and HB0/DJ0BC/P. On 21MHz we have the puzzle of the month - a guy signing X5EBL and asking for cards via YU1FW. I suspect this might be Slim again!

Turning south-west to Somerset I head for Yeovil and **Don G3NOF**. There have been signals to work



Mechanical teleprinters such as the Creed 7B in use (then) in G8CDW's station have faded away, and new techniques required a name change for the original British Amateur Radio Teleprinter Group. They are now known as the British 'Teledata' group (see text).

occasionally, even on 28MHz. Don works sideband of course, and 3.5MHz showed DL0SY/P (IOTA EU42) and JY8ED, while 7MHz was missed.

On 14MHz Don worked A61AF, ET3AA, 1A0KM and OS1A. Up on 18MHz he worked ET3AA again, OX3/G3ZAY, 1A0KM and 4U1TU.

Up again to 21MHz provided G3NOF with C53HG S92YL, and VP5NC. On 24MHz Don logged HB0/DL7UBA, LT2A, TK/IK2QIN/P, and 1A0KM again.

Finally, T91ELD, 9A1CAL and 1A0KM were noted on 28MHz. Incidentally, Don G3NOF has been reporting to my column now for around 30 years and to my predecessor before that, but I don't ever recall such a DX-bare cupboard!

From South Wales, **Leighton Smart GW0LBI**, has been taking advantage of the weather to work on the antenna. At 200 feet. it is, roughly, $3\lambda/8$ wavelength on 1.8MHz and tests are showing that it's working well.

'Top Band' saw Leighton's 5W signal to TK/DL8NBH (a new country for the band), ON, and F5TGR/P with a mere half-watt. Working on s.s.b. Leighton managed DL6UDX, EI7A, and a couple of Gs worked with milliwatts of power.

On 3.5MHz the key at GW0LBI was used to raise DL7VUO(5W), G0UPS, LY2BO, 4R0S, all but the first with

5W. Back on sideband Leighton found GM3TTW. Finally a quick flip to 10MHz tickled up 8P8GU and S59AA, the latter for a new one.

British Teledata Group

Ian Brothwell, G4EAN is the Hon. Sec. of the British Amateur Radio Teledata group, BARTG. Ian recalls how initially the 'T' stood for 'teletype' but the Teletype Corporation objected. This resulted in the word teleprinter replacing teletype.

Years later, thanks to the advent of the other modes, they chose to change teleprinter to 'Teledata'. I can confirm the first part of the story as true, having been able to look up references in my files.

But why 'Teledata'? After all, all amateur radio consists of the exchange of data at a distance. There seems some implication that there is something 'different' about digital exchanges of information. Or am I reading something into it that isn't there?

Deadlines

That's my lot for this month. The usual mid-month deadline applies, for arrival at the usual address of PO Box 4, Newtown, Powys SY16 1ZZ.

E N D

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Round-up

BROADCAST

Peter Shore takes his monthly look at the short wave broadcast bands and reports on an interesting service being proposed by the Nintendo company.

Italy has been much in the news since the election of multi-millionaire Silvio Berlusconi as Prime Minister. Signor Berlusconi is famous for owning a considerable amount of Italy's media, including several private TV stations. He has been fighting a battle with RAI, the state broadcasting organisation, over perceived political bias.

It may be worth tuning to RAI's international service, Radio Roma. English is broadcast to Europe at 0425-0440 on 7.275, 5.99 and 1935-1955 on 9.575, 7.275MHz. The station also broadcasts weekly in Esperanto, on Sunday at 2000 on 11.80, 9.755 and 7.275MHz.

At 1900 daily, RAI's Italian service is carried for 20 minutes on Radio Luxembourg's medium wave transmitter on 1440kHz (anyone remember *FAB 208?*). Italian is also carried to South America from the BBC's Atlantic Ocean Relay station at 0130-0230 on 15.39MHz after the closedown of the BBC's Latin America services.

Short Wave Service

Iceland's short wave service in Icelandic can be heard transmitting in upper side band on out-of-band frequencies for the country's merchant marine fleet. European services are on the air at 1215 to 1300 on 15.77 and 13.86 and between 1855 and 1930 on 13.86 and 11.402MHz.

Radio of the Serbian Republic is being relayed on Radio Yugoslavia's short wave transmitters at 2200-2230 on 7.265 and 0100-0130 on 11.87MHz.

I wonder if any reader has yet managed to log low-powered Radio Miami International on 9.955MHz? English is heard at 0100 for half an hour, followed by two and a half hours of Spanish, except on Sundays when the transmitter is off

the air. Reports on reception of the 50kW transmitter can be sent to **PO Box 526852, Miami, FL 33152, USA.**

Swiss Radio International in the capital, Berne, has started to use Radio France International's relay in French Guiana for broadcasts to the Americas, Africa and the Pacific. The schedule is: 0030-0315 on 13.635 to Central and the East Coast of North America; 0330-0530 on 11.62 to the West Coast of North America; 0830-1045 on 11.64 to the Pacific; 2000-2100 on 9.77 to Africa and 2215-2400 on 11.65MHz to South America.

The transmission at 2215 via Africa No 1 on 12.035MHz has been discontinued.

Canadian Budget

It is four years since the Canadian government cut Radio Canada International's budget by about CAN\$6 million resulting in the closure of several language services. Now a Canadian Senate committee has suggested that the cuts should be reversed allowing the station to continue paying for its existing short wave broadcasts and perhaps restarting some of the dropped languages like German and Japanese.

In the USA, the House of Representatives has voted US\$10 million to set up Radio Free Asia, equivalent to Radios Free Europe and Liberty. The station will broadcast in Chinese, Burmese, Cambodian, Laotian, Korean and Vietnamese. The decision to send programmes to North Korea is strange since reports from the country suggest that the only radios available are specially designed to allow only North Korean stations to be received.

Meanwhile, RFE has moved its Czech language service from its 44-year old Munich headquarters to

Prague. The station is to be privatised by September next year following the massive budget cuts imposed by the US Congress last year.

Radio Moscow will celebrate its 65th birthday on October 29. The station is organising a special forum, requesting listeners to write in with details of how and when they started listening, and what encouraged them to continue listening to their broadcasts. Send your reminiscences on no more than two pages to **Radio Moscow Anniversary, Moscow, Russia.**

New Voice

I have reported the opening of the new Voice of America relay station in Thailand. Now comes news that the BBC World Service is to start constructing a short wave transmitting station there, too. Agreement has been reached for work to start with an estimated completion date of around late 1996.

Radio Korea in the South Korean capital, Seoul, has English to Europe at: 0100-0200 on 15.575, 7.55; 0800-0900 on 13.67, 7.55 and via *World Radio Network* on Astra; 0930-1000 on 13.67; 2030-2100 on 9.87, 9.64, 5.975 and via the BBC in the UK on 5.965 and 2100-2200 on 15.575 and 6.48MHz.

Since the end of June, an English language service has been reported on 9.78MHz from Yemeni Republic Radio in Sana'a. The service is said to be on the air at 0600 and 1800 for an hour.

The current edition of the *World Radio TV Handbook* lists the Yemeni transmission on this frequency coming from a 50kW transmitter in Sana'a. The station address is **PO Box 2182, Sana'a, Yemen Arab Republic**, let me know if you've heard this new English transmission.

A chance to hear a new

American religious broadcaster on short wave from the old WGSN site in Maine (Monitor Radio International now uses just the Cypress Creek transmitter site in South Carolina on the mainland US). The World Voice of Historic Adventism of **PO Box 1844, Mount Dora, FL 32757, USA** operates to Europe: Saturdays at 1450 to 1700, Sundays 1500 to 1730 and weekdays 1500 to 1700 on 15.655 and on Wednesdays at 2230 to 0000 on 9.855MHz.

If you fancy running up an unusually large international telephone bill, then here are two suggestions for how to do it!

Call the Voice of America's news dial-up service in Washington DC on **0101-202 619 2131**, or the Icelandic National Broadcasting Service on **010-354 1 693690** for a recording of the five minute English news bulletin that's broadcast around the country at 0855UTC. Do ask whoever pays the 'phone bill first, though!

Finally

Finally, the end of civilisation as we know it? The Nintendo company wants to start a digital broadcasting service next year to provide games and related images and sound to be received and processed by computer.

Everything from 'karaoke' to video games software previews is planned, together with English language teaching and weather forecasts. Game Boys will clearly rule the airwaves before long, as well as the minds of many of the world's children.

Again space has caught up with me, so until next month keep listening and reporting.

E N D

This month David Butler G4ASR reports of fantastic tropo openings on the 144 and 430MHz bands. David also has news of a Sp-E opening into Russia and information about how you can make your first ever 'moonbounce' contacts.

Fig. 1: Africa! Super-tropospheric propagation on the 144MHz band.

Tropo conditions on the v.h.f. and u.h.f. bands during June and July were very much enhanced. Contacts could generally be made with stations up to 1000km away.

On many days the longest paths were to the south of the UK. This enabled QSOs to be made with stations located in southern France and the north coast of Spain.

With changing weather patterns the paths altered and stations in Germany and Scandinavia could be contacted. Intermingled with these conditions were periods of super-tropo.

Stations on the 144MHz band reported working into the Canary Islands at distances approaching 3000km! It was as good if not better on higher frequencies. Some stations on the 430MHz band even managed to work into the Ukraine.

Into Spain

Contacts into Spain on the 144MHz band occurred on many occasions. According to the DX Cluster the best periods were June 10, 17, 22-23, 26-28, July 9-11 and 25-26.

Normally it's stations located on the south coast of the UK that make most profit of the openings to EA. And so it was this time with the exception that operators in the Midlands, the north of England and Scotland also got into the action.

The stations of **G8GXP** (IO93) and **G1GEY, G4KUX** and **G8ESB** (all located in IO94) reported working or hearing stations in the IN53 region of Spain. **David Anderson GM4JJJ** (IO86) also worked some of the DX and that's nearly 1500km!

There were occasions when the ducting extended all the way to EA8. That's in Africa! Distances approaching, and in some cases exceeding, 3000km were worked. Such openings occurred on June 26-27, July 10 and July 25.

Morning Beacon

Collin Morris G0CUZ (IO82) reports that during the morning of June 26 he heard the EA1VHF beacon very strongly. He then went on to work EA1BZZ (IN62) and EB1EVP (IN52).

As the day progressed the duct became more enhanced. Later in the afternoon, at 1545UTC, Collin heard EB8BT (IL18). This station is located on Tenerife and runs a Kenwood TR-751 and two 9-element Tonna Yagis, as the QSL card, in Fig. 1 shows.

Signals from EB8BT were quite weak and a QSO was not made at this time. However, at 1853UTC, and again at 2017UTC, s.s.b. contacts were made with reports of 52/51 being exchanged.

The super-tropo continued through to June 27 and G0CUZ again worked EB8BT. Fading was severe on this occasion and signals only peaked S1.

Stations located further to the west in Wales were able to work into EA8 with much increased signal strength. **Joe Ludlow GW3ZTH** (IO81) reports that June 26 was a day to remember.

At 0738UTC Joe GW3ZTH worked EB1EVP from his home station. As his QTH has a poor take-off to EA Joe wondered whether he could get better results from a local hill at 300m a.s.l.

By 1330UTC the station of GW3ZTH/P was QRV on the 144MHz band. A number of EA1 stations in locator squares IN53, IN63 and IN73 were worked immediately.

At 1529UTC Joe was called by EB8BT. A contact was quickly established although signal strength at this time was quite weak, S1-3. This was followed by a QSO with EA8BEB, again at the S2 level.

From 1600UTC however the strengths increased dramatically. The stations of EA8BHN and EB8ALZ were

EB8BT

Fernando Borges Dguez.

C/Domingo Hernandez N.21

38.440 La Guancha

S/C de Tenerife



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both contacted on s.s.b. with 59 reports. The last EA8 contact for GW3ZTH/P came at 1832UTC when a c.w. QSO was made with EA8BCJ. All these stations were situated in locator square IL18.

Marine Ducting

Incidentally, marine ducting is not as uncommon as some people think. Stations located in Cornwall, Wales, Ireland and the Isle of Man can expect to work this path a few times every year. Marine ducting doesn't stop at the 144MHz band! In fact the higher in frequency you go the better it gets.

The only problem is that this type of marine duct does not normally extend very far inland. Sometimes it's only a distance of a few kilometres.

Unfortunately the lack of microwave operators in the right place both in the UK and EA8 means that records don't get broken very often. This isn't the case in other parts of the world however.

The path across the Pacific Ocean between California and Hawaii opens every year. This sea path is virtually 4000km in length.

Fortunately there are active operators ideally situated at both ends of the Hawaii. The stations of Chip Angle N6CA and Paul Lieb KH6HME have spent 13 years making contacts on most of the microwave bands.

On July 11 the pair made a record breaking QSO on the 2.3GHz band. The distance for the contact was 3973km.

All bands from 144MHz

and up have now been worked. The only exception being a contact on the 10GHz band. However, arrangements have been made and I'm sure they'll break the world record on that band very soon.

Interesting Opening

As I've already mentioned tropo conditions in the UK have been quite remarkable recently, and **Nick Peckett G4KUX** (IO94) experienced a very interesting opening on July 1. It started when Nick was checking the 144MHz band during the early evening and he noted a number of strong German stations in the JO33/43 region.

A few s.s.b. contacts were made but nothing unusual was noted. By 2000UTC conditions were improving and contacts were made with OK2BXE/P and OK2BXU/P. Both stations were S9+20dB. It was getting better!

Tuning around the band G4KUX heard what sounded like a Russian voice on 144.297MHz. It turned out to be UT5DL/P (KN18).

After breaking the pile-up of ON, PA, DL and SP stations Nick managed to make an s.s.b. QSO at 59 both ways. This was at a distance of nearly 1800km, most of it overland.

Further s.s.b. contacts followed with stations in DL and OK. At 2048UTC OM3KDX/P (KN19) was worked, achieving another very long distance tropo contact.

The station of UT5DL/P was worked again at 2120UTC, still with S9 reports. Slava UT5DL reported that he was running 50W to a 14-element Yagi from a QTH 1500M a.s.l.

Slava mentioned that G4KUX was the only G station he had heard that evening. Definitely a case of being in the right place at the right time!

Into Scotland

The excellent propagation also extended into Scotland. The station of GM4ICS reported a contact on the 144MHz band with UR5DXX/P (KN18) at 2254UTC on July 1.

Another station fortunate to be in the right place was GM3ZBE/P. This was the 430MHz field day contest station of the Aberdeen v.h.f. group. It was run by G3ZBE, G7ANQ, GM3WOJ, GM4CXM and GM4TXX.

On the 430MHz band GM3ZBE/P group were running 400W and four 21-element F9FT Yagis. On July 2 at 2255UTC they were very pleased to work UT5DL/P over a distance of 1917km.

Really amazing propagation. Presumably this is a first GM-UT QSO on the 430MHz band?

Sporadic-E

Let's take a look at Sporadic-E now. The period between July 1-2 saw some excellent tropo propagation from the UK into central and eastern Europe.

The situation however, became very confused when a Sporadic-E event took place on July 2 to similar areas! The Aberdeen v.h.f. Group were again in the thick of it.

Allan Duncan GJ4ZUK (now resident in Jersey for 18 months) reports results of their 144MHz field day station GM4ZUK/P. Operated by GM4AFF, GM4YXI and GJ4ZUK it was running 400W into a group of four 17-element F9FT Yagis.

Between 1555-1617UTC an excellent Sp-E opening into Russia took place. Their first s.s.b. contact was with

UR4EZO (KN78), 59 bothways, a shade under 2700km!

The Russian success was followed by contest QSOs with UT5EC (KN78) at 2660km. The also managed UT5EU/A (KN79) at 2680km, UT5BN (K050) at 2270km and UE3PFW (K073) at 2400km.

During all this frenetic activity the station of RW2F (K004) was also worked. The group was uncertain whether it was via Sp-E or tropo as the distance was only 1450km!

Moonbounce Activity

The months of October and November will allow the possibility of 'normal' fixed stations to participate in some moonbounce (e.m.e.) activity. There are two reasons for this and one is because the ARRL e.m.e. contest is held during these months.

The dates for the 1994 international e.m.e. competition by the way are October 29-30 and November 26-27.

The second reason is because it's expected that some 'mega-stations' will be active. And you'll be able to use their superior capability to make contact with them via the moon.

The principle of e.m.e. operation is relatively simple. All you do is run lots of power into lots of antennas pointing at the moon.

Your v.h.f. (or u.h.f./s.h.f.) signals bounce off the moon to someone on the opposite side of the world. In reality it's a little more difficult than that!

One interesting feature of e.m.e. communication is that it's possible to predict with some accuracy the signal levels over the path. As a very approximate guide a 144MHz station running 500W to an antenna of 21dBi gain will be able to work a similarly equipped station.

I'm assuming that your receiver has a noise figure of 2dB or less and the bandwidth is 500Hz. But, I hear you say, "I can't run 500W and my antenna has only got 16dBi gain".

Well, the interesting point is this: If the station at the other end increases his antenna gain by 6dB to 27dBi it means that you could have an antenna system that had 6dB less gain. That would be 15dBi in this example. Or it could mean that you use 6dB less power, in this case 125W.

Now it's starting to look a little more realistic. Taking this one stage further. If the distant end station increases their antenna gain by 12dB then you could use a 15dBi gain antenna and run 125W.

Simply put, if the station at the other end of the e.m.e. path has a 'mega-antenna' system you'll be able to work them with a good tropo system.

So, what are the minimum requirements needed to allow an e.m.e. contact with a mega-station on either the 144 or 430MHz band?

Irrespective of what your main interests are, the most singularly important item of your station is the antenna system. Your station should consist of a single Yagi in excess of 9-elements and a feed-line of low attenuation. Good quality feeder such as Westflex 103, Popes H100 or Andrews LDF4-50 should be used.

The receiver should have a noise figure below 2dB. Modern transverters will generally possess this important feature. Many modern multi-mode transceivers don't!

However, a low noise amplifier will overcome this deficiency. On the other hand a pre-amplifier will seriously reduce the strong signal handling capability of the receiver especially if you don't know what you're doing. And (unfortunately) most 'appliance' operators don't!

A bandwidth of around 500Hz is useful. Ideally this can be achieved at i.f. but the same gains theoretically can be made with an audio filter. Selectivity achieved at i.f. is the better option though. Strong adjacent signals can be filtered out earlier in the receiver chain.

On the transmit side you'll need about 100W of c.w. power. And I don't mean a 'linear' with 100W stamped on the label! I mean an amplifier with a real 100W at the antenna. Not a solid state brick that may only just squeeze 80W output in the shack.

A problem encountered when using a normal fixed station system for e.m.e. communications is that the antenna cannot normally be

elevated to point at the moon. To overcome the problem it's necessary for the moon to be on or near the horizon when attempting moonbounce contacts.

A single Yagi mounted 10m or so above ground will enable contacts to be made when the moon is up to 20° above the horizon. This is because most Yagis have a fairly broad 3dB vertical beamwidth.

Table 1, gives details of azimuth beam-headings when the moon is rising and setting. It's based on central England and will be correct for use within most of the UK.

Very Large Systems

There are now many stations around the world running very large e.m.e. systems on the 144, 430 and 1296MHz band. During the ARRL contest these stations are especially active.

The chances of making a QSO with the large stations are therefore greatly enhanced. In addition some operators are able to operate from commercial facilities.

One such group is the Toronto VHF Society. They have received permission to use a 46m diameter radio telescope dish antenna. It belongs to the Institute for Space and Terrestrial Science situated in Algonquin Provincial Park, Canada in locator FN05XW.

The Toronto group intend to be active on the 144, 430 and 1296MHz bands with the call sign VE3ONT. Table 2, gives details of their operating schedule. I will give more details of the station set-up and tips on how to work them and other stations in next month's column.

Deadline Time

That's all I have for you this month and I'd better mention deadline time again. Please send your reports to me at Yew Tree Cottage, Lower Maescoed, Herefordshire HR2 0HP or via packet radio @ GB7MAD or the DX Cluster system.

Alternatively, you can telephone me on (0873) 87679. I'm still looking for good quality photographs of your shack or antennas. They will be returned.

E N D

Table 1: Moon rise and set data for ARRL e.m.e. contest.

Saturday 29 October

UTC	AZ	EI
Rise		
0030	076	00
0100	082	05
0130	088	09
0200	093	14
0230	099	18
Set		
1200	256	19
1230	262	15
1300	268	10
1330	273	06
1400	279	01

Saturday 30 October

UTC	AZ	EI
Rise		
0200	087	03
0230	093	07
0300	098	12
0330	104	16
0400	111	20
Set		
1230	250	18
1300	255	14
1330	261	09
1400	267	05
1430	272	00

Table 2: The e.m.e. schedule of VE3ONT Toronto VHF Society.

Date	Time UTC	VE3ONT Tx	VE3ONT RX range
Oct 29	0645-1815	432.050	432.050 - 432.060
Oct 30	0754-1844	1296.050	1296.050 - 1296.060
Nov 26	0538-1645	144.100	144.100 - 144.110
Nov 27	0646-1713	144.100	144.100 - 144.110

The World
of ATV

Andy Emmerson G8PTH has some exciting news on a new ATV world record, as he takes his bi-monthly look at the world of Amateur Television.

An unbelievable 2518 mile ATV pathway has been covered on 434MHz, with full colour reception to boot. That's the exciting news from **Henry Ruh** in the USA, publisher of *ATV Quarterly* magazine.

Henry FAXed over the following in mid-July: "The summer tropo duct between Hawaii and mainland USA opened strong enough on July 11 for the first fast-scan ATV contact over this 2500 mile path. Paul Leib KH6HME, long known for his v.h.f./u.h.f DX from Hawaii to USA, Japan, New Zealand and elsewhere, had to wait nearly two years after ATV equipment was hand carried to his Moana Loa Volcano amateur shack by Tom O'Hara W60RG and Gordon West WB6NOA. Gordon and Paul had been trying for two years, but band conditions were not co-operative for the normal summer tropo conditions until this month.

Paul's 432.0MHz c.w. beacon on horizontal beams was heard in the Los Angeles area, triggering locals' DX alarms. Several coastal amateurs have systems which monitor the frequency and alert the station owner when a signal is detected.

Paul rotated the phase for vertical polarisation for ATV since California uses vertical for ATV. Paul's station consists of a 10W PC Electronics transmitter and a Mirage D1010NR ATV amplifier.

Early in the afternoon Paul and Gordon were rewarded by a strong tropo opening. Initial signals were P2 to P3 and Gordon called Tom to alert other Southern California ATVers to the band opening to Hawaii. As the afternoon went on, the signals got better.

Gordon is about 2508 miles from KH6HME but Gordon's world record ATV DX contact was not to last. In fact it was soon shattered

when Mike Henkoski KC6CCC in San Clemente, California at 2518 miles also received the KH6HME signal.

Mike also supplied *ATVQ* magazine with a photo of his reception, which was in black and white. Mike was able to video-tape his reception using a Hi-8 camera and *ATVQ* has a five minute copy on VHS with live audio as Mike describes the contact to Tom W60RG.

The Elktronics video ID graphics are clearly visible, and Mike's video captured all four screens. Mike KC6CCC is the owner of Microtech video, manufacturer of micro ATV transmitters suitable for radio-control use.

Mike and Gordon West operate the Gordon West Ham Radio School. Both are active and avid radio amateurs. Gordon is also known for his many columns and articles in various magazines and is a keen maritime mobile operator.

The opening lasted about four hours with Paul transmitting 15 minutes on the hour and half hour. A return signal was not accomplished because Paul did not have a TV set in his mountainside QTH! A set was to be taken the next day.

Voice co-ordination between Hawaii and California was on 144.170 s.s.b. This same opening was in later days able to produce a new record 2304MHz contact and efforts were made for 10GHz contacts but without success."

My thanks go to Henry Ruh and Tom O'Hara for this report.

Fig. 2: The test card received from the French special event station for the Channel Tunnel festivities.



Fig. 1: The Kent Television Group provided a special link-up for the civic ceremonies surrounding the opening of the Channel Tunnel on May 6-8 this year. Here's the complex array of video and transmitter gear at station GB0CT at New Romney.

Chunnel Vision

And now a welcome report about GB0CT and TM5TSM from **Ian G4MLY** of the Kent Television Group. Over to Ian for the story of Chunnel Vision!

"In connection with the official opening of the Channel Tunnel, the British Rail Amateur Radio Society along with their French counterparts of the SNCF (French national railways) and allied industries ran a three day special event station.

The French station was at Wimereux, and the British station was established at New Romney Station on the Romney, Hythe and Dymchurch Light Railway. The Kent Television Group had been approached to set up a television link on 430MHz and 1.2GHz ATV.

At first we were a little sceptical of results from this sea-level location, as the French station was 53km away. However, plans were made and the great day arrived.

After contact was made on 144MHz, a great deal of searching took place for the TV signals. Eventually they appeared out of the noise. The 430MHz band was a little disappointing at only P1, so this was not used after the first day. Conditions on 1.2GHz, however, improved both ways throughout the day with peaks of P4 between the QSB.

On the second day we had a pretty constant P4 path and had good shots of their Marconi exhibition. The highlight of the day was when the Chairman of Shepway District Council, Dick Pascoe G0BPS, was able to be televised whilst speaking to the Mayor of Wimereux. We also spoke to the President of the Russian Amateur Radio Society.

On the third day, conditions were not so good to start with, but we did have a vision contact with Russian astronaut Musa Manarov, who was thoroughly enjoying himself on the radio and television. Operators at the GB0CT video link were Group Secretary Ian G4MLY and Technical Co-ordinator Chris G8GHH.

We are most grateful for the help of David G3DGW who the French operators 'found' in the Boulogne area and dragged to the mic to act as interpreter, etc.! The equipment used consisted of various cameras and test card generators belonging to Group members, feeding Ian's vision switcher and home brew T-C running 100W from a 2C39 amplifier.

The antenna was G8GHH's 48-element loop Yagi at about ten metres above ground level. The RX was a satellite receiver preceded by a pre-amp. The French equipment was 50W to a 55-element Tonna on top of the town hall. The other part of the station ran 144 and 430MHz along with h.f. where

several thousand QSOs were made and special QSL cards issued."

More information on Kent Television Group next time or alternatively you can contact Ian G4MLY (QTHR).

That's all from the world of ATV for this issue so until next time keep those letters coming to 71 Falcott Way, Northampton NN2 8PH.



E N D

ARCADE

The PW Shopping Arcade

Welcome to the *Practical Wireless* 'Arcade'. In this section of the magazine, you'll be able to find all those important services 'under one roof' - just like the shopping arcades you see in the High Street.

Let your eyes 'stroll through' the Arcade every month and you'll find all departments open for business including: The Book Service, PCB Service, Binders and details of other *PW* Services. Make a regular habit of 'visiting' the Arcade, because in future, you'll have the chance of seeing special book offers and other bargains. And don't forget, this Arcade is open wherever you're reading *PW*!

Services

Queries:

Practical Wireless,
PW Publishing Ltd., Arrowsmith Court,
Station Approach,
Broadstone, Dorset BH18 8PW.

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

- 1: We **cannot** deal with technical queries over the telephone.
- 2: We **cannot** give advice on modifications either to our designs, to commercial radio, TV or electronic equipment.
- 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 problem adequately, with as much detail as you can possibly supply.
- 5: Only one problem per letter please.

Back Numbers

Limited stocks of many issues of *PW* for past years are available at £2.00 each including post and packing. If the issue you want is not available, we can photocopy a specific article at a cost of £1.50 per article or part of article. Over the years, *PW* has reviewed many items of radio related equipment. A list of all the available reviews and their cost can be obtained from the Editorial Offices at Arrowsmith Court, Station Approach, Broadstone, Dorset BH18 8PW for a large stamped self-addressed envelope.

Binders

PW can provide a choice of binders for readers' use. Plain blue binders are available, each holding 12 issues of any A4 format magazine. Alternatively, blue binders embossed with the *PW* logo in silver can be supplied. The price for either type of binder is £5.50 each (£1 P&P for one, £2 for two or more). Send all orders to PW Publishing Ltd., FREEPOST, Arrowsmith Court, Station Approach, Broadstone, Dorset BH18 8PW.

Constructional Projects

Components for *PW* projects are usually readily available from component suppliers. For unusual or specialised components, a source or sources will be quoted.

Each constructional project is given a rating to guide readers as to the complexity.

Beginner: A project that can be tackled by a beginner who is able to identify components and handle a soldering iron.

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

Advanced: A project likely to appeal to the experienced constructor. Access to workshop facilities and test equipment will often be required. Definitely not for the beginner to attempt without assistance.

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DAYTON

HamVention '95 - Come Fly With PW

DON'T MISS THE AMATEUR RADIO HOLIDAY OF THE YEAR!

Join the *PW* Dayton HamVention holiday, led by Rob Mannion G3XFD, as we depart from Gatwick on Tuesday 25 April 1995 to fly direct to Cincinnati in the USA for £650!

When our Delta Airlines flight into Cincinnati arrives, we'll travel by coach to the Holiday Inn at Englewood in Dayton (approximately one and a half hours), where we'll be staying for a total of six nights.

The Holiday Inn is comfortable, has a good swimming pool and lots of choices for 'eating out' close by, if you don't wish to eat in the Hotel. The Hotel is one of the nearest to the HamVention and there's good public transport available in and around Dayton.

On Wednesday 26th there's a chance to spend the day at the internationally famous American Air Force Museum. You'll be able to visit the superb IMAX 3D cinema (entrance to museum is free, but there's a small charge for the cinema).

Thursday 27th, optional trip to Cincinnati (approximately £15) for a day's shopping and sightseeing. Alternatively, you may visit Dayton or take a look at the giant 24-hour Meijer's Department store close to the Hotel.

The HamVention opens on Friday at mid-day and runs to late Sunday afternoon. On Monday, there's a morning at leisure until our coach transfers us to Cincinnati for the overnight flight to Gatwick.

The £650 is based on sharing a twin-bedded room (if you're travelling alone we'll gladly arrange this for you) and includes: Return scheduled flights from Gatwick and meals on the flight, six nights at the Holiday Inn, return airport/hotel transfers in the USA, entry fee to HamVention, excursion to Air Force Museum, all local city and state taxes and US airport taxes and the new UK airport tax of £10.

Not included in the price are: transport to and from Gatwick, meals during the stay, health insurance, laundry, drinks and personal expenses.

Rob Mannion G3XFD is leading the *PW* party, but as with the successful 1994 trip, the tour is being organised by Andy Garside of Gullivers Groups & Incentives.

**So, don't delay, contact Andy Garside today to book your place on Dayton '95. Write, telephone or FAX Andy at Fiddington Manor, Tewkesbury, Gloucestershire GL20 7BJ.
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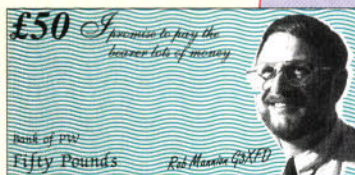
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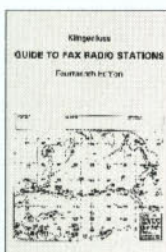
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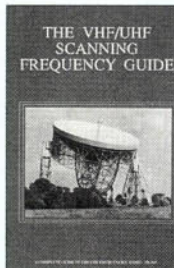
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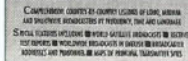
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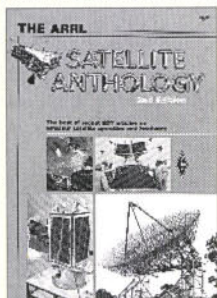
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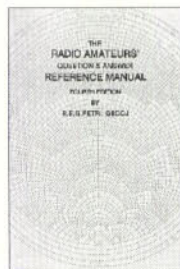
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REVISION QUESTIONS FOR

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Esde Tyler GOAEC

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F. A. Wilson

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Peter Rouse

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Covers a very wide area and so provides an ideal introduction to the hobby of radio communications. International frequency listings for aviation, marine, military, space launches, search and rescue, etc. Chapters on basic radio propagation, how to work your radio and what the controls do, antennas and band plans. 187 pages. £8.95

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Edited by Rev. G. Dobbs G3RJV

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covering everything from receivers, transmitters, antennas and accessories together with sed QRP test equipment. This book is aimed at the keen constructor and provides all the information required to build the host of projects described. 96 pages. £5.00

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TELEVISION

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Mike Wooding G6IQM

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William R. Nelson WA6FGG

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This book will be invaluable not only to Novices, but also to any beginning amateur looking for easy-to-build antenna systems that really work. 52 pages, £5.99

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ANTENNA IMPEDANCE

MATCHING

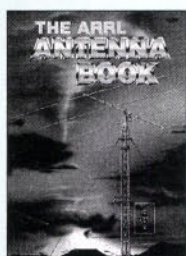
Wilfred N. Caron

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A station is only as effective as its antenna system. This book covers propagation, practical constructional details of almost every

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ARRL ANTENNA COMPENDIUM

Volume Three

Edited by Jerry Hall K1TD

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BEAM ANTENNA HANDBOOK

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(RSGB)

Edited by Erwin David G4LOI

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INTRODUCTION TO ANTENNA THEORY

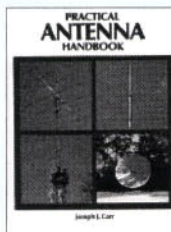
BP198

H. C. Wright

This book deals with the basic concepts relevant to receiving and transmitting antennas, with emphasis on the mechanics and minimal use of mathematics. Lots of diagrams help with the understanding of the subjects dealt with. Chapters include information on efficiency, impedance, parasitic elements and a variety of different antennas. 86 pages. £2.95

PRACTICAL ANTENNA HANDBOOK Vol.2

Joseph J. Carr



As the name suggests, this book offers a practical guide at everything to do with antennas, from h.f. to microwaves. It also has sections on propagation, transmission lines, antenna

fundamentals and a helpful introduction to radio broadcasting and communication. The book neatly balances a practical approach with the minimum of mathematics, good diagrams and a lively text. 437 pages. £23.95

G-QRP CLUB ANTENNA HANDBOOK

Compiled and edited by P. Linsley G3PDL & T. Nicholson KA9WRI/GW0LNU

This book is a collection of antenna and related circuits taken from *Spratt*, the G-QRP Club's journal. Although most of the circuits are aimed at the low-power fraternity, many of the interesting projects are also useful for general use. Not intended as a text book, but offers practical and proven circuits. 155 pages. £5.00

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Doug DeMaw W1FB

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WIRES & WAVES

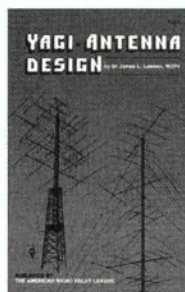
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Les Moxon G6XN

This book provides a reference source for all h.f. antenna work, whether it be for fixed, mobile or using test equipment. In effect it is a manual on antenna work, with useful tips, projects and ideas. 322 pages. £13.99



YAGI ANTENNA DESIGN
Dr James L. Lawson W2PV

This book is a polished and expanded version of a series of articles first published in *Ham Radio* following on from a series of lectures by

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Many radio enthusiasts have to be content with wire antennas. John Heys' practical approach to wire antennas provides plenty of ideas and projects to help get the best out of a simple system. A helpful book, and good reference source. 100 pages. £8.50

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too. No previous knowledge is required or assumed. 102 pages. £2.95

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R.A. Penfold

This book is primarily intended as a follow-up to BP239, *Getting the most from your Multi-meter*. By using the techniques described in this book you can test and analyse the performance of a range of components with just a multi-meter (plus a very few inexpensive components in some cases). The simple add-ons described extend the capabilities of a multi-meter to make it even more useful. 96 pages. £2.95.

OSCILLOSCOPES, HOW TO USE THEM, HOW THEY WORK

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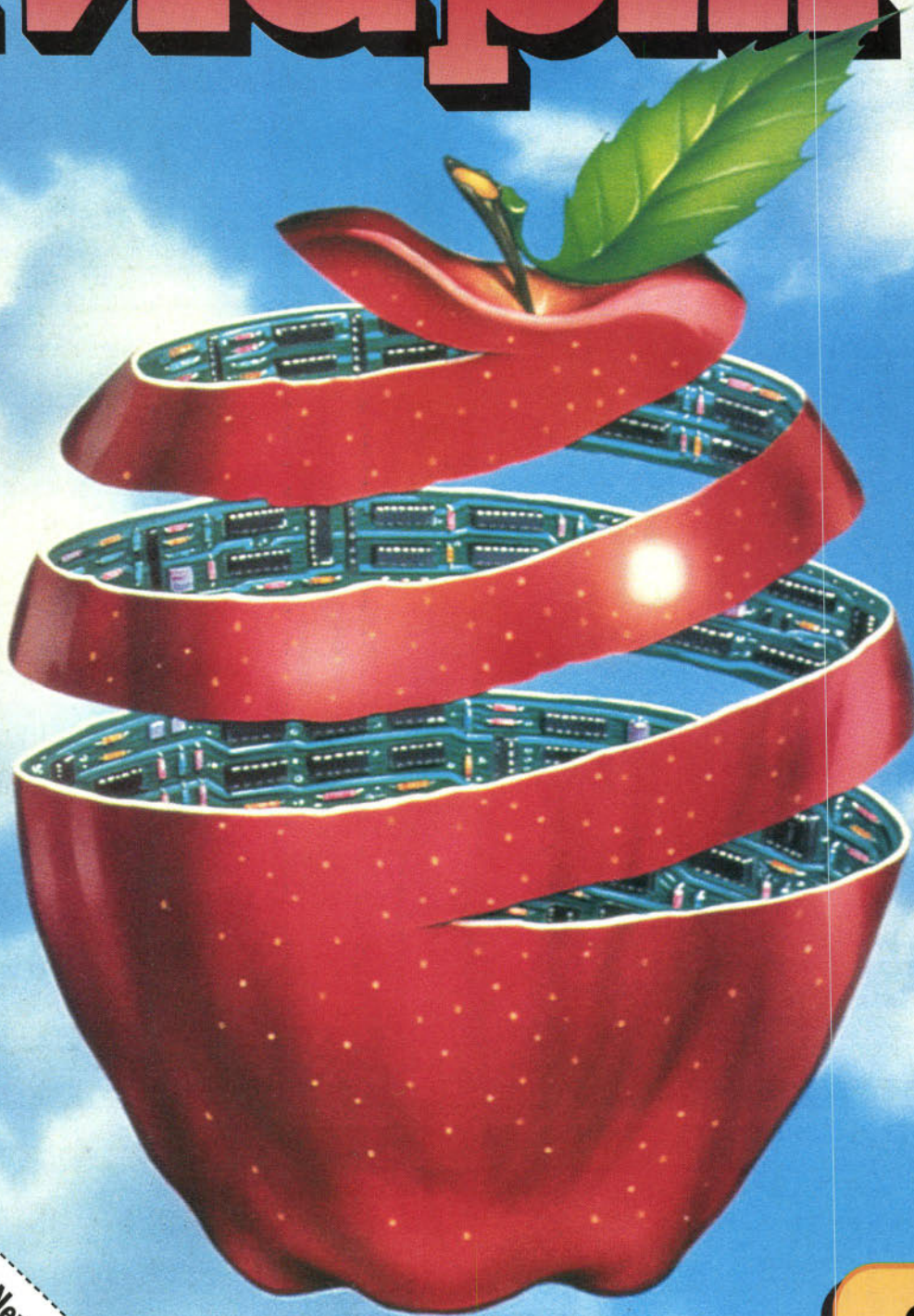
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