• Data Modes - RF Calibrator Update • Buying Second-hand Digital Rigs • Make a Transmit Lowpass Filter

Practical WIRELESS

NOW IN OUR 85th YEAR!

Britain's Best Selling Amateur Radio Magazine

The Cre Special Antenna

Build your own version

The Gurney Slade

AM transceiver for 80 or 160m

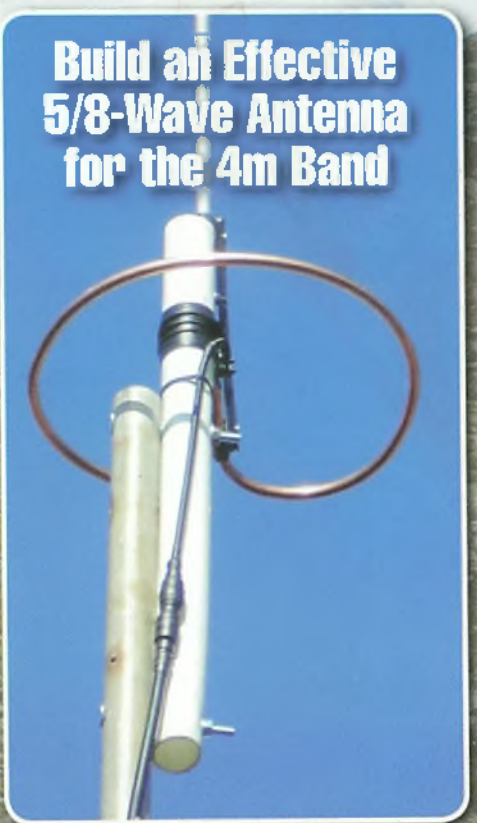
The Siren 6m WBFM Station

Assembly and testing

Student Success

Radio Communications Foundation news

Build an Effective 5/8-Wave Antenna for the 4m Band



August 2017 £3.99 ISSN 0141-0857

9 770141 085129 08

pwp

WATERS & STANTON
EUROPE'S HAM STORE

'SDR takes another step forward with the introduction of 4 new products from Flex and the launch of SmartSDR V2.0 and SMARTlink which provides the simplest method of remote operation yet with single-click setup. If you want to find out more about how you can benefit from the very latest in Flex Radio developments, call me today and ask. I use my Flex 6000 series radios daily!' **Justin G0KSC**

ELECRAFT® Brought to you by W&S!

Microphone and key not included

KX2

Go wherever your imagination takes you thanks to its compact construction, it's only 5.8 x 2.8 x 1.5" making it the smallest full-featured HF radio on the planet. Yet it puts out up to 10 Watts, covers 9 bands and shares many features with the KX3.

To maximize your freedom outfit your KX2 with an internal 2.6 amp hour Li-ion battery (KXBT2) yielding up to 8 hours of typical operation on a single battery charge. There's also an internal automatic antenna tuner module (KXAT2), which can tune a random wire, dipole or whip on multiple bands.

The KX2 can even be used as a hand-held. It includes a built-in mic for HT-style operation.

KX2 £859.95

KX2 ACCESSORIES

CS40	Small compact carry case for KX2, and small accessories	£38.95
CS60	Large compact carry case for KX2 & MH3 mic plus more accessories	£54.95
KXAT2	Internal ATU to tune even non-resonant 'random' wire antenna	£219.95
KXBT2	Internal battery gives up to 8 hours operation from a single charge	£69.95

KX3

HF & 6m ultra compact portable transceiver with advanced DSP.

- 160-6 metre ham bands; general coverage receive from 1.5-32.0MHz (also covers 0.31-1.5MHz with reduced sensitivity)
- All modes: SSB, CW, Data (four sub-modes), AM, FM
- Quadrature down-sampling mixer compatible with PC-based SDR
- 8-band receive audio equalizer
- Built in digital voice recorder (DVR) with two message buffers

KX3-F Ready-built **£1,079.95**
KX3-K Kit **£999.95**

Microphone and key not included

KX3 ACCESSORIES

KXPD3	Precision Iambic Keyer Paddle	£159.95
MH3	Hand Microphone with Up/Down Buttons	£79.95
KXFL3	Dual Passband Roofing Filter	£184.95
KXPA100-F	100W power amplifier for KX3 fully assembled and tested	£949.95
KXAT100	Internal auto ATU used for the KXPA100	£449.95
KXAT3	Internal 20W Automatic Antenna Tuner	£249.95

ELECRAFT® ACCESSORIES • UK's Official Dealer

K3S

- New synth board for lower Tx/Rx phase noise
- IF interface board • 12m-6m low noise pre-amp
- USB interface that carries data and audio
- New 10W driver board • 100W PA upgrade

K3S/100-F £2999.95 K3S/100-K £2849.95
K3S/10-F £2449.95 K3S/10-K £2299.95

KPA500

160-6m 500 + Watts Solid State Auto Band Switching Linear Amplifier in a compact package the size of the K3.

Kit: £2449.95
Ready Built: £2649.95

KPA150

- 1500W
- Very compact design
- Fast, silent PIN diode T/R switching
- Built-in Antenna Tuner with dual antenna jacks
- Compatible with nearly any transceiver 160-6 metres

Price: TBA

IHS™ INTERNATIONAL HAM STORES GROUP

The sign that means a GREAT DEAL!

Three of the UKs leading Ham Radio Retailers (Waters and Stanton, Nevada and InnovAntennas) have combined and operate from a combined distribution centre and showroom in Farlington, Portsmouth. The new facility forms the largest ham radio warehouse and distribution centre in the country housing a wider selection of products than any other UK based company.

IHSG are hiring!
If you believe you have value you can add to our expanding team, mail us! **justin@ihsg.co.uk**

call: **01702 204965** email: **sales@wsplc.com**

Waters & Stanton Ltd • Unit 1 • Fitzherbert Spur • Farlington • Portsmouth • PO6 1TT

@wsplc blog.hamradiostore.co.uk facebook.com/WatersandStanton YouTube Waters and Stanton

StepIR SOLE UK IMPORTER European Distributor and Service Centre. Call for best prices

NEW from ICOM!

Icom ID-4100

Dual band D Star digital transceiver. Now with terminal mode & access point mode. Wireless operation (optional Headset)

- Integrated GPS Receiver
- Wideband Receiver

£479.95

Icom ID51 PLUS2

Dual Band D-STAR Digital Transceiver. Available in several patterns and colours.

- Covers 2 metres and 440MHz
- Receives two bands simultaneously (V/V, U/U & V/U)
- Output: 5, 2.5, 1.0, 0.5 or 0.1 Watts
- 1304 channel memories
- IPX7 waterproof
- Built-in GPS

£449.95

BEKO

IHSG APPOINTED SOLE UK DISTRIBUTORS

HLV-1000

A compact solid state, high efficiency 1kW amplifier providing exceptional performance on 144-148MHz with single input and single output.

£2495.00

HLV-350
A 350W 23cms amplifier, frequency range of 1270-1300MHz..... **£2595.00**

HLV-950
Dual band performance both on 50MHz (1kW) and 70MHz (700W)..... **£2549.00**

FLEX RADIO

Next-Gen SDR from Flex Radio!

Flex 6400..... Now with preselectors..... **£1999.95**
Flex 6400M..Including front panel **£2999.95**
Flex 6600..... Now with 2 x SCU's..... **£3999.95**
Flex 6600M..Including front panel **£4999.95**
All 6400/6600 versions can have optional GPS Disciplined Oscillator (GSPDO)..... **£724.95**

Flex 6700
8 slice Receiver flagship..... **£6899.95**

Flex 6500
4 slice Receiver **£3799.95**

Flex 6300
2 slice Receiver..... **£1849.95**

Flex 6300 ATU

Entry point SDR transceiver, but no slouch!

- All modes including digital
- Covers: 160m-6m
- 100W output

£1999.95

AOR

ONE MONTH ONLY!

AR-8600MkII Mobile Base Station

- All mode: WFM, NFM, SFM, WAM, AM, NAM; USB, LSB, CW
- Frequency range: 100kHz-3000MHz

£619.95

AR-6000..... **£4699.95**
AR-5001D..... **£2669.95**
DV-1..... One month only..... **£1274.95**
AR-8200D..... **£664.95**
AR-8200MkIII..... **£459.95**

LA-400

10kHz to 500MHz Desktop Magnetic Loop Receiving Aerial

£419.95

TOWERS and TRAILER TOWERS from stock

Mobile masts *from* **£4495.00**
Fixed masts *from* **£1695.00**

CABLE

50 Ohms coax with an outer diameter of 4.95mm
RG-58..... (Per Metre)..... £0.70
DRG-58-50..... (50m Drum)..... £23.95
DRG-58..... (100m Drum)..... £45.95

50 Ohms coax with an overall diameter of 6.1mm
Mini-RG8..... (Per Metre)..... £1.00
DR-Mini-RG8-50.. (50m Drum)..... £39.95
DR-Mini-RG8..... (100m Drum)..... £79.95

50 Ohms low loss coax and a diameter of 6.1mm
RG-213..... (Per Metre)..... £1.50
DRG-213-50..... (50m Drum)..... £69.95
DRG-213..(100m Drum) SAVE £5 THIS MONTH ONLY £134.95

50 Ohm low loss coaxial cable - ideal for UHF/VHF or HF
W-103..... (Per Metre)..... £1.50
DR-W103..(100m Drum) SAVE £5 THIS MONTH ONLY £134.95

300 Ohms Slotted Ribbon cable
300-S..... (per Metre)....£1.00

DR-300S..... 100m Drum)..... £85.95

450 Ohms low loss ladder line
450-S..... (Per Metre)....£1.20

DR-450S..... (100m Drum)..... £89.95

MFJ

MFJ-1835..... Cobweb HF antenna £229.95
MFJ-1835H..... 1.5kW version of above..... £269.95
MFJ-226..... Antenna analyser 1-230MHz..£339.95

MFJ-939
Auto ATU 200W Y/K/I.. £169.95

MFJ-939..... Auto ATU 200W Y/K/I..... £169.95
MFJ-994BRT..... Remote antenna tuner..... £459.95

MFJ-949E
Auto ATU 300 Watts.... £194.95

MFJ-557
Practice Morse key..... £54.95

DON'T SEE WHAT YOU NEED? Call us for available stock and BEST PRICES

www.hamradiostore.co.uk

Pay us a visit and check out our amazing demo facility

Sign up to our WEEKLY DEALS at **hamradiostore.co.uk** for exclusive deals and latest news

WATERS & STANTON
EUROPE'S HAM STORE

KENWOOD DEALS

OFFICIAL RE-SELLER

TH-D74

New!

New 144-430MHz handheld featuring Kenwood's APRS, Automatic Packet Reporting System, and the popular D-Star. Kenwood has made it possible to use this handheld in a wide range of radio applications with wideband reception function allowing the user to receive HF SSB and CW.

£599

KENWOOD ACCESSORIES

MC-60A
Popular desktop mic with PTT **£127.95**

MC-43S
Dynamic hand mic with up/down control **£20.95**

MC-90
Desk mic for DSP transceivers.... **£204.95**

SP-990M
Speaker with high/low filters & two inputs **£219.95**

HS-5W
High quality deluxe headphones.. **£56.95**

NEW LICENCE DEAL CALL FOR DETAILS

TS-590SG

Be witness to the evolution of Kenwood's pride and joy - the TS-590SG HF transceiver - pushing performance and technology to its utmost limit, with the receiver configured to capitalise on roofing filter performance and IF AGC controlled through advanced DSP technology.

Call for best prices

FREE SPEAKER

LAST FEW AT W&S SPECIAL PRICE

TS-990S

HF + 6m 200W transceiver with dual TFT display with a dynamic power supply that means no external unit is required.

£4999.95

ICOM DEALS

OFFICIAL RE-SELLER

IC-7300

HF-6m-4m transceiver with integrated SDR and built-in wide frequency automatic antenna tuner, ideal for field operation. Operate with 100 Watts on HF/50MHz and 50W on 70MHz.

£1199.95

SP-38

Matching speaker designed specifically for the IC-7300 improving sound quality and experience. **£129.95**

COMING SOON!

IC-7610

Retail price will be **£3598.00**
Orders taken for first batch now, limited numbers still available!!

Call to Pre-Order yours now

Here at Waters and Stanton we are getting ready for the new and exciting ICOM IC-7610. The IC-7610 is the successor to the IC-7600 and will be a dual-watch capable HF+50MHz 100W base station with built-in antenna tuner. The LCD will be touch screen and you will be able to connect an external display. The radio will be based on SDR technology, so well deployed in the very popular IC-7300. Another nice feature is the ability to output the display to a large external screen.

FULL RANGE OF RT SYSTEMS SOFTWARE AND CABLES FOR ALL KENWOOD, ICOM AND YAESU

We provide finance on all Ham equipment

Buy now pay later or regular finance deals can be arranged in store or over the phone, call for details

YAESU DEALS

OFFICIAL RE-SELLER

New!

FT-991A

Successor to the FT-991 this all band HF - UHF transceiver which includes Yaesu's System Fusion as well as traditional modes. The FT-991A packs the same features as the FT-991 plus an added real time spectrum display and multi-colour waterfall display.

Call for best price

New!

FTM-3200DE

Rugged yet compact System Fusion/FM 65W mobile transceiver. Loud and Crystal Clear Front Panel Speaker with 3W of Audio Output. Instantly recognises digital or analogue transmission and adjusts automatically for flawless coexistence of both digital and analogue users.

Call for best price

FT-891

New!

100W HF + 6m mobile transceiver with AM, USB, LSB and CW modes featuring triple conversion, noise blanker and attenuator. **Call for best price**

FT-2DE

2m/70cm dual band handheld transceiver designed with ease of use in mind such as its 1.7 inch full back-lit touch panel display. Includes FM and System Fusion modes.

Call for best price

FT-857

World's smallest HF/VHF/UHF 100W mobile transceiver including DSP.

Call for best price

FT-450D

Compact yet superb HF/50MHz radio with state-of-the-art IF DSP technology configured to provide worldclass performance in an easy to operate package.

Call for best price

FT-DX1200

HF + 6m transceiver provides up to 100 Watts on SSB, CW, FM and AM (25 Watts carrier) and a rugged state of the art highly balanced receiver circuit configuration for top performance on today's crowded bands.

Call for best price

FT-817 BHI-DSP

FROM STOCK

BHI DSP Filtering This micro size board fits inside the FT-817ND.

A mini press button & LED are installed beneath the top cover for switching. The unit cycles through 4 levels of filtering and then reverts back to 'out of circuit' mode.

£769.95

YAESU ACCESSORIES

MD-100A8X Desk mic with PTT.... **£119.95**
MLS-100
High performance external speaker.... **£28.80**
FC-30
External ATU for FT-897 and FT-857.. **£259.95**

In Stock!

FT-65E
2m/70cm Handheld Transceiver Variable 5W output
£129.95

FT-25E
2m Monoband Handheld Transceiver with Variable 5W output
£89.90

call: **01702 204965** email: **sales@wsplc.com**

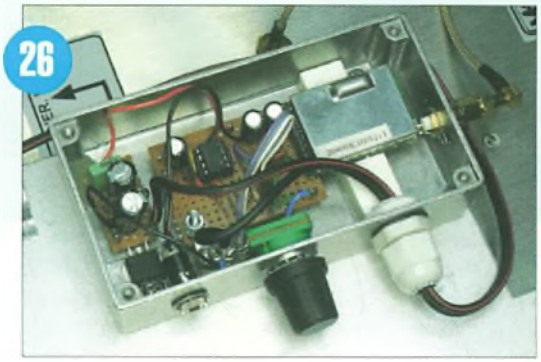
Waters & Stanton Ltd • Unit 1 • Fitzherbert Spur • Farlington • Portsmouth • PO6 1TT

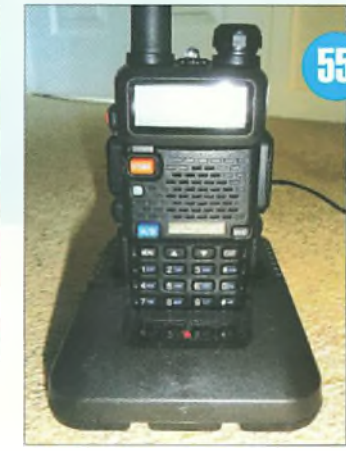
@wsplc blog.hamradiostore.co.uk facebook.com/WatersandStanton YouTube Waters and Stanton

Contents

Practical Wireless August 2017 • Volume 93 • Number 8 • Issue 1323

On Sale 13th July 2017





Published on the second Thursday of each month by PW Publishing Ltd., Tayfield House, 38 Poole Road, Westbourne, Bournemouth BH4 9DW. Tel: 01202 751611. Printed in England by Holbrooks Printers Ltd., Portemouth PO3 5HX. Distributed by Seymour, 2 East Poultry Avenue, London EC1A 9PT. Tel: 020 7429 4000. Web: http://www.seymour.co.uk. Sole Agents for Australia and New Zealand - Gordon and Gotch (Asia) Ltd.; South Africa - Central News Agency. Subscriptions INLAND £44, EUROPE £55, REST OF WORLD £63, payable to *Practical Wireless*, Subscription Department, PW Publishing Ltd., Tayfield House, 38 Poole Road, Westbourne, Bournemouth BH4 9DW. Tel: 01202 751611. *Practical Wireless* is sold subject to the following conditions, namely that it shall not, without written consent of the publishers first having been given, be lent, re-sold, hired out or otherwise disposed of by way of trade at more than the recommended selling price shown on the cover, and that it shall not be lent, re-sold, hired out or otherwise disposed of in a mutilated condition or in any unauthorised cover by way of Trade, or affixed to or as part of any publication or advertising, literary or pictorial matter whatsoever. Practical Wireless is Published monthly for £61 per year by PW Publishing Ltd., Tayfield House, 38 Poole Road, Westbourne, Bournemouth BH4 9DW. Royal Mail International, c/o Yellowstone International, 87 Burlews Court, Hackensack, NJ 07601. UK Second Class Postage paid at South Hackensack. Send USA address changes to Royal Mail International, c/o Yellowstone International, 2375 Pratt Boulevard, Elk Grove Village, IL 60007-5937. The USPS (United States Postal Service) number for Practical Wireless is: 007075.

Keylines

This month Don is reflecting on activity and propagation, both on VHF and the HF bands, the latter including a short trip he made to Crete.

I hope many of you enjoyed the excellent weather during June. It's been a great excuse to go out onto the hilltops with our radios. I managed to get on for both the *PW* 144MHz Contest – my thanks to all of you who gave me a QSO – and also for the RSGB 432MHz Activity Contest a week or so later. The latter was something of an eye opener, although I should have expected it. The previous month I had decided to have a play in the same event but from home. I put up my 19-element Tonna Yagi at about 10m and worked a grand total of nine stations. It's not that I live in a hole. I am on the south facing slope of the Chiltern Hills so although I have rising ground behind me, my take-off across the Thames to the south is pretty good. But out portable, sitting on top of the Berkshire Downs, using the same radio (Yaesu FT-847), power level and antenna, I worked more than 40 stations in just over an hour. If I'd been able to stick around for the whole contest, it would have been considerably more, I imagine there were two factors at work. One is the location – you can't beat a good hilltop for VHF. The second is that, when portable, I used just a few metres of H100 feeder whereas my feeder at home must be a good 50m log (to reach the mast and allow for it to be fully extended to 20m or so). At 432MHz, feeder losses soon start to matter.

The moral is, I'm sure, well-known to most of you – go out to a hilltop and it's remarkable what you can achieve on the VHF and UHF bands. It was a different experience, though, in the RSGB 50MHz Trophy Contest on June 17/18th. I operated from home with a 7-element Yagi, again at about 10m high. I did struggle to work some of the UK entrants but it didn't matter because there was excellent Sporadic E propagation around Europe, mainly towards Eastern Europe and the Balkans, a good direction from my home location. And being at home, I was able to run full power although it probably didn't make a big difference because signal strengths were mostly very high anyway. I ended up, fitting in with various domestic commitments, working about 170 stations, mostly outside the UK and in an arc from Spain, through Italy and Greece right round to Scandinavia. I know some UK entrants did even better.

JT65

One significant development I've noticed this year on the 6m band is the much more extensive use of the JT65 mode for DX working (and it's happening on the HF bands too). Even from the UK, for example, Japan and the USA have been workable on a number of occasions when nothing has been audible from those areas on CW or SSB. The ability of JT65 to copy signals well below the noise threshold shows that propagation is often there, albeit at a level where signals are extremely weak. As a long-time DX chaser, I have mixed feelings about all of this. On the one hand, having achieved something close to 150 DXCC entities worked on the 6m band over a period of 30 years or so, I would be somewhat put out to see a modestly equipped station running low power do the same in just a few years by running a weak-signal data mode. On the other hand, I do understand that these developments open up opportunities to amateurs who simply don't have the funds or real estate to build a big station. What's more, you learn quite a bit about modern technologies into the process.

Operating from Crete

Personally, though, I do still enjoy the more traditional forms of operating. In late June my son and I spent a few days in Crete and I took along my IC-7300 and some wire for dipoles. I struggled to get anything going on SSB, probably because I didn't get spotted on the Cluster network, but one evening I put over 160 contacts in the log on 20m CW in the space of a couple of hours, operating from our hire car parked up by a beach on the northern coast of the island. A number of the people who called in are folk I have met over the years so an exchange of greetings was in order, something that certainly isn't possible with the formal minimal exchange format of the WSJT modes. And even though I was running just 100W into an inverted-vee dipole no more than 3m high at the centre (we threw it over a convenient bush), I still managed to work Japan, the USA and the Canary Islands in addition to Europe, a total of four continents. This was, no doubt, the result of being right next to the sea along with an excellent southerly location – it is very apparent that southern Europe usually tends to enjoy much better propagation than the UK.

This Month

Anyway, to this month's magazine. It's another packed issue and I hope you enjoy reading it as much as I have enjoyed putting it together. And do enjoy what's left of the summer too – the best time of the year to get that antenna maintenance done!

Don Field
G3XTT

Practical Wireless

PW Publishing Limited
Tayfield House
38 Poole Road
Westbourne
Bournemouth
BH4 9DW

Directors Stephen Hunt & Roger Hall

Tel 01202 751611

Managing Editor
Roger Hall G4TNT
roger@pwpublishing.ltd.uk

Editor (c/o PW Publishing Ltd.)
Don Field G3XTT
don@pwpublishing.ltd.uk

Art Editor
Stephen Hunt
steve@pwpublishing.ltd.uk

Advertisement Sales
Roger Hall G4TNT
roger@pwpublishing.ltd.uk

Advertising Typesetting/Admin
Kevin Beach (c/o PW Publishing Ltd.)
kevin@pwpublishing.ltd.uk

Finance Manager
Alan Burgess
alan@pwpublishing.ltd.uk

Book Orders
books@pwpublishing.ltd.uk
Tel:01202 751611

PW Publishing Website
www.pwpublishing.ltd.uk

Subscriptions
Subscriptions are available at £44 per annum to UK addresses, £53 Europe Airmail and £63 RoW Airmail. See the subscription page for full details.

Subscription Administration
Webscribe,
Practical Wireless Subscriptions,
Unit 8, The Old Mill, Brook Street,
Tring, Hertfordshire HP23 5EF
pw@webscribe.co.uk
Tel: 01442 820580
www.mysubcare.com

Components for PW projects
In general, all components used in constructing *PW* projects are available from a variety of component suppliers. Where special, or difficult to obtain, components are specified a supplier will be quoted in the article.

Photocopies & Back Issues
We can supply back issues, but we only keep them for one year. If you are looking for an article or review that you missed first time around, we can still help. If we don't have the actual issue we can always supply a photocopy or PDF file of the article. See the Book Store pages for details.

Placing an Order
Orders for back numbers, binders and any items from our book store should be sent to: PW Publishing Ltd., Post Sales Department, Tayfield House, 38 Poole Road, Westbourne, Bournemouth BH4 9DW with details of your credit card or cheque or postal order payable to PW Publishing Ltd. Cheques with overseas orders must be drawn on a London Clearing Bank and in sterling. Credit card orders (Access, Mastercard, Eurocard, Amex or Visa) are also welcome by telephoning the office on 01202 751611. An answering machine will accept your order out of office hours and during busy periods in the office. The e-mail address is bookstore@pwpublishing.ltd.uk

Technical Help
We regret that due to Editorial timescales, replies to technical queries cannot be given over the telephone.

Any technical queries are unlikely to receive immediate attention so, if you require help with problems relating to topics covered in *PW*, please either contact the author of the article directly or write or send an email to the Editorial Offices and we'll do our best to reply as soon as we can.

Newsdesk

Send your information to:
PW Publishing Ltd, Tayfield House,
38 Poole Road, Westbourne, Bournemouth BH4 9DW.
E-mail: newsdesk@pwpublishing.ltd.uk

Antenna Insulators

It is increasingly difficult to source good quality antenna insulators. Ceramic ones are no longer made and in any case they are very heavy. SOTAbeams are now stocking a new range of insulators made from modern high-performance materials. Two types are available: a ribbed centre or end insulator and an open wire line insulator for high-Z low-loss lines. Both are lightweight and strong. They are suitable for permanent as well as temporary installations.

www.sotabeams.co.uk/insulators-end-or-centre

www.sotabeams.co.uk/open-wire-line-spacers-long

TX Factor

TX Factor, the online TV programme dedicated to amateur radio, is still going strong. The next episode is due out on July 14th. Meanwhile, the summer edition is already out and includes a trip to Norwich where **Pete Sipple M0PSX** spends a day with the Norfolk Amateur Radio Club at their recent annual Field Day 'Radio Active'. Pete discovers for himself why NARC won the coveted prize of RSGB Large Club of The Year 2015 and comes away with some excellent ideas for future Club activities. Pete also chats to RSGB President **Nick Henwood G3RWF** about his Club Initiative.

Mike Marsh G1IAR gives **Bob McCreadie G0FGX** an introduction to operating on DMR, Yaesu Fusion and D-STAR and how he uses the DV4Mini Dongle as part of his digital fun. They also visit a Devon amateur who has set up a Fusion Gateway to find out how he went about it.

For many, QSLs are an important part of the hobby, so the *TX Factor* team have been finding out about how the RSGB is educating amateurs as to what they can do to help speed up the sorting process at the QSL bureau.

All episodes are available on the internet at the *TX Factor* website and on YouTube and because it is professionally produced in HD, it looks great on a full size TV but works equally well on a PC, Mac, tablet or smartphone.

www.txfactor.co.uk

GB5RC (Radio Caroline) to be Active Again

The Martello Tower Group are pleased to announce that following the successful special event operation in 2016, GB5RC will again be active from the evening of Thursday August 3rd until the early hours of Monday August 7th, operating from on board the home of Radio Caroline, the *MV Ross Revenge*, anchored not in international waters but in the Blackwater estuary, close to Mersea Island and Bradwell-on-Sea, Essex.

The group will be concentrating on 80, 40 and 20m with the possibility to retune the 20m antenna to 17, 15, 12 or 10m if the need arises. The antennas will be a combination of verticals and dipoles.

This is expected to be a busy special event. The recent news that Radio Caroline has been issued an AM broadcast licence for 1kW on 648kHz has resulted in an upsurge in interest in the former pirate station and this goes hand-in-hand with August 2017 being the 50th anniversary of the Marine Offences Act, which silenced so many offshore radio stations. As a result of these, general public awareness of Radio Caroline is at a level it hasn't seen for many years.

www.martellotowergroup.com/gb5rc.html

www.qrz.com/db/gb5rc

http://radiocaroline.co.uk

Moonraker News

Moonraker are pleased to announce that they have been appointed as UK dealer/distributor for the Alpha Antenna range of products after the recent trip to the Dayton Hamvention.

The range features both verticals and loops for base and portable operation. They are directional, tuner-free HF antennas that are highly rated and 'customer enhanced'. There are multiband as well as monoband antennas. The verticals can be tripod mounted as can the loops, suitable for a portable antenna system.

http://alphaantenna.com

www.moonraker.eu

The Leixen VV-898SP is a mobile backpack transceiver you can take virtually anywhere. Leixen combined their micro-compact, 25W Dual-Band UHF/VHF Mobile Radio with a powerful 12A Li-ion rechargeable battery and put it all in a sturdy chassis you can fit in your pack or emergency bag for use anytime, anywhere. The price is £149.95.

Dual-Band DMR has also arrived with the Moonraker HT-500D Dual-Band DMR Digital & Analogue handheld radio. The HT-500D operates in analogue and digital modes on UHF (70cm) and VHF (2m) at up to 5W of power. It uses Time-Division Multiple-Access (TDMA) digital technology to double the number of users on a single 12.5kHz channel. The price is £199.99.

Martin Lynch & Sons Summer BBQ

The Martin Lynch & Sons Summer Picnic and BBQ was held on Saturday June 24th and attracted several hundred visitors. The lecture streams were a big success with a good spread of topics. **Andy** from SDRPlay was demonstrating the latest features and benefits offered by the SDRuno software. **Graham** from bhi gave a hands-on demonstration of the latest ParaPro units he spent two years designing. **Chris 2E0UCW** explained the basics of DMR and working with hotspots such as the DV4mini and SharkRF. *PW* columnist and reviewer **Tim Kirby G4VXE** was also on site discussing satellite operation for the beginner and advanced techniques, along with a live demonstration.

Videos of the lecture streams were broadcast live on the ML&S Facebook page and are available on their MLandS.tv channel via YouTube. The day was sponsored by Icom, Kenwood & Yaesu, who were also on site throughout. The next event at ML&S is their Hog Roast & Open Day, Saturday December 2nd.

New Pictures of Arthur Shepherd

During this special 60th Anniversary of WACRAL, the club has discovered some fascinating pictures of the founder, the **Rev. Arthur Shepherd G3NGF** who started WACRAL's predecessor, WAMRAC, in 1957.

If any readers have other pictures or memories of Rev Arthur Shepherd, WACRAL love to hear from them. E-mail **Steve Nicholls G0JFM/EA5FJF** at s.nicholls@gmx.co.uk

SE Tutors Group Fully Taught Full Licence Course

Cray Valley RS, a member of the South East Tutors group of clubs (see website below) is accepting applications for its fully taught and mentored Full Licence training course. The course includes preliminary maths primer evening sessions on October 2nd and 9th and an Intermediate recap day on October 14th ahead of the main intensive course beginning on November 4th for three consecutive Saturdays with the exam on November 25th. For further details of the course, run in Eltham, London SE9, please contact **Kevin M0KSJ** at courses@cvrs.org http://goo.gl/AEV5GN

Essex Skills Night

The hottest day of the year so far saw over 40 local amateurs attend the June Essex Skills Night at the Village Hall in Danbury, near Chelmsford. The evening featured handset programming, test equipment, an auction, a challenging quiz and callsign badges. Regular Skills Night supporters the Essex CW Club operated a live station and Essex Ham ran data modes demonstrations as well as supplying the event's wi-fi and a much-needed fan! The evening included a live link-up to Essex Ham's Monday Night Net. The photo shows **Mike G4NVT** running the auction. www.sxham.uk/skills

Honour for GM4UYZ

Bob Glasgow GM4UYZ, Secretary of the Cockenzie and Port Seton Amateur Radio Club, was recently awarded the British Empire Medal (BEM) for services to amateur radio, the community and charity in South-East Scotland. The club also won Region 1 Club of the Year (2016). The trophy was presented at the Scottish Rally at Braehead by RSGB President **Nick Henwood G3RWF**. Bob is well-known to *PW*'s Editor and kindly compiled last year's *Christmas Quiz*. We offer our heartfelt congratulations.

ID-4100E Dual-band D-STAR Digital Mobile Debuts in the UK

The Icom ID-4100E is a new D-STAR mobile radio that offers digital voice (DV) and data calls through the worldwide D-STAR network. Like the recently launched ID-51E PLUS2 handheld counterpart, the ID-4100E includes new 'Terminal Mode' and 'Access Point Modes', enabling an operator to make D-STAR Callsign routed calls through the internet, even from areas where no D-STAR repeater is accessible.

Compact in size, the ID-4100E features an easy-to-read dot matrix display with a backlight selectable in three colours. The controller is also detachable from its main body, offering the possibility of different mounting positions.

There is now an App for iOS as well as Android devices. The RS-MS1I App (for iOS™ devices) and the RS-MS1A App (for Android™ devices) enable users to wirelessly connect to the ID-4100E and remotely set the DR functions, link with a map application and send/receive messages over the DV mode. In addition, pictures taken by a smart device can be transmitted via the DV Fast Data mode or DV mode.

The ID-4100E is available from authorised Icom amateur radio dealers, with a suggested retail price of £499.99 inc. VAT.

New Amplifiers from The DX Shop

The DX Shop have just released two all new solid-state linear amplifiers, manufactured locally on the Welsh Borders. The G2-1.2K is a 1200W amplifier for 144MHz while the G64-1.2K is a dual-band amplifier giving 1200W on 50MHz and 900W on 70MHz. Both amplifiers share the same specifications:

- Commercial Grade cooling allowing continuous data mode operation at full output.
- Universal power input from 100-260V 50/60Hz.
- Built in sequencer for preamplifiers.
- Drive requirements 2.5-25W.
- Compact dimensions 180 x 315 x 360mm.
- Weight 14.5kg.

www.thedxshop.com

LEFARS win RSGB Region 12 Large Club of the Year Award

Over 25 members of Loughton and Epping Forest Amateur Radio Society (LEFARS) were in attendance at a meeting at their clubroom at All Saints House on June 9th in order to receive the Region 12 Large Club of the Year Award.

Presenting the award to Club Chairman **Richard Clark** was Regional Manager **Keith Haynes G3WRO**, accompanied by District 123 DRM, **Peter Onion G0DZB** and **Jeff Stanton** of W&S (RSGB's Club of the Year sponsor).

The photo (by **Dave De La Haye**) shows the presentation from Keith Haynes to Dick Clark, along with Peter Onion, left and Jeff Stanton holding the bottle of bubbly.

WonderWand WonderLoop 750

British manufacturer WonderWand has recently announced the new WonderLoop 750. Covering 7MHz to 50MHz, this tiny antenna sits on the back of your FT-817ND or any QRP rig to a maximum of 10W.

ML&S's senior salesman **Tony M0TNY**, an avid QRP man, used one outside the ML&S premises and instantly worked an EA (Spain). It is available from ML&S at £109.95.

www.HamRadio.co.uk/wonderloop750

Peterborough Club News

The May meeting of Peterborough & District ARC hosted a fascinating talk by **David M0VTG**, an ex-RAF cryptographer, about the LORENZ coding machine.

David talked briefly about Enigma, which was used at all levels in the German wartime military in conjunction with CW. LORENZ, he stated, was used only used by German high command in Berlin to its Generals in the field. David explained how the 12-reel LORENZ machine sent coded teleprinter messages at high speed, from punched tape that was five holes wide. The configuration of the machine, using five reels on the input and five reels on the output side plus two reels setting the code, made breaking the code very difficult. Originally, code changes were monthly but that increased to weekly and then daily. Each reel had different wiring and alignment but eventually Colossus at Bletchley Park was used to successfully break the code.

The Club also took part in Museums On The Air on June 17th/18th at Flag Fen Museum, on the site of a Bronze Age settlement discovered by **Francis Prior** (of *Time Team* fame). Two stations were set up and a number of contacts made on both HF and VHF.

Mills on the Air 2017

During the weekend of May 13/14th a group of radio amateurs from the Huntingdonshire Amateur Radio Society (HARS) activated GB2DWM from Duloe Tower Mill, Eaton Socon for the National Mills on the Air weekend, which is set up by the SPAB Mills section (Society for the Protection of Ancient Buildings). Some 200 contacts were made on HF and VHF, with the best being A61FK in Abu Dhabi.

FRARS Hamfest

Hamfest was conceived by a group of local amateur radio enthusiasts in 1983 as a way to bring face-to-face contact between people with an interest in all forms of radio communication.

From humble beginnings in the Air Weapons range at the Cobham Sports & Social Club, (in semi darkness!), Hamfest evolved into the largest event of its kind along the South Coast, attracting visitors from UK and the EU countries.

Now held annually, the whole Cobham S&SC site, the home of Flight Refuelling Amateur Radio Society (FRARS) who host Hamfest, is given over to accommodating a large assembly of specialist radio traders who offer everything from small electronic components to large antennas and complete radio systems.

Highlights this year will be a working demonstration of Deep Space Vehicle Monitoring using the FRARS trackable 12ft dish, which will complement one of the technical lectures on this subject.

See our *Rallies* page and the advertisement on p.17 for further details.

www.frars.org.uk

W&S News

Waters & Stanton recently announced the availability of new software for the AOR DV-1 analogue/digital receiver to include NXDN Descrambling and discriminator Direct Recording on SD.

W&S have also announced the release of PowerSDR mRX 3.4.1. There are a lot of new features, some major enhancements and a few fixes. The software works with all the opensource radios, including the Apache Labs radios. W&S have the Anan 8000DLE in stock and able to demo the new software.

W&S are also now stocking various compact loop antennas, including the MFJ-1886 (launched at Dayton), which covers 0.5 – 30MHz at a price of £269.95. They also stock AOR's new receive loop, the LA-400, which covers 10kHz – 500MHz and is priced around £419.

http://hamradiostore.co.uk

G Whip

Geoff Brown G4ICD of G Whip retired in June and his place has been taken by long-time customer **Andrew Rushton GW0UZK**. Andrew will benefit from, and rely on, Geoff's designs, knowledge, expertise, reputation and goodwill that have taken years to achieve. He, and indeed, all of us at *PW* wish Geoff a happy retirement.

gwhip.co.uk

New Exam Syllabus

The RSGB's GB2RS News reports that a complete review of the syllabus for all three levels of the amateur radio examinations has been completed. The draft of the new syllabus is now available for consultation together with a survey for any comments you may wish to make. Please visit the website below to access the syllabus draft document and learn how to make your comments.

rsgb.org/syllabus_review

5MHz for Jamaica

In a recent update to their National Frequency Allocation Table published by regulator the Jamaican Spectrum Management Authority (SMA), the WRC-15 60m Amateur Secondary Allocation of 5351.5 – 5366.5kHz has been granted under ITU Footnote 5.133B, which in the case of Jamaica means a maximum power of 25W EIRP.

www.jamaicaham.org

New Propagation Tool

The RSGB's GB2RS News reports that a new graphing tool has been developed by **Jim Bacon G3YLA** of the Propagation Studies Committee to show the near real-time critical frequency over the UK and the predicted maximum usable frequency (MUF) over different paths.

A feature on how to use the free tool appeared in the July issue of *RadCom* but if you want to try the critical frequency tool on your own, it can be found at:

www.convectiveweather.co.uk/ionosphere

New Radio Museum

The newest radio communication museum in the UK has recently opened its doors in Derby. The museum features an operations room with transmitters connected to antennas, a mechanical workshop, an ESD electronics laboratory and a variety of galleries. The museum exists thanks to **Steve Haseldine GBEBM**. In addition to conceiving the museum, he donated items from his personal collection to create the first displays. The exhibits date from the 1930s to the present, from Collins, Drake and Eddystone to Hallicrafters and FlexRadio. There are also former military and commercial AM radios from Labgear and Geloso.

radiocommunicationmuseum.org

Grimsby Amateur Radio Society

Grimsby Amateur Radio Society now have a new website and domain (below). They welcome any new members and the location and diary can be found on the website. They have also upgraded the D-STAR UHF Repeater GB7GC with new antennas and a receive preamplifier, which will help with better coverage. They will be doing the same with their UHF FM repeater GB3GY, which is now based in Cleethorpes.

http://grimsbyars.uk

Tim Walford G3PCJ • E-mail: electronics@walfords.net

The Gurney Slade Part 1

Tim Walford G3PCJ returns with an AM transceiver for 80 or 160m, using a simple TRF receiver and a transmitter based around a ceramic resonator. This might make a good club project.

This project was triggered by a good Welsh customer – Chairman of his local radio club – who told me that new recruits frequently cannot afford second-hand commercial radios when they are ready to transmit.

It set us both thinking about the least-cost method of getting on air with voice transmission. Undoubtedly this has to be with amplitude modulation (AM). The resulting design is a crystal-controlled simple AM transmitter called the Gurney and a regenerative Tuned Radio Frequency (TRF) receiver called the Slade. Even with shortened antennas for 80 or 160m, contacts over several miles are possible so it is well suited to radio club construction groups – hence the extra discount for multiple Club orders (see the side panel). Satisfactory completion should also get builders through their Intermediate Licence practical assessment. You may have guessed that Gurney Slade is a small village in (northern) Somerset!

The Concept

Apart from ending up with a working phone transmitter/receiver for the 80 or 160m bands where a small tuning range can be arranged, it is highly desirable to score an early success in the really pleasing 'home built experience' by starting with reception of the high frequency end of the Medium Wave (MW) band. (Luckily there are still powerful AM broadcast stations on MW that are easily received!) Following this positive start, the receiver needs to be altered for either of the amateur bands and also be able to copy CW (Morse) and SSB (single sideband) phone. Simplicity, and the ability to receive all three modes, immediately suggests a regenerative TRF design. The block diagram, **Fig. 1**, shows the fundamental sections of the receiver. Signals from the antenna are first passed through an RF amplifier to the tuning circuits, to which is coupled the stage that makes it regenerative. These are followed by an amplitude detector and an audio amplifier for driving modern-style headphones.

Generating AM phone signals is much less complex than SSB and is done by modulating the amplitude of a steady RF carrier. Historically this would have involved an audio power modulator and an awkward audio transformer but nowadays this can be avoided by gate-bias modulation of a MOSFET final RF amplifier stage. To keep things simple a pair of small BS170 devices is used, without a heatsink, for a maximum output of about 1.5W peak on a nominal 12V supply. This means that the steady (no voice) carrier level has to be one quarter of that at about 0.35W (350mW) or less if run on a 9V battery, which can be more convenient for portable use. For these lower bands, antennas might not be full sized so the transmitter output circuit has provision for shorter ones.

The block diagram of the transmitter is shown in **Fig. 2**. Although the transmitter frequency is crystal controlled, for 80 or

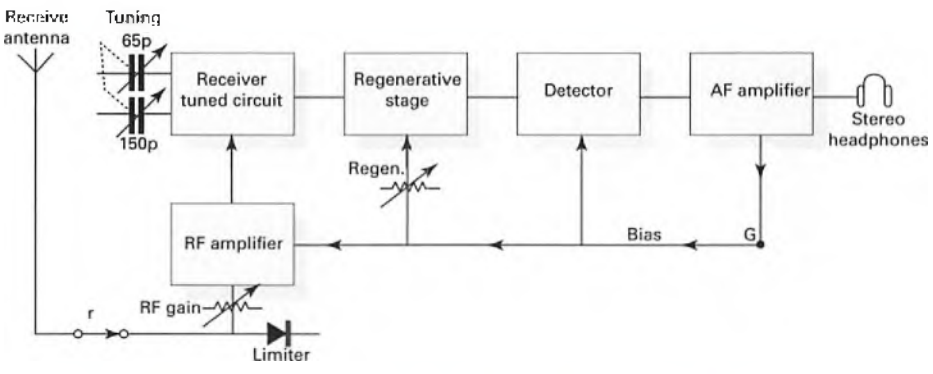


Fig. 1: Block Diagram of receiver.

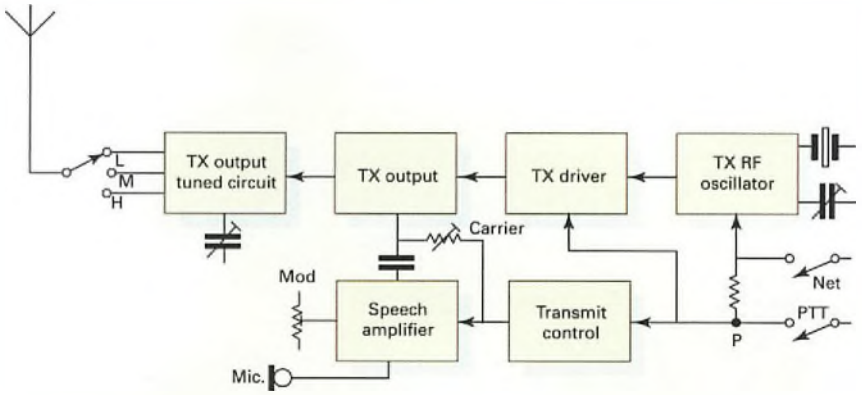


Fig. 2: Block diagram of transmitter.

160m, ceramic resonators can be used. These allow a few tens of kilohertz of tuning range. The transmitter uses a quad CMOS NOR gate for the RF oscillator and the control aspects. The receiver and transmitter are actually 'separates' but, being on a single PCB, they effectively form a transceiver.

Receiver Circuit Design

The receiver circuit is shown in **Fig. 3**. In case you are wondering why I explain the audio aspects first, it is because these stages provide the bias for the earlier stages! Operation with either 9 or 12V supplies is wanted for base station or portable convenience. The receiver has to be able to drive modern lightweight 32Ω headphones, preferably with negligible power consumption when they are not plugged in! A pair of my favourite BS170s MOSFETs, with DC feedback to control the bias, is ideal. The first stage provides most of the voltage gain and the second a little more 'grunt' to drive the relatively low impedance headphones. Note that the two earpieces are in series for a 64Ω load and be aware that their common connection must not be earthed! A plain amplitude detector is needed for receiving AM stations, to drive the audio amplifier. It can be a diode type provided the previous stage has reasonably low output impedance and can be followed by audio filtering at the high impedance input MOSFET gate of the first audio stage. It is convenient to include this detector within the DC feedback loop so that the diodes always have a small forward voltage to turn them on and thus avoid any signal loss due to their 'turn-on' voltage. The gate bias 'turn-on' voltage for these MOSFETs is a 'small zone' near +2V, to which is added 1.5V for the two diodes so that voltage on the source lead of the output stage is reasonably stable against supply variations at around 3.5V. This makes it a good point to derive the bias voltages for the preceding RF and regenerative stages.

Signals from the antenna circuits of the transmitter (hence the limiting diodes), or direct from a receiving antenna, are fed to the source lead of the first RF amplifier BS170 via a preset acting as an RF gain control. This is particularly useful when operating a regenerative TRF to prevent overload, especially because there is no other form of gain control. The RF amplifier stage minimises radiation from the receiver when the regenerative stage is oscillating and allows a single winding inductor to be used for the tuned circuit in its drain supply. The 'initial' inductor is a 100µH bead, which is resonated by all of the PolyVaricon tuning capacitor for the MW or with only a limited capacitance for 160m. For 80m, a 10µH bead inductor is added in parallel and resonated with a smaller contribution from the tuning variable capacitor. The next stage is arranged like a Colpitts oscillator with its fixed capacitors (four) always across the tuned circuit. The adjustable bias for this stage comes from the Regen control, which determines whether the stage can oscillate or not. For AM, the stage should

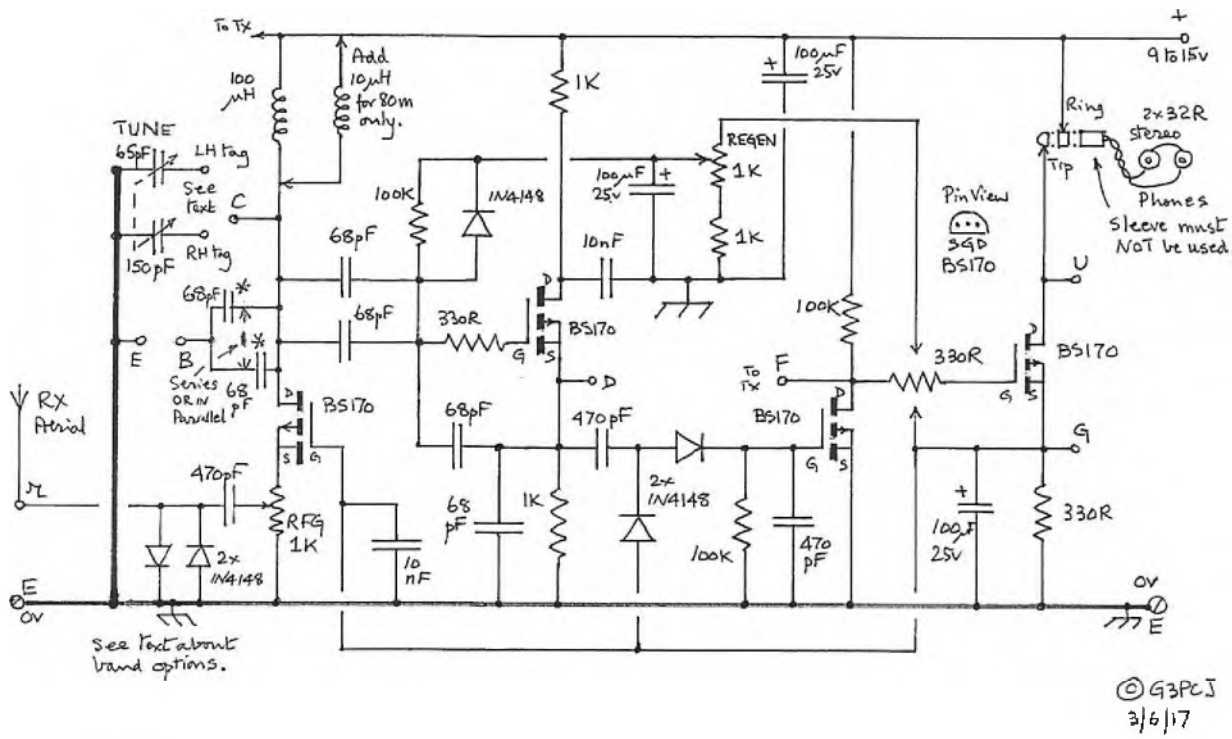


Fig. 3: Circuit of the Slade receiver.

be just 'not quite' oscillating but for CW or SSB it has to be 'just' oscillating to provide the missing local signal for their proper demodulation. The selectivity (and hence gain) of the tuned circuit is very much increased by the regenerative action of the oscillator type of circuit just either side of the critical bias point at which oscillation actually commences. The semi-stable bias supply from the output stage and limited bias adjustment range make the Regen control much easier to use.

Regenerative Action

*It might be worth a note here as to how a regenerative receiver functions, for those of you who are too young or too recently licensed to recall. A regenerative stage achieves higher amplification than a typical amplifier circuit by using feedback so that signals pass through the amplifier more than once. However, if too much feedback is applied, the stage will go into oscillation. The trick, as Tim explains, is to keep the regenerative stage(s) just below or just above the level at which oscillation occurs, depending on the type of signals you are trying to demodulate. For CW and SSB reception, you need to reintroduce a carrier to enable demodulation of the signal – the oscillation of the regenerative stage achieves exactly that – **Ed.**)*

Building the Slade Receiver

To keep the cost low, the transmitter and receiver are both on a single sided 100 x 160mm PCB with the controls mounted on it. You can put it in a protective box if you wish but this is not necessary for desk-type use – you would have the extra hassle of arranging front panel controls, sockets and so on. The photograph, **Fig. 4**, is of the PCB without its knobs fitted. Start by fitting the larger parts whose 'footprint' minimises the risk of using the wrong holes – they will also help you resolve any uncertainties with other parts later. The detailed kit instructions have a 10mm grid reference system to help you locate the right part of the PCB for each component. As ever, if there is any doubt about the holes to be used, check (before soldering) that the track connections to other components do properly correspond with the circuit diagram for them. If not, you have not yet found the correct holes! I always advocate building projects in stages, with a test on each stage before progressing to the next. This method much increases the chance of first time success. If you are building it as part of a club project, it is quite likely that your 'leader' may have already built theirs and you can also visually check against that model.

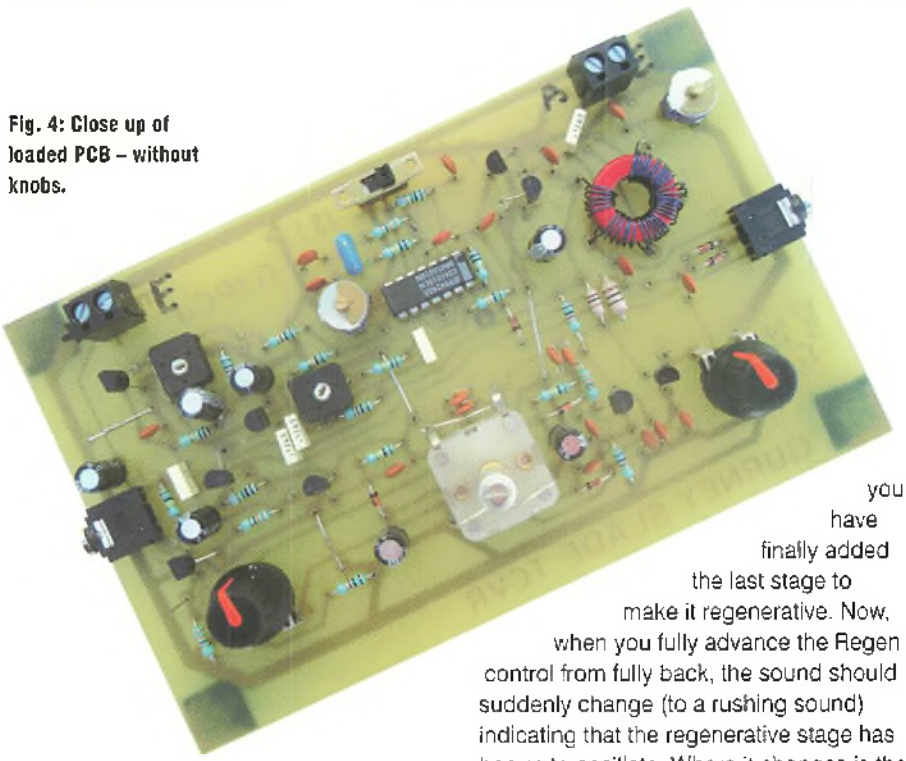


Fig. 4: Close up of loaded PCB – without knobs.

Begin with both stages of the audio amplifier and the diode detector so as to complete the DC feedback path. Check the supply polarity and remember that it will only work when the headphones are plugged in. Check that the output stage source voltage is near 3.5V on point G. You can also do the 'screwdriver hum' test by carefully touching your metallic screwdriver, with finger on its shaft, to the diode detector parts at point D – this should make clicks or other hum-like noises in the headphones. Then add the parts to make it tune the MW band. Make sure you get the correct 100µH inductor. It is the physically smaller of the two with bands coloured brown, black, brown and silver. Both inductors look similar to resistors but are a bit wider – if in doubt, check that their resistance is only a few ohms.

At this stage you can see whether a few metres of wire hung around the curtain rail for an antenna will bring in any stations. Dab it on the tuning capacitor tags – both should be connected to point C for the MW (The capacitors and connections to point B are not needed for the MW). The tuning will not yet be sharp so expect signals to be weak. Then fit the RF amplifier stage and transfer your antenna temporarily direct to the feed capacitor (at point little letter r) from the transmitter tuned circuit. The tuning should be sharper but nothing like as good as when you have finally added the last stage to make it regenerative. Now, when you fully advance the Regen control from fully back, the sound should suddenly change (to a rushing sound) indicating that the regenerative stage has begun to oscillate. Where it changes is the critical point where selectivity is greatest. Just below is best for AM and just above for CW and SSB. The gain and selectivity will be much increased near this critical point so you might now need to reduce the RF gain control for easier listening. If you happen to tune across an AM broadcast station with the Regen control set too far advanced, so it is oscillating, there will be nasty whistles that start with a high pitch, disappear at zero-beat then reappear and finally disappear again at a high pitch – this is all normal and correct!

Changes for Amateur Band Use

Normally in a club, you will have decided which band is best for a local net. Given the likely relatively short distances involved, you don't need huge or high antennas. Many decades ago, 8ft whip antennas mounted on the back of cars were popular and with just a few watts of RF, contacts were made all over the country so don't be put off by a lack of space for an antenna. But in the meantime for reception, much fun can be had with a random length of wire directly connected to the receiver. Get out as much as you can conveniently and the higher the better. For an RF earth, try connecting to any nearby the metallic pipes. For either amateur band, you need to alter the connections to the PolyVaricon tuning capacitor.

For use on 160m, connect point B to the left-hand 65pF section of the PolyVaricon tuning capacitor while leaving its other, 150pF, right-hand tag unconnected. Add the two 68pF

capacitors that are starred on the circuit, Fig. 2, between points B and C, in series. This should make it tune approximately the high frequency half of the 160m band. You can measure the frequency range with a frequency counter connected to point D via a scope-type divide-by-ten probe or listen on a nearby general coverage receiver set for CW or SSB reception but when doing this, you will need to make it oscillate strongly with the Regen control well advanced.

For 80m, you need to add the other 10μH bead inductor (having brown, brown, black and silver rings) in parallel with the first inductor. The right-hand 150pF section of the PolyVaricon is not connected but the two fixed 68pF starred capacitors connected to point B should be installed in parallel and then connected to ground by a short lead underside between point B and the nearby ground tracks. The left-hand 65pF section of the tuning variable is connected by a slightly longer wire to point C. This should permit tuning over most of the 80m band. The actual range can be checked as described above for 160m.

Amateur Band Reception

The receiving method for amateur AM stations is exactly as for broadcast ones. In many parts of the country, AM nets already exist, often based on 3615kHz. Just tune in for best intelligibility and adjust the RF Gain control for a comfortable level with the Regen control just below the critical point where oscillation starts. For listening to the more common CW and SSB amateur signals, you need the Regen control just above that critical point. As you tune across a CW signal, the pitch alters (through zero-beat) in the same manner as for tuning across an AM carrier. You have the choice to use whichever side has least interference to the wanted beat note from unwanted stations. For best intelligibility of SSB, you need to tune to the zero-beat point where the incoming signal's carrier would be, had it not been intentionally suppressed at the transmitter. This takes a bit of practice and will need more a more delicate tuning action than for AM.

You may wonder whether the receiver is sensitive enough but if the background band noise just increases when you connect your antenna with maximum RF gain, then all is well. Provided the band is open and there are signals, you will hear them. Next month I will describe the associated transmitter, which effectively turns this project into a transceiver.

Kit Availability

Complete kits of parts, with extensive instructions, to build the Gurney Slade in the open physical format shown here can be ordered direct from Walford Electronics Ltd using the Paypal facilities on their website: **www.walfords.net**

There is a small discount for *PW* readers ordering single kits, who should enter the code PWGS1 and a price of £37. If the order is for four or more kits as a single club order, please enter PWClubGS and work out the price at £35 each (advance warning to the author at **electronics@walfords.net** would also be prudent!). £6 is automatically added to each order for packing, first class post and Paypal fees.

Feature by Steve Ireland VK6VZ/G3ZZD

c/o PW Publishing Ltd., Tayfield House, 38 Poole Road, Westbourne, Bournemouth BH4 9DW

The Battle Creek Special Part 2

Steve Ireland VK6VZ continues with how to build your own version of the Battle Creek Special antenna, starting with trap assembly.

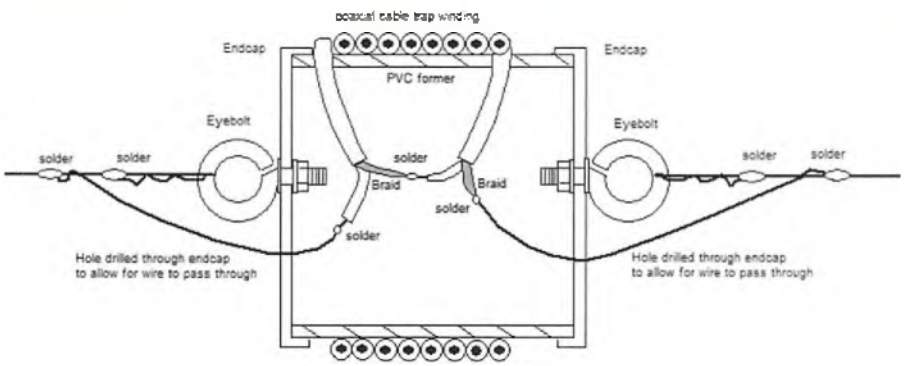


Fig. 1: Cross section of K1ZM coaxial trap used in his version of the Battle Creek Special.

I can't take much credit for this next section, apart from Anglicising some of Jeff K1ZM's constructional details. First, we need to cut two lengths of RG-213 - one of 3.353m (11ft) and the other 1.918m (6ft 3.5in).

The diagram, **Fig. 1**, shows a cross-section of a completed K1ZM coaxial cable trap.

At each end of the pieces of RG213 cable, separate the coaxial cable braid from the poly centre dielectric, in order to create separate 'pigtails' of braid and centre conductor, each 70mm long. The 3.353m length is used for the 3.5MHz trap, while the 1.918m length is for the 7MHz trap.

Now, place a PVC end cap temporarily on one end of the 0.61m length of 100mm diameter PVC pipe.

We will now 'size' the actual length of PVC pipe required for the 3.5MHz trap by temporarily winding the 3.353m length of RG213 around the 100mm diameter PVC pipe. In order to end up with smallest required amount of PVC coil former, start the coil about 12mm below the point on the PVC where the end cap finishes. Now tightly wind the RG213, with each turn directly adjacent to the preceding one. It may be necessary to tape the first few turns temporarily to the PVC former in order to get the degree of tightness required.

Once the 3.353m length of RG213 has been fully wound onto the pipe, estimate the additional length of PVC pipe required to accommodate another PVC end cap (to be positioned at the end of the winding you have made). Now remove the RG213 winding and cut the PVC pipe to final length for the 3.5MHz coil former.

With the original end cap still in place, drill/file a small hole in the PVC at the point at which you started winding the coil. This hole should be just large enough to ram the braid and centre conductor pigtails at one end of the coaxial coil through it and, ideally, should be as snug a fit as possible to the black outer jacket of the RG213.

Once you've got the hole size right, push one set of the coaxial coil pigtails into the PVC former (from the outside of the coil) in such a manner that all of 70mm of the coax pigtails wind up inside the PVC, plus about 20mm of black coaxial outer jacket.

Now wind the 3.5MHz coil again, as tight as possible, and use electrical tape to hold the turns in place as you go, if required. When you are nearing the end of the coil, you will need to estimate where to drill a second hole for the coaxial coil to enter the inside of the PVC former.

When choosing the position of the second hole, make sure that there is sufficient coax able to pass through the hole so the braid pigtail at this end can reach the centre conductor pigtail of the coax at the other end of the coil (see Fig. 1 again). This is necessary in order to make the internal connections required for the coaxial 'capacitor' inside the PVC pipe, which is formed by the capacity between the coaxial cable centre conductor and the braid.

If the braid pigtail going through the second hole needs to be increased in length in order to reach the centre conductor pigtail of the coax going through the first hole, you can separate a little more braid from the coaxial cable at the second hole end.

Once you have estimated the second hole position as well as you can, drill it and insert the coax pigtails at this end into the PVC former, then test the pigtail lengths to ensure that they will actually reach each other comfortably inside it. Before making the capacitor connection, tape the turns of the coil snugly to the former to hold them firmly in place.

Making Your Connections

As I said earlier, you need to connect the braid pigtail from one end of the coaxial coil to the centre conductor pigtail at the other end of the coil to form the coaxial capacitor. Take particular care not to connect braid-to-braid or centre conductor to centre conductor!

Initially, the braid and centre conductor that form this connection should simply be twisted or 'crocodile-clipped' together, to allow checking of the trap's resonant frequency using a grid dip meter or an RF bridge, such as an Autek RF-1. K1ZM has found typically that a 3.5MHz trap correctly made as described will resonate anywhere from 3.490 to 3.525MHz, which is quite acceptable for practical purposes.

Should the 3.5MHz trap resonate significantly lower in frequency than 3.490MHz, then the coax can be shortened slightly and a new hole drilled for the lower

coil pigtail entry. If the resonant frequency is higher than about 3.55MHz, unless you plan to operate on SSB only, oops! – time for a new piece of coax!

I should add that K1ZM has made a number of these traps and says 11ft of coax with just enough pigtail leads to reach each other inside the coil is about perfect for the 3.500 to 3.525MHz CW DX 'window'.

Once you are happy with the trap's resonant frequency, twist the capacitor-forming pigtails together well, doing your best to take up as much tension as possible between the two ends of the coil (leaving as little slack inside the trap former as possible). If you get the coil in place just right, there will actually be some 'holding tension' from the former on the outer coil windings themselves. Now, solder this connection well.

This leaves you with two leftover pigtails – one braid and one centre conductor – at opposite ends of the coil. Firmly twist the stripped end of a 300mm (12in) piece of 14SWG (or similar) stranded insulated copper wire with each leftover pigtail. Twist these wires together well and then solder them securely. Soon they will be totally inaccessible so take care to do a good job.

From the inside of the PVC former, tightly seal the holes where the coaxial cable coil enters it using silicone sealant. It's also a good idea to 'goop' the soldered connections inside the PVC with the sealant, which both insulates them and helps ensure they don't float around inside the coil former (if there is enough tension on these leads, this should not occur anyway).

Preparing the End Caps

Drill a hole in the centre of each end cap just large enough for the 1/4in (or similar) eyehooks to fit through. Mount the eyehooks to the pipe end caps, using one flat washer on the inside and one on the outside of each end cap for strength, with the hook of the eyehook on the outside of the end cap.

Fix the two eyehooks in place using 1/4in nuts. Make sure the 1/4in nuts are tight and use a lock nut if in doubt. These eyehooks are going to hold up the weight of the traps and the antenna wire as well, so they need to be firmly in place.

Now drill a hole in each PVC end cap just large enough for the 14SWG insulated flexible copper wire to snugly pass through.

Battle Creek Special at VP8ORK (South Orkney Islands) with an inquisitive seal admiring the BCS. Photo Ralph K9NZ.

When both PVC end caps have been prepared in this manner, you are ready to glue them onto the PVC coil former. This operation, carried out one end cap at a time, requires some dexterity, because you must first pass the open end of the 14SWG insulated flexible wire lead through the hole in the end cap and spread PVC cement on the inside of the end cap and onto the former where the end cap is to be attached – all basically at the same time!

Note that this operation is complicated by the fact that PVC cement dries in seconds. It is best, therefore, to do a practice 'dry run' first without actually using any glue, just to make sure you don't have any problems.

As you push the PVC end cap onto the PVC former as far as it will go, pull the 14SWG lead snug/tight. You should end up with about 200mm of lead outside a coil former end cap when the gluing operation is completed.

The Battle Creek Special radial field at VP8ORK. Photo: Ralph K0IR.

Battle Creek Special at K9W (Wake Island), overlooking the sea. Photo: Ralph K9NZ.

Finishing off the Trap

You should end up with a tightly-wound coaxial coil around the PVC former and the silicone sealant should keep water out of the coil. However, to be doubly sure, tightly wrap the entire outer surface of the trap with PVC electrical tape.

K1ZM usually uses one to two standard rolls of PVC tape per trap to keep the coil turns snug and to prevent any rainwater from seeping inside the trap. As Jeff says, *"You do not want a swimming pool created inside the PVC – ever!"*

To make sure the trap is entirely watertight, also put silicone sealant liberally around the eyehook flat washer that lies flush to the outside of each end cap and around each eyehook as it exits the end cap. Also, liberally apply sealant to the hole on each end cap where the 14SWG flexible wire lead exits the PVC former through the end cap.

Repeat this final sealing process several times – at about six-hourly intervals. K1ZM says this allows the silicone sealant to set properly between

each coating, allowing a very solid waterproof barrier to be set up. Your 3.5MHz trap is now complete.

The 7MHz trap should be constructed and tested in exactly the same way, using the 1.918m piece of RG213. This should result in a trap that is resonant around 7.00MHz. Again, check the trap's resonant frequency using a grid dip meter or an antenna analyser before final assembly and trim the length of the coax if necessary.

Assembling the Antenna

Cut the 33m of hard-drawn copper wire into three lengths – 10.67m, 8.53m and 13.41m. By the way, one of the reasons hard-drawn copper wire is used is because it's very strong and simply will not stretch with the weight of the antenna and its traps.

The wire dimensions of the K1ZM version of the Battle Creek Special are typically of the order below:

Feedpoint to 7MHz trap – 10.11m (cut to 10.67m initially).

7MHz trap to 3.5MHz trap – 7.97m (cut to 8.53m initially).

3.5MHz trap to end insulator – 12.56m (cut to 13.41m initially).

As shown in Fig. 1, the various sections of wire should be twisted around the 1/4in eyehooks on the ends of the traps to provide a strong mechanical joint. Now, as shown, the ends of each of the pieces of 14SWG flexible wire leads at the end of each trap should be twisted around their adjacent section of hard-drawn copper wire, making the electrical connections between the antenna wire and the associated traps.

Fig. 3: The beautiful Battle Creek Special at FP/VE7SV. Photo: Ramon XE1KK

Initially, do not solder these connections – just twist the wires together well and tightly wrap with pieces of insulating tape to hold the connections together.

You should now erect your Battle Creek Special in its final inverted-L shape, putting as much of it as possible in the vertical plane. Even if you can only get the first 10m of it in the vertical plane, it will work adequately but DX performance on 1.8MHz and 3.5MHz will improve drastically if you can at least get the first 14 to 20m of the antenna vertical, or semi-vertical, **Fig. 2**.

K1ZM adds that before tuning the Battle Creek Special, you should be sure to put it in the position where it will finally hang. Note that the tuning of the antenna on 1.8MHz and 3.5MHz can be affected if the angle between the vertical and horizontal portions of the antenna is changed after adjustment.

Connect a 50Ω RG213 coaxial feeder to the antenna feedpoint. Also, connect up the feeder to the earth system that you laid earlier – you did put down those radials, didn't you?

Using an RF bridge or your transmitter putting out a few watts of RF into the feeder, trim the 7MHz (10.67m) section of the antenna for minimum SWR just inside the lower band edge of 7MHz.

Next, repeat this process for the 3.5MHz section (8.53m), trimming it for minimum SWR just above 3.5MHz. Repeat the process for the 1.8MHz section (13.41m), trimming it for minimum SWR around 1.825MHz, which lies in the centre of the DX portion of topband.

Finally, go back and re-check the SWR on 7MHz and 3.5MHz. While K1ZM has never seen a Battle Creek Special that has been set up in the aforesaid manner needing any further adjustment, he adds you should still re-check the SWR to make sure.

Now, carefully solder all the antenna connections and weatherproof them using PVC tape or silicone sealant.

The End Result

What you will have now got is a competitive DX antenna for 1.8, 3.5 and 7MHz, optimised for each band and taking up the space of a single antenna. For those who live in locations where vertically polarised antennas perform poorly, you could always make two Battle Creek Specials and use them as a very effective trap-dipole for 1.8, 3.5 and 7MHz.

Using a Battle Creek Special is a bit like using a Cubical Quad antenna – it is a famous and proven antenna that most DXers wish they had! You, too, can be the envy of the bunch.

In closing, my best ever 1.8MHz contact was with **FP/VE7SV** at St Pierre and Miquelon Islands – on the so-called long path. Of course, **Dale's** DXpedition was using a Battle Creek Special, **Fig. 3**.

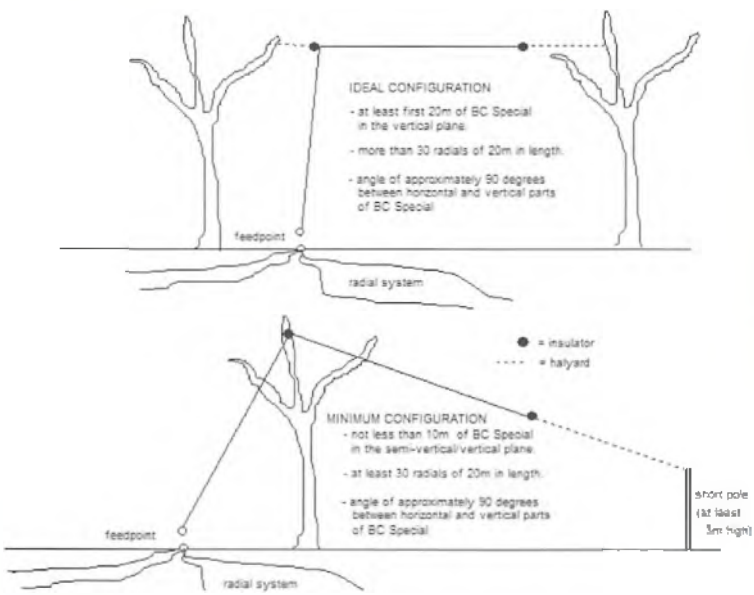


Fig. 2: Possible configurations of Battle Creek Special. Note that the ideal configuration will be a much better DX antenna than the minimum one.

Thanks

Very special thanks go to Jeff Briggs K1ZM/VY2ZM and **George Guerin K8GG** (a Battle Creek original) for their information and also to **Jerry Rosalius WB9Z**, **Ralph Bellas K9ZO**, **Ralph Fedor K0IR**, **Ramon Santoyo XE1KK** and Dale Green VE7SV for the use of their pictures. Without you blokes this article would not have been possible.

• E-Mail: second.hand@pwpublishing.ltd.uk

Buying Second-hand Digital Rigs

Chris Lorek G4HCL gives a brief introduction to the various digital modes on VHF/UHF along with some useful guidance for buying a second-hand digital transceiver.

There are various modes used on VHF/UHF digital amateur radio, namely D-STAR, DMR and System Fusion C4FM. Each of these is, unfortunately, mutually incompatible so you'll need to choose carefully depending on what your local activity mode is. I'll detail the different modes here in turn and give a few hints on what to look out for when buying a second-hand digital radio.

D-STAR

D-STAR (Digital Smart Technologies for Amateur Radio) is a radio system that offers digital voice and data communication. Repeater sites are predominantly connected over the internet and therefore form a wide-area amateur radio network that can span the globe. I've been using D-STAR now for several years and together with my colleague **Andy Sillence G4MYS** we have set up a D-STAR repeater, GB7IV. Since moving to Whitby I'm pleased that my local repeater GB7RW, covering the area between Scarborough and Whitby, is also D-STAR and is technically and very competently managed by **Dave Smith G4DAX** who I've been pleased to meet.

Fig. 1: The Icom IC-51E.

D-STAR is an 'open' digital protocol that was pioneered many years ago by the Japan Amateur Radio League (JARL). As such, any manufacturer may produce equipment for it although the vast majority of D-STAR equipment is designed, manufactured and sold by Icom. All D-STAR radios, to my knowledge, have the capability of being used in D-STAR mode or in analogue FM mode.

Via an internet-connected D-STAR repeater, you can call up another amateur directly by simply putting their callsign into your radio without knowing their location or what D-STAR repeater they are currently using. Repeaters can also be linked as needed by operators on air to form a wider area conference, or system administrators can interconnect repeater gateways to link all voice and data from multiple repeaters together. Repeater systems can be interconnected via 'reflectors', which are essentially servers on the internet with enough capacity behind broadband internet links so as to connect many repeaters together.

Fig. 2: The Icom IC-31E.

Fig. 3: A couple of early MotoTRBO handhelds.

Trading Up

As new D-STAR radio models arrive, usually with added features, existing owners of D-STAR radios are often tempted to trade up to the latest models. The dual-band IC-51E handheld, for example, **Fig. 1**, was launched some years ago, then came the IC-51E PLUS and, later, the IC-51 PLUS2. Other handhelds include the more economic IC-31E, **Fig. 2**, which is a single band 70cm handheld transceiver. Each of these models includes a built-in GPS receiver.

Because the ID-31E is a single band transceiver, many users buy one of these to get them going on D-STAR but then decide to upgrade to a dual-band handheld. This typically results in ID-31E radios becoming available on the second-hand market. Likewise, as new models of the ID-51E appear, earlier models again show up on the second-hand market. If you're considering buying an ID-51E, my advice would be to check which version it is, to save you being disappointed.

An earlier dual-band handheld was the IC-E91, another model often to be found on the second-hand market. My friend Andy G4MYS was very tempted to purchase a second-hand IC-E91 some months ago for just over £90 so there are second-hand bargains to be found.

DMR

DMR (Digital Mobile Radio) was developed as an open ETSI (European Telecommunications Standards Institute) standard for professional two-way radio users. I currently know of no amateur radio manufacturers including this mode in mobile, base or handheld transceivers. However, there are plenty of amateur radio introduced DMR repeaters around the UK, Europe and, indeed, worldwide, based on professional repeater equipment. Every DMR handheld and mobile can operate in both analogue FM mode or in DMR mode, depending on the mode programmed into each memory channel. However, being a professional radio mode, you won't find radios with a frequency readout, VFO, frequency entry keypad, and so on – you

Fig. 4: An early MotoTRBO mobile.

need to program each memory channel and the like individually.

Two of the big players in DMR are Motorola (Malaysia) and Hytera (China) and you'll find plenty of equipment offered on the second-hand market as professional users trade up to later models. This is especially true of Motorola, who market their DMR-compatible radio as MotoTRBO, so you'll most likely see this see this in the description when these radios appear on the second-hand market. Motorola have been been making MotoTRBO radios for many years now and at least three significant model upgrades have been launched in that time. As such, you'll see a variety of ex-PMR DMR radios for sale as users upgrade. Some of these will come onto the market via online auction sites and many will be from PMR dealers wishing to dispose of radios they have taken in part exchange. A couple of examples appear as **Figs. 3** and **4**.

Amateur DMR

The use of DMR in in amateur radio is steadily growing, with an increasing number of DMR repeaters around the UK. As well as one-to-one contacts, each repeater will have a DMR talkgroup, which can be limited either to that repeater only or to a region, country or worldwide in the case of internet-connected repeaters. With DMR being a TDMA (Time Division Multiple Access) mode, each repeater will, along with its input and output frequency, also have two timeslots. Unlike other repeaters, though, each one will have its own colour code, timeslot, talkgroup(s) and the like. There are also two very different amateur repeater interconnection systems – DMRPlus (DMR-MARC) and BrandMeister – so you'll need to know which of these two, if any, your local repeater uses.

Programming

You will need to program a number of parameters into your second-hand DMR radio via a PC and a dedicated programming interface specific to that series of radios. You won't be able to do this yourself through the radio's controls so you'll need a reasonable knowledge of DMR programming. The easiest way before buying second-hand is to ask the seller whether they would program the radio for you. If they're a commercial two-way radio dealer, they'll undoubtedly ask you which parameters you need and a list of these. Also, unlike amateur radio callsigns, DMR uses numeric user IDs. You'll need

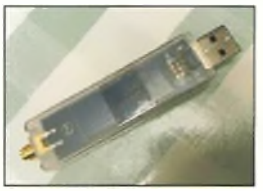


Fig. 5: The Yaesu FT-2DR dual-band C4FM handheld.

to obtain one of these online and ask for it to be programmed into your radio. This is also most important if you're buying second-hand from a local amateur or even a dealer with radio amateurs in their employment who will probably know your local repeater's parameters because the radio will have a different user ID already programmed into it. A programming adapter can cost around £50-60 for MotoTRBO radios and, unlike Hytera where the programming software can be downloaded, the Motorola programming software comes with a price tag. So it may well be very worthwhile in taking your second-hand DMR radio down to your local two-way radio dealer and paying maybe £20-25 to get it programmed.

Yaesu System Fusion C4FM

System Fusion C4FM is possibly the most recent amateur radio VHF/UHF digital mode, having been introduced by Yaesu as their proprietary implementation of digital amateur radio. It uses C4FM 4-level FSK (Frequency Shift Keying) technology to transmit and receive digital voice and data over the amateur radio bands. The radios also each include an analogue FM mode, which allows communication with other analogue radios.

Automatic Mode Selection

Very usefully with System Fusion, Automatic Mode Selection (AMS) can instantly recognise whether the received signal is C4FM digital or conventional FM. The radio mode then automatically switches to match the received mode. Even if a digital signal is being used, you can manually switch to FM to communicate with analogue FM users. A further advantage is that System Fusion repeaters may be pre-programmed into an automatic mode detect and in which mode to retransmit. This means that if the incoming signal is analogue FM, the repeater transmits it in FM while if a C4FM signal comes in, it's transmitted as either C4FM or analogue FM according to the programming. For example, by running the repeater in 'Fixed

Fig. 6: The DV4mini USB dongle.

FM' mode on transmit and AMS mode on receive, the repeater will automatically detect the incoming signal and convert it to an analogue FM transmission.

WIRES-X (Wide-Coverage Internet Repeater Enhancement System) is a system for linking C4FM repeaters and/or home stations together using internet voice technology. This makes it possible to have contacts around the world from your C4FM radio. Due the relative newness of this C4FM mode, there are not that many second-hand bargains to be found although you might be lucky! I have certainly seen both mobile and handheld C4FM transceivers on second-hand sale. Because the System Fusion network is expanding and, at least eventually, amateurs may be tempted to trade up to newer models, you may well find earlier models such as the Yaesu FT-2DR, **Fig. 5**, appearing on second-hand sale.

DV4mini for D-STAR, DMR and C4FM

You don't need to have access to a local repeater for any of the digital modes I've described, as long as you have a PC, whether a desktop or laptop. The DV4mini, **Fig. 6**, is a USB 'dongle' that turns a computer into a hotspot for D-STAR, DMRPlus and BrandMeister, and System Fusion C4FM. It's also capable of operating on dPMR and P25 commercial two-way radio modes. It's a plug-in 'dongle' 70cm transceiver for your PC and includes a modulator/demodulator for GMSK and 4FSK modes along with a 32-bit microcontroller.

The DV4mini comes supplied with software for connection with DCS, XRF and REF reflectors for the D-STAR mode as well as DMR Plus and C4FM reflectors. It works with PCs running a variety of operating systems, including Windows 7, 8, 10 and Linux on a desktop or laptop computer, Raspberry Pi, BananaPi or ODROID, the minimum requirement being a dual-core processor. The DV4mini works only in simplex mode on the DMRPlus and BrandMeister DMR networks.

See You On the Digital Air!

I hope this article has given you a few guidelines with respect to the different type of digital modes used on amateur VHF/UHF and what you need to look out for when buying a second-had digital transceiver for amateur use. You'll find me on D-STAR as G4HCL on the GB7RW repeater, available to link to from anywhere in the world.

Steve Hartley GOFUW, RCF Trustee • E-mail: g0fuw@rsgb.org.uk

RCF Sponsored Student Success

In our June 2016 issue we had an In Focus feature on the Radio Communications Foundation. This month we have news of one of their recent success stories.

Every year the Radio Communications Foundation (RCF) sponsors two students under the Arkwright Trust scholarship scheme. The scholars are selected from the hundreds of successful scholars who have been through a rigorous selection process involving an examination, a project and an interview. Once they have secured a scholarship, the Arkwright Trust link them up with sponsors who can best help them with their A-level studies and/or future careers. Those who cite radio, satellites, electronics and similar as their key interests are referred to the RCF. The RCF offer them the opportunity to experience amateur radio and attempt to arrange suitable work experience, for example with Surrey Satellite Technology or Vodafone.

One of the current scholars was part of a team that won the 'best team' award at a university hosted science competition. **Ben Raven** from Dr Challoner's Grammar School, Amersham picks up the story:

*"At the beginning of the year myself and five other students, **Charlie Manning** (who is also affiliated with Arkwright), **Caleb Alhadeef**, **Serena Ozturk**, **Suzie Murray** and **Saffy Truman** entered the Young Innovator of the Year awards competition. After much deliberation, we settled on our project, a small self-sufficient robot designed to monitor soil conditions in sub-Saharan Africa, with the aim of advising subsistence farmers on how best to maximise crop yields. The robot, around the size of a small dog, would roam around a plot of land marked by GPS markers, taking regular soil samples and testing for nitrate levels, water concentration and acidity. The robot would then compare this against a preinstalled database of crops, selecting the optimum crop for the conditions at hand. Following countless meetings, conducted over many mugs of tea and coffee, a name was decided, Tortobot, and our project was set in stone.*

Ben Raven (3rd from the left) and his winning school team.

Steve Hartley GOFUW with current RCF Arkwright scholars, Roseanna Devos 2E0SHH and Elliott Marshall who was one of the successful candidates at the National Radio Centre.

"Now came the not insignificant challenge of designing our wildly ambitious project, with hours spent researching things such as patents and available products. After a few false starts involving stationary probes we settled on a moving rover. After further more 'heated discussions' (read arguments!) we settled on a tracked vehicle (much to the annoyance of our graphical designer who had the task of modelling the machine). With the design finalised and a short video made, our design was sent off and then began the waiting.

"Following several weeks of waiting as the judges sorted through nearly a thousand applicants, we received a letter containing our invitations to the awards ceremony. Naturally we were all ecstatic, with ice cream being the chosen celebration for the group. A few weeks later we all piled into the school minibus and set off for Harper Adams University in Newport, one of the country's leading agricultural universities.

"We were greeted on the huge campus by too many tractors to count and, naturally, a life-size model of a cow. After a brief tour, we were taken into one of the lecture halls and waited in anticipation.

"Despite stiff competition we were nominated for best team, winning the Judges Choice Award for Presentation due to the fantastic work of Caleb in the 3D modelling of our machine.

"This was a fantastic end to a fantastic year of opportunities and experiences, many of which wouldn't have been possible if not for the ongoing support of the RCF and Arkwright."

Ben will be starting university in 2017 and clearly has lots of potential.

Two of the RCF's other current scholars are licensed radio amateurs who helped out at the National Radio Centre at Bletchley Park earlier this year when the RCF hosted a day of radio activity. Fifteen Arkwright scholars were provided with copies of the Foundation Licence textbook two weeks before the visit. They were guided through the Foundation Practical Assessments by a team comprising RCF Trustees, RCF scholars and RSGB volunteers. Thirteen of the group passed the exam the same afternoon but not before working **Bob VP8LP** in the Falklands for their very first HF contacts. Bob very kindly sent them all individual QSL cards. One of the group has gone on to study for the Intermediate exam and another gave a presentation about amateur radio to his school science club.

These are just two examples of how RCF donations are used to help our young engineers and scientists and how the charity is trying to spread awareness of radio communications in the 21st century. The Trustees are always looking for new projects to support. There is more information about the RCF and its grant making policy on its website (below). On the other hand, if you would like to help out, there is a donate button there too.

commsfoundation.org

• E-mail: roger@g3ldi.co.uk

Proper QSOs?

Roger Cooke G3LDI laments the disappearance of 'proper' QSOs and discusses the best shape for a knob!

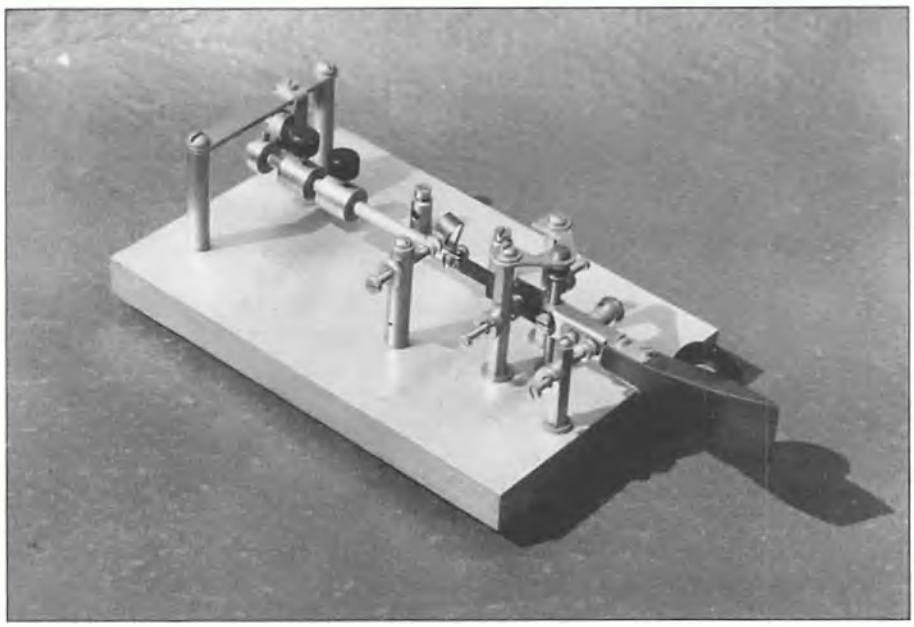


Fig. 1: G3MWO's homebrew side swiper key (see text).

When was the last time you had a 'proper' QSO? Listening on the bands these days, you might assume that there is a constant contest going on. Occasionally a conversation is heard on SSB, very rarely on CW or RTTY. There is a medical term to cover this anomaly. It's called the Slot Filler Syndrome. It's infectious, spread by the deadly Slot Filler bug. It has spread worldwide now and nearly every QSO heard on CW remains 5nn 73 and that's it. The bug has spread to the far-flung corners of the planet. Even if you work a common or garden station in the US or Australia, it is likely that he will be infected too.

It can also be contagious in that a newcomer to the hobby can visit an already established amateur (suffering from Slot Filler's Syndrome) and by experiencing the ubiquitous 5nn 73 type of QSO, he then becomes infected himself.

Is there no cure to this virus? It would seem not! It is no longer working a DXpedition on one band and being content with that, as we did in the 1950/60s era. It is now mandatory to work the DXpedition on every mode and on every band from topband to Light. And to contact every country on every band, every year. While this is fine for the DXpedition – producing fodder for his/their computer program – it is making life difficult for the newcomer, with all the QRM, who only wants one contact. That situation is soon cured once exposed to Slot Filler's Syndrome. He then becomes just like the rest of us, engrossed in the chase.

Yes, I admit that I do it too, and I admit I do have some of those 5nn 73 contacts but this is all due to target chasing, just like everyone else.

Having said all the, I still enjoy a normal ragchew on CW, if the other station can be persuaded to stay for longer than 5nn 73. It does happen! Just ignore the 73 and proceed to give a few details, like name, QTH and antenna and see where that leads. Some will stay and chat so it is not quite the incurable disease that I have propounded above! I miss my long chats with N7ZL, VE7PL, VK2SB and others of similar ilk. They are all my generation of ragchewers and are now having long contacts somewhere else. Contacts lasting upwards of an hour were the norm and that, in my opinion, is proper amateur radio!

Morse Key from the 1950s

Last time I featured a picture of **Derek G3MWO** teaching Morse to the Bury St Edmunds Scout Group. The key was a copy of an American 'side swiper', made entirely of salvaged parts from scrap electricity meters (kWh) and mounted on a solid brass base.

It worked well and was actually in the RSGB Exhibition in Earls Court. Well, he managed to dig up a close-up picture of that key and it is shown in **Fig. 1**.

Also from last time, I featured a picture sent to me by **Dave G3RXP** with some question as to what was really going on. Following that, I received the following from **Ron Gouldstone G3TAG**, *"I believe the picture is of a crude device for adjusting receiver alignment. In the days before scanning signal generators and wobbulators were commonly available, I used this type of setup for peaking IF transformers and other tuned circuits.*

"The control knob of the RF oscillator was connected via a cord drive belt to a potentiometer. This component was provided with a voltage source, normally a few volts from a battery. The potentiometer output was connected to the X-input of an oscilloscope, causing the trace to move back and forth across the screen as the oscillator tuning knob was rotated. RF output from the oscillator was fed to the receiver or circuit under test and the output of this unit went to the oscilloscope Y-input".

So, success there I think. Many thanks indeed for the follow-up on these two items.

Key Knobs

Ian Liston-Smith G4JQT sent this regarding straight key knobs: *"I learned Morse at the Northern Counties Radio School, Preston for my MRGC (and radar ticket) 1976 – 1979. We were taken up to 25WPM for an exam at 20 to 22WPM. All the ship's radio gear was Marconi as, of*

Fig. 2: A domed knob but maybe not domed enough for some operators.

Fig. 4: A drawer knob – probably not suitable for sending Morse?

course, were the keys. I cannot remember the type numbers, only that they had (or should have had) metal covers. I remember two important things about them. First that they were bolted to the front of the bench and second, that the knobs were dome-shaped, not flat.

"Over the years I have acquired various keys but have always had trouble finding ones with appropriately domed knobs and never managed to train myself to get comfortable with the 'wrong' type. I'm assuming this is not a common problem or a wider variety of knobs would be available.

*"I bought a knob from Kent Keys recently, **Fig. 2**, but as you can see, it's only slightly domed and in a pleasant chat with the proprietor (**Robert Kent**, I believe) he said that's the only knob they use. But he did explain something that I was vaguely aware of, and that is the necessary difference in design between keys depending on mounting and use, see **Fig. 3** for example.*

"If the user puts the key at the back of the bench and rests the forearm on the bench, as is shown in all the old US military Morse training videos on YouTube, then a lower profile key and knob are essential since the operator is just using the wrist with more of a tapping action. However, with a key mounted at the front of the bench, the user is more likely to want to hold the Morse key knob, so a flat knob is inappropriate. A finger-plate also makes use more comfortable, especially if the arm of the key has HT on it!

"There are various theories describing the advantages of these two ways of using a key. But I wonder if the preferred method in the USA – with the arm on the bench – was why they invented various paddle keys to overcome 'glass arm' and other forms of operating fatigue?

*"Anyway, I am still on the lookout for the right knob for one of my other keys. I even went to B&Q to look for a drawer knob that might be appropriate. It wasn't, **Fig. 4**!*

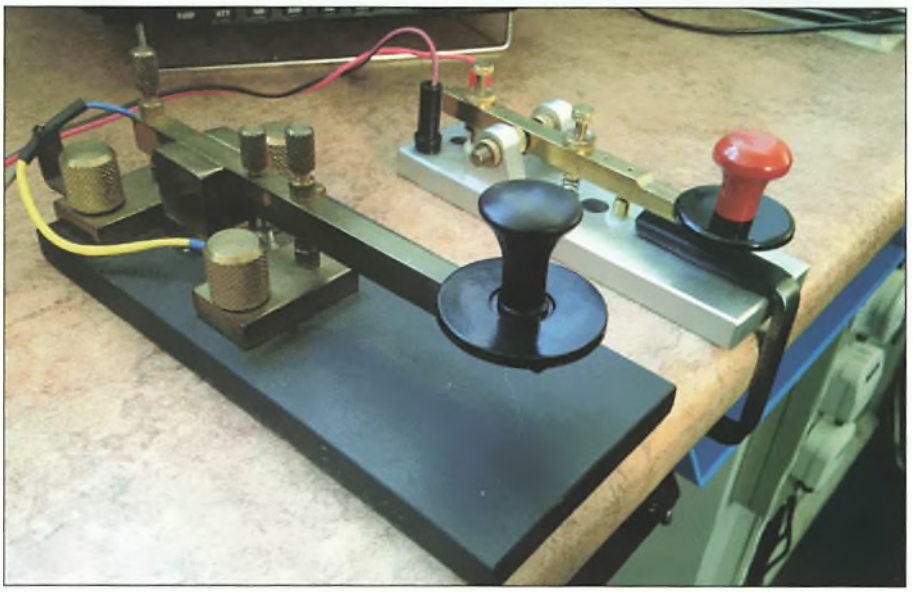


Fig. 3: Two straight keys mounted at the edge of the operating bench but user preferences vary as to the best location for a key.

"I have not seen these nuances in use set out before, and I have no idea if it is ever spelt out to new learners of the code."

Well, I always teach using a straight key with the key near the front of the bench, as shown in Ian's picture, preferably using a key with a knob and skirt, holding it correctly. The taller knobs would not be comfortable for me, however, and I would suggest a more squat knob with skirt. This enables the operator to have the correct 'limp wrist' technique, which I think is essential for sending properly formed Morse with a straight key. Knobs with skirts are not readily available and normally it's necessary to settle for just what happens to be on the key already. This is why older style RAF type keys are in demand. They are normally a lot heavier too.

Brag Time!

I don't normally do this, but I was recently extremely pleased to receive an award from the CWops Club in the form of a plaque. Completely unexpected, it was to be presented to me in Dayton, but **Chris G0DWV** collected it on my behalf and I was finally formally presented with it, by Chris, at the Norfolk ARC meeting, **Fig. 5**. I shall hang it on my wall with pride!

73 and may the Morse be with you.

Roger G3LDI.

Fig. 5: Roger receives his CWops award from Chris G0DWV.

Feature by Mark Bryant MOUFC

• E-mail: m0ufc@btinternet.com

The Siren 6cm WBFM Station Part 2

Mark Bryant MOUFC continues his constructional project, describing how to assemble and test the various modules.

Antenna panels from different manufacturers will vary in size and mounting hardware, but slim panels about 300mm square are more widely available and lend themselves to easier assembly. The back plate, **Fig. 1**, is made from 12mm MDF and to reduce the weight, shaped around the antenna feedpoint but leaving an area to mount the transmitter and receiver boxes. For outdoor use, a waterproof coat of paint will be required and maybe later some touching up for recesses of the exposed screws on the base of the two boxes. Before screwing the panels to the painted board, a decision will have to be made about which polarisation will be used. A choice of vertical or horizontal polarisation only involves turning the panel by 90° but other stations will need to have the same alignment. Because most of the interfering signals tend to be vertically polarised, we have used horizontal for our tests. There should be a label on the panel to show the configuration.

The recommended mast mounting (see website below) has the swivel section removed but other saddle clamps may be suitable. An N-type antenna adapter lead may be required between the panel and the SMA RF input sockets. At this frequency, antenna connections must be very short.

www.blake-uk.com/85-clamps-and-cradles

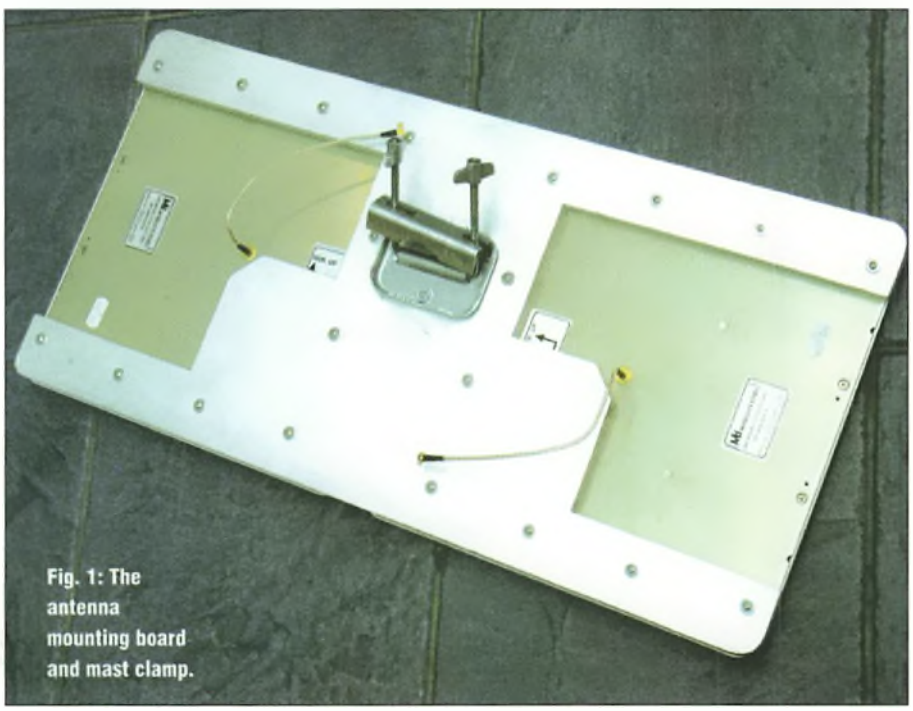


Fig. 1: The antenna mounting board and mast clamp.

Circuit Building

When building the circuit boards it would be wise to work on an antistatic mat or with a wristband. Terminal pins could be used for soldering the wiring to the board, the advantage being that the boards can be wired after they are mounted, or wiring can easily be rearranged. Drill the mounting holes first then solder links and pins (if used). The components can be soldered horizontally or vertically. Use a spot face cutter or 3.5mm HSS drill bit to break the appropriate tracks. Each of the five boards (not the AW transmitter) can be tested separately out of their enclosures using a PSU (preferably current limited), a multimeter, headset and portable powered loudspeaker.

Receiver Construction

The AW receiver module has pins that are pitch compatible for soldering directly to the right side of the receiver Veroboard, **Fig. 2**, which also acts as a support. Before mounting the module onto the board, you will need to remove the 0Ω SMD resistor, **Fig. 3**, near the antenna input and parallel with the edge of the board.

Originally this would have been in circuit to provide a bias voltage but use of an antenna with a DC-short feed would prevent the receiver from working unless the resistor is removed. I used a wet soldering bit wide enough to contact both sides of the resistor to wipe it off (or a pair of fine-tipped irons could be used to melt both soldered ends at once). If you are uneasy about doing this, then leave it in place and put a very low value capacitor (1 or 2pF) in series with the antenna input but with very short leads. The last receiver module I purchased had protruding grounding lugs near the pin-out section so care should be taken not to allow them to be in contact with the Veroboard, or they could simply be snipped off. A separate power regulator board, **Fig. 4**, allows the voltage regulator to be screwed onto the bottom of the box, the pins of IC2 being bent upwards 5mm from the body and inserted and soldered into the copper side of the Veroboard.

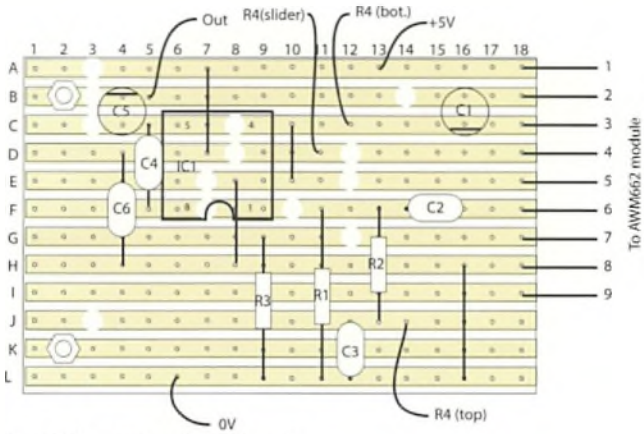


Fig. 2: The receiver board layout.

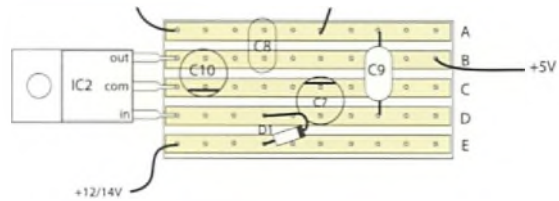


Fig. 4: The receiver regulator board and IC2 pinout

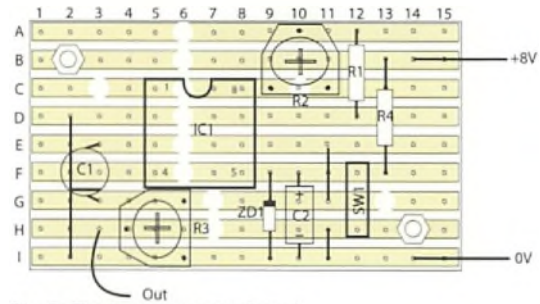


Fig. 5: The tone generator layout.

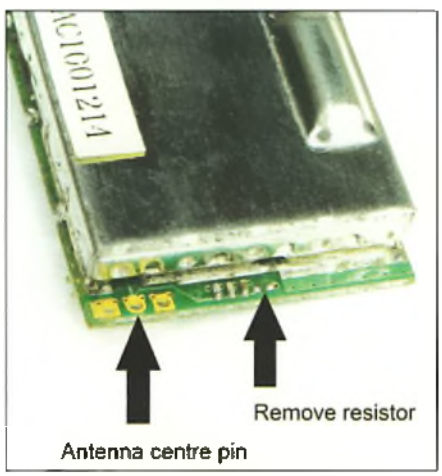


Fig. 3: The antenna connections to the AW receiver module.

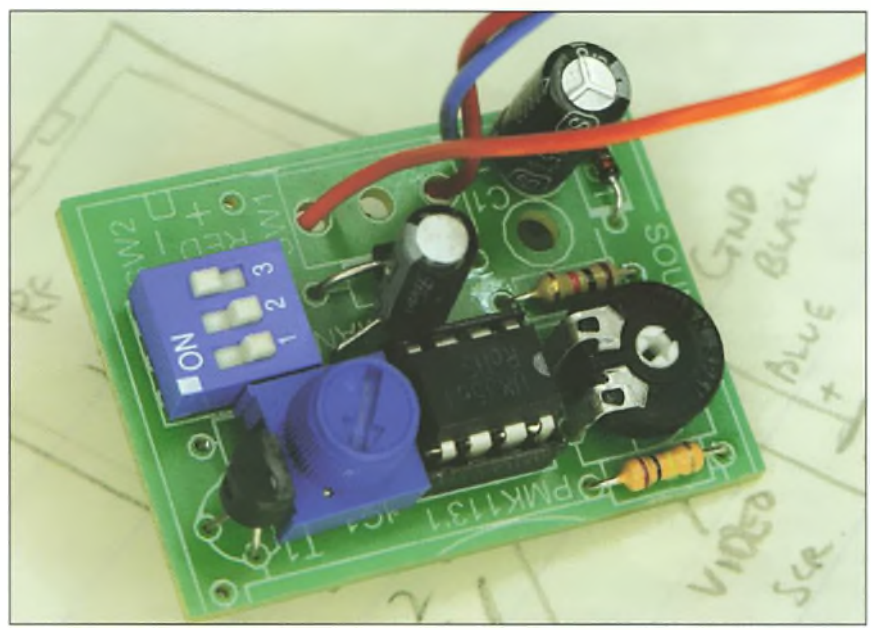


Fig. 6: The cannibalised Velleman siren sound generator.

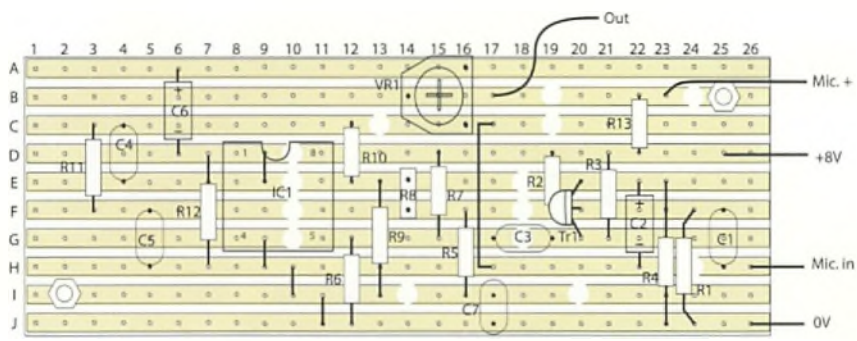


Fig. 7: The layout of the microphone amplifier.

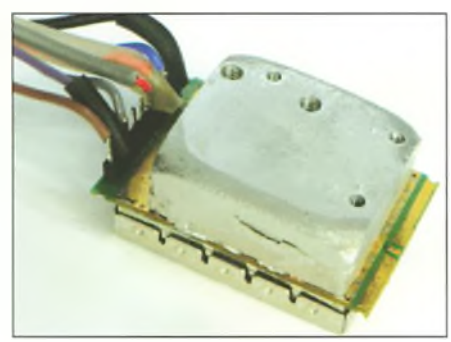


Fig. 8: Flying connections to the AW transmit module.

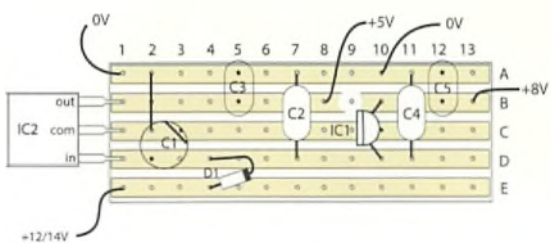


Fig. 9: The transmit regulator board.

Transmitter Construction

A suitable layout for the tone generator is shown in **Fig. 5** but for convenience I purchased the Velleman Siren Sound Generator module kit from Maplin (see URL below), which uses the same chip. After testing, I removed half the board (the loudspeaker and driver transistor), **Fig. 6**, because there is sufficient output from the chip to modulate the transmitter directly.
www.maplin.co.uk/p/velleman-siren-sound-generator-solder-kit-vt28f

The microphone amplifier board layout, **Fig. 7**, should present no problems. Use screened audio cable for the input and output.

The spacing of the pins on the AW transmitter module does not match the Veroboard, so fine wires can be soldered directly to the pins, **Fig. 8**, and then covered with sleeving to prevent cross-contact .

On the voltage regulator board, **Fig. 9**, care should be taken with the orientation of IC1.

Boxing Up

Sealed metal boxes are preferred for their screening, heatsinking and watertight properties. The controls and cable entry points are positioned such that when the station is mounted for operation outdoors, an unexpected shower of rain is unlikely to wet the interior. The drilling dimensions for the recommended boxes, **Figs. 10a, b** and **c**, are a guide – the only critical ones being the SMA sockets and transmitter heatsink, **Fig. 10d**.

Before soldering the SMA socket to the RX module, **Fig. 11**, I used a strip of foam underneath the board to offer up the module to the centre pin, thus ensuring a good contact.

The transmitter heatsink mounting holes and dimensions are also given in the datasheet and can be slightly over-sized for ease of fitting but before mounting, it's a good idea to flatten the heatsink surface and remove any burrs by rubbing with very fine emery paper on a flat surface. Thermal paste should be applied to the surfaces of the AW module and voltage regulators. I used wood screws on the regulators, which also fixed the box to the antenna board. The positions of the boards are shown in **Fig. 12**, where space can be seen for more wood screws to attach the box.

The many grounding wires can conveniently be brought together to a common point in the middle of the base in the transmitter and to the Veroboard mount in the receiver. I used double-pole

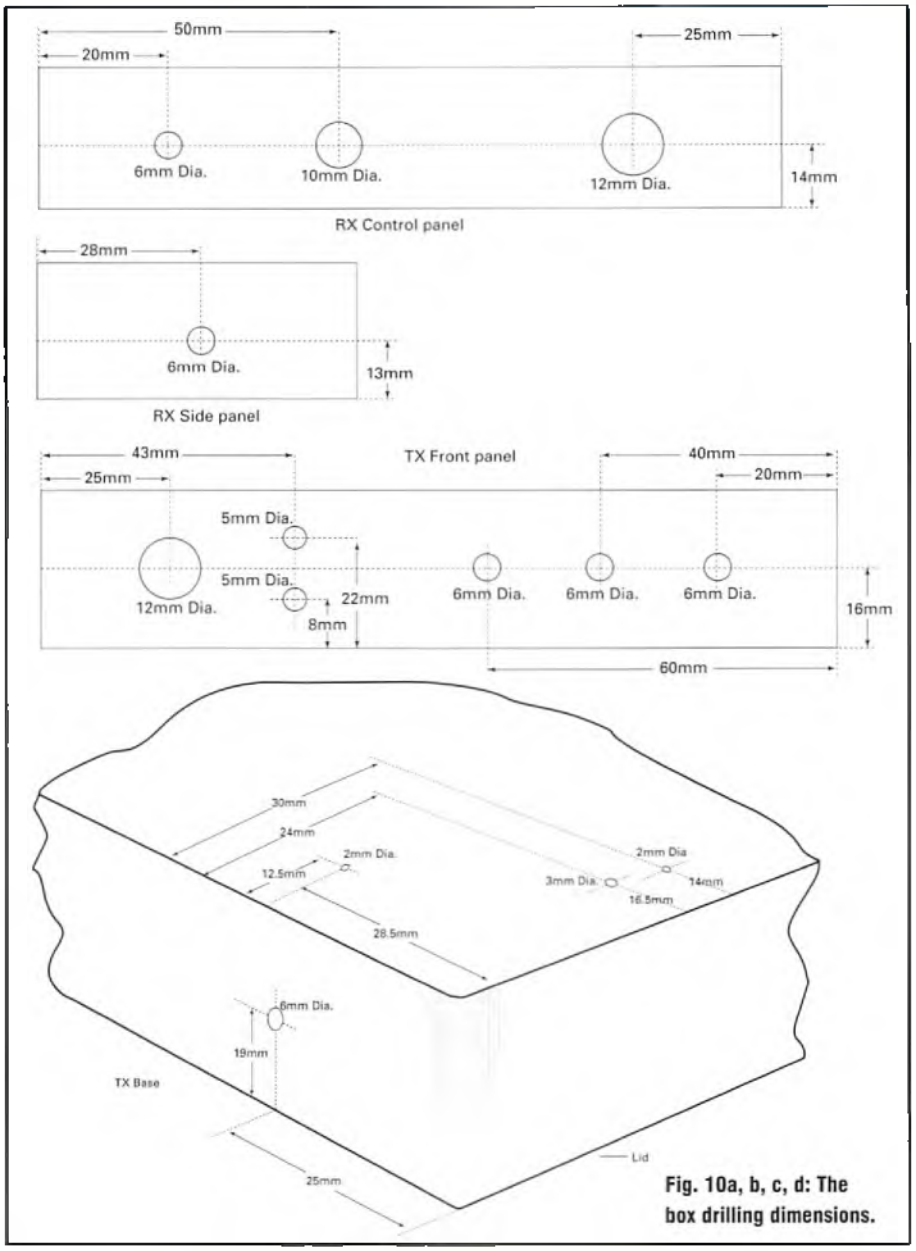


Fig. 10a, b, c, d: The box drilling dimensions.

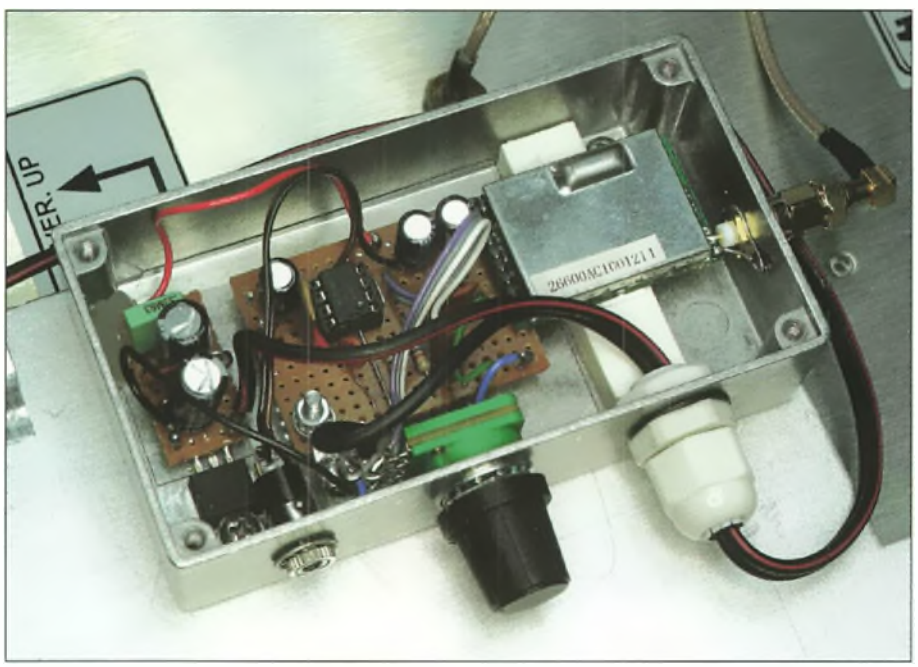


Fig. 11: The receiver board is supported from underneath to make light contact with the SMA centre pin.

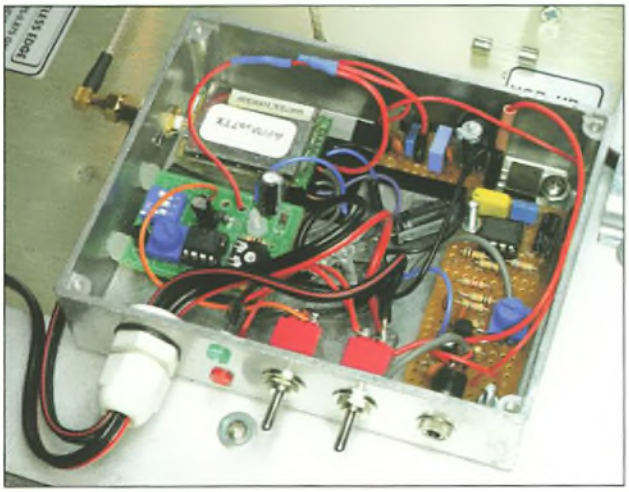


Fig. 12: The layout in the transmitter enclosure.

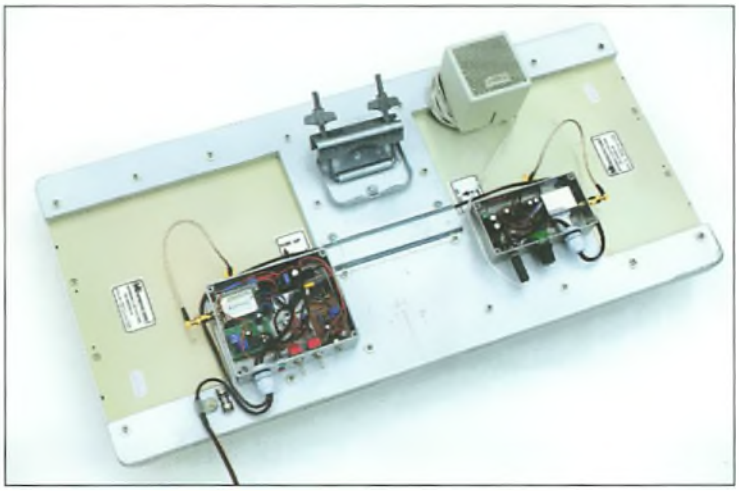


Fig. 13: The complete station. Note the spare fuse, bottom left, and the receiver power lead protected by a galvanised steel cover.

toggle switches in parallel so as to provide additional contacts. Hot melt glue can be used to further support and prevent movement of boards and wiring.

Testing

The complete station, **Fig. 13**, can be powered by a 12-14V battery capable of supplying 1A. The power cable should be fitted with a 500mA in-line fuse and connectors to suit the power source. Current draw from a 12.7V battery is about 200mA on receive and 380mA on transmit. QSOs are likely to be short so a typical 4Ah pack will sustain a few hours of testing and operating. To test, temporarily connect the power to the receiver and transmitter simultaneously but with the receive antenna disconnected. Increase the preset audio levels while listening for a clean undistorted signal. I made the artwork for the box lids, **Figs. 14a** and **b**, in Microsoft Word, which provides simple instructions for other operators. With such simple controls and a foreknowledge of the signal path, contest QSOs can be completed very quickly.

Fig. 14a, b: Lid art work – useful instructions for other operators.

Fig. 15 The transceiver and antenna arrangement constructed by John MW1FGQ.

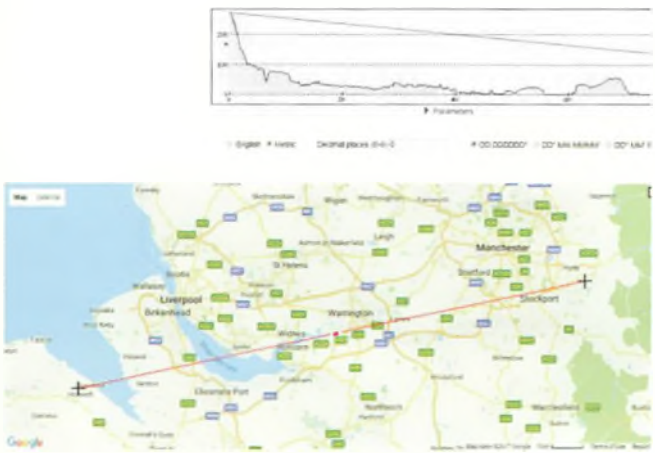


Fig. 16 The DX contact between MW1FGQ/P and M0UFC/P.

Postscript

Since the Siren article was submitted, **John Owen MW1FGQ** resurrected his original transceiver. He found a suitable dish and mounting from his junk box and made a circular waveguide/can feed, **Fig.15**. They were giving gain and better than his previous antenna where he'd used a little log periodic PCB antenna as the feed. In the April SHF Contest, **Dave Yorke G4JLG/P** on Winter Hill IO83RO and I on Werneth Low IO83XK made contact with John who was on a hill near Holywell IO83JG. My location was furthest at 80km, **Fig. 16**, the signal no doubt helped by John's superior antenna arrangement.

• E-Mail: mike@pwpublishing.ltd.uk

RF Calibrator Update

Mike Richards G4WNC starts with an update on the RF Calibrator discussion and moves on to looking at an interesting use of WSPR and how to get started with Spy Server.

Nick Barnes G4KQK contacted me having read my articles on RF calibrators. Nick had followed a similar route to me in trying to find a simple solution.

However, during his research, he uncovered a follow-up article by **Bob Kopski K3NHI** that was published in the May/June 2010 edition of the ARRL's *QEX* magazine. In this article, Bob reports that the AD8307's response to square wave input signals has changed in more recent versions. This change means that square wave signals at −20dBm and below no longer have the predictable relationship to a sine wave that the calibrator relies on! See last month's article for an explanation of the maths. This is a bit of a blow but all is not lost because the performance deterioration starts at −20dBm so the simple solution is to raise the output level of the calibrator to −10dBm. This can be done by swapping the 20dB output attenuator in the original design for a 10dB version. I've shown the modified values in **Fig. 1**. In my modified version, the DVM DC measurement point remains at 158mV but the output level increases to −10dBm when measured with an AD8307. The same output measured with a true, heat-based, power meter should read −13dBm while a spectrum analyser will show the 10MHz fundamental as −14dBm. This latter measurement also applies when using the calibrator to check receiver calibration. This modification can be applied to both the original CMOS oscillator design and the one adapted for use with the **Leo Bodenar** GPS Referenced Clock that I covered last month.

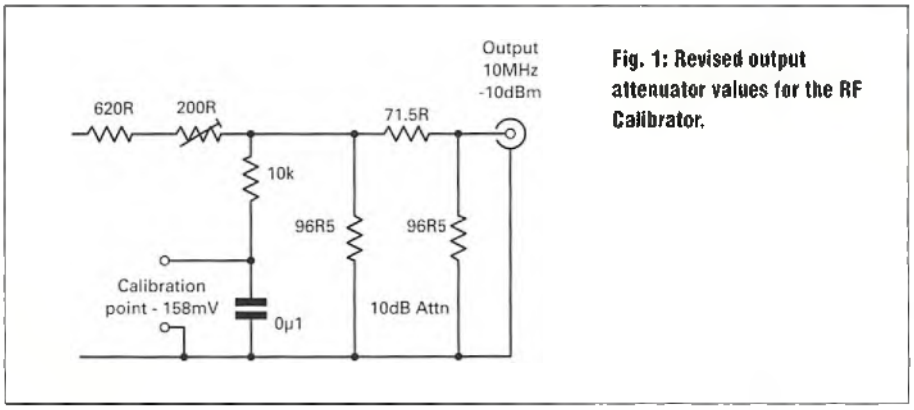


Fig. 1: Revised output attenuator values for the RF Calibrator.

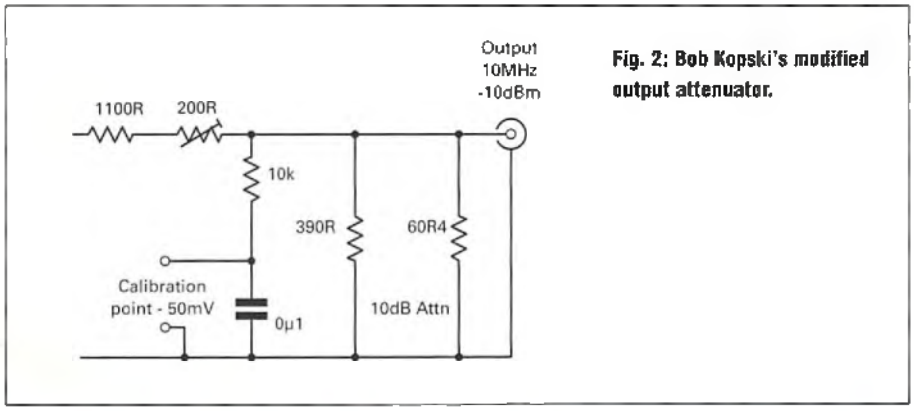


Fig. 2: Bob Kopski's modified output attenuator.

Bob has also published a low component count modification of the original output circuit as shown in **Fig. 2**. As you can see, this abandons the original Pi-type 20dB output matching attenuator in favour of a simple resistive divider using a 390Ω and 60.4Ω resistor from the original attenuator. This maintains the 50Ω output impedance and is an ideal modification for those that have already built a calibrator. In Bob's revised version, the DC calibration voltage at the DMM test point changes to 50.0mV DC. Please note that this modification is only necessary if you're using the calibrator to set up a power meter based on the AD8307 chip.

WSPRing up the North-West Passage!

This year is Canada's 150th anniversary of Confederation and there are a host of activities planned to support the occasion. Of particular interest to us is a group of radio amateurs that are deploying a WSPR beacon on a very special ship. The *Canada C3* expedition vessel is a 67m Canadian flagged icebreaker that was formerly used by the Canadian Coastguard service. To celebrate the Confederation anniversary, the *Canada C3* is sailing from Toronto to Victoria, British Columbia via the infamous North-West Passage on what is expected to be a 150-day voyage, **Fig. 3**. Not only are the seas in that area hazardous but radio communication is often difficult due to the effects of the aurora and 'arctic flutter'. The WSPR beacon has been made available by a group of enthusiasts under the leadership of **Barrie Crampton VE3BSB** and should provide interesting data on propagation in that part of the world. The beacon is using the callsign CG3EXP and

can be found by using a database or map search on the normal WSPRnet website: **http://wsprnet.org**

QRP Labs have set-up a live tracking site where you can see the progress of the vessel. This map can be found at: **www.qrp-labs.com/c3.html**

There is also a full expedition map showing the planned route and all the stops at: **https://canadac3.ca/en/expedition/expedition-map**

So far, the beacon activity has been spotted on 7, 10 and 14MHz. You can help the project by leaving your station monitoring WSPR and reporting to WSPRnet when you're not using it.

Spy Server

Don't worry, Spy Server is not about covert operations but a rather interesting server for the popular AirSpy SDR Receiver. As amateur radio shacks become ever more connected, the ability to remotely access your kit becomes increasingly important. Many people have been using the rtl-sdr server, available free from OSMOCOM, for some time but although it is very useful, it has its limitations. One of the most serious of these is its demand for data bandwidth because it sends the full IQ bandwidth plus receiver controls over the local network. While this works well up to around 2MSPS (Mega Samples Per Second) over a wired 100Mb/s Ethernet link, it quickly falls apart if you introduce Wi-Fi or the wider internet into the link. In many cases it can be a struggle to achieve 250kSPS with any consistency. The new Spy Server from the AirSpy team offers a fresh look with a more adaptable approach to bandwidth and the ability to host multiple connections. Spy Server was first made available back in March but it has been undergoing continuous development ever since. Although it has been designed primarily to operate with the AirSpy range of receivers, it can also work with the popular and cheap DVB-T dongles so this flexibility makes it particularly interesting. Even more interesting is the fact that Spy Server is available for various OS flavours including Windows PCs, Linux and ARM-32 devices such as the Raspberry Pi and Odroid.

Spy Server on the PC

Installing on a PC is extremely simple because the Spy Server executable has been included in the standard SDR Sharp download since version 1525. If you look in your SDR Sharp program

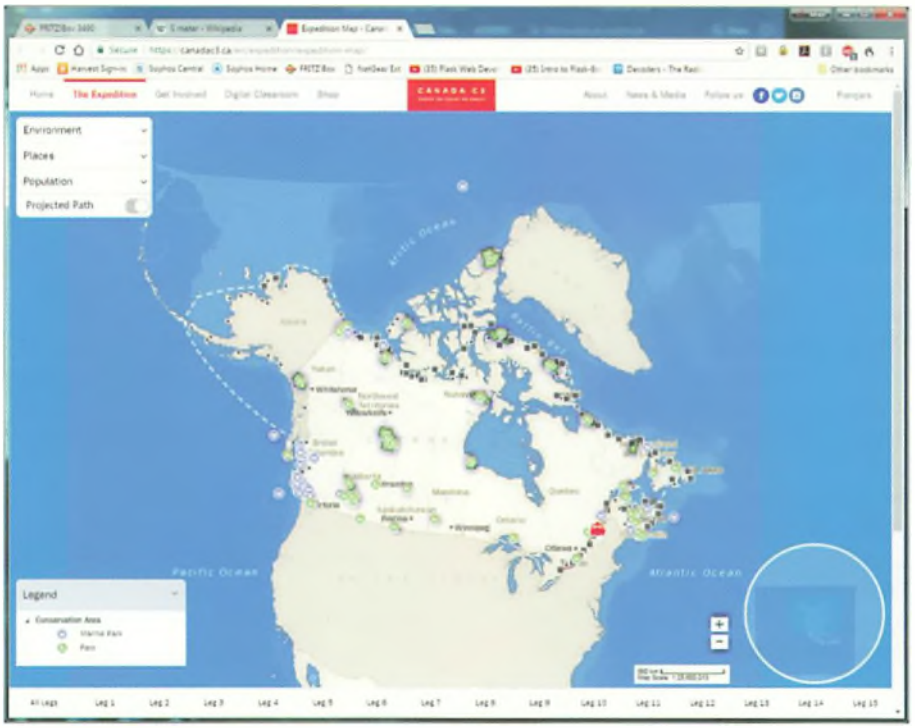


Fig. 3: Canada C3 expedition route.

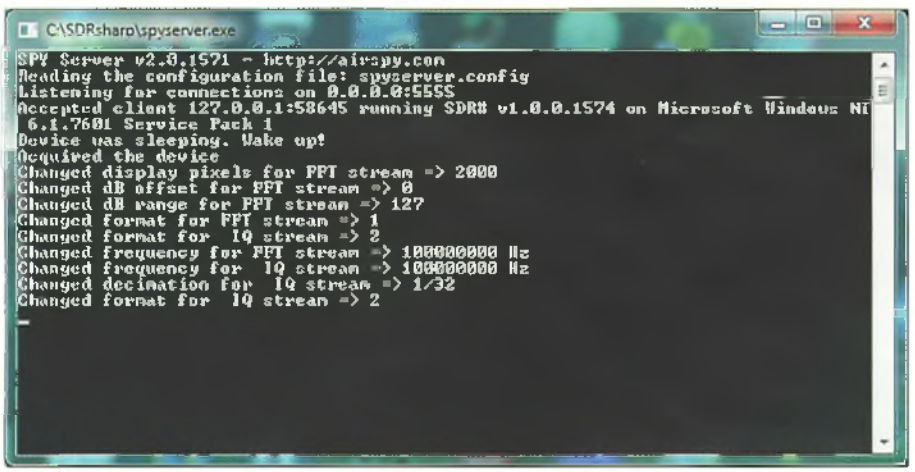


Fig. 4: Spy Server running on a PC.

files, you will see the two important files, which are spyserver.exe and spyserver.config, the latter, fairly obviously, being the configuration file for the server. Running Spy Server on the PC is, therefore, just a question of double-clicking on spyserver.exe. If all is well, you will see a command panel displayed as shown in **Fig. 4**.

Providing you're using an AirSpy receiver, that is all that's necessary to get started. To check that the server is running and fully functional, you can run SDR Sharp on the same PC as the server. When it opens up, go to the Sources panel and select Spy Server as the source. In place of the source IP address, enter 'localhost' and the port should be left at the default setting of 5555, **Fig. 5**. Press the Play button to start the receiver and you should be able to use AirSpy as normal with the full 8MHz bandwidth visible. In the Sources box you should also see the Airspy model and device serial number showing along with the current data demand. If you monitor the open command box, you will see the receiver commands being handled.

Once you're happy that the server is working properly on the host PC, you can try access from another computer on your local network. This is just a repeat of the process so run SDR Sharp on a second computer and select Spy Server as the source. However, this time, you need to enter the IP address of the PC that's running the server but leave 5555 as the port. You should then be able to start SDR Sharp and use it with the full 8MHz bandwidth providing you have a Gigabit local network that's relatively quiet with other traffic. When I've tried this on my home Gigabit network, the

SDR Sharp data demand is around 40MB/s or 320Mb/s. If you only have a 100Mb/s Ethernet, you will find that the data stutters. To help handle lower rate networks, the AirSpy team have devised a clever variable bandwidth option that only sends the IQ data you need for the IF but includes the full FFT data for the spectrum display. That way, you can still see the full 8MHz bandwidth while only taking data for the signal you're decoding. To activate this data management, you need to untick the 'Use full IQ' box in the Sources panel, **Fig. 6**. Using this technique, I was able to run my AirSpy at the full 8MHz bandwidth using a laptop connected via Wi-Fi. Checking the Source panel showed a data rate of 122kB/s or 976kb/s. This connection proved to be reasonably reliable with just the occasional stutter due to data loss. The success will, of course, depend on the speeds available from your home Wi-Fi. I use a Fritz-Box! broadband router here and I've found it to be very good. If your network doesn't support full bandwidth options, the Spy Server control panel has provision for a wide range of bandwidth right down to 15.625kHz.

The data rate flexibility bodes well for using Air Spy over the wider internet but you need to make some additional changes to achieve that. In order to access the PC running Spy Server from outside your local network, you have to configure your router to allow traffic to pass from the PC to the internet. This effectively opens a port on your public IP address so you can access Spy Server. The technique is known as Port Forwarding and you will need to check your router manual to see how to enable it. In this case you want to make port 5555 of the computer running Spy Server available to the internet. Once done, you access Spy Server from the internet using your broadband's public IP address with the port set to 5555. The bandwidth that you can use will depend on the speed you can attain over the entire link but by using the variable bandwidth option on the Spy Server, you should be able to operate over most links. I've tried it here using my mobile phone as a Wi-Fi hotspot with access to the internet via 4G. This proved to be just about usable but, again, it's all down to the overall internet speed that you can achieve.

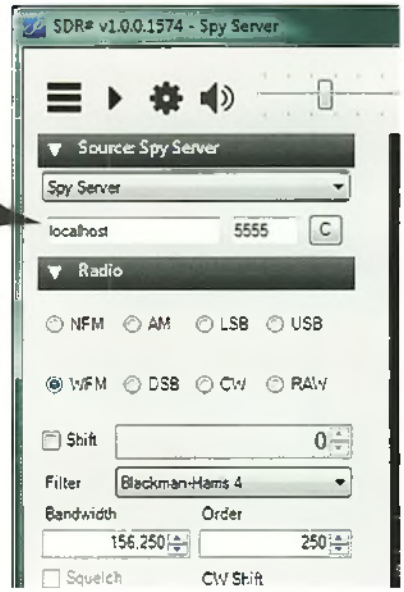


Fig. 5: SDR Sharp Source panel when testing on the same PC as Spy Server.

Spy Server on Raspberry Pi

Having Spy Server available for the Raspberry Pi is a bonus because it opens up the possibility of mounting the AirSpy plus Raspberry Pi close to the antenna with the combination fed and powered over cheap CAT-5 Ethernet cable. Getting the Pi working with Spy Server is a little more complex because you have to use the Linux command line to build some of the software. However, I've published step-by-step instructions on my website and you can find them here: http://photobyte.org/running-spyserver-raspberry-pi-3

For those that want to skip the Linux command line work, I've produced a preconfigured microSD card along with printed instructions that are available from my website: http://g4wnc.com/shop

The Pi has much less processing power than the average PC so there are a few compromises that have to be made. The first is to change the Air Spy sample rate to 2.5MSPS. In addition, it's not possible to make use of the reduced bandwidth option because the Pi processor doesn't have enough power to process the IQ and FFT data. Nevertheless, it's still a useful option if you include the Pi on a wired Ethernet network. Changing the sample rate is done by opening 'spyserver.config' in a simple text editor and removing the # from the beginning of the line: device_sample_rate = 2500000. You can also use the config file to set other useful parameters such as the start-up frequency and gain settings. Next month I'll run

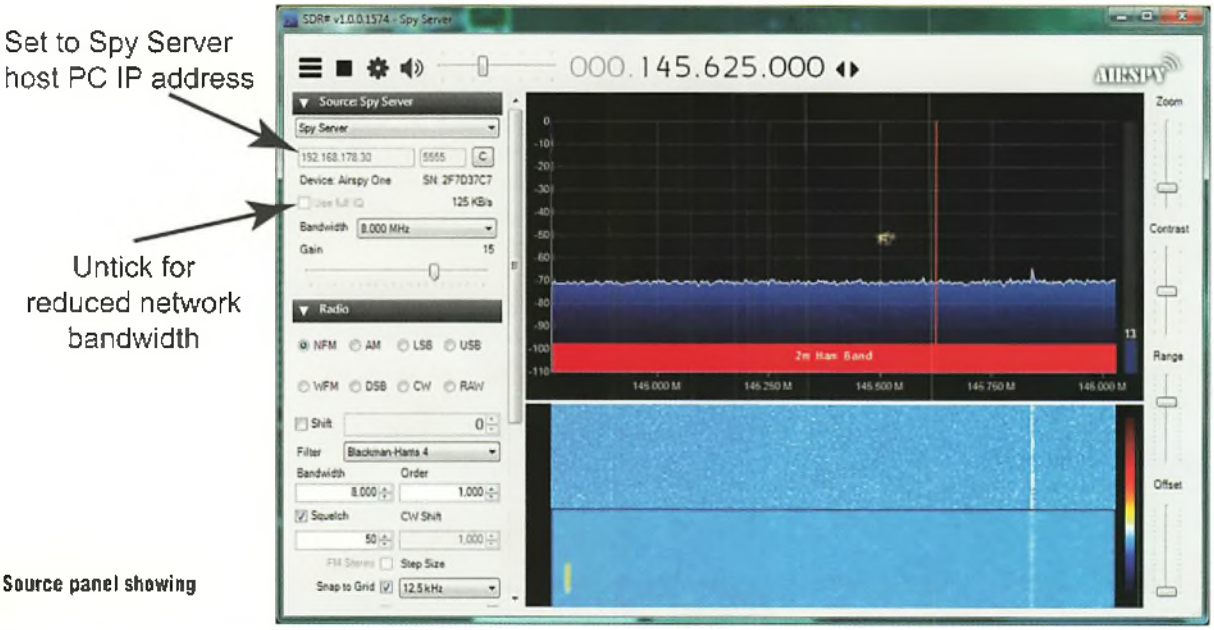


Fig. 6: SDR Sharp Source panel showing data rate control.

WANTED

GOOD QUALITY

USED EQUIPMENT

5 DONCASTER ROAD S70 1TH

CALL OUR TRADE IN HOTLINE

01226 697929

LAMCO
MY FAVOURITE HAM STORE

WWW.HAMRADIO-SHOP.CO.UK

LAMCO NORTH EAST	0191 604 0255
LAMCO SALES LINE TWO	01226 351037
LAM LONDON SALES LINE	0203 432 4414
LAM GM SALES LINE	0141 530 4077
LAMCO SOUTH WALES	01633 509 873

01226 361700

/LAMCOMMS

Willowside, Bow Bank, Longworth, Oxfordshire OX13 5ER
• E-mail: tim@g4vxe.com • Twitter: g4vxe • Facebook: www.facebook.com/worldofvhf

A Little More on Activity

Tim Kirby G4VXE has a packed column this month, resulting largely from the excellent Sporadic E activity on the 6, 4 and 2m bands.

As you'd probably expect, my comments a couple of months ago about patterns of operating attracted a variety of responses. Some agreed with my suggestion that in fact, there was plenty of activity but that it is very diverse and not necessarily evident from a quick tune across 2m FM or SSB segments of the band. Others felt strongly that it was all about FM and that we should be encouraging people to use FM more.

Club nets may have a part to play as well as wider area nets. If you or your club has a net that attracts good activity over a reasonably wide geographical area, then let me know and I'll be pleased to publish details. Perhaps folk nearby will listen out for your net and join in when they can.

If you can operate mobile safely, call CQ on 145.500MHz or your local repeater when possible. It's interesting how many people are scanning the bands and will stop and chat when they hear activity. Just last Friday, I was driving over to an appointment in the next town and heard **Dom 2E0WHQ** call on the Swindon repeater, GB3WH. I responded to him and we chatted for a while. Then **Ken G0PPM** called in briefly from South Gloucestershire and finally, **Steve GW8LGX**, mobile on the M4 called in, saying we were the first voices he had heard since leaving Swansea. I would suggest that none of these QSOs would have taken place if Dom hadn't made his original call! This is one small example but if it were repeated across a range of areas, activity would very quickly seem much greater than it does currently.

There are lots of people listening. So – if you can – call CQ from time to time rather than just listening. And if you hear someone calling, please take a moment to reply to them. Even if you are unable to stop and chat for more than an over or two, your call generates a bit more activity that others may well join.

If you read the VHF columns of *PW* or *RadCom*, you might be left with the impression that it's not possible to make use of interesting propagation on FM. Not so! I have heard a Norwegian repeater fade up out of nowhere on 2m FM and had contacts through a repeater in sight of the Mediterranean, all using a simple FM rig and antenna. If you hear something like this, drop me a note. I will be delighted to include report some details of what you've achieved. No operating mode is any less worthy than any other, despite what some might try to tell you.

So, here's to FM on VHF and the interesting contacts and propagation that we can enjoy with simple equipment and antennas. Please let me know what you work and hear on FM as well as SSB, CW, JT65 and any other mode.

(and further to the above, ***Colin Redwood G6MXL*** *talks about FM with handhelds in this month's* What Next *column - ed).*

The 6m Band

Jeremy Smith M0XVF (Spennymoor, Co Durham) worked OM3CW on May 20th while using a 6m quad made from bamboo and some flex rescued from an old Hoover. Jeremy started off with a dipole in the loft, loved the band and decided to build the new antenna. On May 21st he worked IS0BSR/P and EA3EVL on SSB.

It was good to hear from **Ron Adam GM4ILS** (Elgin) for the first time in a while, reporting a big aurora on May 28th. GM3POI from Orkney was very strong on the band.

Jef Van Raepenbusch ON8NT (Aalter) continues his 6m WSPR activity with some interesting results, including some reports of copy via Es from OY1OF (IP62) and UA1019SWL on May 23rd. Jef has also been active on JT65A running 5W. On May 23rd, he made his first contact on the mode with G0MBL (JO01), followed by many more contacts, including LY3BRA (KO14), SM7MBH (JO75), ES2IPA (KO29) and ES1JA (KO29) on May 24th. On May 28th Jef worked OF5O (KP30) and OH4SS (KP20) and then on May 30th: 9A6IV (JN95), E73DN (JN93), SV7CUD/QRP (KN11), SA2KNG (KP03) and SM3IEK (JP73). Finally, LZ1JZ (KN22) on May 31st. Jef also made some CW contacts on May 22nd, working OH6OW (KP03) and SM2EKM (KP05).

Simon Evans G6AHX (Twyning, Gloucestershire) runs 100W to a loft dipole. By the end of May, Simon had completed contacts to 19 squares all around Europe, typically at about 1500km from Twyning. The most northerly was LA1NG (JP66) on the Arctic Circle.

Kevin Hewitt ZB2GI has also been trying some 6m WSPR as well as some JT65A and on June 4th was delighted to have plenty of reports running 3W to a dipole on his balcony. ZB2TT has also been active on 50MHz JT65A, making plenty of QSOs, so there should be plenty of opportunities to work Gibraltar if you want to. Kev has also been using SSB both from the top of the Rock and from home with good results.

David Smith M0OSA caught a few Es openings over the month, working stations in JM67, JN52, JN53, JN59, JN62, JN63, JN66, JN70, JN71, JN72, JN80, JN86, JN87, JN88, JN89, JN97, JN99, JO50, JO70, JO80, KN18, KP01, KP30 and ES2IPA in KO29 for a new DXCC on 6m. David called TF3ML in HP93 but couldn't break the pile-up and also heard 4X4DK (KM71) calling him. David operates mobile, running 50W to an Outback 2000 antenna from near Huddersfield. Incidentally, if you look up TF3ML on qrz.com, you will see why his portable operations are so successful!

Mark Marment CT1FJC (Algarve) says that the 6m band is alive at last, although he feels that many of the openings have been further north and east, away from him. Mark is up to 62 DXCC countries worked since the end of March. He

was surprised to hear JA8WKE (QN02) but couldn't work him owing to QRM. Highlights from Mark's log are 4Z5ML (KM72) on May 21st, UB7K (KN85), 7X3WPL (JM13), WP4JCF (FK68), WP2B (FK77) and 4U1ITU on May 25th, 9K2GS (LL39) on May 30th, W4AS (EL95) and W3PV (EL96) on June 1st, 5A1AL on CW and FG8OJ on JT65A on June 6th.

Phil Oakley G0BVD (Great Torrington, Devon) has made a good number of contacts with the highlights being SV5IIV on June 1st and 5B4AIF (KM64) on June 4th as well as HV0A (Vatican) for a new DXCC entity.

Ernie Stagnetto ZB2FK is back on the band using his V-2000 vertical but finds that signals need to be quite strong before he is able to make QSOs.

Paul Bowen M0PNN (Newport, Shropshire) got the season off to a good start, working DG5MLA (JN58), OK2EW (JN89) and HA0NAR (KN07) on May 14th, using an FT-817 and small whip, while standing in his back garden! Paul sends a very interesting log, with the highlights being EA8AA on May 27th, OH0Z (JP90) on May 30th and EX8MLT for his 100th DXCC on May 31st. Paul was called by a JA station on June 3rd but unfortunately propagation faded. Paul worked TF2MSN (HP84) and UR3EX (KN78) on June 5th plus VP2ETE (FK88), WP2B (FK77), K1TO (EL87), K4MM (EL97) and AB4B on June 7th.

Jim Edgar GM4FVM (Eyemouth, Berwickshire) writes, "*On June 1st WP4JCF (FK68) heard me off the back of my beam when it was pointed north-east. I worked K0TPP (EM48) on June 8th. At the time European stations has mostly faded out. For many days, Japanese stations have been heard in Europe in the mornings. For example, JH3CUL was heard here on June 1st. It seems that you need to be in the right place to work them and that depends on the propagation at any given time. For me, it is good enough to watch them coming in*".

Peter Taylor G8BCG (Liskeard, Cornwall) says that he was delighted to work JT5DX (yes, Mongolia!) for a new country on 50MHz EME and was even more delighted to work YI1SAL (Iraq) on JT65 for a new country. Peter says he has worked dozens of JA stations on JT65 as well as a few on CW/SSB with some unbelievable North American openings. On June 1st, Peter managed to add an extra hop and worked TI5/N5BEK (Costa Rica). Unfortunately, Peter has suffered some damage to his array and missed some of the excellent openings in the first week in June.

Here at **G4VXE**, I have spent most of my time on JT65A, often operating remotely. Even with just a vertical antenna, it has been amazing to see what can be heard. I have logged, although not worked, YI1SAL, 9K2GS, 9K2OD, A45XR, TY2AC and PV8DX among others. To my delight, I did work WP2B as well as very many contacts around Europe and the UK.

Don G3XTT was pleased to work S01WS (Western Sahara) on the band on SSB on June 9th for a very nice one.

The 4m Band

Jeremy M0XVF reports working OK2BGW, HA6ZT and OK1TEH on the 4m (70MHz) band May 20th while using 50W and a 2-element quad.

Simon G6AHX runs 50W to a 5-element horizontal beam and 25W into an omnidirectional vertical. Simon says he caught a couple of openings, one to the Budapest area, where he worked into JO80, JN99 and KO10. On May 31st, Simon worked 9A4ZM (JN64) on 70.450MHz FM.

Ron Pincho ZB2B found a good opening on May 31st and worked 14 stations, mostly from the UK, including GU6EFB (IN89) and G0JHC (IO83).

Roger Daniel G4RUW (Newbury) is enjoying using his new Icom IC-7300 on 70MHz for the first time. His first opening was on June 1st, working 9A1Z and OK1DL as well as a number of German stations. After the event, he discovered he had been using his 7MHz inverted-vee antenna! Since that opening, he has gone on to work EA, CT, HA, S5 and OM using a 2-element delta loop for 28MHz.

Paul M0PNN has caught a few openings, the first being May 20th when he worked into HA, then SP, DL, OK and OE on June 1st, CT and S5 on June 4th and SP on June 7th.

The 2m Band

Lyn Leach GW8JLY (Cardiff) just missed the last deadline but had some interesting notes on 2m (144MHz) meteor scatter (MS). He writes, "*After many months of really poor MS conditions, things picked up with a bang from the start of May. This follows the pattern of previous years as random meteor activity is at its lowest from mid-January through to late April. At the end of April, we usually experience the April Lyrids meteor shower but as it was last year, the shower again made little or no impact on meteor activity. This was not the case, however, during the Eta Aquarids, peaking around May 5th. As usual, this shower produced very long reflections and I understand these long reflections enabled some G stations to complete contest exchanges using SSB MS with several continental contest stations. I focussed though on working stations using FSK441 and really enjoyed some massive bursts. Some of the more interesting QSOs were with SM6CEN (JO67) who only used 50W because his power amplifier was out of service. During this QSO we both saw bursts of very long duration with the final burst lasting a full minute and a half. During this shower I also worked LY5G (KO05) and SP7THR (KO10) who both used just 50W. Again, this proves that although high power and a big antenna systems help greatly with working DX, 50W to small antennas can make successful MS QSOs if the conditions are right*".

Lyn continues in his report for this month, "*there have been at least five Es openings that reached into the Cardiff area and one that came very close. The one that didn't quite get here reached as close as Newport, just 12 miles to the east of my QTH. Unfortunately, I missed the first three of these but managed to be in the shack for the last two events. On June 7th, during a very spotty 2m Es event, I worked SO3Z (JO82), SP7TEE (JO91) and UT5ST (KN28). All these stations were very strong here. I also heard EW8W in KO42 but couldn't complete a QSO because he disappeared in fading. On June 9th while stations on the east coast of England were working stations in EA8 (Canaries) that were completely inaudible here, CT1HZE (IM57) came out of the noise and I completed a QSO with Joe at 59 both ways*".

Jeremy M0XVF had been inspired by GW8JLY's videos on how to work 144MHz MS and has been operating on this mode for a while, encouraged by **Nick Peckett G4KUX**. Jeremy worked DK5DV, DL1VPL and OK1MDK on May 19th. On May 21st, he worked GW8JLY and GM4TOE on aurora.

During the aurora on May 28th, Ron GM4ILS worked SM4IVE and LA0BY as well as hearing the SK4MPI and GB3NGI beacons.

David M0OSA spent about four hours taking part in the May 144MHz contest, using his Elk 144/432MHz antenna perched on top of a short telescopic pole mounted on a camera tripod. He made 32

Fig. 1: Harry K4BAD's Elk antenna, used for working satellites.

Fig. 2: Patrick WD9EWK operating as CF7EWK/3's to work EB1AO through FO-29.

QSOs in flat condtions, with most being in the north of England, some on the south coast and very little in between. David was particularly pleased to work GI4SNA for a new country on 2m.

Jim GM4FVM writes, "*On June 7th the Es opening extended up to 144MHz. I worked three OM stations, two OK, one each of SP, HA and UR. Slovakia, Czech Republic, Hungary and Ukraine were all new countries for me on 2m and even the Polish contact was a new square for me*".

Satellites

Peter G8BCG said that he stumbled across some satellite signals at the top end of 2m recently and it put him in mind of when he last operated on satellites, when he was H44PT from the Solomon Islands. Peter has some very interesting recordings and data from his operation on Oscar 10, a satellite with an elliptical orbit and amazing coverage. Have a look at:
www.h44pt.org.uk/oscar10.htm

It was a pleasure to hear from **Harry McClellan K4BAD** who is a new subscriber to *PW*. He writes to say that he has been a 'casual satellite operator' for about three years. He uses an Icom IC7000 for the uplink and an FT-817 for the downlink. He has an Elk 2m/70cm antenna, **Fig. 1**, and a small TV rotator mounted on a tripod. The Elk is set with a fixed elevation of 22.5°, using a PVC elbow. Harry uses this setup on AO-85 and SO-50. Please keep the news coming, Harry.

Jef ON8NT attended the annual meeting of UBA (the Belgian national radio society) at the Euro Space Centre. There were three interesting presentations relating to satellites concerning OUFTI-2 and OUTFI-Next, QB50 project and MYSAT-1. Unfortunately there isn't room to include all the details here but if you're interested, you can find more information on the web. Jef worked LX6/DO2SYD/P (JN29) through SO-50 and G7SVF (IO90) and DO3WW (JO43) through AO-85.

Kelvin Crocker G1ZSE (Poole) has been continuing his satellite activity. On May 10th, while out portable, he worked GS3PYE/P through AO-85 and MU0FAL through SO-50. On May 12th he worked ON6KZ/P through SO-50 and DG0ER through AO-85, both from home. Kelvin has bought an SDR dongle to listen to the linear transponder satellites. He has also bought a specially programmed Arduino board to act as an APRS modem for the ISS and NO-84. Good luck with the projects Kelvin.

Mark CT1FJC sends an interesting log as always, with highlights being GS3PYE/P (IO65) as well as RW3XL (KO84) at nearly 4,000km through FO-29.

Patrick Stoddard WD9EWK (Phoenix) once again sends a very interesting e-mail full of activity. Patrick attended the Dayton Hamvention and planned some satellite operation around the trip as well as doing demonstrations from the AMSAT booth. After the Hamvention, Patrick wanted to take the opportunity to use the CF7 prefix for his VA7EWK callsign, so travelled into Canada. He writes, "*After leaving the hotel in Windsor, I drove about 35 miles up the 401 freeway – the long motorway that connects Detroit/Windsor to the province of Quebec, near Montreal – for my first bit of operating. A shallow, western AO-85 pass was the first chance to put CF7EWK/3 on the air and I worked several stations in the western USA from a parking lot at an exit, which was in grid EN82. I had operated from this same parking lot on a previous visit to Ontario, before the 2014 Hamvention.*

"*I only worked one pass from that parking lot, since I wanted to get to grid EN92, and possibly EN93, for the later passes. I drove about 40 miles up the 401 to another exit, in time for a group of XW-2 satellite passes. I was now in grid EN92, a few miles east of the EN82/EN92 boundary. Lots of contacts across the USA and Canada went in the log, including one between CF7EWK/3 and CG4AMU – the special prefix for VE4AMU in Winnipeg, Manitoba.*

"*After the second stop, I pressed on another 50 miles to the city of London, about halfway between Detroit and Toronto. It also sits on the EN92/EN93 grid boundary, which was my target for more passes in the evening. I found a pharmacy's parking lot that was on the grid boundary, which worked well for passes to the west, and worked a few XW-2 passes in that direction.*

"*By now, the sun was setting. I also saw that the parking lot had a horrible view to the east, which would be bad for a transatlantic FO-29 pass just after 10pm (0200UTC). I hoped to hear some Europeans, or even just one, for a chance at my first transatlantic satellite QSO from Canada. EB1AO tweeted that he would be on that pass looking for me and for* ***Ken VE3HLS*** *in northern Ontario. After a swift change of location, I was able to see down to a degree or two above the horizon and completed the SSB QSO with EB1AO,* ***Fig. 2****. I think that was a new grid for him and certainly a new grid and DXCC entity for me from Canada. A quick happy dance, followed by a stop for some dinner, before driving back to the other parking lot on the EN92/EN93 grid boundary for an ISS pass at 11pm (0300 UTC)*".

Thank you for all the news. It's been an interesting and active month as I think you can tell. Let's hope for plenty more to come – please drop me a line and let me know what you have been working and hearing.

ML&S YAESU'S OFFICIAL UK DISTRIBUTOR

ML&S - the world's favourite *original* ham store

ML&S 0345 2300 599

Web: www.HamRadio.co.uk

SAFE ONLINE SHOPPING
Shopping online with ML&S is safe and secure. E&OE

PayPal

FOLLOW US ON TWITTER AND FACEBOOK HamRadioUK

Martin Lynch & Sons Ltd. Wessex House, Drake Avenue, Staines, Middlesex TW18 2AP. E-mail: **sales@hamradio.co.uk**
Opening Hours: Mon - Fri: 8.30am to 5pm. Sat: 9am to 4.30pm. International Tel: +44 1932 567 333

YAESU FTdx9000MP

click! www.HamRadio.co.uk/ftdx9000

ML&S FROM £8299.95

MP: £8499.95
MP+: £9299.95
D: £7499.95

The ultimate machine in the FTDX-9000 range, the MP offers an incredible 400W transmission power and is supplied with the FPS-9000H external power supply with dual speakers and audio filters. Like the Contest, the MP is fully customisable to suit your own particular needs.

YAESU FTdx3000

click! www.HamRadio.co.uk/ftdx3000

HF/6m Base Station

Looking for a HF/6m Base Station sized radio at a VERY LOW PRICE?

ML&S: £1339.95

NEW YAESU FT-991A

Compact base station radio with beautiful touch-screen display & 160-70cm coverage. HF/50/144/430MHz. All-Mode "Field Gear" Transceiver

Offering superb performance from Top Band to 70cm, the FT-991a is compact without being too small, easy to use without missing out on features and above all great value for money.

click! www.HamRadio.co.uk/ft991a

ML&S NOW ONLY £1189.95

FT-991 HARDWARE UPGRADE KIT This Upgrade kit allows Yaesu Musen Distributors and Repair Service Centres to add the following advanced features of the FT-991a to the original FT-991: Real-Time Spectrum Scope, Multi-Colour Waterfall Display, Select from Seven Spectrum Scope Display Colours & Select from Seven Display Colours or Multi-Colour Waterfall Display. The kit can only be fitted by our workshop. **ML&S ONLY £480.**

YAESU FTdx5000MP LTD

click! www.HamRadio.co.uk/ftdx5000mp

HF/50MHz 200W Transceiver Twin RX

ML&S NOW ONLY £3199.95

YAESU FTdx1200

HF/6m Base. Sister Rig to FTdx3000

Can't quite stretch to the FTdx3k? No worries! The ever dependable FTdx1200 is available at a special price still less than £1000.

See ML&S video review
www.HamRadio.co.uk/ftdx1200video

ML&S NOW ONLY £929.95

click! www.HamRadio.co.uk/ftdx1200

YAESU FT-891

HF/6m Base/Mobile

A modern day FT-857 without 2&70. Bang up to date in looks and smaller than a 2m only FM rig of 25 years ago!

click! www.HamRadio.co.uk/ft891

ML&S NOW ONLY £599.95

YAESU FT-450D

The best value HF/6m Base with ATU on the planet.

~~ML&S: £650.95~~
NOW £599.95

click! www.HamRadio.co.uk/ft450d

YAESU FT-70DE

NEW PRODUCT

click! www.HamRadio.co.uk/ft70de

The FT-70DE is a 5W rugged designed (meets IP54) handie, covering 108-137MHz Airband AM and 2/70 transceive on FM/C4FM Digital. A massive 700mW of audio ensures extra-loud volume with Clear Voice technology. **ML&S: £189.95**

YAESU FT-65E

VHF/UHF 2m/70cm Dual Band FM Handheld

click! www.HamRadio.co.uk/ft65e

The Yaesu FT-65e dual-band 2 metre/440MHz has three output power levels: 5, 2.5 or 0.5 watts. Receive coverage is 65-108 (FM broadcast band), 136-174 and 400-500MHz. The FT-65e is compact and light, yet ruggedly constructed. The speaker provides a full 1 Watt of powerful, clear audio.
ML&S: £129.95

YAESU FT-1XD

LIMITED STOCK!
144/430MHz Dual Band C4FM Handie.

Great quality from Yaesu with a really solid feel.

MLS& Only £219.95

click! www.HamRadio.co.uk/ft1xd

YAESU FT-857D

click! www.HamRadio.co.uk/ft857d

Want to work HF mobile? Thousands of Hams around the world use the FT-857D. 160m-70cm, add the optional ATAS-120D to your car and you have an instant HF station on 4 wheels. We even include the YSK-857 remote kit for mounting FREE.

Only £689.95 or with an ATAS-120A Auto-tune antenna only £959.95

YAESU FT-2DE HANDHELD

Advanced FT-2DE C4FM/FM 144/430MHz Dual Band Digital Handie.

ML&S: £399.95
FREE SHC-24 CARRY CASE

Large LCD display

click! www.HamRadio.co.uk/ft2de

YAESU FTM-400XDE

With FREE Snapshot Microphone (MH-85A11U) worth £99.95!

ML&S: £499.95

Large Colour Touch Screen Display

click! www.HamRadio.co.uk/ftm400dxe

YAESU FT-8900E

High-power FM on 10m, 6m, 2m & 70cm. When your local repeater is busy, slip onto 10m & work DX!
ML&S: £269.95

FREE YSK-8900 Remote Kit

click! www.HamRadio.co.uk/ft8900e

YAESU FTM-3200E C4FM 2M TRANSCEIVER

65Watt 144MHz with AMS 2m Mobile.
ML&S: £189.95

With new digital C4FM (Fusion).

click! www.HamRadio.co.uk/ftm3200

FAST DELIVERY

You can now order from ML&S for delivery on a Saturday or Sunday!
Order before 3pm as late as Friday of each week and see it delivered at the weekend.

Web purchases: Just select Saturday or Sunday at the check-out or call to place your order for Saturday or Sunday delivery on **0345 2300 599**

DPD

ML&S NO.1 FOR BHI NOISE CANCELLING

ML&S 0345 2300 599
Web: www.HamRadio.co.uk

SAFE ONLINE SHOPPING
Shopping online with ML&S is safe and secure. E&OE
PayPal
FOLLOW US ON TWITTER AND FACEBOOK HamRadioUK

Martin Lynch & Sons Ltd. Wessex House, Drake Avenue, Staines, Middlesex TW18 2AP. E-mail: **sales@hamradio.co.uk**
Opening Hours: Mon - Fri: 8.30am to 5pm. Sat: 9am to 4.30pm. International Tel: +44 1932 567 333

Designed and Built in Great Britain

bhi Hear those weak signals with a bhi DSP noise cancelling product!

NEW

NEW! PARAPRO
See full page advert inside back cover

NES10-2 MK3
Amplified DSP Noise Cancelling Speaker
Please see web for price.

- 5W input & 2.7W audio
- Headphone socket
- 8 filter levels
- Rotary filter select knob

DSPKR - 10W DSP Speaker
Easy to use - Sleep mode

- Filter level select & store
- Separate volume control
- Input overload LED
- Headphone socket
- Supplied with manual and fused DC power lead

NEIM1031 MKII
Fully featured Amplified Noise Eliminating In-Line module

- 2.8 W audio - Audio & line level inputs/outputs
- 50 Hz to 4.5KHz bandwidth
- 12 to 24V DC, 500mA
- Headphone socket
- Separate input level & volume controls
- 8 filter levels 9 to 35 dB

Dual In-Line
Dual Channel DSP noise eliminating module

- Suitable for all radios, receivers and SDR
- Mono or stereo input & output options
- 7 watt mono audio output, line out and headphone out
- Ideal for DXing, special event stations and field day events
- New improved noise cancelling!

Click! www.HamRadio.co.uk/bhi For Prices

DESKTOP
Amplified DSP base station speaker - 10 Watts audio

- Separate volume and filter level controls - 8 DSP filter levels
- Speaker level and line level input - Sleep mode
- Easy to use
- Size 200(h)x150(d)x 160(w)mm
- Supplied with manual, audio lead and fused DC power lead

New Compact In-Line

- Compact DSP noise cancelling module with new improved DSP algorithm giving even better noise elimination
- Easy to use with mono/stereo or two channel inputs
- Use mobile or in the shack
- Over 40 hours battery life from 2 x AA batteries or use 12V DC input
- Size: 121x70x33mm

HELITRON DV4MINI USB STICK FOR D-STAR AND DMR

DV4mini is a tiny but powerful USB stick that can change any PC into a HOTSPOT for the modes D-Star and DMR (C4FM Fusion is being prepared). It contains a powerful 32-bit micro controller as well as a complete 70cm transceiver and modulator/demodulator for GMSK and 4FSK (including raised cosine) as well as a USB interface.

NOW AVAILABLE IN 2M

ONLY £104.95

Click! www.HamRadio.co.uk/dv4mini

SHARKRF OPENSPOT STANDALONE DIGITAL IP GATEWAY & HOTSPOT

SharkRF

Supports DMR (Brandmeister, DMRplus), D-Star (DCS, REF/DPlus, XRF/DExtra, XLX), System Fusion (FCS, YSFReflector) networks.
More supported networks and features will be available with new firmware releases. Supports cross modem modes. Talk with your C4FM radio on DMR, and with your DMR radio on System Fusion networks! Very easy to use, works without a computer. No additional hardware required, works out of the box. All accessories included. Web interface for configuration and monitoring. Custom 2FSK/4FSK RF protocol support with TDMA. USB powered, low energy consumption, 20mW RF output. Runs fully embedded software written in pure C, running on an embedded real time operating system. No Linux, bulky Windows software or failing SD cards!

ML&S are the UK Distributor for this product. **ONLY £209.95**

Click! www.HamRadio.co.uk/openspot

RF EXPLORER 3G COMBO HAND HELD SPECTRUM ANALYSER

Up until now the RF enthusiast have had to limit themselves to cheap "RF Power Detector/ Frequency counter" devices. But these are limited to display data for a single point of maximum power, and traditionally power metrics are too unreliable, in the order of 20dB or even 30dB inaccuracy. In contrast, a spectrum analyser like RF Explorer will display full frequency spectrum in the band, including carrier and modulated shape, it will display Spread Spectrum activity, if that exists, and will show bandwidth to monitor collisions, frequency deviation from expected tone, etc.

ML&S PRICE: £209.95

Click! www.HamRadio.co.uk/rfexplorer

LATTE PANDA - 4G/64GB WITH WINDOWS 10 INSTALLED

THIS IS A COMPLETE KIT (not just a bare board)! All you need to get up and running. This kit requires the download of a Windows key on set up (within 90 days - it will work out the box). LattePanda is the first development board that can run a full version of Windows 10! It is turbocharged with an Intel Quad Core processor and has excellent connectivity, with three USB ports and integrated WiFi and Bluetooth 4.0. It also includes an Arduino co-processor that enables you to master the physical world by controlling interactive devices using thousands of plug and play peripherals. Harness the power of LattePanda to create and innovate!

KEY FEATURES
- *Full Windows 10 OS*
- *LattePanda is different from the Raspberry Pi and other development boards as it supports a complete Windows 10 system. With abundant software resources and a mature Windows ecosystem at your disposal, LattePanda gives your ideas more accessibility and power!*

RRP: £229.95
ML&S PRICE: £199.95

Click! www.HamRadio.co.uk/lattepanda

mRS MiniVNA Antenna Analysers

Perfect for checking antennas and RF circuits for hams and commercial users.

MiniVNA Pro with Bluetooth 100kHz-200MHz £329.95
MiniVNA Extender For Pro only, extends range to 1500MHz £299.94
MiniVNA Tiny Huge coverage, 1MHz-3GHz. Android controllable ..... ONLY £389.95

Click! www.HamRadio.co.uk/minivna

MyDEL Sark110 Vector Impedance Antenna Analyser

Pocket-sized Antenna Analyser providing fast and accurate measurement of vector impedance, VSWR, vector reflection coefficient, return loss, and R-L-C (as series or parallel equivalent circuits). Typical applications include checking and tuning antennas, impedance matching, component test, cable fault location, measuring coaxial cable losses, and cutting coaxial cables to precise electrical lengths.

ONLY £329.95

Click! www.HamRadio.co.uk/sark110

MS-5 HANDS FREE MIC

Looking for a hands-free mic for your car that actually works?

The MS 5. A safety microphone for mobile or base use that really is "plug & play". Available for most Icom, Kenwood & Yaesu Radios.

ONLY £39.95

Click! www.HamRadio.co.uk/ms5

ML&S NO.1 FOR NEW PRODUCTS

NEW

New! Four Lovely Miniature Mobile Radios that are so tiny (and cheap!) you won't believe just how well made they are.

MyDEL **AT-788U**
70cm 18W 199mems, CTCSS/DCS
£59.95

MyDEL **AT-788V**
2m 18W 199mems, CTCSS/DCS
£59.95

MyDEL **AT-778VU**
Twin Band 2/70, 30W 250mems, full feature
£89.95

MyDEL **Apollo11**
CB or 10m Band 15W 12/24V
£79.95

UK'S NO.1 CHOICE FOR KENWOOD & ICOM

ML&S OFFICIALLY THE UK'S NO.1 DEALER (AGAIN) KENWOOD

NEW

KENWOOD TH-D74E

Dual Band Handie with unique APRS, D-Star & HF SSB receive coverage.

ML&S PRICE: £599.95

Click! www.HamRadio.co.uk/thd74e

KENWOOD TS-590SG HF/6M TRANSCEIVER

ML&S PRICE: £1239.95

The best-selling HF transceiver just got even better.

160-6M BASE WITH ATU

Upgraded version HF & 6M FULL DSP Base Transceiver

Click! www.HamRadio.co.uk/ts590sg

KENWOOD TH-D72E

2/70 HANDIE WITH GPS+TNC

WAS £379.95

NOW ONLY £299.95. LAST FEW!

Click! www.HamRadio.co.uk/thd72e

KENWOOD TS-990S

HF+6M FLAGSHIP

RRP: ~~£5999.95~~ £CALL

200W HF/50MHz Base Station Transceiver with Dual TFT Display and Dual Receiver.

CANCELLED ORDER (UNOPENED BOX) FULL WARRANTY £4999.95

Click! www.HamRadio.co.uk/ts990

ICOM

Click! www.HamRadio.co.uk/ic7300

ICOM IC-7300 ML&S: £1199.95

100 Watt · HF/50/70MHz TRANSCEIVER with SSB / CW / RTTY / AM / FM

The IC7300 sports HF+6m+4m coverage, it's 100W, houses an eye-catching touchscreen TFT display and includes an internal antenna tuner.

NEW ICOM ID-4100E

Very first D-Star 2/70 mobile radio with built-in terminal mode/ access point.

COMING SOON! PRICE TBC

NEW

Click! www.HamRadio.co.uk/id4100

PLACE A £25 DEPOSIT NOW TO SECURE ONE OF THE FIRST UNITS.

The ID-4100 makes using DSTAR more fun and more comfortable thanks to the terminal mode/access point mode for the first time in mobile devices. This feature enables DSTAR via the Internet from any location you do not have access to a DSTAR repeater.

NEW ICOM IC-R8600

COMING SOON!

New 100kHz-3GHz Receiver with SDR technology from IC-7300.

*** PLACE A £100 DEPOSIT NOW TO BE ONE THE FIRST IN THE QUEUE! ESTIMATED PURCHASE PRICE TO BE AROUND £2500.***

Click! www.HamRadio.co.uk/icr8600

ICOM IC-7600

Mid-range HF base station.

Last few in stock. 3-Year Warranty, only £2229.95. Generous Part-Ex Deals!

Click! www.HamRadio.co.uk/ic7600

NEW ICOM IC-7610 COMING SOON! PRICE £3599.95 TBC

NEW

The Icom IC-7610 is a complete redesign of the former IC-7600 following on from the huge success of the IC-7300. 100W, Dual band receive, Huge widescreen display. Delivery schedule is hopefully June/July 2017.

For more information with prices

Click! www.HamRadio.co.uk/ic7610

ICOM IC-273D DUAL BAND MOBILE ML&S £289.95

A practical easy to use Dual Bander with remote head.

FREE MBF-4

Click! www.HamRadio.co.uk/ic2730

ICOM ID-5100 ML&S ONLY £574.95

Latest 2/70 D-Star Touch Screen Transceiver from Icom. Bluetooth connectivity and second station control through an Android device.

Click! www.HamRadio.co.uk/ic5100

ICOM IC-7851 IN STOCK NOW!

Built to order like its predecessor, the new IC-7851 is set to be a master-class transceiver of the highest order. Based on the Limited production run and very exclusive IC-7850, the IC-7851 is available today to order. Top prices paid on all trade-ins.

Last few! IC-7700 200W base. Call Sales Now! 3-Year warranty included.

Click! www.HamRadio.co.uk/ic7851

ICOM IC-9100 ML&S NOW ONLY £2799.95

HF through to 23cms Base Transceiver.

UX-9100 23cm Module £623.99
UT-121 D-Star Board £180.00
FL-430 6kHz Roofing Filter £60.00
FL-431 3kHz Roofing Filter £60.00
Or Plus 4 Pack with all 4 options. Only £3649.95

Click! www.HamRadio.co.uk/ic9100

ICOM IC-7100 ML&S: £1099.95

HF/6/4/70 Base & Mobile Transceiver with remote control head unit.

Click! www.HamRadio.co.uk/ic7100

WOUXUN

WOUXUN HANDIE, KG-UV9D PROPACK ONLY £154.95

- KG-UV9D Transceiver
- Two batteries
- Two belt-clips
- Software and transfer data cable
- Fast charger dock and power supply
- Hand speaker mic
- Battery eliminator
- Manual
- Wrist strap
- Leather case
- In-car charger
- SMA-PL259 adaptor
- Hands-free kit

Click! www.HamRadio.co.uk/kguv9dpropack

WOUXUN KG-UV950PL NOW WITH 4M! ONLY £289.95

Includes FREE programming cable and software for only £289.95.

Up to a full 50W output on 4m, this unique QuadBand mobile/base from Wouxun exclusive to ML&S. Bands covered are 4m / 5m / 2m / 70cm.

Click! www.HamRadio.co.uk/kguv950pl

WOUXUN KG-UV950P ONLY £239.99

Quad band heaven!

Same as above, but bands covered are 10m / 6m / 2m / 70cm

Click! www.HamRadio.co.uk/kguv950

MD-380 DMR HANDIE FROM TyT

RETURN OF THE CLASSIC! £99.95

Simple to use, bomb-proof performance DMR 70cm Handie. In stock now! MD-390 also available.

Click! www.HamRadio.co.uk/md380

LOOKING FOR COMMERCIAL GRADE DMR FROM YOUR FAVOURITE STORE?

Hytera

Hytera AR-685
Handheld UHF, FM, DMR, GPS.
1 watt / 4 watt inc. PC45 cable and UK code plug.
£299.95

PD-685G 70cm, Small, lightweight & slim this version has GPS fitted. **£499.95**

PD-785 Rugged version, Large TFT Display etc. **£419.95**

MD-785G Base or mobile with GPS. **£399.95**

X1P Ultimate DMR Handie. GPS & Bluetooth. **Price from £629.95**

Click! www.HamRadio.co.uk/hytera

NEW MINI-APRS-TRANSCEIVER PICOAPRS WITH GPS RECEIVER (KIT)

The World's smallest APRS transceiver with TNC offers many applications. Matchbox-sized, built-in GPS receiver.

The transceiver can not only be used as an APRS tracker and receiver for APRS data, but also as TNC (KISS protocol) for computer. **£169.95.**

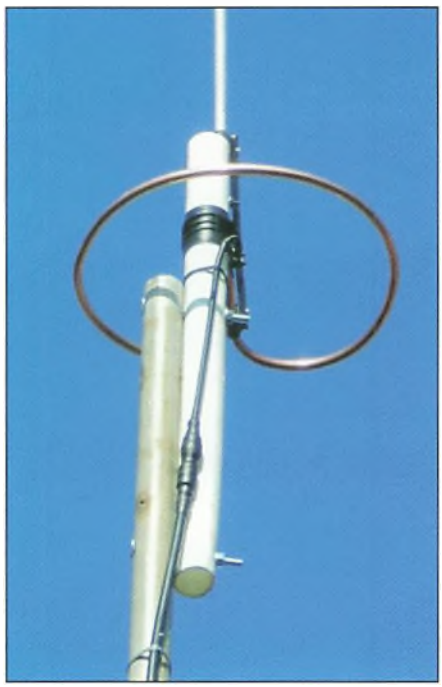
Click! www.HamRadio.co.uk/miniaprs

ML&S NO.1 FOR SDR RADIO, ACCESSORIES, NEW PRODUCTS, AMPLIFIERS, AUTO TUNERS & MUCH MUCH MORE

• E-Mail: g3zse1@gmail.com

An Effective 5/8-Wave Antenna for the 4m Band

John Adams G3ZSE returns with another antenna-related project. This time it's a handy vertical antenna for the 4m (70MHz) band.



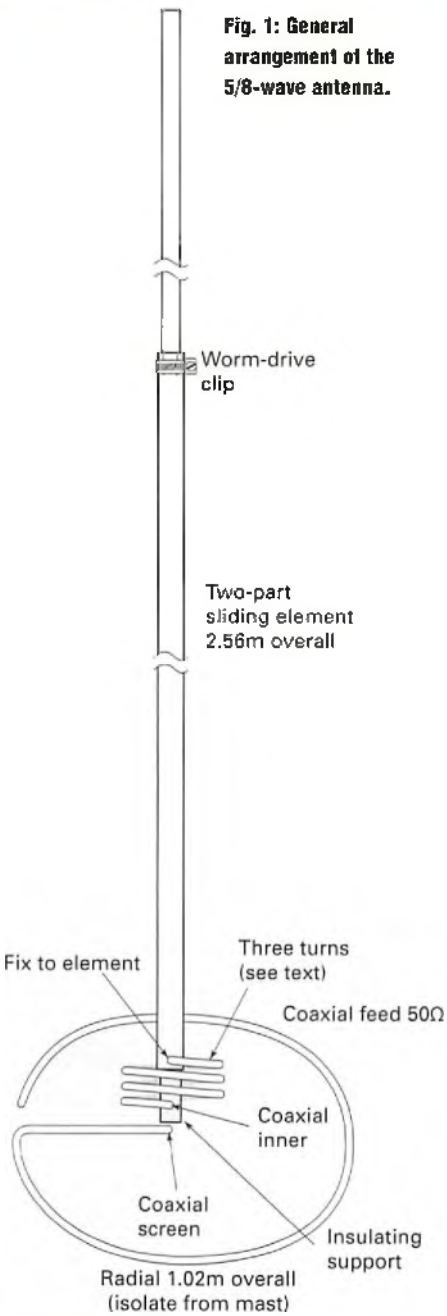


Fig. 1: General arrangement of the 5/8-wave antenna.

The 5/8-wave antenna has been around for a long time – first on HF and then on VHF and UHF. It is easy to match to 50Ω and has good low-angle radiation when mounted vertically. I built the one described here from simple materials and with modest tools, and have had very good results. It is straightforward to make but does involve some dexterity along the way! The general arrangement is shown in **Fig. 1**.

Theory and Practice

The basic VHF antenna is a half-wave dipole, with the current maximum at the centre. This is also the point where the maximum signal occurs. The dipole can be centre-fed from a 50Ω source. However, it's handy to feed vertical antennas from the bottom. Trying this at VHF with a half-wave results in an impedance of hundreds of ohms, which can be trickier to match. So the ¾-wave antenna came into being, which is easier to match again, and can be fed like a quarter wave against a ground plane or radials. The ¾-wave keeps the main current maximum high up. If you use 5/8-wave, half-way between a half and a ¾-wave, you get the same high current maximum but also a better low-angle radiation pattern while achieving a feedpoint impedance not far from 50Ω. In fact, the resistive part of the impedance is near to 50Ω, leaving a small amount of capacitance to tune out. I have looked at theoretical assessments of the inductance needed to do this as well as looking at other designs, including those that recommend winding 1/8-wave of wire into an inductor. In practice, I have built a number of 5/8-wave antennas over the years and always found it better to find the best inductance by trial and error. I did it here, and the coil described gives excellent matching. It could be a fraction of a turn smaller but an adjustment in length of the antenna element by a centimetre

Fig. 2: Suitable plastic waste pipe.

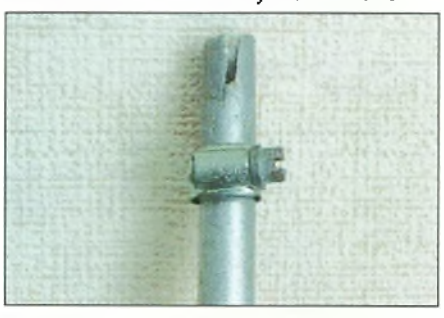


Fig. 3: Clamping one tube inside the other.

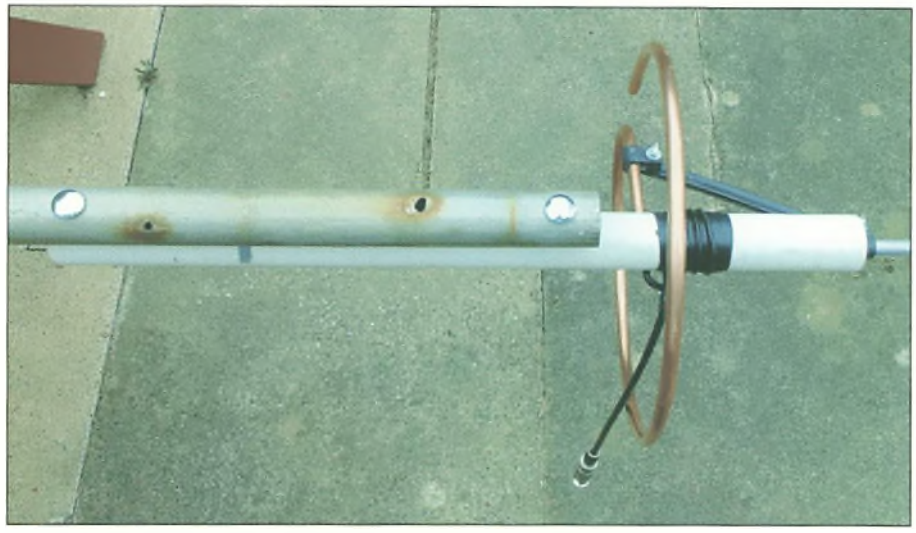


Fig. 4: Coach bolts are used to clamp the aluminium mast to the plastic pipe.

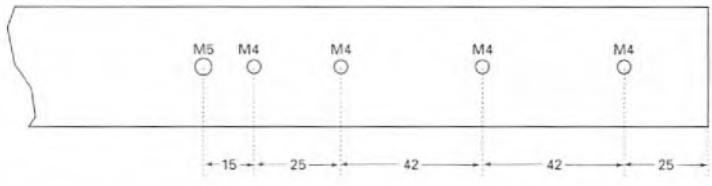


Fig. 5: Rough dimensions (in mm) for drilling.

or two compensated easily. I chose to use a single quarter wave radial and to form this into a circle. This is the minimum that can be used as a ground plane or counterpoise. The circular design means that the visual impact is fairly low and the antenna can be manoeuvred into position on a mast quite readily. Note that the radial is insulated from any metal supporting mast.

Main Materials

The antenna is built around a length of 40mm waste pipe, **Fig. 2**. I had some, but it is cheap, or you may be able to beg an offcut of around 0.5m from a plumber. Note that this needs to be thick-walled (around 2 to 3mm) so that there is enough mechanical rigidity. Staying with plumbing, the radial is made from 10mm outside diameter microbore central heating tube. It is fairly low cost and can be bought from DIY outlets in 10m coils. This is a lot more than you need but this tube is very handy for other antenna projects too. The main element needs to be adjustable in length and is formed from two aluminium tubes, with one being a sliding fit inside the other. The inside diameter of the larger tube is 10mm. The aluminium tubes need to be about this size because the length-to-diameter ratio of the element will impact the actual element length needed. If, like me, you are re-using aluminium from old antennas (such as CB ones), then clean the aluminium up using wire wool. The top end of the lower part of the element will need to have a slit in it, so that the finished element can be clamped together with a standard worm-drive clip, **Fig. 3**.

The coil is constructed from 2mm diameter enamelled copper wire. Wire of about this thickness needs to be used or the RF resistance will be too high. Various nuts, bolts and washers are used, and these are 'bright plated' finish or if you have stainless steel, that would be even better.

Construction

The exact length of plastic pipe needed will depend on how you intend to mount it to a mast. For simplicity and lightness, I chose to use coach bolts, **Fig. 4**. My pipe is 540mm long. The diagram, **Fig. 5** shows approximate dimensions relating to drilling holes but these are not critical. Drill the plastic tube first because it can be awkward to position holes exactly, **Fig. 6**. Then drill the holes in the lower half of the element to match the holes in the tube, **Fig. 7**. Next construct the radial. Start by cutting a length of copper tube to 1020mm. Tip: Cut a piece of wire to this length and tape it to the copper first. A small pipe-cutting tool is ideal and leaves a nice finish but it's fine to use a hacksaw. De-burr the ends with a de-burring tool or a file. Flatten about 15mm of one end, either with a large vice or a club hammer. Drill a 5mm hole close to the end. Form this length into a rough circular shape, **Fig. 8**. Take time to do this well – the critical thing is to end up with the hole near the centre of the 'circle', with the hole in the right plane to allow fixing to the plastic tube. The exact shape isn't really critical.

Next, make the coil. Start by cutting a 390mm length of the 2mm wire. Scrape off 10mm of enamel from one end and use fine abrasive paper to ensure it is 'clean'. Crimp an eyelet on and solder it as well.

Fig. 6: Drilling the plastic pipe.

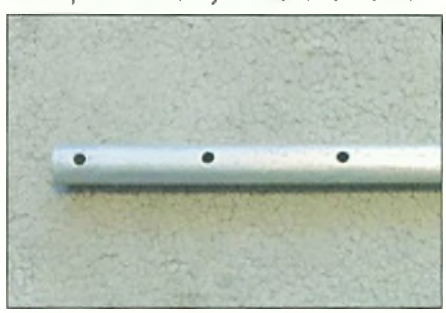


Fig. 7: Drilling matching holes in the aluminium.

Materials Used

Plastic waste pipe approx. 540mm long, 40mm outside diameter (thick wall).

Copper tube 1.02m long and 10mm outside diameter

Aluminium tube approx. 1.5m long and 10mm inside diameter, and worm-drive clip to fit.

Aluminium tube approx. 1.3m long and 10mm outside diameter, and plastic cap to fit.

Enamelled copper wire 390mm long and 2mm diameter.

RG8 Mini coaxial cable approx 0.5m long.

PL259 connector and female-to-female adaptor.

Plastic material for brace (see text).

2 x SWA cleats, size 5.

4 x eyelets (M4 clearance).

General hardware: Various nuts, bolts, plain and spring washers – mostly M4 (one M5).

Mast hardware: 2 x 100mm long M8 coach bolts, washers nuts – or as appropriate.

Miscellaneous: Self-amalagamating tape, varnish, feedpoint sealant, cable ties.

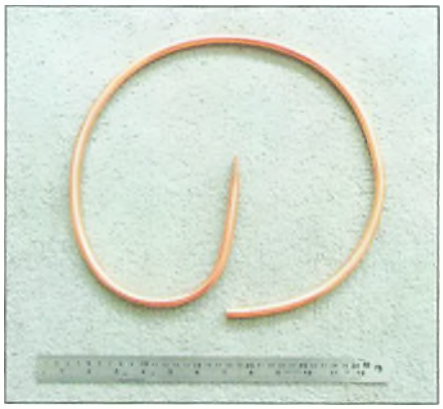


Fig. 8: The radial, formed from copper tubing.

Fig. 9: The matching coil.

Fig. 10: The base of the antenna – the matching coil can be seen wound around the plastic pipe.

Fig. 11: The hanger.

Fig. 12: The brace.

Fig. 13: Coaxial assembly for the feedpoint.

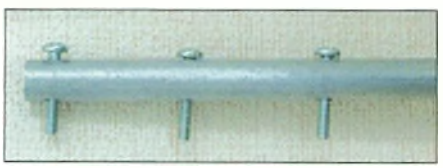


Fig. 15: The lower part of the element with bolts in place, ready for assembly.

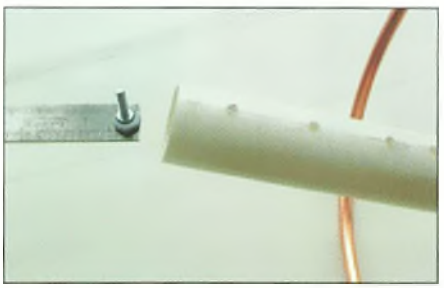


Fig. 14: How to insert the M5 bolts from inside the tube!

Fig. 16: The lower part of the antenna prior to final weatherproofing.

See **Figs. 9** and **10** for what you need to achieve. Form a three-turn coil around the pipe, between the two M4 holes that are 25mm apart. Now you can see where exactly to cut the second end so that the coil will fit nicely in place with the second eyelet on. Check your measurement before cutting the wire! Fit the second eyelet, as the first, and ensure that the two eyelets are aligned so that they fit nicely against the pipe. Clean any flux off of the eyelets.

To stop the radial moving (under the weight of a well-fed pigeon, for example!), fabricate a brace from any suitable piece of plastic, **Figs. 11** and **12**.

I used a small hanger from some clothes packaging. It will need to be around 200mm long.

Finally, make a short (around 0.5m) coaxial cable assembly from RG8-Mini or similar, **Fig. 13**. One end should have a PL259 plug (or an inline socket) and the other two eyelets that have been crimped, soldered and cleaned of flux.

Main Assembly

First fit the radial, using a ruler and Blu Tack, as shown in **Fig 14**, to position the M5 bolt. Fit a plain washer, the radial, a spring washer, another plain washer and a nut. Tighten the nut. Now fit the lower coil bolt using just a nut, and tighten. Next fit the coil in position and fit a nut on its lower connection. Put three bolts in the lower part of the element, **Fig. 15**. The element can then be fitted inside the tube, with the bolts protruding through, one of which secures the top end of the coil. Fit plain washers to the upper two bolts and three nuts to secure the element and coil in place. Ensure all nuts are tightened. The assembly so far sounds more complicated than it is – just don't rush it. Next attach the coax assembly to the antenna. Fit the eyelets over the lower coil point and radial bolts, followed by plain washers and nuts and tighten.

Fitting the Brace

You need two plastic P-clips or similar. I used size 5 SWA cable cleats, designed to go round about 13mm. The exact length of the brace will depend on the shape of your radial. Again, see Fig. 10. This shows how the clips are fitted with the brace – you will need to drill holes in the brace as appropriate. It's likely that you will need some thin rubber or some tape to make the clips a snug fit on one or both of the element and radial.

Performance

The VSWR across 70 – 70.5MHz should be less than about 1.3, with a figure near 1.0 mid-band. The power rating, assuming that the coaxial connections are sound, should be fine up to 100W.

Testing and Installation

For installation and testing, once again, see Fig. 10. Set the overall element length to 2.56m and tighten the worm-drive clip. Position the antenna in a reasonably clear spot on a short mast. My 'test range' is a short mast inserted through the picnic bench in the middle of the patio. This gets the base of my test antennas up at around 2.5m. Measure the VSWR at around 70.250MHz. Do this on low power with a transmitter or with an antenna analyser if you have access to one. If the VSWR is very close to 1.0:1, then no further adjustment is required. It is more likely that at first it will be a little higher. In that case, look at the VSWR at the band edges. If it is lowest at the bottom of the band, then shorten the element, and if lowest at the top of the band, lengthen the element. Do this 10mm at a time and note the VSWR readings. When you are satisfied, then the antenna is ready for weatherproofing.

Weatherproofing

How you go about weatherproofing the antenna will depend to some extent on personal preference and what you have to hand. I used a little varnish over the lower three bolt connections, for the radial and coil (remove the coaxial cable for this). Also, I applied some varnish to the back of the lower element bolt (inside the plastic tube) because this too is a connection. After this was dry I used liquid rubber feedpoint sealant from InnovAntennas, available on eBay and elsewhere. I applied this on all the nuts. When dry, I reattached the coaxial cable and added more over those connections (take care to keep the actual contact surfaces clean of any proofing!). Finally, layers of self-amalgamating tape were used. The photo, **Fig. 16**, shows the antenna prior to painting the liquid rubber on the feedpoint and adding the final self-amalgamating tape.

Make sure that there is no chance of water getting into the coaxial cable. Also, if an in-line connection is used (as shown) then use self-amalgamating tape over the connectors. Further, tape over the worm-drive clip and either fit a plastic cap to the antenna top or use a piece of blanking material and self-amalgamating tape to seal it.

Mounting on a Mast

Don't forget to use appropriate strain relief, such as cable ties, to ensure that the weight of coaxial cable isn't pulling on the antenna connections. Also, use pliers to 'nip up' the PL259 connectors quite tightly, prior to applying the self-amalgamating tape.

Some Notes for Experimenters

The basic design presented here could be adapted for other mechanical implementations, depending on your mechanical skill and workshop facilities. If you try out straight radial(s), then some adjustment of the coil and/or the element length may be required. It is also possible to have the radial electrically connected to a metal mast but, again, it may need adjustment of the coil and element length.

c/o PW Publishing Ltd, Tayfield House, 38 Poole Road, Westbourne, Bournemouth BH4 9DW
E-mail: teleniuslowe@gmail.com

Wireless Telegraphy Manual 1917

Steve Telenius Lowe PJ4DX takes us back 100 years into history through the pages of the 1917 Navy Wireless Telegraphy Manual.

Fig. 1: Despite faded covers the 100-year old book is in remarkably good condition.

Some years ago I paid £3 at a second-hand bookshop for the *Wireless Telegraphy Manual for H.M. Fleet, Vol. I, 1917*. After glancing through it a few times, it remained on my bookshelf, gathering dust, until I realised it was now a century old and therefore officially an antique. Surely this meant it was worth another look?

The plain hardback covers are now faded by age, **Fig. 1**, but the 301-page book is in good condition, suggesting it also sat on the bookshelf of some hapless naval rating and has hardly been opened since!

Mics, Jars and "~"

Some of the units used by the Admiralty in 1917 were interesting. The *Manual* states: *"10^6 micro-henries = 1 henry. Now the micro-henry is a very convenient unit in which to measure the inductance of our oscillators, so for shortness it is called the "mic." Again, 10^6 micro-farads = 1 farad. Even the micro-farad is too large for our purposes, although it is generally taken as the unit in books on wireless. This entails using small decimals in talking of W.T. circuits, so we in the Service use the "jar," being approximately the capacity of an ordinary pint-size Leyden jar. 900 jars = 1 micro-farad."*

In Chapter II the frequency of waves is explained: *"The number of complete cycles or alternations performed in one second is called the "frequency" or "periodicity," and is generally denoted by the letters "n" or "f," or else by the sign "~"* [A footnote explains: *"The latter is called "cycles per second," or, more commonly, "cycles." In this book we shall use "f" and "~".*] *"Thus, 100 ~ means that the frequency is 100, or there are 100 complete alternations carried out in 1 second... Frequencies are spoken of as being "high" or "low," but it must be remembered that such terms are purely relative and conventional. Thus 50 or 100 ~ would be called a low frequency, while one of 10,000 or 100,000 ~ would be described as a high frequency..."* It's interesting that in 1917 a frequency of 10kHz would have been described as a 'high frequency'!

Everything is in imperial measurements, even wavelength, which is explained as follows: *"...Now imagine the oscillations in the aerial to continue without interruption for one complete second. By the time the last wave is formed the first one will be 186,000 miles away. Let there be F of them in all, then the distance between any pair, henceforward to be called the "wave-length," will be, in miles 186,000/F."* The *Manual* does, however, concede that *"other units commonly met with outside the Service"* include metres and feet. Anyone for calling CQ on the 'five-hundred and forty-three feet band'?

The Transmitter

A chapter on 'The Transmitting Circuit' spends most time addressing safety arrangements, perhaps not surprising with hundreds of volts of both DC and AC around, but it does describe a typical transmitter, shown here as **Fig. 2**. After admitting that *"any particular installation may indeed differ considerably in detail"* the circuit is described: *"Briefly we have D.C. supplying a rotary converter or motor alternator... From the slip-rings come the A.C. mains in series with which we have several safety arrangements, the signalling key, and finally the primary of a step-up transformer... The terminals of the secondary winding of the transformer are connected to two bare copper wires carried on porcelain insulators. These constitute the high-tension mains, and together with the primary of the oscillator must be regarded as the most dangerous parts of the circuit to touch."*

The book suggests that the high-tension mains and some other components should be encased in *"an iron cage or screen"*, adding: *"The aerial circuit must often of necessity be situated outside the screen, but the shock from the aerial will probably not be fatal of itself... Until recently no case had occurred of a man taking a long spark from the aerial of a large power set; but one has now happened in which the aerial sparked about 10 inches into a man with no evil effects... It is difficult to say whether a man holding on to the aerial and touching nothing else would receive a shock or not."* It concludes this section, with what is certainly unintentional black humour, by stating that: *"Birds sitting on the roof wires have been observed to fall off into the water, but whether they were electrocuted or drowned is not apparent."*

I'd always assumed that spark transmissions would always sound like

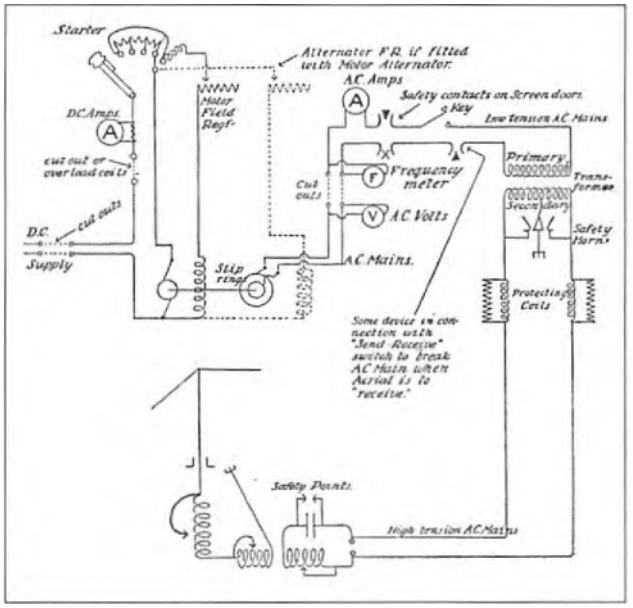


Fig. 2: Typical spark transmitter from 1917.

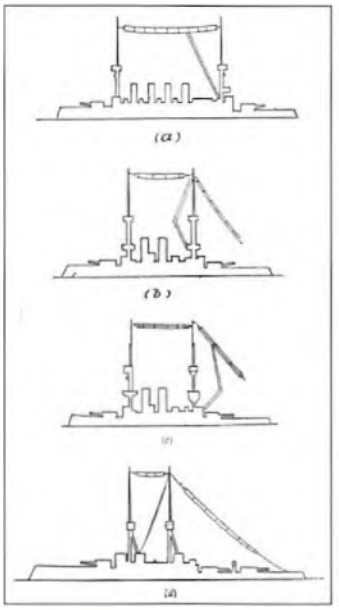


Fig. 3: Various configurations of antennas aboard ships.

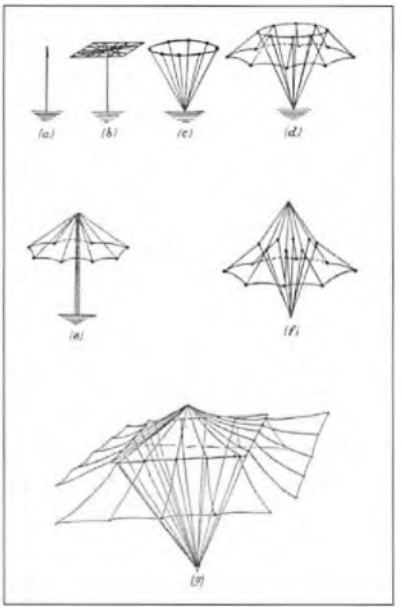


Fig. 4: Typical shore-based antennas in 1917.

a rough buzzing noise but it seems that wasn't always the case: the *Manual* talks about *"the musical spark"* and *"the singing spark"*. *"When telephonic reception is used it is found that each train of waves in the transmitting circuit will produce one "click" in the telephone diaphragm."* ('Telephonic reception' refers to the signal being heard on a 'telephone', meaning headphones and is not a reference to 'telephony', the transmission of speech. Although a form of AM telephony was demonstrated by **Reginald Fessenden** in 1900, its use did not become commonplace until about 1920 and then was used for radio broadcasting, not military communications.) *"The frequency of these clicks will determine the "pitch" of the note heard in the telephones... To give out the note equivalent to the middle "C" on the piano, the telephone diaphragm must vibrate 256 times a second... The human ear can distinguish notes of frequencies varying from 16 to 33,000* [sic] *per second, but it is thought that the most sensitive hearing is obtained when we are listening to that part of the gamut which corresponds to the middle of the piano scale..."* It's interesting that the *Manual* is cagey about the part of the audio spectrum where the human ear is most sensitive (*"it is thought that..."*) and yet states quite categorically that the human ear can hear up to 33kHz. This seems to be a clear factual error: when I was in my teens I could hear up to about 18kHz but I doubt any human can hear an audio tone of 33kHz (the frequency of dog whistles is between 23 and 54kHz).

Although the human ear is most sensitive to frequencies of around 350Hz, a note one octave higher *"would produce a proportionately louder noise in the telephone because its frequency is more suited to that of the telephone receivers."* The discussion continues by saying, *"A peculiar effect is to be noticed if we put the spark half-way between the two original places... In the telephones at the other end it will be possible to hear apparently the high and the low notes going on simultaneously with possibly the superimposition of intermediate notes (like those on a bugle), which are called the "harmonics" of the fundamental lowest note. The whole thing sounds as if someone were playing a chord by striking several strings on a fiddle. The value of a musical note at the receiving end for reading through or over atmospheric or other interference cannot be over-estimated, and will at once be recognised by anyone who hears the musical spark for the first time."*

The Antenna

Yes, 'antenna': the title of Chapter XI is *"The Aerial Wire or Antenna"* and the chapter begins *"We will now consider the principles of design and construction of the aerial wire system, often called the antenna."* The two terms are used interchangeably, suggesting that 'antenna' has been in use in British English for over 100 years and isn't a recent Americanism as many people think.

'Mics' and 'jars' appear again: *"A ship's aerial will have a virtual inductance (an expression to be explained later) of from 40 to 60 or 70 mics, while its capacity might be from 1¼ to 2¼ jars. These figures apply to aerials such as those fitted in battleships."* Antennas aboard ships were generally limited to multiple wires suspended between the ship's masts, **Fig. 3**, but there are some interesting land-based designs. *"The most strongly radiative antenna is the straight vertical wire, commonly called the "Marconi aerial," since it was with this type of antenna that Marconi first demonstrated the practicality of telegraphy without connecting wires. The capacity of such an aerial is, however, very small, so that it is now customary to connect to the top of the vertical wire or wires a system of wires more or less parallel to the surface of the earth. The ideal aerial, therefore, consists of a large overhead area, carpet, or "roof" stretched out parallel to the earth at as great an elevation as possible, and connected to earth by several vertical wires. The large overhead carpet makes for a large capacity, the great height is necessary for efficient radiation, yet tends towards a small capacity, so that the two desiderata, the great height and the large capacity, are antagonistic. We, therefore, have to adopt a compromise in practice by getting masts as high as possible, and then making the overhead area as large as possible."*

Some of the shore-based antennas are shown in **Fig. 4** and are described as follows: *"(a) Gives the Marconi aerial; (b) its development into the more efficient form of a "roof" or "carpet" type; (c) is the inverted cone type, one which is fairly effective, but it requires many masts. We shall call the overhead part the "roof," and the vertical part the "feeder." (d) is a double cone aerial and is better than (c) on account of the larger roof, but limitations*

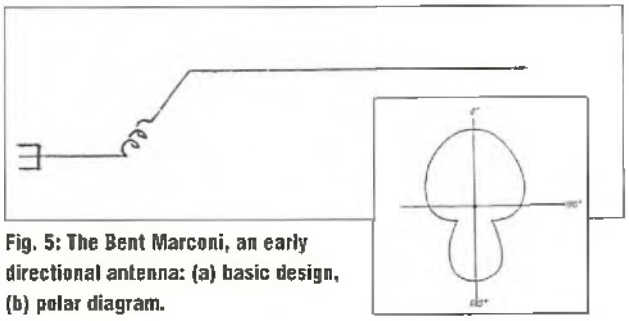


Fig. 5: The Bent Marconi, an early directional antenna: (a) basic design, (b) polar diagram.

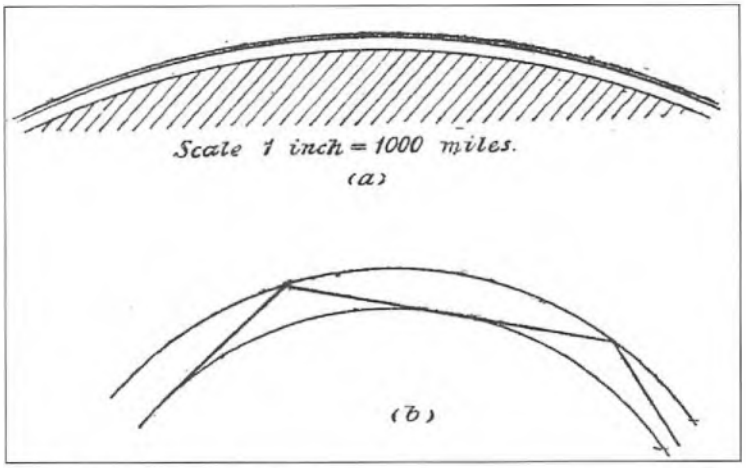


Fig. 6: Propagation of 'ether waves'.

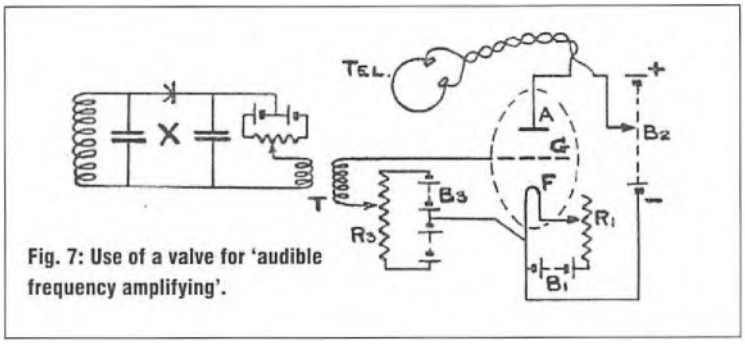


Fig. 7: Use of a valve for 'audible frequency amplifying'.

on the number of masts available will cause it to take the form of (e) or (f) if but one mast is available, or the form (g)... if more masts are fitted."

An early form of directional antenna is also described: the 'Bent Marconi aerial', **Fig. 5**. The far more sophisticated *"Braun's directive system"* is mentioned. although with few details of its construction: *"Braun's system has not yet been employed on a large scale. He employs three aerials set up at the points of an equilateral triangle. In these antennæ he can produce oscillations, which differ from each other in phase by any required amount. By these arrangements it is possible to cause the waves emitted by the whole system to combine together and assist one another in a certain direction, but to neutralise each other in certain other directions."* A polar diagram in the *Manual* shows a cardioid pattern as one that can be achieved with Braun's system. It was developed by German physicist Karl Braun (1850 – 1918) who shared the Nobel prize in Physics with Marconi in 1909, although it seems his directional antenna was not in widespread use in 1917 (and this was nine or ten years before **Professors Uda** and **Yagi** developed the Yagi beam in Japan.)

Ether Waves

Ether Waves is the title of Chapter XII. In 1917 the nature of radio waves and propagation was not yet properly understood (indeed, even in 2017 we cannot say we fully understand radio wave propagation). The chapter starts by defining what is meant by 'ether'. *"The facts that electrified bodies or magnets attract or repel each other at a distance, and that electric currents can create other currents in wires at a distance, and that these actions are not entirely dependent upon the presence of any material substance in the interspace, but can take place also through a perfect vacuum (that is, in the absence of air) have always impressed competent thinkers with the idea that there must be an "electro-magnetic medium" which forms a vehicle for the transference of these actions across the intervening space. It may be that when a satisfactory explanation of the real character of this medium is found it will furnish at the same time an explanation of what actually transmits the "pull" of gravity...*

"We are compelled to admit that if light is due to vibrations propagated through a medium at this tremendous rate of 186,000 miles per second, the medium capable of this must possess qualities very different from those of any form of tangible matter with which we are acquainted. The medium called the ether must necessarily be universally diffused, and must interpenetrate all ordinary matter."

Fig. 6 is taken from the *Manual* and in (a) shows what it calls an *"upper shell of conducting air"* at 35 to 40 miles in height, in scale with the curvature of the earth. In Fig. 6(b) *"The height has been exaggerated... in order to show how the path of the wireless rays, which normally would travel in straight lines, is carried round the earth by reflection."*

We now know that it is the D-layer, which is at the height described but that it is mainly responsible for the absorption – not the reflection – of radio waves. The British physicist **Oliver Heaviside** (1850 – 1925) and the American **Arthur Kennelly** (1861 – 1939) had independently predicted the existence of a reflecting layer in the atmosphere as early as 1902 but this was not confirmed until 1924. **Edward Appleton** (1892 – 1965) proved its existence (for which he received the Nobel prize for Physics more than two decades later), and called it 'the Kennelly-Heaviside Layer'. This is now known as the E-layer and is at heights of 90 – 150km (56 – 93 miles). It was interesting to see what was understood about propagation during that period before the existence of the Kennelly-Heaviside Layer had been confirmed. Although we now know that the reflecting layer is higher than then supposed, the basic mechanism of propagation was recognised in 1917.

Valves

Lee de Forest (1873 – 1961) invented the triode valve in 1906 but it would appear that valves did not have widespread use in H.M. Fleet in 1917. They are only mentioned in the *Manual*'s final chapter, which covers their design and use. Typical circuits are given for the use of valves in *"audible frequency amplifying"*, **Fig. 7**, *"high frequency amplifying"* and their use as detectors and high frequency generators.

Conclusion

Having now had a more detailed look through this antique book I found it fascinating to see how much 'wireless telegraphy' has changed in a century. However, in conclusion, here is a quote from the Preface of the book: *"The telegraphist must be able to read weak as well as rapid signals, and, further, be able to read through atmospheric, accidental, and even deliberate interference."* Perhaps not so much has changed in 100 years after all?

c/o PW Publishing Ltd, Tayfield House, 38 Poole Road, Westbourne, Bournemouth BH4 9DW
• E-mail: teleniuslowe@gmail.com

Don't forget – all reports to Steve by the 1st of each month please!

Deleted Entities Reappear

Steve Telenius-Lowe PJ4DX reports a U-turn by the ARRL and has plenty of operating news despite the early summer doldrums.

A reminder that the RSGB IOTA (Islands On The Air) Contest runs for 24 hours from 1200UTC on July 29th. Activity is on 10, 15, 20, 40 and 80m CW and SSB. Send and receive a report and serial number; all island stations additionally must send their IOTA reference (EU-005 for the mainland of Great Britain). More details were in this column last month and the full rules are at: www.rsgbcc.org/hf/rules/2017/iota2017.shtml

Now You See Them, Now You Don't

In the June column I reported on the ARRL's *"surprise announcement"* that they had deleted Midway Island and Kure Island from the DXCC List. After reading the announcement I concluded that someone at ARRL must have misunderstood their own criteria for the deletion of DXCC entities and made an error – and it seems I was correct. On May 11th, the ARRL issued another press release saying that, *"After further review it has been found that the deletion of these two entities is not supported by the changes that were made to the relevant administrations."* Midway and Kure have therefore been reinstated to the DXCC List: www.arrl.org/news/midway-and-kure-islands-reinstated-as-dxcc-entities

Gary Jones W5FI, Chair ARRL DX Advisory Committee, points out that the original, erroneous, decision to delete the entities was made by the ARRL Awards Committee without consulting the DXAC. There were no operations from either Midway or Kure during the period the two islands were not on the DXCC List.

Fig. 1: Martin Kay's FT-817 and Miracle Whip leaning out of the window, used to work K6DTT/1.

Readers' News

Martin Kay G1EOJ (Leighton Buzzard) wrote to say he recently returned to amateur radio after a break of 30 years. He bought a Yaesu FT-817 and 'Miracle Whip' antenna and *"For three months I have scanned the bands (pretty dead at present!) and also took the rig to South Africa where I thought I would contact the world from Kruger. Wrong! Not one QSO in two weeks. Then finally back in the UK I fired it up one night with the whip just hanging out of a bedroom window,* **Fig. 1**, *and it happened! K6DTT, temporarily in Maine, and the following night Z35A in Skopje. No ATU, no counterpoise, just 2.5W and a telescopic whip to get across the Atlantic. So the interest is certainly back even if it means a few dead days/nights in a row."* Welcome back into amateur radio Martin. It is amazing what can be worked with QRP, as shown almost every month by our regular reporters to this column. Martin also said he is planning to put up an outdoor antenna, which I am sure will help a lot, leading to fewer 'dead days'.

Geoffrey Powell M1EDF (Tamworth) says he is 76 years young, has been reading *PW* since he was 10 years old, and still finds it always an interesting read. He commented, *"I use an Icom IC-718, an offset dipole and no more than 40W with a Marconi straight key. I have been doing CW since I left school, trained on double-key sounders on the railway. I only use 40W because of TVI with neighbours; amazing how far one can achieve with CW on low power."* Geoffrey sent in a summary of his QSOs with *Akademik Fedorov*. **Fig. 2**, the Russian icebreaker and research vessel, saying *"I first picked up RW1AI/MM abeam Montevideo, coming up the South Atlantic to St Petersburg, his home port. I followed his track daily on SAILWX, which you put into the computer, insert the name of the vessel and his position will come up. I followed him from April 29th to May 13th daily. I listened for a month but did not QSO every day due to conditions. Signals faded a great deal around the coast of Senegal and Bay of Biscay."* Geoffrey's contacts were on 20m and 30m and most were with reports of 589 or 599.

Fig. 2: Russian icebreaker Akademik Fedorov, from where RW1AI/MM was active.

Mike Clark M0ZDZ/P (nr Chichester) went out portable on three occasions during May. His first trip was on May Day. *"Conditions seemed better than on my last few trips out, only a little QSB and propagation opened quite early to North America with some 59+ exchanges."* Having seen Alaskan stations spotted on the DX Cluster, Mike went out again early morning on May 6th. *"Sadly no KL7 but a nice surprise: WH6 and 7s (Hawaii). Signals peaking at S9+20dB with flutter... Long path to VK and ZL was poor: only*

managed to work three VKs peaking at 57." Mike's final session was on May 17th: *"Conditions tough on 20m... but managed to work some nice DX from all corners, mainly off the Cluster but I did find a weak T88MZ [Palau] calling CQ with no takers. After a few minutes he popped up to peak at a real 59 and I worked him first call. I posted him on the Cluster and within minutes he had a nice pile-up going. Some big signals from the Middle East area. Just as I was shutting down J28PJ [Djibouti] showed on the Cluster, managed to work him for an all-time new one (ATNO) on my second call with a 55 exchange. Missed out on VU7KP [Lakshadweep Islands]; he was starting to come from the noise level to 45 then went QRT."*

Fig. 3: The 2E0HPI/P station at GFF-0235 Dorset Heathlands.

Carl Gorse 2E0HPI (Hartlepool) was on his holidays in Dorset in May and activated six WWFF sites, **Fig. 3**, and *"also managed to fit in a SOTA summit. Total number worked was 261 over three days. The conditions were very poor but with plenty of short skip contacts on 20m into the UK. While down in Dorset I did G/SC-013 Nine Barrow Down SOTA, met up with* ***Roger M0AUI*** *and* ***Ian G0RPA*** *and had a very enjoyable few days. Sadly the weather and the very poor conditions took its toll on things but I managed to get enough contacts for each WWFF, the qualifying number for which is 44. I also took delivery of the new Yaesu FT-891, which I plan to use at home and also portable and mobile when time permits over the summer months."*

Etienne Vrebos OS8D wrote from a very hot Brussels (34°C) saying he had just returned home after *"a very nice journey in Wales with my motorcycle, riding about 3000km, with continually 20° to 22°C and a blue sky, unusual for Wales."* Etienne sent in a short log of his HF highlights but added, *"Very sorry I didn't manage more DX or even HF radio: I wanted to move south, north, west and next week east with my bike, as long as health and weather allow."*

Terry Martin M0CLH (Wantage) thought we were going through *"a bit of summer doldrums. Some shack reorganisation (need a bigger room!) and gardening have all taken their toll this month but a few nice slots from Japan, India, Cayman Islands, Namibia, Palestine and Botswana (A25UK with welcome 'selective hearing' of UK stations on occasions). All in all, not too bad with the appearance of a bit of Sporadic E towards the end of the month providing the opportunity to fill a few of the more awkward slots for near countries. For those who enjoy decorating their shack, I recommend joining the European Phase Shift Keying Club (EPC) where colourful awards can be collected at zero cost,* **Fig. 4**. *This was discussed in some detail by* ***Colin Redwood G6MXL*** *in his May 2016* What Next *feature."*

Fig. 4: Some of the colourful European Phase Shift Keying Club awards issued to Terry M0CLH.

Kevin Hewitt ZB2GI (Gibraltar) says his highlights for the month were *"operating maritime mobile,* **Fig. 5**, *and portable, working one new country and operating WSPR from the top of the Rock."* During the month Kevin operated as ZB2GI from home, ZB2GI/P from 412m ASL, ZB2GI/MM from the Bay of Gibraltar along with **John King ZB2JK**, and also as ZB2BU, the callsign of the Gibraltar Amateur Radio Society.

Our 10m-band aficionado **Tony Usher G4HZW** (Mobberley, Cheshire) has been *"busy birding but listened from time to time and had WSPR running for extended periods. The month has been good for Sporadic E contacts across Europe although I've not heard any openings via two-hop to the eastern seaboard of the USA so far. As an example, on the 14th of the month a quick scan across the beacon frequencies revealed some strong signals but there was no activity between 28300 and 28500kHz. A CQ call resulted in a succession of contacts, including DO1FT running 5W to a vertical and DJ3GZ with 1W also to a vertical."* Tony's advice is to *"call CQ!"* He continued, *"WSPR has revealed propagation most days, beaming north-west has resulted in many 'contacts' with TF3HZ at all hours of the day and night, but the highlight occurred on May 30th when the 10W WSPR signal from*

Fig. 5: Kevin ZB2GI operated maritime mobile from this yacht in the Bay of Gibraltar.

VY0ERC, **Fig. 6**, *was detected at 1844UTC at a strength of –11dB, loud enough to be heard and a normal CW contact would have been possible! The station is located in Eureka in the Nunavut Territory and is the most northerly amateur radio club in the world. Three other G and one PA station also reported the signal at the same time. I wonder what mode of propagation was involved?"*

Owen Williams G0PHY (Biggleswade) reckons *"It was a pretty good month for working DX... May started with a 20m contact with the UK group in Botswana, A25UK, followed by a mid-afternoon contact with 8J1ITU, also on 20m. This was a Japanese special event station celebrating the founding of the International Telecommunication Union. There then followed five days of working various Russian stations using the RP72 victory prefix commemorating 72 years since the end of World War II. It was a good opportunity to practice giving G0PHY using the Russian phonetic alphabet... The end of the month saw three nice DX entities worked on successive days. The first was the Sahrawi Amateur Radio Club station, S01WS, in Western Sahara on 17m. The next evening also on 17m I worked E44WE (this was* ***Janusz SP9FIH*** *operating from Bethlehem). The third evening ended with a 20m contact with the DXpedition to Eritrea, E31A. All three contacts were made the 'old fashioned way' by just tuning the bands to see what was on... I also managed to snag E31A towards the end of the DXpedition one morning on 17m. Although none of these contacts were all time new ones, the contacts with E31A provide two new band slots."*

Victor Brand G3JNB (Shefford, Beds.) says *"What a difference a day makes!"* Or, in his case, a month. On May Day **Dale CE2AWW** provided a 'Grand Opening' 17m DX contact, working Europe with ease. *"Such a contrast to the closing days of April,"* Victor commented. *"May 2nd and 17m showed that it was again the 'money band'. A25UK in Botswana was very weak in the morning but became much stronger mid-afternoon and worked with reasonable ease. Day 3, CE2AWW was back in the log. Day 4 and RW1AI/MM in the mid Atlantic replied first call. Then on 20m, A25UK came up loud and was worked immediately with 50W to the doublet. And so it went on, day after day! On 17m W1N was an intriguing special event call logged from Texas, FY5KE and FY5CY logged from French Guiana and Dale still holding his strength each evening, plus TI5/N3KS worked from Costa Rica, who was having a wonderful time."*

Fig. 6: WSPR screenshot of remarkable 10m propagation between VY0ERC and G4HZW.

Victor noted that, *"Paradoxically, improving conditions supported amazingly strong signals from 9Q6BB and VU4YC. They were being heard around the world for hours and thus difficult for a low-power operator to break the enormous pile-ups."* However, on the 10th, conditions above 40m deteriorated for a few days allowing Victor to work VU4YC on 17m CW. He concluded his report by saying, *"Regrettably, the hugely popular E31A Eritrea DXpedition eluded me. I chased them across 30, 20, 17 and 15m but they just did not hear me. I will be interested to see how other readers got on"*. Well, Victor, your neighbour Owen G0PHY worked them on a couple of bands and I worked them on four bands from PJ4 but no one else mentioned E31A.

David Smith M0OSA/M (near Huddersfield) thought there was *"Nothing too exciting to report this month but I did manage to catch a couple of Sporadic E openings on 10m. Worked ER1MM for DXCC number 105 confirmed plus DG5MLA, EU6DX, HB9GFP, IS0FWY, IZ2EWX, R6NN, SP0MC (73rd anniversary Monte Cassino special event), SP9H, and YT2PFR."*

Band Reports

Here's the best of the log from Mike M0ZDZ/P. 20m SSB: 4X69KS, 9Q6BB, A61AS, A71AE, A92FQ, AH6GT, CN8AM, DS3EXX, DU3/F4EBK, E44WE, HZ1BL, J28PJ, JJ1FXX, KH7XS, OH0/DG6TOM, OD5VB, SU1AM, T88MZ, VK3MO, VK5PZ, VK6AHR, VK6ALF, VP2ETE, VU2AU, VU2RBI, WH7W, WP4PRS, YB0AZ, YB1DNF plus many USA stations.

Carl 2E0HPI/P reports the following during his three days in Dorset. 40m SSB: DF1WR, F4GTT, GW4VPX, IW1PNJ, PH0NO. 20m SSB: EA1DFP, GM1MKP/P (QRP-QRP), HA8LKM, HB9RYZ/MM, I8TSL, K1RO, LZ1DM, OE1SZW, OH3GBS, SA7AUH, SV2HSZ, UT5ZC, RX9CCJ, RZ1AU.

The report from Etienne OS8D includes 40m SSB: 4U1ITU, GJ7LJI/P, GS8VL, GT4BRS, VK3IO. 20m SSB: A25UK, DS3EXX, E44WE, FR4PJ, V85TL, YI3WHR. 17m SSB: OH0/DG6TOM, ZD7FT. 15m SSB: 5V7P, A25UK, S79Z, TR8CA.

Kevin ZB2GI, operating from home, portable and maritime mobile, worked: 20m SSB: CT1JGA, E770BAB, EA1IMP, F6HMH, G4HCC, ON4STA, PA150LIM, SV9RKU, TZ4AM. 20m JT65: EA5AIH, F6EAO/P, IZ2FNS, MM0HVU, PD0LH, R3RR, S51TC. 15m JT65: CO3VR, ER1PB, F1GTU, IU0ICA, KJ3L, OK1IVO, R6AZ, S58N, SQ2HCZ, UT1EG. 17m JT65: 5B4ALX, EA7KBP, ER1PB, G0KLD, GW4TPG, HB9PLH, SM2SUM, SV9RNG, TF2MSN.

Terry M0CLH reports the following: 40m JT65: PA3CPS. 30m RTTY: SV5/DL3DRN, 4O7CC. 30m PSK63: GS3PYE/P. 30m JT65: RD3TS. 20m SSB: V53DX. 20m CW: LZ395SG, TM7U. 20m RTTY: VU2NKS. 20m PSK63: EV72M. 20m JT9: N5ZY. 20m JT65: AE3T, JA9CM, PT2AP, VE6UX, ZS2PF. 17m SSB: A25UK, E44WE. 17m CW: A25UK, EA6VQ. 17m PSK63: E44WE. 17m JT9: ZF1EJ. 17m JT65: JF1FAO, JR3UIC, KF4BI, VU2IBI. 15m CW: A25UK. 15m JT65: LY2EW. 12m JT65: RW3DKK. 10m CW: LA8HGA. 10m JT9: SP5UAF. 10m JT65: 9H1AE.

In addition to the stations listed in the readers' news, Victor G3JNB also worked, on 40m CW: TA0/DL7UCX (Marmara Island). 30m CW: BH4IGO, OX3XR, OY1CT, TA0/DL7UCX, ZD7BG. 20m CW: XO1X. 17m SSB: PJ4DX (Victor managed to find his microphone to give me a call!) 17m CW: 9H3SQ, EG9TOR, FM5FJ, PJ2/WI9WI.

Signing Off

Thanks to all contributors. Please send all input for this column to **teleniuslowe@gmail.com** by the 1st of the month (August 1st for the October issue, September 1st for the November magazine). 73, Steve PJ4DX.

INTERNATIONAL HAM STORES GROUP

Icom ID-51E Plus 2

NEW

- Dual Band Transceiver
- New Terminal Node and Access Point Modes

£449.95

Icom IC-7610

NEW

- HF/50MHz 100W SDR Transceiver

GENEROUS PART EXCHANGE on your old radio

£3599.95

APACHE LABS

NEW — SPECIAL INTRO PRICE

ANAN 8000DLE - In Stock!

Stunning HF+6m 200W SDR Transceiver

- Modes: CW, SSB, NFM, AM, Digital
- Probably the best performing SDR released to date!
- Generous Part X available

~~£4199.95~~ **£3999.95**

FLEX – SDR Transceivers

New Products released at Dayton 2017!

With improved receiver specs, and lots more!

We are taking DEPOSITS NOW!

Flex 6400M/6600M

Flex 6400/6600

Flex 6400	Now with pre-selectors...£1999.95
Flex 6400M	Including front panel.....£2999.95
Flex 6600	Now with 2 x SCU's.....£3999.95
Flex 6600M	Including front panel.....£4999.95
Current range - still available	
Flex 6700	8 slice flagship.....£6899.00
Flex 6500	4 slice flagship.....£3799.00
Flex 6300	2 slice flagship.....£1899.95

SIRIO Antennas

SYS0-5
5 element
50MHz 10.5 dBi

£129.95

HF/VHF/UHF Beams

SYS0-3	3 el 50MHz 8.5dBi.....£99.95
SY68-3	3 el 70MHz 7dBi.....£79.95
SY27-3	3 el (26-28)MHz 10.65 dBi.....£84.95
SY27-4	4 el (26-28)MHz 13.15 dBi.....£99.95
SY-400	6 el 70cms (w de band) 11.0 dBi.....£79.95
WY-140	3 el 144MHz (wide band) 10.5 dBi..£89.95

Base Antennas

SA-270LN	Dual Band 5.3S/7.95 dBi 2.79m.....£99.95

Mobiles

HP-2070R	Dual Band 1.00m.....£34.95
HP-2070M	Dual Band 1.08m.....£36.95

MASTRANT

Quality guy ropes and accessories
Full range in stock

P type general polyester Guy ropes

P2	2mm 100kg B/s.....£14.95
P3	3mm 200kg B/s.....£21.95
P4	4mm 400kg B/s.....£29.95

M type Thinner higher performance with Dyneema

M2	2mm 240kg B/s.....£31.95
M3	3mm 100m 390kg.....£49.95
M4	4mm 900kg B/s.....£119.95

Full range of Pulleys, clamps and fittings in stock

SPIDERBEAM

Antennas, Telescopic Poles, Aluminium Masts

UL-40/L Ultra-lite Dxpedition antenna
Dipole covers: 40, 20, 17, 15, 12, 10.6m.....£109.00

Fibreglass Telescopic Poles

12mtr	Heavy Duty.....£89.95
18mtr	Standard.....£199.95
22m	'Long John' NEW.....£399.95
26mtr	Standard.....£499.95
	Base Plate for Fibreglass Poles.....£28.95

Aluminium Telescopic masts

10 metre	Standard.....£299.95
10 metre	Heavy Duty.....£325.00
12.5 metre	.....£329.95
14.5 metre	Heavy Duty.....£425.00

NEVADA Telescopic Masts

33 ft.	Aluminium, 7 ft. retracted.....£99.95
26 ft.	Aluminium, 5.5 ft. retracted.....£89.95
20 ft.	HD Fibreglass 5.5ft retracted.....£179.95
30 ft.	HD Fibreglass 7.5ft retracted.....£249.95

Also see our web for Spiderbeam masts and Mastrant guys and fittings

BEKO

Amps below in stock for immediate delivery!

HLV-950

Dual Band solid state amplifier

- Covers 50MHz & 70MHz
- Output 1kW for input from 1W to 25W

£2549.95

HLV-1000-10

1kW solid state amplifier 144MHz, Input: 10W max

£2495.00

HLV-770	770W 70cms.....£2550

Amps below available to order (4 weeks delivery)

HLV-1950	2kW 4m.....£4,395
HLV-2000	2kW 2m.....£4,299
HLV-1100	1kW 70cms.....£3,699
HLV-350	350W 23cms.....£2,595
HPP-144	2.5kW low noise 144MHz Pre-amp.£649.95
HPP-432	2.5kW low noise 70cms Pre-amp.....£649.95

MOSLEY Antennas

New shipment just arrived!

TA-33MVSP	5 Band 4 element Beam.....£859.95
TA53MSP	5 band 4 element Beam.....£1049.95
TA31JR	Rotary dipole (14,21,28MHz)...£299.95
TA32JR	2 el. Beam (14,21,28M-Hz)...£399.95
TA33JR	3 el. Beam (14,21,28M Hz)...£549.95
Mini 33AW	Compact 5 Band Beam.....£699.95
RV-8C	6 band Vertical (40-10m).....£499.95

AMERITRON Remote Ant Switches

RCS-4X	4 Way 2.5kW SO239 100MHz..£174.95
RCS-4LX	4 Way 2.5kW SO239 100MHz..£219.95
RCS-8VX	5 Way 5 kW SO239 250MHz...£189.95
RCS-8VNLX	5 Way 5kW N type 250MHz.....£239.95
RCS-10X	8 Way 5kW SO239 100MHz.....£194.95

STEPPIR Antennas

2 Element Yagi	(20-6)m 3kW.....£1549.95
3 Element Yagi	(40-6)m 3kW.....£2174.95
4 Element Yagi	(40-6)m 3kW.....£3199.95
DB18 3El Yagi	(40-6)m 3kW.....£3424.95
DB18E 3El Yagi	(40-6)m 3kW.....£3924.95
DB36 4El Yagi	(40-6)m 3kW.....£5499.95
DB42 Monster IR	(80-6)m 1.5/3 kW.....£7249.95
Small IR Vertical	(20-6)m 1/4 wave.....£999.95
Big IR Vertical	(40-6)m 1/4 wave.....£1249.95
Crank IR Vertical	(40-2)m Vertical.....£429.95

CREATE Japanese High Quality!

Rotators

RC5-1
Medium Duty

£509.95

Rotators

RC5-3	Medium Duty Plus.....£609.95
RC5-B3	Heavy Duty.....£1244.95

Log Periodic

CLP-5130-1N	21 elements (50-1300)MHz...£419.95
CLP-5130-2N	17 el. (105-1300)MHz.....£279.95

NEVADA

QUALITY POWER SUPPLIES 2 YEAR WARRANTY!

PS-40M Linear

- 40A (max) with meter
- Voltage: 1.5-15V DC
- Cigar adaptor output

£129.95

PS-30M Linear

- 30A (max) with meter
- Voltage: 3.0-15V DC
- Cigar adaptor output

£99.95

PS-08	Linear 8A (max) 13.8V DC.....£34.95
PSW-50	Switch mode 50A (max) 9-15V DC..£129.95
PSW-30	Switch mode 30A (max) 9-15V DC...£79.95
PSW-30H	Switch mode 30A (max) 9-15V DC...£69.95
PS23-SW1	Switch mode 23A (max) 13.8V DC...£59.95
PSW-07	Switch mode 7A (max) 13.8V DC.....£29.95
PSW-04	Switch mode 5A (max) 13.8V DC.....£24.95

ACOM

NEW ACOM A600S

- 600W solid state amplifier
- Covers 1.8-54MHz
- Ideal for portable or travel use
- Weighs just 12kg

~~£2999.95~~ **£2289**

A1200S...1.2kW 1.8-54MHz arrives soon.. £2999.95

ALINCO DIGITAL

NEW Digital/Analogue Handhelds

Heavy Duty, feature rich, with outstanding audio clarity

DJ-AXD4: UHF Version
DJ-AXD1: VHF Version

- DMR Tier I and Tier II
- RF output 1W to 5W
- 1000 ch. in 16ch/zone
- Text messages
- IP67 dust & waterproof
- Key Lock, Talk around, TOT,
- Call Logs, DTMF tones,
- Scans and more!

£149.95

DJ-MD40: UHF

- RF output 1W to 5W
- 1000 ch. in 16ch/zone
- Text messages
- IP54 dust & waterproof
- Voice recorder

£159.95

ALINCO MOBILES

DR-735E
Twin Band Mobile 'Rainbow' display

Full featured VHF/UHF transceiver

- Extended RX 108-174MHz, 400-479MHz
- Power 50/20/5W output
- Computer programmable

£299.95

DR-138HE	VHF/FM mob TX 144-148MHz...£169.95
DR-185H	VHF/FM TX 136-174MHz.....£169.95

ALINCO POWER SUPPLIES

DM-330MWMkII
30A Deluxe Supply variable voltage, low noise, extra filtering

£129.95

DM-330FXE
30A Standard Switch mode variable voltage standard filtering

£119.95

DM-30E
Lightweight 30A Switch Mode Digital Volt/Amp meter

£89.95

ALINCO HANDHELDS

DJ-V57
VHF/UHF Handy

- IPX7 waterproof
- Computer programmable
- Tough case
- Fully featured

£129.95

DJ-G7E
Tri-band Radio, die-cast chassis

- 2m/70cms/23cms
- 1000 memory channels
- Full duplex
- 39 CTCSS and 104 DCS encode/decode

£299.95

ELECRAFT

ELECRAFT
Full range now available!

K3S
The new version HF+6m transceiver with many improvements

K3S/100-F	100W (Assembled).....£2999.95
K3S/10-F	10W (Assembled).....£2449.95
K3S/10-K	10W (Kit).....£2299.95
K3S/100-K	100W (Kit).....£2849.95

KX3
160-6m
All modes + DSP

KX3-K	(Kit).....£999.95
KX3-F	(Fully assembled).....£1079.95
KX2	80-10m 10W (Assembled).....£859.95

KPA-500
160-6m
500W Amplifier

KPA-500	(Kit).....£2449.95
KPA-500	(Assembled).....£2649.95

KPA-1500 NEW - Arriving soon!
1500W HF+6M Amplifier with built-in ATU
Limited quantities - reserve yours now!!

Call for other Elecraft accessories

ALINCO

DX-SR9
HF Transceiver + SDR capability

- Receiver 150kHz-30MHz
- 3 Ceramic Filters
- Built-in CW Keyer

£599.95

DX-R8E
HF communications receiver - top seller!

- Frequency range: 150kHz-34.999MHz
- Modes: AM/FM/LW /MW/CW/LSB/USB
- Power: 11.7-15.8V DC (not supplied)

£469.95

INRAD

Full range of INRAD filters for Elecraft and Yaesu - **NOW IN STOCK**

YAESU

705F	500Hz CW.....£159.95
712F	300Hz CW.....£159.95
717F	2.3kHz SSB Collins.....£179.95
720F	2.0kHz SSB.....£179.95
726F	2.9kHz SSB.....£179.95

ELECRAFT

708L	250Hz CW.....£159.95
701L	400Hz CW.....£159.95
711L	1.8kHz SSB.....£159.95
716L	2.8kHz SSB.....£159.95

LOTS MORE on our WEBSITE!

MORSE KEYS

Bencher BY-1

Vibroplex Iambic Standard

Bencher BY-1	.....£183.95
Bencher BY-2	.....£239.95

Vibroplex Keys

Iambic Deluxe Paddle	Chrome.....£239.95
Iambic Standard Paddle	Black.....£169.95
Code Warrior Jr	.....£169.95
Standard Vibrokeyer	Black.....£189.95
Deluxe Vibrokeyer	.....£239.95
Standard Straight Key	.....£189.95
Deluxe Straight Key	.....£239.95

MUCH MORE ON OUR WEBSITE 24/7.....SHOWROOM OPENING HOURS: MON - FRI 9AM - 5:30PM CLOSED SATURDAY

OPEN: Mon to Fri 9.00am - 5.30pm
Unit 1 Fitzherbert Spur Farlington
Portsmouth Hampshire PO6 1TT

www.nevadaradio.co.uk

ICOM

IC-7300
100W HF+6m+4m
- RF direct sampling
- Touch screen control

GENEROUS Part X CALL NOW!
£1199.95

IC-718	100W 160-10m base/portable	£589.95
IC-7100	HF/VHF/UHF 4m (70MHz) touchscreen	£999.95
IC-7200	HF+6m rugged style transceiver	£829.95
IC-7600	HF+6m twin DSP base transceiver	£2399.00
ID51EPlus 2	Dual Band Handheld D-Star	£449.95
ID5100E	Standard version Dual Band D-Star	£574.95
AH-4	Automatic antenna tuner 120W	£333.95
SM50	Top of the range desktop microphone	£249.95
SM30	New compact style microphone	£119.95
SP23	Deluxe extension speaker	£249.00
SP38	Matching speaker for IC7300	£149.95

Icom ID-4100
Dual Band D star Digital transceiver
Now with terminal mode & access point mode Wireless operation (optional Headset)
- Integrated GPS Receiver
- Wideband Receiver

~~£499.95~~ **£479.95**

INRAD RX-7300

New 2nd receiver socket option for the Icom IC-7300

Easy to install plug-in mod. requires no soldering, simple to install and easily reversible. Can be used for the insertion of accessory items into the receiver chain, like receive-on y bandpass filters, low noise preamps, etc

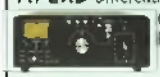
Kit only £49.95
Fully Fitted by Nevada £99.95

PALSTAR

HF-Auto 1.5kW fully auto antenna tuner

Covers 6-160m
Output power: 2-1800W
Display: 4 line large print
£1599.95

AT-2KD Differential HF Tuner



Covers 6-160m
Power: 2kW RF
£599.95

AT-500 600W PEP manual antenna tuner

Covers 6-160m
Built in 4:1 balun
SPECIAL OFFER!
~~£529.95~~ **£499.95**

AT-5K	3.5kW manual tuner	£1249.95
AT-4K	2.5kW manual tuner	£1024.95
AT-2KD	2kW Differential manual tuner	£599.95
DL-1500	1500W high power dummy load	£199.95
BK4C/1:1	4kW 1:1 ratio current balun	£99.95
BK4C/4:1	4kW 4:1 ratio current balun	£99.95

LDG

Z11-Pro2
(160-6m) 125W **£167.95**

IT-100	For Icom IC-7100, IC-7000	£209.95
KT-100	For Kenwood 125W HF–6m	£209.95
YT-100	For Yaesu 125W HF+6m	£199.95
Z-100 Plus	Economy tuner	£169.95
AT-100 Pro II	125W HF+6m	£244.95
AT-200 Pro II	200W HF+6m	£259.95
AT-600 Pro II	600W HF+6m	£395.95
AT-1000 Pro II	1kW peak HF+6m	£519.95
AT-897 Plus	For Yaesu FT-897	£209.95
Z-817	For Yaesu FT-817	£129.95
M-600	Large display meter	£129.95
M-1000	Extra-large meter	£139.95
RT/RC-100	Remote tuner + DC feed	£249.95
RT-600	Remote tuner 600W peak	£429.95

CUSHCRAFT Antennas

ASD-5S
5 Element 50MHz Yagi
£259.95

A-3WS	12/17m 3 element Yagi	£599.95
R-9	9 Band Vertical	£779.95
AV18S	18ft Vertical 80 - 10 m	£164.95
MAS-VA	Vertical 10,12,15,17,20m, 2m	£379.95
ARX-2	Ringo Ranger 2m Vertical	£104.95
AR-270	Ringo Ranger 2/70cm	£164.95
AR-6	6m Ringo Ranger vertical	£129.95

YAESU

FT-991A
- Coverage: 160-6m, 145/433MHz
- All modes AM/FM/SSB/Data
- 100W HF/6m-50W 145/433MHz
- NEW colour waterfall display

SEE WEB FOR BEST UK PRICE!

FTDX5000MP	Premium Class Transceiver	£3399.00
FT991A	160-6m Transceiver	£1199.95
FT857D	Multiband HF/VHF/UHF mobile	£699.95
FT817ND	All mode multiband portable	£529.95
FT4500	100W all mode HF/6m+ATU	£599.95
FT891	Mobile	£599.95
FT7900E	Twinband 144/433MHz mobile	£229.95
FT1DE	Ipx5 digital handy	£269.95
FT2DE	C4FM/FM 144/430MHz digital H/H	£299.95
FTM400XDE	Twinband digital/analogue mobile	£499.95
FTM100DE	New C4FM 50W Dual Band mobile	£299.99
FTDX3000D	100W HF/6m all mode TX	£1429.95
FTDX1200D	100W HF/6m all mode TX	£999.95
VX6E	Submersible 144/430MHz handy	£139.95
G2800DXC	Extra heavy duty rotator	£899.95
G5500	Azimuth/elevation rotator	£644.95
G10000DXC	Varispeed heavy duty rotator	£489.95
G450C	Rotator + 25m cable kit	£388.95
STA77	Stereo headphones	£79.95

Yaesu FTDX5000 MP
200W HF/50MHz Premium Class Transceiver with 2 independent receivers, plus many options

SEE WEB FOR BEST UK PRICE!

Yaesu FT-70D
Dual Band Digital Transceiver
- AMS (Automatic Mode Select)
- Sophisticated C4FM Digital Functions
- 5 Watts RF Power
- Rugged - IPS4 rated

£189.95

DAIWA SWR Meters

CN-901HP
Professional grade with extra large display
- Freq: 1.8-200 MHz
- Power: 20/200/2kW

£129.95

CN-101L
- Freq: 1.8-150MHz
- Power: 15/150/1.5kW

£89.99

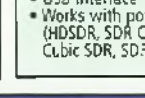
CN-801S11	0.9-2.5GHz 0.2/2/20W	£199.00
CN-901HP3	1.8-200MHz 30/300/3kW	£139.95
CN-901VN	140-525MHz 20/200W N type	£119.95
CN-801VN	140-525MHz 20/200W N type	£119.95
CN-103LN	140-525MHz 20/200W N type	£69.99
CN-501H	1.8-150MHz 15/150/1.5kW	£89.99
CN-501H2	1.8-150MHz 20/200/2kW	£89.99
CN-501VN	140-525MHz 20/200W N type	£69.99

SDRplay

RSP-2
Enhanced SDR receiver
- Covers: 1kHz (VLF)-2GHz
- Supports HF & VHF antennes simultaneously
- Includes SDRuno software
- Software upgradeable

£156

RSP-2 Pro As above but in a rugged steel case **£189.95**



RSP-1
Powerful wideband SDR
- Covers: 10kHz-2GHz
- Built-in filters
- Low noise floor
- USB interface
- Works with popular SDR software (HDSDR, SDR Console, Cubic SDR, SDRuno)

£119.95

KENWOOD

Kenwood TH-D74E
Dual Band Handheld with APRS and Digital (D-STAR) capability
- Built in GPS
- Wide band receive: HF, VHF, UHF
- IF filtering / DSP

Soft Case for D74E ... £29.95 **£599**

TS-2000X	Allbander classic includes 23cms	£1469.00
TS-480SAT	100W mobile/base HF/6m ATU/DSP	£659.95
TS-480HXE	200W DSP mobile/base HF/6m	£719.95
TS-590SGE	100W DSP HF/6m all mode TX	£1159.95
TS-2000E	HF 50/144/430MHz transceiver	£1279.95
TM-V71E	Twinband 145/433MHz with APRS	£299.95
TM-281E	High power 2m 145MHz mobile	£169.95
TMD-710GE	Twinband VHF/UHF/APRS/TNC/GPS	£479.95
TH-D72E	VHF/UHF handheld GPS/TNC/APRS	£399.95
MC60A	Classic style desktop microphone	£122.95

Kenwood TS-480SAT
HF + 6m 100W Mobile Transceiver
Still popular!
- Great performance
- Built in ATU

£659.95

TS-480HXE ... 200W version ... £719.95

Network Antenna Analysers

MetroVna DELUXE
with Bluetooth connectivity
- Covers up to 250 MHz
- Same spec as Pro below

FREE DELIVERY **£299.95**

MetroVna Pro Model
with Bluetooth connectivity

- Touch Screen - colour
- Freq coverage: 1-180MHz
- Measures: SWR, R, Z, X, phase, filters, Return Loss Transmission Loss
- Link by Bluetooth or USB

Phone not included

FREE DELIVERY **£259.95**

MFJ

We hold HUGE STOCKS!
If you don't see it in the list below, visit our web site for lots more!

MFJ-1835
5 Band Cobweb Antenna
£239.95

225	1-180MHz graphic analyser	£429.95
226	Graphic analyser (1-230) MHz	£359.95
259C	HF/VHF portable antenna analyser	£299.95
266	New style HF/VHF/UHF analyser	£349.95
269C	HF/VHF Digital Ana yser	£369.95
385B	Deluxe Comms. Speaker	£54.95
407D	Deluxe CW Keyer	£99.95
461	Morse Reader-pocket sized	£99.95
492-X	CW Memory Keyer	£164.95
550	Popular Morse code practice key	£19.95
557	Morse code key with oscillator	£46.95
826B	Digital SWR/Wattmeter	£209.95
901B	Versa Tuner 200W HF	£119.95
912	Remote 4:1 balun box	£84.95
921	2m Antenna Tuner	£114.95
923	2m Tuner & SWR/Power	£249.95
931	Artificial ground unit	£114.95
934	300W Tuner + artificial ground	£219.95
941E	300 Watts max Versa T, her II	£164.95
945E	1.8-60MHz 300W manual tuner	£149.95
948	300W PEP reading antenna tuner	£174.95
949E	300W tuner + Dummy load	£199.95
959C	Receive antenna tuner + pre-amp	£145.95
969	300W tuner 160-6m	£229.95
971	Portable Ant. tuner 1.8-30MHz	£139.95
986	1.5kW HF tuner	£369.95
989D	1.5kW HF tuner	£399.95
993B	Auto T, ner 150W/300W	£309.95
994BRT	600W remote Auto Tuner	£409.95
998	1.5kW Auto Tuner 1.8-30MHz	£719.95
998RT	1.5kW remote Auto ATU	£779.95
1020C	Tunable Active Antenna	£129.95
1025	No se canceller/signal enhancer	£209.95
1026	QRM elim nator + active antenna	£214.95
1118	High Current DC Multi outlet	£94.95
1700C	6 Way coax switch	£144.95
1701	6 Way coax switch 2kW (SO239)	£89.95
1704 (F)	4 way coax switch 2.5kW (SO239)	£84.95
1704 (N)	4 way coax switch 2.5kW (N type)	£95.00
1705H	RF By-pass switch	£38.95
1707	Auto RF sensing Ant switch	£109.95
1708	RF Sensing T/R Switch	£94.95
1763	3 Element 2m beam	£74.95
1786X	Loop (10-30)MHz 3ft dia	£479.95
1788X	Loop (7-21)MHz 3ft dia	£529.95
1779B	80/40m Dipole	£84.95
1799X	9 Band vertical	£479.95
1868	D scone antenna with cable	£94.95
2980	Wire vertical (40m-6m)	£99.95
4416B	Super battery booster	£174.95

Nevadamasts

TMF-15-TM Trailer mast
15 metre Heavy Duty retractable mast, trailer mounted, with all guys and accessories **£4495**

TMF-15-FS Free standing mast
15 metre Heavy Duty retractable mast, free standing with base mount socket

Full details on our website **£2395**

HY-GAIN ANTENNAS USA

NEW RANGE designed by Justin G0KSC!

DB46M8EL
Dual Band 4/6m Yagi
- Covers 4 & 6m with 4 elements on each band
- Boom: 32mm dia. 2.1m long
- Gain: 6m 8.52 dBi/4m 7.86dBi

£299.95

LFA6M-4EL
6m 4 element LFA Yagi
Boom: 50mm dia. 3.9m long. Gain: 10.7 dBi ... £379.95

LFA6M5-EL
6m 5 element LFA Yagi
Boom: 50mm dia. 6.2m long, Gain: 11.8 dBi ... £499.95

Hy-Gain Verticals

DX-77A	10/12/15/20/30/40m	£399.95
14AVQ	4 band 10/15/20/40m	£229.95
12AVQ	3 Band 10/15/20m	£179.95
AV-18VS	10 to 80m base loaded	£164.95

Beams

TH-3JR	Triband Yagi 10/15/20m	£509.95

1kW - End Fed Wire Antennas

MyAnt EFW 80-10
Resonant on 80/40/30/20/17/15/10m
NO ANTENNA TUNER REQUIRED!
Length: 130ft

MyAnt EFW 40-10 **£159.95**
Resonant on 40/20/15/10 + WARC with tuner Length: 63ft **£149.95**

ANYTONE

AT-588
70MHz (4m) 50W FM Transceiver
Fully featured classic mobile for 4M
- Covers: 66-88MHz
- Memories: 200
- CTCSS/DCS/DTMF

£159.95

PC-588 Programming software & lead ... £9.95

COMET

H-422
Rotary Dipole covers: 7, 14, 21, 28MHz
£289.95

HF Antenna

CWA-1000	5 band trapped dipole 19.9m long	£124.95

VHF/UHF Antennas

GP1-M	145/433MHz length 1.25m	£59.95
GP3-M	145/433MHz length 1.78m	£69.95
GP6-M	145/433MHz length 3.07m	£99.95
GP9-M	145/433MHz length 5.15m	£149.95
GP15N	50/145/433MHz length 2.42m	£119.95
GP93N	145/433MHz–23cms length 1.78m	£99.95
GP9B	145/433/1200MHz length 2.94m	£119.95

50MHz Antennas

CA52HB	2 element Yagi	£79.95
CA52-HB4	4 element Yagi	£129.95

Quad Band Mobile for FT-8900

UHV-4	Mobile whip 4-Bands 10/6/2/70cms	£89.95

Antenna Tuners

CAT-10	10W 3.5-50MHz Manual Tuner	£99.00
CAT-300	300W 1.8-60MHz Cross Need e	£199.95

Accessories

CB-2500	Balun 2.5kW (CW) 1.8-56MHz	£44.95
CB-1000	Balun 1kW (CW) 1.7-30MHz	£39.95
CF-30MP	Low Pass Filter 1.8-30MHz 1kW CW	£59.95
CF-360A	Duplexer 1.3-30/49-470MHz	£49.95
CF-416DB	Duplexer 1.3-170/350-540MHz	£39.95
CF-416A	Duplexer 1.3-170/350-540MHz	£39.95
CF-530	Duplexer 1.3-90/125-174MHz	£49.95

LOTS MORE on our WEBSITE!

PRICE PLEDGE WE ALWAYS AIM TO BE COMPETITIVE - SEEN IT CHEAPER? LET US KNOW!

PART EXCHANGE or CASH WAITING for your used gear!

023 9231 3090

nevada®

E-Mail: tony@pwpublishing.ltd.uk

Making a Transmit Lowpass Filter

Tony Nailer G4CFY responds to a customer request by developing a lowpass filter suitable for transmit purposes.

One of the projects I have wanted to create for some time as companion to my 5-band receive bandpass filters is a 5-band transmit lowpass filter. Fortunately I had a request from a prospective customer for a 4-band transmit lowpass filter so I had motivation to bring it to fruition.

The last time this was done in *PW* was an article entitled *HF Bands Low-pass Filter* by **Stefan Niewiadomski** in February 2005. It used a 3-band board that could be daisy chained to another to produce a 6-band filter set. These two boards were housed in a stand-alone case with two switches, one for input and one for output.

It was quite practical but not very elegant and entailed 18 toroidal coils and wiring six input coaxial cables and six output coaxial cables. I still advertise a 6-band version of his board in the *PW* PCB Service.

Filter Choices

A lowpass filter is usually a Pi shape (like Stonehenge) with capacitor supports to ground and an inductor as the lintel. Alternatively is can be a T shape with two inductors in series between input and output and with a central capacitor support in the middle.

The most popular configuration is the Pi and the smoothest is the **Butterworth** that has a flat low frequency characteristic and then rolls off smoothly at the cut-off frequency before diving at a rate of 6dB for every doubling of frequency, for each Pi section. Although it has relatively poor attenuation, it does present a near constant load impedance across a wide frequency range.

An improvement over the Butterworth is the **Chebychev** type that uses different Pi sections in series to sharpen the slope of the roll-off and it was this type using a 3-section Chebychev network that Stefan used in his family of filters.

The penalty for a sharper roll-off and greater ultimate attenuation is more passband ripple and non-constant input impedance with frequency. This is not really an issue when used as a lowpass filter with a cut-off just above the operating frequency but there is no guarantee that the filter will present low impedance at some higher spurious or harmonic frequency where serious attenuation is needed.

A further development of the Pi network is to add a capacitor in parallel with each inductor in the network to produce parallel resonance at specific frequencies. This filter is called an Elliptic lowpass filter and each support and lintel are called branches, so a double Pi is called a 5-branch network.

In a 5-branch filter there will be two parallel resonances, one placed as close as 1.5 times the cut-off frequency and the other further on to prevent the stopband from rising unnecessarily.

This filter uses the first parallel resonance to create a notch frequency to make the roll-off steeper. The effect would be to have a return curve on the upper side of the notch, which would spoil its ultimate attenuation and that is the purpose of a subsequent notch to pull the curve back down again.

As a result of these notching techniques, the Elliptic filter has a much sharper roll-off than even the Chebychev filter and a better ultimate attenuation. The passband also, strangely, stays smooth like that of a Butterworth filter.

Tables for the various components for the 5-branch filter have been published in the *ARRL Handbook* since the mid-1990s. These have been selected from an almost infinite number of possible variants for those with standard values for the support capacitors, which have the largest values.

My 5-band Filter

No doubt you realise where this is leading and my filter uses a 5-branch Elliptic LPF with values derived from the *ARRL Handbook* table as set out in **Table 1**.

The bottom four filters were chosen as the closest at a tenth of the wanted frequency and the values from the tables were then simply divided by ten to give operation ten times higher.

C2 and C5 are the parallel resonating capacitors and all but three are non-standard values.

Table 1. Filter Components

Filter	Band(m)	C1(pF)	C2(pF)	C3(pF)	C4(pF)	C5(pF)	L1(μH)	L2(μH)
28	80	470	33+18	1000	150	390	2.16	1.84
1x10	40	270	33	560	47+47	220	1.21	1.0
13x10	20	120	8.2+4.7	270	18+18	100	0.59	0.51
14x10	15	120	10+3.3	220	22+15	100	0.45	0.38
22x10	10	68	5.6+2	150	22	56	0.33	0.28

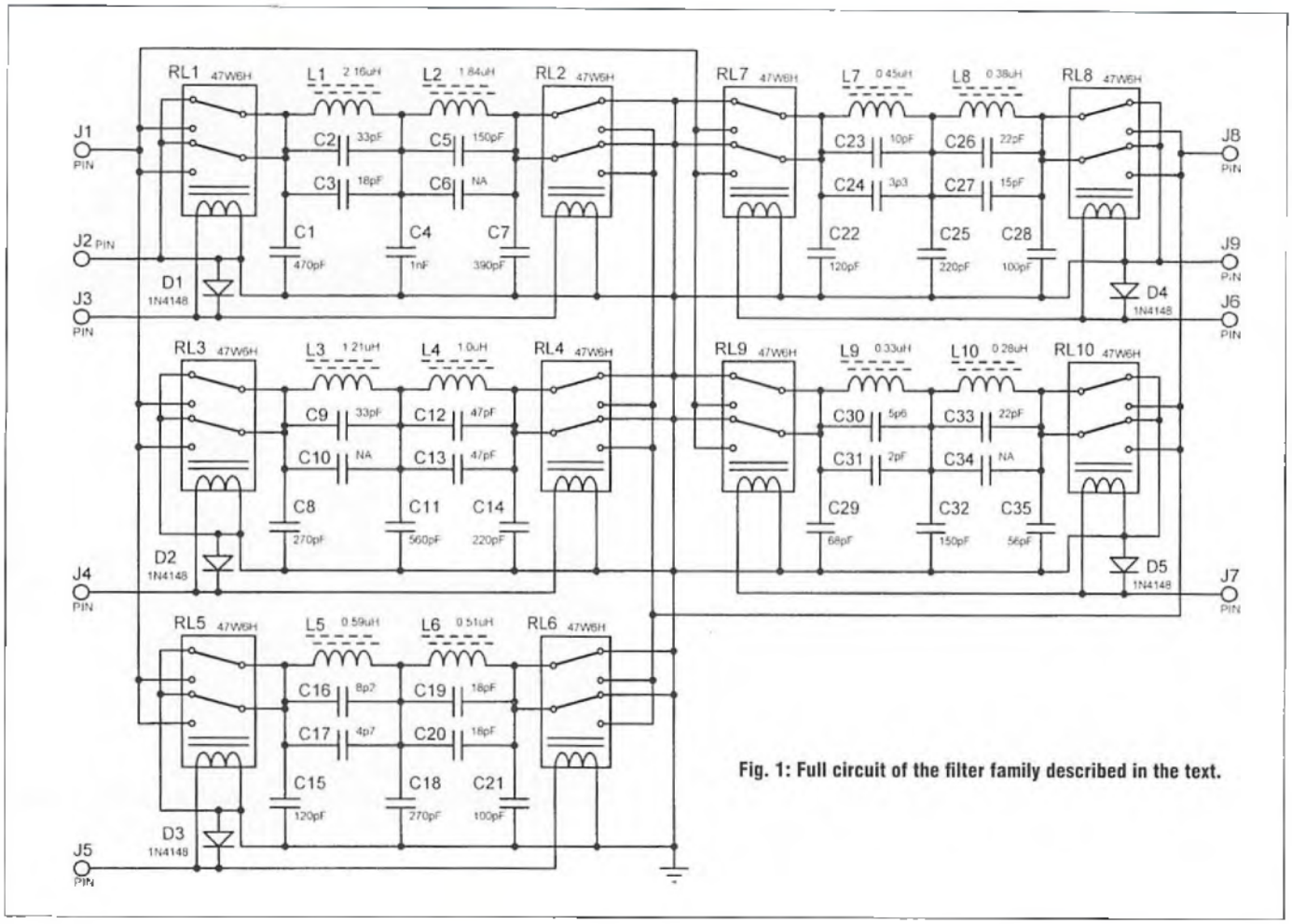


Fig. 1: Full circuit of the filter family described in the text.

My 5-band receive filters are switched using special diodes with low forward voltage drop and high RF isolation. This is possible for transmit and has often been used in private mobile radio (PMR) transceivers up to 25W and on both VHF and UHF.

My transmit filter, though, was originally intended to handle up to 50W so I decided to use high sensitivity versions of the 47W/6 Post Office approved relay. They are capable of carrying 2A across the contacts and by paralleling the switch sections, means a 4A continuous capability. So the power handling is $P = I^2 \times R$, $= 16 \times 50 = 800W$, which is way more than necessary. A pair of relays used for each filter draw a combined current of 30mA from a 13.5V line.

Making the Coils

When using toroids it's a good idea to use ones with sufficient inductance factor that the number of turns is not excessive. The T68-2 is good at low HF and has an inductance factor A_L of 3.6μH per 25 turns. This means that for 2.16μH and 1.84μH required for 80m they need fewer than 25 turns. The calculation is $N = 25 \times \sqrt{(A_L/\mu H)} = 25 \times \sqrt{(3.6/2.16)} = 19t$. For this number of turns 19SWG enamel wire is suitable.

A similar procedure was used for 40m where T68-6 cores were used with a factor of 2.9μH/25t, then for 20m, 15m, and 10m T50-6 cores with a factor of 2.5μH/t were used. See **Table 2**.

Printed Circuit Board

The full circuit of a family of filters is shown in **Fig. 1.** I laid out a PCB to accommodate relays each side of the filters with space for all coils to be T68 size and for a pair of parallel resonating capacitors across each coil. The toroids would be mounted with their axes at 90° to each other and the adjacent filters to have coils also at right angles to neighbouring filters.

Capacitors could be 50V or 100V working low-k NPO ceramic types if possible and polyester blocks for large values. Unfortunately, ceramic plate types are increasingly difficult to obtain and values over 100pF are now usually only available in multilayer ceramic COG types. Polystyrene types are fine at low HF but are too inductive at higher frequencies and are also as much as £2 each. Mica are fine at all frequencies but are also as much as £2 each.

So the board had to be laid out to accommodate disc ceramic, multilayer ceramic or polyester block, each with 5mm lead spacing. A board was produced and went well with good component density and no links or crossovers. An artwork was printed off and used during a PCB manufacturing run and the board was drilled, cropped and filed.

Table 2. Coil Details

Band	Coil L1	turns	cm	Coil L2	turns	cm	SWG	core
80	2.16	19	43	1.84	18	40	19	T68-2
40	1.21	16	34	1.0	14	32	19	T68-6
20	0.59	12	25	0.51	11	23	21	T50-6
15	0.45	10	20	0.38	9	19	21	T50-6
10	0.33	9	19	0.28	8	18	21	T50-6

Assembly and Test

I assembled the 80m filter first, complete with input and output relays, and tested it using a Marconi TF2370 110MHz spectrum analyser and tracking generator combination.

The filter had the cut-off in the right place but the notches for the parallel resonances were not deep. The ultimate stopband was poor with a return to just 10dB down at about 15MHz.

I spent about two hours going through everything, including removing the first coil from the board, adding 56pF in parallel with it and putting it in-line between generator output and analyser input. I calculated that it should resonate and provide a notch at 14.47MHz. The analyser showed it to be spot on so my toroidal coil design was correct.

Many times I looked at the board to see whether I had somehow done something silly and connected tracks wrongly or left something unconnected. Eventually I decided that the odd component was the multilayer ceramic 470pF at the input so I changed it for a polystyrene type. The improvement was spectacular, with a notch in the right place to nearly 50dB down but the stopband was not really acceptable, being only 25dB down.

All the other filters were made and tested in turn and I even used a T37-6 for the 10m coils. When all the filters were in place, the characteristics were quite good on some but not all. Then I noticed that when no filter was selected, there were all sorts of returns on the display, suggesting that the input and output lines were suffering crosstalk, probably due to poor earth paths.

When I had laid out the board it had been necessary to link the coils of input and output relays for each filter and this meant a track running almost the full width of the board. The position of this track seriously disrupted the earth path of the shunt capacitors in each filter and increased earth impedance down the board. I linked the earths across from one filter to the next using tinned copper wire and the input to output crosstalk reduced dramatically. When tested by activating each filter in turn, they all had improved to an ultimate attenuation of 35dB or better.

With the filters now operating as required and all with the proper roll-off frequencies, I decided to put it to the RF test and fired up my Yaesu FT-102. I tried the filters on 80m and 40m, putting 50W through them, and everything worked fine with no noticeable heating of coils or capacitors. So I increased the power to 100W and went through all the bands one at a time with key down for a minute or two on each.

On 10m the T37-6 coils did get warm so I rewound both coils using T50-6 cores and then they became only slightly warm to the touch with 100W continuous passing. A picture of the development PCB is shown in **Fig. 2.**

Final Remarks

To overcome the problem of suitable capacitors in the 100pF to 1nF range, I have found some suitable polypropylene capacitors, of a similar size to the boxed polyesters but 4mm (0.15in) wide and with available values 100pF, 220pF, 330pF, 470pF, 680pF and 820pF. I have ordered 100 of each value where I don't have proper NPO disc ceramics.

The PCB artwork has now been modified with the coil connections broken by low value or even zero ohm resistors and with much improved earth tracks linking the filters together. The board has also been extended to include large corner pads for screw fixing, something that was omitted from the original board. As an example of the performance, the screenshots, **Fig. 3**, shows the characteristic of the 80m filter.

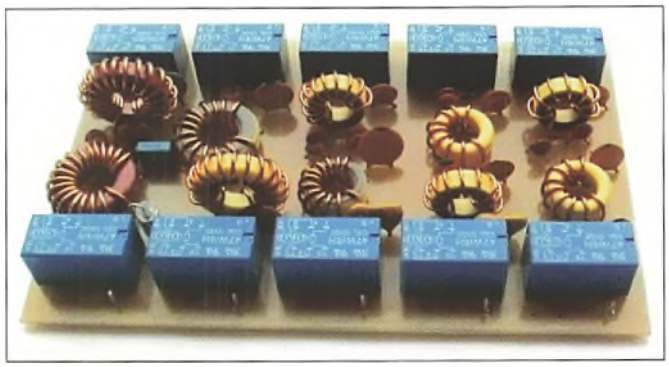


Fig. 2: The development PCB.

Fig. 3: The 80m filter characteristic as measured in Tony's workshop.

I expect that the modified layout will have even better stopband performance because according to the ARRL table the stopband should be better than 45dB down.

PS – Conclusion of A Modern Crystal Calibrator in last month's Doing it by Design

The photographs below show that a suitable box was found to house the unit and that I had decided to use metal instead of ABS plastic. The reason was that the user can then control the amount of RF coming out of the unit through the BNC socket rather than it radiating from the PCB and wiring. Output levels are 0-1V pk-pk 1kHz, 10kHz, 100kHz and 1MHz and 0-160mV pk-pk at 10MHz.

The original version in the two-part painted aluminium case looked pretty but was a little too large and too expensive. Going for the painted diecast box saves a valuable £5 in boxed version price. Given that some people will have a suitable spare box in the shack, the unit is available boxed or unboxed.

A PCB Kit with 5-way switch and 1kΩ linear level potentiometer will cost £25.25. The same plus a drilled and labelled box and with all the other hardware will cost £57.50. Both prices include tracked carriage by Hermes.

• E-Mail: what.next@pwpublishing.ltd.uk

Introduction to Analogue VHF/UHF FM Handhelds

Colin Redwood G6MXL presents a step-by-step guide to getting on the air with an analogue VHF/UHF FM handheld transceiver.

This month I'm going to look at getting on the air with a budget analogue VHF/UHF FM Handheld transceiver. This will include an overview of using CHIRP to programme repeater parameters into the transceiver's memory. Next month I'll explore a variety of things that can be done with these transceivers. Some readers may be wondering why I am doing this. With transceivers becoming ever more complex, the gap between the essentials covered as part of a Foundation course and the complexity of most modern transceivers seems to me to be getting ever wider. It's no wonder that some newly licensed amateurs struggle to get started. There has also been some correspondence, reflected in **Tim Kirby G4VXE's** *World of VHF* column about VHF activity, or lack of it, especially on FM.

Fig. 1: The Baofeng UV-5R with its supplied antenna.

Baofeng UV-5R

There are many VHF/UHF handheld transceivers on the market. I've chosen the Baofeng UV-5R, **Fig. 1**, to base this article on because it is broadly typical of the budget transceivers on the market. The topics I'll be covering will also apply to many other VHF/UHF analogue handheld transceivers.

The Baofeng UV-5R is a very popular transceiver for beginners. It has a maximum power output of 5W, which is comfortably within the Foundation licence maximum power limits.

Not a Review

Before I go any further, I should make it absolutely clear that this is not a review of the Baofeng UV-5R and that I have no commercial links with Baofeng, their dealers and distributors, other than as a normal private customer.

Accessories

Most handhelds are available with a number of optional accessories. I chose a bundle that included the transceiver, rechargeable battery, charger, external speaker/microphone, external programming cable and a CD. From another source I purchased a case and adaptor enabling me to use an external antenna and also an alternative to the antenna supplied.

It's a good idea to check that every item that is listed as being included in the manual has been supplied. Usually this will include the transceiver itself, a rechargeable battery and a charger. If you've ordered some additional items such as a case, programming lead and/or external speaker microphone, you should check that they have been included. Some transceivers intended for different markets may have different accessories. For example, power supplies for recharging batteries are usually supplied according to the local mains voltage and mains plug standards.

The next step is to skim through the manual to familiarise yourself with the contents and key features of your transceiver, paying particular attention to arrangements for charging the battery.

Batteries

The Baofeng UV-5R charger can charge the battery stand-alone or while it is attached to the transceiver. Initially, the battery will usually be completely flat so it will need several hours to become fully charged. I'd suggest keeping an eye on this for the first time. The LED on the charger base will show red while charging, **Fig. 2**. This is an ideal time to read the instruction book in detail. Once the battery is charged, the LED on the charger base will change to green and the battery can be attached to the transceiver, if you have not already done so.

Antenna

Before switching on the transceiver, make sure that you have fitted the flexible antenna by screwing it in to the SMA connector at the top of the transceiver. Make sure you do this before you switch on so that you don't accidentally transmit without an antenna connected.

Most handhelds are supplied with a flexible whip antenna, attached using an SMA connector. I would describe the connector on the Baofeng UV-5R as an SMA male and the connector on the antenna as an SMA female. Other transceivers use different arrangements of SMA and sometimes other connectors.

On-Off

The Baofeng UV-5R uses the rotary volume control on the top of the transceiver to switch the transceiver on and off. Some others have a button that must be pressed to switch on and held down to turn off.

I was greeted with 'Welcome' displayed on the liquid crystal display, followed by a rather stern sounding female voice announcing 'Frequency Mode'. These details will vary with other transceivers.

Configuration

On most handheld transceivers the squelch is set by a menu command.

Fig. 2: Charging the Baofeng UV-5R with the battery already fitted. Note the red LED on the base showing charging underway.

Initially, I suggest opening the squelch fully so that you can hear any signals that might be present. You'll need to refer to the user's manual to find out how to do this. In the case of the Baofeng UV-5R, when the squelch is open for whatever reason, the LED on the front panel will glow green. It changes to red when transmitting.

You'll also need to check that the correct frequency steps have been selected. On 2m in the UK, 12.5kHz is the norm these days. On 70cm in the UK, 25kHz is the norm.

When I started to use the transceiver on the air, I discovered that I also needed to adjust the maximum transmission time. As supplied it was set to just 60 seconds. By referring to the manual, I increased this to five minutes (300 seconds), which I considered quite long enough for my purposes. If you only use a local repeater, then setting the transmission timer to the same timeout as the repeater might be worth considering.

Out of Band

The Baofeng UV-5R has two VFOs, each of which can be operated on 2m or 70cm. In common with many handheld transceivers it is able to transmit well beyond the 2m and 70cm amateur allocations on both VFOs. I would therefore suggest that one of the first things to do is to reduce the risk of transmitting out of band by entering the 2m FM and 70cm FM calling frequencies (145.500MHz and 433.500MHz respectively) into both the A and B VFOs. Programming the transceiver's memories with frequencies that you use and just using the memories will reduce the risk of out-of-band transmissions still further.

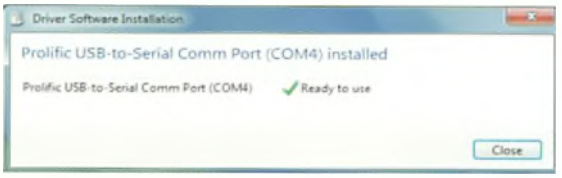


Fig. 3: Driver installed – You'll need to note the COM port number each time.

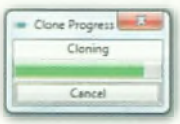


Fig. 4: CHIRP downloading the frequencies in the radio into the database.

Programming

There are two ways of programming handheld transceivers. The first is to do so manually using the buttons on the transceiver. The complexities of this approach vary. For many of the low-priced Chinese models such as the Baofeng UV-5R, the process for each channel can be a bit tedious. I would advise against doing this manually unless you only want to program a handful of frequencies such as your local repeater and your local club's simplex net frequency.

If you want to use a wide range of frequencies and repeaters, then I would suggest using a computer to program these into the transceiver. Essentially this involves entering the relevant information into a screen that looks a bit like a spreadsheet. You'll need the correct lead to go between the transceiver and a USB socket on your computer. I'd suggest getting this from the supplier of the transceiver.

The next step is to install the necessary drivers. Connect the lead to one of your computer's USB sockets but not to the transceiver. Your computer will then obtain the required drivers from the internet. If this fails, then you can use the CD that comes with the lead. Once the driver has been installed, you will see a message stating which port has been used, which you will need to note, **Fig. 3**.

CHIRP

The most commonly used program for programming handhelds is called CHIRP (not to be confused with the sound of an unstable transmitter being keyed!). CHIRP will program not only budget Chinese handhelds but also over 80 models of handhelds and mobile transceivers from the mainstream manufacturers, including Alinco, Icom, Kenwood and Yaesu. CHIRP can be run on Windows, Linux and Apple computers. The website shows which transceivers and which features are supported by the latest version. http://chirp.danplanet.com/projects/chirp/wiki/Home

Using CHIRP

For the software to recognise which radio and firmware version you have, you must start by downloading the memory data already stored in the transceiver.

Download from Radio

Downloading from the radio takes whatever is already programmed into your radio, creates a template of your particular set, including whatever version you have, and loads it into the CHIRP database on the computer, **Fig. 4**. The LED on the front of the UV-5R flashed red while this is happening. As delivered, my Baofeng UV-5R had 24 frequencies preprogrammed, none of which was within an amateur band.

2m Repeaters

For 2m repeaters, the split is −600kHz so a repeater with an output (the frequency you need to listen on) of 145.600MHz will require an input (the frequency you need to transmit on) of 145.000MHz.

In CHIRP you'll need to enter the receive frequency into the **Frequency** column, **Tone Mode** set to tone, **Tone** (See CTCSS below), **Duplex** set to – and **Offset** to 0.600. The **Mode** should be set to NFM for 2m and the **Power** to High or Low depending on what power you need to access the repeater from your location. I'd also suggest entering the repeater's callsign into the **Name** column to help with future changes. The other columns should be left blank.

70cm Repeaters

Most (but not all) 70cm repeaters in the UK have a split of +1.6MHz so a repeater with an output (the frequency you need to listen on) of 433.000MHz will require an input (the frequency you need to transmit on) of 434.600MHz. These days there are also 70cm repeaters with different splits. For example a repeater with a split of +7.6MHz, with an output (the frequency you need to listen on) of 430.850MHz, will require an input (the frequency you need to transmit on) of 438.450MHz. There are also a small number of 70cm analogue

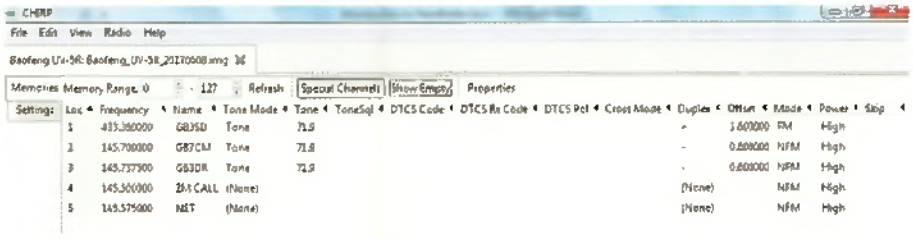


Fig. 5: CHIRP – showing the first few repeater and simplex channels I programmed.

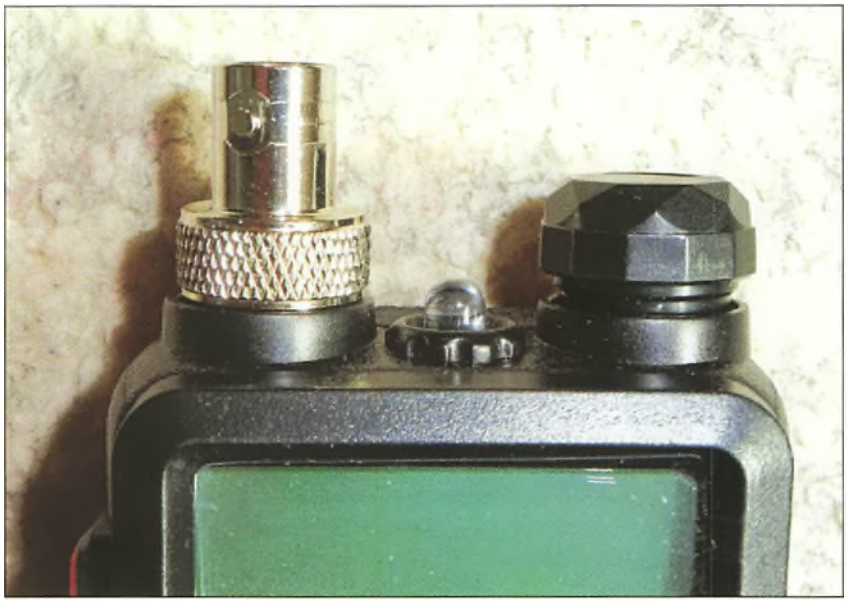


Fig. 6 A BNC to SMA adaptor fitted to the top of the Baofeng UV-5R transceiver.

repeaters with a −9MHz split. In CHIRP the **Duplex** and **Offset** settings will need to be entered accordingly, while for 70cm the **Mode** should be FM.

CTCSS

Most UK repeaters require a Continuous Tone-Coded Squelch System (CTCSS) tone to access them so you'll need to know the correct CTCSS tone for each repeater you wish to program into your transceiver. This is usually based on the county in which the repeater is located, **Table 1**, so will be different for repeaters on the same input and output frequencies in different parts of the country. The best source of up-to-date information on all UK repeaters can be found at: https://ukrepeater.net

Upload to Radio

Once you have made the additions, deletions and changes you want in the CHIRP database, the final step is to upload the new database to your transceiver. This completely replaces whatever was previously programmed in the transceiver. Before entering many repeaters, I would suggest testing a few entries to ensure they work as expected, **Fig. 5**. There are some additional guides and example of using CHIRP at: www.miklor.com/COM/UV_CHIRP.php

External Antenna

An external vertically polarised antenna mounted high up and fed with low-loss feeder will certainly increase the range over which you can hear and be heard. Knowing that my location is not a particularly good VHF site, I anticipated that I would want to have the option of using an outside antenna mounted on a pole above the ground. I fed this with some low-loss coaxial feeder and connected it to the transceiver with a suitable adapter, **Fig. 6**, to convert the BNC plug on the coax to the SMA connector on the transceiver.

First Contacts

With the transceiver programmed and an external antenna connected, I was well equipped to have my first contacts locally on simplex (no repeater shift) and through my local repeaters.

Next month

Next month, I'll move on to look at some of the things that you can do with an analogue VHF/UHF FM handheld. There's a lot more you can do than simply having a contact with a friend across town through the local repeater!

Table 1: The Usual CTCSS Frequencies for Each County.

County	Tone	Frequency
Aberdeenshire	A	67.0Hz
Angus	F	94.8Hz
Anglesey	H	110.9Hz
Argyll and Bute	G	103.5Hz
Avon	J	118.8Hz
Ayrshire	G	103.5Hz
Bedfordshire	C	77.0Hz
Berkshire	J	118.8Hz
Border Counties	J	118.8Hz
Buckinghamshire	C	77.0Hz
Cambridgeshire	F	94.8Hz
Caithness	C	77.0Hz
Channel Islands	B	71.9Hz
Cheshire	G	103.5Hz
Cleveland	J	118.8Hz
Clwyd	H	110.9Hz
Cornwall	C	77.0Hz
Cumbria	C	77.0Hz
Derbyshire	B	71.9Hz
Devon	C	77.0Hz
Dorset	B	71.9Hz
Dumfries and Galloway	G	103.5Hz
Durham	J	118.8Hz
Dyfed	F	94.8Hz
Essex	H	110.9Hz
Fife	F	94.8Hz
Glamorgan	F	94.8Hz
Gloucestershire	J	118.8Hz
Greater Manchester	D	82.5Hz
Gwent	F	94.8Hz
Gwynedd	H	110.9Hz
Hampshire	B	71.9Hz
Hereford and Worcester	J	118.8Hz
Hertfordshire	D	82.5Hz
Highland (West/Islands)	E	88.5Hz
Highland (East Coast)	A	67.0Hz
Humberside	E	88.5Hz
Isle of Man	H	110.9Hz
Isle of Wight	B	71.9Hz
Kent	G	103.5Hz
Lanarkshire	G	103.5Hz
Lancashire	D	82.5Hz
Leicestershire	C	77.0Hz
Lincolnshire	B	71.9Hz
London	D	82.5Hz
Lothians	F	94.8Hz
Merseyside	D	82.5Hz
Norfolk	F	94.8Hz
Northamptonshire	C	77.0Hz
Northern Ireland	H	110.9Hz
Northumberland	J	118.8Hz
North Yorkshire	J	118.8Hz
Nottinghamshire	B	71.9Hz
Oxfordshire	J	118.8Hz
Perthshire	F	94.8Hz
Powys	G	103.5Hz
Shropshire	G	103.5Hz
Somerset	C	77.0Hz
South Yorkshire	B	71.9Hz
Staffordshire North	G	103.5Hz
Staffordshire South	A	67.0Hz
Suffolk	H	110.9Hz
Surrey	D	82.5Hz
Sussex (East and West)	E	88.5Hz
Tyne and Wear	J	118.8Hz
Warwickshire	A	67.0Hz
West Midlands	A	67.0Hz
West Yorkshire	D	82.5Hz
Wiltshire Northern	J	118.8Hz
Wiltshire Southern	B	71.9Hz
Worcestershire	J	118.8Hz

The Cedars, 3a Wilson Grove, Heysham, Morecambe, Lancashire LA3 2PQ
E-mail: G3LLL@talktalk.net

Guarantees and Accuracy

Harry Leeming G3LLL ponders what a guarantee is worth and moves on to claims of accuracy in frequency measurement.

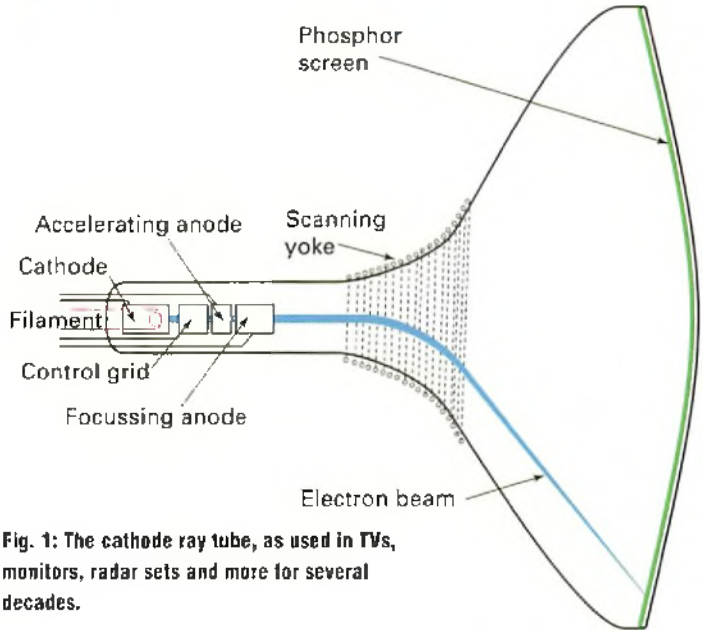


Fig. 1: The cathode ray tube, as used in TVs, monitors, radar sets and more for several decades.

When I started work on my 15th birthday as an apprentice radio and TV engineer in 1952, a 12in black-and-white TV cost around £60 (for an adult, about six weeks' wages), and came with a 12 month 'guarantee'.

If after, say, 10 months, the picture started looking dim, the owner decided to have it looked at 'while it was still under guarantee', he was in for a shock.

The catch was in the small print. The TV manufacturer's guarantee did not cover labour, the valves or the cathode ray tube (CRT). In fact, it did not cover much at all that was likely to fail and the valves were only covered separately by their manufacturers for three months. If the cause of the dim picture was due, however, to the CRT having lost most of its emission, this was only guaranteed for six months. A new tube would set the owner back about two weeks wages plus fitting charges and quite often, because the owner would have the set on hire purchase (HP) and be struggling to keep up with the HP payments, this was a major disaster. To 'pass the buck', the shop manager would give the customer the address of the CRT maker and suggest that they write a sob letter expressing their dissatisfaction. Occasionally this did the trick.

CRTs, used in all early TVs, were really just large valves, in which the electrons radiated by a cathode bombarded a sensitive layer on the inside of the screen, made it glow, and so formed the picture,

Fig. 1. The fall-off in the emission of the tube's cathode and hence picture brightness, could also be a very expensive problem for dealers renting out TVs because a new tube would cost them a large part of a year's rental income. Sometimes the emission from the cathode could be increased by stepping up the tube heater voltage beyond the maker's recommendation and small transformers were specially made with adjustable heater tappings for this purpose. Usually a 10% boost would considerably improve the picture but as the tube got older even more voltage would be risked. TV sets on rental commonly had quite a bright glow coming from the tube heater at the rear as the dealer tried to put off the expense of replacing the tube.

It is hardly worth the trouble of trying to extend the life of normal low power valves but I wonder if when expensive PA valves in a high power linear amplifier develop low emission, it would be possible to get a little extra life from them by boosting the heater voltage? I have never had chance to try this myself but if they are on their way out anyway, I can't see that it would do any harm to give it a go and I would be interested in hearing the results.

I hear that the BBC have limited funds and have only a small number of PA valves in stock for the 198kHz long wave transmitter. I wonder if they too will use this dodge to try and squeeze a little more life out of them?

Frequency Counter Accuracy and Temperature Controlled Ovens

"My frequency is spot on 435.0002MHz. I know because I have checked it with my counter." How many times have you heard someone make such claims?

These claims, like many manufacturer's claims, should be taken with a large pinch of salt. I wonder, for instance, just how much equipment that is stamped as complying with European standards, actually does, and I am sure that it is not just car manufacturers that are guilty.

The reading on any counter (or a rig's digital display), is only accurate if the reference crystal oscillator is bang on frequency and counters or displays in the average radio amateur's shack are unlikely to have accuracies of better than a few parts per million. If your counter has an accuracy of, say, ±10PPM (parts per million) and you are on the 160m band, you can be assured that it reads to within ±20Hz – for most practical

purposes spot on. If, however, you try to make measurements on the 70cm band at 435MHz, ±10PPM represents a possible error of over 4kHz – rather a different story.

I once purchased from the USA a rather neat looking frequency counter, that was advertised as being capable of checking frequency to within ±1PPM. When I tested it, the warm-up drift of the reference oscillator during the first couple of hours was 17PPM so I complained to the supplier. I was told that to get the claimed accuracy every time I used the counter, it was necessary to set the counter's calibration trimmer after the counter had warmed up for a few hours. This seemed somewhat deceptive and not very convenient. The counter was a neat modestly-priced unit and otherwise worked well and, given that sending it back to the USA really would have been too much trouble, I decided to try to cure the problem myself. I obtained and fitted a high quality crystal that was intended for use as a reference oscillator. The drift fell dramatically and it was then possible to make measurements to within one or two parts per million.

How to Check a Frequency Counter

The simplest way check the accuracy of a frequency counter this is to use it to measure the frequency of an oscillator that you know to be correct but how do you produce an oscillation that is spot on frequency? If you make up a simple 1MHz or 5MHz crystal oscillator such as that shown in **Fig. 2**, and then set this accurately by beating a harmonic of it against a frequency standard station, such as those on 5, 10 and 15MHz, you then have your own reference standard (until, of course, it drifts off and needs resetting). Checking against a standard that is broadcasting on the short waves, however, is sometimes easier said than

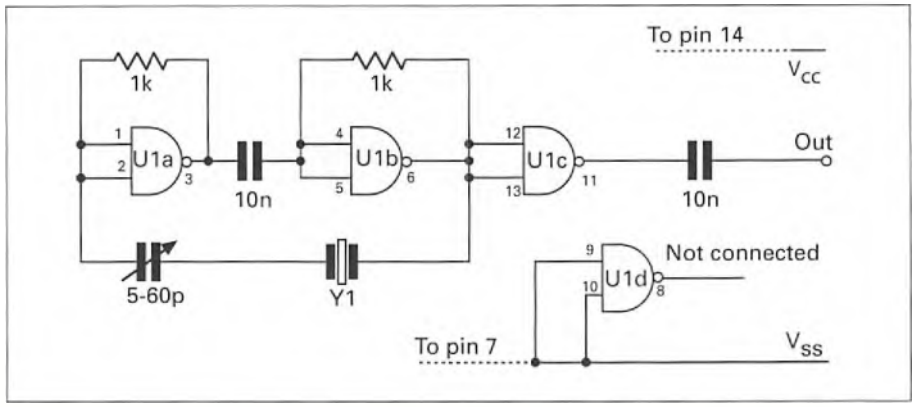


Fig. 2: A simple crystal oscillator circuit based on 7400 series logic, originally from the ARRL Handbook.

done because shortwave propagation is not 100% reliable and by 'Murphy's Law' you can be sure that just when you want to do the check, there will be interference or a fade out.

In the UK at the moment, by far the most convenient frequency standard is Radio 4 at 198kHz. This is maintained to a fantastic standard of accuracy and puts out a good signal throughout the UK. Unfortunately, 198 is not a terribly useful frequency but several manufacturers produce crystal calibrators that are locked to this and have outputs at more useful frequencies such as the Quartzlock one I used for many years, **Fig. 3**. I had only to connect my counter to its 10MHz output and if the reading was within ±10Hz, I knew that my Blackstar counter's clock oscillator was set to an accuracy of within 1PPM. The counter's clock calibration trimmer is adjustable through the small hole in the front panel just below the display, **Fig. 4**.

If I wanted to check the accuracy of a receiver on the 2m band, for instance, I could tune to a harmonic of the 1 or 5MHz output of the Quartz Lock calibrator at 145 or 146 MHz, which I knew would be exactly on frequency.

Accuracy does not have to cost a fortune. I see from his website that *PW* contributor **Tony Nailer G4CFY** of Spectrum Communications makes a kit for a calibrator unit which is locked to 198kHz, with switched outputs at various frequencies from 1KHz to 10MHz, for well under £100 *(and see also last month's* Doing it by Design – ***ed)***.

Once you have a signal source that is spot on frequency, it is quite easy to correct the calibration of your counter's reference oscillator by adjusting the appropriate trimmer but that is not the end of the story. Even good quality crystal oscillators, such as that in my Black Star counter, drift from day to day with temperature. Temperature changes can be compensated for to some extent and on my counter I have managed to cancel out most of these effects by experimentally connecting negative temperature coefficient capacitors in parallel with the trimmer that sets the frequency of the 10MHz clock reference oscillator.

You can purchase a counter with the crystal oscillator mounted in a temperature-controlled oven. The catch here is that you then have to switch the counter on to warm up for an hour or so before you try to make measurements and even then, a low priced counter with an oven will tend to cycle slightly either side of the correct setting as the crystal oven thermostat switches on and off. A better answer in the UK, if you want fantastic accuracy, is to switch off the

Fig. 3: The Quartzlock off-air frequency standard.

Fig. 4: Harry's Black Star frequency counter.

counter's internal clock oscillator and replace it with a signal from an oscillator locked to the BBC on 198kHz, but this is perhaps, a little over the top for most amateur radio uses.

Manufacturers' Self-Testing

In the 1970s I looked after the electronic side of a small family audio and photographic business and I was asked to make 'Something to test camera shutters'. I made enquiries and found that most photographic retailers, and quite a number of camera repairers had no means of checking shutter speeds. When with the help my senior technician **Derek Fielding** I managed to make what *Amateur Photographer* and several other UK and America magazines recognised as the first low-priced simple-to-use camera shutter tester that was suitable for home users or retailers (I was even granted a patent for it). I was shocked to find how lax some camera manufacturers were. On one supposedly semi-professional camera, the indicated 1/1000 speed was often nearer to a 1/500 and the 1 second speed close to half a second. Without actually naming the camera, I mentioned its country of origin in an advert and received a rather carefully worded but slightly threatening letter from the importer's solicitor. I replied, giving them my test results, and asked them if they would be willing to indemnify us and any other retailers against the cost of any prosecutions under the Trade Descriptions Act, if we continued to sell the camera. I'm still waiting for a reply.

Laws and Regulations

Designing and marketing the tester cost us very little because we did most of the work in our spare time (if you want to read the full story of our tester, obtain and load the *PW In The Shop* CD, install the free Adobe Reader and type 'Shutter Tester' in the search box). It would be a very different now because since 1992 new equipment has had to pass all sorts of safety and EMC standards before it can be sold. It seems to me that this would have meant that our shutter tester and later the G3LLL RF clipper and other bits and pieces I marketed, would have been strangled at birth.

The problem with 'standards' is that large manufacturers can now 'self test' and market devices such as washing machines that catch fire, computer network devices that cause terrific interference and polluting cars that are then sold for many years before anyone complains. While items may even comply with regulations in the maker's laboratory, it doesn't necessarily mean that they will comply in the real world.

Often the people importing or selling the goods, and even sometimes Trading Standards themselves, have no way of testing for compliance, yet any small inventor, who only expects to sell a few dozen items, is expected to do just that.

Small companies, or would-be part-time inventors are placed at a great disadvantage because the cost, time, equipment and effort needed to make sense of the regulations to ensure compliance will often require far more in time and money than any likely profit. A friend made 'bespoke' language labs for schools but with the advent of the EMC regulations, he decided to close that side of the business down because it would have cost him over a year's income to get the testing done.

Of course, the path to compliance may not be as difficult as it seems to me, hence I am sure the editor would be interested to hear from any readers who have managed to tread through the minefield of designing equipment, ensuring EMC and EEC compatibility, and then marketing it in their spare time and would be willing to give advice to other would-be kitchen table innovators.

A Final Thought about Oven Controlled Counters

We are all equipped with our own very precise temperature control system, which under normal circumstances maintains body temperature within ±0.5% of 98.6°F. I used to take my watch off at night and it lost a few seconds a week but I now wear a cheap quartz watch with a metal bracelet, which keeps time to within a few seconds a year (an error of about 0.1PPM). The secret is that I wear it 24/7 just slightly up my sleeve and it takes advantage of my built in 'temperature controlled oven'.

Theoretically it would be possible to build a very accurate counter, with a miniature separate reference oscillator maintained at body temperature. If you should try the idea, do be careful where you put it please – I don't want a queue of *PW* readers at A&E!

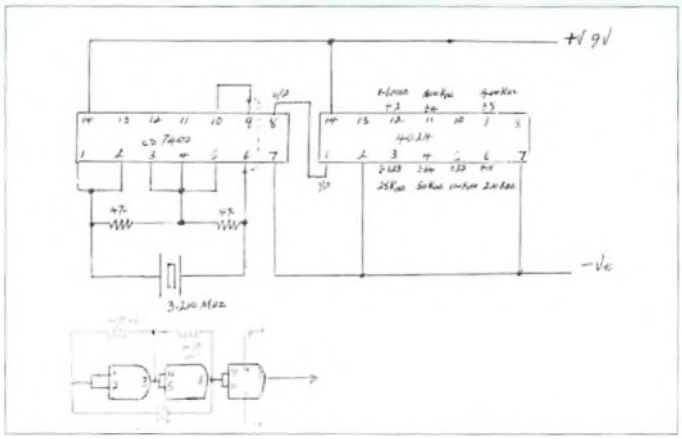
See you in a couple of months. Harry.

*(**Editor's note:** Harry talks about reference oscillators and it might be worth mentioning that very high accuracy is obtainable nowadays from GPS-referenced oscillators. A Google search will produce some and there is an interesting reference on **Andy Talbot G4JNT's** website, URL below:*

www.g4jnt.com/SimpleGPSDO.pdf)

Letters

Send your letters to:
Don Field G3XTT, PW Publishing Ltd, Tayfield House,
38 Poole Road, Westbourne, Bournemouth BH4 9DW.
E-mail: don@pwpublishing.ltd.uk



Crystal Marker

Dear Don,
Having seen **Tony Naylor's** article (*Doing it by Design*, July) on a crystal marker, I looked up my old squirreled away notes and came out with the diagram above. If you exclude the Veroboard, battery and two IC holders (I prefer to use the holders rather that solder an IC direct onto Veroboard), you end up with a total of five components. These are:

a) a crystal for 3.200MHz (can be obtained from Quartzslab or an old junked FT-101ZD)
b) two resistors, each 470Ω
c) one CD4700 IC
d) one CD4024 divider IC

I hope this is of interest. I not only built the checker but also built a separate crystal oscillator, which I use with my Mark 123. Plug the transmit crystal into the oscillator, insert the output of the crystal oscillator to the antenna socket of the Mark 123, zero beat the signal and that is the receiver of the 123 set to the transmit frequency. A very handy item.

Ross Bradshaw G4DTD
Cornwall

Various

Dear Don,
A few comments regarding items in the June issue of *PW*.

If I had heard a callsign like M3D (your *Keylines*), I would have simply ignored it and tuned away because I would have assumed that it is not a valid licensed amateur callsign. My understanding is that all amateur callsigns in the UK consist of two or three letters after the digit and in the case of M3 callsigns, it is always three letters so M3D is not an amateur callsign and I would be in breach of my licence if I established communications with that station.

On the letters page **Tony Morgan G0CAJ** has a good point about all repeaters having the same CTCSS access tone. One of the reasons CTCSS was introduced was to stop the possibility of a 1750Hz tone opening two repeaters but does this really matter now? At least if your CTCSS tone and *"listening through"* call opens two repeaters, it's doubled your chances of making a QSO.

Paul Burgess G3VPT and your reply make perfect sense – you get what you pay for. Because we pay no licence fee we get nothing. I reported abuse of a 70cm repeater to Ofcom and got a very short reply on the next working day advising me that it was not their job and advising me to contact the RSGB Amateur Radio Observation Service. Although I am not currently an RSGB member, I have now received a reply to the effect that they are dealing with my concerns.

Dave Allsebrook G1VAC
Derby

Beryllium Oxide & LED Lighting

Dear Don,
An important addition is needed to the warning about beryllium oxide by **Graham Jones G3VKV** (*Letters*, April).

RoHS exempted certain toxic substances because banning them would have a negative economic impact – beryllium is one of them. This problem isn't eventually going to go away. Beryllium is still rolling off production lines.

Beryllium is not exactly rare in general power semiconductors and it's not uncommon in RF power semiconductors. It also turns up in various other types of component that need to get rid of a lot of heat. There could well be beryllium enhanced ceramic bases for 'battleship' PA valves. Its probably not very dangerous when sintered into ceramic – until you crush it.

On another matter, **Tim Langabeer** (*Letters*, May) mentioned the RFI nuisance of LED lighting. The switched mode type seem to be losing ground to wattless droppers – the less you pay, the more likely you are to get a no RFI wattless dropper. The best way to make sure is by cracking one open. I usually destroy the metal cap so I can get at the plastic body with big side-cutters. The globe is usually real glass and a hazard. Breaking chunks off the plastic body usually cracks the glass when you get closer to it and you have to hold on to something!

The GU10 type lamps are more likely to be switch mode and a real pain to crack open.

Ian Field
Letchworth, Herts

5MHz

Dear Don,
I look forward to **Richard Lamont's** Part 2 of *Getting Started on 5MHz*. However, he missed including notes on the South African allocation. The story that the SARL is telling is as follows:

The South African Radio League (SARL) canvassed for 5MHz and received an allocation of two spot frequencies from the regulator. SARL claim they paid the licence fee for the privilege. So, the SARL say that only SARL members can use these spot frequencies. Selling amateur radio frequencies off to a group is against the IARU policy. I have established the veracity of the above and seen nothing to deny it.

As a signatory to ITU and agreeing to CEPT licensed operation, South Africa is bound by international agreements. However, the government and the regulator ICASA have shown scant regard to cooperating with international obligations.

As an example, the digital migration of terrestrial TV is still to be finalised. There is no regulation in place or legislation that has been enacted even though South Africa signed up for the changeover to have happened some years ago!

Just as an aside, I have not heard anything since the announcement that 2,100 amateur radio licensees (about two-thirds of the ZS and ZR guys) lost their licenses and will have to reapply if they want them reinstated. Some will be those who paid for five years and are still valid operators. The others did not pay in time, many because the invoice did not get through the mail! How many will make a new application, and how long will that take, in a country where it can take up to seven years for a naturalisation application to be processed completely, is anyone's guess. My wife and I pay ours before the due date and I phone up the regulator and their finance department to make sure they got my money! Such is life in ZS.

Tom Morgan ZS1AFS, ZT1T, G0CAJ
South Africa

Please note: The opinions expressed in any letter published in *PW* are those of the named correspondent whose letter has been published and they don't necessarily reflect the opinions of the editorial staff or PW Publishing Ltd. **Editor**

£20 STAR LETTER

VHF/UHF

Dear Don,

On page 34/5 of June *PW*, **Tim Kirby G4VXE** argues that VHF and UHF have more to offer than ever, despite often seeming dead to the casual listener. After a brief discussion of the usual perception (*"I never hear anyone on"*), he then says that he would like to try to convince newly licensed operators that there is more to VHF/UHF. The piece then goes on to mention moonbounce, satellites, 2m aurora and other similar activity, for much of which a certain expertise is required, which may well come to the new operator in time.

Coincidentally, on pages 18/19 of the same issue, **Colin Redwood G6MXL** introduces the *PW* 144MHz QRP contest, taking place on June 11th. He says, *"The only equipment you'll need is a low power 2m transceiver, and an antenna"*. This would seem ideal to a new operator, until he reads the next two sentences. *"You can expect to make some contacts with a basic 2m FM transceiver. But most of the activity is likely to take place on SSB"*.

I find this a bit contradictory. You have one article trying to encourage VHF/UHF activity but discussing topics that might seem quite exotic and another promoting essentially SSB activity. As far as I know, because I've hunted in vain for one, there are no VHF/UHF only transceivers on the market today that have SSB capability (I still have an FT-290!). An FT-817, mentioned by Colin, is really an HF rig that can also cover the VHF/UHF bands and much more but at a substantial price, particularly for a new operator, still unsure of the kind of amateur radio in which they want to invest their time and money.

For the new operator, a cheap handheld is a great way to start. But these sets are FM only. Hence, they cannot join the SSB activity on the day of the contest, nor can they contemplate moonbounce!

So, how about promoting more use of FM during the contest? What about declaring one of the hours of the contest as an FM only hour? Surely, the way to encourage more activity on VHF and UHF is to provide more opportunities for operators, new or older, to use what they have?

Joe Chester MW1MWD
Bridgend

Editor's comments: *Thanks for your e-mail Joe. You raise some interesting points. I see the PW contest as encouraging QRP activity on 2m (which, sadly, tends to rule out FM to a large extent – SSB is a far more effective mode with low power), while Tim raises some interesting and valid points about the diversity of current VHF operation. There are, of course, VHF/UHF only rigs that have SSB but they tend to be very expensive (the Icom IC-9100, for example). Older rigs such as the FT-221 do pop up on eBay and elsewhere from time to time. Most serious VHF operators (DXers and contesters) nowadays tend to use an HF driver with a transverter. The good news in respect of what you are asking is that the RSGB (who, quite rightly, sponsor far more contests than PW) have added FM sections to their increasingly popular Tuesday activity contests. It will be interesting to see how this pans out long term. But Colin Redwood has taken your thoughts to heart and this month and for the next couple of months is looking at what the new operator can do with a simple VHF/UHF handheld.*

The Star Letter will receive a **voucher worth £20** to spend on items from our **Book Store** or other services offered by ***Practical Wireless***.

Rallies

Send your rally info to:
PW Publishing Ltd, Tayfield House, 38 Poole Road,
Westbourne, Bournemouth BH4 9DW.
E-mail: newsdesk@pwpublishing.ltd.uk

Plan your rally visits with our comprehensive list of forthcoming events.
PW Publishing Ltd. will be at shows marked* – come along to our stand for great deals on subscriptions to *Practical Wireless* and *RadioUser*.
Club Secretaries and Event Organisers – please send us details of your event if you would like it to be mentioned here.

JULY

July 13th (Thursday)

The Dover ARC Table Top Sale

The Dover Amateur Radio Club will be holding a Table Top Sale in the Engineering Department at East Kent College, Maison Dieu Road, Dover, Kent CT16 1DH. The event is associated with a regular club night (between 6.00pm and 9.00pm), which is open to all, not just club members. Please note that East Kent College is a high-security environment. Therefore, to gain entry on the night, non-members are advised to ring the mobile number given on the Dover ARC homepage. Also, there are videos on the website to help non-members find the entrance to the venue (both by car and on foot).
www.darc.org.uk

July 14th, 15th and 16th (Friday/Sunday)

HAM RADIO Friedrichshafen

HAM RADIO 2017 will be held at Messe Friedrichshafen, Neue Messe 1, 88046 Friedrichshafen, Germany. The doors will be open between 9.00am and 6.00pm on Friday and Saturday and from 9.00am to 3.00pm on Sunday. There will be car parking, trade stands, a flea market, special interest groups, lectures (with some in English), a licensed bar, catering and facilities for the disabled.
www.hamradio-friedrichshafen.de/ham-en

July 16th

The McMichael Radio Rally

The McMichael Amateur Radio Rally & Car Boot Sale will be held at Reading Rugby Football Club, Holme Park, Sonning Lane, Sonning-on-Thames, Reading, Berkshire RG4 6ST. The doors will open at 9.30am and admission will cost £3.00. There will be talk-in on S22, free parking, trade stands, a car boot sale, computer equipment, demonstrations and lecture, a prize draw, special interest groups, catering and a licensed bar. No dogs allowed, assistance dogs only.
Andy M5ALG (Bookings Manager)
E-mail: m5alg@radarc.org
www.mcmichaelrally.org.uk

July 23rd

The Finningley ARS Rally

The Finningley Amateur Radio Society Rally will be held at The Hurst Communications Centre, Belton Road, Sandtoft, Doncaster DN8 5SX. The doors will open at 10.30am and admission will cost £3.00. In addition to free parking, the event will be all on one level and offer massive indoor and outdoor traders' areas, with major traders and club stalls (microwave components to QRP kits) together with hot food and drinks all day.
Kevin G3AAF
Tel: 07831 614640
E-mail: kevin@avery03.fsnet.co.uk
www.g0ghk.com

July 30th

The Chippenham Radio Rally

The Chippenham & District Amateur Radio Club Radio Rally & Car Boot Sale will be held at Kington Langley Village Hall & Fields, Church Road, Kington Langley, Chippenham, Wiltshire SN15 5NJ. The doors will be open between 10.00am and 3.00pm and admission will cost £2.00 (under 16s free). There will be talk-in on S22 (**145.550MHz**), on-site parking, trade stands, a car boot sale and refreshments (hot food and drinks) will be available on-site. The venue is 1.5 miles south of M4 J17 – follow the signs from the A350.
www.g3vre.org.uk

AUGUST

August 6th

The Great Eastern Radio Rally

The 28th King's Lynn Amateur Radio Club Great Eastern Radio Rally will be held at Gaywood Community Centre, off Gayton Road, King's Lynn, Norfolk PE30 4DZ. The doors will open at 9.00am and admission will cost £2.00. There will be talk-in on 145.550MHz, free parking, trade stands, a Bring & Buy and on-site catering. In addition, there will be amateur radio car boot pitches outside as well as tables in the hall.
Ted G4OZG
Tel: 01553 768701 or 07946 838656
E-mail: g4ozg@raynet-uk.net
www.klarc.org.uk

August 6th

The Lorn Radio Rally

The Lorn Radio Amateur Club Radio Rally will be held at Crianlarich Village Hall, Main Street, Crianlarich, near Oban, Perthshire FK20 8QN. The doors will open at 10.30am and admission will cost £2.00. There will be trade stands, a Bring & Buy and on-site catering (tea, coffee, rolls and so on). Raffle tickets will cost £1.00 and the draw will be held at 1.30pm. There is no charge for traders' tables. However, prizes for the raffle would be appreciated. New traders always welcome.
E-mail: lornradioclub@gmail.com

August 11th (Friday)

The 24th Annual Mini Rally Night

The Cockenzie and Port Seton Amateur Radio Club 24th Annual Mini Rally Night will be held in the main hall at Port Seton Resource/Community Centre, South Seton Park, Port Seton, Prestonpans EH32 0BQ. It is an opportunity for you to bring along your 'junk' and sell it yourself. The event will run between 6.00pm and 9.00pm. There is no charge for tables (available on a first come, first served basis) and admission for both sellers and buyers will cost £2.00. There will be a prize draw and food and drink will be available. The venue has toilets and disabled access.
Bob Glasgow GM4UYZ
E-mail: gm4uyz@cpsarc.com
www.cpsarc.com

August 13th

The Flight Refuelling HAMFEST

The Flight Refuelling Amateur Radio Society HAMFEST will be held at the Cobham Sports and Social Club Ground, Merley, near Wimborne, Dorset BH21 3DA. The doors will open at 10.00am and admission will cost £3.50 (under 14s free). There will be talk-in on 145.550MHz, free parking (including spaces for the disabled), trade stands (both indoors and outdoors), a car boot sale, lecture stream and demonstrations, special interest groups, a licensed bar and catering will be available. Camping is available on Saturday night in an adjacent field.
E-mail: hamfest@frars.org.uk
www.frars.org.uk

August 20th

The Rugby Rally

The Rugby Amateur Transmitting Society Annual Radio Rally will be held at Princethorpe College, Princethorpe, Rugby CV23 9PY (NGR: SP395710; 52.336N 01.421W). The doors will be open between 10.00am and 4.00pm (8.00am for sellers) and admission will cost £3.00. There will be trade stands, a car boot area and on-site catering will be available.
Tony G0OLS
Tel: 07759 684411
E-mail: rally@rugbyats.co.uk
www.rugbyats.co.uk

August 27th

The Milton Keynes ARS Rally

The Milton Keynes Amateur Radio Society Rally will be held at The Irish Centre, Manor Fields, Watling Street, Fenny Stratford, Milton Keynes MK2 2HX (opposite Dobbies Garden Centre). The doors will open at 10.00am and admission will cost £3.00. There will be talk-in on 145.550MHz (S22), free on-site parking, trade stands, catering and facilities for the disabled. Full details can be found on the Milton Keynes ARS website.
Tim Cowell (Rally Coordinator)
Tel: 07866 673192
E-mail: rally@mkars.org.uk
www.mkars.org.uk/mkars/rally

August 28th (Bank Holiday Monday)

The Huntingdonshire ARS Rally

The Huntingdonshire Amateur Radio Society Rally will be held at Ernulf Academy, Barford Road, St Neots, PE19 2SH. The doors will open at 9.00am and admission will cost £3.00. There will be free parking, trade stands, an RSGB bookstall and catering (hot meals and drinks) will be available on-site. Traders will have access to the venue from 7.00am.
Malcolm M0OLG
Tel: 01480 214282
E-mail: events@hunts-hams.co.uk

Classified Adverts

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.

Antennas

G4TPH MAGLOOPS Remote tune and manual tune models. 40m through 10m, 100 Watts, SSB. See *PW* review on website. Details at www.g4tph.com

TRAPPED DIPOLES & INVERTED-L Spectrum Lite Trapped Dipoles with Low-Z twin feeder. Rated to full legal limit. Low TVI. Typically 2 to 3 S-points quieter than G5RVs and verticals. Air-cored low loss 1:1 Balun Trapped Inverted-L aerials for small gardens. Spectrum Low-Z feeder available in 100m drums or by metre. Tel: 01305 262250, jean@spectrumcomms.co.uk, www.spectrumcomms.co.uk.

For Sale

CTCSS ENCODER AND DECODER KITS. DTMF kits and modules. Pic development kits. https://cstech.co.uk

For Sale

USB CAT, CI-V & PROGRAMMING CABLES. Control & programme your rig from your PC – logging, satellite tracking etc. SiLabs CP2102 or FTDI chipset for guaranteed reliability. For these and more great items go to www.technofix.uk

KITS & BUILT PRODUCTS Transverters, 100W 4m Linear Amplifier, HF & VHF Preamps, Masthead VHF Preamps, 25W VHF Linear Amps, VLF & VHF Converters, Noise Bridge, HF Power Meter, Capacitance Meter, Regenerative Receivers, PSK31 Interface, Single & Triband PSK31 Receivers, Dual Peak Notch Filter, CW and Speech LS Audio Filters, VFO, etc, Tel: 01305 262250, jean@spectrumcomms.co.uk, www.spectrumcomms.co.uk.

COMPONENTS Resistors, Capacitors, Trimcaps, 10mm Coils,Polyvaricons, Broadcast Variables, Dust Iron Toroidal Cores, Ferrite Toroidal cores, Binocular Cores, Ceramic Wafer Switches, Transistors, FETs, MOSFETs, Diodes, Linear IC's, CMOS 4000 series IC's, Connectors, Potentiometers, Tel: 01305 262250, jean@spectrumcomms.co.uk, www.spectrumcomms.co.uk.

Valves

VALVES AND ALLIED COMPONENTS IN STOCK Ring for free list. Valves/books/magazines wanted. Geoff Davies (Radio). Tel: 01788 574774.

QSL Cards

PLEASE NOTE THE SAD PASSING OF CHRIS DARLINGTON MODOL who advertised his services here for many years.

Repairs

REPAIRS TO RECEIVERS, TRANSMITTERS ETC. New/old, valve/transistor. Call 07903 023437 for details. Web: www.kent-rigs.co.uk

While 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.

ORDER FORM FOR CLASSIFIED ADS

PLEASE WRITE IN BLOCK CAPITALS

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 20% 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, Tayfield House, 38 Poole Road, Westbourne, Bournemouth, Dorset BH4 9DW. Tel: 01202 751611.

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/PO. for £.....(42p per word, 12 minimum, please add 20% VAT to total).

Name:.....

Address:.....

.....

.....

Telephone No.:.....

Box Number @ 70p: Tick if appropriate.....

Category heading: .....

Please photocopy this form or write on a separate sheet if you prefer

Bargain Basement

Bargain Basement adverts now cost £5 per advert (subscribers still free) and will also be published in *RadioUser*, our sister magazine, unless requested otherwise.

Send your advert to PW Publishing Ltd, Bargain Basement, Tayfield House, 38 Poole Road, Westbourne, Bournemouth, Dorset BH4 9DW, or E-mail your advert to tex@pwpublishing.ltd.uk (If you don't want to include your credit card details on your E-mail, just 'phone us on 01202 751611.

Please write your advert clearly in BLOCK CAPITALS up to a maximum of 30 words, plus 12 words for your contact details on the form provided and send it together with your payment of £5 (subscribers can place their advert free of charge as long as they provide their subs number or mailing label). Cheques should be made payable to PW Publishing Ltd., credit card payments also accepted.

Please help us to help you by preparing your advert carefully. Any advert which contains ?? marks indicates that the advertising dept. could not read/interpret the wording.

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

AOR LA-380 loop antenna, 10kHz–500MHz, in good working order, with PSU and instructions, £150 inc. P&P.
Tel: 07757 952703 (Kendal)

AOR LA-400 RCK 10m (33ft) extension leads for AOR LA-380/400 loop antenna, complete with manual and box, unused and as new, £45 inc. P&P – no offers.
Tel: David 07806 629818 (Kent)

AOR SDU-5600 in superb condition, with all original leads and manual, also includes PSU. Can supply pictures of unit working. £450 inc. fully insured P&P.
Tel: John 07711 230291 (Wilts)

CENTURY 21D RECEIVER (like Lowe SRX-30), large green display and in good condition with manual £90. Trio R-600 receiver with fine tune modification in good condition and GWO, £120 inc. manual and P&P.
Tel: Rob 01273 834355 (Sussex)

CODAR AT5 with preselector and PSU. It's not been used since acquired 20 years ago. Genuine offers only please, buyer to inspect/collect.
E-mail: gw4hbk@talktalk.net

EX-BBC AIR MAST, unable to air test, mechanically OK but needs TLC to clamps. Collect only £20. Yaesu FRG-965 for spares/repair, £35.
Tel: Dave 01538 266381
Highfield House, Foxt, Staffs Moorland ST10 2HJ.

JRC 545 DSP RECEIVER. Factory fitted CHE-199 VHF/UHF board. 100kHz-2GHz continuous. Matching NVA-319 speaker. Excellent condition with manual, £995. Buyer to collect.
Tel: Noel 0747 9520285 (Clacton)
E-mail: pnoelw@yahoo.com

HUNTER-750 LINEAR amplifier in working order and with original box, now surplus to requirements, inspect and collect only, £700 ONO.
Dennis GW4XKE 02920 512959 (Glamorgan)

ICOM IC-V101 two-channel rig (for repeater), but no microphone or power lead £15, Intek HR-2800 28MHz, 20W rig, boxed £40. FA5000 CB rig, boxed £30, Pofeng VHF handheld, £15.
Tel: Tom M3EHA 01606 597342 (Cheshire)

ICOM IC-W2E dual-band rig, with BC-03 charger, HM-70 speaker/mic, BP-83 NiCd, plus two BP-90 battery cases, AD-20 charge adapter, CP-13 car adapter, all boxed and immaculate with manuals. Offers for the complete set only.
Tel: 01253 697569 (Blackpool)

QRP KITS – UNMADE Malta 40m CW transceiver £45, Kanga LCK CW £40, Hands Electronics 20m SSB/CW transceiver £155 (cost over £300), Rigsat RX2 receiver £35, Kanga VFO MkII £15. Plus other kits available but I don't have the time to build them.
Tel: Tony 01253 697 569 (Blackpool)

YAESU FT-847 transceiver, HF, 50, 70, 144 and 430MHz, in excellent condition, boxed and owned from new, very little used, £600. Yaesu FT-101ZD MkIII HF transceiver in good working order, £300.
Tel Marsha, 01691 657014 (Shropshire)

EXCHANGE

FT-450 HF TRANSCEIVER one year old, but I have unreasonable neighbours so would exchange for a suitable D-STAR handie in good condition and set up.
Tel: Roy GW7UVO 07768 248480 (Deeside)

WANTED

4004 and 8008 microprocessor integrated circuits. They need not work as they're wanted for static display.
Tel: Godfrey G4GLM 020 8958 5113
E-mail: cgmm2@btinternet.com
63 The Drive, Edgware, Middlesex HA8 8PS

ALINCO EQUIPMENT such as: Alinco DX-77T transceiver, EDX-1 manual antenna tuner 1.8–30MHz, EDX-2 automatic antenna tuner, Alinco microphones, EDS-5 microphone extension cable 1.5m (5ft), ERW-4C PC interface serial RS232C cable, ERW-7 PC interface USB cable or any other accessories, etc. I will pay for the above plus postage and packing costs.
Tel: Brian G8NHN 0779 285 9886 (Manchester)

DENCO GREEN plug-in coils for the shortwave bands. The type that has six pins and an adjustable slug. Ring or e-mail me please if you can help.
Tel. 01634 891017 (Chatham)
E-mail: gw.woo@btinternet.com

HEATHKIT RA-1 receiver, preferably in complete and working order.
Tel: Hugh G8JAO 01684 893594 (Malvern)

HIGH SIERRA mounting bracket HS-201C for HS-1800 IPRO, or I'll buy a defective antenna to get hold of the bracket.
Tel: Richard G0WEL 01730 825630 (W Sussex)

We know a lot of people use the internet for second-hand sales nowadays but this is a free service for subscribers and very cheap otherwise so please USE IT OR LOSE IT.

Don't forget to make cheques and postal orders payable to PW Publishing Ltd.

ONLY £5

Bargain Basement order form

Please insert this advertisement in the next available issue of Practical Wireless.

☐ For Sale ☐ Wanted ☐ Exchange

PLEASE NOTE: as a security measure, you must include your house number and postcode.

Name.....

Address.....

.....

.....Post code.....

Telephone Number .....

CARD NUMBER

Signature..... Security number

Last three digits on the back of the card

Switch issue number (if on card).....

Start date of card ..... Expiry date of card .....

My Subs Number is.....(or send mailer label)

PW & RU ☐

PW ONLY ☐

Please make any cheques or Postal Orders for advertisments payable to PW Publishing Ltd.

		(30)	

CONTACT DETAILS FOR ADVERT. Please only write in the contact details you wish to be published with your advert, ie. do you want your name & address, or just your telephone number? Your advert, you decide! PLEASE - No FAXed Ads! (12)

Traders Table

The equipment for sale on these pages is second hand or ex-demonstration

Nevada 023-9231 3090

1. Yaesu FTDX-5000 **U** Premium HF/50MHz Transceiver.....£2695
2. Yaesu FT950 **U** quality 100W HF/6M Transceiver.....£749
3. Yaesu FT-897D **U** all mode HF/VHF/UHF Transceiver.....£599
4. Yaesu FT-857 **U** Portable HF/VHF/UHF Transceiver.....£499
5. Yaesu FT8900 **U** quad bander mobile transceiver.....£245
6. Yaesu FTM-3200DE ED 65W VHF C4FM/FM Mobile.....£179.95
7. Yaesu SP-102 **U** Classic extension speaker.....£89
8. Yaesu MMB-80 **U** Mobile Bracket for FT-897.....£15.95
9. Kenwood TS-2000E + SP23 Speaker **U**.....£999
10. Kenwood TS-2000E U Shack in a box.....£899
11. Kenwood TS-870 **U** 100W HF DSP Transceiver.....£799
12. Kenwood D-72E U VHF/UHF Handheld + GPS.....£259
13. Alinco DX-R8E U Communications Receiver.....£379
14. Alinco DM30E-**ED**..NEW 20-30A power supply.....£85
15. Alinco DR138H-**ED**..high power 145MHz FM mobile.....£139
16. Alinco DRB185-**ED**..85w 145MHz FM mobile transceiver.....£149
17. Alinco DR638H-**ED**..high power 145/433MHz mobile.....£235
18. Alinco DR735E-**ED**..NEW MODEL twin band 145/433MHz.....£269
19. Alinco DX-SR9E-**ED**..hybrid SDR/100w HF transceiver.....£579
20. Alinco EDX2-**ED**..automatic HF antenna tuner.....£269
21. Antex 690D-**ED** pro-style digital soldering station.....£175
22. Antex TCS-**ED** soldering iron with temp control.....£59
23. Anytone AT588-U..145MHz FM mobile transceiver.....£99
24. Anytone QHM-02-**CL**..DTMF hand microphone AT5189.....£19
25. Bearcat UBC30XLT **ED** 200ch AM/FM handheld scanner.....£49.95
26. BHI NES10-2 U Noise Eliminating Speaker.....£69
27. Cable 100M Drum **U** 8D-FB Japanese Low loss.....£199.95
28. Cable 50m length **U** 10D-FB Japanese Low Loss.....£99.95
29. Cable 50m length **U** 8D-FB Japanese Low Loss.....£99.95
30. Cable 100m length U LDF450 U Low Loss.....£299
31. Eton Turbodyne Road Torq-**CL** self-powered roadside torch.....£19
32. Fody Tempus-**ED** home weather station.....£35
33. Fody Tempus Pro-**ED** Bluetooth (BLE) weather station.....£69
34. MFJ 998 **U** 1.5kW Automatic HF Intelligent tuner.....£659.95
35. MFJ 969 300W **U** 160m – 6m Antenna Tuner.....£179
36. Midland Arctic-**ED** waterproof marine handheld radio.....£89
37. Midland D200-**ED**..digital/analogue PMR licence free radio.....£125
38. Midland G7Pro-**U** latest style Pair PMR 446 handhelds.....£49
39. Midland Street Guardian-**CL** full HD car camera wide lens.....£69
40. Midland Street Guardian GPS model-**CL** full HD camera.....£79
41. Midland XTC260-**CL** lightweight action camera LAST FEW.....£59
42. Midland XTC280-**CL** all action HD camera LAST FEW.....£59.95
43. Midland ER-300 **ED** Crank/Emergency Radio.....£44.95
44. Nevada PS30M-**ED**..30amp variable voltage power supply.....£90
45. Nevada PS40M-**ED**..40A variable voltage linear PSU.....£99
46. Nevada PSW50-**ED**..50A switch mode supply.....£119
47. Nevada DAB **CL** omni Dipole for DAB.....£7.95
48. Palstar AT2KD-**ED**..2Kw manual antenna tuner.....£569
49. Palstar AT500-**ED**..600w differential antenna tuner.....£499
50. Watson CX-SW3N **U** Low loss 3-way N type switch.....£44

CL - Clearance **ED**- Ex-Display **U**-Used

Short Wave Shop 01202 490099

TRANSCEIVERS

ALAN HP450 2A RUGGED with desktop charger and kit case.....£40
ALINCO DJ-S11.....£75
ICOM IC-7000.....POA
ICOM IC-7700 WITH KEYBOARD AND MIC.....POA
ICOM IC-756.....£590
KENWOOD TH-F7E.....£190
KENWOOD TMD700E.....£230
YAESU FT690R MK2 + FL-6020 LINEAR AMP.....£420
YAESU FT-DX1200.....£750
YAESU FT-DX1200.....£799
YAESU FL-6020.....POA

RECEIVERS

ALINCO DJ-X2.....£110
ALINCO DJ-X7.....£160
COMMTEL 214 SPORTSCAN.....£50
ICOM IC-R10.....£165
ICOM IC-R71E.....£349
ICOM IC-R75.....£550
JRC NRD-525.....£349
RACAL RA1792 HF.....£495
ROBERTS R-871.....£75
SANGEAN ATS 909.....£150
SONY SW100.....£159
UNIDEN UBC30.....£50
UNIDEN UBC360CLT.....£85
UNIDEN BEARCAT UBC 120 XLT.....£120
UNIDEN BEARCAT UBC 220 XLT.....£79
UNIDEN SPORTCAT UBC 180 XLT.....£100
UNIDEN SPORTCAT UBC 280 XLT.....£110
YAESU FRG 7700.....£199
YAESU FT-990.....£799
YAESU VR500.....£165
YUPITERU MVT-7100.....£139

ACCESSORIES

AV200 SWR.....£55
AV200.....£40
ICOM AT-150 Tuner.....£125
ICOM PS-55.....£75
JRC MVA 319 SPEAKER.....£145
MANSON EP-925 25AMP PSU.....£75
MFJ-260C Dummy Load.....£45
MFJ-969 ATU.....from £125
MFJ 993B.....£199
MICRONTA 22-220 MULTIMETER.....£15
MORSE KEYS – Various Prices From.....£15
MRP2000 PRE AMP.....£25
NAG 144XL AMPLIFIER.....£385
PS85 PSU.....£145
RS NISSEI 502 SWR/POWER METER.....£65
SCANMASTER SP-55.....£35
STAR-MASTERKEY II.....£55
TRIO AT230 WITH STATION MONITOR SM220.....£300
VARIOUS PADDLE KEYS – various prices.....POA
VARIOUS DIP METERS – Various prices from.....£35
YAESU SP-6 EXTERNAL SPEAKER.....£110
YAESU MH-31 MIC.....£20

PLEASE SEE OUR NEW WEB SITE :-
http://www.shortwave.co.uk

Radio Book Store

You can see full descriptions of all these books and order securely online at
www.pwpublishing.ltd.uk

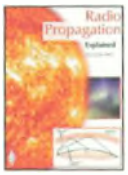
NEW IN NOW

THE VINTAGE RIG GUIDE

Amateur radio equipment saw great changes from the 1960s onwards with the arrival of solid-state designs and there is much superb equipment from the latter decades of the 20th century available in the second-hand market. This brand new publication focuses-in on the amateur radio equipment from theses decades in the same format as the *The Rig Guide*, describing the basic information about the equipment along with when it was first made and what it may be worth.
Price: £5.99 plus p&p.

RADIO PROPAGATION EXPLAINED

Understanding radio propagation is essential for anyone with an interest in radio communications who wants to know how signals travel from A to B. Written by acknowledged expert Steve Nichols G0KYA, *Radio Propagation Explained* provides everything you need to know about this fascinating topic.
Price: £12.99 plus p&p.



RESTORING OLD RADIO SETS

For many, there is nothing more charming than an old broadcast receiver glowing away in a substantial wooden or Bakelite case. However, these are now a rarity and it is much more likely that old radio sets will be non-working curios found at car boot sales in a dusty, unloved condition. *Restoring Old Radio Sets* is a book that sets out to provide a step-by-step guide to bringing an old set back to life, getting it working properly and restoring its looks. **Price: £8.99 plus p&p.**

HF SSB DX BASICS

Contacting far flung parts of the world (DX) on the High Frequencies (HF) on single side-band (SSB) is one of the enduring fascinations of amateur radio. *HF SSB DX Basics* provides a practical guide to making the most of this endlessly fascinating area of operation **Price: £8.99 plus p&p.**

RSGB WORLD PREFIX MAP - RADIO AMATEUR'S MAP OF THE WORLD

This quality map is printed on top quality silk finished paper. Not only does it show the location of worldwide prefixes, there is also an A-Z list of prefixes and expanded map sections covering the Caribbean and Europe, making them much easier to read. This map will grace the wall of any shack. **Price: £6.99 plus p&p.**

LF TODAY: A GUIDE TO SUCCESS ON THE BANDS BELOW 1MHZ

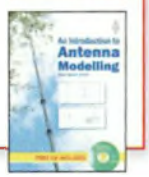
Low frequency operating has never been more popular, and the introduction of a new international amateur allocation at 472kHz means that, with 136kHz, there are now two bands below 1MHz. LF Today distils nearly twenty years experience of the low frequencies and aims to help you get the most out of operating in this part of the spectrum. In short, *LF Today* is a one-stop shop for anyone seeking information on amateur radio operation below 1MHz. **Price: £13.99 plus p&p**

RTTY/PSK31 FOR RADIO AMATEURS

Data modes appear to be a daunting prospect to newly licensed radio amateurs, but they do not have to be. This book is a practical guide to the two most popular data modes, RTTY and PSK31. *RTTY/PSK31 for Radio Amateurs* does though carry a warning: Buying this book may lead to an enjoyment of RTTY, PSK31 (and Data modes in general) that it's highly addictive!
Price: £7.99 plus p&p.

AN INTRODUCTION TO ANTENNA MODELLING

For many years the only way for most radio amateurs to work out how well an antenna design would work was to build it and find out. The arrival of computer based antenna modelling programmes has changed this. This book looks at the Free MMANA-GAL antenna modelling program that will let you design and optimise a whole host of antennas, and all on your PC. **Price: £9.99 plus p&p.**



You can see full descriptions of all these books and order securely online at
www.pwpublishing.ltd.uk

NEW IN NOW

RADIO LISTENER'S GUIDE 2017 EDITION

The *Radio Listener's Guide* is an annual guide for UK radio listeners. It is packed with news, radio reviews and station information. This year's edition includes reviews of personal radios, analogue portable radios, clock radios, DAB radios, internet radios, mini systems and tabletop radios. You'll also find our list of recommended best-buys.

The *Guide* is full of information about analogue and DAB digital radio stations. You'll also find details of radio carried on the main TV platforms as well as information about internet radio and podcasts. This year we have looked at the latest developments with new technology – including BBC iPlayer Radioplayer's new in-car device and the Amazon Echo Dot.

Frequency and transmitter information is listed for UK and Irish national, local and community stations. Our frequency indexes, for both FM and AM, will help you to identify unknown stations.

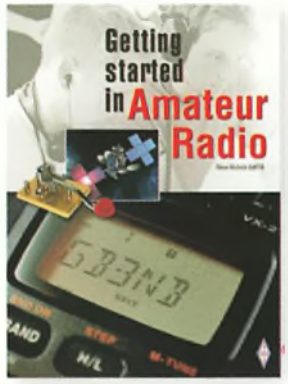
The *Radio Listener's Guide* is your indispensable guide to UK radio. **£5.95**

	Pages	Price
SCANNING & FREQUENCY GUIDES		
● WORLD RADIO TV HANDBOOK 2017	672	£35.00
● RADIO LISTENER'S GUIDE 2017 Edition	160	£5.95
● SCANNERS 7 B Robertson & P Rouse	245	£9.95
ANTENNAS//PROPAGATION		
● NEW AN INTRODUCTION TO ANTENNA MODELLING Steve Nichols G0KYA (RSGB)	80	£9.99
● NOVEL ANTENNAS Steve Telenius-Lowe PJ4DX (RSGB)	192	£14.99
● ANTENNAS MASTERED Peter Dodd G3LDO (RSGB)	288	£14.99
● STEALTH ANTENNAS 2 (RSGB)	208	£14.99
● RSGB ANTENNA FILE (RSGB)	288	£14.99
● HF ANTENNAS FOR EVERYONE (RSGB)	336	£14.99
● BUILDING SUCCESSFUL HF ANTENNAS (RSGB)	224	£14.99
● HF ANTENNA COLLECTION Edited by Erwin David G4ILQI (RSGB)	233	£19.95
● PRACTICAL WIRE ANTENNAS 2 Ian Poole G3YWX	172	£11.99
BEGINNERS/LICENCE/MANUALS		
● NEW HF SSB DX BASICS Steve Telenius-Lowe, 9M6DXX (RSGB)	96	£8.99
● NEW RADIO PROPAGATION EXPLAINED Steve Nichols G0KYA	128	£12.99
● HAMSAT (RSGB)	128	£9.99
● GETTING STARTED IN AMATEUR RADIO (RSGB)	96	£8.99
● TECHNICAL FOR THE TERRIFIED BOOK II (PWP)	128	£12.99
● TECHNICAL FOR THE TERRIFIED BOOK 1 (PWP)	124	£12.99
● ADVANCE! THE FULL LICENCE MANUAL Alan Betts G0HIQ & Steve Hartley G0FUW (RSGB)	104	£11.99
● AMATEUR RADIO EXAM SECRETS Alan Betts G0HIQ (RSGB)	104	£12.99
● FOUNDATION LICENCE NOW! 5th Edition Alan Betts G0HIQ (RSGB)	32	£4.99
● HF AMATEUR RADIO 2nd Ed. Ian Poole G3YWX (RSGB)	144	£12.99
● INTERMEDIATE LICENCE – BUILDING ON THE FOUNDATION 4th Edition Steve Hartley G0FUW (RSGB)	76	£6.99
● MORSE CODE FOR RADIO AMATEURS (RSGB)	32 inc. CD	£8.99
● SECRET OF LEARNING MORSE CODE Mark Francis (Spa)	84	£6.95
DESIGN & CONSTRUCTION		
● HOMEBREW COOKBOOK (RSGB)	208	£12.99
● CIRCUIT OVERLOAD (RSGB)	504	£18.99
● THE ART OF SOLDERING R Brewster (Babani)	84	£3.99
● BUILDING A TRANSCEIVER E Skelton EI9GQ & E Richards G4LFM (RSGB)	176	£12.99
SHACK ESSENTIALS		
● NEW WORLD PREFIX MAP (RSGB)	980x680mm	£6.99

Telephone:
01202 751611
or order securely online at **www.pwpublishing.ltd.uk**

NEW BOOKS IN STOCK NOW

	Pages	Price
● **NEW RTTY/PSK31 for Radio Amateurs** Roger Cooke G3LDI (RSGB)	48	£7.99
● **NEW LF TODAY** Mike Dennison G3XDV (RSGB)	192	£13.99
● **NEW RSGB YEARBOOK** 2017 edition (RSGB)	544	£19.99
● **RSGB AMATEUR RADIO OPERATING MANUAL** 8th edition (RSGB)	240	£16.99
● **NEW DELUXE LOGBOOK & DIARY 2017** (RSGB)	80	£4.99
● **NEW THE RIG GUIDE** S W White (RSGB)	96	£5.99
● **NEW HART REVIEWS** (RSGB)	192	£12.99
● **OUT OF STOCK 25 YEARS OF HART REVIEWS** (RSGB)	264	£14.99
● **RSGB PREFIX GUIDE** 12th edition (RSGB)	80	£9.99
● **SIX & FOUR** Don Field G3XTT (RSGB)	288	£13.99
● **AMATEUR RADIO ASTRONOMY 2nd Edition** J Fielding (RSGB)	384	£16.99
● **DXPEDITIONING - BEHIND THE SCENES FOR RADIO AMATEURS WORLDWIDE** N Cheadle & S Telenius-Lowe	180	£6.95
● **AMATEUR RADIO ESSENTIALS** G Brown (RSGB)	288	£25.99
QRP		
● **QRP BASICS** George Dobbs G3RJV (RSGB)	204	£14.99
VHF & HIGHER		
● **MICROWAVE KNOW HOW** Andy Barter G8ATO (RSGB)	192	£12.99
HISTORICAL		
● **NEW THE VINTAGE RIG GUIDE** Steve White G3ZVW	80	£5.99
● **NEW RESTORING OLD RADIO SETS** Philip Lawson G4FCL	80	£8.99
● **THE LONG SILENCE FALLS VOLUME II** The Life & Times of a Merchant Radio Officer 1900-2000	376	£25.00
● **OUT OF STOCK LONDON'S PIRATE PIONEERS** Stephen Hebditch	322	£14.95
● **OUT OF STOCK PIRATE RADIO** Keith Skues	160	£20.00
● **OUT OF STOCK CQ-GTZM - DIARY OF A MARITIME RADIO OFFICER** Ross Bradshaw	152	£16.99
● **INSTRUMENTS OF AMPLIFICATION** H P Friedrichs	300	£14.95
CRYSTAL SETS		
● **THE VOICE OF THE CRYSTAL** H Peter Friedrichs	185	£11.95
ELECTRONICS		
● **COMPUTERS IN AMATEUR RADIO** with CD (RSGB)	256	£14.99
● **TEST EQUIPMENT FOR THE RADIO AMATEUR** (RSGB)	250	£14.99



GETTING STARTED IN AMATEUR RADIO

If you want to know something about the hobby or are newly licensed, or are even just looking for something different, *Getting Started in Amateur Radio* provides the answers. What about receiving digital images from the International Space Station? Or talking to friends around the world via satellite? Or perhaps being able to help out during natural disasters? All of these things are possible with amateur radio and *Getting Started in Amateur Radio* details these and many other possibilities.

£8.99

Getting Started in Amateur Radio provides information on the activities to explore when using your first VHF/UHF or HF station and what other equipment you might need.

WORLD RADIO TV HANDBOOK 2017

The Directory of Global Broadcasting

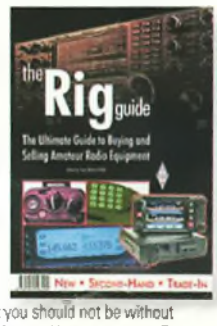
The best selling directory of global broadcasting on LW, MW, SW & FM.
This is the 71st edition of *World Radio TV Handbook* and this great directory continues to offer the most comprehensive guide to broadcasting on the planet providing the most up-to-date information on medium wave, short wave and FM broadcasts and broadcasters available in any publication.

- The Features section for this 71st edition contains articles on Remote Receivers, A Pacific Radio Adventure, The Mighty KBC Station, CKZN St. John's, and the International Radio for Disaster Relief Project as well as equipment reviews and other articles of interest.
- The remaining pages are, as usual, full of information on:
- National and International broadcasts and broadcasters by country with frequencies, powers, languages, contacts, and more, including Clandestine and other target broadcasters.
- MW frequency listings by region. International and domestic SW frequency listings, as well as DRM listings.
- International SW broadcasts in English, French, German, Portuguese & Spanish.
- Reference section with Transmitter locations, DX clubs, Internet Resources, and much more.
- Articles on topics of great interest to professionals, listeners and DXers alike.
- Reviews of the latest receivers and equipment.
- Maps fully updated showing global SW transmitter sites.
- Features – Colour pages giving articles, radio reviews, propagation predictions, and colour maps.
- National Radio – The world's national radio services, and the broadcasters, listed by country.
- International Radio – Full broadcaster details and the winter SW frequencies as supplied by the broadcasters together with an expanded Clandestine section.
- Frequency Lists MW frequency lists by region; international and domestic SW broadcasts by frequency; International broadcasts in English, French, German, Portuguese and Spanish by UTC; DRM broadcasts.
- Television – Details of the broadcasters arranged alphabetically by country.
- Reference – International and Domestic SW Transmitter sites, Standard Time and Frequency Transmissions, DX Club information, Internet resources and other essential information.

£35.00

NEW EDITION. THE RIG GUIDE. £5.99

What should you pay for a second-hand radio?



The Rig Guide is a unique publication that sets out to answer the question 'what is the right price for this radio?'. What will you get for a radio if you trade it in or try to buy or sell it on an online auction site? - *The Rig Guide* provides the answer.

The Rig Guide continues to define the prices of amateur radio equipment in the UK, fully updated and covering more than ever before. Which is why *The Rig Guide* is rightly one of the most popular amateur radio books around.

If you are planning to buy or sell any amateur radio equipment you should not be without *The Rig Guide*. The book begins with tips for buyers and a guide to selling and trading. There is a handy guide to selling on ebay and even tips on how to avoid getting lumbered with stolen gear. *The Rig Guide* contains a list of the abbreviations used in the descriptions and an explanation of them all. Amateurs trust RSGB reviews and a full list of *RadCom* reviews since 1990 is included and when piece of equipment was reviewed by *RadCom* it is highlighted on the listing.

The Rig Guide isn't limited to popular commercial amateur radio transceivers but also covers receivers, scanners and linear amplifiers too. You'll find extensive lists of past models from Acom to Yaesu, with over 20 manufacturers listed in-between, including Icom, Ten-Tec, Kenwood, etc. We're not just talking about current models either and you will even find details on the many Chinese manufacturers. DSP isn't forgotten either with a dedicated section on the equipment available. Overall, *The Rig Guide* contains details of around 400 of pieces of amateur radio equipment covering HF, VHF & UHF. Each item is described in an easy to understand listing that covers its main features, band coverage etc. with a photograph of the equipment.

Knowing the worth of any piece of equipment means you can easily cover the cost of *The Rig Guide* with just one purchase or sale.

THE LONG SILENCE FALLS VOLUME II

The Life and Times of the Merchant Navy Radio Officer 1900-2000

Available in soft back only.

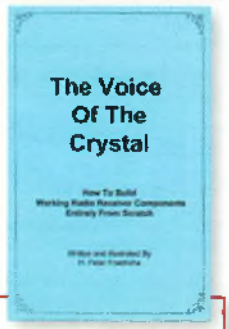
£25.00

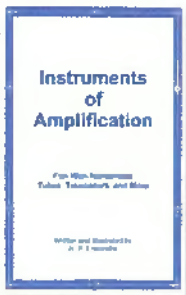
The previous volume, which is now out of print, was extremely successful and sales far exceeded wildest expectations. From the very earliest days of radio, ships carried Radio Officers. However, with the onward march of technology this post has become redundant and since 2000 ships no longer carry specialist Radio Officers. *The Long Silence Falls Volume II* continues with more stories, written by the Radio Officers themselves, which are broken down into various sections covering many topics from a life at sea. This book is published by the Radio Officers Association and reflects the wide experience of their members over the years. At over 376 pages, *The Long Silence Falls Volume II* is an extensive book with an extraordinary glimpse into the practice and art of the Radio Officer. If you are fascinated by this now past age and enjoyed the first volume, this book is hugely interesting and thoroughly recommended.

THE VOICE OF THE CRYSTAL

185 pages of practical information on the fabrication of electronic components suitable for use in building crystal radio sets. Basic theory and simple analysis is combined with dozens of examples of historical practice, work by contemporary experimenters and construction details for many instruments fabricated by the author himself.

£11.95





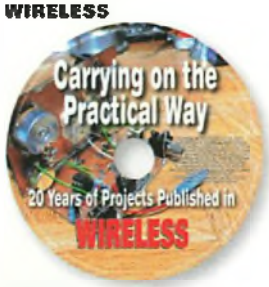
INSTRUMENTS OF AMPLIFICATION

£14.95

Rob Mannion G3XFD wrote: Peter Friedrichs has written a truly superb book but has chosen a title that really hides its 'light' under the proverbial bushell Armed with the book, an interested constructor can literally build a radio from scratch anywhere! Maybe a better title should have been 'Desert Island Radio for the Shipwrecked' because everything is covered from simple earphones, detectors and mechanical amplifiers to home made valves (tubes) and transistors. If you enjoyed *Rough Science* on BBC Two, you'll love this book! **Very highly recommended.**

CARRYING ON THE PRACTICAL WAY

20 YEARS OF PROJECTS IN PRACTICAL WIRELESS



£14.99

Since 1996, there has been an on-going series of small practical projects in the *Practical Wireless* magazine. The Rev. George Dobbs G3RJV has been the mainstay of this series by far, having written around 95% of the articles that appeared up to date. So, as a tribute to George's love of the hobby and to the other authors who take over the task of demonstrating that building your own projects is easier than you might think, we've collated them into one electronic archive.

Because of the wide-ranging subjects it's not easy to catalogue them because there are around 230 articles to browse through. Some of necessity are similar in nature, but all are unique in showing how easy it can be to create small circuits that can be coupled together to produce receivers, transmitters, test equipment or just plain novelties to amuse. But all are part of the self-training aspect of the hobby.

HARRY LEEMING'S IN THE SHOP

£14.99

A collection of Harry Leeming running *In The Shop* series in *PW*. Find hints, tips, and anecdotes about customers that Harry met while running Holdings HiFi Audio, an amateur radio shop. If you've got an older Yaesu transceiver, this is the CD-ROM for you with some 300 searchable pages.

MIKE RICHARDS' DATA MODES

£14.99

Since he started his regular column some years ago, Mike Richards G4WNC has explained the many data modes using a computer with your radio. They're all here, but these are not the only computer related topics Mike has covered, find out how to use the Raspberry Pi, a £25 Linux computer, or create projects using the Arduino system. All this in 178 fully searchable pages.

You can see full descriptions of all these books and order securely online at **www.pwpublishing.ltd.uk**

BINDERS

- PRACTICAL WIRELESS OR RADIOUSER.....£10.00

IN STOCK NOW!

NEW AND AVAILABLE NOW!

The archive sets are each on a single optical disc and provided in a searchable portable document format (PDF). It's ideal for any computer running a PDF reader program – there should be no problems!

PRACTICAL WIRELESS 1965-1969 ARCHIVE.....£24.99
PRACTICAL WIRELESS 2016 ARCHIVE.....£14.99
RADIOUSER 2016 ARCHIVE.....£14.99
PRACTICAL WIRELESS 1970-1974 ARCHIVE.....£24.99
PRACTICAL WIRELESS 2010-2014 ARCHIVE.....£24.99
RADIOUSER 2011-2015 ARCHIVE.....£24.99
PRACTICAL WIRELESS 2015 ARCHIVE.....£14.99
RADIOUSER 2015 ARCHIVE.....£14.99
IN THE SHOP.....£14.99
DATA MODES.....£14.99
CARRYING ON THE PRACTICAL WAY.....£14.99
PRACTICAL WIRELESS 1975-1979 ARCHIVE.....£24.99
PRACTICAL WIRELESS 1980-1984 ARCHIVE.....£24.99
PRACTICAL WIRELESS 2014 ARCHIVE.....£14.99
RADIOUSER 2014 ARCHIVE.....£14.99
PRACTICAL WIRELESS 1985-1989 ARCHIVE.....£24.99
ANTENNA COLLECTION ARCHIVE.....£14.99
PRACTICAL WIRELESS 1990-1994 ARCHIVE.....£24.99
PRACTICAL WIRELESS 2013 ARCHIVE.....£14.99
RADIOUSER 2013 ARCHIVE.....£14.99
PRACTICAL WIRELESS 1995-1999 ARCHIVE.....£24.99
PRACTICAL WIRELESS 2012 ARCHIVE.....£14.99
RADIOUSER 2012 ARCHIVE.....£14.99
PRACTICAL WIRELESS 2000-2004 ARCHIVE.....£24.99
PRACTICAL WIRELESS 2011 ARCHIVE.....£14.99
PRACTICAL WIRELESS 2010 ARCHIVE.....£14.99
PRACTICAL WIRELESS 2005-2009 ARCHIVE.....£24.99
RADIOUSER 2011 ARCHIVE.....£14.99
RADIOUSER 2006-2010 ARCHIVE.....£24.99

HOW TO ORDER

Telephone: 01202 751611

or order securely online at **www.pwpublishing.ltd.uk**

Call the Bookstore, Monday to Thursday 9am to 4pm (closed Fridays)

Your order will usually be delivered to you within a week but please allow 28 days for delivery.

Outside these hours your order will be recorded on an answerphone.

Post: Write to the Bookstore, remembering to include your name, address, daytime telephone number and payment details (Sterling please - cash not accepted. **Cheques made payable to PW Publishing Ltd.**)

at: PW Publishing Ltd., Bookstore, Tayfield House, 38 Poole Road, Westbourne, Bournemouth BH4 9DW.

E-mail: bookstore@pwpublishing.ltd.uk

Order Securely online: www.pwpublishing.ltd.uk

Photocopies & Back Issues: To order a back issue, please call the Order Line or e-mail us to check availability (we hold back issues for one year only). We can photocopy or PDF articles from issues that are not available - we have a Review List going back years!

	Current Issue	Back Issues
Practical Wireless	£3.99 (inc UK P&P)	£5.00 (inc UK P&P)
RadioUser	£3.99 (inc UK P&P)	£5.00 (inc UK P&P)

Overseas post: Europe or ROW postal charges to be added to the above.

Photocopies / Reprints (per article): £3.00 (inc P&P).

Overseas: Please add £1.50 to the above prices. E&OE

order form

08/17

Photocopies are acceptable

Please try to order from an up-to-date magazine to ensure correct prices and availability.

.....Price (£).....

.....Price (£).....

.....Price (£).....

.....Price (£).....

.....Price (£).....

.....Price (£).....

.....Price (£).....

.....Price (£).....

Total cost of books ordered: .....**Price (£)**.....

Postage & Packing charges: Please remember to add P&P to your order.

UK: £2.30 P&P for one item, £1.65 per item thereafter

Overseas Europe:
£3.50 P&P for one, £2.50 per item thereafter

Overseas Rest of World:
£5.50 P&P for one, £4.00 per item thereafter (£) .....

Total cost of order including postage £

Prices include VAT where applicable

Send this completed form to:
BOOKSTORE, PW PUBLISHING LTD., TAYFIELD HOUSE, 38 POOLE ROAD, WESTBOURNE, BOURNEMOUTH BH4 9DW

Payment Details. Please note: For security purposes, you must include your house number and postcode.

Name .....

Address .....

.....

.....

Postcode .....

Telephone (Daytime) .....

I enclose my Cheque/Postal Order for £.....

Please note: Cheques MUST be made payable to PW Publishing Ltd.

or please debit my MasterCard/Visa/Amex

Expiry Date ..... Security No.

or please debit my Maestro/Solo

Expiry Date ..... Security No.

Start date ..... Issue No (if on card).....

Signature.....

Orders are normally delivered within a week but please allow 28 days for delivery. Prices correct at the time of going to press. Please note: all payments must be made in Sterling, cash not accepted.

A subscription is a great gift that lasts all year!

Practical WIRELESS Subscribe today!

Britain's Best Selling Amateur Radio Magazine

- Never miss an issue
- Have it delivered to your door
- Subscribers get their copies before they reach the shops
- Save money
- Introduce friends and get **FREE ISSUES**

AVAILABLE NOW! Searchable 2016 UK Callsign CD

FREE FOR ALL NEW SUBSCRIBERS

New subscribers: Subscribe TODAY to ensure you get your FREE CD.

THIS OFFER ENDS SOON!

Practical Wireless or RadioUser Subscription

	3 Month*	6 Month*	1 Year*	2 Year	3 Year
UK	☐ £11	☐ £22	☐ £44	☐ £82	☐ £116
Europe			☐ £53	☐ £98	☐ £142
ROW			☐ £63	☐ £117	☐ £173

Joint Practical Wireless & RadioUser Subscription – Save £££s

	3 Month*	6 Month*	1 Year*	2 Year	3 Year
UK	☐ £21	☐ £42	☐ £81	☐ £151	☐ £215
Europe			☐ £87	☐ £163	☐ £250
ROW			☐ £110	☐ £214	☐ £318

*3 and 6 month subscriptions are only available by Direct Debit. 12 month subscriptions are available to pay by Direct Debit if you wish (no more renewal letters!) Sorry, but due to financial restrictions, this service is not available for 2, 3 year or overseas subscriptions.

To order a subscription please contact our subscription agency:

Practical Wireless Subscriptions
Unit 4
College Road Business Park
College Road North
Aston Clinton HP22 5EZ

Please note: any cheques should be made payable to PW PUBLISHING LTD and CASH is NOT accepted by ourselves or Webscribe.

Orders taken on:

01442 820580

between 9am - 5pm. Outside these hours your order will be recorded on an answering machine.

Secure internet orders can be placed at:

www.webscribe.co.uk/magazine/pw

or via e-mail to:

pw@webscribe.co.uk

On-line facilities are available as well as the usual way to pay by cheque, postal order, credit card and now by direct debit too.

Existing subscribers will be offered the option to pay by Direct Debit at the end of their subscription.

Order a new subscription online Simply pay with a credit card or set up your direct debit subscription online using our secure server

Check the status of a subscription online Existing subscribers can now log in to their own accounts and see how many issues they have left to run.

Update your details online If you move or change your personal details, you can now update them online without having to write in to let us know.

Renew an existing subscription online We've made renewing easier too. Everything you need to renew is now available online as well as by regular mail. (Subscribers still get a reminder in the post when it's time to renew unless it's payable by Direct Debit).

If you wish to pay by direct debit please call Webscribe, our subs agency, to set it up - it's simple!

☐ *I wish to order a one/two/three* year subscription to* **practical wireless** *starting with the.....issue.*

☐ *I wish to order a joint one/two/three* year subscription to* **practical wireless & radiouser** *and starting with the.....issue.*

Payment Details

I enclose my Cheque/Postal Order* for £.....

*made payable to PW Publishing Ltd.

or please debit my MasterCard/Visa/Amex card No.

☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐

Security Number: ☐☐☐

Expiry Date.....

or please debit my Switch card No.

☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐ ☐☐☐☐

Security Number: ☐☐☐

Start Date.....Switch Issue Number (if on card).....

Switch Expiry Date.....

Signature.....

Name.....

Address.....

.....

.....

.....

Postcode.....

Daytime Telephone Number.....

E-mail.....

Please note: For security purposes, you must include your house number and postcode.

Orders are normally despatched by return of post but please allow 28 days for delivery. Prices correct at time of going to press. E&OE.

Please note: All payments must be made in Sterling.
Cash not accepted.
Cheques made payable to PW Publishing Ltd.

**Delete as necessary. Photocopies of this page are acceptable*

coming next month

IN THE UK'S BEST AND ONLY INDEPENDENT AMATEUR RADIO MAGAZINE

Practical WIRELESS

SEPTEMBER 2017 ISSUE
ON SALE 10TH AUGUST 2017 AT ALL GOOD NEWSAGENTS

Current issues are available direct for the cover price (post free) by calling

01202 751611

WE HOLD BACK ISSUES IN STOCK FOR 1 YEAR

The Gurney Slade (Part 2)
Tim Walford G3PCJ completes the project by describing the transmitter design and construction.

Review – Super Antenna MP1DXMAX
PW reader and indefatigable portable operator **Carl Gorse 2E0HPI** shares his hands-on experience of using the Super Antenna MP1DXMAX.

Review – QYT KT8900D
Tim Kirby G4VXE has his hands on yet another dual-band VHF/UHF transceiver, the QYT KT8900D. An interesting feature is the Bluetooth add-on.

Review – the LAMCO DU1500T and DU1500L Tuners
Vince Lear G3TKN takes a look at a pair of high power antenna tuning units from LAMCO.

Valve & Vintage
Once again **Ben Nock G4BXD** takes a break from his military collection, this time to focus on a number of receivers from kit maker Heathkit.

The Ninth PW 70MHz Contest
Colin Redwood G6MXL brings you the rules of the *PW* 70MHz Contest, with full details of how to take part.

What Next
Colin Redwood G6MXL continues his overview of what you can achieve on the VHF and UHF bands with a simple handheld transceiver.

In Focus – ICQ
We take a look at the story and the people behind the ICQ podcasts.

There are all your other regular columns too, including *HF Highlights, World of VHF, Data Modes, Emerging Technology, Making Waves* and *Doing it by Design.*

The publishers reserve the right to change content according to circumstances.

Specialist Dealers

Advertisers index

Having trouble finding Practical Wireless?

The best way to ensure you receive every issue of Practical Wireless and/or RadioUser is to place an order with your local newsagent. Once set up, your copy of Practical Wireless and/or RadioUser will be held for you to collect, saving you the time and the frustration of having to search the newstand. Some newsagents may even offer a home delivery service making it even easier to obtain your copy. So don't miss an issue, simply complete the form opposite and take to your local newsagent today.

Keep a look out for the logo and next time you visit your newsagent remember to Just Ask! about obtaining copies of your chosen magazines.

Please reserve/deliver* a copy of..... on a regular basis, commencing with the .....issue. *delete as appropriate

Title/Mr/Mrs/Ms.....

First name..... Surname.....

Address.....

.....

.....Postcode.....

Daytime Telephone No:.....

YAESU
The radio

The Perfect Choice
Sophisticated Dual Band Digital Transceiver

Built to Commercial Grade Specifications

《Actual Size》

- Advanced C4FM Digital
- System Fusion Compatible
- Combines FM and Digital Communications with AMS (Automatic Mode Select)
- Coordinated Group Operation with Digital Group ID
- 700mW of Loud, Clear Voice, Audio Output
- 5 Watts of Reliable RF Power from a Compact Handheld Unit
- Wide Band Receive Coverage 108 - 579.995MHz
- Rugged Construction Meets IP54 (Dust & Water protection)
- Large Multi-Color Operating Mode Indicator
- Huge 1,105 Channel Memory

C4FM/FM 144/430MHz DUAL BAND 5W DIGITAL TRANSCEIVER

FT-70DE

C4FM Digital Communications
Clear and Crisp Voice Technology

AMS Automatic Mode Select

YAESU
The radio

YAESU UK Ltd
Unit 12 Sun Valley Business Park, Winnall Close
Winchester, Hampshire SO23 0LB

For the latest Yaesu News , visit us on the Internet at www.yaesu.co.uk