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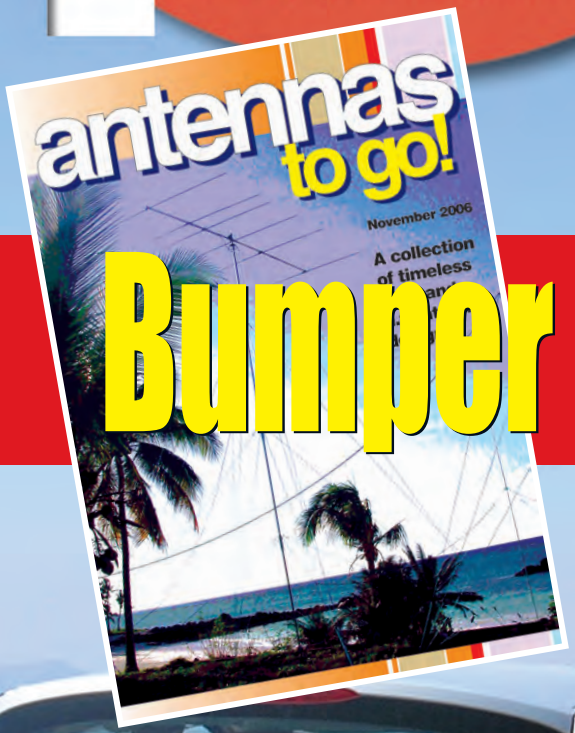

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Up to 6W out with Li-ion battery and **"scanner" style coverage from 100kHz to 1300MHz** including SSB on receive! This is a great radio to have at all times when you are on your travels.

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All prices in this advert Valid until 31st October

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RSGB Radcom:
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Key Specifications

Rx - 12kHz to 65MHz
Tx - 1.8MHz to 52MHz (Ham)
Power - 1W - 100W (500mW 6m)
IMD - 99dB
MDS - 130dBm (14MHz 500Hz)
Modes - SSB CW AM FM

*Realtime Panadapter
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*AGC after brick wall filter
*Graphic Equaliser & Compander
*Variable bandwidth Tx filter
*Iambic Memory Keyer

Prices

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SDR-1000 1 Watt	£649.00	**VFO Knob**	£59.00
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WR-G303 Features

HF 9kHz-30Mhz Dual Conversion SSB FM AM
Real-time spectrum analyser; Plug and Play installation, 2nd IF totally SDR; Easily updated, Simple USB connection; 3 scan modes; S-meter reading S-points - dBm or uV; Triple AGC speeds or manual; Extensive memory feature; Dual real-time spectrum scopes; Bandwidths of: 0.5, 2.5, 3, 4, 6, and 12kHz; SSB sens. typically: 0.3uV; AM Sens: 0.9uV.

Specification

Mode: AM AMN AMS SSB CW NFM
Tuning steps: 1Hz **Image reject**: 60dB
IP3: +5dBm@20kHz **MDS**: -135dBm
Phase Noise: -148 dBc/Hz @ 100kHz
RSSI Accurate: 5dB **RSSI Sensitivity:** 1uV
Scan Speed: 40chs per sec
IFs: 45MHz; 12kHz **Stability:** 10 ppm 0-60C
Antenna: 50 Ohm. **Supply:** 12VDC Unit or PCI

WR-G305 Features

HF-UHF 9kHz-1800MHz Dual Conversion SSB FM AM
Real-time spectrum analyser; Plug and Play installation, 2nd IF totally SDR; Easily updated, Simple USB connection; 3 scan modes; S-meter reading S-points - dBm or uV; Dual Loop variable speed AGC; Manual IF gain; Unlimited memory; Audio filter: Dual real-time spectrum scopes; Multifunction squelch; Graphi hit count; Bandwidths of: 0.5, 2.5, 3, 4, 6, 12 and 220kHz; SSB sens. typically: 0.3uV; FM Sens: 0.7uV.

Specification

Mode: AM AMN AMS SSB CW NFM
Tuning steps: 1Hz **Image reject**: 60dB
IP3: 0dBm@20kHz **MDS**: -135dBm
Phase Noise: -148 dBc/Hz @ 100kHz
RSSI Accurate: 5dB **RSSI Sensitivity:** 1uV
Squelch: Level, noise, voice, CTCSS, DCS
Scan Speed: 60chs per sec max
IFs: 109.65 MHz;12kHz **Stability:** 10 ppm 0-60C
Antenna: 50 Ohm. **Supply:** 12VDC Unit or PCI

WR-G313 Features

HF 9kHz-30MHz (180MHz*) Dual Conversion SSB FM AM
Real-time spectrum analyser; IF Shift & Notch Filter; 2nd IF totally SDR; IF spectrum record, USB connection; 3 scan modes; S-meter reading S-points - dBm or uV; Triple AGC speeds or manual; Extensive memory feature; Dual real-time spectrum scopes; Noise Blanker; Test & Measure features; Bandwidths variable 1Hz - 15kHz; 600 Ohms line output; SSB sens. typically: 0.25uV; AM Sens: 0.9uV.

Specification

Mode: AM AMS SSB DSB ISB CW NFM
Tuning steps: 1Hz **Image reject**: >70dB
IP3: +8.5dBm@20kHz **MDS**: -135dBm
Phase Noise: -148 dBc/Hz @ 100kHz
RSSI Accurate: 2dB **RSSI Sensitivity:** 1uV
Dynamic Range: 95dB
Scan Speed: 40chs per sec
IFs: 45MHz; 16kHz **Stability:** 0.5 ppm 0-60C
Antenna: 50 Ohm. **Supply:** 12VDC Unit or PCI

WR-G315 Features

HF-UHF 9kHz-1800MHz Dual Conversion SSB FM AM
Real-time spectrum analyser; IF Shift & Notch Filter, 2nd IF totally SDR; IF spectrum record, USB connection; 3 scan modes; S-meter reading S-points - dBm or uV; Dual Loop variable speed AGC; Manual IF gain; Unlimited memory; Audio filter: Dual real-time spectrum scopes; Multifunction squelch; Nise Blanker; Bandwidths of: variable 1Hz - 15kHz; SSB sens. typically: 0.25uV; FM Sens: 0.5uV.

Specification

Mode: AM AMS SSB DSB ISB CW NFM
Tuning steps: 1Hz **Image reject**: 60dB typical
IP3: 0dBm@20kHz **MDS**: -135dBm
Phase Noise: -148 dBc/Hz @ 100kHz
RSSI Accurate: 5dB **RSSI Sensitivity:** 1uV
Dynamic Range: 90dB
Squelch: Level, noise, voice, CTCSS, DCS
Scan Speed: 500chs per sec @1kHz steps
IFs: 109.65 MHz;12kHz **Stability:** 0.5 ppm 0-60C
Antenna: 50 Ohm. **Supply:** 12V DC or PCI

Prices

WR-G303i	HF PCI module	£385.95	**WR-G313e**	HF External USB	£809.95
WR-G303e	HF External USB	£454.95	**WR-G3133e180**	HF External USB	£999.95
WR-G305i WFM	HF-UHF PCI module	£469.95	**WR-G315i WFM**	HF-UHF PCI module	£1499.95
WR-G305e WFM	HF-UHF External USB	£539.95	**WR-G315e WFM**	HF-UHF External USB	£1699.95
WR-G313i	HF PCI module	£699.95	**WR-PDO**	Pro demod software	£69.95
WE-G313i 180	HF PCI module	£869.95	**WR-DNC3300**	3300MHz down converter	£174.95

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november 2006 contents

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Neill Taylor G4HLX operating as F5VLD on top of Mont Ventoux deep in the south of France, during the 2006 QRP Contest.

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features

regulars

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rob mannion's keylines

Rob Mannion G3XFD

Judging by the response from *PW* readers, the recent theme I raised on the subject of publicity for the Amateur Radio hobby has certainly attracted attention! Letters and many E-mails on the subject have proved to the editorial staff that there's much support for the 'Publicise Amateur Radio' initiative.

The letter from **Mario Brashill M5EXY/G6YAS** in the reader's letters section says much for the dedication of that particular Deputy RSGB Regional Manager! But to achieve the aim that Mario and many of us wish to achieve, a very special effort has to be made.

Fortunately, one reader - I'm sorry to say I've forgotten who - made the original suggestion (please remind me!) and came up with a wonderful idea; a special *PW* car sticker. It's an extremely simple but effective form of advertising and one that the editorial staff think could be a real winner.

Slogan Competition

Talking the car sticker idea over with my colleagues, we all came up with some interesting ideas. However, one colleague came up with the brightest idea - why not run a competition and see how many good slogans readers can think up?

We have many thousands of keen Radio Amateurs and short wave listeners all over the world. So, why not have a go yourself? Your slogan could help to promote our hobby and you could win a special prize!

Think about your idea, write as many versions as you can around the word theme you've chosen before sending your single best choice entry (**on a postcard only please, not forgetting to include your name, address and telephone/E-mail details**) to the **Amateur Radio Publicity Slogan Competition** at the *PW* editorial address. Don't forget the stamp as the Royal Mail does not deliver unstamped mail nowadays!

When you're thinking about your entry, try to sum up your thoughts on our hobby. Some of my own efforts might be 'The World's A Smaller Place With Amateur Radio', 'Amateur Radio - Friendship The World Over' and so on.

Your slogan need not necessarily include the *Practical Wireless* title or logo (we may include it somewhere on the sticker) but you can be sure we will look at and discuss every entry sent in.

Don't forget the old adage, that 'many hands make light work'. In this case many heads will be involved. I have no doubt that some splendid slogans will come our way.

The closing date is **Friday 8 December**. Please ensure your entry gets to us in time. The winner will be announced early in the New Year. A special, mystery prize will be announced at the same time!

Don't forget, we are planning to produce the special sticker during the 75th anniversary year of *PW*. I'm sure 2007 will be a year to remember for both the magazine and the hobby.

Despicable Theft

All theft is despicable, not to mention the shock for the owner who suffers the loss. I speak from personal experience because a much used and treasured tool kit - complete with a socket set that was purchased over 40 years ago - was stolen from the back of my car while it was parked in our house in West Moors, Dorset in the 1990s. I'd just got back from my school radio club and Mandy my Labrador (unusually) got out of the car before she was sure I wasn't going out again. If she'd stayed the thieves would have certainly not approached the car if they'd seen her, even though she would have probably just wagged her tail!

Unfortunately, some youths in a car (I actually heard them drive away but didn't realise what was going on) snatched all the equipment - including special attachments for my artificial arm - and were away in seconds. It was only later that I realised the equipment had gone forever. I was very upset, especially as the thieves were obviously local. Lesson number one - 'never leave your car doors open', even in your own driveway!

Someone who has also suffered a loss - much greater than mine - is **Donald Nobel GM3NCS**, based in Burghead (home of the 198kHz long wave transmitter) in the Scottish Highlands, Donald lost his equipment overnight on 9/10th September. The list includes an FT-1000MP Mark 5, (serial number 5G30009) an FT-920AFS (serial number 3C610003) and an MD Desk Microphone, ID 1981. An FT-900 and PSU were also stolen, along with a CapCo a.t.u.

The **Crime Number** is **043 857 0906** and if you hear of the sale of 'bargain equipment', or are offered any of the stolen items please contact **Detective Sergeant Gunn**, **Grampian Region Police** (**Lossiemouth Police Station**) on **(01463) 720371** or **(01463) 715555**. As it's so unusual and of high quality let's hope the thief is unable to sell it!

Everyone at *PW* hopes that your equipment is recovered Donald and the thieves are soon apprehended! **Rob G3XFD**

amateur radio waves

Publicising Amateur Radio

● **Dear Rob**

I'm writing with regard to your Keylines article featuring Publicising Amateur Radio (page 6 of the September issue) about the man at the Tesco car park, your roadside stop at Wisbech in Cambridgeshire and having to explain about the world of Amateur radio!

Yes Rob, I agree absolutely 100% with you, and many others, that Amateur Radio, in this country needs to be promoted more - not just by the RSGB, *Radcom* and *PW* but by all licensed Amateurs and short wave listeners who should be, (and I know many who are) Ambassadors of our unique hobby.

We must promote Amateur Radio in this country and quite rightly 'come out of the closet' to promote our fascinating world of the radio hobby to the wider public.

Quite correctly, as you have stated in the article, the public in many other countries have a far greater understanding of this 'thing' called 'ham radio'. In fact the future of Amateur Radio, to a great extent, does depend on how we now sell the product...our hobby! The young (and not so young!), M3s, 2E0s and M0s are our future local club (and perhaps) even RSGB committees, managers, board members, presidents, magazine editors and the future International Amateur Radio Union (IARU) representatives. In the future they will work to ensure that Amateur Radio still has a future. I for one **know**, that given a chance, they will do well to promote and protect the hobby for the generations of Amateurs to come.

How do you then, as a Radio Amateur, change the way the general public see you and this strange thing called 'ham' radio (Amateur Radio in the UK)? In one word - it's Publicity**!**

There are many ways to put Amateur Radio on the local map, open days, special event stations such as lighthouses, museums and 'Windmills on the air'. The local carnival, fete and Science Week (March each year) are all ideal times to 'strut' the Amateur Radio theme and show the uninformed public what it's all about. The local papers and radio stations love it too!

So there we go, the next time you are asked, be it at Tesco, Asda or B&Q, by someone about the strange looking thing on the car roof, don't tell him it's the latest super-duper 5/8th wavelength antenna and what a great gain it has (it will probably mean nothing to him!). Instead, tell him about Amateur Radio, what we do and how he can get involved. Be an ambassador for Amateur Radio. Point the enquiring person towards the nearest club. I do! 73, de Mario.

Mario Brashill M5EXY/G6YAS
RSGB Deputy Regional Manager (Region 42) East Yorkshire
Chairman of The East of Greenwich RAC
42 Bannister Street
Withernsea
East Yorkshire HU19 2DT

Thank you Mario. You certainly seem to be the man for the job yourself from what I've learned! I ask readers to join me on the Keylines page for an update on the PW Publicity Initiative for 2007. You can help us achieve the target Mario and many others have of further Publicising the hobby. ***Editor***

Valved Equipment

● **Dear Rob**

Please put me on your list of people who make and use valve gear. Within the last three years, I have made an HRO type of receiver and two valve transmitters. Most of my gear is made in the classic manner but when appropriate I use p.c.b. techniques but never etch it - that would be going too far!

It's not too hard to find suitable components if you know what you are looking for. By this, I also mean what may be of use, for example most valve gear that you may see at rallies contain useful power supplies, high voltage capacitors, valve bases and so on. When things appear hard I think how easy it is today compared with the struggles of our forefathers in the early days when you had to make your own grid leak resistors!

May I also take the opportunity of telling you about the 'Top Enders'. This is a loose group of Radio Amateurs who operate at the top end of 80m c.w. between 3.573 and 3.579MHz and want to put the 'magic' back into Amateur Radio. The ideal Top Ender uses a simple valved transmitter, a bug or straight key and a classic valve receiver. However, all who share our aims are welcome: QRP, QRO, QRS, QRQ, QLF, black box, as long as you believe that radio is magic you are a de facto member! Best wishes.

Gerald Stancey G3MCK
Oakham
Rutland

Thanks for the information Gerald! We hope that all PW readers - including Gerald will let us know what their likes and dislikes are through our recent survey form. It's important for us to know just what readers wish to see. Unless you express your interests we won't know what they are! ***Editor***

Plasma TV Problems

● **Dear Editor**

I'm writing about plasma TV problems. The main culprit in my case is the Bush TV model NO-PDP42 TV006. The receiver creates 5 & 9 +20 of QRM on spot frequencies from h.f. to 144MHz. I also have another interfering TV in the vicinity but have no details of this as yet. I have approached RSGB and have spoken to Ofcom. But they say that unless the problem, i.e. the interference, is affecting my TV or Band II v.h.f. f.m. broadcast reception, there is nothing they can do!

However, if we cause TVI look out! We would soon get a visit as we all know, but the Amateur Service is not protected.

The TV set in question is 300 yards away and it appears to radiate from the antenna, and the other TV is 100 yards (approximately) away. Before these TVs appeared on the scene I had no noise of any note on any band.

The EMC regulations specs, etc., regarding all the new equipment coming onto the market seem to be very poor as regards the Amateur. But then, we are in a minority, I suppose.

Also, I know people who have given up the hobby because of problems of this nature. Perhaps the problem should be aired more in the Amateur Radio press and the relevant authorities will be made more aware.

Well Rob, and everybody at *Practical Wireless,* I hope you can make something of my ramblings and will look forward to readers' response in due course. Thank you for your help and understanding Kind regards and best 73 to you all at *PW*.

Sid Smith M0SRS
St. Neots
Cambridgeshire

Sid confirms he has been in touch with the manufacturers and I understand that the source of QRN mentioned by him is a growing menace. I've not experienced the problem and I don't know of anyone else with the same difficulties. Do you suffer from plasma TV interference? If so, please let us know. ***Editor***

More Veroboard Projects Please!

● **Dear Rob**

I've just been looking through a pile of *PW* issues dating back a year or so. I've noticed that although there are plenty of construction projects, there isn't one Veroboard layout. I'm sure that many would-be experimenters and builders are probably discouraged from trying construction through lack of printed circuit board (p.c.b.) production facilities or have a lack of confidence in attempting to route an 'ugly' style construction circuit correctly.

A Veroboard or strip board layout would allow anyone to get a project working both quicker and neat enough to fit straight into an enclosure and be proud to show it off!

Maybe my memory is playing tricks but I'm sure that this never used to be the case in years gone by, and nearly every project had a Veroboard layout included in the article. This type of construction technique is also my preferred

style and I do use some software to produce a Veroboard layout captured from a drawn circuit diagram

However, I fear that this software is no longer available (it's called *Stripboard Magic*). I wonder if *PW* readers know of any alternatives, which could assist any would-be home-brewers a chance to make a neater project?

Perhaps future authors could bear this in mind too. Do others feel the same I wonder? Regards to you all at *PW*.

Andy Foad G0FTD
Whitstable
Kent

Andy has raised an old problem for the Editorial staff! Please join me on the Topical Talk page where once again - in the hope of solving the Veroboard problem - I will invite debate. Readers may even punch holes in my arguments on the subject! ***Editor***

Hole Punch Set

● **Dear Rob**
This letter is just to let you know that, following the information in October edition of *PW* regarding hole punch kits; I contacted the **Middlesex University Teaching Resources** by telephone and was dealt with politely and efficiently by a young lady. She took the order and said it would be processed that day, (Monday afternoon) and that the item should be with me on Wednesday morning.

The hole punch kit duly arrived on Wednesday morning as advised, complete with a catalogue of the range that the Resource Unit handles. Post and packing costs were very reasonable. All-in-all, I was extremely pleased with the punch and the way the transaction was handled.

Thanks to *PW* and well done to the Middlesex University Teaching Resources!

Terry Greenwood G4AYR
Oxford
Oxfordshire

Pleased to help Terry. Other readers have purchased the punch kit from MUTR and report they are also very pleased with their purchase. Other readers have now told me of numerous sources of the punch kit for even cheaper prices paid by Terry (Did enterprising importers eventually see a market for them?). Because of the change of availability I advise anyone in search of a cheaper bargain to search the web carefully! ***Editor***

Antenna Modelling Article

● **Dear Rob**
Thanks for publishing my article on antenna modeling and *4Nec2*. In case anyone has difficulties with the web address given in the article, the most recent version of *4Nec2* can now be got from the author's webpage at
http://home.ict.nl/~arivoors/

Putting *4Nec2* into the Google search engine is the quickest route. The address given in the article brings up an older version and, unfortunately points to the author's old homepage. As with a lot of websites, addresses can change at short notice. It must be a nightmare for magazine publishers! Thank you.

Paul M1CNK
Eastleigh
Hampshire

Thank you for the update Paul. ***Editor***

West Somerset Railway & *PW*

● **Dear Practical Wireless**
In August I and my family visited the **West Somerset Steam Railway at Minehead**. During our journey from Minehead towards Taunton and our campsite, my family made friends with a large bearded man who - to my surprise - spoke some Dutch. Travelling with two grandchildren the man was *PW* Editor Rob Mannion. After we got home to the Netherlands a copy of your magazine was waiting for us. I read the story about the Tesco store - a supermarket perhaps?

Also, he knew about Holland and our railways. Your Editor told us he had visited hams in the Netherlands. Surely the way to promote ham radio is to do what Rob does very well - talk and make friends. Talk to the visitors to your country, you will make friends and also make friends for your hobby too. If it has as many friendly people like Rob, you will win many more friends! My copy of *PW* is now at our daughter's school. Thank you.

Jan Smeesters
Amsterdam
The Netherlands.

We all enjoyed the trip in the last coach of that train Jan! My two eldest grandchildren Georgia and Freddy had a great time. My colleagues call me a 'compulsive communicator'. Translated in to colloquial English this means I talk too much but it does help in making friends like yourself and your family! ***Editor***

amateur radio rallies

Radio rallies are held throughout the UK. They're hard work to organise so visit one soon and support your clubs and organisations.

October 15
Rusty Radios Rally
E-mail: **info@rustyradios.com**
Website: **www.rustyradios.com**
The 2nd Rusty Radios Rally will be held in Cottered Village Hall, Cottered near Buntingford, Hertfordshire SG9 9QP located on the A507 between Baldock and Buntingford (A1M J10 and the A10). Doors open at 1000 and entry is £1, concessions for under 16s. Refreshments and snacks will be available with car parking.

October 15
The Blackwood and District ARS Rally
Contact: **George**
Tel: **(01495) 724942**
The Blackwood and District ARS are holding their rally at the Newport Centre, Newport, South Wales NP20 1UH, which is one mile from junction 25a of the M4 (junction 26 when travelling from the west). Doors open 1030 for disabled visitors or 1045 for other visitors. Entry is £2, children free.

October 22
Galashiels and District ARS Radio & Computer Rally
Contact: **Jim**
Tel: **(01896) 850245**
E-mail: **gm7lun@qsl.net**
Galashiels and District Amateur Radio Society will be holding their Annual Radio and Computer Rally in The Volunteer Hall, St John's Street, Galashiels, Scotland TD1 3JX. Doors open 1100 and admission is £2. There will be traders, a Bring & Buy and refreshments.

November 12
The 15th Great Northern Hamfest
Contact: **Ernie Bailey**
Address: **8 Hild Avenue, Cudworth, Barnsley, South Yorkshire S72 8RN**
Tel: **(01226) 716339 between 1800 and 2000**
The 15th Great Northern Hamfest will be held in the Metrodome Leisure Complex, Queens Road, Barnsley, South Yorkshire S71 1AN. Doors open at 1100 for all. The venue is on one level with excellent disabled facilities. All the usual trade stands, component and specialist interest groups and a large Bring & Buy. Tables are allocated to Radio Amateurs to sell their own equipment at a nominal charge.

November 12
Kempton Radio and Electronics Rally
Contact: **Paul Berkeley**
Tel: **(01737) 279108**
E-mail: **paul@radiofairs.co.uk**
Website: **www.radiofairs.co.uk/**
The Kempton Radio and Electronics Rally will take place at Kempton Park Racecourse. Show opens at 1000, with tickets available from 0930. Entry £3.50 under 16s free. There will be RSGB sponsored 'Byte Size' lectures, h.f. special events station and Bring & Buy.

November 19
Coulsdon ATS Autumn Bazaar
Contact: **Andy**
E-mail: **g8jac@btinternet.com**
The Coulsdon Amateur Transmitting Society (CATS) Autumn Bazaar will be held in the Scout HQ, Lion Green Road, Coulsdon, Surrey CR5 2RB at the rear of the council car park (free parking on Sundays!). Gates open at 1000 and it will finish at 1400. This year they have extended the time by popular request.

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. Look out for representatives from *Practical Wireless* and *RadioUser* at rallies printed in bold.

Letters Recieved by e-mail. A great deal of correspondence intended for 'letters' now arrives via E-mail, and although there's no problem in general, many correspondents are forgetting to provide their postal address. I have to remind readers that although we will not publish a full postal address (unless we are asked to do so), we require it if the letter is to be considered. So, please include your full postal address and callsign with your E-Mail. All letters intended for publication must be clearly marked 'For Publication'. **Editor**

amateur radio news & products

A comprehensive look at what's new in our hobby this month

Come and Learn with MKARS!

The **Milton Keynes Amateur Radio Society** (MKARS) offers free courses for the Foundation, Intermediate and Advanced Amateur Radio licences. All the courses are taught by experienced Radio Amateurs, with a very high level of first-time success. For details on taking part in training courses E-mail: **training@mkars.org.uk** or take a look at **www.mkars.org.uk/**

The MKARS meet every Monday night (except public holidays) at 1930 in the club room: (Green Room, B Block annex), **Bletchley Park, Wilton Ave, Bletchley, Milton Keynes MK3 6EB**. New members are always made very welcome.

For all membership enquires please contact **Information@mkars.org.uk**

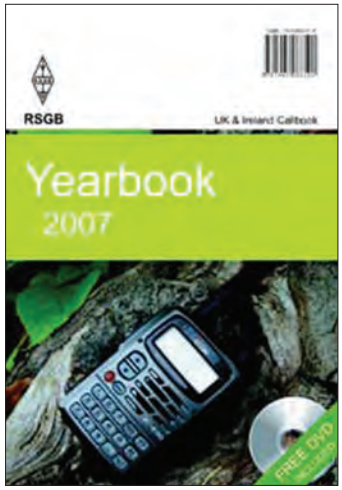
Different Foundations

The latest Foundation course run by the **Chelmsford Amateur Radio Society** (CARS) was different from usual in that one of the candidates was blind. This meant that a rethink was necessary on the way in which the material was presented and how the assessments were done.

The Chelmsford club contacted **Kelvin Marsh M0AID** from the **Radio Amateurs Invalid and Blind Club** (RAIBC) for help and advice on how to help the Foundation candidate. Kelvin (totally blind himself) kindly provided the club with an MP3 CD version of the RSGB *Foundation Licence Now*! training manual so the course could be completed successfully.

For further information on the courses run by the club, contact **Clive Ward G1EUC on (01245) 224577, E-mail: training2006@g0mwt.org.uk** If you're interested in learning more about the RAIBC take a look at **www.raibc.org.uk/**

In Stock Now!



The PW Book Store has just taken delivery of the brand new *RSGB Yearbook 2007,* edited by **Steve White G3ZVW**. This updated 2007 edition contains an up-to-date database of callsigns, names and addresses in the UK & Ireland Callsign Directory. Of the 504 pages there are 196 pages of information about the Society, clubs, licensing and operating.

Also included is a Video and Computer DVD. In video mode viewers can watch two short films, DXpeditions - for the rest of us and What is Amateur Radio'? These are also both available in mpeg format when the DVD is being used in a computer. The software on the DVD includes *WSJT* and *Spectran*, *WinDRM*, CW-RTTY-PSK-FSK-MFSK transmit/receive programs, soundcard packet and APRS, a locator calculator, satellite tracker and contest logging software.

The RSGB Yearbook is a mine of useful information and a must for every Radio Amateur. What are you waiting for order yours today direct from the **PW BooK Store, Tel: 0870 224 7830** for **£18.99 plus P&P.**

Looking for Speakers

The UK Microwave Group is seeking microwave experts to speak at its annual round table , which is being held at BT Adastral Park, Martlesham, Suffolk on 12-13th November. The round table is the UK's flagship Amateur microwave event, attracting more than 100 attendees from the UK, Europe and North America.

The organisers have already lined up some speakers for the event, but are still keen to hear from others interested in taking part. If you think you have something interesting to say about Amateur microwaves, contact the UK Microwave Group chairman, **Peter G3PHO, via: microwaves@blueyonder.co.uk.**

In addition to the lectures, the event will include a beginner's workshop for those new to Amateur microwaves, the UK Microwave Group's annual general meeting, an annual dinner at a local hotel and an indoor bring and buy market.
More information on the UK Microwave group can be found at **www.microwavers.org**.

Which, What, Who and When?

Often, when thinking about buying a piece of second-hand equipment, it's great to have some idea of what others think about the unit. Very often you know it's been reviewed in one of the radio magazines, but you're unsure when, or even which magazine. Now, you can find out which, what, who and when a piece of radio related equipment has been reviewed in *Practical Wireless, Short Wave Magazine, Radio Active* magazine or the new *RadioUser* magazine through the PW Publishing Ltd. website.

The web pages list in alphabetical order the magazine the month and the year of the review. The pages carry an almost complete listing and are being updated regularly. So, have a look at **www.pwpublishing.ltd.uk/reviews**

Send all your news and club info to
Donna Vincent G7TZB
at the PW editorial offices
or E-mail:
pwnews@pwpublishing.ltd.uk

Success - 250 Different Summits Activated!

Richard Newstead G3CWI recently became the first **SOTA** participant to activate 250 different summits (called Uniques in the SOTA programme). Having been involved in setting up the programme, Richard was able to get off to a good start, bagging two summits on the day SOTA started in March 2002.

Since then, Richard has travelled far and wide in search of new summits to activate, ranging from the far north of Scotland, across Wales to the very end of Cornwall and even right across to the west coast of Ireland. He has mainly used 7MHz c.w. for his activations and has a simple light-weight radio set-up consisting of an Elecraft KX1 running 3W, a Palm paddle and longwire antenna supported on a fishing pole.

Richard comments, "this has been a difficult achievement, getting to and from some very remote summits, often in poor weather conditions. Snow, rain and even hail have all been part of the fun. On one occasion I had to close down as I was no longer able to hear the radio due to the noise of hail and wind around me!"

Richard has carried out nearly 400 SOTA activations in total. He comments, it has been an ideal way to refine my portable radio set-up and techniques. And says, "I never know what problems I might encounter on a hilltop and have had time to develop efficient methods for carrying out SOTA activations come-what-may." He added that h.f. operating c.w. has proved ideal for SOTA as it works just about anywhere. Although, there were few c.w. participants in the early days of the award programme, there are now several dozen and he says it's always encouraging to hear friends calling him - especially when he's cold and wet.

Details of the Summits on the Air award programme can be found at **www.sota.org.uk**

Pennine Way Activations

As first mentioned in the News pages in the June issue of *PW*. **Jimmy Read M3EYP** (aged 13) and his dad, **Tom Read M1EYP**, have now completed the 268 mile Pennine Way trek from Edale in Derbyshire to Kirk Yetholm in Scotland. They set off from Edale on Tuesday 25 July, and finally arrived in Kirk Yetholm at 1840 on Sunday 13 August.

Although the pair are experienced hikers, this was their first long distance trail. The Pennine Way, as well as being the country's first National Trail, is also reputed to be one of the toughest.

Jimmy M3EYP and Tom M1EYP carried Amateur Radio equipment with them and made transmissions from eight summits along the route, as part of the SOTA (Summits On The Air) programme. They faced challenging weather on the summits, with temperatures of 34° on the first two days (Kinder and Black Hill) and then heavy rain and strong winds experienced on all of the other six summits! They did have some pleasant weather for walking on many of the days in between though! Tom and Jimmy also took the opportunity to climb some of the smaller hills in Southern Scotland on the day after they finished - Monday 14 August. Accompanied by good friend and Radio Amateur, **James McGinty M0ZZO**, Jimmy and Tom completed SOTA activations from Black Hill GM/SS-253, Sell Moor Hill GM/SS-211 and Linton Hill GM/SS-263.

Jimmy was raising funds for local children's charity 'Friends For Leisure', and although sponsor mony is still being collected and totals finalised, it's believed he has raised in the region of £1500 for the organisation, which provides leisure opportunities for disabled youngsters. Tom and Jimmy are particularly grateful for the support and generosity shown by the UK's Amateur Radio community and by locals in the Macclesfield area.

AMSAT-UK Welcomes Foundation Satellite Access

The changes to the Amateur Licence announced by Ofcom mean Foundation holders now have access to the Amateur Satellite Service. They will be able to work through the many Amateur Satellites as well as using the Voice and Packet repeaters on the *International Space Station* (*ISS*). They can also talk directly to Astronauts in space. All three astronauts currently onboard the *ISS* are licenced Radio Amateurs and in their spare time operate the *ISS* Amateur Radio Station usually on 145.8MHz f.m.

Every year AMSAT-UK runs a Satellite Beginners Workshop to teach newcomers how to operate through the satellites. Now that Foundation holders have this valuable new privilege, AMSAT-UK, can look forward to record numbers attending the next workshop.

Oscar News is AMSAT-UK's newsletter, which is packed full of Amateur Satellite information. For membership details contact the secretary:
Jim Heck G3WGM. Tel: (01258) 453959.
Email: g3wgm@amsat.org Website: http://www.uk.amsat.org/

Good Publicity

The Braintree Club recently participated in the annual **Gosfield Scarecrow Trail**. Residents of Gosfield are invited to make up Scarecrows and display them in their gardens. People come from miles around to view the event, which is held over two days on the 2 & 3rd September.

Braintree Club member **Geoff,** who lives in Gosfield, suggested that the club make up a Scarecrow and participate in the event with a club station running in his front garden. And so , 'Roger Ham' was born. 'Roger' was made up by various members and, as can be seen from the photographs, looked very convincing (what does that say about Radio Amateurs?).

The club also ran a competition to guess the longest distance contact made over the weekend and, despite poor conditions and very bad local QRN, the club made 35 contacts using the call **GX3XG**, the longest being UA9MC at a distance of 2855 miles. The prize of a Wind-Up Radio was won by a local resident. At 50p an entry the club made £57 to go to Braintree MENCAP. The small number of contacts made reflects the interest shown by the public, because the members spent more time talking and explaining Amateur Radio to visitors than operating!

Radio Officers Campaign

The frequency of 500kHz was officially recognised as the maritime calling and distress frequency by the International Wireless Telegraph Convention signed by 27 countries on 3 November 1906. In some parts of the world it is still in use as the calling and distress frequency using c.w., despite the use of satellites for the GMDSS system.

It was at the same convention that it was declared that SOS would be the international distress signal, although some Marconi operators continued to use CQD as well. The SOS system came into use on 1 July 1908 and was first recorded in use in 1909, this shows that the *Titanic* was not the first ship to send SOS in 1912, as is commonly reported.

The **Radio Officers Association** is using the centenary of the recognition of 500kHz to officially launch its campaign to maintain 500kHz as a 'heritage' frequency, to be operated, as it has been for a hundred years, and to recognise the fact that it has saved many thousand lives with the use of SOS. They will be operating a special event station to mark the centenary on Friday 3 November 2006 using the callsign **GB500KCS** from the Lizard site in Cornwall of the early Marconi Coast Station. The station will operate mainly on c.w. as befits the frequency it honours. On Saturday 4 November, GB500KCS will operate from the Poldhu Marconi Centre using c.w. and s.s.b.

Silent Key

Bob Devereux G4PYS - Secret Amateur

Rob Mannion G3XFD writes: I first got to know **Mike Devereux G3SED** in the mid-1960s when we worked on 1.8MHz. Mike then started his now famous business in a corner of his father's music shop in Portsmouth. Although, Bob Devereux never showed interest in his son's all consuming hobby, it turned out he had an Amateur Radio secret!

Mike Devereux G3SED writes: I enclose a picture of my father **Bob Devereux G4PYS** (aged 84 years) taken last year when **John G3WGV** took him flying for the 'trip of a lifetime' in John's new 'plane. My father talked about it for weeks after - it really gave him a lift. He passed away on 23 August 2006 in St Mary's Hospital, Portsmouth after a short illness

My father served in the RAF during the war as a radio operator/navigator and never lost his love for flying. It was his old RAF Morse key, left lying in a drawer that caught my eye in 1959, when I was just 12 years old and that started a life-long love of Amateur Radio!

Over the years, my father suffered a collection of very large (and dangerously erected) masts in our back garden, whilst the young G3SED tried to work the world on 1.8MHz. Yet not once did he express an interest in what I was doing, rather he told me off for being up half the night on the band!

Dad was an excellent c.w. operator - again I only found out after he got his licence, imagine all those years I operated and had no idea he could still read c.w.

I remember that in 1982, when I was called on 160 metres by a G4PYS. I thought I recognised the voice, it was none other than my father, who at the age of 62 had secretly studied for the RAE and Morse test gaining his licence and the callsign G4PYS! I was amazed, he had never shown any real interest in my hobby (I was licensed at the tender age of 15 years) and yet all the while he had been very proud of me and my radio achievements, only to follow in my footsteps just before he retired.

Dad worked for me as area sales manager briefly before he retired, he was a real inspiration to me and I'll miss him dearly.

Mike Devereux G3SED

Editor's comments: *I take this opportunity to thank Mike for the wonderful story of his father's secret passion and success as an Amateur. Normally, a Silent Key announcement tends to be sombre but both Mike G3SED and I laughed when the story was retold. Our sympathies go to Mike and his family.*

Rob G3XFD

amateur radio clubs

Keep up-to-date with your local club's activities and meet new friends by joining in!

Club Organisers: please include your event's full address, including its postcode, with any news item sent to us for publication.

HAMPSHIRE

Horndean & District ARC
Contact: **Stuart Swain G0FYX**
E-mail: **g0fyx@msn.com**
Website: **www.hdarc.co.uk**

Meetings of the Horndean & District Amateur Radio Club are held on the 1st and 4th Tuesday of every month at: the Lovedean Village Hall, 160 Lovedean Lane, Lovedean, Hampshire PO8 9SF. Doors open at 1930 and visitors are always welcome. Why not go along to one of these?: **November 7:** Social evening; **28th:** Talk by **Dave Bartlett** on 'Egypt, the island of Philae' and **December 5**:Social evening. Please note there will be no meeting on December 26.

KENT

Bromley & District ARS
E-mail: **bdars-news@hotmail.co.uk**
Website: **www.bdars.org**
The Bromley & District Amateur Radio Society meets on the 3rd Tuesady of every month in the Victory Social Club, Kechill Gardens, Hayes, (off B265, Hayles Lane) Kent BR2 7NG. Dooors open at 1930 for a 2000 meeting start. Future meetings include: **October 17:** Construction Contest and **21st**: A History of Radio (Part Deux) with **Ruth M0UYR.** Why not fo along and join in?

NORTHERN IRELAND

Antrim and District ARS
Contact: **David GI4FUM**
E-mail: **david@gi4fum.net**
Website: **www.gn4siw.co.uk**
The Antrim and District Amateur Radio Society (GN4SIW) meets in Greystone Community Centre on the Ballycraigy Road in Antrim on the 2nd Friday of each month at 1930. Forthcoming meetings include:
October 13: "Vintage and Military Radios" - speaker to be confirmed; **November 10:** "All about repeaters" - speaker to be confirmed and **16th:** AGM and club dinner at Massereene Golf Club. Guests and new members are very welcome to attend the meetings.

WEST SUSSEX

Horsham ARC
Website: **www.harc.org**
Horsham Amateur Radio Club meet the first Thursday for each month at the **Guide Hall, Denne Road, Horsham, West Sussex. NRQ TQ1** at 2000. The club offfers a variety of lectures covering a wide range of subjects and run two nets.In March and October the club hold a surplus equipment sale at which anybody can bring along items to be auctioned off. The club takes a small commission for this service. Check out the club website for more details and of fortchoming meetings.

Keep your club news coming to **pwnews@pwpublishing.ltd.uk** and **please remember** to include full details of your club, E-mail and telephone contact details and the **postcode** of your meeting venue - it helps potential visitors to find you!

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MX2000 HF/VHF/UHF internal Tri-plexer (1.6-60MHz) (110-170MHz) (300-950MHz) **£59.95**
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CS201-N Same spec as CS201 but wi h N-type fittings **£19.95**
CS401 Same spec as CS201 but4-way **£39.95**
CS401N Same spec as CS401 but wi h N-type fittings **£59.95**

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YS-130 Medium duty VHF **£79.95**
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RC5-3 Heavy Duty HF inc pre set cont ol box **£419.95**
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RC26 Alignment Bearing for RC5-1/3 ..... **£49.95**
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HKITHD-38 Heavy duty adjustable 3/8 hatch back mount **£29.95**
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RKIT 38 Aluminium 3/8 rail mount to suit 1" oof bar or pole **£12.95**
RKIT-SO Aluminium SO rail mount to suit 1" oof bar or pole **£14.95**
RKIT-PR Stainless SO239 rail kit to suit 1" oof bar or pole **£24.95**
PBKIT-SO Right angle SO239 pole kit with 10m cable/PL259 *(ideal for mounting mobile antennas to a 1.25" pole)* **£19.95**

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Enamelled copper wire 16 gauge (50mtrs) **£13.95**
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(Other lengths available, please phone for details)

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CDX Lightening arrestor 500 watts **£19.95**
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TMF-1.5 Fibreglass mast ★ 5 sections 200cm each ★ 60mm to 30mm ★ App ox 30ft erect 8ft collapsed **£179.95**
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HF Yagi

HBV-2 2 BAND 2 ELEMENT TRAPPED BEAM FREQ:20-40 Mtrs GAIN:4dBd BOOM:5.00m LONGEST ELEMENT:13.00m POWER:1600 Watts **£399.95**

ADEX-3300 3 BAND 3 ELEMENT TRAPPED BEAM FREQ:10-15-20 Mtrs GAIN:8 dBd BOOM:4.42m LONGEST ELE:8.46m POWER:2000 Watts **£329.95**

ADEX-6400 6 BAND 4 ELEMENT TRAPPED BEAM FREQ:10-12-15-17-20-30 Mtrs GAIN:7.5 dBd BOOM:4.27m LONGEST ELE:10.00m POWER:2000 Watts **£599.95**
40 Mtr RADIAL K T FOR ABOVE **£99.00**

Mini HF Dipoles (Length 11' approx)

MD020 20mt version app ox only 11ft **£39.95**
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(slimline lightweight aluminium construction)

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VR3000 3 BAND VERTICAL FREQ: 10-15-20 Mtrs GAIN: 3.5dBi HEIGHT: 3.80m POWER: 2000 Watts (wi hout radials) POWER: 500 Watts (with optional radials) **£99.95**
OPTIONAL 10-15-20mtr radial kit **£39.95**

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OPTIONAL 10-15-20mtr radial kit **£39.95**
OPTIONAL 40mtr radial kit **£14.95**

EVX5000 5 BAND VERTICAL FREQ:10-15-20-40-80 Mtrs GAIN: 3.5dBi HEIGHT: 7.30m POWER: 2000 Watts (wi hout radials) POWER: 500 Watts (wi h optional radials) **£169.95**
OPTIONAL 10-15-20mtr radial kit **£39.95**
OPTIONAL 40mtr radial kit **£14.95**
OPTIONAL 80mtr radial kit **£16.95**

EVX6000 6 BAND VERTICAL FREQ: 10-15-20-30-40-80 Mtrs GAIN: 3.5dBi HEIGHT: 5.00m RADIAL LENGTH: 1.70m(included) POWER: 800 Watts **£299.95**

EVX8000 8 BAND VERTICAL FREQ:10-12-15-17-20-30-40 Mtrs (80m optional) GAIN: 3.5dBi HEIGHT: 4.90m RADIAL LENGTH: 1.80m (included) POWER: 2000 Watts **£319.95**
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(All verticals require grounding if optional radials are not purchased to obtain a good VSWR)

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(Hi grade heavy duty Commercial Antennas)

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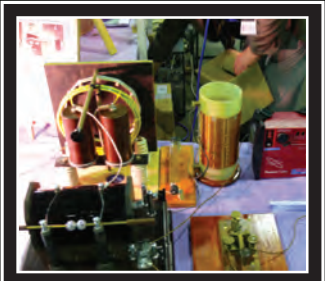
MTD-3 (3 BAND) FREQ:40-80-160 Mtrs LENGTH: 32.5m POWER: 1000 Watts **£99.95**
MTD-4 (3 BAND) FREQ: 12-17-30 Mtrs LENGTH: 10.5m POWER: 1000 Watts **£49.95**
MTD-5 (5 BAND) FREQ: 10-15-20-40-80 Mtrs LENGTH: 20m POWER:1000 Watts **£89.95**
(MTD-5 is a crossed di-pole with 4 legs)

ALL PICTURES ARE FOR REFERENCE ONLY

The 35th Leicester Radio Show Report

Although not quite on the same scale as the Dayton or Freidrichshafen, there were still over 100 traders and plenty of visitors over the two day show, which is unusually on a Friday and Saturday. The event supports a lecture programme covering a wide range of topics as well as the usual Bring & Buy and trade stands. Many of the local and national radio groups, such as the Royal Naval Amateur Radio Society, RAFARS and Radio Amateur Invalid and Blind Club (RAIBC) are represented over the weekend, giving members a chance to meet up.

Outside there is always a Flea Market area with a very wide range of radio-related goodies on offer - and some non-radio ones too. There were many visitors seen carrying large bags of cooking and eating apples from one of the Flea Market stands!



There really was something for everyone!

Yaesu had a very impressive stand, which is always interesting to watch being built and taken down. Paul Bigwood and Ailsa Turbett can be seen here with the FTDX-9000, the h.f. and 50MHz transceiver.

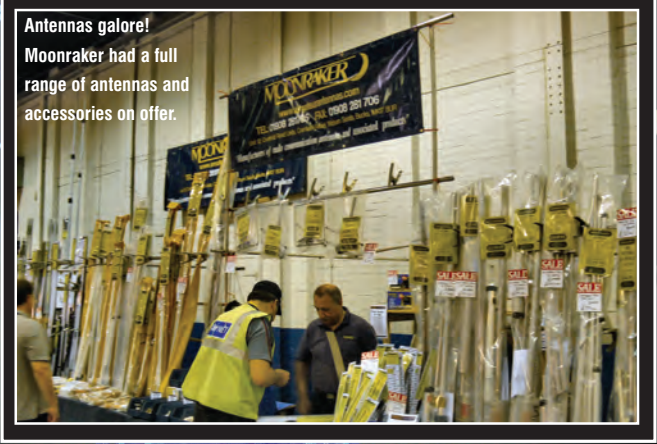
The queue soon built up as the sun shone and the bargain hunters eagerly awaited the doors opening.

Specialist interest groups like the Royal Air Force Amateur Radio Society are always well represented at the Leicester show, offering the opportunity for old friends to be reaquainted and new members to be signed up.

The new Icom IC-R9500 professional communications receiver was on show and created a great deal of interest with both visitors and other traders alike. Chris Danby (RSGB advertising manager) and Peter Lowrie (Northern Ireland Region Representative) were taking a close look.

Garry Austin from Tetra Communications has told us that they raised £311.60 at the show for Macmillan Cancer Support. He said that a big vote of thanks was due to the many visitors who contributed to this worthwhile cause.

Kenwood always have a bright stand. David Wilkins G5HY was just one of the staff on hand to answer visitors questions on the range of Kenwood equipment available.



Antennas galore! Moonraker had a full range of antennas and accessories on offer.

doing it by design

Tony Nailer G4CFY, continues his design work on a double sideband suppressed carrier transmitter project. However, he's worried about the 'deafening' silence!

The previous article in this series, in the September issue *PW*, so far has been greeted with a deathly silence. Except for an Amateur at the Wimborne (**Flight Refuelling**) Rally in August, who asked me if I had actually built the whole thing!

Maybe the readers are not interested in the double sideband suppressed carrier (usually referred to as d.s.b.), or are not going to get involved until I do the power amplifier stage and output filter? The other possibility is that a QRP d.s.b. transmitter on its own is of little value.

Or it could be that developing it into a transceiver will be of more interest. So, after the transmitter is complete I'll proceed with a matching direct conversion (DC) receiver.

Microphone Amplifier Board

Since producing the previous article, a small quantity of Microphone Amplifier printed circuit boards (p.c.b.s) has been made. One of these has been built and tested and during construction I noted that Tr2 as shown in the diagram, Fig. 5 (p17 September 2006 *PW*), is the wrong way round. In the prototype board, at the start of the article, it can be seen that it is back-to-back with Tr1.

With Tr2 correctly fitted, the microphone amplifier gave a gain of about eight times, to the signal from a standard 600Ω microphone. Next, I had to build the diode ring mixer again. (The one in the original prototype is still hiding under a stack of papers at the *PW* office!).

Then I built and tested the IF/RF Amplifier board as detailed in the last article. The units were all hooked together and a 7.9-8.4MHz Portland VFO with Buffer 2 attached. My own v.f.o. is set up for 70MHz working. I also connected a Two Tone Oscillator (TTO) to the microphone amplifier board.

Circuit Testing

Then, it was time to begin circuit testing. Initially nothing happened! I checked the stages individually for solder splashes and shorts and did a number of direct current (d.c.) tests to verify the stages were working properly. I was foxed for a bit as I could not work out the reason why there was no d.s.b. output.

Eventually, when I undertook alternating current (a.c.) tests I found the v.f.o. was delivering signal to the ring mixer but the microphone amplifier board was not delivering signal to the mixer. Disconnected from the mixer and it worked fine! Only then did the reason dawn on me - I had connected the microphone amplifier to a toroid input. The toroid winding appears as almost a short circuit at audio frequencies!

I rearranged the ring mixer so that the v.f.o. was fed to a toroid winding and the microphone amplifier was connected to a centre tap winding. Then things started to go right!

Initially, I was overdriving the r.f./i.f. amplifier as distortion was evident on the envelope on the 'scope. Turning down the audio drive I then started tuning the coil of the amplifier stage. The signal kept increasing as the core went in and I had to keep backing off the audio from the TTO.

Eventually, I went through resonance and then back to the peak. The core still had more tuning range and will be fine for use on 7-7.1MHz.

The gain of the system was extremely high, but the *Q* of the tuned circuit on the i.f./i.f. amplifier was so high that the signal fell off sharply as I tuned the v.f.o. The solution was to 'dampen' the tuned circuit with a resistor fitted in the position provided on that board.

Flat Response

To achieve a flat response across 100kHz at 7MHz means choosing a -3dB bandwidth of let's say 200kHz. This corresponds to a *Q* of 7MHz/200kHz = 35. Now the inductance of the 3892 TOKO coil is 2.7µH. f = 7.9MHz in this case.

The inductive reactance will be XL = $2*\pi*f*L$.

XL = $2*\pi*7.9*10^{6}*2.7*10^{-6}$.

XL = $134*10^{6}*10^{-6}$ = 134.

The damping resistance Rd required will be *Q**XL.

Rd = 134*35 = 4690Ω. (Use 4.7kΩ).

This resistor was added and the output was almost flat across a 100kHz range, as required.

An additional effect was that some of the excess gain had been traded for bandwidth. The drive from the TTO was also now at a more realistic level. Using just one tone from the TTO gave a d.s.b. signal, which looks the same as that using

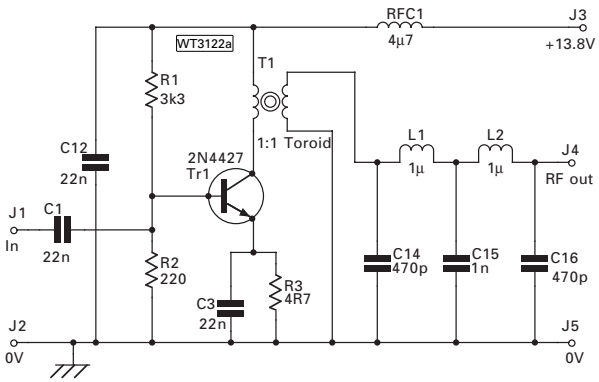


Fig. 1: Circuit of a prototype low-power, r.f. power amplifier circuit capable of producing around 300-500mW.

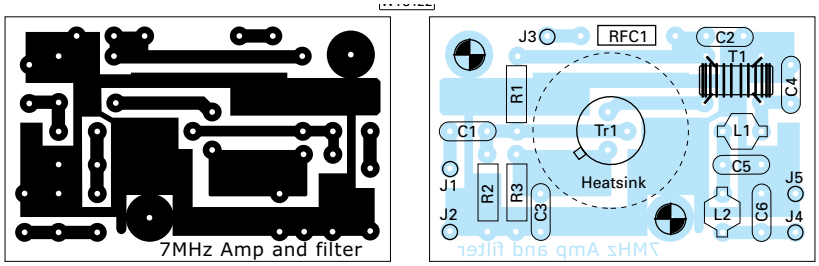


Fig. 2: Track pattern and overlay diagram of the circuit shown in Fig. 1.

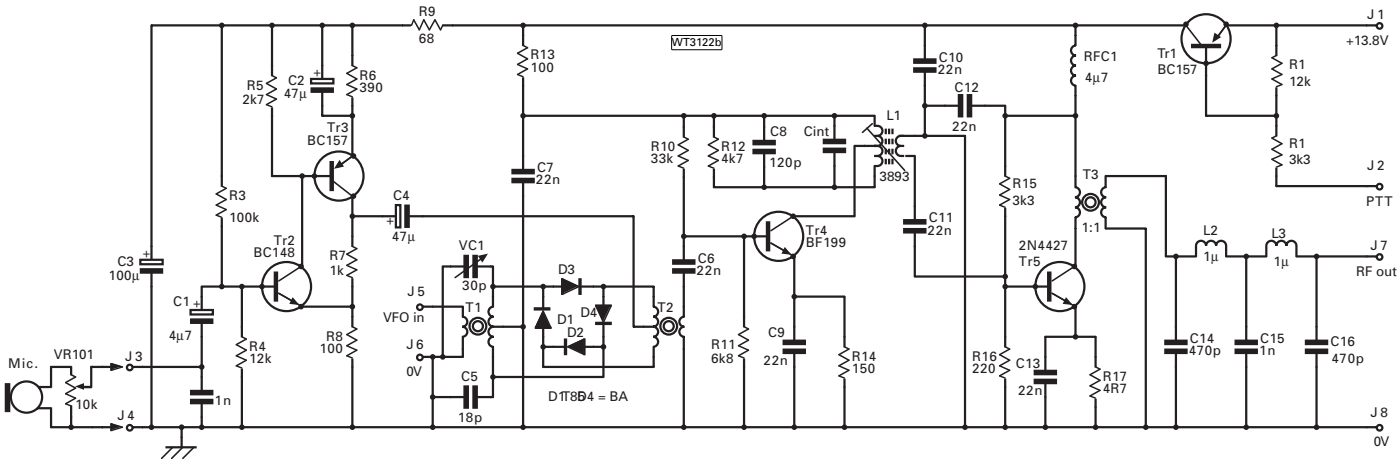


Fig. 3: The full circuit of the 7MHz d.s.b. transmitter that incorporates the mini-p.a. stage of Fig. 1.

two tones with an s.s.b. transmitter.

Tests with and without modulation revealed a carrier feed-through of about 80mV p-p without modulation, and 3V p-p fully modulated. This is a ratio of 1:37. The carrier suppression is therefore 20*Log(37) = 31dB. This is not as good as I would like, as I always aim for 40dB.

Perhaps there was supply line-feed through, or crosstalk, or maybe just poor diode and toroid balance? To check, I tested the supply rail with the 'scope and found it carried about 100mV of carrier on it. Decoupling it didn't have any effect though and so I think it must be mixer imbalance.

A Trick

A trick I learned from my days of owning an FL-100 transmitter, was to pad one side of the mixer ring with a fixed capacitor and to pad the opposite side with a trimmer capacitor (trimcap) of double the value. The trimcap can then be adjusted to reduce the carrier imbalance.

This was done and improved the feed through to 60mV, a suppression now of 34dB. Still not particularly good but quite usable With QRP gear the signal at the other end is likely to be low S-units. So, a carrier even just 30dB down is likely to be buried in the noise.

The RF Amplifier

Next, I started looking at the r.f. amplifier. I had intended here to experiment with a power m.o.s.f.e.t. of some sort but thought it would be a good idea to get something conventional going first. I eventually chose the familiar 2N4427 bipolar device for this job.

Not knowing in advance how much power I would achieve, I guessed at 500mW output. With an efficiency of 66% this is about 750mW d.c. input. With a 13.5V supply and a saturation voltage of, let's say 1.5V, it provided an a.c. swing of 12V. For an input of 750mW the collector current would be 62.5mA.

Note: This device has a maximum d.c. current gain of 200 and I will assume a typical of 100 to be on the safe side. This means that at 62.5mA collector current, the base current would be 62.5/100 = 0.63mA.

The base bias chain then needs to carry at least five times this for stability. This means the total base bias resistance needs to be between 3 and 4kΩ.

In order to allow the collector as much swing as possible, the voltage across the emitter resistor needs to be kept low, only maybe 100mV. Let the base voltage be about 800mV, then the emitter will be about right.

The top resistor Rt of the bias chain is chosen initially to be 3.3kΩ.

Let the bottom resistor be Rb.

Then 0.8V/13.5 = Rb/(Rt + Rb).

Multiplying out gives 0.8*(Rt+Rb) = 13.5*Rb.

0.8*Rb + 0.8*Rt = 13.5*Rb.

Then 0.8*Rt = (13.5 - 0.8)*Rb.

Finally Rb = 0.8*Rt/12.7.

Rb = 0.8*3k3/12.7 = 207.8Ω. (Use 220Ω).

If the emitter voltage being 0.7V below the base, is 0.1V. Then for a quiescent current of 20mA the emitter resistor Re will be Re = 0.1/0.02 = 5Ω. (Use 4.7Ω).

All input and decoupling capacitors should be chosen to be nominally 1Ω at 7MHz.

So XC = 1 = 1/(2*π*f*C).

Then C = $1/(2*\pi*f*7*10^6)$

C = $1/(44*10^6)$

C = 0.022µF.

The Collector Circuit

Now comes the tricky bit, what to do about the collector circuit? The load that a collector presents is RL = $V^2/2*Po$, where V is the collector swing and Po is output power. If the device runs 0.5W and the collector swing is 12V then RL = 144/1 = 144Ω. If the power is 1W out then RL = 72Ω.

Without knowing the output capability in advance, it's not really possible to choose the correct transformation. Obviously, one route would be to design a tunable network, which can be tweaked for maximum output. It 's an option I might come back to later!

For simplicity, I assumed the output might be as high as 1W and I decided on a

1:1 transmission line transformer. The alternative would be to use a 2:1 transformer, which would match properly for an output power of 360mW.

A 1:1 transformer can be made easily by twisting two wires together and winding a toroid about three quarters full of turns. The toroid should be a ferrite type to provide a high *mu* factor. Almost any type will do and will need to be a convenient size between say 6 and 12mm diameter.

I found a 12mm toroid I use for d.c. supply line filtering and wound 12 turns of a twisted pair onto it. The circuit as shown, **Fig 1**, was constructed without the output filter and added to the breadboard transmitter. A dummy load wattmeter was connected as a load. The Track pattern and overlay are shown in **Fig. 2**.

Switched On

The system was switched on and immediately showed significant output. The coil on the r.f./i.f. amplifier was tuned and the power came up to about 600mW. Viewed on the 'scope the envelope was asymmetrical. The top parts were as before but the lower halves of the envelope were cramped.

This is indicative of Class AB, where the amplifier works over the whole of half a cycle and just a bit of the other half cycle (this is what was expected!). The spectral display of this also revealed a number of high level harmonics. When these are removed by a low-pass filter the signal looks symmetrical again.

Low-Pass Filter

The low-pass filter came next. And although it's now common practice to use a three section Pi network low-pass filter, I decided that for QRP work a two section harmonic half-wave type would be suitable. This type has particular advantages. It is easy to design, its response is smooth within the pass band and gentle beyond cut-off. Its output is phase shifted 180° from its input but otherwise it's a mirror image of its input.

The design is very basic - just consider two individual Pi networks each with components with 50Ω reactance. Now, join them together so the middle capacitor becomes twice its value and consequently half its reactance.

Let fc = 7.1MHz.
Let XL = 50 = $2*\pi*f*L$,
then $L = 50/2*\pi*f*7.1*10^6 = 1.12\mu H$.
I'll assume that L is 1µH.

Let XC = 50 = $1/2*\pi*f*C$, then $C = 1/2*\pi*f*50$,
$C = 1/2*\pi*7.1*10^6*50 = 0.00035\mu F = 448pF$.

Use 470pF for the end capacitors and 1nF for the middle one. For my version I used 400pF at each end and 820pF for the middle capacitor.

The filter was built onto the r.f. amplifier and the unit was put into transmit. The power now registered was just 300mW, but the envelope observed on the 'scope was symmetrical with low level distortion.

Kits & Bits

The RF Amplifier p.c.b. costs £3. P&P 75p.
The p.c.b. and component parts including heat sink and wound toroid £8.50. P&P £1.50.
The 7MHz DSB Transmitter p.c.b. costs £6. P&P 75p.
The p.c.b. and component parts including heat sink and wound toroids £19.75.
The microphone gain 10kΩ log potentiometer costs £1.50. P&P £1.50.

Next, I wound up a trifilliar transformer to produce a 2:1 ratio and tried it. No output power at all! The transistor just got hot and I have no explanation for this, as two of the windings were in series as the primary and the other as the secondary. They were checked with a continuity tester, before and after the test.

I also tried a push-pull pair of 2N4427s with trifilliar input and output transformers but there was no output from that either. I also tried using a VN66AFD f.e.t. with the 1:1 transformer in its drain circuit but that didn't work either! There are reasons why each of these variants did not work but there wasn't time to find out why.

Complete Project

Having a usable stage using the 2N4427 with 300mW output, I decided to cease development and complete the project by laying up the p.c.b.s. I then laid out the r.f. amplifier with the filter as a stand alone unit. This could be used together with the Microphone Amplifier unit, the DiBD Mixer section, and the r.f./i.f. Amplifier board to make the complete d.s.b. transmitter.

The complete circuit of the 7MHz d.s.b.transmitter was drawn up and is shown in **Fig. 3**. It includes a simple p.t.t. circuit, which is not included in the other modules. A p.c.b. was laid out for this and is shown together with the component placement in **Fig. 4.**

If you wish to correspond about this project. First send a blank E-mail with subscribe in the subject box to **pw-g4cfy-on@pwpublishing.ltd.uk**

Note it is .ltd.uk and not .co.uk When the server responds, you can correspond using **pw-g4cfy@pwpublishing.ltd.uk**

Your E-mail will be answered by the *PW* team or myself. You will also share views of other subscribers to this list. Cheerio for now.

PW

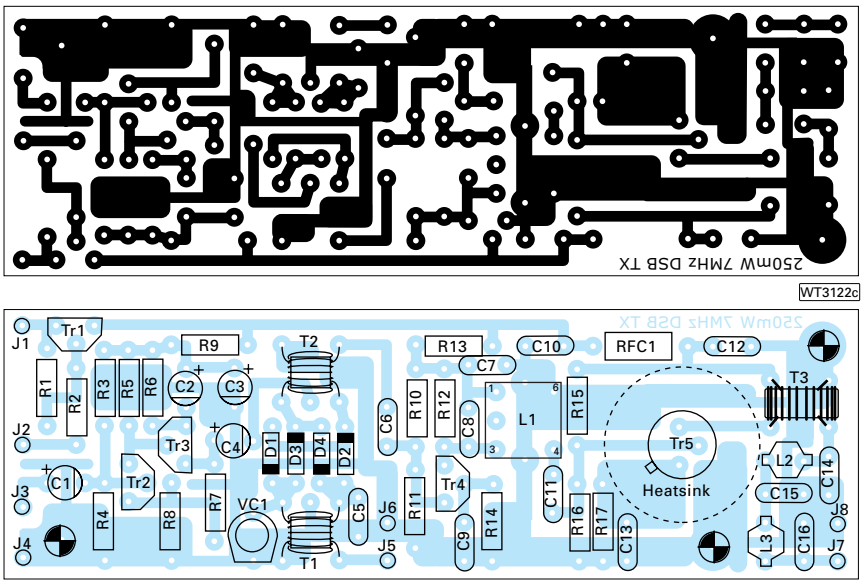
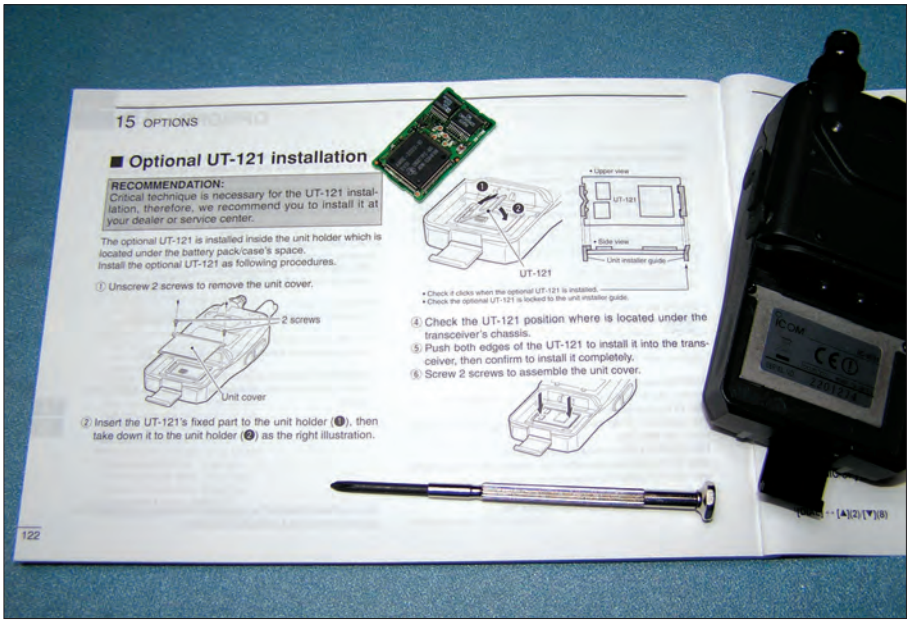


Fig. 4: Track and overlay patter of the circuit of Fig. 3.

The UT-121 Board & RS-91 Software

Having had his appetite whetted during the evaluation of the IC-91E, Richard Newton G0RSN has now had the chance to take an extra look at an Icom add-on digital communications unit.



Although the UT-121 digital board and RS-91 software looked daunting at first, Richard G0RSN found that it was not a difficult task as he first thought, as he describes in this review.

I recently had the pleasure of reviewing the Icom IC-91E dual-band hand-held transceiver and the programming software. I had great fun using this great little rig while on holiday in Shropshire, making full use of its extended receive capability as well as enjoying great contacts with local Amateur Radio stations.

One aspect of the Icom IC-91E that I was unable to report on at the time, was the fact that the rig can be fitted with the UT-121 (**Fig. 1** and **2**) an optional digital communications module (Fig. 1 and 2). This was because none had arrived in the country at that time. As soon as they arrived, Icom were kind enough to return the Icom IC-91E to me along with a UT-121 to have another look at the rig in its full glory!

Digital Voice & Data

With the UT-121 Digital Unit fitted, the transceiver is capable of both digital voice and data communication. Incidentally, readers may remember that I had the opportunity to try out digital voice last year when I reviewed the Icom IC-V82 hand-held radios. These were quite rugged, p.m.r. style rigs, whereas the Icom IC-91E is built more with the Amateur market in mind. It was going to be interesting to draw a comparison!

Before I could do anything, I had to fit the UT-121 module. It seemed a bit of a daunting prospect considering the cost of the module, coupled with the fact that the handbook very sensibly suggests the module is fitted by a dealer!

However, I soon discovered my fear and trepidation were without foundation as the instructions were very easy to follow. The socket for the module is located under the battery compartment and is accessed by removing two small screws with a jeweller's screwdriver. The module then just slips into the socket and the job is done. Easy as A B C and the whole job was over in five minutes. I then turned the rig on and I was up and running, it was that simple!

Digitally Enabled

The digital mode works only on Band B of the IC-91E and obviously it's only possible to communicate with other digitally enabled rigs. But, Icom were kind enough to supply me with an IC-V82 hand-held and an IC-2200H mobile rig.

Selecting the digital mode on the Icom IC-91E was very simple indeed. I just toggled through options using a one button press control action.

The audio quality in digital modes is quite different to normal audio. It has that processed, almost 'flat feel' to it but the thing that really strikes me is the clarity and the almost complete absence of background noise. Indeed, it's quite uncanny.

If a digital transmission is monitored on a normal radio only white noise will be heard, likewise a normal signal on a digital radio will be indecipherable. This may cause a problem when operating on a frequency, as you may not hear if the frequency is in use. But worry not! The Icom IC-91E has a really great function to solve this problem.

The operator can set the rig to automatically check an incoming signal, if it's digital the receiver will decode it. If it's a normal transmission the receiver will switch and the transmission will be heard as normal. **Note:** To reply it's necessary to come out of digital mode.

Operating in Digital mode is quite different to normal radio, here the operator sets their callsign and the radio transmits this each time the transmit button is pressed. This will be decoded by other stations on the same frequency. In use, the operator can also set callsigns they want to call, or the rig can be set to the 'CQ' mode to put out a general call.

New World

Basically, the digital mode opens up a whole new world to explore! For example, the operator can even set the rig to transmit a short message with their callsign. Receiving stations will get a message such as 'hello' or perhaps during a RAYNET exercise it could be set to transmit a callsign with a message to 'Check Point 1'.

It's also possible to send and receive low-speed data communications. For this an optional cable and software are required.

Note: I discovered that when I connected

the Icom IC-91E to a computer using the OPC-1529R data cable it would log incoming calls and display the station call sign. This included any preset message, the length of the transmission, plus other information besides. It struck me that yet again these facilities offer a real advantage in RAYNET exercises or similar situations.

Information From GPS

The IC-91E will also accept information from a geographical positioning system (GPS) receiver using RS232/NMEA format. The GPS can be connected to the data socket of the IC-91E and will transmit the station's position information at the same time as the voice transmissions.

It would take a human interface to turn the received information into a position on a map but I am sure there must be some way to capture and feed it directly into mapping software designed to accept GPS information. It would just mean playing around and making up some leads. Sounds dangerously like good old fashioned Amateur Radio to me!

One feature that really caught my imagination was the auto-reply. This links a voice recorder function and the operator can record voice notes or even segments of received audio.

I recorded a message, "Hello, thanks for your call, I am not by the radio right now but will be back soon, from G0RSN." I then set the rig to auto-reply and to use the voice recording. When a digital station calls, specifying my callsign the rig would then recognise it as a call for me and automatically transmits the recorded message!

I'm sure there are some unattended operation conundrums here if I were to leave it on monitoring while I was out. But it was fun playing with it nonetheless!

Much Easier

In comparison to the IC-V82, the IC-91E is much easier to configure. Digital set-up menus are a challenge to begin with and the menu layout of the IC-91E is much better, with the added bonus of the programming software there's no contest!

Fig. 1: Getting down to the job - Richard G0RSN quickly inserted the digital p.c.b. and was soon on the air (see text).

I'm not sure how digital communication will take off for the everyday chit-chat, time can only answer this question. Despite this, I have been very impressed with the audio quality offered by digital voice communication on both the IC-91E and the IC-V82 in noisy situations, where good quality communications is important. I can see this having a real use in emergency communications such as RAYNET.

The other tantalising feature of this digital stuff is that it is new - it opens up new possibilities and things to explore and find applications for. It's something to tinker and play with. Isn't that what the hobby is all about? Have fun!

PW

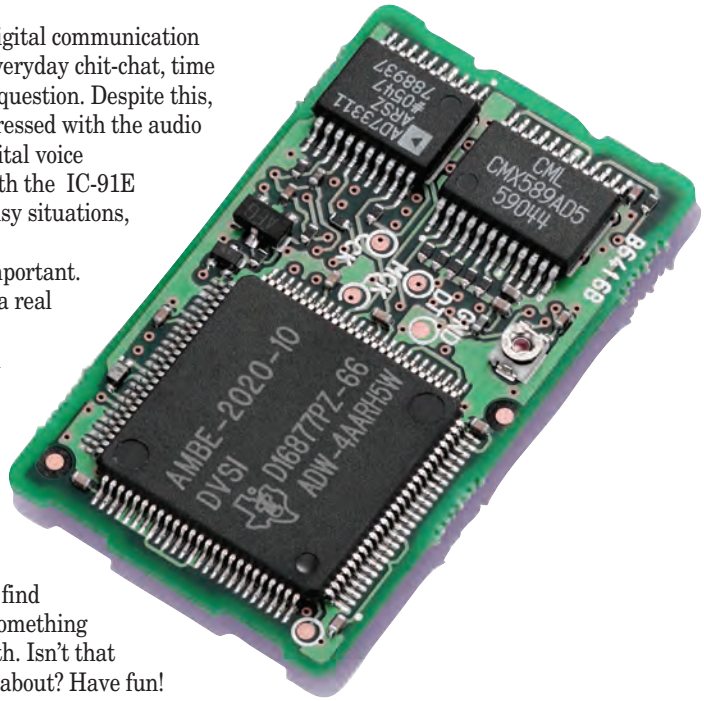


Fig. 2: A close up view of the Icom UT-121 digital board. Once installed Richard thoroughly enjoyed the transceiver's performance using the digital mode.

Product
Icom UT-121 digital panel p.c.b. and RS-91 software.

Company
Icom UK Ltd.

Contact
Sales **(01227) 741741**

Pros
Easy to install...impressed with audio quality...real use for RAYNET...opens up new possibilities to explore and enjoy.

Cons
Possibly the price! (as per my original review).

Price
UT-121 digital board £129.96 including VAT.
Software RS-91 £58-76 including VAT.

Supplier
My thanks for the loan of the review items go to **Icom UK Ltd., Sea Street, Herne Bay, Kent CT6 8LD.**
Tel: (01227) 741741
FAX: (01227) 741742
E-mail: sales@icomuk.co.uk
website: www.icomuk.co.uk

The Practical Wireless 144MHz QRP Contest 2006 Results

Neill Taylor G4HLX, presents the results of the 2006 contest. It was a wonderfully sunny day and the main disappointment was that although the some of our friends in Ireland joined in, none submitted an official entry!

Ever hopeful beaming towards the UK! Neill Taylor G4HLX operating with his French callsign F5VLD, perched on top of Mon Ventoux (JN24) in the deep south. He tried in vain although many stations were beaming towards the south!

Rob Mannion G3XFD/EI5IW writes: Once again I have great pleasure in thanking Dr Neill Taylor G4HLX for his hard work organising the QRP contest. It's been a little more difficult this year as Neill is working on a major EU nuclear accelerator project in the south of France. Mind you, he didn't escape the rare snow there earlier in the year! Thank you Neill for your great support and help. Hopefully, in *PW*'s 75th anniversary year we will have a much better entry level and those friends of ours in Ireland who joined in this year are encouraged to submit an entry for the 2007 contest. Thanks again Neill, and here's to next year! **Rob**

The 2006 Results

A blazing hot sunny day was enjoyed by most contestants in the 23rd annual *PW* 144MHz QRP Contest on 11 June. With 56 of the 63 stations who entered choosing to go portable, this was welcome weather. Radio conditions were not the greatest but there were still a lot of good contacts to be made.

A close contest for the top position ended with **Chris Owen M0WEN/P**, as the overall winner. Congratulations to Chris, this is only the fourth time in 23 contests that a single operator has been the winner! Chris has been entering the QRP contest for several years, previously in a multi-operator group, from a site in IO93 square near Sheffield. This year his achievement wins him the *Practical Wireless* QRP Contest Winner's Cup, which was presented to him in September at the **Leicester Amateur Radio Show**.

Fig. 1: Tony G0OVA/P , in Surrey said it was "Very hot!"

In second place, narrowly, is **Dave Hewett GW8ZRE/P**, **Fig. 1**, who wins the runners-up shield, also presented to him at the Leicester show. Dave had been the leading single operator on seven occasions since 1996, and in fact at the Leicester show he also received, somewhat belatedly, a trophy to mark this achievement last year, the **2005 Nevada Trophy**, sponsored by **Mike Devereux G3SED** of Nevada. Curiously, this year Dave was expecting someone to beat him but didn't think it would be Chris (more on this later).

No Entries From Eire

There were two entries from Northern Ireland, but none from Eire, so the *PW* EI/GI Trophy Clock is won by **Ralph Gault 2I0RPM/P**. This trophy is donated annually by **Rob Mannion G3XFD/EI5IW**, to the

leading EI or GI station, and it would be nice to see a bit more competition for it. For the first time ever, there were no entries from north of the border in Scotland, meaning that the trophy sponsored by Tennamast (Scotland) Ltd., in Memoriam to **Frank Hall GM8BZX** remains unclaimed.

Oldham Radio Club

Worth a note is the leading fixed station, the **Oldham Radio Club G1ORC**, who have been entering the contest for many years from portable sites. In 1998 they were the overall winners and have often been found near the top of the results table.

Last year they were absent, so it's good to see them back this year, operating from their club shack and taking the leading fixed station spot. Let's hope they'll be back on a hilltop next year!

Tables & Website

Other details of the results will be seen in the tables, and a full detailed results list can be found on the website **www.contest.org.uk**

All leading stations, including the leaders in each locator square, will be sent a certificate marking their achievement, as will all entrants who submitted the corner-flash coupon published with the rules. These certificates have again been sponsored by **Chris Rees GU3TUX**, now firmly settled in his Alderney location; 12 entrants were happy to work Chris in the contest for the valuable IN89 square.

Incidentally, I was grateful to Chris for sending me his log as a check log, and also to the others who sent check logs: **Andy Foad G0FTD/P**, **Ken Coxon G0HDV/P**, **Roger Piper G3MEH** and **Ian Hasman G3XFU**. Thanks everyone, you're most helpful!

Locator IO83JA

But let's go back to the goings-on in locator IO83JA. This has long been the favourite spot for **Dave GW8ZRE/P**, from where he has been very successful, as noted earlier. This year he was joined in IO83JA by **Charlie Jordon GW0PZO/P**, who has also been entering the contest for very many years.

The two stations were about 3.6km (2 miles) apart. "After several years of being leading single operator," writes Dave, "I decided to attempt to help Charlie. I attempted to send as many stations as possible to Charlie's frequency in the hope he might just pip 'ZRE to the finishing post!"

Nice try, Dave but while Charlie had the larger number of QSOs, Dave's square multipliers were more numerous, leaving Charlie in third place overall. But get this, in case two stations in the same locator isn't enough, Dave reckons there's space for two more. "Perhaps next year we could attempt a new record of how many stations could operate from IO83JA", he says, "Cyrn-y-Brian has two more possible sites along the ridge." Anyone interested in risking this and with a particularly bullet-proof receiver front-end, is invited to contact Dave direct!

Weather & Problems

The glorious hot weather was noted by many entrants, although with it came two common problems, the first noted by **Tim Raven G4ARI/P**, **Fig. 2**, "fantastic weather, even though I did get sun-burned" and the second by **Tony Crake G0OVA/P**, **Fig. 3**, "it was an incredibly hot day and although I took four litres of water and a big flask of tea by the end I was feeling very tired and started to make daft mistakes like speaking without pressing the PTT! I think this must be down to the dreaded dehydration."

The good weather did not last in all regions, though, for example the **Trewellard Radio Group MX0TRG/P**, near Penzance, Cornwall commented that "it turned cold and misty and by late afternoon with an hour to go, tipped down and made unpacking the radio gear even harder."

Unfortunately, the good weather conditions contrasted with the radio propagation conditions, which most operators found mediocre at best. "Propagation was only average", observes Tim Raven G4ARI/P, "where were all the GM and EI stations, and also despite searching all day I never heard any signals from IO84?"

Indeed there were no entries from either Scotland or the Republic of Ireland. It was the same over in Holland where **Contest Club Alkmaar PI4ALK/P**, **Fig. 4**, in JO22 square, reported "conditions very poor this year. It was very hot too, on top of the sand dunes so we stopped at 1200 UTC as there was not a single station for us to work."

Since the contest takes place at the start of the sporadic-E season, we are always hopeful of an opening, but as often happens the best was a tantalising burst that resulted in no QSOs. **Derek Southey G0EYX/P** (in IO82) writes "the conditions were varied, starting off with hearing Europe very strong then all went quiet from there." And in Cornwall, the Trewellard Radio Group MX0TRG/P (IO70) reported "we heard a 9A Croatian station calling, but he disappeared into the noise very quickly."

If anyone was over-optimistic of a sporadic-E opening, it was probably myself. My work has exiled me to the south of France for all of 2006 and I could not arrange to be in the UK on the day of the contest. Instead, I took to the highest convenient nearby mountain, Mont Ventoux near

Fig. 2: Tim G4ARI/P, operating from the position which earned him a dose of sunburn!

Fig. 3: Dave GW8ZRE/P, one of two stations operating from IO83JA - is there room for any more?

Fig. 4: Gert PA1VW, operating the station of Contest Club Alkmaar, PI4ALK, on top of a very hot sand dune near the North Sea coast. With no stations to to work because of the poor v.h.f. conditions, they gave up because of the tremendous heat!

Avignon, in JN24 square, and operating as **F5VLD/P**, beamed towards the UK all day in the forlorn hope of a brief opening to let me join in the action. Of course it never happened, and I'm grateful to several entrants who commented, like Tony Crake G0OVA/P, "I kept beaming to France but did not hear you."

At least, I can claim to have been the station at the highest altitude, over 1900m a.s.l. and with an almost cliff-edge take-off to the north. Despite being more than 500m higher than Ben Nevis, Mont Ventoux is very accessible, with good roads to the summit from both east and west sides. Unfortunately, I chose the east route initially only to find, two-thirds of the way up, that it was closed for a sporting event (no notice had been given at the bottom!).

It took me more than two hours to descend, find a route around to the west side (encountering another closed road on the way), and make my way up the mountain. I would have been particularly annoyed if my late start on-air had led to my missing an opening, but of course the truth is that the whole venture was wildly optimistic.

Someone else who had moved to an outlying location for the contest was **Ron Gray G4AWO**, who writes, "in past years I have entered from IO91, a highly populated part of the country. From Devon it's a whole different ball game. What a pity stations do not work the weaker stations first and leave the loud ones till last."

Paul Webster F/PE7B/P explains how the hot weather led to him changing his location: "my original intention was to activate the JO10JS square Loker, in Belgium. However, the weather on the day was tropically warm and sunny with temperatures in excess of 30°C and the originally planned operating location did not offer any form of shade whatsoever from the sun. The day started therefore, not with setting up the station, but rather with a search of the hills for a location offering some form of shade. The search actually ended across the border in France!"

Operating On AM

In the article published with the rules, at the suggestion of Andy Foad G0FTD, I recommended that those interested in the use of amplitude modulation (a.m.) on 144MHz could use the opportunity to have an activity period in the last hour of the contest in the sub-band 144.500 - 144.550MHz, in view of recent renewed interest in this mode. Unfortunately, this seems not to have resulted in any a.m. contacts.

Andy himself says, "I was disappointed by the lack of any a.m. QSOs." Several others say that they gave it a try, like **Roger Lapthorn G3XBM**, "although I was keen to try for some a.m. QSOs I did not get any takers to my calls using a.m. on 144.55MHz in the last hour of the contest."

Nevertheless, Andy G0FTD did send in a check log with his single sideband (s.s.b.) contacts and explains that the experience was a revelation to him: "It was the first time that I had ever put any real effort into anything above 29.7MHz. I must confess that I've only ever treated 2m as something I use for the local packet link or to chat across town occasionally. So, I decided to use the event in an 'activity day' concept just to see what I could achieve with a minimal set up. I made a 3-element beam from an old Band II v.h.f. f.m. antenna and my shopping trolley

Overall placings

Pos	Callsign	Station Name	Points
1	M0WEN/P	Chris Owen	3600
2	GW8ZRE/P	Dave Hewitt	3450
3	GW0PZO/P	Charlie Jordan	2983
4	G4RLF/P	SADGITS	2596
5	M0ERG/P	Eagle Radio Group	2486
6	G4ARI/P	Tim Raven	2261
7	G0AOD/P	Dave Heathcote	1980
8	G2XV/P	Cambridge & District ARC	1785
9	GW4EVX/P	Ron Price	1620
10	M0SGB/P	M0SGB	1566
11	G0OVA/P	Tony Crake	1548
12	GW4IDF/P	Malvern Hills 'B'	1479
13	G2CP/P	Scarborough A.R.S.	1314
14	G7WAY/P	Stuart Foster / Roger Davis	1305
15	M0UKR/P	Norfolk Mountain Rescue	1292
16	G2HDF/P	The Midland Contest Group	1258
17	G1WOR/P	Worthing & District Amateur Club	1246
18	G6ZYD/P	Andrew Jervis	1241
19	G8VOI/P	Bob Reeves	1173
20	G3BPK/P	Wigan-Douglas Valley ARS	1156
21	G3VGG/P	Bromsgrove & D.A.R.C	1110
22	G5RV/P	MSARS	1092
23	G0EYX/P	Derek and Paul	1054
24	G6SFP/P	Nigel Ramsey	966
25	G4RUL/P	Alastair Turner	960
26	MW1DOU/P	Barry and Graham	884
27	G1WKS/P	West Kent ARS	812
28	G4FAA/P	Lawrie Atkinson	768
29	G4NVM/P	J E Duddridge	735
30	G1ORC	Oldham Radio Club	715
31	GW3BV/P	Quentin Cruse	644
32	G4VRC/P	Bob Doran	637
33	G4TJE/P	Clifton Country Club	540
34	G6LD	Denby Dale Amateur Radio Society	528
35	G0JJG	Joe Butt	476
36	G4MCQ/P	G4MCQ and G4EIA	407
37	G4VFG/P	Peter Lewis	372
38	G4JYN/P	Waterside (New Forest) Amateur Radio Society	348
39	G0VZV/P	David A'Bear	330
40	2E1HWQ/P	Sean William Cannon	308
41	G0ECX/P	Hayfeaver Contest Group	288
41	G6MXL/P	Colin Redwood	288
43	G0LJD/P	Brian Howard	270
44	G4AWO	Ron Gray	234
45	2E0ELC/P	Patrick Hawkins	224
46	2I0RPM/P	Ralph Gault	216
47	G0TLK/P	Bromley & District Amateur Radio Society	207
48	2E0TLB/P	Fred Smith	200
49	MX0TRG/P	Trewellard Radio Group	192
50	G4RYV	David Rumbold	171
50	G0NWT/P	North Norfolk Amateur Radio Group	171
52	G3XBM	Roger Lapthorn	162
53	G4ZDT/P	Terry and Dave	132
54	GX8PRC/P	Plymouth Amateur Radio Club	112
55	M0WTD/P	Slawomir Gajda	110
56	M3JYH/P	Gary Swain	105
57	G0TUK/P	Steve Tucker and Ian Pomfret	85
58	GW0VPR/P	St Tybie Amateur Radio Society	70
59	GI0OUM/P	Richard Ferris	60
60	G7XYZ	The Man from Wem	56
61	PI4ALK/P	ContestClub Alkmaar	42
62	F/PE7B/P	Paul Webster	40
63	G3WDS/P	Denis Spooner	6

Table 1: Practical Wireless 144MHz QRP Contest 2006.

station. I walked up the local hill and was shocked to be working as far as Yorkshire, Wales and Norfolk from here in Kent."

While Andy, like so many before him, discovered the thrill of long-distance contacts with a simple 144MHz station, Ron Gray G4AWO started with excitement of a different sort: "in past years I have teamed with my son Mark G8AWO for this event but now we live 250 miles apart so individual entries had to be made but on the lighter side, Mark was my first contact, which gave me a very big buzz."

Newly Formed Groups

Newly-formed contest groups often try to come up with original names. One of the oddest, displaying a touch of humorous sarcasm, is surely that of **M0UKR/P**, '**Norfolk Mountain Rescue**'. **Mark Tuttle G0TMT** explains, "we came up with the team name of 'Norfolk Mountain Rescue' during a pub discussion about our biggest problem in any of the v.h.f./u.h.f. contests we enter; that of the sheer lack of anything resembling a hill in Norfolk." Their location is certainly no mountain but at a mere 45m above sea-level it's considerably higher than the Fenland it overlooks.

The group attempted to compensate for the low altitude with a good antenna system and report, "Our team member **2E0AWG** welded his 30-foot crank-up tower to a rebuilt boat trailer a couple of years ago and we can now wind up a decent antenna array. We spent many long hours surfing the net for designs and inspiration and settled on the BV02 8-element Yagi for two metres. We figured that a couple of them would give us approaching 15dBd of gain and still maintain a useful 35° beam-width.".

It seems that the group's effort worked, they ended up the highest placed of any of the 16 stations in the JO squares.

First Taste

It's very satisfying that every year we welcome operators having their first taste of v.h.f. contesting. "This was my first ever contest", writes **Bill Cannon 2E1HWQ/P**, as well as several others.

But it's also great to have regulars who come back year after year, such as **Rob Mott G0ECX**, who remarks, "you may be interested to know that I have taken part in the *PW* contest since the first one 23 years ago, it is the only contest I ever enter."

Ron Price GW4EVX/P is another regular, and like many other entrants he sums up the day thus: "Very enjoyable contest as usual!"

So, let's start to plan for next year's contest, as it's never too early. The date will be **Sunday 10 June 2007**, and we hope that many stations will take to the air in celebration of the *Practical Wireless* 75th anniversary year. Rules and information will be published in *PW* in due course, and keep your eye on the contest website **www.contest.org.uk**

Good luck to you all! **PW**

Leading Stations

Category	Name	Callsign
Overall Winner	Chris Owen	M0WEN/P
Runner Up	Dave Hewitt	GW8ZRE/P
Leading Single Operator	Chris Owen	M0WEN/P
Leading Multi-Operator	SADGITS	G4RLF/P
Leading Fixed Station	Oldham Radio Club	G1ORC
Leading English Station	Chris Owen	M0WEN/P
Leading Welsh Station	Dave Hewitt	GW8ZRE/P
Leading N. Ireland Station	Ralph Gault	2I0RPM/P

Table 2: Leading stations in 2006.

Leading single-operator stations

Pos.	Name	Callsign	Score	QSO	Sq	Loc	Tx/Rx	Antenna	asl(m)
1	M0WEN/P	Chris Owen	3600	180	20	IO93	TR751E	12 ele ZL-special	415
2	GW8ZRE/P	Dave Hewitt	3450	150	23	IO83	TR751	7 ele ZL-special	561
3	GW0PZO/P	Charlie Jordan	2983	157	19	IO83	FT817	9 ele Tonna	577
6	G4ARI/P	Tim Raven	2261	119	19	IO92	FT817	14 ele MET yagi	237
7	G0AOD/P	Dave Heathcote	1980	99	20	IO93	FT817	9 ele Tonna	488
9	GW4EVX/P	Ron Price	1620	108	15	IO83	FT817	9 ele yagi	526
10	M0SGB/P	M0SGB	1566	87	18	IO83	FT290	12 ele ZL-special	477
11	G0OVA/P	Tony Crake	1548	86	18	IO91	IC706 Mk2G	13 ele modified Tonna	75
18	G6ZYD/P	Andrew Jervis	1241	73	17	IO93	IC706 Mk2G	14 ele Parabeam	426
19	G8VOI/P	Bob Reeves	1173	69	17	IO90	IC211e	13 ele Tonna	90

Table 3: Leading single operator stations.

Leading multi-operator stations

Pos.	Name	Callsign	Score	QSO	Sq	Loc	Tx/Rx	Antenna	asl(m)
1	Coventry Contest Group	M0CUS/P	7035	201	35	IO91	IC-910	2 x 17 ele Tonnas	300
3	North Wales Wafflers	GW0CCR/P	2470	130	19	IO82	FT-736R	4 x 17 ele Tonna	560
4	Chris Owen & Stuart Dobbs	M0WEN/P	2358	131	18	IO93	TR751E	17 ele Tonna	415
5	Stuart Foster / Roger Davis	G7WAY/P	2310	110	21	IO92	FT-847	17 ele Tonna	320
7	Bristol Contest Group	GW6YB/P	2280	114	20	IO81	FT-290R	9 ele Tonna yagi	750
9	Wigan-Douglas Valley ARS	G3BPK/P	1649	97	17	IO83	IC-746	12 element yagi	168
10	Scarborough Am. Radio Society	G2CP/P	1520	80	19	IO94	FT-221	2 x 9 ele Tonna yagis	296
14	M0SUM/P	M0SUM/P	1392	87	16	IO83	FT-290R	4 element beam	477
17	Denby Dale ARS	G4CDD/P	1309	77	17	IO93	FT-736	14 element beam	274
18	Cambridge & District ARC	G2XV/P	1296	72	18	IO92	FT-290R/Mutek	9 ele Tonna	77

Table 4: Leading multi-operator stations.

Leading station in each locator square

Square	Name	Call	Entrants In square
IO70	Trewellard Radio Group	MX0TRG/P	2
IO74	Ralph Gault	2I0RPM/P	2
IO80	SADGITS	G4RLF/P	7
IO81	Malvern Hills 'B'	GW4IDF/P	3
IO82	The Midland Contest Group	G2HDF/P	5
IO83	Dave Hewitt	GW8ZRE/P	8
IO90	Worthing & District Amateur Club	G1WOR/P	4
IO91	Tony Crake	G0OVA/P	8
IO92	Tim Raven	G4ARI/P	3
IO93	Chris Owen	M0WEN/P	7
IO94	Scarborough A.R.S.	G2CP/P	1
IO95	Denis Spooner	G3WDS/P	1
JO00	MSARS	G5RV/P	2
JO01	West Kent ARS	G1WKS/P	6
JO02	Norfolk Mountain Rescue	M0UKR/P	5
JO03	Sean William Cannon	2E1HWQ/P	1
JO10	Paul Webster	F/PE7B/P	1
JO22	ContestClub Alkmaar	PI4ALK/P	1

Table 5: Leading station in each locator square.

Off-air Frequency Standard

Stefan Niewiadomski needed an accurate frequency standard, enterprising as usual, he built his own instrument, locked to a very accurate frequency signal.

An accurate frequency source is very useful in the shack. It can be used to provide an accurate time base for frequency counters, a clock source for multiplying up to higher frequencies and accurate marker pulses up to the v.h.f. regions for receiver calibration purposes. This unit provides selectable 10, 1MHz or 100kHz 1:1 mark/space ratio or narrow pulse waveforms, as well as a frequency accurate 1kHz sinewave output.

The frequency of such a source is very accurate because it's locked to a radio transmission, hence the name 'off-air' frequency standard. The 400kW Radio 4 transmitter on 198kHz at Droitwich, in the English Midlands, maintains an extremely accurate frequency. It's frequency-locked to a Rubidium standard 'clock' and maintained to an accuracy of one part in 10^{11}, which is around one second in 31,700 years.

The Droitwich transmitter is intended for reception in England, Wales and Ireland. In Scotland the Westerglen and Burghead transmitters also transmit on 198kHz, and maintain the same accuracy.

The off-air standard that I'm about to describe, takes about 60mA from an external 12V power supply. This saves the cost and complexity of an in-built mains powered supply, though one can be fitted if a self-powered unit is required. The unit has been tested with a supply voltage down to 9V making portable operation from a 9V battery perfectly possible.

While creating this unit, it struck me that it would make a good club project! With younger members building and testing the boards under the supervision of more experienced members. I say this because the design contains most of the fundamental building blocks used in electronics and therefore makes a good learning experience, especially if a little more research is done to investigate how the blocks work beyond my relatively simple explanations.

The electronic blocks built in my designs include: an r.f amplifier, r.f mixer, passive and active filters, op-amps and transistors, a voltage controlled crystal oscillator, a phase locked loop and loop filter, digital divider chains and pulse generator. The boards for the project are single-sided, relatively simple and can be marked out by hand (as were my prototypes) before being etched.

Circuit Description

The block diagram is shown in **Fig. 1** and the circuit diagrams of the receiver, **Fig. 2**, the 10MHz generator and divider, **Fig. 3** and the 1kHz generator and filter, **Fig. 4** comprise the complete unit. The 198kHz signals from the long wave transmitter (as already explained) are received on the ferrite rod winding, tuned by the parallel combination of C1 and C2. The *n*-channel f.e.t. Tr1 buffers the tuned circuit and amplifies the 198kHz signal, passing it to the NE602 mixer IC1.

Injection of the local oscillator, at 200kHz is supplied to pin 6 of IC1 from the wiper of R5 which sets the level of the injected voltage. This injection waveform has been filtered by C13, C14 and RFC3 forming a low-pass filter to ensure 'good' mixing.

The output of the mixer is filtered before IC2, amplifies the remaining audio signal by ten times (set by the ratio of R8 to R6). The output of IC2 passes, via R11, to an audio p-filter. Resistor R11 matches the 1kΩ drive impedance of the filter.

There's a passive low-pass filter, with a cut-off frequency of about 3kHz that feeds dual op-amp IC3 and associated components, forming a sharp 2kHz active band-pass filter. Resistor R13 sets the centre frequency of the active filter and allows the filter frequency to be set to exactly 2kHz.

The band-pass filter op-amp, IC3, is followed by op-amp IC4 which further amplifies the 2kHz signal and drives its output close to rail-to-rail This stage drives the comparator input of the 4046B phase comparator IC8, via potential divider R24 and R25. The signal also drives the signal strength meter M1, via the rectifier and smoothing network D2, R26, and C27.

A mid-rail voltage is generated for the

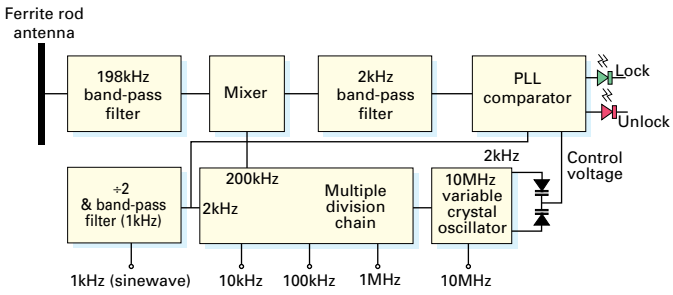


Fig. 1: The block diagram of the Off-Air Frequency Standard

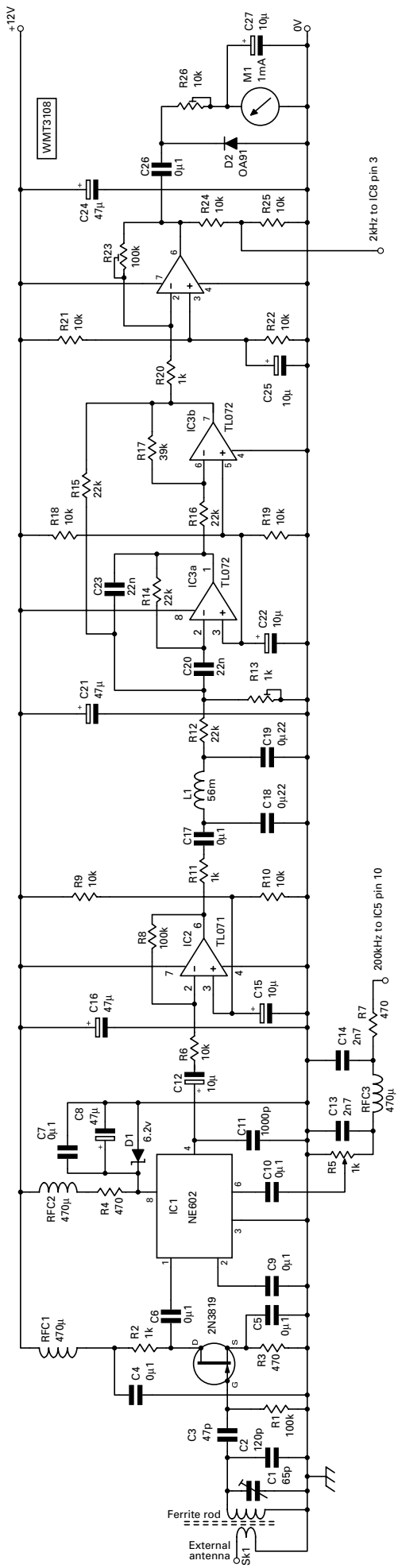


Fig. 2: The receiver and 2kHz i.f. processing section of the project.

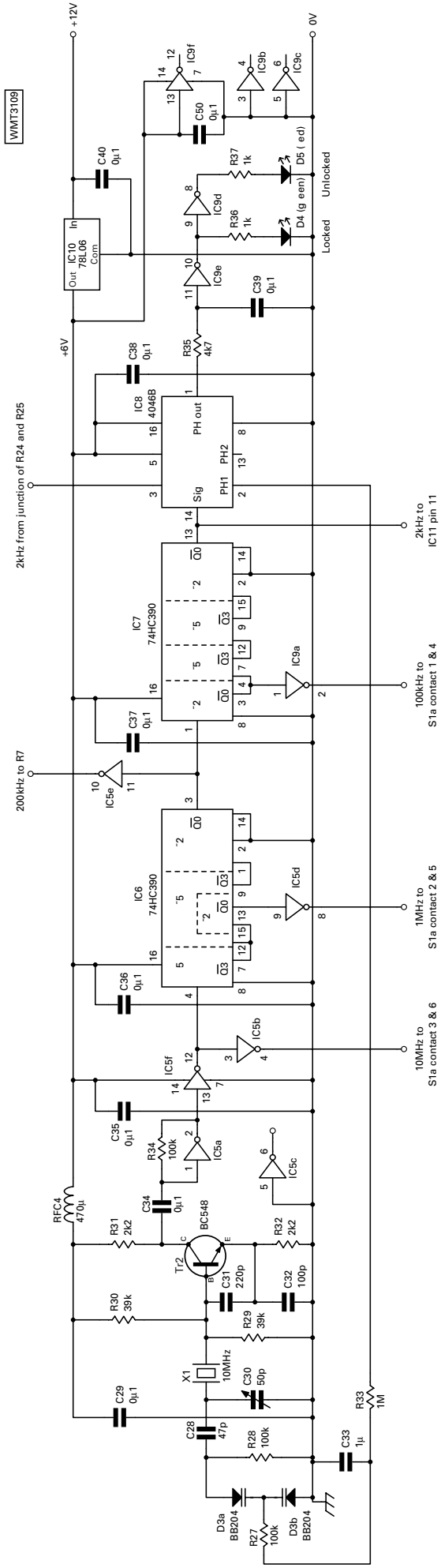


Fig. 3: The 10MHz reference oscillator and frequency division circuits.

non-inverting inputs (+input) of each of the op-amps by simple potential divider resistor networks decoupled by a 10µF capacitor for each i.c. The potential divider approach also has the advantage that whatever the supply voltage, the networks still generate a mid-rail voltage. I've found that the supply could be operated down to below 9V, making battery operation possible.

Into The Mixer

Now let's look at how the 200kHz signal injected into the mixer i.c. is generated, and how the phase-locking action of the receiver works. In Fig. 2, transistor, Tr2 and associated components, form a 10MHz voltage controlled crystal oscillator (VXCO) whose basic frequency is set by a 10MHz crystal. The actual frequency of oscillation is determined by the variable capacitor C30, and dual varicap diode D3.

Changes in temperature will also change the exact frequency, due to changes to the crystal and the capacitance value of components. The centre frequency is set by C30, but the varicap diode(s) lock the exact frequency to 10MHz under the control of the control voltage applied via R33.

The 10MHz output of Tr2 is amplified and limited by 74HC04 inverter IC5a, biased as an amplifier, before buffering by another inverter IC5f. The 'square' 10MHz signal 'clocks' IC6 and is also fed to a switch, S1, via IC5b.

A dual divider chip, IC6 (a 74HC390) contains two divide-by-5 (÷5) and two divide-by-2 (÷2) stages. The routing through IC6 is unusual. The first ÷5 feeds both the second ÷5 and the first ÷2. This stage ensures that the 1MHz created, has a waveform with a 1:1 mark/space ratio.

The second ÷5 stage (with the first ÷5) forms a ÷25 stage, its 400kHz output is further divided to produce a 200kHz signal with a 1:1 mark/space ratio at pin 3. This signal is fed to the receiver mixer via a low-pass filter, as described earlier.

The 200kHz signal from IC6 also drives another 74HC390 device, IC7, which further divides down the signal. The first ÷2 stage inside IC7 produces a 1:1 mark/space ratio 100kHz signal for output via inverter IC9a.

The final output of IC7, pin 13, is at 2kHz, feeds pin 14 of IC8, the 4046B phase comparator and to one part of the dual-latch, IC11, connected to provides a further divide by two. This gives a 1kHz waveform to filter and use as an audio reference signal (see later).

The two-stage filter, around IC13, operates similarly to the 2kHz filter of IC3 but with a 1kHz centre frequency The filtered 1kHz sinewave is passed to Sk3 via d.c. blocking capacitor C47.

The phase-lock loop i.c., IC8, compares the 2kHz reference signal from IC7 and the recovered 2kHz signal from the receiver chain. The PH1 output (pin 2) of IC8 produces pulses, that after filtering, create a voltage level, used to correct the phase (and the frequency) of the recovered and reference 2kHz inputs via the VXCO.

A further filtered output of IC8 (pin 1) drives l.e.d.s D4 and D5, via IC9. Diode D4 (green) indicates that the system is in-lock and D5 (red) that indicates an unlocked state. The reason for having two l.e.d.s is explained later.

Depending on its setting, S1a passes 100kHz, 1 or 10MHz to IC14, which produces narrow negative-going pulses at

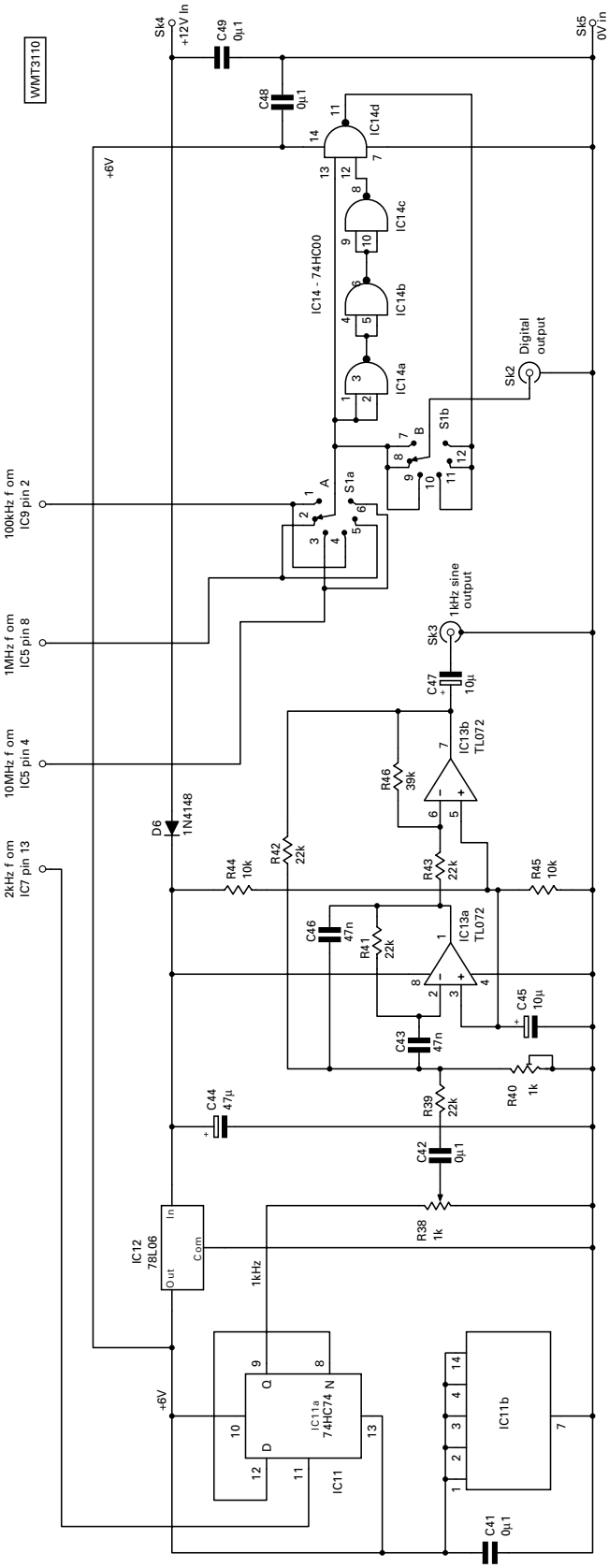


Fig. 4: Final 1kHz generation and filtering section of the project.

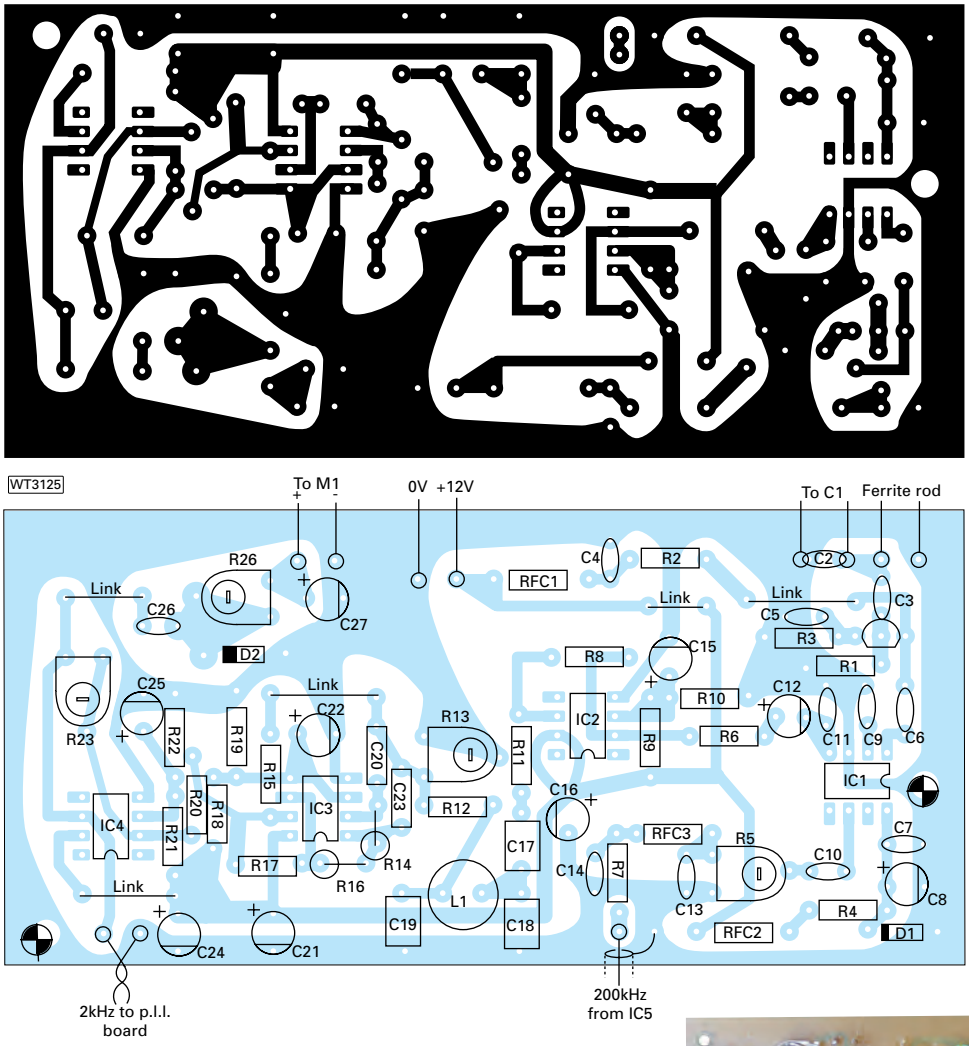


Fig. 5: The track pattern and overlay of the receiver section.

pin 11. The chain of IC14a/b/c produces an inverted and delayed version of the input waveform, and this is 'mixed' with the original input, so forming the pulses on the output.

The narrow output pulses being rich in harmonics, are used to create signals from h.f. to v.h.f. at multiples of 10, 1MHz or 100kHz. Switch S1b selects whether 1:1 mark/space ratio or narrow pulse versions of the output waveform are output at Sk2.

External 12V DC power is connected to the unit via D6 to prevent any damage to the unit if the external supply is connected the wrong way round.

Three Board Prototype

The prototype unit was built on three printed circuit boards (p.c.b.s), referred to as the receiver board **Fig. 5**, digital board, **Fig. 6**, and 1kHz generation and filter board, **Fig. 7**. I used sockets for all the dual-in-line i.c.s, as this makes testing the unit easier and avoids the risk of damaging the i.c.s if they're soldered into the boards.

When making up the boards, mount the components in ascending order of size, taking care to correctly orientate all devices. There are several wire links on the board, all of which can use bare copper wire because there is no risk of shorting to any components on the board. **Note:** I use clipped off resistor leads for the links.

Insert 1mm terminal pins into the holes for the inputs and outputs to the board to facilitate inter-board wiring, rather than trying to insert wires into the board itself. C2 and C1 are mounted in parallel on terminal pins.

The ferrite rod antenna (Maplin code LB12N) had four leads to the winding and it wasn't obvious which wires connected to the long wave winding. I measured the resistance between the wires and between one pair I measured about 1.5Ω and between the other pair I measured about 10Ω. This was therefore the winding I used.

A few turns of insulated wire were wound at the other end of the rod. This winding was fitted to allow connection to an external antenna.

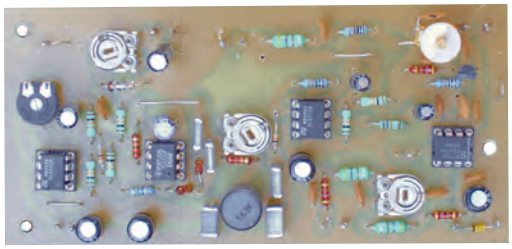
There are five trickier links, labelled A-E on the digital board of Fig. 6. These links should be made with insulated wire to prevent danger of shorting to components on the board. Only the end-points of these links are shown but simply connect A-A, B-B and so on.

In the prototype unit, the 10, 1MHz, and 100kHz connections and the 200kHz connection to the receiver board were made using miniature r.f. coaxial cable, type RG-174. Miniature audio screened cable or simple twisted pairs should be used for the audio frequency connections.

The layout of the prototype unit can be seen in **Fig. 8**. Make sure you have all the panel-mounted components before you start drilling: exact dimensions of components may vary considerably. Capacitor C49 and protection diode D6 are mounted on the input connections.

Setting Up & Using The Unit

Before starting, again check the locations and polarity of the components on the three boards and check all solder joints, with no solder bridges or shorts on the undersides of the boards. Before plugging in the external power supply, check that it is set to 12V and preferably limited to 100mA.



I found that the best way to test the unit is to start with the digital board, starting without the i.c.s fitted and the other two boards un-powered and unconnected. This allows power shorts and wiring errors to be isolated very easily.

Connect the power to the digital board and check that the 6V regulator IC10 is working correctly by measuring the voltage across the supply pins of the i.c.s and all should be close to 6V. It should now be safe to move to the next stage of testing without danger of damaging the i.c.s. Though they're not expensive, it's certainly inconvenient if you haven't got a spare!

Now turn off the power to the digital board, insert IC5 (74HC04) and turn it on again. You can now check that the 10MHz VCXO on the digital board is oscillating at the correct frequency under the control of the crystal, which it will be as long as all the components are mounted correctly. Note that a this stage, IC9 has not been inserted and so the oscillator control line is floating. Check that rotating C30 varies the VCXO frequency.

Monitor the output of IC5f with an

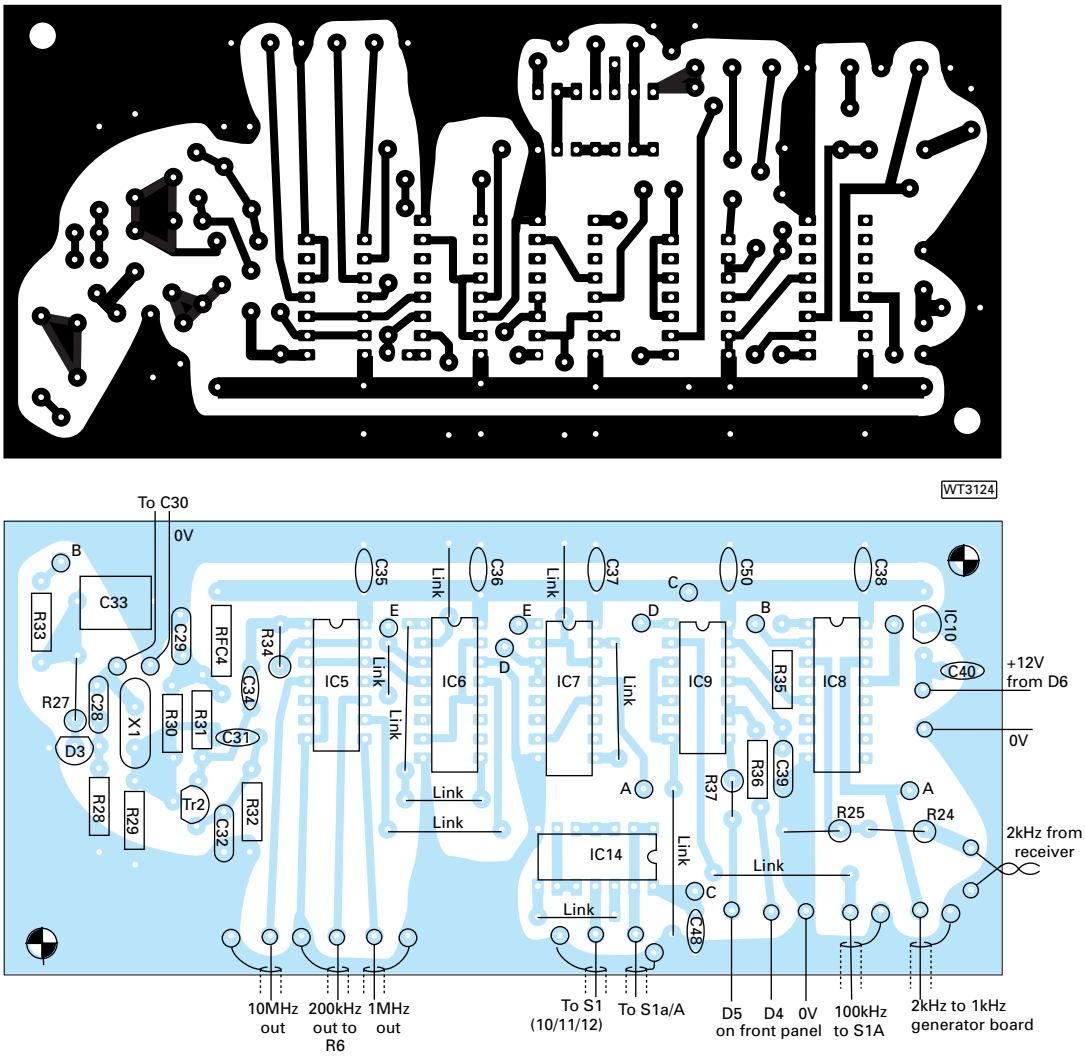
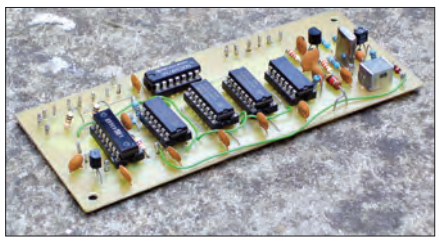


Fig. 6: The digital p.c.b. section. Note: IC14 of Fig. 4 is mounted on this p.c.b.



oscilloscope and verify that it is a squarewave with a period of about 100ns, or use a frequency counter if available. If the insulated link (B-B) from IC9 is removed and a variable supply (between 0 and 6V) is applied to the VCXO, the basic frequency can be seen to vary. The exact frequency and range are not too important.

Turn the power off, insert the other i.c.s and turn the power on again and check the frequencies down the divider chain, verifying that the various frequencies are as expected. The supply current of the digital board should be about 25mA.

At this stage both l.e.d.s will probably light. If either is unlit might be connected the wrong way round. So, it's worth checking them again and reversing their connections to see if they then light.

The receiver board can now be connected up to the digital board. Again start with all the i.c.s unplugged and check that the +12V rail voltage is present on the correct pins of the sockets. Also check that the mid-rail voltages are present at the +ip pins of the op-amps. Set all the pre-set potentiometers to about mid-way.

Now insert IC1 and verify that a sinewave at 200kHz (from the digital board) is present at pin 6 and that its amplitude can be varied by adjusting R5. Set R5 at about its mid-point.

Turn off the power, insert IC2, IC3 and IC4 (being very careful with their orientation), and switch on again. With the ferrite rod winding connected to the input of the receiver, a deflection on the signal strength meter, M1, should be seen. This should be increased and decreased by adjusting R23, as it sets the gain of the limiter stage.

If an excessive deflection on M1 is seen, rotate R26 to produce a reasonable reading. Also the signal strength should peak as the tuning capacitor, C2, is rotated. Choose the position, which gives the best reading on M1. The 2kHz filter centre frequency also needs to be peaked at 2kHz by adjusting R13.

Check that a 2kHz signal is present at the output (pin 6) of IC4, and half that amplitude at the junction of R24 and R25. The supply current of the receiver board should be about 30mA.

The setting up process sounds more complicated than it actually is and will be completed fairly quickly. In most areas the ferrite antenna will give a strong signal but in some remote areas an external wire antenna may need to be connected to Sk1.

A good way of checking that everything is working correctly once the adjustments have been made, is to remove IC1 and the reading on M1 and the 2kHz signal at the output of IC4, should disappear. This indicates that the filter and amplifier stages are stable and not oscillating.

The 1kHz board can now be checked. Connect it to the digital board, initially with the socketed i.c.s not inserted. Check that the correct supply voltages are present on the i.c. socket pins. Insert the i.c.s into the 1kHz board. The total supply current of the unit should now be about 60mA at 12V. Reducing the supply voltage to 9V should produce a reduction in the supply current of about 10mA.

The Q output of IC11a (pin 9) is a 1kHz squarewave. Now monitor the 1kHz sinewave output of the unit and adjust R40 for the best sinewave and R38 for amplitude. These adjustments are a little inter-dependent and either can affect the amplitude and purity of the sinewave. But adjustments are easy and quick to make.

Actions Checked

The wiring to S1 and the action of IC14 can now be checked. Monitor the digital output of the unit (Sk2) and check that as S1 is rotated clockwise from its anti-clockwise extreme, the output goes through: 100kHz, one and 10MHz squarewave, 100kHz pulses, 1MHz pulses

and finally 10MHz pulses. If this isn't so, re-check the wiring to S1.

The frequency locking action of the receiver can now be checked. Set S1 to the 1MHz squarewave position (or monitor the 1MHz output from the digital board directly) and rotate C30 slowly. A position should be found where the green l.e.d. (D4) is lit and the red one (D5) is fully extinguished.

Check D5 carefully to ensure that it is not glowing slightly, as it indicates the loop is only close to being locked. It will take a few seconds for the loop to fully settle down. When D5 is fully extinguished, the phase locked loop is locked to the recovered 2kHz signal from the receiver board.

If the unit is turned off and on again, the loop should lock very quickly without having to adjust C30 again. This will only be needed if the unit is operated over a large temperature range.

When the the unit is locked, the 1 or 10MHz outputs are as close to those frequencies, as you can get without having your own rubidium frequency standard. But as your frequency counter's internal timebase isn't as accurate, it's unlikely to show exactly the right frequency.

The prototype stayed in lock for many days with no adjustment of C30, indicating that the p.l.l. is compensating, by keeping the system in lock, for variations caused by normal domestic temperature changes.

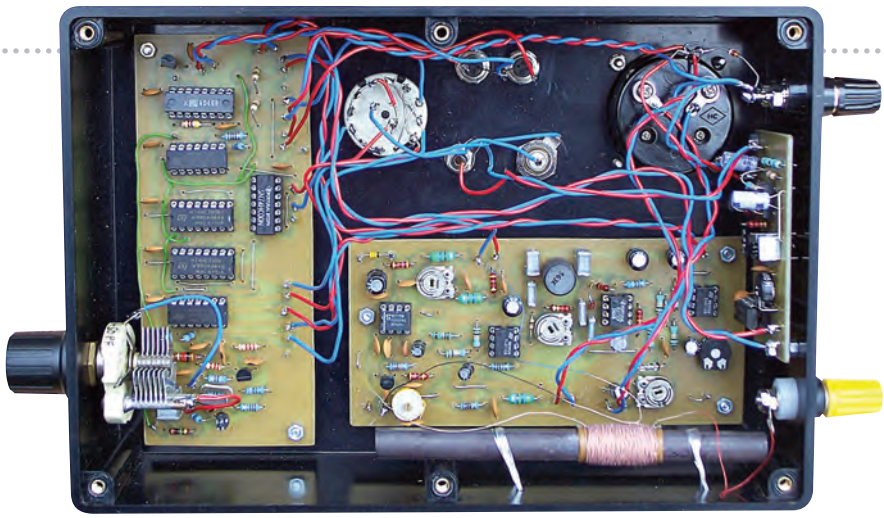


Fig. 8: Looking inside the completed prototype as designed and built by Stefan.

Design Decisions

During the design of the unit, many design decisions were made, such as the output frequencies, the loop filter component values and so on. Once you've built it, you can make any modifications to suit your requirements. For example, you could have separate outputs, rather than having them switched. You could also take other frequencies that are available down the divider chain and these can be taken to external sockets.

If the 1kHz sinewave is not needed, the 1kHz board could be omitted altogether as it's independent of the rest of the unit. Alternatively more audio frequencies can be produced by adding additional audio boards. For example a 500Hz sinewave output can be added by feeding a '500Hz board' from the 1kHz output of IC11 and changing the values of C43 and C46 on this new board.

The p.l.l. components C33 and R33 are ripe for experimentation. Many different combinations of values can be tried, each varying the lock time, lock range and output noise of the unit. Also the PH2 output of IC8 (pin 13) has been made easily accessible on the p.c.b. and so you could experiment with using this phase comparator output rather than the PH1 output used in the prototype.

In Use

In use, after powering up the unit, adjust C30 for lock, as indicated by D4 being on and D5 being fully off. For use as a digital clock source to feed the external clock source into a frequency counter, simply connect a coaxial cable between Sk2 of the off-air frequency standard and the counter's external clock input. Before doing this, check that the counter's input is compatible with the 6V digital waveform coming out of Sk2.

The unit's 10MHz output (or any other for that matter) can be used as a reference source for a v.h.f. or u.h.f. frequency synthesiser. The accuracy of the off-air source ensures the accuracy of the up-converted signal at the higher frequency.

The unit can also be used as a calibration source for receivers and transceivers. Simply connect a short length of wire to Sk2 and set S1 to the spacing (100kHz, 1 or 10MHz) needed and all harmonics of the selected frequency will be present. If the squarewaves are selected, the odd harmonics will be weaker but will still be present

On the receiver, (set to c.w.) tune for zero beat, and make the necessary calibration adjustment. The audio beat note should sound pure, indicating that the output of the standard does not suffer from noticeable jitter and noise.

The unit generates an accurate 1kHz audio sinewave that can be used for testing audio circuits and amplifiers. The level of this sinewave can be adjusted by R38, or alternatively if you anticipate using this output often, a simple volume control between the output of IC13 can be fitted, the wiper going to Sk3 via C47.

There you have it. All finished! You now have a splendidly accurate audio and r.f test-set, that is ideal for any Amateur's shack. **PW**

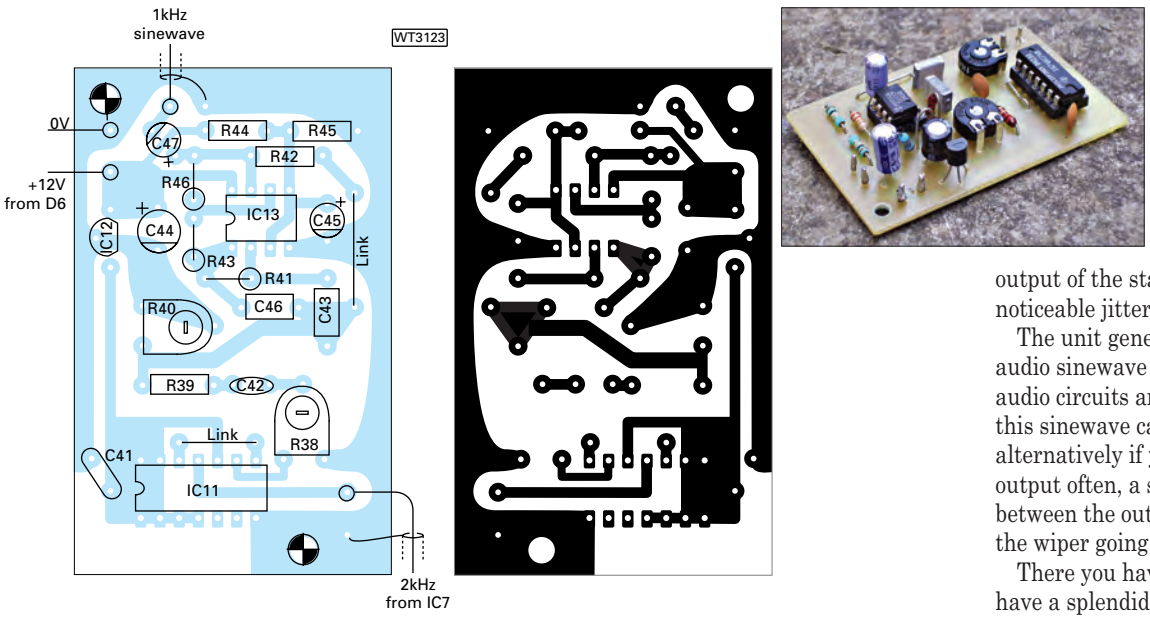


Fig. 7: The track pattern and overlay of the 1kHz signal generation p.c.b.

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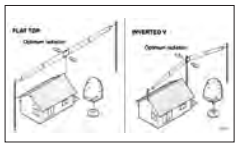

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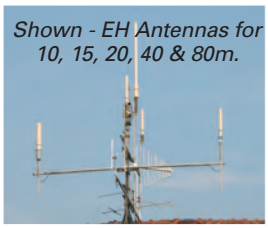

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Miracle Ducker Like the Miracle Whip but has BNC socket in lieu of whip to connect random wire £99.95
Miracle Ducker IL Latest model! Identical to Ducker but has BNC plug for mounting instead of PL-259.....£99.95

Daiwa Meters

Daiwa CN-101L: SWR/PWR Meter 1.8-150Mhz
Power range: 15/150/1.5kW .....ML&S only £59.95
Daiwa CN-103LN: SWR/PWR Meter 140-525MHz
Power range: 20/200W.....ML&S only £65.95
Daiwa CN-801H: SWR/PWR Meter 1.8-200Mhz
Power range: 20/200/2000W .....ML&S only £109.95
Daiwa CN-801:V SWR/PWR Meter 140-525MHz
Power range: 20/200W .....ML&S only £119.95
Daiwa CN-801S SWR/Power Meter 0.9-2.5Ghz
Power rating: 2/20 watts.....ML&S only £139.95

accessories at ml&s

Tigertronics Sound Card - Radio

For all available Digital modes, the SignaLink SL-1+ also supports the latest Voice modes such as Internet Repeater Linking (EchoLink, VOIP, etc.), Remote Base, and Voice Keyer operation. Tell us which rig you have and we will supply you with the correct leads. **£69.95** **Extra leads from £14.95**

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Antenna Mounting Hardware from

W3-BP Buddipole Compact Portable Dipole 40m-2M.....**£179.95**
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W3-BP DELUXE
The complete package from Buddipole.....**£354.96**

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NEW! PPK. The smallest retractable straight key!**£49.95**
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Code Cube Bolt-on memory keyer for Mini-paddle.....**£79.95**

Full range of Kent Keys now available!

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We have literally sold hundreds of these with fantastic customer reports. At last a vertical that gives you REAL PERFORMANCE on 80m and 40m, as well as the other bands. No radials required. Just mount 18 inches above the ground, connect to a decent earth spike close by and operate.

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Forget the G5RV. Install a proper TRAPPED wire dipole MutiTrap for 80-10M. Only 66'. Must be centre supported. **£99.95**

MyDEL MegaTrap

Same as Multitrap but 160m/80/40m, 105' long . **£109.95**

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A new rage of PSU's from MyDEL. The neatest smartest looking desk top power supplies that money can buy. Ideal for powering any main rig or accessory requiring 13.8V DC at up to 25 Amps.

MyDEL MP-250A Only £89.99

25 Amps maximum, 22Amps constant, ideal for most modern HF Transceivers

MyDEL MP-4128 Only £69.99

Another new switch mode PSU from MyDEL. Similar in spec to the MP-250A but without meters or cigar lighter o/p. 22-25 AMP output with heavy duty binding posts on the front panel and push on terminals for lower current output on rear. Fully protected.

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Linear 25-30A 13.8VDC PSU, using a large transformer, twin meters to monitor Volts & Amps. Been on the market for over 20 years in various different brand names and model numbers.

MyDEL MP-9600 £179.94

The latest in a line of switch mode power supplies from MyDEL . This high current (60 AMPS) switching mode DC regulated output power supply is designed with a highly efficient active power factor corrector. The constant current limiting protection allows the output current to remain stable but the output voltage decreases to a level that permits safe operation of the power supply. Remember ALL MyDEL PSU's come with 2 years warranty. Unlike other high current switch mode supplies on offer, the MyDEL MP-9600 is OVER VOLTS PROTECTED direct from the factory.

Yaesu FP-1030A £179.00

A power supply for Life? Probably. 25-30 Amp.

MFJ PRODUCTS AT LOWER PRICES

MFJ-461 Pocket size Morse Code Reader with built in display. Just place in front of your speaker to copy CW - instantly! Fully self contained, battery powered. **£69.95**

MFJ-418 Pocket size Morse Tutor with built in display. Random sending of Morse characters with confirmation on screen of what has been sent. Fully self contained, battery powered. **£69.95**

MFJ-1704 Probably the best 4 way antenna switch available. Cast Alloy construction, Power 2.5kW ● Isolation 60dB at 30MHz, 50dB at 500MHz ● Range DC ->500MHz. **£59.95**

MFJ-971 An ideal QRP ATU. Easy to use and very compact. QRP Portable ATU ● 1.8 - 30MHz ● 300W/30W 6W selectable ● Cross needle meter ● 12V DC Ext ● SO-239 sockets ● Tunes wire, coax, balanced lines ● Terminals & earth post ● Size 160 x 150 x 60mm ● Weight 870g. **£89.95**

MFJ-902 Tiny Travel Tuner. Tiny 4½ x 2¼ x 3 inch tuner handles full 150 Watts! Covers 80-10 Meters, has tuner bypass switch, tunes nearly anything! **£65.95**

MFJ-904H Tiny Travel Tuner/ SWR/Wattmeter & Balun. Tiny 7½ x 2¼ x 3 inch tuner handles full 150 Watts! Covers 80-10 Meters, has tuner bypass switch, tunes nearly anything! **£109.95**

MFJ-949E 300 Watt Antenna Tuner. More Hams use MFJ-949's than any other antenna tuner in the world! Why? Because the world's leading antenna tuner has earned a worldwide reputation for being able to match just about anything. **£124.99**

MFJ-974H 160 Thru 6 Meters Balanced Line Antenna Tuner. The MFJ-974H is a fully balanced true balanced line antenna tuner. It gives you superb current balance throughout its very wide matching and frequency range. **£159.95**

MFJ-993B 300 Watt IntelliTuner Automatic Antenna Tuner. The MFJ-993 IntelliTuner lets you tune any antenna automatically balanced or unbalanced - ultra fast. It's a comprehensive automatic antenna tuning center complete with SWR/Watt-meter, antenna switch for two antennas and 4:1 current balun for balanced lines. **£199.95**

MFJ-994 Similar to 993 above but 600 Watts. 1.8-30MHz, Auto ATU **£269.95**

MFJ-259B/L Special With FREE Loop Antenna Range: 1.8-170MHz. MFJ's favourite Antenna Analyser with HF frequency coverage. It's simple to operate and keeps your antennas in check. MFJ-259B gives you a complete pictures of your antenna's performance. You can read antenna SWR and Complex Impedance 1.8 to 170MHz. **£189.95**

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10kHz-3300MHz All Mode.....**£369.95**
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+SM-20+SP-21+MP-250A
100W HF, 6m and 2m
complete with internal ATU

What a package!
New IC-7400 with Matching Desk Mic, Speaker & MyDEL Metered Base PSU. *Subject to status.

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The best 2/70 & 23cm dedicated all mode base. 23cm included.
RRP £1675
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Basic Version (without 23cm)
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VHF/UHF DUAL-BAND FM TRANSCEIVER

CALL FOR SPECIAL INTRO PRICE!

A truly versatile multi-featured radio that further advances Icom's lead in digital amateur communications!

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Triple Band Handie
Only £199.95!
Or available with 4m and extra antenna for
Only £239.95

Icom IC-703
IDEAL FOR M3 USERS
10W Portable/Base HF Transceiver with built-in ATU.
RRP £703 ML&S £449

Icom IC-E208
2/70 mobile 50/55W Transceiver with host of additional features. Remote head leads included.

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NEW Icom IC-E7E
The latest micro Twin Band Handie from Icom! 2m/70cms.
ONLY £169 or add a LC-161 for only £16.99. in stock now!

Icom IC-718
Basic ready to go 100W HF Transceiver supplied with Microphone & DC Lead.

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or 48 x £13.29 p/m

kenwood

Kenwood TS-2000E
Just superb on all bands 160m-2m with optional 23cm (X-Version)
RRP £1699 ML&S £1299

Kenwood TS-2000X
As above but with 23cm fitted. **RRP £1999 ML&S £1699**

TS-2000E Bundles

Bundle 1. TS-2000E Supplied with hand Mic, DC Lead **£1299**
Bundle 2. As above with MyDEL MP-250A PSU **£1379**
Bundle 3. As above with MC-60A Desk Mic **£1499**
The TS-2000X (fitted with 10W 23cm module) version of any of the above is available for as additional £400 on the above prices.

Kenwood TS-2000LD

Special Edition Black version
FINAL FEW AVAILABLE FROM STOCK - PLEASE CALL

TS-570DGE
From M3 to G3 the TS-570 still sets the standards in easy to use HF operating.

Although the TS-570DGE is now finished, we always have mint used examples from £599. Please call for availability or see web.

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The best selling Kenwood H.F. Can be used mobile or base. Includes ATU.
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As TS-480SAT but 200 Watts, no ATU. **ML&S £799.95**

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The Icom Flagship Base Transceiver just keeps getting better & better. Now fitted with 3 Roofing Filters for even more receiver performance.

On permanent display next to the FTdx9000.

yaesu

The Rig of the Year has arrived!

now in stock!

- Two Versions, MP & D Specification
- FT-2000MP 100 Watts, 160-6m, Internal PSU
- FT-2000D 200 Watts, 160-6m, External PSU
- Variable RF Tuning & Roofing Filters as standard
- Orders being taken today, trade-ins welcome

Yaesu FT-2000MP: £1,995.95.
Yaesu FT-2000D: Price to be confirmed (approx £2400)

FT-857D + ATAS-120 Auto Antenna Bundle

Still only £759 for both (Rig only £559)
The Ultimate HF Mobile Installation!

FREE YSK-857! (whilst stocks last)

Yaesu FT-897D Bundles

5-Ways to buy your FT-897!

High Power version of the FT-817. Use as a transportable, (20W) or as a base/mobile (100W)

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FT-897D 'Vanilla' Basic FT-897 HF-70cm Transportable.
Bundle 2. Only £849
FT-897D + LDG AT-897 & MP-4128 22Amp PSU.
Bundle 3. Only £849
FT-897D, FP-30 7 FC-30
The most compact HF base with built-in mains PSU & Bolt-On Auto ATU.
Bundle 4. Only £849
FT-897D, 2 x FNB-72, CD-24 & PA-26
The ultimate HF/V/U system with both batteries, charger & adapter.
Bundle 5. Ultimate FT-897D System! Only £1079
As above but with MP-4128 23 Amp PSU & LDG AT-897 Auto-Tuner.

Yaesu FT-817ND Bundles

CALL - LOW PRICES ON THESE BUNDLES
Bundle 1. FT-817ND 'Vanilla' - Basic FT-817
Bundle 2. FT-817ND + YF-122C 500Hz CW Filter
Bundle 3. FT-817ND + YF-122S COLLINS SSB Filter
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All ML&S FT-817ND's include; 2 Years Warranty, Metal Hydride batteries, charger, mic, etc.

Why not add a CSC-83 Carry Case for only £19.95?

Yaesu FTdx9000D 200 Watts or 400 Watts, TFT Screen or not. You choose. Call for more info or see www.FTdx9000.com 'D' spec now shipping at **£7299**

Yaesu FT-7800 Bar make the tea it'll give you 2m/70cm @ 50W/40W .....**ML&S: £239**

Yaesu FT-8800 Similar to the FT-7800 but can receive on 2 & 70 simultaneously.....**ML&S: £269**

Yaesu FT-8900 One-stop solution to high-power FM on 10m, 6m, 2m & 70cm. When your local repeater is busy, slip onto 10m & work DX! .....**Only £339**

FREE MyDEL HANDS FREE OR YSK-8900 YOU CHOOSE OFFER SUBJECT TO AVAILABILITY

NEW!

Yaesu FT-1802E 2m FM Mobile. 5-50W out. Very similar to the FT-2800.
ML&S: £139

Yaesu VX-2E Micro Handie 2/70 with scanner. Complete with Li-ion battery, charger & antenna.....**Now only £119.95**

Yaesu FT-60 Latest twin band handie complete and ready to go.....**£129.95**

Yaesu VX-7R The UKs best selling Triple Band Handie. **ML&S: £219 or wi h lapel microphone: Only £229**

Quadra VL-1000 The easiest way to get 1kW output from any Yaesu HF Transceiver. Plug in 240V, attach rig & antenna and you have a fully automated amplifier with auto tuner. **£Call (always in stock)**

Don't forget! ML&S are approved stockists for the following: AOR, bhi Ltd., Icom, Kenwood, Maldol, MF

new ChapStick

'ChapStick' MP-1. 10 Band Dipole from Super Antennas USA

Complete kit including additional 80m Traps covering 80-10M, 15' Heavy Duty Tripod, everything you need to get going portable on HF.

Chris Taylor says:

"Confused about this new addition to portable HF Antennas? It sets the bench mark for quality and heavy duty engineering. The only system with 80M too! A Must".

Intro Price £359.95

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NEW Product

Maldol MFB-300

1.8-60MHz Vertical. **Only £259.95**

● Continuous Coverage TX/RX 160m - 6m ● RX 1MHz-60MHz ● Typically better than 1:5:1 VSWR on most bands ● No ATU Required! ● 7m tall ● Can be used without guys (supplied) at 5.3m or improved range full 7m ● 4.1kg weight

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Linear Amplifiers

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SLA-300 1-8-30MHz Linear Amp, up to 300W output 2-15W drive. Band-Pass filters for each band.....**Only £299.95**

SLA-817 Designed for the FT-817/IC-703 offering100W output .....**Only £229.95**

SLA-50V/U Ideal for any dual band Handie/mobile or base, DUALBAND (2/70) .5-20W I/P 50-100W PEP LINEAR AMPLIFIER **£229.95**

SLA-200 Increase your 2m output! 1-50W I/P 60-250W-PEP 2M LINEAR AMPLIFIER **£229.95**

SLA-517 More power on 6M. 6M 1-10W I/P 50-100W PEP LINEAR AMPLIFIER **£199.95**

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HF Linear Amplifiers

"The Best Built Amplifiers in the World"

DX-1D Cool 1kW, small foot print. **£1699.95**

DX-2 Slightly larger than the DX-1 but offering 1500W key down. **£2799.95**

DX-2SP Already the most popular of the range, same as DX-1 but a minimum of 2kW output (2500W PEP).....**£3199.95**

DX-3 Emtron's "Big Gun" using a GU-78B and producing in excess of 3kW key down.....**£4599.95**

DX-4 If you thought the DX-3 is over the top how about the DX-4 producing over 4kW, or run on 3-phase for 5kW! **£6399.95**

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Conditions Apply

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AT1KM Meter

1200 Watt Antenna Tuner.....**£289**

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BT1500A 1500 Watt Double L Balanced Antenna Tuner **£439**

AT-AUTO 1500 Watt Automatic Antenna Tuner **£829.95**

AT4K 2500 Watt Antenna Tuner **£629.95**

AT5K 3500 Watt Antenna Tuner **£829.95**

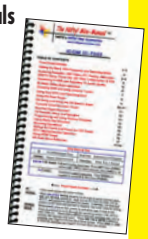
DL2K 2000 Watt Dummy Load **£139.95**

DL5K 5000 Watt Dummy Load **£279.95**

nifty

Equipment Manuals

Nifty Equipment Manuals and Quick Reference Cards for Yaesu, Icom, Kenwood, Elecraft & Ten-Tec radios



Mini-Manuals are fully laminated and spiral bound booklets, 4.25 x 8 inches, providing simplified step-by-step instructions for all your radio's features.

These short-form manuals are smaller, more durable and easier to use than manuals normally supplied with a radio. Compact - small enough to be kept with your transceiver. Very rugged.

Quick Reference Cards are designed as a three-page foldout the size of a credit card for easy carrying in a wallet or purse.

See our web site under "Books"

ten tec

Ten Tec Orion 2

Visit our showroom and compare the Orion 2, IC-7800 & FTdx9000D side by side!

At last! The new Orion 2 has arrived. Using mode appropriate crystal roofing filters & IF-DSP as part of the main receiver, the new Orion 2 is still in a league of its own. For full details see: **www.hamradio.co.uk/orion2.shtml**

TenTec 566AT Orion 2 with internal ATU**£3599.00**

TenTec 566 Orion 2 without ATU **£3349.00**

mydel

NEW MyDEL CG-3000. Only £199.95

High power version. With 200W and 200 memory channels.

- Tunable frequency: 1.8 - 30 Mhz with long wire antenna from 8 meters
- Input impendence: 50 ohms
- Input power: 10 - 200W PEP
- SWR: <2:1
- Power supply voltage: 12V +/- 10%
- Current consumption: <0.8A
- Auto tuning time: Approx. 2 seconds (first time tuning)Less than 1 second (return to memory frequency)
- Memory channels: 200
- Weight: 1.8 KG
- Size: 310 x 240 x 72mm (L - W - H)

MyDEL CG-2000 Remote ATU.

A simple to use remote end-fed wire ATU for 160m - 10m. 100W, 150 memories. **Only £149.95**

LDG

LDG Tuners & Accessories

If you see LDG advertised cheaper in this magazine (or on the web) from a UK stockist we will try and BEAT it! Please call.

ML&S have been appointed Main Distributor for the US built LDG Product range.

LDG Z-100 100W Auto ATU 160M-6M .....**Only £119.95**

LDG AT-100Pro & AT-200Pro 100W or 200W Auto Tuner, 160M-6M with 2 Antenna outputs **AT-100Pro £169.95**

.....**AT-200Pro £179.95**

LDG AT-1000 1kW Auto Tuner, wide tuning range (10:1 SWR) 160M-6M .....**Only £499.95**

AT-897 Bolt-on Alternative Auto Tuner for the FT-897. Wider tuning range and cheaper too! .....**Only £179.95 Special 'Intro' price**

LDG Z-11Pro Portable compact & tunes 100mW to 125W.....**£139.95**

LDG RT-11 Waterproof remote ATU 1.8-54MHz **£149.95**

LDG RBA-1:1 & RBA 4:1 Probably the best 1:1 & 4:1 baluns out there. .....**£29.95 each**

LDG TW-1 & TW-2 Talking Wattmeters! TW-1 HF 0-2kW TW-2 6/2/70 250W. .....**£109.95 each**

LDG DTS-4+4R & DTS-6+6R Remote Antenna Switchers. 1.5kW 1-54MHz. Either 4 or 6 way,.....**£89.90 & £119.90**

FT Meter - External meter

Add-on analogue meter for the FT-857 and FT-897. Just plug & go! Enables you to read signal strength. Discriminator, power output, s.w.r., ALC etc. **£39.95**

NEW PRODUCT! LDG AT-7000

£139.94

Specifically designed for the IC-7000! The AT-7000 is the ideal tuner for your shiny new IC-7000. First, it matches up to 10:1 SWR (3:1 on 6 meters), so just about anything you can feed with coax is good to go. And, it has 2,000 (not a typo; that's 2,000!) memories.

Take Away Now and Pay NOTHING Until This Time Next Year!!

Having many years of experience offering specific finance packages for our customers, we can now offer various options on payment. We have added "Take-Away Now & Pay Later" to all our products over £199. It works like this: 0% APR An example of our Take-Away Now: Discounted price of £300. Pay no interest provided you pay by the date the amount is due, in full. After the 12 months period has expired pay £15.76 for 36 months. TAP £567.43 Please note that interest is calculated from the date of the original agreement. 29.8% APR. E&OE

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AMATEUR & CB RADIO KITS & MODULES

TRANSVERTERS for 2 or 4 or 6 metres from a 10 metre rig, or 4 or 6 metre from a 2 metre rig. Includes new overtone local oscillator, and integral interface unit. 20dB receive gain, 25W transmit power. Low level drive dual IF versions **TRC2-10dL, TRC4-10dL & TRC6-10dL**, high level drive single IF versions **TRC2-10sL**, **TRC4-10sL**, **TRC6-10sL, TRC4-2sL, TRC6-2sL**, Complete kit **£163.00**. **Built £244.00**

TRANSMIT AMPLIFIERS, for 2 or 4 or 6metres, single stage switched class AB linear. Diecast box with SO239 connectors. 1W to 5W drive, 8W to 30W output, Types **TA2SA, TA4SA, TA6SA**. **Complete kit £59.00, Ready Built £82.00**. 5W to 20W drive, 22W to 60W output, Types **TA2SB, TA4SB, TA6SB**, **Complete kit £65.00. Ready built £88.00.**

TRANSMIT AMPLIFIER & RECEIVE PREAMP, for 2 or 4 or 6metres. Receive gain adjustable 0 26dB gain. Switching for either part or straight through. RF & DC switched on transmit. Diecast box with SO239 connectors. 1W to 5W drive, 8W to 30W output, Types **TARP2SA, TARP4SA, TARP6SA**. **Complete kit £72.00, Ready Built £109.00**. 5W to 20W drive, 22W to 60W output, Types **TARP2SB, TARP4SB, TARP6SB**, **Complete kit £75.00, Ready built £112.00**.

MELLSTOCK 4M AM 1W TX Two channel transmitter with 1W carrier power and high quality audio from integral speech processor. Subject of PW Sept and Oct 2005 articles. **PCB £16**. Mod transformer **£9.50**. Complete kit with PCB, transformer, mic gain pot, channel switch & mic chassis plug **£57.50**. Complete kit plus drilled and labelled box and other hardware **£76.50**.

MELLSTOCK 4M AM RX Two channel double superhet receiver to go with the Mellstock transmitter. 0.4uV sensitivity. Subject of PW Nov 2005 article. **PCB £10**. Components including volume pot, channel switch, crystals, & signal meter **£47.00**.

CB to 10FM CONVERSION, suitable for CB's with LC7136/7 or TC9119P PLL IC's. Puts the rig on 29.31 29.70MHz. Each board is aligned prior to despatch. Data available for a variety of chassis types. Please state rig type when ordering.
SC29 Built & aligned £23.00.

STATION PREAMPS for 2 or 4 or 6metres. RF & DC switched. Adjustable 0 26dB gain. 100W power handling. **RP2S, RP4S, RP6S, PCB & Hardware kit £29. Ready Built £47.**

MASTHEAD PREAMPS 100W through handling for 2 or 4 or 6 meters. 20dB gain 1dB NF. RF switched & DC fed via the coax. Heavy duty waterproof masthead box, and a DC to RF station box with SO239 connectors. **RP2SM, RP4SM, RP6SM, PCB & hardware kit £38.00, Ready Built £57.00**. **New masthead fitting kit option £6.00.**

MASTHEAD PREAMPS 400W rated, for 2 or 4 or 6metres. RF switched. DC fed via a separate wire. 20dB gain 1dB NF. Heavy duty waterproof masthead box with SO239 connector. **RP2SH, RP4SH, RP6SH. New lower price. PCB & hardware kit £40.00. Ready built £62.00. New masthead fitting kit option £6.00.**

POUNDBURY SSB IF UNIT
9 or 10.7MHz SSB generator & receive IF unit with receive front end mixer. Incorporates a speech processor, double balanced mixer and crystal filter. Crystal carrier Oscillator. Receive IF amplifier, balanced demodulator and AGC generator, and S meter circuitry. Also a 1W audio amp. Supplied with a 9MHz 6 pole crystal filter and matching carrier crystal for USB generation. **PCB and component kit £82.50 including P&P**. Optional extras mic gain pot, volume control pot, £1.75 each, signal meter £9.00, 8ohm loudspeaker £2.00, P&P £1.50.

PORTLAND VFO as featured in March 2006 *PW*. 7 7.2MHz as local oscillator for a 40m direct conversion receiver or transceiver. Otherwise as 7.9 8.4MHz to use in conjunction with a mixer vfo system as local oscillator for a 4 meter receiver/transmitter with a 9MHz or 10.7MHz IF. Available with Buffer 2 to drive a diode ring mixer directly or with Buffer 1 suitable for IC and mosfet mixers, including the MIXER VFO unit. **VFO PCB with Buffer 1 or Buffer 2 PCB and parts kit with potentiometer £14.50. PCB and parts kit with drilled box £23.50.**

MIXER-VFO for 4metres as described in DiBD PW May 2006. A crystal oscillator and mixer and amplifier producing 61 61.5MHz or 59.3 59.8MHz local oscillator signal when used with the Portland VFO. **PCB & parts kit £23.30. Ready built and tested £34.00**.

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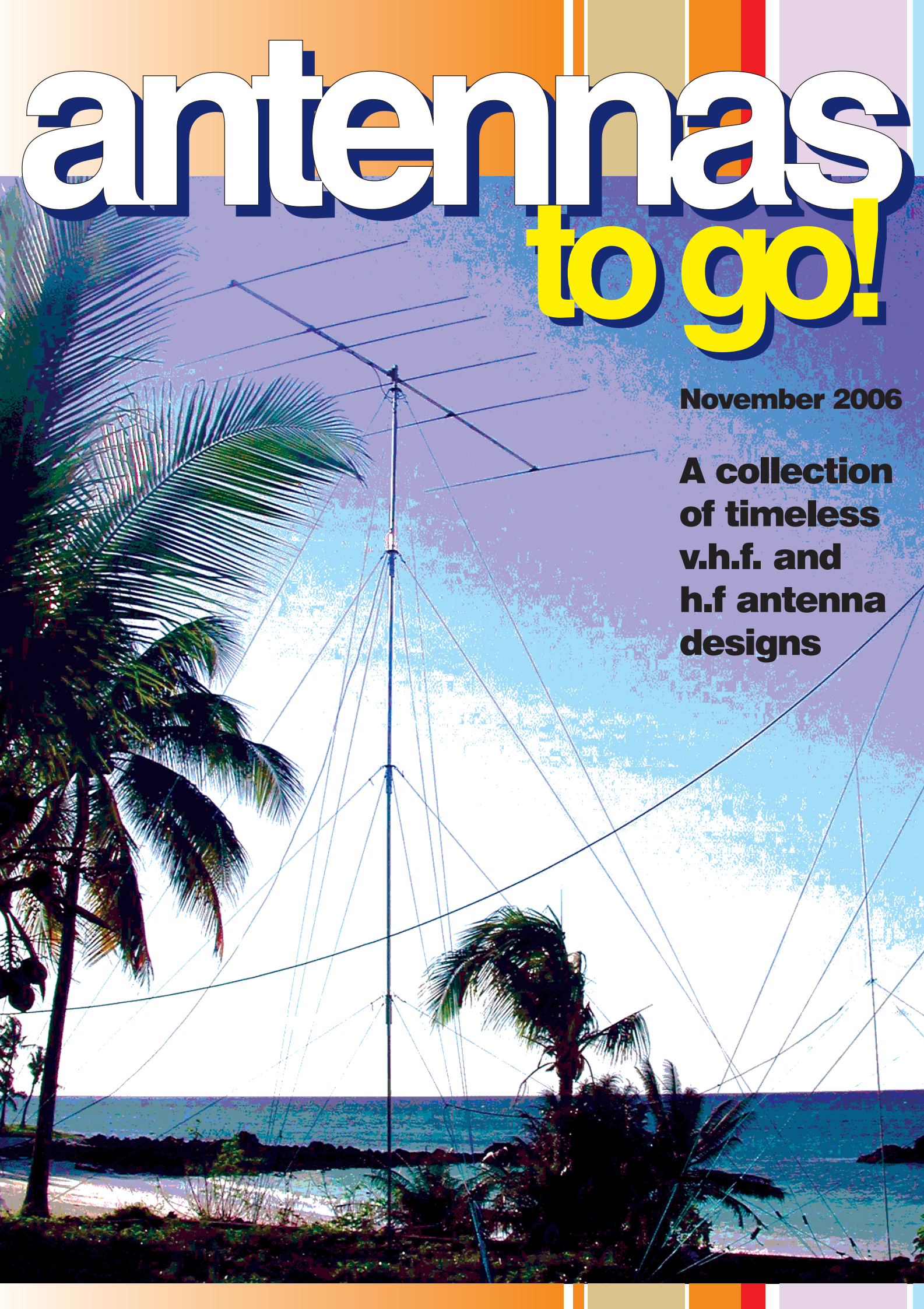
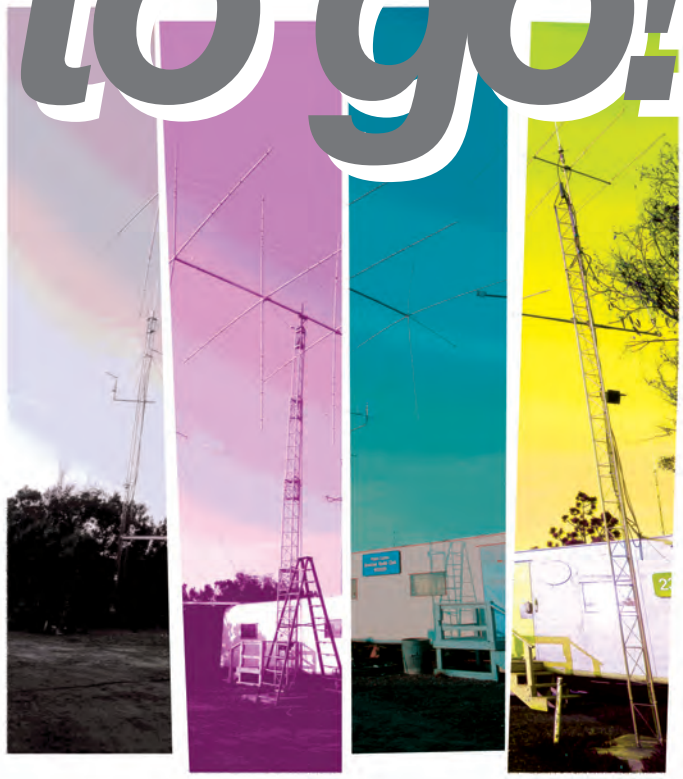


November 2006

A collection of timeless v.h.f. and h.f antenna designs

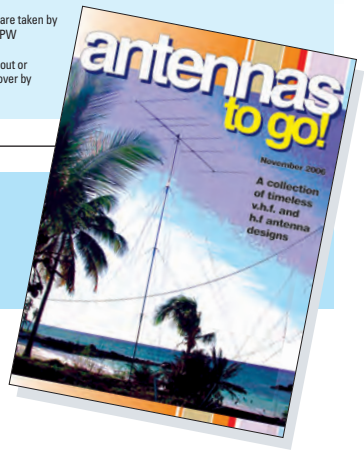
antennas to go!



Section Front Cover. Our thanks go to **Mike Devereux G3SED** for supplying the front cover photograph for this 16-page antenna section. The photo was taken by Mike on the British organised, 2001 DXpedition to the Comoros Islands (callsign D68C). It shows the view to Europe from a Force 12 EF610 6-element 10 metre beam at 40ft high! The DXpedition team made a world record beating 168,722 QSOs!

Editor: Rob Mannion G3XFD **Production:** Donna Vincent G7TZB **Technical:** Tex Swann G1TEX **Art & Design:** Steve Hunt

editorial



Mix & Match Selection

Welcome to the latest *Antennas To Go* where the *PW* Editorial staff hope that you'll enjoy the selection of 'mix & match' h.f. and v.h.f. projects we've chosen for you. All work well and may provide a good laugh along the way!

For example, **John Heys G3BDQ**'s 'Slinky' antenna really caught the imagination of a group of our Norwegian friends. Quite a few were built by readers in Norway and it seems they worked well and provided some chuckles along the Fjords!

Magic Antenna

Antenna projects are always extremely popular with our readers. Everyone dreams (this is a joke in the office) of the magic antenna that folds down to matchbox size, works on all bands from 16kHz to 30GHz, provides 30dBd gain in all directions and doesn't require it to be mounted on a mast!

Although we cannot provide the 'magic' antenna, it is possible to seek out and publish some really practical ideas. These ideas mostly come from you, the reader and we're always interested in hearing from potential authors.

The appetite for antenna projects in *PW* reflects the fact that for many, experimenting and developing innovative ideas is their main enjoyment. It's often the case that an owner of one of the superb Japanese built commercial transceivers will never 'go inside' the main rig. However, they are more than happy to experiment and play with antennas and this is why we produce *Antennas To Go* - Enjoy!

Rob G3XFD

Practical Portable Operating

Rob Mannion G3XFD, passes on practical tips and suggestions aimed at encouraging you to enjoy our hobby out of doors. Rob says you don't need to be an athlete to 'run' an outdoor station!

Regular *PW* readers will know that I thoroughly enjoy operating 'portable' from some delightful spots in the countryside. It doesn't matter where I am, whether it be in deepest Dorset or some lofty spot on my way to a club visit - I'll always try to get on the air for a while.

In fact, I've had some of the most enjoyable contacts while operating /P. On one occasion, operating on 70MHz in the mountains above Clonmel in County Tipperary, operating with my Irish callsign **EI5IW**, I worked back to Gloucestershire in England. The contact was with an old friend who has always encouraged me on to 70MHz and the contact seemed to immediately shrink the geographical distances within these Islands. Yes, /P operating is great fun and I'm sure this article will help and encourage some more recently licensed Amateurs take up the invitation of a day out with the hobby.

Telescopic Mast

Over the last 10 years or so I've based my /P antenna system on the well known fibreglass fishing pole mast, imported from Germany by my old friend **Robin G4NFV** of **Sycom**. The system has worked very well indeed although I have gradually changed the system from a vertical radiator to the arrangement shown in **Fig. 1**. Here, the mast is mounted in the Tennamast Tenna Tourer drive-on mast base.

The illustration clearly shows how I have operated portable in the last few years. Originally, I used a length of wire (wound spirally on the mast) to act as the radiating element. The wire only need to be wound around the mast five or six times - just enough to keep it close to the mast and stop the wire from flapping in the wind. If you've ever heard the sound coming from yachts in a marina you'll know how noisy that can be!

Verticals antennas are ideal for DX working, but if you are keen on working (let's say on 7MHz) within G or EI, it's better to use a dipole. The diagram in Fig. 1 shows how I employ the mast.

At the highest point possible (before the tapering sections become too slim) I mount my Sandpiper 144MHz delta beam. This can then be rotated almost 360° for beaming purpose on 144MHz. The centre feed point of the dipole is actually slung on a short length of halyard so that as the mast rotates the halyard is gradually wound around the mast. This system allows the rotation of the v.h.f. antenna without compromising the h.f. antenna. In practice it only takes a little while to work out how long the halyard should be to allow the Delta beam to almost complete 360° rotation. Simple and very effective.

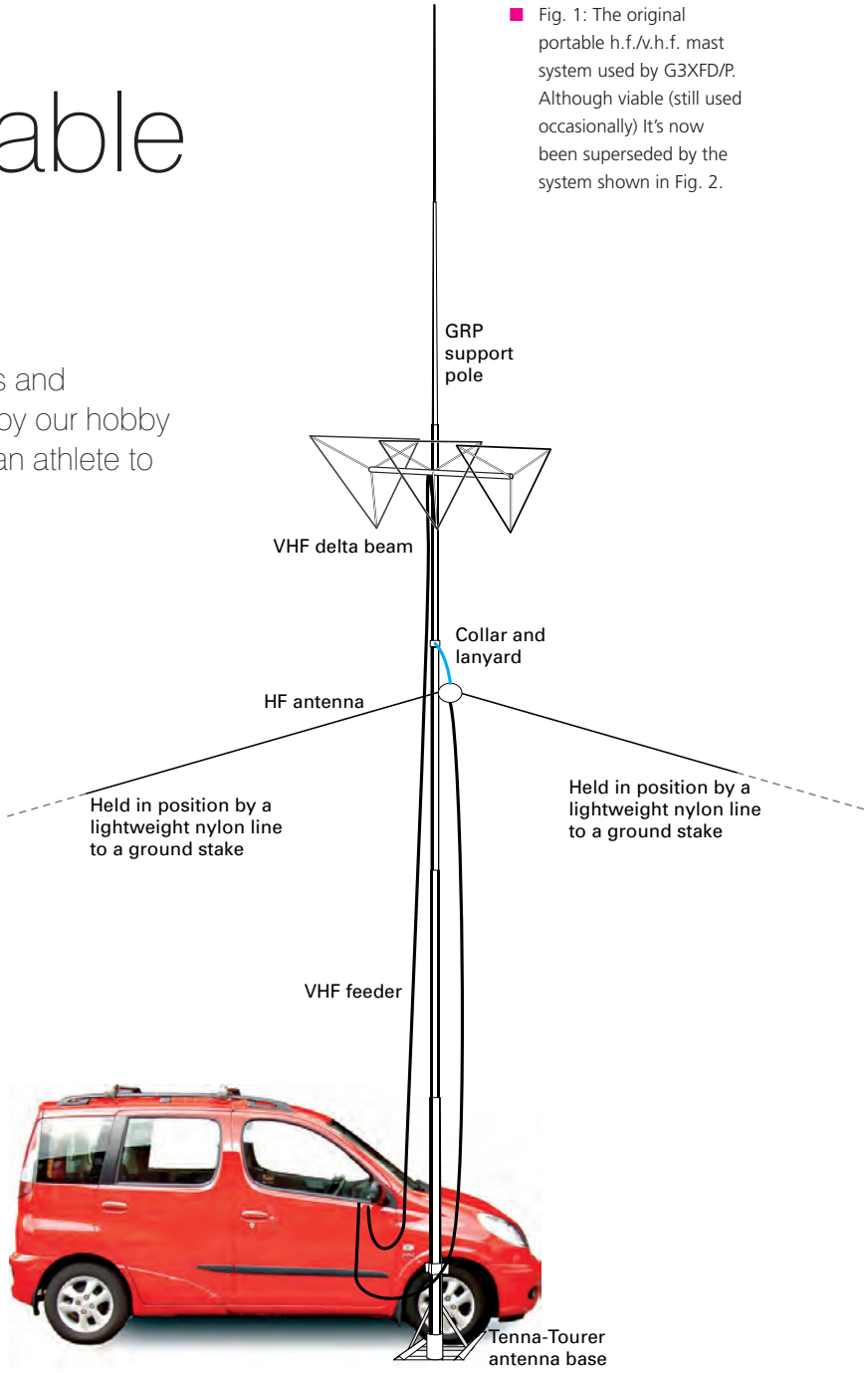


Fig. 1: The original portable h.f./v.h.f. mast system used by G3XFD/P. Although viable (still used occasionally) It's now been superseded by the system shown in Fig. 2.

The HF Dipole

Many Radio Amateurs believe that the dipole type of antenna provides the best possible results for very little outlay. It's a very simple antenna to make and - in practice - you'll be able to achieve excellent results in return for minimum technical effort.

I always base my 7MHz dipoles on a 66ft (approximately 20m) length of wire. Used with my manual antenna tuning unit (a.t.u.), I've found it very effective indeed on 7, 14, 18 and 21MHz. It's extremely easy to set up, tune and use, providing excellent contacts on all the specified bands.

At one time I tried making a trapped dipole based on 3.5MHz but came to the conclusion that (for portable working) it was a waste of time using a length wire, which, in effect, was not employed all the time. Additionally, I've found that /P working during the day on 3.5MHz was a lottery as noise levels and activity often does not warrant operating on the band. Instead, 7MHz and the bands above (during the day) provided me with as many contacts as I could cope with.

Transceivers For Portable

For portable working on h.f. I normally use my Alinco DX-70 or the old (but reliable) Trio TS-120 (the low power version rig). In bright sunlight the brighter phosphorescent display on the Trio rig sometimes copes better than the liquid crystal type on the Alinco transceiver.

When I operate on v.h.f. I use my battered but exceptionally reliable AKD-2000 type f.m. transceiver. Extremely basic it may be but both my 70 and 144MHz versions have more than earned their keep!

My old but again very reliable Trio TR-9000 multi-mode transceiver is delightfully easy to use on 144MHz. The audio quality is good and the rig's easy-to-use front panel controls seem to be designed for /P operation. However, due to the fact that the display is not so bright nowadays, I have made a card cowling to screen it from bright sunshine.

Note: Before readers write in to tell me that there are circuits, modifications and projects available to brighten up the TR-9000 display, I can confirm I already know of them! Unfortunately, it's rather a fiddly job and I've not got round to modifying either of my '9000 rigs. Incidentally, as they are such a nice little transceiver - often appearing in Bargain Basement adverts - I strongly recommend that anyone capable of working on these rigs (discrete components are in the majority) to cherish, modify and use them on the bands.

Antennas For VHF

Operating portable on the v.h.f. bands has provided many years of enjoyments for me. In the late 1960s I used a Pye Reporter valved transceiver with a J Beam Halo antenna.

Halo antennas (the name aptly describes what they look like!) were very common 30-35 years ago but are rarely seen nowadays. Providing horizontally polarised radiation they were useful in the days when vertical polarisation was not the norm. As they were so distinctive, Amateurs using them for mobile/portable operations often found that members of the public enquired what the strange looking mini-netball pole (without a net) was for!

Home-brewed 2-element Yagi arrays were very popular for a time and I made one so that the reflector and driven element rotated on the main boom, allowing all the elements to lay flat alongside each other for transport. The antenna then formed a slim package to fit inside my Morris Minor, which itself had a hole carved in the centre of the roof for one of the Pye rubber whip bases to which I connected a 144MHz whip (it didn't pay to buy a car previously owned by G3XFD/M).

Eventually, I graduated towards 2-element cubical quad antennas for 70 and 144MHz. In fact, readers may remember the 50, 70 and 144MHz Nelson cubical quad antennas that **Tex G1TEX** and I promoted via *PW*. Very effective they were too, unfortunately they became unavailable after the death of **Ernie Quinelle G4JEV**, of Nelson Electronics.

Next, I used a Japanese made lightweight 5-element folding Yagi array. I had a number of these, as they were excellent performers but I tended to damage them - usually breaking the elements by treading on them on the ground. Something else was needed!

Knowing of my interest and success with cubical quad antenna on v.h.f., **Chris Foster GW6MKR** of **Sandpiper Aerial Technology** in South Wales contacted *PW* to tell us about his development work on the same subject. Eventually we published a review featuring the Sandpiper 3-Element delta beam antenna. From that moment on, I was sure that this antenna was absolutely ideal for me and it's certainly proved to be extremely effective, very easy to use and transport.

In fact, the assembled Delta beam, **Fig. 3**, is so neat and relatively small, that it can travel on the rear passenger seat of my car ready to be mounted. Additionally, the antenna is so light that it can be mounted on a fibreglass mast without any guys - provided that it's not too high on the thinner telescopic sections.

The Delta beam has proved to be so successful, that I've now built a stub-mast system to mount it on my Toyota Yaris Verso car. The system is very simple and helps to get over the increasing problems caused by anno domini and arthritis.

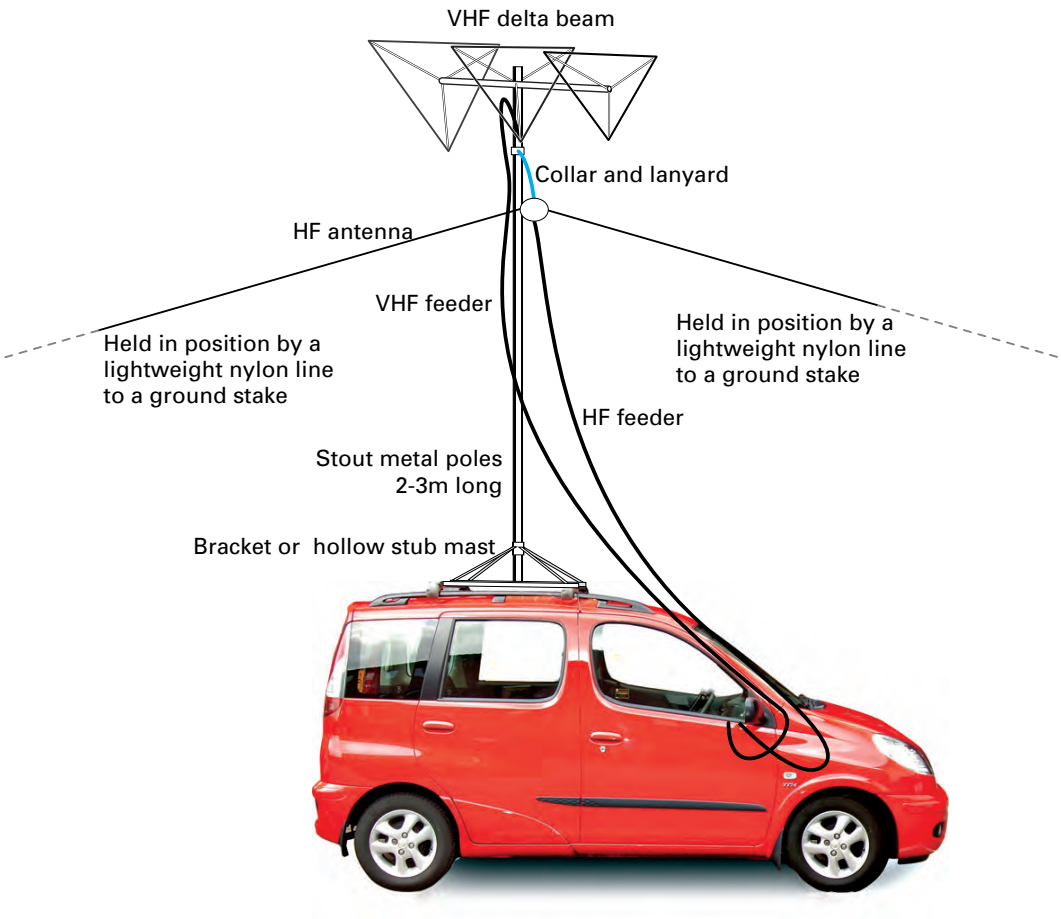


Fig. 2: The new antenna system used by G3XFD for v.h.f. (mainly) and occasionally for h.f. /P operations. The system utilises a Toyota supplied set of roof bars, which attach cross-wise on to the vehicle's standard equipment side roof bars. The cross bar (forming the roof rack) has a stub mast attached to it acting as a socket for a broomstick supporting pole (see text). The assembly used by G3XFD will support a lightweight Sandpiper 144MHz Delta beam at 10ft (3m) above the vehicle. However, the author strongly recommends the use of lightweight nylon type guy ropes, or the use of a 7MHz dipole to reduce possible damage in hilltop winds.

Roof Rack Mast

Arthritis is a real problem for me nowadays but I'm

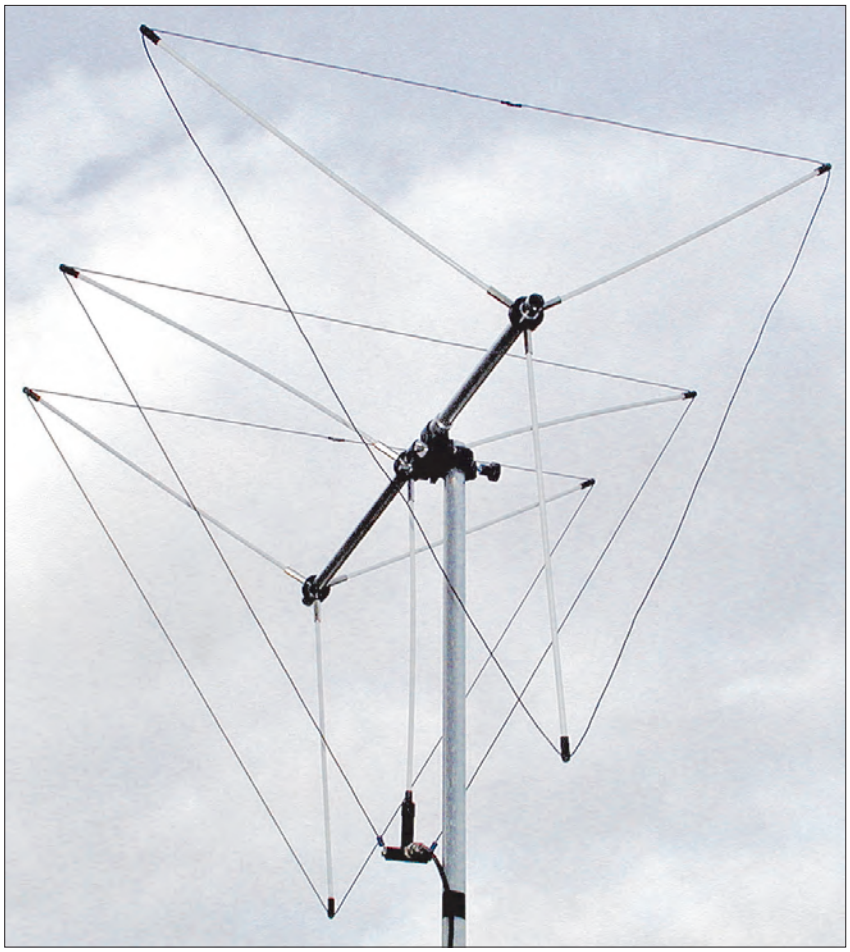


Fig. 3: The Sandpiper Aerial Technology 144MHz Delta beam antenna, as reviewed in the June 2005 issue of *PW*.

determined to continue enjoying the occasional trip out into the countryside to enjoy the views and Amateur Radio at the same time. However, carrying my aluminium scaffold pole system on the roof rack has become extremely difficult because I cannot lift it on to the rack by myself. Even the Tenna Tourer drive-on mast base has become rather heavy to lift into the back of my car.

A new technique had to be arranged and through the excellent technical draughtsmanship provided by Tex Swann G1TEX, it can be seen in **Fig. 2**. Incidentally, Tex tells me he sneaked out of the office and photographed my car to incorporate it into the illustration. His efforts are much appreciated because it clearly depicts the method I now use. **Note:** for clarity purposes, the 70 and 144MHz antennas mounted on the vehicle for /M use are not shown .

The basis of the new system is exceptionally simple. Using the Toyota supplied roof bars as a mount, I've made an upright base mount from a length of aluminium tube. When required this is mounted on to the roof bars by using a TV antenna type angle mounting bracket.

The tube is long enough, at 1ft (300mm) to enable one or two heavy duty broomsticks (joined by a ferrule) to be slipped into it snugly. This system will easily support the lightweight Sandpiper 144MHz Delta beam antenna. It's exceedingly easy for me to raise the assembly and once it's in place the array can be 'beamed' into the incoming transmission.

Note: For safety reasons I would not recommend the wooden mast support to be longer than 10ft (approximately 3 metres). The lighter weight broomsticks for household use aren't really suitable. Instead, I recommend the heavier duty type sold as replacements for garden hoes, leaf sweepers, etc.

In practice, I tend to use the system with either my 7MHz lightweight wire dipole or with a set of three nylon cord guys. In practice, there's enough 'stretch' in the guys to rotate the antenna through almost 360°. A saw cut slot in the base tube allows the ends of the tube to be tighten with the use of a pair of quick release latching grips (Mole Grips are ideal). Crude but effective - the antenna can be rotated and locked within seconds.

Although I've not used cross-bracing myself, Tex had added them into the drawing to show what can be achieved. In effect (from each corner formed by the roof bars) a set or pre-formed stiff wire/rod links can be clipped to the outside top of the stub tube. These can then be tightened to provide extra support for the top of the tube to reduce the leverage effect of the mast on the tube assembly.

Note: I strongly advise that you don't attempt to use any more than three supporting/strengthening links. It's very easy to set-up and adjust three such supports. Four can be very difficult and if you've ever tried sorting out problems on a table with one leg shorter than the other you'll know just what I mean! It's very difficult.

Out & About

If you are a newcomer to Amateur Radio, you might be under the impression that by taking your radio hobby out for the day means you avoid problems. You'd be wrong! Instead, everyone doing so has to be very careful indeed!

Firstly, you must avoid all overhead electricity supply lines. It's all too easy to forget that the commercial electricity supply companies have their overhead lines everywhere and they can be extremely difficult to spot at times, especially if the supporting poles are out of your view. Remember - in recent years at least one Amateur has been killed when the antenna he was erecting touched an overhead line. Others have suffered serious burns. Please be very careful!

Other problems for the Amateur considering portable operations might not seem so obvious as overhead 11 and 33kV overhead lines. However, most modern farmers use electric fences that can produce powerful 'cracks' of static on the h.f. bands. They can also effect v.h.f. too!

Modern electrical fencing tends to use rayon or nylon fibre with a conductive coating applied along its length, rather than traditional wire. Designed to keep cattle and sheep where the farmer wants them - this form of fencing can provide humans with a very unpleasant shock. If you're fitted with a heart pacemaker please avoid them!

Additionally, even if you are some distance away from an electric fence, the radiated signal radiated from an electric fence, can shock-excite signals in another fence some distance away (for this reason I suggest you never use a wire fence as a 'radial' type of earth). It could happen in a fence near to where you've parked your car! To reduce this problem, if I park near a standard wire fence, I always connect each wire strand to earth as - despite appearing to be earthed - they are very likely providing a high resistance path to ground.

Note: If the fence appears to have the strands mounted on little ceramic insulators I recommend you find somewhere else to park. You may be sitting right next to system that could become 'live' at the farmer's convenience!

Despite the occasional difficulties, taking our hobby to the great outdoors is great fun. It also means that those who are extremely restricted at home can get a real 'sniff' of freedom! See you on the bands soon.

PW

Small-Loop Receiving Antennas

The late Joe Carr K4IPV looks at antenna design for a receiving antenna. With the ability to null-out local interference, it might allow you to work stations that are otherwise lost in the noise.

Let's face it, the bands are crowded today. In fact, they have been crowded for quite some time, and with more and more wireless services coming on line every day the situation doesn't look promising. We can, fortunately, do something to reduce the apparent QRM on the bands from the viewpoint of the receiver.

For the low frequency bands the situation can be ameliorated by the use of a small-loop antenna. At frequencies up to about the 6MHz band, the small-loop antenna may be the key to reception.

The problem is not so much gain as it is the directivity of the antenna. On the low frequency bands directivity is hard to get, if you count size as important and who owns enough land to put up a 3.5MHz three element Yagi beam? The directivity of the small-loop antenna could be ideally suited to such operations.

Small Loop Antenna

So what is a small-loop antenna? And how does it differ from a large-loop antenna? The difference is primarily one of wavelength. One textbook lists a small-loop antenna as a loop antenna with an overall wire length of less than 0.18λ, while another textbook lists the overall length as less than 0.10λ. The illustration **Fig. 1** shows the concept of a small-loop antenna.

I have shown the square type of loop, although they're circular, hexagonal and octagonal styles as well. The square loop is a little bit easier to build than the others, so I chose that one to illustrate the point. The comments are appropriate to all small-loop antennas, however.

A large-loop antenna, on the other hand, has a length of at least 0.5λ (λ/2), with most being either one or two wavelengths long. A consequence of the difference in size is that the r.f. current flowing in the small-loop antenna is uniform…it's the same throughout the antenna, no matter where you look at it. The large-loop antenna, on the other hand, produces distinct voltage and current nulls and maxima throughout the length of the wire.

There may be one or more turns of wire in a small-loop antenna. The length of the sides is **A**, and the depth of the winding is **B** in Fig. 1. The only constraint is that the length of A must be at least five times the length of the loop winding (B).

The winding turns can be either planar wound (all in one plane) or solenoid (one layer) wound. Of these, the planar wound results in a sharper null (theoretically that is, as it's difficult to achieve in practice!), while the solenoid wound form is often a little easier to implement.

The tuning capacitor in Fig. 1 is optional, but is highly recommended. The reason is that the output voltage of the loop is increased markedly by the presence of the capacitor. I've seen some books quote that the output voltage is increased by the *Q* of the capacitor, which can be 100 to 500. The capacitor should resonate the loop inductance to the frequency being received.

Radiation Pattern

The radiation pattern of a small-loop antenna is the standard figure of eight pattern with the nulls aligned broadside to the plane of the loop (the maxima are off the ends of the loop). This points out another difference between the large-loop antenna and the small-loop antenna.

The pattern of a large-loop antenna is just the opposite of the small-loop one. The nulls are off the ends and the maxima are broadside to the plane of the loop. It is those nulls that make the antenna an exciting prospect for receiving on crowded bands. The gain of the small-loop antenna is less than that of a dipole, although larger than an isotropic antenna.

But the gain is not the real issue. The real issue is the depth and sharpness of those nulls. By placing the nulls (in their deepest extent) on the offending interfering station you increase the signal-to-noise ratio (S/N) of the situation.

And radio reception is a game of S/N period! This works if there is a difference in azimuthal direction of more than a few degrees between the two stations. Even though the desired signal is not in the maxima of the

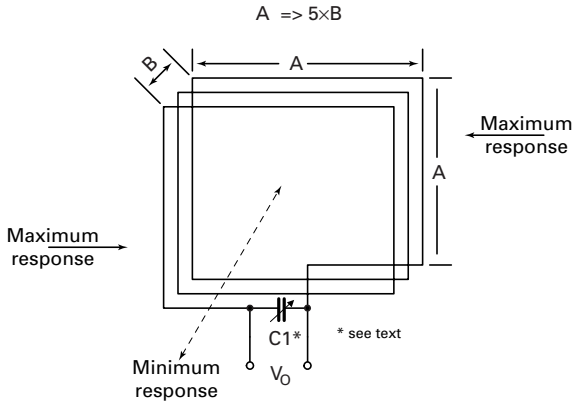


Fig. 1: The small-loop antenna is physically small in relationship to the wavelength, but has many advantages. See text for more detail..

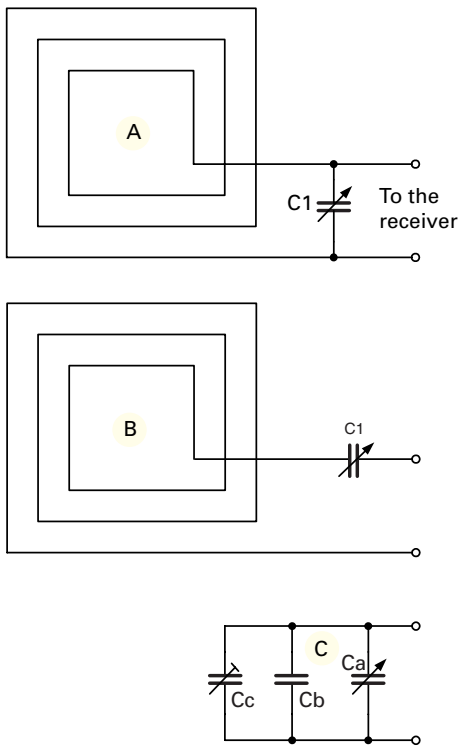


Fig. 2: The various loop tuning schemes: A parallel tuned loop is shown above a series tuned loop, and below them both, is a scheme for padding the capacitor value.

loop, it will perform wonders on the desired signal if the ratio between the two signals is improved (made bigger).

Works Wonders

Not only does the small-loop antenna work wonders on the reception of weak signals on the low frequency bands, it also improves the performance of some receivers on those bands. If the dynamic measures of the receiver's performance are at all compromised by the crowded conditions, then the loop is the answer.

Those dynamic performance parameters include the dynamic range, the third-order intercept point and the desensing signal levels required. The problem is too much r.f. at the r.f. amplifier and the mixer stages, and that drives these stages beyond their capability, producing increased intermodulation distortion noise (IMD) products. This is especially likely to affect the receiver is the third-order difference products ($\{2F_1\}$-F_2 and $\{2F_2\}$-F_1) are present.

Tuning Schemes

Look now at **Fig. 2**, which shows two different tuning schemes for the main loop. The parallel tuned version is shown at the top, while the series tuned version is shown just below. There are apparent differences between series and parallel resonant circuits, but the practical difference is not audible.

Getting the capacitance range needed, does not depend on the availability of the exact capacitor. The lower part of Fig. 2, shows a parallel arrangement in which a trimmer capacitor and a fixed capacitor are used to pad the value of the variable capacitor. Any series, parallel, or series-parallel combination of capacitors can be used in this application.

Loop Impedance

The loop impedance of the loop in Fig. 1 is typically very high, but your receiver wants to see a low impedance feed (a value of 50Ω is a popular choice). The answer to the problem is to use a coupling loop within the main tuned loop.

The coupling loop as shown in **Fig. 3**, is concentric with the main loop, a multi-turn tuned loop similar to Fig. 1. The coupling loop may be one or two independent turns of wire that forms a low impedance coupling to the receiver.

Sometimes, the smaller coupling loop is also tuned, as shown by the additional coloured capacitor in Fig. 3. But the capacitance value required for resonance is typically several times the capacitance needed to tune the main loop. For that reason, one only occasionally finds the coupling loop tuned as well.

Shielding The Loop

Shielding the loop in its own Faraday cage, makes good sense, even if it can be a pain doing it. Shielding the loop, reduces capacitance coupling to nearby voltage sources minimising local noise pickup.

Shielding, or screening the loop has another beneficial effect, as the loop interacts with its environment. The benefit is of reducing the effects of the distortion to the loop's radiation pattern.

The distortion differences are due to capacitance coupling to the environment and their effect is to reduce the sharpness of the nulls. Indeed, in extreme cases the small-loop antenna can show very shallow nulls.

Reduction of nulls, affects the signal-to-noise ratio that can be obtained with the loop! I've seen loop nulls deteriorate from better than –40dB in the direction of a null (maximum being 0dB), to less than –15dB. the change of 25dB (or more) is a significant deterioration of the loop's pattern!

The shielding of the loop antenna is shown in **Fig. 4**, in this case a circular loop is used, but the same discussion could apply to other forms as well. In the drawing of Fig. 4, the loop only has one loop for sake of simplicity, but it may have many turns.

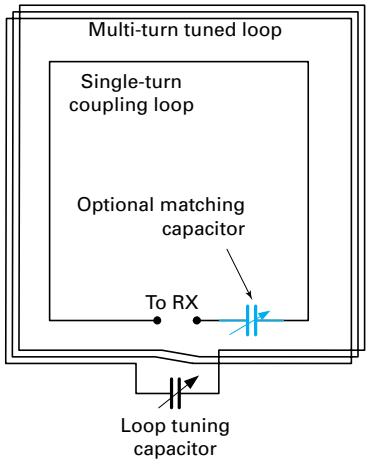


Fig. 3: The use of a coupling loop can make matching to the input of the receiver much better. Although the coupling loop may be at resonance, it's unusual because the value od the capacitor is often much larger than the main loop tuning capacitor.

Note that the shielding is not continuous. There is a gap in the shielding that can be as little as a few millimetres width. The effect of the loop is preventing the shielded loop from acting as a single-turn loop in its own right.

The shielded loop antenna then is sensitive only to the magnetic field component of the electromagnetic signal, rather than the electric field component, the typical wire or tubing antenna responds to the electric field rather than the magnetic one.

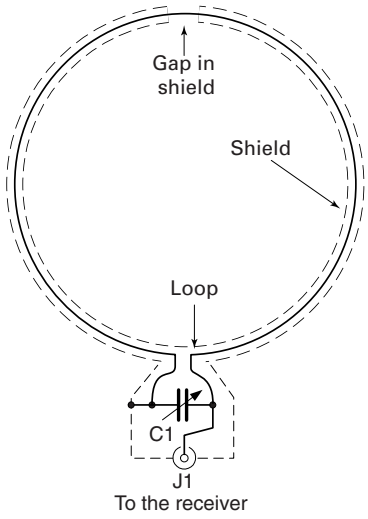


Fig. 4: A shielded loop has many advantages over an unshielded one. (see text for more detail).

Peeking Through

By shielding the loop, allowing only a small segment to peek through the shield, you allow the magnetic field vector to affect the antenna, but not the electric. The noise generated by lightning and man-made spark oriented interference on the band, tends to be electric field oriented so, the shielded small-loop antenna also tends to discriminate against this form of unwanted noise

So, small-loop antennas are antennas with an overall wire length less than 0.18l or 0.10l. The result of the small size of the antenna is that the current flowing is the same at all points within the antenna.They have advantages over large-loop antennas which shows distinct voltage and current nulls and maxima.

Try a small loop out and I'm sure you'll come to the same conclusion: that small-loop antennas with their figure of eight radiation pattern can be used to null out interference, increasing the S/N of the desired signal. Try it…you'll like it. **PW**

When Joe wrote this article for us, he added the following postscript: "I would like to thank those who welcomed me as a columnist for *Practical Wireless* after my first column. It's truly an honour to be named to this post, and I will endeavour to be worthy of the honor the magazine has done me".

Sadly Joe became a silent key on the 25 November 2000. A loss, not only to his family, but to the whole of Amateur Radio. An obituary appeared on pages 10 and 11 of the March 2001 issue of *Practical Wireless*.

The 7OGN 8-for-6
A DX Antenna For 50MHz

Dennis Arnold G7OGN enlists the aid of Duncan Cadd G0UTY to 'stretch' the G2BCX antenna design to work on 50MHz.

The antenna I'm about to describe started off as a 'I wonder if...' style of idea after I looked at the G2BCX antenna design presented in *More Out Of Thin Air* (and originally in *Out Of Thin Air* too. **Editor**.).

The antenna is based rather loosely on an original design by the late **Fred Judd G2BCX**, It's a design using two driven phased folded dipole elements in combination with other parasitic elements to create a small, but effective beam antenna for the 144MHz band. But would the redesigned antenna work on 50MHz? Read on and find out.

I make few claims of originality for the basic design, but tweaking the new antenna for a decent match on the 50MHz has proved interesting. These tweaks involved the removal of a few elements and a change of element thickness (relative to wavelength). And it's made a difference to the feed-point impedance as you would expect.

In the light of experience, a few practical modifications have been needed. In my new design, all the elements are spaced 675mm apart. Using the computer programs *NEC2* suggested that the input impedance is purely resistive, at around 30-35Ω, with little reactive components.

Impedance Transformed

The antenna input impedance is transformed, using a matching stub transformer, to the more 'usual' 50Ω needed to match into the coaxial cable. The 450Ω 'phasing' line is bought forward from the the crossed-over feed points between the driven elements to a waterproof box towards the front-end of the boom. This box also contains the 'shorting' bar matching system.

As the 450Ω phasing and λ/2 transformer line is longer than the distance between the two mounting points. So, it has to be kept away from both elements and the boom by non-metallic supports if it is not to cause losses and mismatch.The feeding coaxial cable, then runs from the

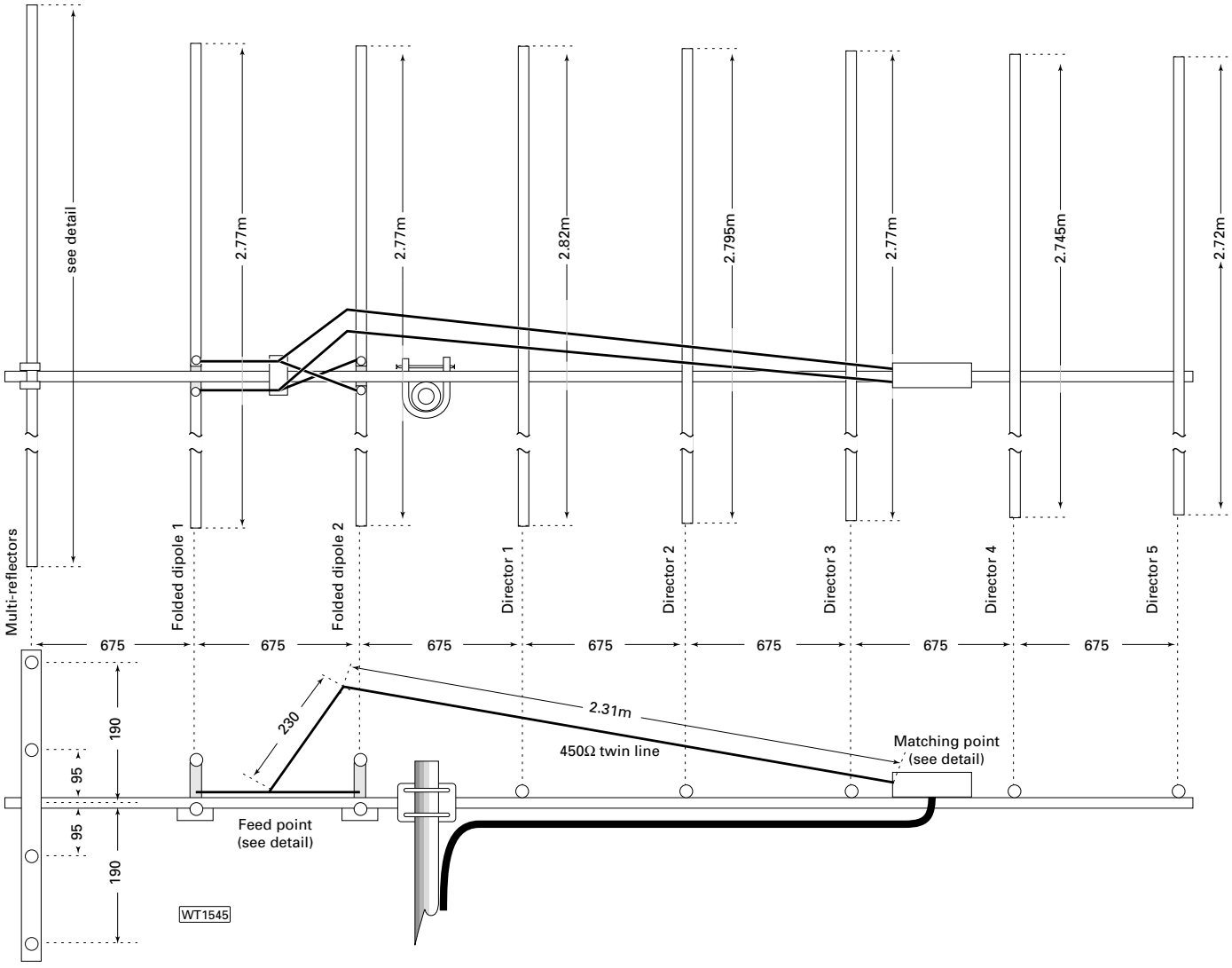


Fig. 1: The antenna that Dennis G7OGN built - seen from above and the side. All dimensions are in millimetres unless stated.

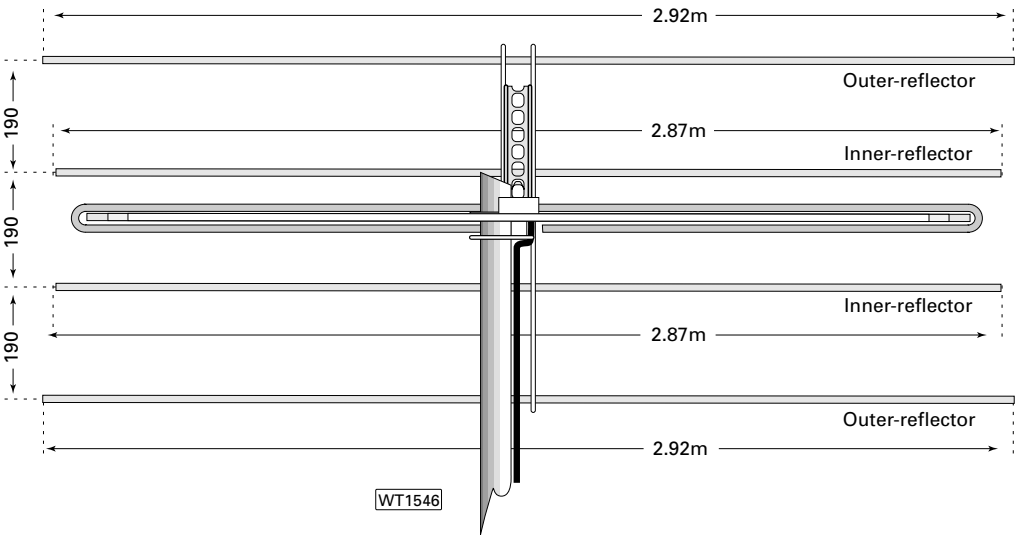


Fig. 2: Looking from the 'sharp-end' into the antenna shows the four reflector elements are longer on the top and bottom elements.

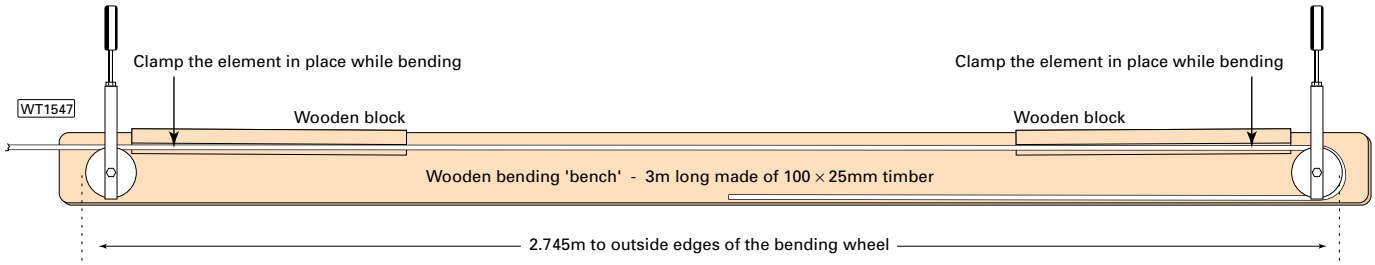


Fig. 3: The bending 'bench' and jig that was produced to make production of the folded elements easier and more consistent.

adjustable feed-point in the box, under the boom back towards the mast, and then down to the transceiver.

Antenna Layout

Let's have a look at the general construction and layout of the '7OGN' antenna, which can be seen in **Fig. 1** and **Fig. 2**. The two driven elements are folded half-wave dipoles, with five directors and a multi-element reflector. In the final design I've used 'half-inch' aluminium tube throughout.

The reflectors are mounted on a small 'sub-boom' with the two outer ones rather longer than the two nearer the main boom. All element spacing is constant at 675mm between element centres. The phasing line should be held in the shape shown with a non-conducting support under the high point.

The Construction

Now it's time to turn to the construction of the antenna, which is quite straight forward. The only tricky bits being the forming of the folded dipole elements. Each element needed to be bent from a single length of aluminium tube for rigidity, but the slightest miscalculation could be costly in tubing.

So, as a compromise on the initial prototype antenna, each element was made up of five pieces of tubing: a 'top piece of 2.67m long, two lower parts - each 1.32m long and two 'U' bends of 9/10mm ($^{3}/_{8}$in) for the end pieces. Now the two ends are 'trombone' sliding fit pieces, and could be used to give a slight change in matching to give the best s.w.r. reading.

When the best dimensions for the folded elements had been determined (2.77m 'tip-to-tip'), each of the folded dipole elements was made from a single 8m length of 12.7mm ($^{1}/_{2}$in) diameter aluminium tubing. To ensure repeatability, we made a wooden bending jig shown in the diagram of **Figs. 3** and **4**. A bending 'bench' such as the one shown is extremely useful.

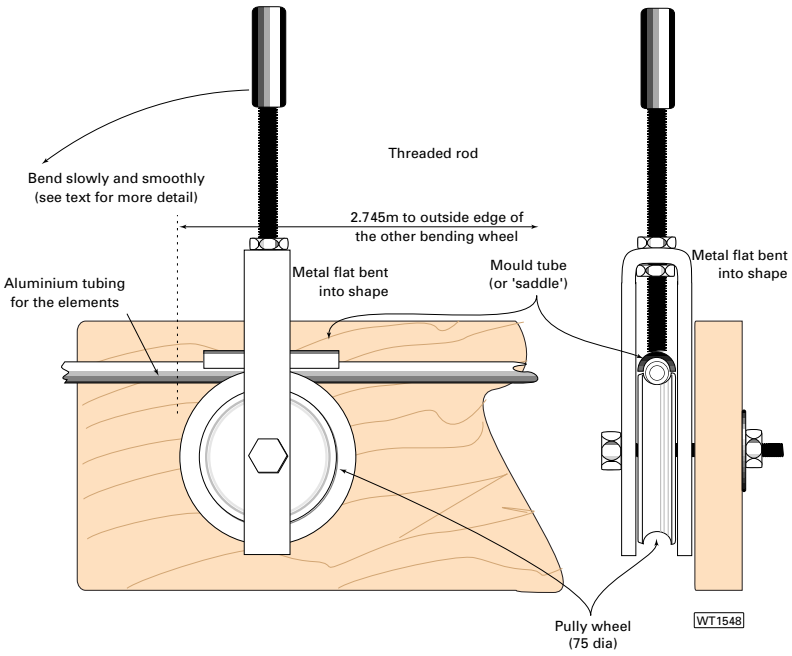
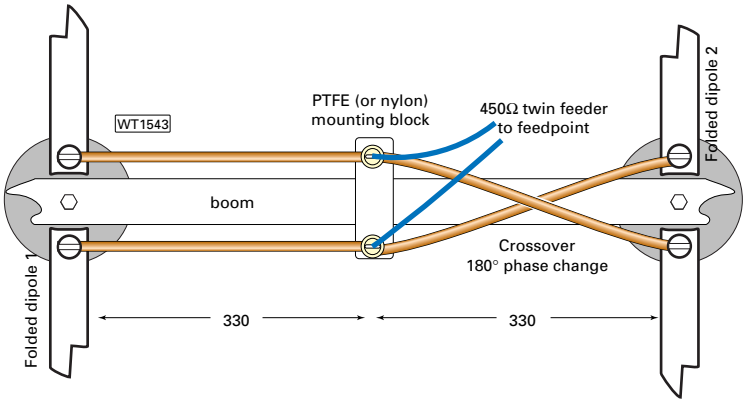


Fig. 4: The tube forming 'end' in more detail. (See the text for more information).

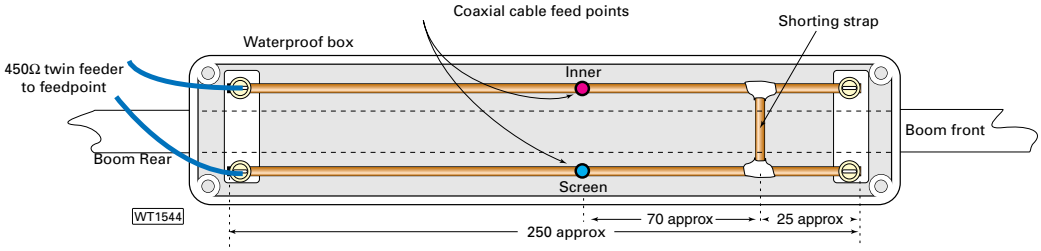
Bending Wheels

The bending wheels were two 75mm diameter pulley wheels that held the tubing with a snug fit inside the rim. The mould tube, or saddle is a short section of steel tube that had an internal diameter the same as the tubing used for the elements. The 'inside' of this saddle should be as smooth as possible.

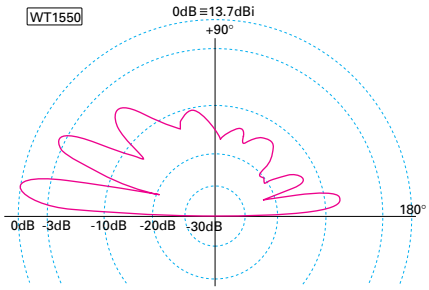
The bending bench, or jig, was made from one three metre length of 100×25mm timber with two 75mm diameter aluminium pulley wheels, mounted so, that when the aluminium tube was in place, and bent around the



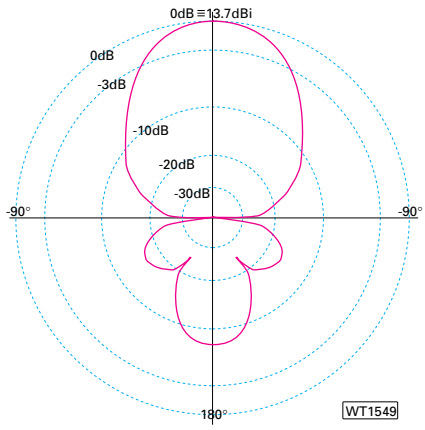
■ Fig. 5: The cross-over phasing lines can be made from heavyweight insulated copper wire, but should be isolated from each other and the boom. The elements are held onto the boom by commercial dipole mounting kits available from Deecom. (See text for more detail).



■ Fig. 6: The shorting bar matching system employed in the antenna. As the impedance can change quite quickly only small



■ Fig. 7: The theoretical radiation pattern of the antenna in the vertical plane (redrawn from a computer printout).



■ Fig. 8: The theoretical radiation pattern of the antenna in the horizontal plane (redrawn from a computer printout), the forward gain is around 11dBd (13.7dBi).

wheel, the outsides of the curved elements measured 2.77m apart. For initial measurements, only short sections of tube were placed on the pulley wheels.

If you don't want to go to the lengths of making your own jig, then tube formers, to aid bending the tubing accurately, should be available from all good plumbing suppliers ('half-inch' Pipe Benders). However, I can recommend making your own jig, if you have a good mechanical workshop available.

Bending Technique

There is a technique for using pipe-bending formers that gives a good smooth bend without flattened tubing. The technique is to have a bending set-up where all the parts fit neatly and closely together. When making the bend, try and carry out the action in a single smooth movement as evenly as possible.

When bending the tube, especially with aluminium, it's no good try to 'take a run' at it, or snatching the thing. This method often leaves kinks in the tubing or changes of direction at the bend. So, with that in mind and having completed the bending of the element, they should lay flat on the ground.

I used two dipole boom-mounting adapters (originally from **Deecom**) as mounting supports for the driven elements. These were mounted upside-down **underneath** the boom and the folded element was mounted above the boom, the mounting bolts also holding the feeding lines from the common point on the upper side of the boom. The cross-over feeding lines are basically as shown in **Fig. 5**.

Matching & Adjusting

Now a few words about how the matching is checked and adjusted. The dimensions shown in The feed-point-box of **Fig. 6**, make a good starting point.The box itself should be made of some weatherproof insulating material, and the items should be isolated from the boom.

Movements of the shorting strap make large changes to the matching and these should be limited to about one millimetre at a time. Changes to the feed-point position cause less of a change in matching and so, may be used to 'fine-tune' the matching. Take care to seal the case before putting the antenna into operation

Radiation Patterns

The radiation patterns, were originally printed out using *xnecview* that runs under the *Linux* operating system rather than the more usual *Windows95/98*. The patterns, **Figs. 7** and **8**, show that the lobes are broad in the horizontal plane (reducing the antenna 'aiming' problems) but quite narrow in the vertical plane. The patterns themselves have been plotted using the standard ARRL plotting conventions, which will readily enable comparisons with other published designs.

For the purposes of modelling, the antenna was assumed to be 10m above a 'Sommerfeld' ground model for 'average' earth. (This computer model assumes a dielectric constant of 13 and a conductivity of 10^{-5} so, it approximates 'the real world' well).

Since there is some cost involved with making this antenna, both in terms of techniques and cash, it would seem to be an ideal club project. The costs being 'shared' among the members. This is my next task to get our radio club (**Northampton Radio Club G8LED** and **G3GWB**) active on 50MHz.

At my own location, where the original antenna is used, I've noted wind speeds in excess of 75knots (around 135k.p.h.) sustained over several days. The antenna has, in spite of the long unsupported elements, survived it all with honours and allowed me to work into '5B4', '9A', 'SV9', 'ZS6', 'ZB2' and most areas of Europe.

This project would have been far more difficult to complete without a lot of help from **Duncan Cadd G0UTY**, who stepped in to help with the mathematics and computer plots for the antenna,when my own knowledge was 'flagging'. Thanks Duncan!

PW

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Zig-Zag Log Periodic

Derek Bundy G3JQQ describes a cheap, compact, wide band antenna covering the bands of 14-28MHz.

I first came into contact with log periodic array antennas (l.p.a.) professionally in the mid-1960s. This type of antenna offers, in transmitting terms, the convenience of small v.s.w.r. excursion over several octaves of frequency range. Although the actual v.s.w.r variation does depend on the constants chosen when creating the design.

On reception, an l.p.a. offers useful forward gain and front-to-back ratio, though these parameters are not as good as those of a rhombic antenna. However, the l.p.a. uses less real estate than a rhombic, which is likely to be of greater consideration for most readers.

Multi-Band Coverage

For Amateur applications the main advantage of the l.p.a. is its multi-band coverage, especially on the h.f. bands. Though this is tempered with the need still for a fair amount of space. The other consideration is that only part of the antenna is in use at any one time.

However, if some sacrifice in forward gain and a range of s.w.r. variation is acceptable, it's possible to create a compact design that is small enough to fit into an average garden. The design presented here will achieve that and has an s.w.r. swing of up to 3:1.

The two most significant design constants are the relative spacing, designated by the Greek character σ {sigma} and the geometric constant, the Greek letter τ (tau). I chose a σ factor of 0.06 and a τ of 0.8 for this design, parameters that give an maximum antenna width of 10.36m. (*The constant τ is the geometric rate of change of the element lengths along the antenna. The constant s is the relative spacing between two adjacent element - it's related to the longer of the two elements by σ.* **Editor**)

Design Criteria

I won't go deeply into the design criteria, but choosing design constants to reduce the array length has resulted in a reduction of forward gain of around 1.5dB (down to 4.5dB theoretical).

There is a very good explanatory chapter on l.p.a. antennas in the *ARRL Antenna Book* and it should be consulted if you are looking for more information about the antenna.

The antenna has five elements within its 3.96m array length, to give a theoretical forward gain of 4.5dBd over the bands 14-30MHz, with a front-to-back ratio that's between 10-20dB over the range. I have since confirmed the front-to-back ratio on DX signals by using two similar antenna mounted pointing in opposite directions.

The basic design may be implemented in various ways, a popular version being a wire dipole form. But this does require a rather more complicated centre feedline, and spacer system with alternate elements transposed.

For this project, I've employed the simpler Zig-Zag configuration, **Fig. 1**, where each element is fed from the end. The feeder line carries on to become the elements themselves, resulting in an antenna/feeder arrangement combination free of joints or terminations right down to the balun itself.

More Wire

Although the Zig-Zag arrangement uses more wire than that required for a conventional l.p.a. it benefits from simplicity and the lack of troublesome joints. I use *ptfe* covered silver-plated stranded wire (an extravagance made possible by a visit to the Longleat rally some time ago), but pvc covered stranded wire, of almost any size, may be used to good effect.

The finished antenna could be hung from a catenary if three elevated points are available. Alternatively, and this is my preferred method, it may be suspended from two 10mm diameter aluminium tubes to the sides of the array.

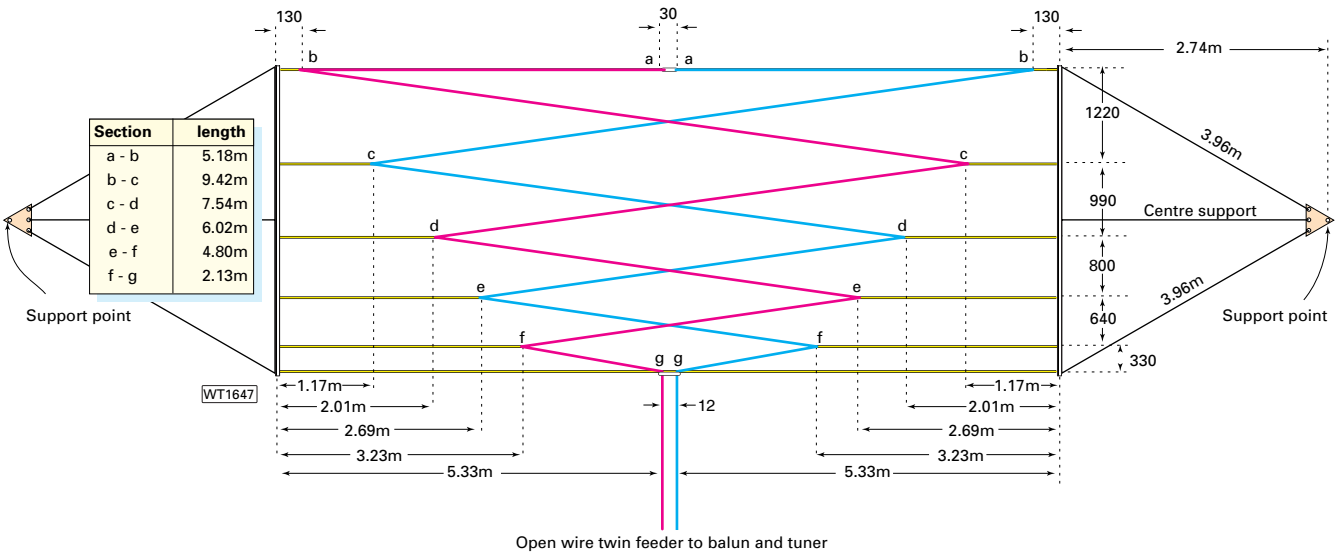
Of course you could use other material other than aluminium if it's available. But I've found that the lightweight strength of the tubing, when augmented with a three-point suspension method as shown, holds the array in good shape.

The various feedline and rear element central spacers **Fig. 2**, **Fig. 3** and **Fig. 4**, are made from the lightweight plastic material often used for soffit boards. A friendly builder is the ideal place to start for offcuts to make up the pieces at minimum cost.

An alternative material for the spacers is Perspex, although it does degrade in sunlight over time. I've not tried sections of the grey plastic water pipe, available from builders, but using a little ingenuity you can keep the costs down easily.

The Construction

Now let me turn to the construction of the antenna



Section	length
a - b	5.18m
b - c	9.42m
c - d	7.54m
d - e	6.02m
e - f	4.80m
f - g	2.13m

■ Fig. 1: The overall layout of the Zig-Zag log periodic array.

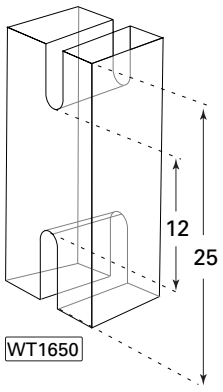


Fig. 2: The feedline spacers may be cut from a section of plastic material often used for soffit boards. See text for more detail.

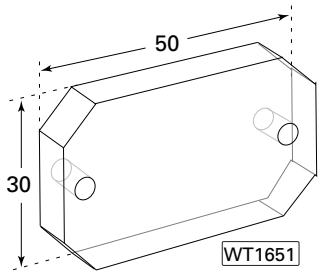


Fig. 3: The rear element has a centre spacer made from the same material as the feedline spacer.

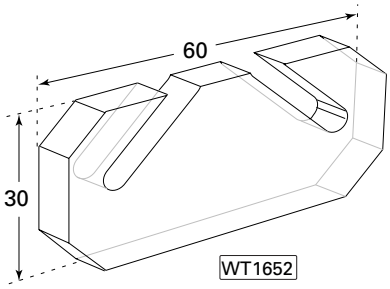


Fig. 4: The support for the front element has slots cut into it to make mounting easier. The slots should be sealed as described in text before permanent mounting.

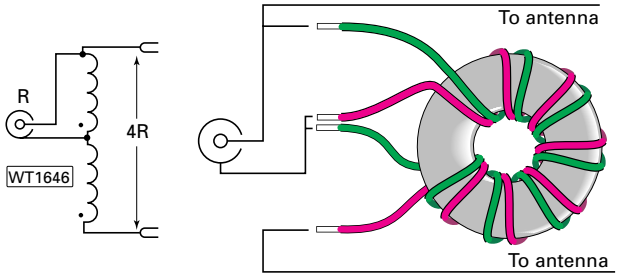


Fig. 5: A typical ferrite cored balun with seven bilfilliar wound turns gives a 4:1 impedance set-up when used in this format.

array, which is best carried out on a large flat space. To minimise problems, I would suggest banning from the area, all household members, friends and pets, unless they are helping directly in the job. I'll deal with the construction in a series of steps, as I feel this technique has much to offer in ensuring success.

Step one:
Measure or estimate the length of the extra wire that will become the twin wire open feeder. This length is added to the overall length of each half antenna array element. As the length needed for array is a little over 35m the lengths involved can be quite long. Accurately measure off the total length needed for each element (perhaps adding a little more to cover errors) and coil each wire onto a separate drum or large cardboard box.

Step two:
Prepare the two suspension tubes by marking the various support points on each tube with a marker pen. I used the rear end as the reference point, but start from one end only when measuring and marking. Tie each string onto its correct point leaving enough free to tie and adjust the lines when completed. Attach the low frequency centre insulator to the ends of the two wires on the drums.

Step three:
Start by carefully measuring the wire forming the rear element and bind a small loop of wire to form the suspension point at the outer end of the element. If possible ask someone else to verify the measurement before making the loop.

Step four:
Measure length of the next element forward and make another loop for its suspension point. Again try to have the measurement verified before any action.

Step five:
Repeat step four on each of the smaller elements until you arrive at the feed-point position. Place the drum or cardboard box on the ground. Now repeat steps three to five for the mirror image of the array.

Step six:
Add in the centre support insulator and tie each antenna half to it. Loosely tie each suspension point onto its support line, and suspend the whole antenna at a comfortable height to trim and fix the various lines for equal and even tension in them. Add in the centre support insulators if you are going to use them. Tied in place, they help to keep the antenna in shape, rather better than just simply allowing the wires to float around.

Step seven:
This step is to form the twin wire open feeder from pre-cut plastic spacers to give a wire to wire spacing of 12mm or so. Put spacers about every 300mm along the wires. The end of each slot was sealed using a gas powered soldering iron on medium heat. **DO NOT breath in the fumes**!

Opposite Directions

I actually use two of these antenna for some time mounted, at a height of around six metres, pointing in opposite directions but slightly offset from one another. Each antenna has its own balun, which may be air or ferrite cored, can be quite near the shack. The pair are fed from a changeover switch mounted in the coaxial cable feeder running back to the shack, the whole arrangement can be quite efficient.

The balun used, **Fig. 5**, should have a nominal step up ratio of 4:1 and may be either seven turns bilfilliar wound on a suitable ferrite toroidal core. Or it could also be double linear wound (26+26 turns) on 30mm diameter formers as shown in **Fig. 6**.

The back-to-back set-up has allowed me to gauge the front to back ratio of the antenna and to guess the forward gain lobe, which seems to be rather broad in use. My reference antenna has been a trapped dipole at around the same height, and the logs show that the Zig-Zag antenna to be several S-points better in signal gain.

We have had some severe storms in this area since I erected the antennas, but no problems or damage have been experienced in the set-up. I do, though have the main suspension point running over a pulley with a counterweight to keep the tension on in normal use, but allow for some movement.

For those of you with more space available, you could extend the antenna coverage down to the 7MHz band, keeping the geometry of the design, as long as the longest element is slightly greater than a half wave long at the lowest frequency. Similarly you could scale the values to extend the values to extend the design higher in frequency

PW

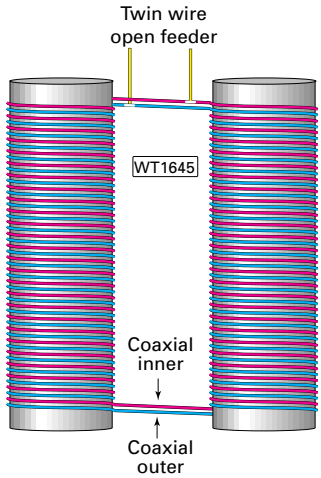


Fig. 6: An alternative balun with two windings of 26 turns wound side-by-side on 30mm diameter plastic waterpipe. The two formers should be separated by about 30mm.

Antenna Workshop

Having Fun With A Slinky!

John Heys G3BDQ has been playing with a popular children's toy to create an antenna that can crawl downstairs!

I'm sure that you have all seen the well known children's toy that can 'walk' downstairs, known usually by the generic name of Slinky. The toy is essentially a helix or coiled spring, usually made from metal or plastic (but we cannot use that form as an antenna for obvious reasons). But before embarking on descriptions of successful h.f. antennas that I've made from these Slinkies, a short description of their vital statistics may be in order.

Slinky Helix

The Slinky helix is made from a silver-grey metal that although it's magnetic never seems to rust, even after a long exposure to the great wet British outdoors. The metal itself may be easily soldered for connections. When at rest, the 230gm coil of metal fits easily into its small-almost cubic-card-box.

Made with an oblong cross-section (0.5mm thick and 2.5mm wide) the Slinky has 87 complete turns with an overall diameter of 69.5mm with a complete length of about 19m. The comparatively large surface area of the metal shape gives it the capability of being a good r.f. conductor. The length of one complete turn is some 218mm.

When building helically wound elements for antennas, a well known characteristic is that the length of wire needed for each element has to almost twice as long as the freespace wavelength. I've found that, on any band, the overall length needs to be some 69% (conveniently 70%) longer and that changing the stretched out length of the Slinky makes negligible change to the resonant frequency of the antenna.

My experiments with Slinky coils have all been made indoors, which makes it easy to adjust for resonance without enduring the rigours of our climate. For checking resonance and bandwidth, I use my trusty Autek RF-1 antenna analyser, which makes things quite easy.

Dip Oscillator

If you do not have access to an antenna analyser, then a dip oscillator and the station s.w.r. meter can be used, as a substitute. I began by pulling the Slinky out to some 3.35m and strung it up above head height along the upstairs landing. The antenna analyser soon showed that it had a resonant frequency of 6.8MHz and when fed against the station earth had a feed-point impedance of 40Ω.

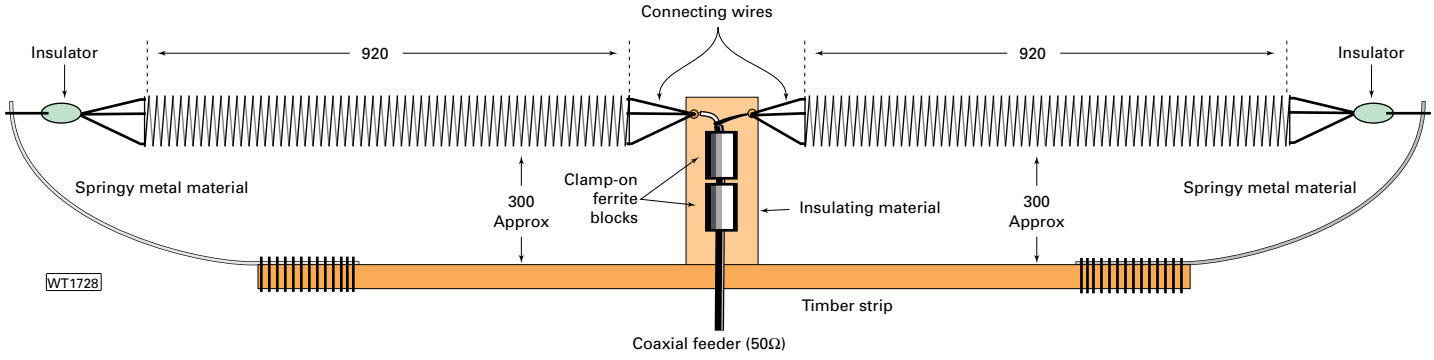
I didn't trim the helix to resonance, I just connected it directly to the a.t.u. On the receiver, some signals in the 7MHz band were as strong as if I had used an external antenna, although other signals were some 6-18dB down. With just 60W of output power, I had many c.w. and voice contacts with European stations.

An Antenna that can crawl downstairs!

The basic model, available in most toy shops is manufactured by **James Industries Inc. of Hollidaysburg, Pennsylvania, USA.** When looking for one it pays to look around in a variety of shops as the prices charged can vary quite a bit. My local stationer-newsagents, with a small toy department upstairs, charged a pound less than a leading toy shop!

Encouraged with the results on 7MHz I turned to the 21MHz band, for which I decided to make a half-wave dipole. For this band a normal wire dipole would be some 6.75m long...however, the Slinky version was only 2m long!

The constructional details of this design are shown in **Fig. 1**. Initially I made each side 31 helical turns, but analysis with the



■ Fig. 1: Shortened dipoles for h.f. bands follow this general design. (See text for more details for band design principles).

Autek showed that the resonant frequency was too low. By shorting out a few turns, the correct length was soon discovered.

The unwanted turns on each side were held together with thin bare wire, which was soldered together. and I was pleasantly surprised to find the 70% rule held on this band too. The feed-point impedance turned out to be 45Ω and the midpoint so, I could use an eight metre length of 50Ω coaxial cable to the transceiver. A pair of clamp-on ferrite blocks at the feed-point formed an effective current balun.

Good Bandwidth

In use the antenna had a good bandwidth with a range of 150kHz in the centre of the 21MHz band where the s.w.r. was 1.4:1 or below. This tiny dipole gave an incoming signal reports of S6-S9+ with European stations and a few DX stations were also worked.

Oddly, some signals were stronger on the Slinky than on a well placed outside tri-band dipole, others being some four S-points down. I had no problems finding c.w. stations to work and the voice contacts expressed surprise at the make-up and location of the antenna!

Should the overall length of the extended Slinky be over four metres long I can recommend that a length of heavy duty monofilament line is used as a support. If so, run the monofilament along inside the coil, tie both ends down and extend the antenna along it.

Indian Rope Trick

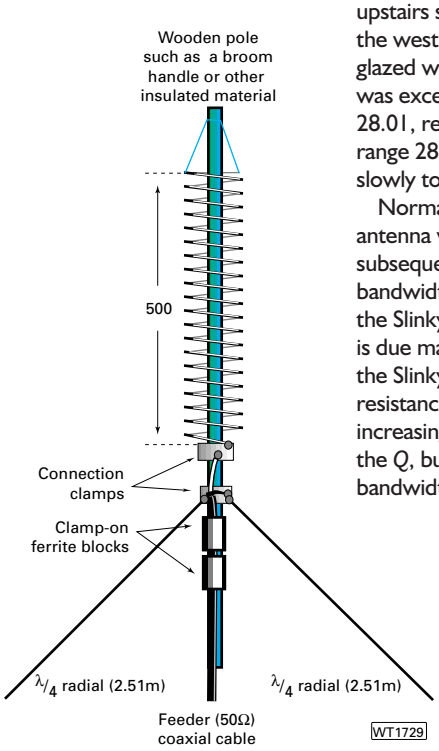
Now to try something like the Indian Rope trick, by creating a vertical Slinky antenna for the 28MHz band. A vertical λ/4 for this band is normally about 5m high, so the Slinky was calculated being 70% longer, which turned out to be 20 helix turns.

I checked the Slinky for resonance above a λ/4 ground plane, and at 20 turns it was rather long, needing one less turn to bring it to resonance at 28.45MHz. I then added a second radial, the overall layout is shown in **Fig. 2** and the photograph of **Fig. 3**. The vertical support I used was a short length of glass fibre (g.r.p.) tubing.

The Slinky was extended to cover just half a metre, the same length as a λ/4 vertical for the 144MHz band. The feed-point impedance however, depends on the layout of the two ground radials. I also found that, with the two in line 180° apart and angled down 45° there was no loss of sensitivity in any one direction and the feed-point impedance was close to 50Ω.

The mounting pole for my 28MHz vertical was a broomstick arranged on the spare room adjacent to the upstairs shack, 'looking' out to the west through a big double glazed window. The s.w.r. curve was excellent. being 1.5:1 at 28.01, reducing to 'flat' over the range 28.3-28.65MHz, rising slowly to 2:1 at 29MHz.

Normally an inductively loaded antenna would have a high *Q* and subsequently a narrow bandwidth, but not the case with the Slinky! This wider bandwidth, is due mainly to the resistance of the Slinky helix material. The resistance has the effect of increasing the losses so, reducing the *Q*, but which gives a wider bandwidth.



■ Fig. 2: A vertical for the 28MHz band, just the same length as a λ/4 for the 144MHz band.

DX Potential

The DX potential of the Slinky vertical antenna was surprising as many stations were worked with only 60W of r.f. In round terms signals reports were from 1-2 S-points down on the signal from the outdoor tri-band dipole, but during the 2001 ARRL SSB Contest many American stations were worked first call.

Later contact with USA stations were interesting, when I got some 'real' reports which ranged from S4 to S7 rather than the somewhat rubber-stamp S9 contest report. Moving the antenna to my stairway landing area, with its eastwards looking window this allowed many solid contacts with European stations, often with S9 or S9+ signal reports.

Devising an indoor antenna for the 3.5MHz band is not easy! A quarter wave on this band is 19m long, needing a Slinky helix length of over 32m if the 70% rule holds. So, to start, I soldered two Slinkies together to produce a double length helix of some 38m.

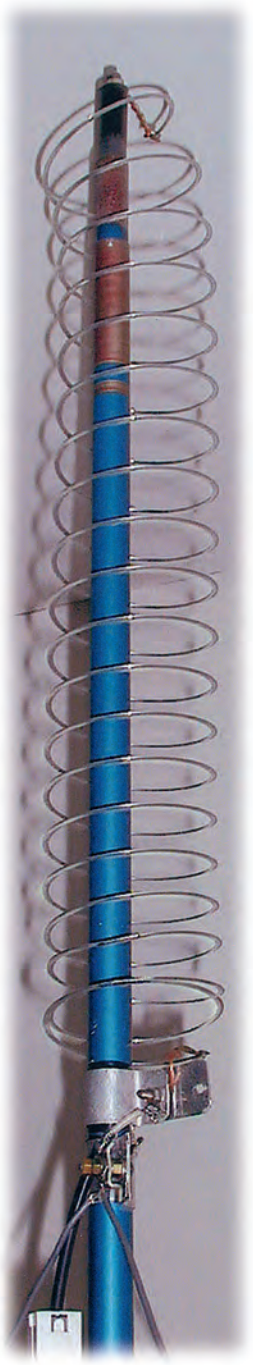
With a strong monofilament through the middle, I pulled the Slinkies out to cover some six metres, and tied a support line in the middle to counteract sag. The whole thing was slung along the landing and into the spare room.

Antenna Analyser

On using the antenna analyser, I found that this double length was resonant a way under the 3.5MHz band. By using an a.t.u. and tuning against the station earth, I achieved a usable s.w.r. on the s.s.b. section of the 3.5MHz band and was soon operating, receiving S8 and S9+ signal reports.

By shorting out 10 turns, I was able to operate without an a.t.u. with an s.w.r. of 1.3: at 3.65MHz. Again only the station earth line was used without additional radials.

But what else can you do with Slinkies? Well to answer that question, although I've not actually tried it myself, there are enthusiasts that have made up Beverage type receiving antennas using several Slinkies soldered together. As a Beverage antenna has to be at least two wavelengths long, creating such a length, even for the lower bands should be quite simple.



■ Fig. 3: Compare this photograph with the illustration of Fig. 2.

A plot of land smaller than a football pitch would accommodate at some 27 to 30 Slinkies in line. They would need only to be just over head height so, a series of support poles around two metres long would be needed to hold the antenna up.

Slinkies could also be used as ground plane wires where space is very limited. What about other designs using Slinkies in place of elements? What about a really 'baby' quad for one of the h.f. bands? The possibilities are almost endless! **PW**

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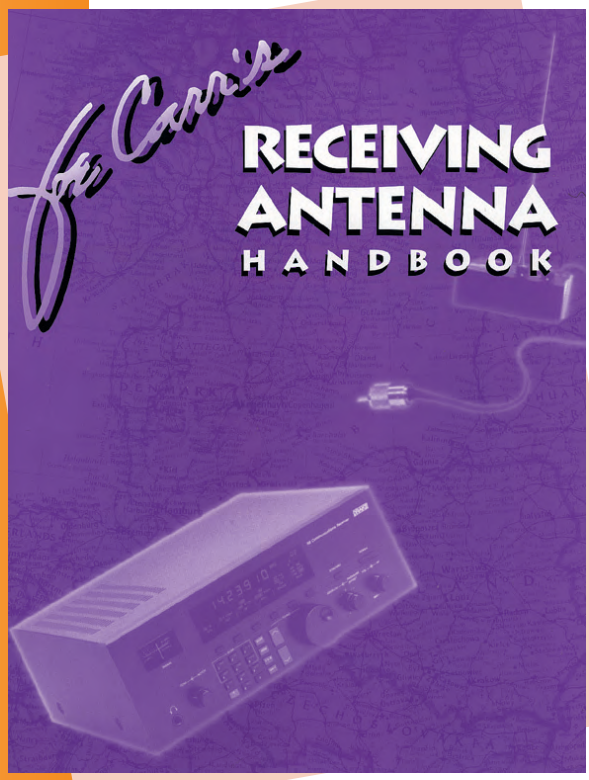

If you enjoyed the article, Small loop Antennas, by the late **Joe Carr K4IPV** on pages 40 & 40 of this issue, then you should consider buying this book to add to your collection.

Joe Carr's *Receiving Antenna Handbook* offers a complete guide to high performance receiving antennas from longwave all the way up to the upper end of the shortwave spectrum. Topics covered in the book include:

- Basic theory
- Special designs for indoor and limited space
- Getting a good ground connection at radio frequencies
- Safety considerations
- How signals propogate over long distances

Construction details are given for each antenna and most can be easily built using only wire or alumunium tubing, so will be well within the reach of most readers. The designs in Joe's book should help you pull those signals out of the noise!

Normally, this book sells for £17.50 plus P&P but this month we're giving you the opportunity to buy it at just **£8.75 plus £1.75 P&P** (Uk only, overseas customers please call for prices) - thats 50% off!

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Going QRP on Satellites Part 2

Peter Perera G4AJG presents his second, and final, article which is aimed at encouraging newcomers to try low power Amateur Radio satellite communications. This month, Peter describes several very useful commercially made transceivers that he considers are ideal to get you 'into orbit'.

Thanks to VU2POP, Secretary, of AMSAT India, we are able to show the successful launch photograph of Hamsat-VO-52.

I'll start off part two of the article by describing several rigs that can help you get started and get your signal 'into orbit! So, let's now consider the two Kenwood transceiver options.

The first is the TH-D7E hand-held f.m. transceiver, **Fig. 1,** (reviewed in the May 1999 issue of *PW*)**.** This unit is a dual-band v.h.f./u.h.f., f.m. rig packed with a unique and impressive range of modes and facilities. It serves a wide range of Amateur radio portable applications, including Satellite operations. Like many modern radios it's microprocessor controlled and menu driven with just a toggle switch, keypad and a rotary control to access all its functions.

The inclusion of a 1200/9600Baud Terminal Node Controller (TNC), makes the rig ideal for satellite telemetry data gathering as well as terrestrial packet operations.

In keeping with the customary Kenwood standards the radio is built on a die-cast base, the outer cover being an impact resisting shell in a steel grey satin crackle finish, similar to its big brother the Kenwood TS-2000.

The transceiver dimensions are 54 x119.5 x 35.5mm and weighs 380g (13.4oz) when fitted with the higher capacity PB-39 battery installed and 340g (12oz) with the lower capacity PB-38. With the 9.6V, PB-39 battery it's able to output 5W r.f. Using an external d.c. power source of 13.8V the transmitter gives an r.f. output of 6W on v.h.f. and 5.5W on u.h.f. into a properly terminated load.

Three r.f. power levels are selectable i.e. **Extra Low**, **Low** and **High**, the corresponding power output levels being in the range 50mW to 6W on v.h.f. or 5.5W on u.h.f. The higher power being possible using a 13.5V power source (as previously mentioned). Dummy load tests confirmed these levels of r.f. power output.

Note: The battery's duration in service depends on the selected modes and length of operation. Battery level indication is available only when the operator activates the PTT transmit switch, which I found a little unusual. Perhaps an l.c.d. panel indication as in the TH-F7 described below would have been better? Also, while charging the battery there's no indicator l.e.d. to confirm charging is under way.

The specification quotes an input sensitivity of 0.14μV for 12dB SINAD, signal-to-noise ratio. This is a figure close to those verified by independent laboratory tests for a typical batch sample.

Two Comprehensive Manuals

The transceiver is supplied with two very comprehensive manuals. The first contains the general instruction manual and the second covers the more specialised features

such as Automatic Packet/Position Reporting System (APRS) and DX packet cluster operations. The detailed explanations are thorough, and cross-referenced for ease of access.

The front panel contains the liquid crystal display (l.c.d.) and a prominent four-position toggle/cursor key. There's also an alpha-numeric keypad with clearly marked white lettering on a black background, while other lettering is in colour etched on the panel itself. All have multi-function interactive capability. On the left-hand side are located the **PTT** control switch, panel illumination and the **Monitor/ Squelch** buttons.

On the right-hand side are sockets for **Speaker**, **Microphone** and PC and GPS sockets. A well fitting neoprene cover protects each one independently.

At the top of the unit is the dual concentric rotary knob for **Volume/Function** control and an SMA type screw-on connector for the supplied helical whip antenna.

Frequency Ranges

The frequency ranges covered by the Kenwood TH-D7E are 144-146MHz and 430-440MHz. The rig has separate v.f.o.s for each of the two bands, A and B, selectable by the **Band** control.

A total of 200 memories are available for the Bands. I found the various key operations ergonomically well located and easy to operate.

For direct entry of frequencies for each of the two bands, you need only to select either band and press the two keys marked **VFO** and **ENT** and key in the required frequencies using the keypad. To select a frequency step, press keys marked **F** and **8** and using either the up/down cursor or the rotary control knob.

Provision Of APRS

The provision of access to APRS activity is a significant feature of this Radio. The second manual supplied is entirely devoted to this mode of operation and is well presented to enable any newcomer to try this fascinating system.

I used the function utilising the *UI-View32* software and it performed extremely well using the internal TNC operating at 9600Baud. In fact this is the same TNC used by Kenwood in the TS-2000 base station transceiver. (More about this later).

The **Menu** key on the front panel gives access to this internal menu, which in turn is divided, into three levels **Radio**, **APRS** and **SSTV** (slow scan TV). Each level divided into further sub levels to access the wide variety of operating modes.

Daunting as this may seem at first glance, a closer study of the clearly set out menu configuration within the manual enables the operator to become familiar with the various features within a relatively short time. **Note:** I found it best to have the manual close at hand to nudge my memory now and then!).

The manual in its entirety can also be downloaded from the main Kenwood website at **http://www.kenwood.net**

Also downloadable from the site is the Kenwood **Memory Control Program**, which enables the operator to copy to their PC memory data they've previously programmed into the radio.

Access to TNC operation is via a key marked **TNC** on the front panel and its settings via the main menu. The TNC, though not a full blown stand-alone TNC, is quite adequate for satellite operations at 9600Baud. It's custom built for APRS applications with built-in APRS software. An l.e.d. confirms receipt of packet data and the manual gives a full list of TNC commands in tabulated form.

Using APRS

As APRS is gaining popularity in Amateur Radio, it's worthwhile to give a brief overview of the system and techniques. The APRS acronym, as already briefly mentioned, stands for Automatic Packet/Position Reporting System, a software programme and a registered trademark of **Bob Bruninga WB4APR**.

Bob's programme enables Radio Amateurs to track mobile stations and locate fixed stations on computer screen. A variety of country maps are selectable enabling the operator to locate stations not only in the UK, but also in many other parts of the world.

Terminal Node Controller

The TNC in the TH-D7E provides a serial output via the output socket marked PC. As briefly mentioned earlier, I used the programme called *UI-View32* designed by the late **Roger Barker**, available via the link **http://www.UI-View.com**

The set-up window of this software already has the TH-D7 TNC in its list, so once the parameters required have been filled in, the newcomer can soon be 'up and away', watching all the stations (including their own), appearing on the PC display screen. What's shown can be their respective QRA locations, both here in the UK, along with those in other countries operating on the international nodal networks.

Fig. 1: The Kenwood TH-D7E has many features that Peter G4AJG considers to be very useful for use when working via Amateur Radio satellites.

Fig. 2: The Kenwood TH-F7E is also useful for satellite working.

Each station can input the Longitude/Latitude position data manually. Alternatively, if a GPS unit is available and is provided with Data in/out socket, this can be connected via a NMEA cable to the GPS input on the TH-D7E. The movement of each station is then automatically transmitted to the chosen repeater and nodes cluster operating on 144.8MHz. This enables anyone operating the APRS system to communicate via Packet. The system can also transmit a specific station Icon, position data, text, speed, direction, and altitude data.

Digipeat operation on APRS is possible via the *ISS - International Space Station* digipeater. Full information about ISS operation can be obtained by logging on to **www.rac.ca/ariss**

Finally, as readers may have realised - APRS is a subject by itself and detailed comments are beyond the scope of this article. I suggest if you want to read more on the subject, you might find the article Bringing Packet Alive - APRS (published in the March 2001 issue of *PW*) to be helpful.

Continued on page 54

Access To DX Cluster

A very useful feature is access to the DX cluster from GB7DXH on 144.9MHz. I discovered that in less than a minute, DX stations just heard by monitors in the UK on 14 and 21MHz, appeared on the TH-D7 panel and on the screen of the *UI-View32* programme accompanied with a voice confirmation. A typical selection reported heard at 1036 UTC included: V51AS, JH3CUL, 8Q7BR, 4L6AY, NJ2OM EA3NW.

In the context of satellite reception the operator can input notification of signals heard on the satellite at the time. This could be in the form, "G4XYZ heard on 435.305MHz @1605Hrs on Echo 51." The DX Cluster is a great source of information about band openings on the h.f. bands and satellite activity in general.

Slow Scan Television

The Kenwood TH-7DE is also designed for slow scan television (SSTV) operation using an accessory called a VC-H1. This consists of a slow scan converter, a CCD colour camera, and an l.c.d. colour monitor. This enables receiving and transmission of full colour images.

Unfortunately, Kenwood were unable to supply this unit for me to evaluate for, as it's no longer marketed in the UK. But you may still be able to get a unit used or new from dealer, via Bargain Basement or even eBay.

However, the slow scan mode can be still used in conjunction with most SSTV software and a PC. For example, an excellent program, called *MMSSTV* and designed by JE3HHT, is available as a free download on the internet.

All the operator has to do is connect the received SSTV signal audio out from the D7 to the soundcard input of a PC or Laptop to receive high quality images. Incidentally, when High Earth Orbit (HEO) satellites become available it may be possible to find quite a few SSTV signals from distant locations, as was the case with the AO-40 satellite several years ago.

Satellite Operation

Let's now look at satellite operations using the TH-D7E transceiver. Although the Kenwood manual refers to the rig's duplex operation capability, this merely refers to its ability to receive packet on band A and transmitting or receiving audio on band B. In satellite parlance, duplex operation means the ability of a transceiver to be able to monitor your down link signal whilst transmitting on the uplink.

However, for satellite operation, the operator can set transmit on say v.h.f. band **A** and receive the satellite downlink signal on 430MHz on band **B** by quickly switching between the two by pressing the A/B key. It's advisable to use headphones to avoid any possible feedback problems.

Fig. 3: The (camera shy?) author demonstrating the American made Arrow antenna system.

For true duplex operation, for an operator to hear the signal on the downlink from the satellite, a suitable spare hand-held can be used. I used the Kenwood TH-F7E with the 64Hz pilot tone enabled and fitted with a replacement half wavelength telescopic antenna.

If a mobile set-up is available, it may well be possible to use its vertical antenna for accessing the satellite on v.h.f. uplink. The hand-held Yagi beam on can be used for receiving u.h.f. Generally, a quarter-wave or a three-quarter wave ground plane, works quite well for uplink applications.

By setting the **Step Frequency Tuning Rate** to 5kHz (Function key F/8/+control) it's possible to manually keep in step with the Doppler frequency changes as the satellite passes overhead. This is achieved by pressing the cursor up /down as required or turning the rotary tuning control on top of the transceiver.

Another option is to programme, let's say five memory channels, in steps of 5kHz. These can then be select each by either the cursor or the rotary control.

Setting The CTCSS

Setting up the appropriate continuous tone control squelch system (CTCSS) frequencies is quite straightforward on the l.c.d. display. All that's needed is to select say band **A** by pressing the **A/B** key, followed by the keys marked **F** and **4**. Then it's necessary to scroll up or down with the cursor and press **OK** control to set the required frequency, as shown on Page 39 in the manual.

For satellites AO-51 and SO-50 the required CTCSS tone is 67Hz. In the case of the latter satellite it's also required to initially trigger the satellite receiver by transmitting a 74.4Hz CTCSS signal, and once it's open, the operator has to revert to 67Hz to continue operations. This requirement is a battery power conservation feature on the satellite so that the transponder is switched on only when required by the user.

The Kenwood TH-F7

The second Kenwood transceiver provides an alternative lower cost option. The TH-F7, **Fig. 2**, (reviewed in the December 2001 issue of *PW*) is a v.h.f./u.h.f. hand-held f.m. transceiver. This model retails at around £250 from most retailers.

The transceiver is smaller in overall length than the TH-D7, but comes without the built-in TNC and APRS software facilities. However, it does have input/output connections for an external 1200/9600bps TNC and a PC via a special cable available ready made. Or as a cost saving measure they can be made up easily enough in your shack. Incidentally, details are given in the manual to make up such an interface cable.

The transceiver features v.h.f. or u.h.f. transceiver facility on bands **A** and **B** and wide band receive on band B, covering a frequency range from 100kHz to 1300MHz (1.3GHz). A total of 400 channels in eight user selectable groups along with memory scan are provided.

The modes on band B are c.w., lower sideband (l.s.b.), upper sideband (u.s.b.), f.m., wide f.m. (w.f.m.) and amplitude modulation (a.m.). Fine-tuning from 1kHz down to 33Hz is available on the Amateur h.f. bands on c.w. and single sideband (s.s.b.), which is very useful when monitoring signals.

On other bands the tuning rate varies from 5kHz to 50kHz. Direct frequency input on the v.f.o. is possible with two key strokes to access any frequency on either band.

Battery Capacity: Pressing keys marked **F** and **Low** provides a bar indication on the l.c.d. display of the residual battery capacity. I found this to be very useful on extended sessions on the air.

Ferrite Bar Antenna

The TH-F7 has a built-in ferrite bar antenna for frequencies below 10.5MHz, which can be manually switched on or off. Under normal operations it automatically switches to the bar antenna below 10.1MHz. Incidentally, the provision of a user selectable 10dB attenuator was very useful with strong signals on all bands.

As this radio has relatively fewer features than the 'D7, the alphanumeric keypad is somewhat simpler to operate, and access to modes rather more direct.

Under test the rig registered 5W r.f. into a dummy load with the PB4-42L, 1.550Ah Li-Ion battery, and 5.5W with an external 12V source. There are l.e.d. indicators that display **Charging**, **Busy** and **Transmi**t conditions.

On satellite voice operation on v.h.f./u.h.f. it performed as well as the 'D7. The VOX facility, although tricky to adjust, is useful on dual band satellite operation, saving a key

operation to change bands quickly. Additionally, a useful menu selectable volume balance control enables the relative audio output of band A and B to be adjusted as required.

For satellite telemetry data download I used an external 9600bps TNC and its performance was satisfactory. A special **Telemetry Data**, free download programme is available for Echo telemetry on the AMSAT web page **www.amsat.org** (look under Echo Telemetry).

Note: It must be borne in mind that error free telemetry downlink data retrieval is subject to steady signal conditions. These conditions may not be always available, due to factors such as rapid variation of signal strength caused by the slow spin of the satellite in space.

A total of 400 Memory channels are available for storing frequencies, modes and other operating conditions for bands A and B. As with the 'D7, a memory programme is available for computer management of memory data.

The 58-page manual is very detailed in content and specific areas of operation easy to locate.

Both transceivers operate well in satellite applications and taking into account all the other extensive features available in each radio, the TH-D7E and TH-F7E represent excellent value for money.

Antenna Systems

The best type of antenna system for QRP satellite operation is generally the Yagi hand-held beam. For home construction a wooden or square section light aluminium boom, with elements made from light aluminium rods could be an option to consider.

A useful article featuring a 430MHz Yagi array was published in the January 2005 issue of *PW*, which could be perhaps be optimised for satellite use. This could be achieved by the addition of a 144MHz element set at right angles, a worthwhile experiment to pursue if you wish to construct your own Yagi antenna.

Note: Remember the use of good quality cables and connectors are important ingredients for a successful antenna project

A half or three-quarter wavelength, ground plane vertical whip antenna on 144MHz, with 5W from the TH-D7E or the 'F7E, can access the satellite, but for reliable downlink signals a 430MHz multi-element Yagi is best.

Arrow Portable Antenna

A very well engineered, dual band 144/430MHz hand-held Yagi antenna, popular amongst satellite operators, is the US made Arrow antenna and this is currently available from AMSAT UK for £85 including p&p.

An Update & A Challenge!

An interesting micro satellite, CO-58, designed by Tokyo University, was launched on the 27th October 2005 and is currently operational on Mode U Beacon, Downlink frequency 437.4650MHz c.w. mode and Mode U Telemetry Downlink 437.3450MHz AFSK 1200bps. It's a 100 x 100 x 100mm cube and operates on very low power. It's a challenge for the very keen but very rewarding and exhilarating when successfully captured!

The antenna has three elements on 144 and seven elements on 430MHz. These provide a gain of about 7.5dBd on 430 and 5.5dBd on 144MHz, assuming ideal conditions with negligible ground reflections. It's rated at a maximum of 10W r.f. input.

The photograph, **Fig. 3,** shows this antenna being used by the author on location. It's an ideal compact, lightweight portable antenna weighing just 538g (19oz), with light screw-on aluminium elements, which are easy to assemble and dismantle. A neat shoulder carry case is available as an accessory item. This holds the antenna in its dismantled state, ideal for use whilst on holiday.

The antenna provided with a Duplexer* built into the handle, and a single cable from the duplexer to the hand-held transceiver. It has a convenient umbrella type handle, which you hold and point in the general direction of the Satellite. It can also be mounted on a camera tripod to give you more freedom of operation. BNC plugs and cables are provided for the 144 and 430MHz Yagis, which connect, to the Duplexer, but each antenna can also be independently connected to separate transceivers for true Duplex operation. This is the ultimate in connectivity!

***Editorial note:** Many readers will know this device as a diplexer; it does the same job as those used on Band II/Band IV/IV u.h.f. TV, v.h.f. radio antenna system, enabling one downlead cable to be used.*

Operating Tips

Time for some tips on operating now and we're almost ready to go! Let's take the Echo AO-51 satellite as an example.

First, check the Transponder Schedule on the AMSAT web page **www.amsat.org** and choose days on which 144/430MHz, i.e. V/U mode, is on. Wednesdays are usually set aside for QRP operations only, when it's possible to meet operators with similar QRP set-ups as I have described operate.

Next: From your Satellite programme select AO-51 and determine when and where the satellite appears over the horizon. It's best to take a printout of all the passes for the day, so the times at which the satellite is accessible are known. This will also give the Elevation and Azimuth angles on a minute-by-minute basis. Azimuth is measured from true North, right through 360° and back to North. Use a pocket compass to determine directions.

Then set the transmitting frequency to 145.92MHz band A with CTCSS Tone enabled and set band B on a frequency of 435.3MHz. Ensure that the squelch setting is set to off on Band B.

Next, aim the hand-held antenna in the direction of the satellite as it rises above the horizon and tune the receiver about five to ten kilohertz **above** the nominal receive frequency 435.3MHz. Then, while tuning down in five kilohertz steps listen for when the f.m. noise begins to quieten.

A marked change in the noise level will be noticed when the antenna is pointing in the true direction of the satellite. Listen for activity and move the antenna in the direction of travel of the satellite to keep track of the signals. Rotate the antenna either side of its axis to get best reception.

Using the transceiver with the power output setting to maximum (symbol **HI** on the display) the wanted station can be called. Switch to B band on 435.31MHz and tune in 5kHz steps down, until the other station is heard calling. If a separate hand-held is available to operate the uplink, it's possible to monitor the transmitted call on the downlink and determine the determine the exact downlink frequency

Remember to keep contact times short, exchange reports and unless another station calls, be prepared to give way to others who wish to use the satellite.

Don't forget, the total pass time may be only about 12 minutes for a given pass and that there are several passes separated by about 101 minutes. This means that if contact is impossible at first, the next pass may be successful.

Here is a DX tip if you wish to work stations on the East coast of the USA on Echo. Choose a low elevation pass and locate yourself on an open field or hill with a clear view of the horizon. You will be thrilled with the results!

The future prospects for satellite communications certainly looks very promising indeed, with several more multimode satellites due for launch within the year.

Thanks To VU2POP

The author wishes to express his appreciation to **VU2POP**, Secretary, of AMSAT India for permitting use of the launch photos of Hamsat-VO-52 in Part 1 and 2. Thank you also to all the readers who have contacted me. I wish you all good look 'working the birds!"

PW

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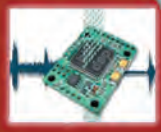

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The Fly Swat

Ian Simpson GM0SIM, asks "is this a project, or is this a lesson for helping you raise your knowledge?" In reality it's both!

When building any project or kit, the knowledge of why something is built in a particular way it is and how it works (or should work!) is always beneficial when debugging is required. In the 'old days' of the Radio Amateur Exam (RAE) learning how and why things worked was often taught in a dry and boring manner. Learning is always much more fun if it's directly targeted to a specific need, especially if you get a piece of useful kit at the end of the process.
The new licensing structure is great for bringing people into the hobby. This project is intended as a targeted learning process to help people progress with the more technical aspects of the hobby (but hopefully, not in a dry manner). You will probably be surprised at how much you know but may not have 'joined together' before.

If you already knew the following points, you could have designed this a.t.u.

a) A perfect inductor in parallel with a perfect capacitor make a perfect 'band-stop' resonant circuit.
b) If things aren't perfect you don't get a perfect stop-band.
c) Inductance gives a positive reactance and capacitance gives a negative reactance.

The starting point for this project was being mightily impressed with a friend's new Miracle Whip antenna (as its construction quality, convenience and the performance considering its size). And I came to the conclusion that I wanted something like that. For many there's also possible XYL restrictions, which can limit the 'buy' option of an a.t.u. (a common problem?).

Internal investigation of the Miracle Whip (many thanks to **MM5AON**) revealed a very high quality construction that, although it would have been possible to make a 'Chinese copy' of, would not have been easy to replicate.

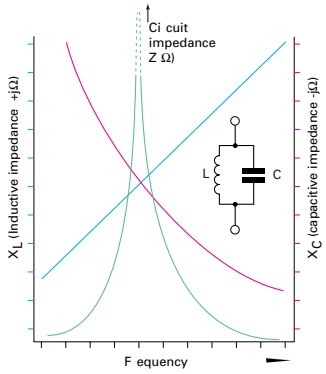


Fig. 1: Linking perfect inductors and capacitors, will create an infinite impedance at the frequency where the impedances of both components are numerically the same.

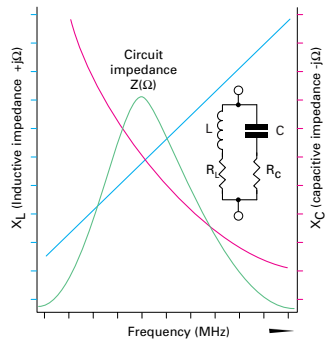


Fig. 2: In the real world, circuit resistances reduce the impedance value at resonance.

First Principles

Let's start from first principles. Consider a perfect inductor in parallel with a perfect capacitor as shown in **Fig. 1**. Now consider the current that flows through the parallel combination. At d.c. or very low frequencies, there's an effective short to ground via the inductor.

At the other end of the scale, at very high frequencies, there's another effective 'short' to ground via the capacitor. At one particular frequency the inductor and capacitor impedances are identical. The inductor and capacitor are said to resonate.

At this single frequency, the whole network becomes an infinite impedance across the end terminals. In this case there's a perfect 'band-stop'. The important point to remember is that the system has effectively simulated a very high resistance, without having any resistance being present at all.

Unfortunately, there's no-such thing as a perfect world, all inductors always have some resistance, however small (they also have a small amount of self capacitance too but I shall ignore that for the purposes of this article). Even capacitors will have some resistance, both in series with the capacitance and as leakage, effectively an extremely high resistance in parallel with the capacitor.

In spite of the apparent problems mentioned, the same comments of a stop-band action are still basically true. But now there's no longer a perfect band-stop, as there will be some energy leaking through the circuit. The effective circuit resistance at resonance, is no-longer infinite. But the effective impedance can still be high.

With non-perfect components it's still possible to simulate high circuit resistances, even when only low resistances are present in the real components. In effect many of the exact requirement for an a.t.u. have been created.

With the above imperfect circuit, it doesn't matter if the basic 'loss' resistance is in the inductor (RL), or the capacitor (RC) or even if extra resistance is added in the same places, **Fig. 2**.

After the development work, the basis of the basic 'L' type a.t.u. is ready for use. The two standard variants are as shown in **Fig. 3**. The antenna resistance (Ra) is in now effectively in series with one leg of the parallel tuned circuit. An action that just makes this leg look more 'lossy' (just like RL or RC in the 'imperfect' tuned circuit of Fig. 2).

At resonance an higher resistance will remain when 'looking' into the circuit from the left. When the values of L and C just right, the circuit will 'see' 50Ω looking in from the left. The figure of 50Ω is usually a good match for both most coaxial cables and transmitter outputs.

It makes no real difference if it's the coil that has 10Ω resistance (RL) and it's connected to a straight parallel tuned circuit with no antenna anywhere near it or if the coil has virtually no resistance (RL= 0) and a 10Ω resistive antenna (Ra) is placed in series with it.

The circuit labelled 'a' in Fig. 3, is normally preferred for two reasons. The first reason, is that harmonics have more difficulty in reaching the antenna with this circuit as the rising impedance of the coil reduces these higher frequencies. The second reason that layout 'a' is preferred, is because antennas only rarely appear as the perfect resistor that has been assumed (simplistically) above.

If the antenna wire is less than a quarter-wave long it will be less than 50Ω resistance and will probably appear capacitive too. The shorter the antenna, the higher the effective capacitive reactance.

Look at the illustration of **Fig. 4**. In the first circuit with the 'series' inductor there's

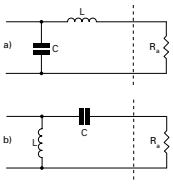


Fig. 3: Two forms of L-match impedance matching circuits. See text for more details.

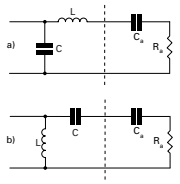


Fig. 4: The L-match circuits of Fig. 3, feeding a physically short whip antenna's impedance represented by Ca and Ra. See text for more details.

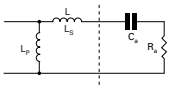


Fig. 5: The final circuit of the Fly Swat, uses two inductors instead of an inductor and a capacitor. See text for more details.

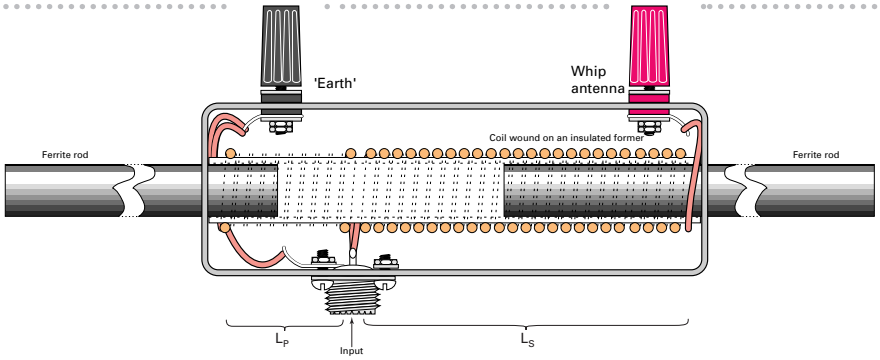


Fig. 6: The circuit of Fig. 6 was implemented with a tapped coil within a plastic box. Adjustments to the inductance values were made by sliding the ferrite sections in and out.

not a problem. Just make the 'positive' reactance of the inductor slightly higher than previously calculated by just the right amount and it will counteract the 'negative' reactance of the antenna capacitance.

Then everything is solved. To put it crudely a few more turns on the inductor will solve the short antenna's capacitance problem.

With the component list of 'one broken transistor radio' and some single core insulated wire stripped for old mains cable (I'd decided on a tight budget!), I started. Then, it was time to build the first attempt of a Miracle Whip equivalent.

Extract the variable capacitor from the radio, use as the parallel capacitor in circuit, Fig. 4a. Take the ferrite rod out and wind some of the copper wire around this for the series inductor. Linked together with the recovered variable capacitor, and it's ready for a first attempt.

Now, while it's perfectly possible to make a very good a.t.u. with this configuration, if the variable capacitor from the broken radio was one of the broken parts (as I found out) then this can somewhat limit the performance.

It's back to square one. My component list was now limited to some wire and a ferrite rod. Not a great starting position I must admit but can it still be done? The answer is of course, yes!

Look at circuit Fig. 4b again. Probably there's not the exact value of capacitance (C) admittedly but as the antenna is 'short' it's already capacitive (Ca). But 'Murphy's Law' will dictate that Ca isn't the right value to replace C. Unlike the previous case, where I totally nullified the antenna capacitance by making the series inductor 'too large', if I just add a small inductance in line with the antenna's own capacitance, this should be reduced to the needed value (but still remain capacitive).

It's possible to generate the required capacitance by using an inductor! Hence circuit of **Fig. 5**. As the unit will be working across various frequencies and various antennas impedances the two inductors need to be independently variable. I didn't think there was much chance of building high quality roller coaster variable inductors from recovered wire and toilet roll tubes!

All is not lost, a simple and effective variable inductor can be made by winding the wire around the outside of the ferrite rod, then moving the rod in and out of the coil. As two variable inductors are needed, it's no problem. Break the ferrite rod into two pieces! (one larger than the other).

Construction

Wind about 30 turns around the ferrite rod. (Though two individual inductors could be made, a single 'tapped' coil is easier and the mutual effects are not too problematic)

One end of coil is the earth for the both the coaxial cable screen and for the antenna, if it's available. Solder the coaxial cable centre to a point about six turns up from the 'earthy end' of the coil. The whip is attached to the other end of the coil.

Operation

Vary the inductances by inserting the two bits of ferrite rod into the coil from opposite ends. Adjust for best match. It works!

The 'proof of concept demonstrator' (initially it was a lash-up) was created in a plastic (non-conductive) box as shown in **Fig. 6**. The coil is a length of 15mm plastic water pipe to make it more secure and to allow the ferrite rod to slide smoothly for adjustment. The ferrite rod had some paper wrapped around it to make it a reasonable fit into the tube (it remains in position once set).

The unit was attached to 3m of 6mm Aluminium tube as the 'whip' antenna and checked out on an MFJ259B antenna analyser. I found that on 14MHz an s.w.r. of 1.2:1 was easily obtained. On 18MHz an s.w.r. of 1.1:1 was obtained. And finally on 21MHz the reading was an s.w.r. of 1.1:1.

Above 21MHz the ferrite was completely out of the coil (hence no further adjustment was possible). To operate on the higher h.f. bands, trim a few turns off each end of the coil.

Below 14MHz the ferrite was totally in the coil. If you want 7MHz, then you'll need more turns and /or larger diameter coils. Anyone that manages to work QRP on a very small antenna in the crowded 7MHz band has my total admiration!

The shorter the whip, the higher the capacitive reactance, This means that more turns are needed on the 'top end' of the inductor depending on the whip used. We could go through the equations but 'suck it and see' is often an easier option.

Note: A perfect 1:1 is possible but 'proximity effects' mean that the tuning will vary slightly as objects are moved in the region of the unit, including your hand while tuning! Finding the best match was a bit fiddly but was easy to do once I had had a bit of experience of adjustment.

The Fly Swat, doesn't quite have the frequency range of the commercial product, but what do you expect for zero cost? It met the requirements for the bands I was most interested in and it compared well against the much higher cost commercial products.

It was interesting to note that when my friends and I checked the 'miracle whip' out on the analyser, we needed not just to set the switch position, but we also needed to vary the antenna's physical length to obtain the best match. Leaving the whip at maximum extension and adjusting the switched inductor left us unable to get an s.w.r. of lower than 2.8:1. With hindsight this effect wasn't totally unexpected!

Minor Caveats

There are a few minor caveats, though! Don't try putting too much power through the unit, the ferrite will saturate and become non-linear. And that's not good! For higher power operations, use air-cored inductors with switchable tapping positions. This is a short wire a.t.u. It relies on the antenna's own capacitance. It's great for whips and short bits of wire but don't expect it to work for long wires.

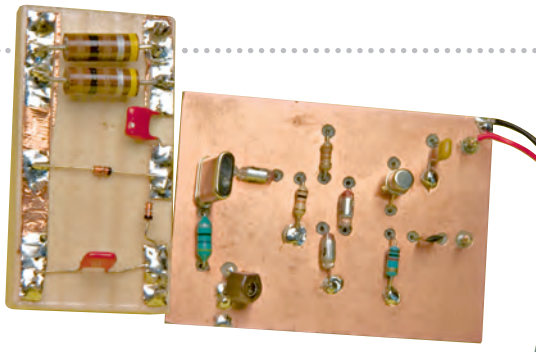
The unit needs to be at the antenna end of the coaxial cable, which is the best place for any a.t.u. anyway! Don't expect it to work in the shack with a mile of cable leading to a bit of wire. Let's admit it, in terms of 'power-per-pound' it's hard to beat!

Get the soldering iron out and have some fun!

PW

Carrying On The Practical Way

This month, the Rev. George Dobbs G3RJVV says he's getting 'a little help from the slugs!' Intrigued? - read on and discover how!



The techniques used in this month's project are based on a gardener's anti-slug system. George G3RJV remarks that it's one of the few occasions he can be thankful for the garden pests!

'Slim Shiny Slug Slime Slithers down the Slide.'
(Traditional tongue twister)

Over the years, I've used Carrying on the Practical Way (COTPW) to discuss many ways of building circuit boards without the use of an etched printed circuit board. Regular readers will know that my preferred methods are 'ugly' construction and Perfboard construction. Recently however, I described the use of copper plated nails pinned into a printout of the circuit.

Some of the methods are useful for prototyping prior to making a permanent circuit board and all of them are fine for a finished project. We are usually making a one-off board for personal use so the main criteria are easy construction and lack of fuss, rather than how beautiful the completed project looks. The aim is a simple and reliable method of making the required electrical connections between the components.

Sticky Tape & Slugs

Recently, on the G QRP Club internet list someone mentioned a sticky-backed copper tape used by gardeners to repel slugs. Perhaps this could be used to provide copper tracks for circuit boards? So, I did a little investigation. It was no urban myth!

Several companies produce slug-repelling copper tape. It's a favourite with garden suppliers with an organic emphasis. The commonest product appears to be Fito Slug Stoppa Tape, sold in four metre rolls of 32mm wide tape.

The adverting blurb says "When slugs try to pass over this tape, a tiny electrical charge is generated, stopping them in their tracks. Perfect for pots and planters." At £5.99 a roll, it's not cheap but four metres of 32mm tape could provide a lot of interconnections.

I ordered a reel by mail and it arrived covered in a cellophane seal. This was obviously to prevent oxidation of the copper. Since the reel will last a long time, I would advise other users to do what I did - wrap the reel in Clingfilm after use.

The copper tape has a peel-off paper layer, which reveals the adhesive backing. Initially, I tried sticking bits of it on to various surfaces and seeing how it reacted to a hot soldering iron. It stuck to wood, plastics and printed circuit board (p.c.b.) materials very well. It tinned with solder with great ease, although lingering with the iron for prolonged periods did tend to make narrower tracks peel-off the mounting material.

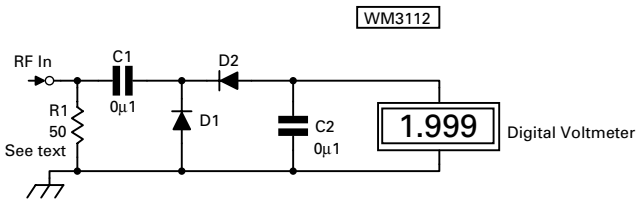


Fig. 1: To try out the copper anti-slug tape, George G3RJV built a small wattmeter as in the circuit shown here.

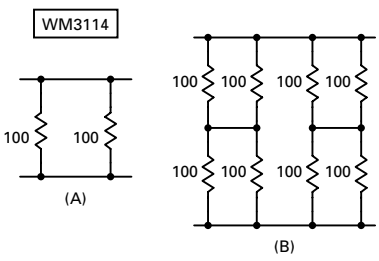


Fig. 2: Configurations for resistor R1 in the wattmeter circuit.

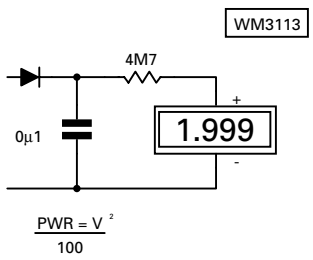


Fig. 3: Using the circuit with most digital meters makes the maths a little easier, see text.

Easy Wattmeter

My first attempt to make a board was very simple. I built an 'Easy Wattmeter', surface mount style on a small scrap of wood. The circuit is shown in **Fig. 1**.

The r.f. signal from a QRP transmitter is terminated with a 50Ω dummy load. The signal is fed via C1 to a pair of diodes in a voltage doubler circuit. I used a pair of common silicon diodes (1N914 and so on) for D1 and D2, although Schotty or germanium diode would probably be better. The resultant voltage is decoupled by a capacitor and fed to a digital voltmeter. The 50Ω load resistance must be able to handle the power offered by the input. The diagram, **Fig. 2**, suggests a couple of ways that resistors could be configured to handle the required power. I used two 100Ω, 1W resistors for a capability of 2W.

Working out the r.f. power present at the 50Ω load from the recorded voltage is very simple: Multiply the voltage reading by 0.707 to give the root mean square value. Then square the result (multiply it by itself) and divide the result by 100 (move the decimal point two places left). This is 100, not 50, (the resistance of the load) because of the voltage doubler arrangement.

The illustration, **Fig. 3**, shows method of making the calculation even simpler. Here a 4.7MΩ resistor is connected in series with the voltmeter (This assumes that the digital voltmeter has the usual input resistance of some 11MΩ). The potential divider circuit provided by the resistor and the resistance of the meter allows the meter to record the root mean square (RMS) across the load resistor.

The calculation now becomes: $V^2/100$. That's the voltage reading multiplied by itself and the decimal point moved two places left. This is probably the easiest way to measure r.f. output power of a few watts or less.

Wood Base

The circuit of **Fig. 1,** was built on a scrap of wood as a base (about 60mm x 30mm), a strip of copper tape (about 5mm wide) along

one edge forms the ground connection. A similar strip of copper tape along the opposite edge is cut in to three sections to mount the components, **Fig: 4**.

The input and output connections are made to p.c.b. pins (Vero pins). These are pushed through the copper tape into the wood, after making a pilot hole with a needle.

The project went together with great ease, the copper tape taking solder without any problems. **Note:** In operation it's advisable to use screened leads for the input and the output to the meter.

Having tried the simplest possible construction method with the copper tape, the next stage was to attempt a more complex approach. The intention was to add tracks to a piece of p.c.b. material.

The side without the copper would be the surface to take the interconnecting tracks. The copper clad side becomes the component side in the style of a double-sided p.c.b. that uses the copper on the component side as a ground-plane.

The component leads are insulated from the copper by removing a circle of copper around the hole. This can easily be done using a countersink drill or a large drill bit.

Note: Grounded components do not require a hole as they can be directly soldered to the copper surface.

Single Stage Circuit

I then decided to try a single stage circuit to test the technique. The diagram, **Fig. 5**, shows the circuit I used. It's a variable crystal oscillator (VXO), built for the 7MHz band. The project could be used as the local oscillator for a direct conversion (DC) receiver or as the frequency source for a QRP transmitter.

The oscillator is based on the well know Colpitts circuit with a variable capacitor and inductor to shift the frequency of the crystal. The crystal must be a fundamental type.

Capacitive feedback between the emitter and base is provided by C1 and 2. The values of C1 and 2 will vary according to frequency and I have given suitable values for three popular Amateur bands in **Table 1**.

The 100pF capacitor between the base and the crystal minimises the effects of the C1 and C2. The capacitor shown as 100p should work fine for the three suggested bands.

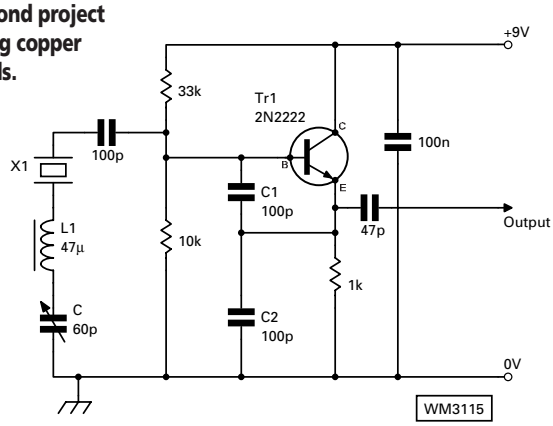
By using an inductor (L1) and the variable capacitor the crystal should pull a little either side of the nominal frequency. I have suggested 60pF for the variable capacitor but found that 100pF also worked well on 7MHz. The larger the value, the greater the frequency swing but if the value is too high oscillator activity may become unreliable.

The suggested values of inductor are available as standard, 'off the shelf', moulded inductors. With these values, shifts of several kilohertz should be possible but I can make no numeric promises as this will vary with individual crystals! **Note:** Lower frequencies give less frequency 'shifting'.

This method of construction requires a little preparation to avoid mistakes in the placement of tracks. Those people who can think upside down (or is it inside out?) will have no trouble but I find turning a board over and having to think of layouts as mirror images is not easy! Don't forget - with this method it's not possible to hold the board to a light and see through it because of the copper layer.

I began by making an actual size layout drawing viewed from the component side. I used the actual components to get the correct spacings and I did it on tracing paper. The drawing included the tracks as they would be seen from the top of the board. It helps to add a big dot wherever a hole is required and another symbol (I used a cross) where a component is grounded to the copper.

Fig. 5: The circuit of the VXO, the second project used by G3RJV to try out the anti-slug copper tape to make 'non-etch' circuit boards.



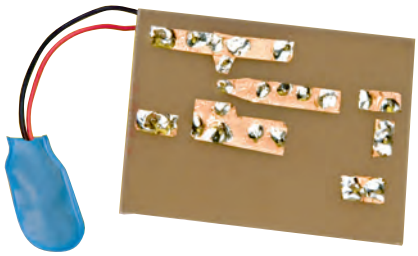


Fig.6: The reverse side of the variable crystal oscillator.

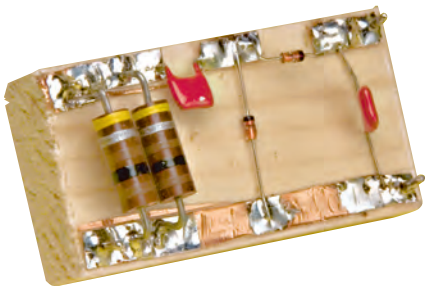


Fig. 4: The wooden baseboard wattmeter.

Band	L1	C1, C2
3.5MHz	100µ	220p
7MHz	47µ	100p
14MHz	15µ	47p

Table 1.

Drawing Completed

When I completed the drawing it was 'Sellotaped' to the copper side of the board and the holes drilled through the tracing paper. A drill of 0.8mm or a 1mm diameter will work for most component leads.

Once the holes were drilled, I remove the tracing paper and turn over the board to the plain side. Using the bottom view, through the tracing paper, I marked out the tracks with a felt tipped pen. This provided a clear indication where the tracks were to be placed.

I used small sharp scissors to cut the track to size and carefully peeled back the protective backing and placed them along the marked track positions. It's possible to play safe and oversize the tracks and then reduce them by trimming with a sharp modelling knife and peeling back the unwanted copper tape.

Pushing the component leads through the holes would probably push the tape off the board. To prevent this, I pushed a sharp needle through the track from the copper side. The components will then easily fit into place, **Fig. 6.**

Mounting Components

In practice I've found it easy to mount the components and solder them in place using the layout drawing as a guide. Don't forget not to let the soldering iron linger too long with the risk of raising the copper track from the surface of the board! Despite this warning I had no problems at all in mounting and soldering any of the parts.

My tracks were quite thick and I didn't bother to make them look attractive by curving the ends. The little VXO worked well and showed me the viability of using slug tape for more complex circuits.

I guess it would be possible to build a more complex project a stage at a time using this technique. It's one of the few times I have to be thankful for slugs!

PW

Common RF Connectors - A Pract

Angus (Gus) Malcolm G8DEC worked in telecommunications for many years, with a special interest detecting and curing interference. He has some interesting facts to pass on about r.f. connectors. You'll never take them for granted again after reading his article!

We've all, at some time, had to fit plugs onto coaxial cables and looking at some of the examples I have seen in 20 or so years with the old Radio Investigation Service, it is hard to believe the number of different ways the public at large manage to fit the plug onto the end of the TV antenna lead!

Some of the 'experts' were also Radio Amateurs! In this short article I hope to cover the most common radio frequency (r.f.) plugs and sockets.

Belling Lee?

The good old TV antenna connector, **what do you call it**? The Belling Lee? Well they certainly made a lot of them. The BREMA (The TV manufacturers association) co-ordinated the design of BS3041 (British Standards) and set the specification.

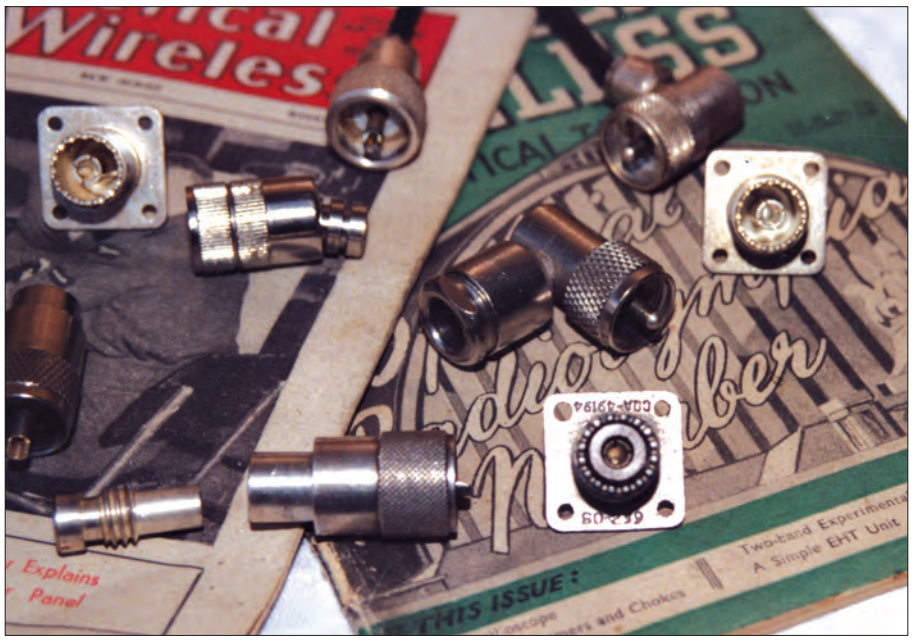
In the 1950s and 1960s both manufacturers and amateur constructors pressed this connector series into use, as little else was readily available. As time progressed and the 'black box' arrived from the Far East the situation changed and 'professional' plugs became more readily available and the most common of these was the device commonly called a PL259.

A little history first! Back in the 1930s **E. Clark Quakenbush**, (I've seen other spellings) designed a series of connectors for the American radio broadcast industry, which were given the title UHF. When the USA Military authorities adopted part of the series they used their own 'Catalogue item Number' (Like the old GPO with its 'Plugs Coaxial 4A' for the TV antenna plug). Hence the PL259's common name.

The item codes also imply a specification and here the PL259 is badly let down. The original specification was for a silver-plated brass body and MFB (Mica filled Bakelite) insulation (Later superseded by PTFE), this is a 500V working connector proof up to 3kV. Some of the cheap imports, with their bright plated bodies and dubious insulation are only suitable for low power at no more than CB frequencies!

I have been known to refer to the brown (insulation?) as re-constituted copralite! (Fossilised dinosaur droppings!).

The one way to recognise a real PL259, is this; it will have the reference stamped on the side together with the manufacturer's name or code. You pay your money and you take your choice! Interestingly, the PL259A had an improved braid clamp but I find the only real improvement came with the 'pressure sleeve' version.



A selection of UHF plugs and sockets placed on magazines of a similar period.

Sockets Misnamed

Sockets are also misnamed, only the four-hole flange, surface mounted is an SO239. If the PL refers to a plug and SO a socket, then why is the socket-to-socket coupler a PL258?

For most purposes the quality versions of this series will perform satisfactorily up to 200MHz or so and with care up to 500MHz. I certainly would not reject say a triband antenna (50, 144 and 430MHz) just because it was fitted with this series.

The actual connector series is described as non-constant impedance, but the actual amount of energy reflected is small at these frequencies. Better series of connectors exist and should be used where possible above the 144MHz band. The use of UHF was an unfortunate title, but in the 1930s no one questioned it. Perhaps the 'Q series' would have been better, after its designer.

How many products in the field of radio and electronics designed in the 1930s are still in general use? I'm not sure, but it can't be anywhere near as bad as the academics would have us believe.

Constant Impedance

To move on, the first 'Constant impedance' connector was the 'N' series designed in the 1940s by **Paul Neill**. This shares the same coupling nut diameter and thread as the UHF series. End covers and dust caps are interchangeable with UHF, but here the similarity ends.

The N connectors are made as 50 or 75Ω impedance and never the two should be mated! The obvious difference is the smaller diameter of the 75Ω version's centre pin. Again 'quality costs', but for ease of

ical View

assembly use the pressure sleeve braid clamp where possible.

The series is generally fine up to 10 or 11GHz. Although precision versions can go up to 18GHz.

A major advantage at all frequencies, the connectors are inherently waterproof and much superior to others for outside uses especially where larger diameters of cable are to be used.

A common misconception the centre pin and its securing arrangements, if any, play no part in securing the cable in the plug. The free pin variety presents the lowest signal reflections.

Concellman C Series

A quick word on another series, designed by **Carl Concellman**. His 'C' series was available with both bayonet and screw coupling. The series is constant impedance and is available in both 50 and 75Ω impedances. But again, please do not mix them!

Basically, the 'C' series are a good connector and are usable up to microwave frequencies. But they are usually only available new from specialist sources.

The BNC Connectors

The final series I wish to deal with in any detail are the BNC connectors. This series was a result of the co-operative effort of both Neill and Concellman. It's a smaller connector using a bayonet device to lock the plug and socket and is usable up to about 4GHz.

A later threaded version BNC was designed for less noise caused by vibration. The waterproofing qualities of the later version are also superior.

The BNC types are made as constant impedance for both 50 and 75Ω but here the two can be coupled without any damage. The only obvious external difference lies in the socket's dielectric shape. With the plugs it's a physical impossibility to fit 50Ω cable into a 75Ω variety; the centre conductor hole is too small!

Note: Anyone with a small lathe or pillar drill (and a little patience) can drill out the hole.

While the braid clamp may be a little loose for the 50Ω cable (a little padding with either a short length of 'Hellerman' sleeving, or heat shrink may be needed). In fact, I can detect no difference at all when using the plugs up to 430MHz. Here again the pressure sleeve varient is easiest to terminate. The same centre pin securing arrangements apply as for the N series.

Fig. 1: N-type plugs from a reputable manufacturer.

Fig. 2: A box full of connectors, allowing differing systems to be interconnected. Gus G8DEC can connect anything-to-anything!

Crimp Plugs

In the computer industry large numbers of crimp plugs exist for much higher impedance cables. Here again it's necessary to drill the pin out. Don't crimp! Solder instead as the wall thickness left is rather thin but again a usable plug results, if you have the tools and the inclination!

Reading manufacturers' catalogues they suggest using 50Ω connectors for 75Ω cable where precise matching is unnecessary. With a little forethought the reverse must equally apply.

A final word on plugs! With a majority of new hand-held transceivers now using SMA type antenna sockets, it's probably better to use a BNC to SMA adapter rather than attempt to make up a lead using an SMA plug unless you are familiar with them. (You may find a short lead already made up at a rally).

Read The Instructions!

A few general comments now; **please**, always read the instructions, don't guess the cutting and stripping dimensions. Use a suitable soldering iron for the job in hand. A tiny piece of cored solder pushed inside the centre-pin hole usually results in a perfect joint first time.

The braid should be carefully teased apart and dressed to shape, according to the clamping arrangements of the plug type. Keep a pair of good scissors just to trim the braid to the correct length. Crossing strands may be cut when the plug is assembled and tightened.

I claim no originality for using the two wooden spring clothes pegs glued to a piece of plywood, parallel and about 50mm apart. This allows both the pin and braid to be gripped while I'm soldering. (It's also a good method for audio jack plugs).

Another point worth remembering; all of the plugs mentioned are of American origin and don't forget they still use

Imperial inches and not the Metric system! Spanners need to fit well, be thin and in a.f. sizes.

Any connectors to be left outside should have a double wrapping of self-amalgamating tape. This is the least you can do.

Now, here's a little codge and bodge! Take a PL259 and with a slight enlargement of the braid hole, a flush mounted TV socket will fit. The same applies with the 'Car Radio' socket that accepts the plug with a protruding centre pin. The arrangements described totally disregard impedance matching.

Just remember if the socket on the radio has the centre and braid of the coaxial split and the braid terminated as a pigtail under a fixing screw, then any mismatch caused by the plug becomes quite insignificant.

Minute Selection

In this article I've only covered a minute selection of the connectors that have appeared and disappeared over the last 70 years or so. Different industries and organisations seem to have their favourite connectors. The broadcasters still have patch panels using MUSAs and the PET finds favour in the nuclear industry. The military have their own ideas, with NATO catalogue numbers, MIL and JAN, to name but three!

One of our major problems, as Radio Amateurs, is that we often know just what it looks like but what do we call it? And how do we find a plug to fit that elusive socket?

To help, I suggest that you try to collect old manufacturer's illustrated catalogues from rallies and junk sales. This is the only help I can offer. Remember that new catalogues only list current stock!

Currently, my box of assorted couplers, adapters and short patch leads weighs in at 28lbs - I'll leave the Editor to do the conversion to metric *(approximately 12.6kg Gus! **Editor**)* and I guess I can intercept or connect most things together.

Incidentally, my box of assorted plugs and sockets has been collected simply by looking in the boxes on the floor at rallies or stripping them from junk chassis and panels. Old silver-plating cleans up well with a brass wire brush, or another little forgotten secret - hot water and soda crystals in an aluminium bowl! The effect can appear to be magic. (Use about half a cup of soda to a pint of very hot water - the bowl can be glass, lined with cooking foil).

The method also works with capacitors if they are silver-plated brass. The neoprene seals may be damaged but are usually reusable for Amateur purposes. Here again the pressure sleeve comes out best.

You could always resort to buying your wife or partner one of those ultrasonic jewellery cleaners! An ideal present, but avoid the cheap varieties. **PW**

Fig. 3: A simple jig - such as this example borrowed from the G8DEC washing line - helps when making up leads with sockets or free plugs.

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Valve & Vintage

Ben Nock G4BXD has been rather busy recently. On display this month is some interesting Italian and German equipment, together with a truly wondeful Eddysytone r.f. pan-adaptor visual display unit.

A very big 'hello' once again as I carry out my latest stint in the V&V 'shop'. It's been a busy few months, with trips abroad and a few rallies attended. The trips included a most interesting visit to the Second World War U-Boat pens at Bordeaux, but that's slightly off topic I guess.

It's a shame though, that rallies these days seem to offer little to me, as far as I can see in the way of 'real radio'. The plethora of computer parts and cheap audio visual items at rallies does little to stimulate new interest in the hobby. I'm not sure what, or if there's an answer to this problem. Anyway, enough of the soap box and let's start with a set briefly mentioned last time.

The VRC-247A

The Industria Radio Elettrica e Telecomunicazioni in Trieste, Italy (IRET) 247A, **Fig. 1**, was where sets were built to a standard not compatible with the NATO systems. In fact, they employed loudspeakers, microphones and connectors totally different from those commonly used on NATO sets.

Perhaps the industrial strategy found its motive in the fact that almost the total of IRET production was destined to non NATO nations and specially to South America and Arabic countries. For instance in the middle of the 1980s IRET furnished Iraq with a large quantity of v.h.f. sets used by the their army during the Gulf war.

A quality test of the IRET sets made by the Americans on captured sets issued to the Iraq troops resulted in a negative evaluation. While the quality may not be comparable to the USA produced sets the negative evaluation was somewhat exaggerated.

Connected to the IRET trade-mark are other models marked BERO, ELECTRA or ISKRA, firms that probably for commercial reasons were tied up with the IRET. Some years ago, the IRET company ceased production at the Trieste city plant.

The frequency range of the '247 is from 2 to 30MHz in 100Hz steps. Modes of operation include single sideband (s.s.b.), A3J, compatible amplitude modulation (a.m.), A3H and continuous wave (c.w.), A1, for Morse operation.

There's also the possibility of frequency shift keying (f.s.k.) with an auxiliary adapter. Power output is switchable between either 2 or 20W.

A built-in antenna tuner is provided on the manpack version, PRC-247A but is excluded on the vehicle set. There's a whip antenna (AT-30) provided for the manpack and whip antennas for vehicles. The power supply is 24V d.c. via a NiCd battery package or external power supply unit.

Fig. 1: The VRC-247A transceiver, the compact design and rugged construction make it neat little rig.

Fig. 2: The PRC-64A transmitter receiver. The battery is housed under the cover top right of the set.

While the set works very well on both the a.m. and s.s.b. modes, with good audio reports, it does have one or two annoying little peculiarities. For example, the automatic gain control (a.g.c.) tends to fully quieten the receiver on any large noise spike. The time constant is too long really and needs to be decreased. Also, the audio and radio frequency (r.f.) gain control is via a four position 'click stop'. This would be better as a fully adjustable control. If anyone can help with a circuit diagram I would be most obliged.

Compact PRC-64A

Now for a really nice compact little set, the PRC-64 (**Fig. 2**) the US Army's adoption of the Delco 5300. The set tunes 2.2 - 6MHz and has a bandwidth switch on receiver.

Battery testing circuitry on the unit is simplified (tests only the 24V), the transmitter uses a larger type CR-89 crystal so that receiver and transmitter crystals cannot be accidentally interchanged presumably.

The Morse key on the PRC-64 is implemented with a panel-mounted microswitch. This perhaps makes it easier to keep the front panel watertight.

The original Delco 5300 is a portable solid-state high frequency (h.f.) transceiver developed in the early 1960s. It resembles a small lunch box, with a hinged lid. It transmits on four crystal-controlled channels, with a power output of 5W c.w. and 1.5W a.m. and can be operated from a high-speed keyer such as the GRA-71.

The receiver also has four (separate) crystal-controlled channels and includes a beat frequency oscillator (b.f.o.). Most models include a switch to select two bandwidths: 6kHz and 500Hz (the latter using a Collins mechanical filter).

Power is supplied by a battery carried in the set that provides 4V (receiver), 24V (transmitter), and 12V for the modulator, (only required for a.m.). The set is unusual for a clandestine radio in that it supports a.m. voice transmissions on the h.f. band. There's also a 'whisper switch' fitted, which increases the microphone sensitivity.

The antenna matching circuitry is far less flexible than most earlier sets, so the user would be required to pay more attention to proper antenna configurations. Some interesting 'clandestine' features

include a plunger-type switch that turns off the power when the lid is closed. If you're in a hurry, just close the lid - you don't have to remember to turn off the receiver or transmitter.

It's claimed by those in the know that certain units operating the '64 even sharpened the lid edges so that if need be, the lid could be slammed shut in a hurry cutting the antenna and earth leads. However, I think though there would be problem as it might cut the earphone or microphone leads at the same time.

There are two earphone jacks and one microphone jack and all are of the sub-miniature transistor radio type of plug. The H-264 earphone for the PRR-9 is nearly identical to the PRC-64 earphone and works well as an alternative. The earphone can also be used as a substitute microphone. PRC-64A: same as PRC-64, except that there is an added 'daughter board' on the transmitter module that improves high-speed keying performance.

I have powered the set up on external supplies and it certainly works well. The limitation of crystal control on receive and transmit is a problem for Amateur use but once the standard low power (QRP) channels are installed along with the a.m. channels the set could be useful. However, the built-in Morse key is not really usable, certainly not on my example as there is too much play in it for decent quality Morse. Still, it's an interesting set to try in the field in the future.

German LO40K39

The LO40K39 German two-stage transmitter, **Fig. 3**, originally made for smaller merchant ships, was introduced in around 1939 to the German armed forces and their navy. Different variants, 'A' through to 'G', with slightly different frequency range according to version between 3 - 16.6MHz or 5 - 16.6MHz, subdivides into three bands.

Different basic configurations produced either the 40W (SGLE 0, 17/2) or 70W (SGLE 0, 2/2) versions. The connection for the Morse key is via the power supply unit and a modulator was later added to enable a.m. voice communication.

The LO40k39 uses the German RL12P35 valve, one as the main oscillator and two in parallel as the output stage. Apparently, according to web based information, the original design was successfully tested in 1937 on one of the Zeppelin airships.

The main tuning control rotates coils within the main oscillator and power amplifier tuned circuits and hence varies the frequency. A large built-in antenna matching unit completes the transmitter line up. A search of the web suggests that the transmitter was also used on U-Boats, possibly as a back up transmitter but more research is needed.

The set that arrived here in Kidderminster worked well for a short while until one day I found that the tuning control had seized. After investigation I discovered the shaft on the oscillator coil had stuck fast. Removing the coil assembly proved extremely difficult, **Fig. 4**, the pins holding the shaft coupler took some knocking out. In the removal operation I broke a small bit off the (quite solid) ceramic coil former, which turned out to be a blessing!

Through the gap formed by the break I was able to unsolder the connection from the internal coil to the shaft and extract the seized component. Thinking I would need to completely cut the outer shell of the shaft to free it, I made the first cut and found to my delight that the shaft was now released and the extra cut wasn't needed.

After applying a suitable lubricant I reinstalled the shaft, again being able to resolder it through the broken gap. After reassembling the coil and coupler into the transmitter, the problem was solved. I now need to complete a power supply and modulator for the unit (unless someone out there has a spare?), and I will give it a good twirl on the bands.

Fig. 3: The German Naval transmitter, tuning window on the left, with the power amplifier and antenna controls on the right.

Fig. 4: The valves and oscillator coil out of the LO40K39, the stuck shaft (see text) was removed and repaired.

Fig 5: The Eddystone EP-961B display unit, showing a 500kHz calibration pip.

Eddystone EP-9961

Another recent addition in the Kidderminster Kollection is the Eddystone EP-961. This is a panoramic display unit, **Fig. 5**, which was introduced in the early 1970s and used solid state devices, save for the display cathode ray tube (c.r.t.) of course. The EP961A covered a range of 50 to 800kHz and was suited to monitoring i.f. ranges on many sets.

The model I have is the EP961B with a tuner covering 500kHz to 36MHz and offering a 6kHz resolution. Price in 1972 was just over £1000. The unit is sensitive enough to be connected directly to an antenna and give a good display of band activity. I am still playing with this unit so more later.

Well that's about it for this year for my stint at the V&V shop. I hope you have enjoyed the selection I have brought you and I hope it has whetted your appetite for things old and valved.

As always I can be contacted direct at **62 Cobden Street, Kidderminster, Worcestershire DY11 6RP**, or via E-mail at **military1944@aol.com**

I send my best wishes for the coming festive season and I look forward to being with you next year. Cheerio for now.

PW

Trader's Table

The equipment for sale on this page is secondhand or ex-demonstration

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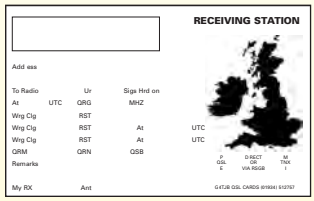

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DAVID G4ASR CONTINUES TO TAKE A LOOK AT SPORADIC-E OPENINGS ON THE 144MHZ BAND

During July, there were 13 days when Sp-E openings occurred on the 144MHz band. On a number of days, however, there was more than one opening and I've calculated that at least 25 separate Sp-E events were observed from the UK during July. The openings were reported on July 1, 5, 6, 7, 9, 12, 13, 14, 16, 17, 20, 23 and 26.

To begin, I'll take an in-depth look at those events that occurred on the 144MHz band. The first Sp-E opening of the month was an half hour event on July 1 between 1840-1910UTC. As it coincided with the RSGB v.h.f. National Field Day it enabled a number of portable stations to make contacts into Portugal (CT) and Spain (EA).

The 144MHz opening only favoured UK stations situated in the north of England and Scotland with everyone else missing out. The portable station of MM0CPS/P (IO84) running a Yaesu FT-847 transceiver into a 400W amplifier and an array of eight, 7-element Yagis did well by contacting the stations of EA1FAQ (IN71), EB1DRO (IN70), EC1DKX (IN71) and ED4URA (IM79).

The Spanish stations of EA1FAQ (50W and a 2-element Yagi) and EB1DRO (120W and a 9-element Yagi) both reported working the stations of MM0CPS/P (IO84) and MM0GPS/P (IO85) around 1900UTC. In Portugal the station of CT1DIZ/P (IM69) running an Icom IC-910H transceiver into a 300W amplifier and a 9-element F9FT Yagi, contacted G0WYY (IO94), M0AFC/P (IO84) and M0JKQ (IO84).

An opening into Spain on July 5 between 1920-2005UTC favoured stations in southern England and Wales. **David Johnson G4DHF** (Lincolnshire IO92) running an Icom IC-7000 transceiver, GS35B amplifier and four 7-element Yagis reported that the opening was rather patchy at his QTH. He made s.s.b. contacts with the stations of EA7AJ (IM87) at 1699km, EA7ERP (IM87) at 1761km, EA7DFH (IM87) at 1767km, EB7BKY (IM77) at 1768km and for best DX of the evening EA7GNO/P (IM86) at 1801km.

SERIES OF SPORADIC-E EVENTS

A much better series of five discrete Sp-E events occurred on July 6. It consisted of openings between 1135-1155UTC to Bulgaria (LZ) and Serbia (YU7), between 1325-1340UTC to Portugal, between 1430-1440UTC to Czech Republic (OK), Germany (DL) and Switzerland (HB9) and around 1600UTC to Portugal. Later in the day, between 1735-2030UTC there was a very large opening into Austria (OE), Azores (CU), Bulgaria, Croatia (9A), Greece (SV), Hungary (HA), Italy (I), Poland (SP), Romania (YO), Serbia, Slovakia (OM), Slovenia (S5) and Ukraine (UX).

During the first opening of the day, the Bulgarian station of LZ1AG (KN22) reported making s.s.b. contacts between 1138-1152UTC with the stations of G0NNF (IO92), G3LQR (JO02), G3ZEZ (JO01), G4TIF (IO92), G4VPD (IO92) and G8HGN (JO01). The next opening lasted less than 15 minutes and at the QTH of CT1HZE (IM57) s.s.b. contacts were made with a number of UK stations that included G4HGI (IO83), G6CRV (IO84) and GW8ASA (IO81).

The station of **Gordon Wyatt GW8ASA** (Mid-Glamorgan IO81) also reported another brief opening at 1430UTC when he contacted DF6GQ and HB9DKM both in locator square JN37 with 59 signals. The best was yet to come with an opening to southeast Europe at 1735UTC that lasted for three hours. The station of LZ1ZP (KN22) running an Icom IC-706 transceiver, 4X150A amplifier and a 10-element DJ9BV Yagi, made 45 QSOs with stations in G, PA and ON. He reports making contacts with the UK stations of G0CUZ, G4PBP, G6JJP, G8ADD, G8TIC (all in IO82), G0UWK, G4UKP, GW8ASD (in IO83), G4AEP, G4PCS, G4RGK (in IO91), G4CLA, G4DHF, G4KWQ, G4TIF, G6HKS, G8VHI, M3SDE, (in IO92), G0PQF, G3BNE, G3YDY, G4KDH, G4ZFJ, G6WYH, G8HGN, G8RZA (in JO01) and G0JJG, G4HUP, 2E0BEW (in JO02).

The station of **Mark Turner G4PCS** (Hertfordshire IO91) was pleased to contact LZ1ZP at 2156km as he only uses a 2-element Yagi mounted in the roof space. Mark also worked the stations of YU1IO (KN04), YZ7NOU (JN94) and heard LZ2FO, YU1EV and SV2JL. I was active at my QTH (Herefordshire IO81) during the 144MHz event and my (G4ASR) best contact was made at 2020UTC when I heard the station of SV2JL (KN10) calling CQ on 144.300MHz.

The signal was quite weak at first but built up to 55 enabling a quick s.s.b. contact to be made over a 2338km path. Towards the end of the event around 2000UTC a rare path opened up to the Azores situated in the middle of the North Atlantic Ocean. The station of **Derek Hilleard G4CQM** (Devon IO70) reports that during the opening he worked the Ukrainian station UX1DK (KN18) at 1925km to the east at 1900UTC followed at 1956UTC by a contact with CU8AO (HM49) some 2420km to the west.

There were two 144MHz openings on the following day of July 7. The first, between 1045-1150UTC, enabled operators located towards the western side of England, Wales and Scotland to contact stations in Austria, Croatia, Hungary, Italy, Slovenia and Switzerland as shown in **Fig. 1**. The expedition station of **GM4SIV** (IO57) operating from the archipelago of St. Kilda, the remotest part of the British Isles some 66km west of Benbecula in Scotland's Outer Hebrides, managed to make a number of contacts in Italy and Switzerland.

Some of the s.s.b. contacts made on 144.305MHz included the stations of HB9BQU (JN37), HB9FAP (JN46), IK0BZY (JN61), IW0FFK (JN61), I1JTQ (JN35), IW2BSQ (JN45) and IK5YJY (JN53). The second opening of the day occurred around 1400UTC, with stations in southern England making contacts into Portugal.

Two further openings were reported on July 9, the first at 0715UTC to Italy and the second between 0830-0935UTC to Italy, Sicily (IT9) and Malta (9H). **John Lemay G4ZTR** (Essex JO01) running a Kenwood TS-2000 transceiver, 400W amplifier and a 16-element Yagi reports that the longest distance worked during the opening was 2090km. He contacted IT9VDQ (JM68), IW9AWL (JM68), 9H1CG, 9H1ET, 9H1GB and 9H5L (JM75).

LONG LASTING

It's often the case that if a Sp-E opening lasts for much of the day on the 50 or 70MHz band it may well keep popping up to the 144MHz band every now and again. **Note:** if you hear about an event earlier in the day keep listening as there may well be another opening in a similar direction a few hours later.

Propagation on July 12 was just like that with four separate events being reported in the five-hour period between 1355-1900UTC. The first Sp-E opening of the day occurred between 1355-1455UTC to stations in Italy, Sicily and Malta. At the QTH of G4ZTR s.s.b. contacts were made with IW2BNA (JN45), I4RHP (JN54), IC8FAX (JN70), IW9IWP (JM68) and

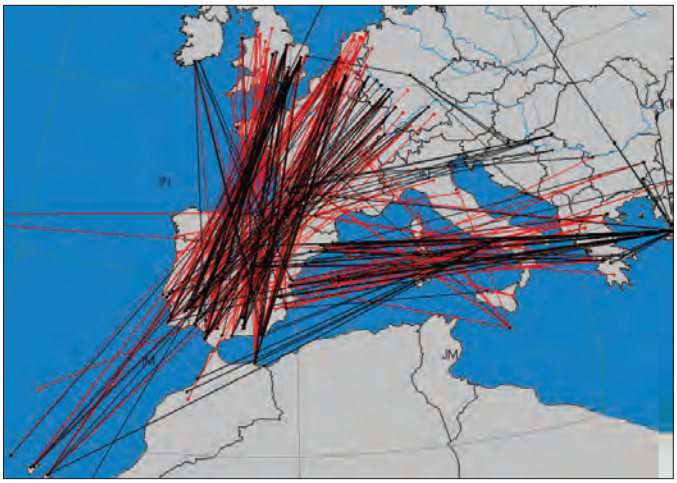

Fig. 1: The 144MHz Sporadic-E opening on July 7.

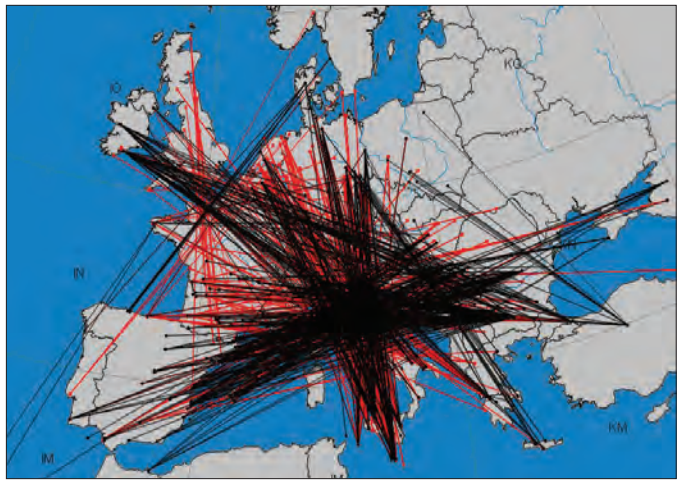

Fig. 2: The 144MHz Sporadic-E opening on July 12.

9H4W (JM76). Between 1515-1530UTC the band opened up to Greece with the station of **Dave Edwards G7RAU** (Isle of Wight IO90) hearing SV3CYM (KM08) on 144.305MHz and SV3GKE (KM08) on 144.330MHz, both over a 2281km path. The next opening between 1715-1805UTC appeared to favour stations located in Northern Ireland, Scotland and Wales although some G stations managed to make a few contacts into France, Spain, Austria, Switzerland and Italy as shown in **Fig. 2**.

Some of the DX stations worked on the 144MHz band included, EA3ESE (JN01), EB3EHJ (JN02), F5VHX (JN04), F6DRO (JN03), HB9DFG (JN37), HB9JAW (JN47), IW2BNA (JN45), IZ5EME (JN52) and OE3EFS (JN78). The last opening of the day reported by stations in southern England was a brief event between 1850-1900UTC to Bulgaria and Serbia. The station of **Colin Roberts G4ZFJ** (Essex JO01) running an Icom IC-275H transceiver, 100W into a 9-element Yagi made QSOs with LZ1ZP (KN22) at 1835km and YU1DGH (KN03) at 2101km. Dave G7RAU reported s.s.b. contacts with the stations of LZ2CC (KN23) at 2129km and LZ2ZY (KN13) at 1990km. Only one contact was reported at 1117UTC on July 13 between the stations of G4RRA (IO80) and 9A3XR (JN83).

It may have been a meteor burst but the 70MHz band was open via Sp-E to Greece with UK stations working SV1OE (KM17) at exactly the same time. There was no doubt about the Sp-E opening on July 14 though. It lasted for one hour between 0850-0950UTC with contacts being made into Albania (ZA), Croatia and Italy. **Tim Fern G4LOH** (Cornwall IO70) was very pleased to make a QSO with the station of ZA/I8YGZ (JN91) at 2110km for a new DXCC country. He also worked 9A1UN (JN65) and 9A5ID (JN74). **Carlo Politi IK5CQV** (Italy JN53) mentions that he uses a Yaesu FT-736 transceiver, 200W amplifier and a 13-element Yagi. He made s.s.b. contacts with G0KPW (JO02), G0UYC (JO02), G4KWQ (IO92) and G4ZTR (JO01).

A brief opening to Croatia (9A5Y) at 0955UTC on July 16 was followed later in the day by an excellent opening that lasted for nearly two hours. Propagation between 1540-1720UTC was to Portugal and southern Spain (EA7 call area) and into the African continent to Ceuta (EA9) and Morocco (CN). The station of **Francisco Costa CT1EAT** (Portugal IM68) running a Yaesu FT-847, 200W and a 17-element Yagi reports making 18 QSOs with UK stations in central and southern England. Colin G4ZFJ mentions making s.s.b. contacts with 5 x CT stations, 6 x EA stations, CN2MI (IM85) and EA9IB (IM85).

A three minute opening between 0820-0823UTC was reported by **Sokalsky Stanislav UX1DC** (Ukraine KN18) on July 17. Running an Icom IC-746PRO, 100W and a 9-element Yagi he contacted the stations of G4AJC (IO91) and GW8JLY (IO81). The opening only lasted one minute at the QTH of G7RAU but that was enough time to work SQ9W/P (JO90) and US5WU (KO20). Later in the evening, between 0945-2015UTC the 144MHz band was open to Corsica (TK5JJ), France (F1NSR), Italy (IH9GPI) and Sardinia (IS0CBC). Another short opening was reported on July 20 between 1840-1915UTC to Portugal and Spain.

The station of CT1EAT mentions that as he drove home he was listening to BBC Radio 4 on the Band II v.h.f. f.m. broadcast band. At his home QTH he then made 144MHz contacts with G4ABM (IO94), G4CBW (IO83), G4EZT (IO92), G4IGO (IO80), G4KWQ (IO92) and G4UKP (IO83). Gordon GW8ASA spotted yet another brief event between 0952-1005UTC on July 23 when he contacted I1DMP (JN35) and OE6EMG (JN77).

SOMETHING MUCH BIGGER

It's often the case that a few days of fairly short openings are followed by something much bigger. And that was the case on July 26 with an enormous Sp-E opening that lasted for over five hours. It started at 0830UTC to Corsica, Italy, Malta, Sardinia and Sicily and by 1030UTC had tracked itself westwards across the Mediterranean area to southern France, Balearic Islands (EA6), Portugal and Spain. Around 1250UTC a path opened up to the Canary Islands (EA8) some 3000km from the UK. This faded out after 15 minutes, being replaced by more propagation to Portugal and Spain until 1345UTC when all DX signals disappeared. In between all this activity there were additional paths popping up with UK stations making contacts into Austria, Switzerland, Croatia, Montenegro (YU6 and 4O) and Greece.

Richard Staples G4HGI (IO83), using an Icom IC-746 transceiver and a pair of 7-element Wimo Yagis contacted CT1ANO (IN51), CT1EPC (IM68), CT1HZE (IM57), EA/DJ6OL (JN11), EA3TI (JN11), IZ4AIK (JN63), I8KPV (JN70), IS0CBC (JM49), IS0GQX (JM49) and IW8PNY (JM89) for best DX of the event at 2121km. Colin G4ZFJ mentions that he was very pleased to go home at lunchtime from work as he was rewarded with two contacts in the Canary Islands, EA8BPX at 2942km and EB8AYA at 2954km. Other DX stations worked on the 144MHz band from the UK included EA6DD (JM19), EA8BEX (IL27), IH9GPI (JM56), IS0CBC (JM49), IT9ESW (JM67), IZ0JKB/M (JN61), SV3GKE (KM08), TK5JJ (JN41), YU6AO (JN92) and 9H1ZC (JM75).

DEADLINES

Oh dear - I've run out of space again and there's still a fantastic 144MHz Sp-E opening in August to report about and I haven't even mentioned all the DX on the 50 and 70MHz bands yet! This summer has really been fantastic and it will take months to catch up on your reports. Good luck with the autumnal tropo DX and see you again next month.

73 David G4ASR

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HF Highlights

AS USUAL, INFORMATION, REPORTS AND PHOTOGRAPHS TO ME PLEASE BY THE 15TH OF EACH MONTH.

Jan Hallenberg, SM5DJZ (ex-SM0DJZ) has been the QSL manager for SJ9WL and LG5LG since 1995.

CARL GW0VSW ROUNDS UP ALL THE LATEST NEWS FROM THE HF BANDS

Tom Callas KC0W in Minnetonka, Minnesota, has been mentioned in readers' reports a few times operating from Martinique NA-107 as TO0O with his latest operation being in June this year where he made over 14,000 QSOs. Tom loves to work Australia, UK and Japan as "these operators are **very** considerate". With a further visit expected in 2007 you will have the chance to work him again and he has promised to let us know when that will be and on what h.f. bands!

CONDITIONS AGAIN!

Like most of us in the past year, band conditions have not been at their best making operating extremely difficult at times. Because of this, the special event station **GB4SNF** (Support International Forces) organised by **Dennis Egan GW4XKE** did not achieve the results expected in June from its location in Colerne, Wiltshire, so it was therefore decided to operate once again during July from a location near to Cardiff. This added an additional 156 calls to the 500 or so previous entries. Although, most of the contacts made were inter 'G', several calls outside the UK were made. Other countries to make it through the high QRN including Finland, France, Holland and Sweden.

Steve GJ7DNI/P in St. Hellier, Jersey called in whilst on holiday for a 5/5 report and this was followed shortly after with a call from Bob W9ARV on 3.5MHz with a good 5/8 signal from his home in Daytona, Florida. Running 100W, the special event station received just a 3/3 from Bob who was pleased to get them in his log. On several days conditions were so bad that not one signal was heard so, operations were abandoned until they improved. Dennis would like to thank all those that called in or sent in a report. Your cards are on their way via the bureau.

DX NEWS

Onto some DX news again and for those of you who need to work Togo, you might try listening out for **Robert Bonnafous 5V7BR**, as he can sometimes be found on 14.114MHz after 0600UTC. As of the 1 June this year the QSL Manager for 5V7BR is Gerard F2VX and QSL cards are alright via the bureau.

In America **Dennis Martin WA2USA**, will be operating as **WA2USA/5** from Grand Isle NA-168 located in Caminada Bay, Jefferson County, Louisiana between the 19 and 30th of this month. He will be active during the CQWW SSB DX Contest on the 28-29th of October, although no category has yet been given. Activity will be on all bands from 3.5-28MHz before and after the contest although emphasis will be on 14MHz during the day and 3.5/7MHz in the evenings with some time being spent on 10MHz. A QSL is good via his home callsign at **5577 Victoria CT, Newburgh IN 47630, USA**.

Listen out for the call **8J3R,** which will be used until the end of the month on all bands to celebrate the 5th Anniversary of Ritto City, near Lake Biwa in the Southern part of Shinga, which lies in the West or 'Kansai' region of Japan.

In Korea, **Kang Sung Min DS4DRE**, will be active as **DS4DRE/4** from Hong Island AS-093 until the end of the year. Activity will be on all bands from 3.5 to 28MHz using both c.w. and s.s.b. and QSLs are okay via his home callsign, through the bureau or direct to **166 Senam-Dong Kawng San Gu, Kwangju City, Korea.**

Closer to home and on Texel Island EU-038, Holger Adelsberger will be operating as **PA/DH1AD** until the 19 October. This will be a 'holiday-style' operation on most bands using 100W and wire antennas please. QSL to his home callsign via the bureau.

Several members of the Bulgarian Federation of Radio Amateurs (BFRA) will activate the special event callsign **LZ1900K** (LIMA ZULU ONE NINE ZERO ZERO KILO) until the end of the year. This call is to commemorate the 1900th anniversary of the proclamation the of ancient city of Pautalia, now Kyustendil, by Roman Emperor Mark Ulpiy Trayan (Marcus Llpius Trajanus AD52-AD117) for Municipia, the Province centre. The proclamation also included the right of the city to issue its own coins. The QSL route is preferably via the LZ Bureau to LZ1BJ.

QSL UPDATE

Jan Hallenberg, SM5DJZ (ex-SM0DJZ) has been the QSL manager for **SJ9WL** and **LG5LG**, the station at Morokulien on the border between Sweden and Norway since 1995. The name Morokulien is made up from the Norwegian word 'moro' and the Swedish word 'kul' for fun. The word 'lien' has to be added to make Morokulien a 'ham-state' between the two countries!

If you visit and operate at Morokulien for several days you have to change the callsign from LG5LG to SJ9WL every other day. The Morokulien Amateur station has a new mast, just over 30m (100ft) high, as well as new dipoles for 1.8, 3.5, 7 and 10MHz and a new five band 8-element Log-Periodic antenna for 14, 18, 21, 24 and 28MHz. As of the 20 August the QSL route has now changed and cards should be sent to **Svenn-Erik Spigseth LA4EKA** either direct to **Ullern, 2100 Skarnes, Norway** or through the Norwegian QSL bureau. Cards already sent to SM5DJZ will be forwarded to the new QSL manager.

If you want to visit this station you can send an E-mail to the booking manager Odd Westby SM4SXQ at **odd.westby@telia.com** (The cost is approximately 32 Euros per 24 hours and the only items you will require are bedding and food). Further information on can be found at **www.east.no/priv/la7tia/arim/engarim.htm**

On the Turks and Caicos Islands, operators Frank Widmann WA2VYA, Tony Scandurra W2WAS and John Imhof N2VW will be active as **VP5T** during the CQWW DX SSB Contest as a Multi/Multi or Multi-2 entry. All QSLs should be via N2VW. Their activity will be from VP5JM on Providenciales NA-003 but you will also find them using c.w. and operations on the WARC bands before and after the contest. Operators will sign using VP5/homecall and if you work any of

Two of the QSL cards sent to Martin Addison 2E0MCA this month.

the operators the QSL goes via their individual home calls with no eQSLS accepted.

YOUR REPORTS

On to your reports now and first off is **Leighton Smart GW0LBI**, Trelewis, Mid-Glamorgan who used his Yaesu FT-100 with 50W c.w. to a 67m (220ft) long wire antenna tuned against earth. Leighton worked OY3QN (Faroe Islands) EU-018 at 2112. He also worked OK1AVI (Czech Republic) 2120, DR35AGCW (Germany) celebrating 35 years of the AGCW at 2142, a new Top Band country 4O3F (Republic of Montenegro) 2200 and EA2RA (Spain) at 2300UTC.

THE 7 & 10 MHz BANDS

The 7MHz log of all c.w. man **Ted Trowell G2HKU** on the Isle of Sheppy in Kent, had two contacts around 2000UTC. These were OH0/SM5AJV (Aland Island) EU-002 and OY3QN (Faroe Islands) using a Ten Tec Omni 5 at 70W to a G5RV.

Also on the band was **Martin Addison 2E0MCA** in East Finchley, North London, who logged ON4LBN/P (Belgium) 0644, PA1WLB/P (Netherlands) 0909, DJ7FY (Germany) 0927. Also worked were EJ/G0RTN (Ireland) on Inisheer EU-006 at 1144 and OZ/OP4A (Denmark) on Romo EU-125 at 1721UTC using s.s.b. from a Yaesu FT-840 and 10W to a folded half-size G5RV.

In Cumbria, **Roy Walker 2E1RAF** used his Kenwood TS-570DG and 5W c.w. into an 80m wire loop to find Axel MJ/DF4ZY/P (Jersey) EU-013 who was also QRP using an Elecraft K2 home-built transceiver at 0848 followed by OM5AW (Slovak Republic) at 1948UTC.

THE 14MHz BAND

On to the log of **Owen Williams G0PHY** in Biggleswade, Bedfordshire who used s.s.b. from his Yaesu FT-757 and 100W into his dipole on 14MHz. He logged 4O3T (Slovenia) 2038, HR2DMR (Honduras) 2303 and W2VQ/P/C6A (Bahamas) NA-021 at 2321UTC.

Meanwhile, **Martyn Medcalf M3VAM** in Chelmsford, Essex used s.s.b. once again for EO6F (Georgia) 1228, IG9Z (Italy) 1746, F5AOK (France) 1658, 7X4AN (Algeria) 1908 and EC8ADW (Canary Islands) AF-004 at 2308UTC using an Icom IC-746 and half-size G5RV antenna with SGC-237 auto tuner.

Concentrating on one band this month was **Gary McKelvie G7USC** in Guildon Sutton near Chester whose large log included DL7UCW (Germany 1030, PA1PDM (Netherlands) 1137, F5BDD (France) 1220, SP1MWN (Poland) 1556, EA3DVY (Spain) 1729 and OZ0ACA (Denmark) 1906 on s.s.b. A change to RTTY allowed contacts with DL5WF (Germany) 1345, UR7EY (Ukraine) 1727, 5F50KD (Morocco) 1833, TI8CBT (Costa Rica) at 2031, 9Z4FZ (Trinidad & Tabago) SA-0-11 at 2043, LU5DIT (Argentina) 2124 and HK6DOS (Columbia) at 2145 while PSK31 found HA5AEZ (Hungary) 1319, RZ1AG (European Russia) 1728 and HZ1IK (Saudi Arabia) at 2054UTC. He was using a Yaesu FT-857D with DSP and 40m delta loop antenna.

Ted G2HKU worked c.w. stations A71M (Qatar), 8R1J (Guyana) and 8P6CF (Barbados) around 2100UTC. Roy 2E1RAF worked 50W to log OH8GZN/1 (Finland) 1236, LZ1ND (Bulgaria) 1254, SI9AM (Sweden) 1434, LA9HC (Norway) 1819 and DL7BA (Germany) at 1825UTC.

THE 21MHz & 28MHz BANDS

On 21MHz the s.s.b. signals of Martin 2E0MCA reached DJ9AO (Germany) at 1014, while 9A4M/P (Croatia) on Korcula Island EU-016 was worked at 1938UTC. Martyn M3VAM listed OH2HQ (Finland) 1235, 4N9HQ (Montenegro) 1257 and HG3M (Hungary) at 1955UTC.

Moving up to 28MHz, Owen G0PHY managed 4O3T (Rep of Montenegro) at 1126, as Roy 2E0RAF bashed the key again finding DJ4EJ (Germany) 1324, I2ZBX (Italy) 1338, RK3ER (European Russia) 1441 and OK1NU (Czech Republic) at 1443UTC.

SIGNING OFF

Well that's it for another month. A slightly disappointing one as far as the DX was concerned, with long distance openings few and far between. However, our reporters have done well and thanks to them for sending in their logbooks showing that there is still plenty to work if you are prepared to put the effort in.

Thanks also to **Tedd Mirgliotta KB8NW** editor of the *OPDX Bulletin* and **Mauro Pregliasco I1JQJ/KB2TJM** editor of the *425 DX Newsletter* for the DX information. Until next time have a good DX-filled month.

73, Carl GW0VSW

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DISCLAIMER Some of the products offered for sale in advertisements in this magazine may have been obtained from abroad or from unauthorised sources. *Practical Wireless* advises readers contemplating mail order to enquire whether the products are suitable for use in the UK and have full after-sales back-up available. The publishers of *Practical Wireless* wish to point out that it is the responsibility of readers to ascertain the legality or otherwise of items offered for sale by advertisers in this magazine.

Whilst prices of goods shown in advertisements are correct at the time of going to press, readers are advised to check both prices and availability of goods with the advertiser before ordering from non current issues of the magazine.

Valves

VALVES:- OVER 50000 STOCKED Ham, Vintage, Military, Audio. SAE for FREE list to: Wilson Valves, (Jim Fish G4MH), 28 Banks Ave., Golcar, Huddersfield, West Yorks HD7 4LZ.
Tel: 01484 654650/649380/650725.
Mobile:- 07733 283084.
Fax: 01484 655699.
E-mail: wilsonv@zoo.co.uk
Visa etc. Fast & personal service.

VALVES AND ALLIED COMPONENTS IN STOCK Ring for free list. Valves/books/magazines wanted. Geoff Davies (Radio). Tel: 01788 574774.

TOP PRICES PAID
for all your valves, tubes, semi-conductors and ICs.

Langrex Supplies Ltd.
Unit 4, Daux Road, Billingshurst, W. Sussex RH14 9SJ
TEL: 01403 785600. FAX: 01403 785656.

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REPAIRS TO ALL AMATEUR AND VINTAGE Rx/Tx Cost effective service. Phone or call in for details. Medway Aerials, Rear of 14 Luton Road, Chatham, Kent ME4 5AA.
Tel: 01634 845073.

Aerials

GAREX ELECTRONICS VHF/UHF accessories and aerials, PMR equipment and spares. www.garex.co.uk
Tel: 0771 4198 374 PO Box 52, Exeter EX4 5FD.

Classified Advertisment Dept.
PW Publishing Ltd,
Arrowsmith Court,
Station Approach,
Broadstone,
Dorset BH18 8PW

For sale

Qtz x-tals 455kHz to 150MHz Std 10.106, 10.245, 10.7, 11.155MHz £1.00/unit. Callg 3.56, 7.030, 21.06, 28.06 £1.00/unit. 1.4MHz fltrs £14.00. 10.7MHz 10kHz fltrs £3.25 P&P £1.00 + VAT. IQ Electo 0208 391 0545. vincent@jakomin.fsnet.co.uk

Wanted

OLD HALF INCH FERRITE RODS Must be half inch in diameter and be six inches long or more. Tel: Peter Tankard 0114 2316321.

QSL Cards

FULL COLOUR QSL CARDS for all your QSL needs. Shirts and caps with callsigns and also ham cartoons by GW3COI. For free samples contact Chris M0DOL. E-mail: qslers@aol.com P.O. Box 184 Northampton NN3 9JH.

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The prepaid rate for classified advertisements is 42 pence per word (minimum 12 words), box number 70p extra. Semi-display setting £13.90 per single column centimetre (minimum 3cm). Please add 17.5% VAT to the total. All cheques, postal orders, etc., to be made payable to PW Publishing Ltd. Advertisements, together with remittance, should be sent to the Classified Advertisement Dept., Practical Wireless, Arrowsmith Court, Station Approach, Broadstone, Dorset BH18 8PW. Tel: 0870 224 7820, Fax: 0870 224 7850.

Please insert this advertisement in the ..... **issue of Practical Wireless** (if you do not specify an issue we will insert it in the next available issue of PW) for ..... insertion/s. I enclose Cheque/P.O. for £.....(42p per word, 12 minimum, please add 17.5% VAT to total).

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Telephone No.: .....

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Bargain Basement

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YOUR ATTENTION PLEASE!

Bargain Basement rules - £4 per advert

Please write your advert **clearly** in **BLOCK CAPITALS** up to a maximum of **30 words**, plus **12 words f**or your contact details on the form provided and send it together with the dated corner flash and your **payment of £4** (**subscribers** can place their advert **free of charge** as long as they provide their **subs number and corner flash**), cheques should be made payable to **PW Publishing Ltd.**, credit card payments also accepted.

Send your advert to **Bargain Basement, Practical Wireless, Arrowsmith Court, Station Approach, Broadstone, Dorset BH18 8PW** or E-mail your advert to **peter@pwpublishing.ltd.uk** (If you don't want to include your credit card details on your E-mail, just 'phone us on **0870 224 7820**.

Please help us to help you by preparing your advert carefully. Any advert which contains **??** marks indicates that the advertiseing dept. could not read/interpret the wording.

Please avoid FAXing your advert - it could delay publication.

Advertisements from traders or for equipment that it is illegal to possess, use or which cannot be licensed in the UK, will not be accepted. **No responsibility will be taken for errors and no correspondence will be entered into on any decision taken by the Editor on any of these conditions.**

You should state clearly in your advert whether equipment is professionally built, home-brewed or modified.

The Publishers of *Practical Wireless* also wish to point out that it is the responsibility of the buyer to ascertain the suitability of goods offered for purchase.

FOR SALE

4m PHILIPS FM-1000 trans mic, etc., £55. Heathkit SB-300 Rx, working, £45. Carriage extra or collect. Tel: 0777 649 5381 after 6pm please. (Dorset).

AR88 LF BEAUTIFUL CONDITION Hallicrafters S27C 130 to 200MHz, excellent, another S27C, needs improving. Collins TCS 12 transmitter, original unmodified and working. Moving house. Best offers please. Jim G4XWD 01692 630285 (Norfolk) E-mail: jandr@macunlimited.net

CLARKE PUMP-UP MAST. 30ft with hand pump fitted and mast base, £100. Buyer collects or aranges carriage. Tel: 01482 896471 (Hedon, East Yorkshire).

ELECTRONIC MORSE KEYER PIC programmed for 5-35wpm. for practice or transmit with automatic switch-off. Easy build details provided, needing very few extra components, only £10. E-mail: chick@chickene. freeserve.co.uk

MARCONI AM/FM SIGNAL GENERATOR TF-995/A1 1.5-220MHz, handbook, £50. Buyer collects. Roberts R9914 portable radio AM/FM/SSB as new, £50. Cirkit FET DIP OSC. 0.8-170MHz, G3WPO design, £25. Tel: 01275 876155 (North Somerset).

MORSE KEYS Lorenz ZTK-129 straight key, £25. USA J-37 straight key, £20. USA speed – straight key, £20. Postage included. Collins TCS transmitter complete original unmodified. FREE. Must be collected. Tel: G4AQZ QTHR 01255 429117 (Clacton-on-Sea).

RADIO JUNK from clear-out. Useful to young constructors or schoolboy. Available for collection now. Tel: 01234 711538.(Beds).

RECEIVERS Lowe HF-225 Digipad, Zenith Trans-Oceanic 7000. FRG-7. SIG Gen Taylor 60AM. Racal Dana frequency meter 9916, UHF. TEK 2245 4 channel 100MHz. B/W, Philips PM-3206 scope, 15MHz B/W. Tel: 01522 537935 or 07984 802351 (Lincolnshire).

SGC 2020 tranceiver**,** Icom ICR-8500 communications receiver, Bencher key, SGC Smarttuner, Aerial unit, Diawa PSS30V 30A power supply, Discone aerial, MFJ Deluxe electronic keyer. Other items too, all reasonable prices as station closing. Tel: 01256 473508 (Basingstoke).

YAESU FT-290R MARK 2. All mode, 2m tranceiver. Boxed complete with manual, £145.00 plus postage or collect. IC-T8E Triple Band hand-held. 6m, 2m, 70cm. Imaculate, boxed with case & charger, £145.00 plus postage. Tel: Andy 0116 2741857 (Leicester).

YAESU FT-902DM HF, all mode transceiver in exceptional condition. Offers around £100. P&P £15. Tel; 01268 728396 (Basildon, Essex).

YAESU VR5000 Scanner. Only about 12 hours use. £350 o.n.o. Icom IC-756PROII. TX/RX As new condition, £1395.00 o.n.o. Tel: Ron 01453 822017 (Glos).

WANTED

10m TO 4m TRANSVERTER. Commercial made or home brew accepted. Must be in good working order. Tel: Pete 01858 469535 (Market Harborough).

CREED NUMBER 7 TELEPRINTER and any associated equipment. Must be complete. Also, any communications equipment. Tel: Graham G7KYX 01205 871624 (Lincolnshire).

OLD HALF INCH FERRITE RODS must be half inch in diameter and be six inches long or more. Will pay very good money for the rods. Tel: Peter Tankard 0114 2316321 between 9am and 10pm (Sheffield).

WANTED TO FINISH G2DAF Tx A 1.5MHz or 2.535 crystal. Any type of holder also wanted. Any unfinished G2DAF Rx projects. Components, Philpots, chassis, etc. Tel: Ken 01759 304315 (York).

bargain basement order form

Please insert this advertisement in the next available issue of *Practical Wireless*.

❑ **For Sale** ❑ **Wanted** ❑ **Exchange**

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Address .....

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..... **Post code** .....

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Your advert, you decide! PLEASE - No FAXed Ads!

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B.B. Nov '06

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Please note: All payments must be made in Sterling. Cash not accepted.
Cheques made payable to PW Publishing Ltd.

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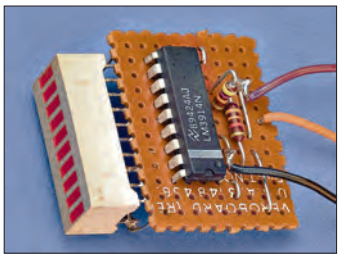
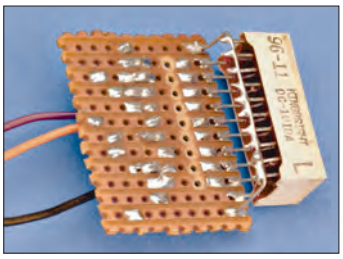
rob mannion's topical talk

This month's topical chat reflects on a request by a *PW* reader (and author) regarding the use of punched hole matrix copper clad board - well known and marketed under the Veroboard name.





The letter from **Andy Foad G0FTD**, in this month's Amateur Radio Waves raises a hoary old problem for *PW*! Indeed, I've discussed the problems we've had with Veroboard projects before and I hope I don't bore readers this time but it's an important subject and worthy of discussion. You never know - as I mentioned in my editorial comment - readers may well punch holes in my argument and sink them alongside the harbour wall!

Personally speaking, I've never had much success using Veroboard in conjunction with radio frequency (r.f.) projects. There's been a definite jinx for me there! In fact, when the superb little ZN414 'one chip' tuned radio frequency (t.r.f.) device first appeared I couldn't get it to work. Why? The answer is that I tried building it on Veroboard and the high gain circuit literally 'took off' (started oscillating). Unfortunately, it took me a long time to discover what had happened. In fact, I only discovered the cause of the problem when I found a strong r.f. signal interfering with the shack broadcast radio. It was the ZN414 operating successfully as a low power transmitter!

Audio Projects

After my failure using the Veroboard with the high gain ZN414 chip, I avoided using the Veroboard for r.f. projects. There were no problems with audio frequency (a.f.) and other circuitry but as far as I was concerned, r.f. was definitely a 'no' decision.

Additionally, I've always found building anything other than really simple circuit on Veroboard as extremely difficult! Andy mentions a well-known computer program once available for planning the layouts of Veroboard projects. However, computers weren't available for the hobbyist when I was attempting to use Veroboard!

Over the (approaching two decades) time I've been Editor of *PW*, we've only published a small number of projects using Veroboard. And, despite valiant efforts from the editorial staff, literally every one of those projects caused problems

Not only did we run unto our own problems (mainly, I think, they were caused by the hypnotic effect of those straight copper laminate tracks!), readers also had difficulties. However, despite what I've just written - perhaps I could be wrong? It maybe you've had success with Veroboard? If you have and can still obtain the material, please let me know. Editing *PW* is not a job where I score points over valued readers! Instead, we aim to pass over the best information we can. So, if you regard that your information and success is better than mine, please write in and tell us so we can share it with readers.

Finally, I must agree with what Andy Foad suggests regarding alternatives to the etched printed circuit board. And in fact, we do try to publicise alternative circuit board methods. To this end the **Rev. George Dobbs G3RJV** has been experimenting in Carrying On The Practical Way with copper laminate tape marketed for garden pest control - especially slugs!

Have you ever had aluminium foil from chocolate wrappings inside your mouth? If you have, you'll remember the unpleasant tingling as electrolysis started by the acids in your mouth set up a voltaic current. Hence the tingles! When the slug creeps over the copper tape the chemicals in their thick slime help produce tingles in their gastropod 'foot' so they avoid it.

Amateur Radio is well and truly alive when we've got authors such as G3RJV and yourselves writing for us. Please write in with your own comments, you could end up as an author yourself! **PW**

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Index to Advertisers

KENWOOD

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Black Version

TS-2000 All-mode Multibander HF/50/144/430MHz

Kenwood is celebrating its 60th anniversary with a Limited Edition model (black version) of the renowned TS-2000. Functionally identical but visibly different, this Limited Edition offers the same advanced features as the original model, but with a front panel, main tuning knob and carrying handle all finished in exclusive black — a feast for the eyes.

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Unique serial number


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HF/50 MHz Transceiver

FT-2000

- FT-2000D 200 W with External Power Supply
- FT-2000 100 W with Internal Power Supply

Shown with after-market keyer paddle, keyboard, and monitor (not supplied). Optional Data Management Unit (DMU-2000) and monitor are required for viewing of Aud o Scope and other display features.

Specifications subject to change without notice. Some accessories and/or options may be standard in certain areas. Frequency coverage may d ffer n some countries. Check with your local Yaesu Dealer for specific details.

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