• Battle Creek Special Antenna - How to Build Your Own • Frequency Counter & Crystal Tester Kit Reviewed

Practical WIRELESS

NOW IN OUR 85th YEAR!

Britain's Best Selling Amateur Radio Magazine

The Siren 6cm W[illegible]tation

Pr[illegible]h in Microwave Contesting

Retevis RT22

Inexpensive UHF Handheld Reviewed

LDG RT/ RC-100 Remote Auto ATU Reviewed

July 2017 £3.99 ISSN 0141-0857

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 (KX8T2) 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

KPA1500

- 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

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

BEKO IHSG APPOINTED SOLE UK DISTRIBUTORS

All models available call for details

INTRODUCTORY OFFER FREE SHIPPING on all BEKO products

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 with a Frequency range of 1270-1300MHz. The very compact design makes this amplifier ideal for DXpeditions and portable operating as well as a permanent shack fixture.

£2595.00

HLV-950

A compact solid state, high efficiency amplifier providing dual band performance both on 50MHz (1KW) and 70MHz (700W) with single input and single output.

£2549.00

FLEX RADIO

Next-Gen SDR from Flex Radio!

6400/6600

6400M/6600M

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..... £2149.00

FLEX-6300

Entry point SDR transceiver, but no slouch!
- All modes including digital
- Covers: 160m-6m
- 100W output

£2499.95

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

RG-58

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

RG-213

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

W-103

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

300-S

450 Ohms low loss ladder line
450-S..... (Per Metre)....£1.20
DR-450S..... (100m Drum)..... £89.95

450-S

MFJ

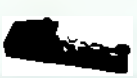
MFJ-1835..... Cobweb HF antenna £229.95
MFJ-1835H..... 1.5kW version of above..... £269.95
MFJ-226..... Antenna analyser 1-230MHz..£339.95

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

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, similar to the very popular IC-7300.

£3599.95

£25.00 secures one of our first batch!

ID-51E-PLUS2

2m/70cm handheld with the same features as its previous iteration plus new 'Terminal mode' and 'Access mode' for connecting to D-star through the internet and places where no D-Star repeater is usually accessible.

Call to Pre-Order yours now

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.. £56.95

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 July 2017 • Volume 93 • Number 7 • Issue 1322

On Sale 8th June 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., Portsmouth 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 £56, 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

Don wonders about the place amateur radio takes in our lives, recommends ensuring you have an up-to-date profile on qrz.com and raises the thorny subject of public liability.

I haven't done any travelling during May but have tried to be reasonably active on the bands, including my first foray onto 70cm SSB in many a long year, in one of the RSGB Tuesday evening Activity Contests. These events are proving very popular, especially the 2m ones, and significantly more so than the 24 hour weekend contests. A reflection, perhaps, of the busy lives that many of us lead?

What's Your Hobby?

And on the subject of busy lives, I was intrigued by a recent press release that hit my inbox concerning hobbies followed by the British. It seems that the young (aged 18 to 24 in this case) were found to have five hobbies on average, while those aged 35-44 averaged just two regular pastime pursuits. I've no idea about older respondents – maybe they didn't have any! Anyway, the survey also concluded that 34% feel they waste their spare time while 54% count watching television as their primary leisure pursuit. Interestingly, almost a fifth (19%) of UK adults claim to have taken up a new hobby in the past 12 months.

Where does that leave *PW* readers? The good news, I presume, is that you all have at least one hobby – amateur radio. I've often noticed that photography and/or music are popular among radio amateurs too. I'm not sure whether there's any connection although I would say that I'm more of an 'audio' person (amateur radio, listening to classical music) than a visual person – at least, my wife complains that I never notice anything visual, whether it's her new hair-do or a reorganisation or redecoration of one of our rooms. Many radio amateurs also have another technical hobby such as model making or, understandably, various aspects of IT. One amateur radio friend of mine not only engages in private flying but also built his own aircraft (albeit from a kit but that must have been one heck of a kit).

The nice thing about our hobby is that it can engage such a wide variety of age groups and backgrounds. We have young people who enjoy hillwalking to activate summits and trigpoints. We have housebound participants who find that amateur radio enables to them get out of the house, albeit virtually but in a much more personal way than those so-called 'social media' sites on the internet. We have the elderly for whom the hobby can also be something of a lifeline. It's a hobby that truly brings together humble labourers and company directors and I'm pleased to number both extremes among my amateur radio friends.

Yes, maybe we watch a bit of TV too and enjoy other pursuits such as travel (amateur radio can fit well with that) but what we share in common is a hobby that can be part of our lives for decades even if our specific interests within amateur radio and the degree of engagement may change as the years go by.

QRZ.COM

qrz.com is the online callbook to which most amateurs turn as their first choice (and which is also accessed via a number of logging programs). It makes sense, therefore, for every one of us to ensure we have a valid entry on there and that it's up to date. There's no need to post your full address if you don't want to but you can, for example, set out your QSL policy, talk about your local club, describe your station or pretty much anything that relates to your amateur radio activities. There are a number of editing facilities available to enable you to personalise the page and add photographs (for example, a scan of your QSL card). You can also do some clever things like having a live feed of your log from Club Log. What's more, **Vlad UA6JD** has written a book *Bells and Whistles on QRZ* that describes in some 149 pages how much more you can do with your qrz.com entry – it's available as a free PDF download from Vlad's qrz.com page.

Insurance and Liability

I had several exchanges a few months back with one of our readers who was concerned about the liability of radio amateurs should something untoward happen to a third party as a consequence of our activities. This applies particularly to clubs when, for example, out and about on Field Days and special event stations open to the public (which, indeed, is still a requirement when special event callsigns are issued, I believe – that they are open to visitors).

It's standard practice nowadays for pretty much any public event to require participants to complete a risk assessment and to carry suitable insurance. The simple answer for radio clubs is to affiliate with the RSGB because that then takes care of the insurance aspect. It's certainly worth ensuring that you have taken all necessary steps and precautions – I have now been involved, for example, in two special event operations that took place from schools and both required risk assessments, suitable insurance and Disclosure Checks (what used to be known as CRB checking) because we would be in contact with students. Don't let any of this put you or your club off from running such activities or, for example, helping with communications for a public event such as a sponsored walk or half-marathon but do ensure that you are properly covered to avoid problems downstream. And if you have any specific experiences or recommendations that you think might help other readers, do drop me a line.

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

Technical Editor (c/o PW Publishing Ltd.)
NG (Tex) Swann G1TEX/M3NGS
tex@pwpublishing.ltd.uk

Consultant Editor (c/o PW Publishing Ltd.)
Rob Mannion G3XFD/E151W
rob@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
kevin@pwpublishing.ltd.uk

Finance Manager
Alan Burgess
alan@pwpublishing.ltd.uk

Book Orders
books@pwpublishing.ltd.uk

PW Publishing Website
www.pwpublishing.ltd.uk

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

Subscriptions
Subscriptions are available at £42 per annum to UK addresses, £51 Europe Airmail and £61 RoW Airmail. See the subscription page for full details.

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 and 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 help. If we don't have the actual issue we can always supply a photo copy 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 to telephone to the office 01202 751611. An answering machine will accept your order out of office hours and during busy periods in the office. The email address is **bookstore@pwpublishing.ltd.uk**

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

Any technical queries by e-mail are very unlikely to receive immediate attention either. So, if you require help with problems relating to topics covered by *PW*, then please write to the Editorial Offices, we will do our best to help and reply by mail.

Newsdesk

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

New FlexRadio Products

Waters & Stanton have announced new Flex 6400 (which replaces the 6300) and 6600 series radios, available in August/September. Orders are being taken now with a 10% deposit. Both new models are in a taller case, allowing for modular construction, which will lead to easier and faster servicing.

The Flex 'M' series (see photo) is exactly the same as the flex 6400/6600 but with a traditional radio front panel (Flex Maestro style) for those that prefer the look and feel of the 'classic' transceiver. However, as with the existing Flex 6000 models, the Flex 'M' can still be used with an additional Flex Maestro in order that, for example, two operators can use the same radio on different bands at the same time.

The 6600 model features two SCUs (Spectral Capture Units), previously only available on the Flex 6700. This allows two operators to work two bands simultaneously. They can use different antenna sockets too.

While the SmartSDR software can be used on any Flex 6000 series, it is provided free of charge on the 6600. Remote operation of the transceivers has been simplified considerably, with single-click click-and-connect operation.

FlexRadio Systems products are available from all IHSG companies: Nevada Radio, W&S and InnovAntennas.
http://hamradiostore.co.uk/amateur-radio/hf-multiband-recievers/flexradio-hf.html

New from Nevada

Nevada Radio are now stocking a new range of Hy-Gain (USA) antennas for the 6 and 4m bands, designed by **Justin Johnson G0KSC**. The first in this series is a compact dual-band 6/4m Yagi on a 2.1m boom, with four elements on each band. The DB-46M8EL is ideal for countries where both bands are available. The antenna is constructed using high-strength T6061 aluminium, with a 1¼in boom and Hy-Gain's traditional element mounting hardware. It sells for £299.95. There are also three 50MHz monoband LFA Yagis in the new range with 4, 5 or 7 elements.

Nevada have also announced a new range of NEVADAMAST telescopic and trailer-mounted masts, for both amateur radio and commercial use. The TM15 is the first in the series and supports a three-section (100mm base box section) mast with head unit that winds up to a height of 15m. UK manufactured to the highest specifications, the heavy-duty mast is constructed of high quality steel, hot dip galvanised for long life and weathering. The trailer mast is supplied complete with manual winches, guy ropes and shackles. A lockable box attached to the trailer stores all guying materials for easy erection. In addition, the trailer has a tow hitch and lock. The TM15 is priced at £4495 and should be of interest to clubs and contest groups. It is also available as a separate item for home mounting and supplied with a slot-in base section, guys and head unit. Prices start from £2395.

Both items are held in stock at Nevada's Portsmouth warehouse but they can also arrange delivery and installation if required.

The masts and antennas are available through all IHSG members, including Nevada, InnovAntennas & Waters & Stanton.
www.nevada.co.uk
www.nevadaradio.co.uk

Mills on the Air

The South Essex ARS (SEARS) were active for the Mills On The Air Weekend in May, using the callsign of GB2RWM, from Rayleigh Windmill. The 2m station was extremely busy, partly due to SEARS linking with two other local windmill stations (Upminster and Meopham), allowing locals to make contact with three Mills on the Air Stations on the same frequency. Over 60 local contacts were made, as well as contacts on HF CW and SSB.

In the same month, the SEARS club night saw a presentation by **Pete M0PSX** about his time in the hobby, the formation of the online club Essex Ham and Pete's passion for training, which has led to the creation of the online Foundation Licence training course.

5MHz News

The latest edition (No. 18) of *The 5 MHz Newsletter* is now available for free pdf download from:
https://tinyurl.com/ln5f2p4

This edition includes 14 new allocations, 60m coverage of Europe, 5MHz from a 'postage-stamp' garden, a report on the Blue Ham 2 exercise and Beacon news. Recent 5MHz developments include the arrival on the band of Malta (9H), the UAE (A6), Mexico (XE) and Poland (SP) and an extension of the 5MHz trial in Iceland (TF).

Edinburgh and District Amateur Radio Club

After many years absence, the Edinburgh and District Amateur Radio Club GM4HAM has been re-established. Former and new members are welcome. For further details contact the secretary, **Norman Stewart** by e-mail to gm1cnh@arrl.net or telephone 07740 946192.

Icom ID-51E

Icom's latest generation of D-STAR hand portable is now available. The ID-51E PLUS2 allows users to make digital voice and data calls through the worldwide D-STAR network. This new model incorporates features found in previous versions, including integrated GPS, an independent AM/FM receiver and V/V, U/U, V/U Dualwatch. It also 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.

The ID-51E PLUS2 allows users to connect through a PC or Android device and to send voice and/or data through the internet gateway to a destination repeater. In addition, it can be used as a D-STAR Hotspot so other D-STAR enabled radios can use it as a gateway to the D-STAR network.

The ID-51E PLUS2 is available from authorised Icom dealers, initially in grey, with a suggested retail price of £449.99 inc. VAT. Each radio comes supplied with the OPC-2350LU PC/Android data cable for use with the RS-MS1A Android Terminal Control Software.

ML&S News

The ML&S Big Summer Picnic takes place on June 24th (see ad. on page 13). Martin and his team open their doors at 8am, giving away freebies and refreshments and joined by their leading Japanese manufacturers. Martin promises low prices and lecture streams taking place throughout the day in the Ham Radio Training Academy.

HamRadio.co.uk/picnic

ML&S have introduced a pair of digital power/SWR meters covering 1.8-470MHz. The RS-50 & 70 are compact in-line type meters that present power and SWR on a digital backlit LCD display. Easy to use and supplied with a Micro-USB lead to power the devices, the RS-50 (HF at 200W) and RS-70 (2/70 at 120W) are ideal for mobile or shack use. Both take AAA batteries (rechargeable or dry). The introductory price is £69.95 each. **www.HamRadio.co.uk/nissei**

ML&S have also announced a new accessory for Icom's IC-7300, the MyDEL-7300SPG, a pair of side panel guards with handles with integrated protection for the rear panel. With metal construction and anodised in satin black, the kit is supplied with a set of stainless steel mounting screws and can be fitted in a couple of minutes. The design protrudes from the front panel of the transceiver with two integrated grab handles for transport. It also extends to the back of the IC-7300, offering a level of protection to the rear panel interfaces. The panel guards are supplied as a pair and available from stock at £59.95.

HamRadio.co.uk/grabhandles

ML&S were also awarded the JVC-Kenwood Ham Radio Dealer of the Year Award for 2017. The award is based on volume of Kenwood sales along with excellence in customer service and showroom experience.

Finally, along with Yaesu Icom & Kenwood, ML&S now have a dedicated illuminated display for the FlexRadio product range.

www.MLandS.co.uk

Breakthrough in Antenna System Performance Analysis

Frank Donovan W3LPL has one of the few 'super-stations' in the world. While using two WSPRlite antenna testers from SOTAbeams to compare antenna arrays, he noticed that excellent results could be obtained if he filtered the reception data so that he only used truly simultaneous reception reports. Since WSPR transmitters transmit at random time intervals, such simultaneous reports would be relatively rare – unless you are using a 'super-station'! SOTAbeams analysed Frank's data and agreed that it was an interesting discovery. Thus they worked to incorporate this into their antenna analysis system. The first stage was to upgrade their DXplorer.net data analysis system to allow filtering by simultaneous spots and also by range/wave angle. In addition to this enhancement, real-time statistical analysis was incorporated.

Not everyone has a super station so a hardware upgrade was done to the WSPRlite transmitters to allow pairs of transmitters to work synchronously but also pseudo-randomly so as to correctly share the WSPR frequency slots. This greatly increases the amount of data and makes simultaneous analysis of even small low-efficiency antennas possible.

These changes make real-time performance analysis of antenna systems available in a way that has never before been possible. This new analysis method is now live and Frank spoke about it during his Contest University session at Dayton.

www.sotabeams.co.uk/wsprlite

See the Air Cadets Smile

Under senior invigilator Lt Cmdr. **Robert James** (RNR), two air cadets from the 106 (Orsett Hundred) Squadron based in Grays (E. London) attempted their amateur radio examination recently.

The cadets **Smith** and **Crafter** passed both sections. **Nicholas Wilkinson** a member of the training team stated, *"the cadets worked really hard to pass the exam. Everyone involved was really pleased to see the two cadets achieve their goal".*

(L – R) Miles MOLHA, Cadets Smith and Crafter, Lt Cmdr Robert James.

Dayton News

The 2017 Dayton Hamvention is now history. After many years at the Hara Arena, it moved this year to the Xenia Showground, about 20 miles from Dayton. Other than some traffic congestion on the first day, successfully reorganised and cured on Day 2 by the local police, the new venue appears to have met with universal approval. The indoor facilities were an improvement and onsite catering was perfectly adequate, the only downside being that the extensive fleamarket was on grass rather than tarmac, not helped by some torrential rain over the weekend.

PW's man in Dayton reports that there was little by way of new product announcements, other than the new FlexRadio products, which we report elsewhere in these pages. One interesting product announcement, though, was in respect of the mcHF-QRP transceiver. This SDR transceiver was designed by **Chris M0NKA** (see website below), inspired by the Elecraft KX3.

www.m0nka.co.uk/?page_id=16

It appears that the mcHF-QRP will be manufactured in China and sold by Connect Systems (better known for their DMR radios) for those unwilling or unable to build the kit but wanting to enjoy the radio.

PW advertiser bhi also launched their new ParaPro EQ20 Audio DSP product (see photo). We hope to have more details next month.

Halls of Fame

As usual at Dayton, there were the annual announcements of inductees to the various CQ Magazines halls of fame.

The CQ Amateur Radio Hall of Fame honours those individuals, whether licensed amateurs or not, who have made significant contributions to amateur radio and those amateurs who have made significant contributions either to amateur radio, to their professional careers or to some other aspect of life. Among the 2017 inductees are **King Bhumibol Adulyadej** of Thailand **HS1A** (Silent Key – SK), **John Brosnahan W0UN** (SK) – past President of Alpha Power, NOAA physicist and instrumental in design and construction of the HAARP facility in Alaska, **Garrett Brown W3AFF** – Inventor of the Steadicam, which earned him both Oscar and Emmy awards for filmmaking technology, **Britton Chance W2IBK** (SK) – Pioneer in magnetic imaging; MIT professor, team leader in MIT Radiation Lab developing WWII radar; US Olympic gold medallist (sailing, 1952), **Limor Fried AC2SN** – Founder of Adafruit Industries, major supplier of open-source electronics to the Maker community; honoured by **President Obama** in 2016 as a *"Champion of Change"* and by the Internet of Things Institute as one of the 25 most influential women in the IoT industry, **Robin Haighton VE3FRH** (SK) – Founding member of Amateur Radio on the International Space Station (ARISS), former president of AMSAT-NA, **David Honess M6DNT** – Developed AstroPi project, which sent two Raspberry Pi computers to the ISS as platforms for students on Earth to write and run their own computer code in space; honoured for this work with the Sir Arthur Clarke Award, **Kristen McIntyre K6WX** – Apple software engineer and inventor (her name is on 22 granted or pending patents), promoter of STEM (science, technology, engineering and math) subjects for girls through various talks and YouTube presentations, **Andy Nguyen VK3YT** – Pico-ballooner, pioneered round-the-world microballoon flights carrying amateur radio, **Tim Peake KG5BVI** – UK astronaut very active in ARISS program during time on ISS; coordinated ISS end of the AstroPi project (see David Honess, above), **Gerald Youngblood K5SDR** – SDR pioneer and founder of FlexRadio.

Two new members each were also inducted into the DX and Contest Halls of Fame. New members of the Contest Hall of Fame are **Dave Robbins K1TTT**, builder and owner of a contest superstation in western Massachusetts and **Bob Wilson N6TV**. The CQ DX Hall of Fame inductees are **Bill Moore NC1L** (SK) the ARRL's DXCC Manager for over 20 years. Bill was severely injured in a car accident in 2014 and died last year. Secondly, **Jerry Rosalius WB9Z** – an accomplished DXer and DXpeditioner, he has 'worked them all' with the exception of North Korea and has participated in multiple major DXpeditions, including seven that were named as DXpedition of the Year by the Southwest Ohio DX Association.

Norfolk Amateur Radio Club News

Radio amateurs at the Caister Lifeboat Visitor Centre in Norfolk managed to contact 193 other radio amateurs in 35 different countries on April 22nd when they took part in the annual International Marconi Day to mark the inventor's birthday. Using the callsign GB0CMS and a mixture of Morse, SSB and data modes, contacts were made across the UK, Europe, Australia and the USA. Notable were contacts with other special Marconi stations in the UK, Italy and Ireland.

The Norfolk Amateur Radio Club (NARC) ran the all-day special event station to commemorate the village's original Marconi Wireless Station, which was established at Caister in 1900. The station was in a house in the High Street known as Pretoria Villa and its original purpose was to communicate with ships in the North Sea and the Cross Sands lightship.

Scunthorpe Steel Amateur Radio Club

The Scunthorpe Steel Amateur Radio Club will use the callsign GB1AFV for a period of 28 days commencing July 30th, to acknowledge the first use of wireless in a British armoured fighting vehicle (AFV) at the 3rd Battle of Ypres on July 31st 1917 in the Great War. This vehicle was the recently introduced Tank.

Communications from trenches at the Front to Headquarters up to this time had been either by written despatch notes or 'wired' communication by Morse telegraphy or latterly telephony, or Trench Spark Coil transmitters, all from fixed positions. The Tank was not an ideal vehicle for laying electric cabling so, initially, carrier pigeons were carried for communicating back to HQ.

For the Battle of Ypres, the Mark 1 Tank was being replaced by the more reliable Mark 4 so six Mark 1s had their armaments removed and were converted to Wireless Tanks. Guns were removed from the 'sponsons' mounted on each side and replaced with wireless equipment initially consisting of spark induction coil telegraphy transmitters and reception sets consisting of perikon or carborundum crystal detectors. A hinged antenna mast, which could be raised to about two and a half times the height of the Tank, was mounted on its upper-works.

Because of the main engine noise and the shaking motion, the wireless equipment could only be used when stationary.

GB1AFV will be based at the radio club's room at the App Frod Sports Club, Brumby Hall, Ashby road, Scunthorpe DN161AA.

A book entitled *The Life & Times of a Tankie from Lincolnshire in the Great War* has been recently published by club member **John Allen M0JAE**, about his great uncle, **C S Allen**, who was awarded the Distinguished Conduct Medal for *"grit & determination under heavy fire"* for his actions, which went beyond the call of normal duty.

Rodney Hoffman GOCBO and Kim Medley G4WUG operating GB0CMS.

PW Publishing Ltd., Tayfield House, 38 Poole Road, Westbourne, Bournemouth BH4 9DW • E-Mail: tex@pwpublishing.ltd.uk

LDG RT/RC-100 Remote Auto ATU

Tex Swann G1TEX was given an LDG remote ATU to play with – here's what he thought!

The two units that make up the complete system. At the rear of the ATU box is the L-shaped bracket and on the controller rear are two SO-239 sockets and a coaxial power socket.

I've had and used LDG auto-ATUs for quite a few years, starting with the original LDG AT-11MP kit that I reviewed on page 55 of the September 2002 issue of *PW*. Since then, I've acquired the LDG Z-11 Pro model with the control/power lead for my base station rig. So when the opportunity to have a play with the LDG remote auto-ATU came along I jumped at the chance. I occasionally go out on 'Days-in the Field' with my radio club, Poole Radio Society, trips out that give me the chance to try other antenna arrangements than my setup at home.

Overview

The manufacturer's specification appears in the sidebar. Let me start with what's in the box. There are the two units making up the combination, the RT100 remote ATU, in a grey weather-resistant plastic box, with two SO-239 sockets and an Earth or grounding post complete with its wing nut. At the other end of the box is a securely screwed-on bracket to attach the unit directly to a mast or pole. This is accompanied with a suitable U-bolt clamp. There is the smaller black metal-boxed controller, fronted by a status LED and two control buttons. It also features two SO-239 sockets at the rear alongside a coaxial power socket. A suitable power lead comes with this unit, along with two handbooks, one for each of the units.

Unit Descriptions

The LDG remote ATU system comprises these two units, RT-100 the main weatherproofed – but not immersible – box containing the actual ATU board and a companion RC-100 Controller desktop bias 'T' and control unit. The power for the ATU is fed into the rear of the RC-100 unit along with the RF from the rig. Both are combined to pass out of the second SO-239 socket along the coaxial cable to the remote unit where they're separated again. On the front of the controller are two switches, one for power and one to initiate a tuning sequence. A red LED indicates that the tuner is connected when power is switched on.

The RT-100 ATU and its companion unit, the bias 'T', allow the ATU to operate remotely, much closer to the feedpoint of the antenna system without the bother of a separate power source nearby. For those of you who may not have come across the bias 'T' method of feeding both DC and RF down feeders, I've shown a diagrammatic explanation, **Fig. 1**. The two choke inductors (L) allow the DC to flow through them, while effectively blocking that path to RF. Meanwhile the two capacitors (C) block the DC while allowing the RF to flow through them.

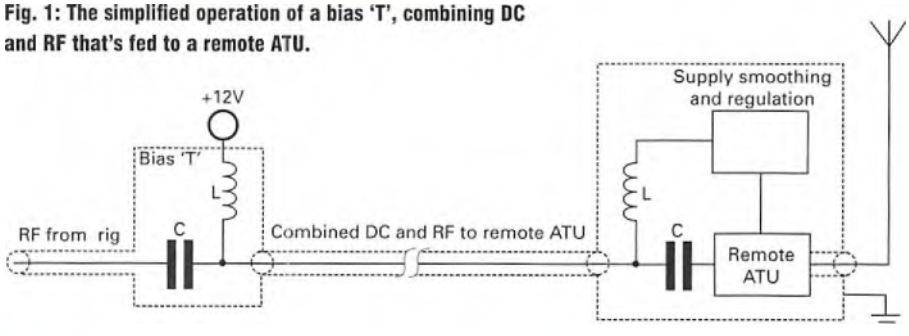
In answer to what some may perhaps question, as to why go to all the bother of adding a bias 'T' to operate the ATU remotely in the first place, the answer is twofold. Putting the matching unit (more frequently called an ATU) remote from the shack and much nearer (preferably at) the feedpoint of the antenna increases the likelihood of more RF getting to the antenna to be transmitted, and on the return path, fed to the receiver.

Secondly, because the matching on the coaxial cable feeder will be nearer to an SWR of 1:1, there will be less radiation from, and much less local noise picked up on receive by the coaxial cable itself. This has two important side-effects – less chance of annoying neighbours, along with a cleaner received signal.

First Tests

I decided to try the system out on my

Fig. 1: The simplified operation of a bias 'T', combining DC and RF that's fed to a remote ATU.



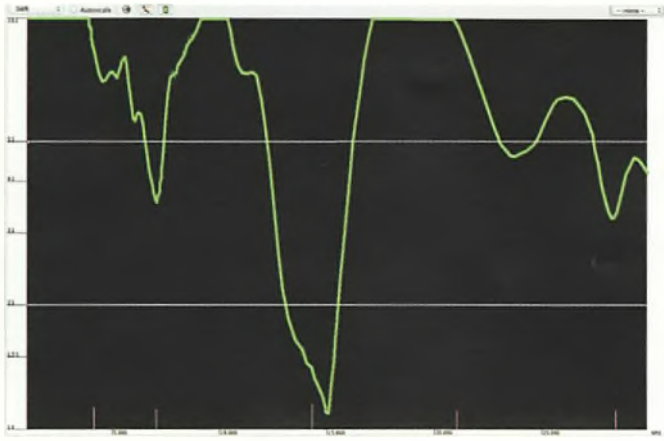


Fig. 2: A 'naked' plot of the SWR of my main home antenna – not brilliant is it?

usual antenna system first. My shack is upstairs and the house is towards the front of a narrow plot. I've settled on an asymmetric dipole for 7MHz but fed at around nine and an half metres above ground. A further complication is that it's set out as an 'L' antenna with the short 'leg' angled downwards with its end only about 2.5m above ground level. Added to the mix is that, although the 'run' of the longer leg is basically horizontal, the ground underneath slopes upwards, by almost two metres towards the far end.

Having suffered in the past with problems of coaxial cable feeder and an antenna with very variable band matching, my present system uses a home made 1:1 balun, with some 10m of Spectrum's heavy-duty low impedance twin feeder. Though not ideal, it minimises the problems of RF getting back along the feeder into the shack and rig. So, I thought I'd start with the RT-100/RC-100, just replacing my own ATU, feeding the balun and twin feeder to get an idea of how it works.

I've shown an SWR plot of my antenna system in the screen grab of **Fig. 2**. As you will probably see, it cannot be considered brilliant by any means. Either of my two present auto-ATUs will give an adequate match (under 1.5:1) to the short coaxial cable feeding the balun on most bands from 3.5MHz upwards, with a poorer match (3:1) on 1.8MHz. The RT-100/RC-100 combination certainly matched these reading on all bands except 1.8MHz, where only a 4.5:1 match was obtained. More of that later!

I decided that my primary use of such a system would be for portable operation with a 10m vertical wire loosely wound around a 10m fishing pole, fed against a set of radials. At the risk of intriguing the neighbours, for the initial tests, I set up the vertical at the far end of the garden with the three radials of 10, 5 and 2.5m attached to the 'Earth' connection of the RT-100 rather than to another section of coaxial cable. I connected the vertical wire with a soldered-on PL-259 directly into the antenna connection of the ATU. So now it really was at the feedpoint of the antenna!

A 20m length of good coaxial cable was brought down into the house, through the kitchen window (the XYL was out for the evening) and a second set of tests was carried out after getting a 'feel' for the unmatched antenna. As you might expect, it was rather like the 'curate's egg', with some bands showing low SWR and others somewhat higher.

In operation the RT-100/RC-100 combination managed to keep all bands from 7MHz upwards under complete control. With the exception of 7, 21 and the top end of 14MHz, the SWR dropped to less than 1.3:1 after a initial period of adjustment. 7MHz adjusted to around 1.6:1, 21MHz adjusted to 1.8:1 and the top end of 14MHz drifted towards 1.5:1 although, lower in the band, it also dropped to 1.3:1. All in all, I decided that it's a useable system for portable use. On 3.5MHz, the SWR was around 3:1 and on 1.8MHz it was rather higher at 6:1.

I did note with the vertical setup, though, on Topband (160m) at 1.95MHz that, in spite of this higher SWR, there was lower noise so I was able to listen to a small net chatting away. I know at least one of the stations was in the Portsmouth area and using a horizontal dipole. Perhaps not fantastic DX at around 60-70km but given that the band is normally no-go on the main antenna due to a fog of switch-mode PSU screams, I considered it a great improvement. I think a 9:1 UNUN at the output to the vertical wire might improve the SWR but I have yet to try that.

Another test was to pass the two units over to club members operating the club station, with its equally unusual antenna arrangement. In some respects it's similar in layout to my own although the horizontal run is longer and the 'shorter' leg connects to one or more grounded earth rods. The feedpoint is only around four and an half metres high but the wire then rises to over 10m before continuing horizontally again.

The club wire antenna does need quite a bit of matching at the rig end to work most bands, the station being at the end of around 25m of good quality coaxial cable. However, with the remote ATU in place, matching became much easier, even on the lower frequency bands.

The Insides

That's enough of how it worked with a few antenna systems, let's now turn to 'the insides' and how the ATU performs its work. Most of the auto ATUs I've come across are based on an L-match format, where a chain of inductors of various values are connected in series with the inner of the feeder and one side of the antenna. The other part of the 'L' is a series of capacitors switched to ground at one or other end of the inductor chain. The diagram of **Fig. 3** illustrates this basic layout.

Let's suppose there are a number of inductors in a 1, 2, 4, ... series of values and a number of capacitors in a similar series of values. By various combinations of switches or, more usually, relays, various overall values may be created. Thus a number of feedpoint impedance values can be dealt with. My previous LDG auto-ATUs have eight of each component type, capable of creating 256 inductive values and 256 capacitive values, giving 65,536 possible combinations. In

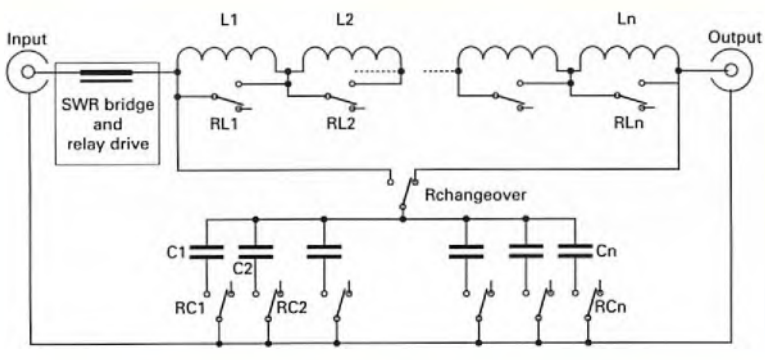


Fig. 3: The simplified operation of a typical Auto ATU, which is often a modified L-match.

addition, there's another relay to swap the capacitor bank from input to output (or vice versa) so increasing to 131,072 possible combinations.

As you can imagine, to choose one combination from all of these can take some time. Therefore, to counteract a possible holdup that would occur every time the cycle had to start all over again at each change of frequency, there are over 2,000 memory locations. Each memory location can store combinations that have been already been found to match the antenna at each previously used frequency.

To reduce standing power further after the cycle is complete, the RT-100 uses latching relays, which only need power during switchover conditions. I measured only a few tens of milliamps of power needed at the matched condition, thereby extending operating time if working from batteries.

Looking at the inside of the RT-100 unit, **Fig. 4**, shows that there are seven relays for each set of components and when the switchover relay is added in, that gives 32,768 combinations. The reduction in combinations compared to my other auto-ATU probably explains why there was a difference in performance on 1.8MHz, compared to its stablemate. I guess that, because this system is probably aimed at portable operation, the lower frequency bands are much less likely to be used.

Conclusions

Having played with the system for a couple of weeks, what are my conclusions? Well, it certainly works as well as my main auto ATU, bearing in mind the slight reduction at the lower end of the HF bands. It could be put into operation at my QTH feeding a vertical wire antenna, if I wanted to listen on the lower bands. When I get the opportunity to try a longer kite-elevated wire, I'm sure that operation on 1.8 and 3.5MHz will be perfectly possible with a low SWR.

However, as most of my portable operation is during the daytime, then it is more than adequate 'as is'. Having had the chance to try it, I'm sure it will find its way into the shack equipment box to make portable operation even more fun.

My thanks go to Martin Lynch & Sons for the loan of the RT/RC-100 pair. They are available for £249.95 from their shop or website. For those with greater power handling needs, look out for the RT/RC-600 combination that Martin can supply as an alternative.

www.hamradio.co.uk/ldg

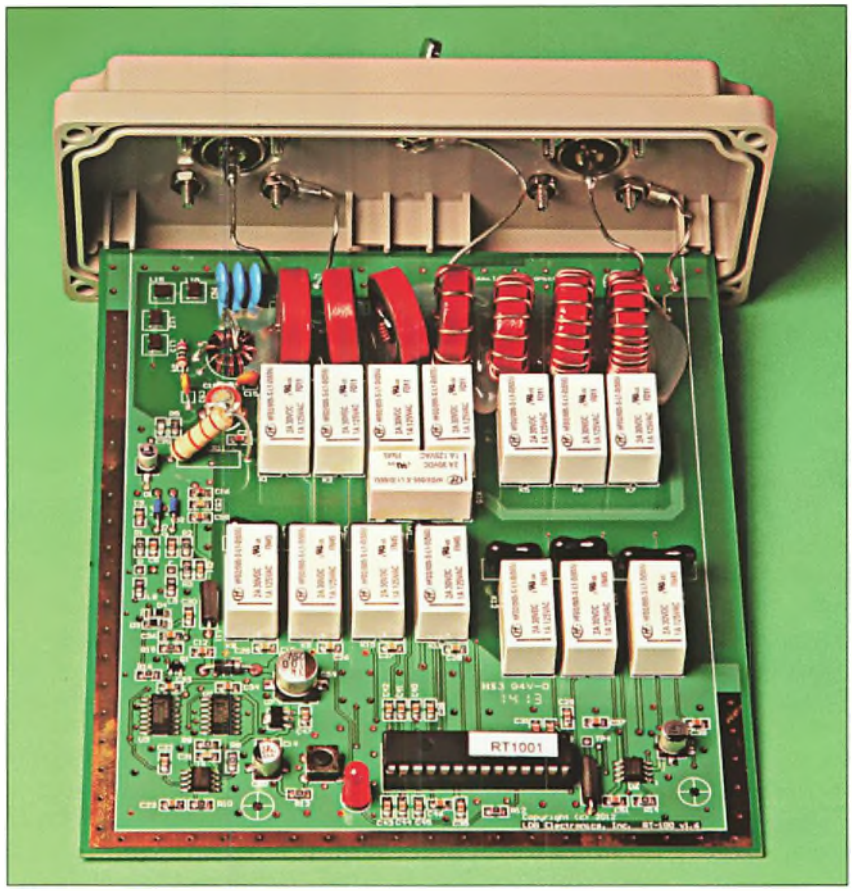


Fig. 4: Looking inside the ATU shows a board with 15 latching relays offering over 32000 impedance combinations. The bias 'T' separating network is to be seen at the top left of the board – four surface mount inductors and three blue high voltage capacitors.

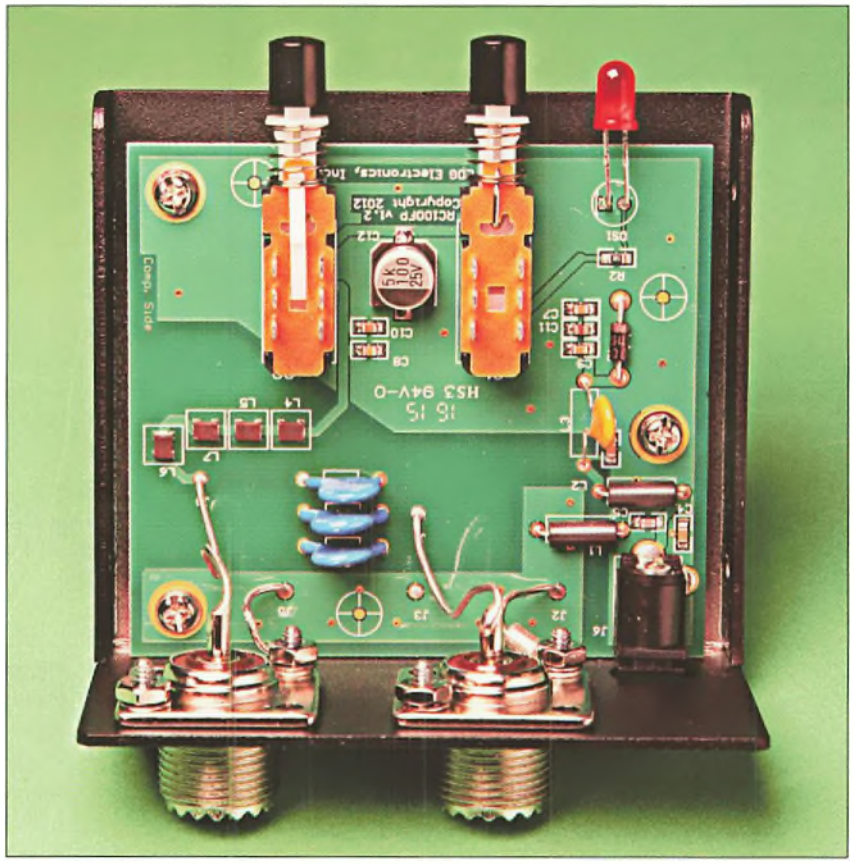


Fig. 5: Inside the controller and feeding bias 'T', the four surface mount inductors prevent the RF passed via the three blue capacitors from the input socket (lower right) getting back into the power supply. The lower left socket is the output cable to the remote unit.

Manufacturer's Specifications

- 100mW to 100W (peak on SSB operation, or 30W on 100% duty cycle modes. Maximum 125W peak power).
- Latching relays for ultra low power static operation.
- 2000+ memories for near-instantaneous frequency and band changing.
- +12V @ 500mA supply needed, fed down the coaxial cable via the RC-100 bias 'T' controller (or similar is supplied by the user).
- 1.8-54MHz operation.
- Matches 4-800Ω loads (16-150Ω at 50MHz+). Can cover 16-3200Ω with optional 4:1 balun.
- May be used with dipole, verticals V-beam or any coaxial cable fed antenna.
- Water resistant case, though not immersible.
- Operating temperature 0 – 110°F (–18 to +43°C)
- Optional external balun allows tuning of random length long wires or antennas fed with ladder line.
- Optional RC-100 bias 'T' controller with On/Off switch and Tune button.
- Dimensions 3.5 x 5.5 x 7.0in (HWL) [101 x 140 x 178mm]
- Weight 1lb 0oz (454g).

The RT/RC100 combination or the greater power RT/RC-600 combination are available from Martin Lynch & Sons, Wessex House, Drake Avenue, Staines, Middlesex TW18 2AP. Tel: 0345 2300 599. The RT/RC-100 pair costs £249.95, while the more powerful combination of the RT/RC-600 pair costs £429.95.

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 1

Steve Ireland VK6VZ relates the tale of the Battle Creek Special antenna – a DXing Legend – along with describing how to build your own.

Battle Creek Special being put up at VP8ORK (Photo: Jerry WB9Z).

Over the last three decades or so, there is a low-band antenna that has truly gone into DXpedition history - the Battle Creek Special.

In terms of low-band DX history, I reckon the Battle Creek Special has been as significant an antenna as **Stew Perry W1BB's** original topband inverted-L design (Stew was one of the key figures in the early days of 160m DX chasing).

This antenna has been the choice for 1.8, 3.5 and 7MHz operation on several tens of DXpeditions - famously from the likes of 3Y5X (Bouvet Island 1990), AH1A (Howland Island 1993), VK0IR (Heard Island 1997), 9M0C (Spratly 1998) and, more recently, VP8ORK (South Orkney 2011), K9W (Wake Island 2013) and VK0EK (2016). Its excellent performance on those bands from a huge variety of exotic locations has had DX operators worldwide salivating. *PW* Editor **Don G3XTT** along with **Chris Burger ZS6EZ** used one on their Walvis Bay/Namibia (ZS9Z, V51Z) DXpedition in 1994 (written up on the website below).

www.qsl.net/g3xtt/zs9z.htm

However, the Battle Creek Special cannot be bought and details of how to build one are relatively hard to find. Part of the reason for this is that the Battle Creek Special is much more than an antenna design - it is perhaps better described as a philanthropic endeavour to make sure DXpeditions carry a high-performance lowband antenna with them. Indeed, it would never have been described as a base station antenna – what the DXpeditions were loaned was a complete kit, down to guy stakes and a mallet, all contained in a very substantial wooden crate that was a two-person lift (at least).

Let me tell you a story.

Genesis

Back in the 1960s, **Barry Boothe W9UCW** described in *QST* magazine [1] an antenna he had designed called the Minooka Special. In essence, this was a 50 to 60ft (15-18m) high 1.8MHz top-loaded vertical and could also be used as a shorter vertical on the other HF bands with an L-match antenna tuning unit at the base, owing to the 1.8 MHz loading coil acting as an RF choke at 3.5MHz and above.

This was the early days of DXpeditioning in the 1960/1970s and the Minooka Special was subsequently used by expeditions to the Caribbean, South America, Heard Island and Mellish Reef on 1.8, 3.5 and 7MHz, as a complement to a 3-element TH3 or TA33 tribander that was the standard equipment for DXpeditions back then.

The story goes [2] that one of the people who built a version of the Minooka Special was **Charlie Dewey W0CD**. However, W0CD found the power handling capabilities of the Minooka Special's loading coil could be improved and he started on a redesign.

What Charlie ultimately developed was a trapped inverted-L Marconi antenna for 1.8, 3.5 and 7MHz that he called the Battle Creek Special, **Fig. 1**. The vertical part of

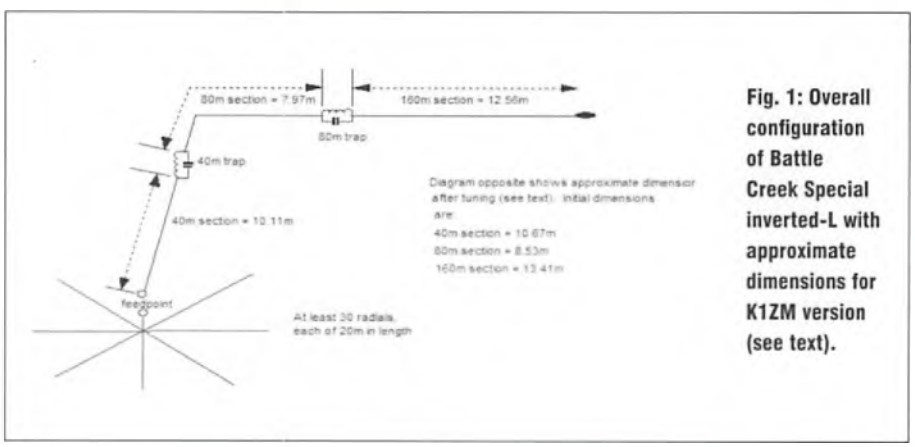


Fig. 1: Overall configuration of Battle Creek Special inverted-L with approximate dimensions for K1ZM version (see text).

the antenna was originally made of tubing, although simpler wire versions were subsequently made.

So why call it the Battle Creek Special? As W0CD lived in Battle Creek, Michigan - just as W9UCW lived in Minooka, Illinois - Charlie named the antenna in a similar fashion.

W0CD along with his friends, **George W8UVZ** and **George K8GG** – all low-band DXers - then went on to build a number of these antennas, which could be loaned to DXpeditions to rare countries that needed to put out a competitive signal on 1.8, 3.5 and 7MHz. This loan system, run by the three men, has gone on for about three decades and resulted in thousands upon thousands of lowband contacts with very rare countries.

The Battle Creek Special loan antennas are all shipped in custom-made wooden crates. There is a tradition that each DXpedition signs the crate and perhaps attaches a small memento from their expedition, which can range from a feather to a washed-up part of a sea creature (Photo: Dale VE7SV).

A Few Technicalities

The basic principle of operation of the Battle Creek Special is quite simple. The antenna is electrically a quarter-wave Marconi antenna on each band, fed against a minimum earth system of 32 radials at least 20m in length.

The use of two parallel-tuned circuits in the antenna, one tuned to 7MHz and the other to 3.5MHz, isolates sections of the antenna so as to form a resonant quarter wave on each of these bands, while on 1.8MHz the whole 32m-plus of the antenna's length, in addition to the inductive loading provided by the two traps, is used for quarter-wave resonance.

The Battle Creek Special should provide an SWR of less than 2:1 between 7 and 7.3MHz, while on 80m it has an SWR below 2:1 between 3.5 and 3.6MHz. To cover the SSB DX window just below 3.8MHz, a 300 - 500pF high voltage variable capacitor can be placed in series with the antenna and tuned for minimum SWR.

On 1.8MHz, the match to the 50Ω RG213 feeder is only fair, because the antenna looks like 25 to 30Ω impedance. However, the Battle Creek Special uses a simple 2:1 or 9:4 ratio 'unun' (unbalanced-to-unbalanced) matching transformer wound on a ferrite toroid to get a virtual perfect match at resonance on this band.

A suitable unun, made to a design by **Jerry Sevick W2FMI**, can be bought from Amidon Associates (part no. 2:1-HDU50) or homebrewed [3].

Let me now declare a special interest in this type of trapped inverted-L antenna. Back in the early 1970s, I designed a trapped inverted-L antenna for 160, 80 and 40m, along similar lines to the Battle Creek Special. However, it was a vastly inferior antenna to the latter because of one major weakness – the quality of its traps.

Fig. 2: Base of Battle Creek Special at VP8ORK showing radial connections and unun transformer at the antenna feedpoint. (Photo: Ralph K0IR).

I lived in the UK back then, where the HF power limit on CW was 150W input. My traps were simple conventional parallel tuned L-C affairs, with inductors of 18SWG wire and high voltage mica capacitors that were designed for use in valve televisions.

These traps were fine up to powers of about 50W - about all I could get out of the single 6146 PA valve of my KW Vespa Mark 1 transmitter – but much more RF

than this and the trap capacitors would go up in smoke.

For the original Battle Creek Special, W0CD wound traps made from small coils of coaxial cable. The necessary inductance was provided by the coiled coaxial cable, which also served as the capacitor due to the capacitance that exists between the inner and outer conductors of the cable.

One of the best articles I know about for building these types of coaxial traps is an old *QST* article by **Robert N4UU** [4]. This shows how to build traps using coaxial cable for trapped dipoles, inverted-Ls and beams for the HF amateur bands using RG174 or RG58 coaxial cable.

As N4UU says in the article, *"Coaxial cable traps have been found to be broadband, inexpensive, easy to construct, stable with respect to temperature variations and capable of operating at surprisingly high levels of power."* Using RG-58 coaxial cable, an antenna capable of taking up to 400W PEP can be simply built.

Extra Battle Creek Special

However, power levels have increased substantially worldwide since then. For those who would like to build traps for a Battle Creek Special antenna with a very big RF safety factor, topband (160m) legend **Jeff Briggs K1ZM/VY2ZM** has come up a trap design using RG213 coaxial cable wound on 4in PVC tubing.

As Jeff says, these are really rugged and can take up to 1.5kW, but are somewhat heavier than RG58 traps.

Jeff and I have been making contacts on 1.8 MHz for over 20 years now and he has kindly allowed me to publish details of his version of the Battle Creek Special. Jeff is the author of *DXing on the Edge – The Thrill of 160m*, a book that is indispensable if you are interested in topband DXing, its history and the necessary tools and equipment to work really long distances on this band. The good news is Jeff has just published a new version [5].

The Battle Creek Specials made by W0CD, K8GG and W8UVZ that are loaned to DXpeditions use a high-grade aluminium vertical section approaching 19m in height. This is made from lengths of telescoping tubing, ranging from 5 to 2.5cm outside diameter, which contain both the 7MHz and 3.5MHz traps. These days the traps are made from 10-gauge wire and capacitors formed by short lengths of RG213 coaxial cable.

The final top-loading wire used to achieve resonance on 1.8MHz is connected to the 3.5MHz trap and fastened to a convenient tree or mast so it is as near to horizontal as possible. However, on a number of DXpeditions, as the result of a lack of suitably high supports for the end of the top loading wire, this has been sloped down at around 45° to the vertical.

The Battle Creek Special loan antennas are engineered to withstand 100mph winds and to be assembled and reassembled many, many times. As a result, they need to use high-quality and relatively expensive materials in their construction that are not necessary for the average amateur installation. There is a close-up picture of the base of a Battle Creek loan antenna, **Fig. 2**, that gives you some indication of its build quality.

In contrast, the K1ZM version of the Battle Creek Special is much cheaper and easier to construct, being essentially made of wire and coaxial cable, and can be supported by two cheap supports, such as convenient trees or simple aluminium or wooden masts. One is used for the vertical section of the antenna and the second to support the (relatively) horizontal section, so the entire antenna is supported in inverted-L fashion.

The 3.5MHz and 7MHz coaxial traps used in the K1ZM version of the Battle Creek Special are cut/tuned for the CW ends of each band. On the basis that DXers usually use both SSB and CW, K1ZM has found it best to cut/tune the traps/antenna for the CW rather than the SSB end of the bands and use an Antenna Tuning Unit when you want to use SSB.

If you wish to build Jeff's version of the Battle Creek Special, you will need the following parts.

1. About 5.5m (18ft) of RG-213 (poly dielectric) 50Ω coaxial cable.
2. About 610mm (2ft) of 100mm Stormvent or SWV diameter thin-wall PVC septic pipe (what is called Schedule 40 in the USA). Note: Make sure you get the white, entirely PVC pipe - not the grey pipe that uses some metal in its manufacture.
3. Four end-caps for 100mm diameter PVC septic pipe.
4. 1.22m (4ft) of 14SWG (#12 USA type THHN) insulated stranded copper wire (or similar).
5. Four rolls of PVC electrical tape.
6. One tube of silicon sealant.
7. Four 1/4in (or similar) stainless steel or galvanised steel eye-hooks.
8. Eight 1/4in (or similar) stainless steel or galvanised steel flat washers.
9. Four 1/4in stainless steel or galvanised steel nuts.
10. Four 1/4in stainless steel or galvanised steel lockwashers.
11. A small can of PVC pipe cement (Bostik Plumb-Weld – use the high pressure 'green' type).
12. Around 33m of 14-gauge hard-drawn copper wire.

Next Month

Next month I will take you step-by-step through the assembly and testing of the antenna.

References

[1] Page 36, *The ARRL Antenna Anthology*, Edited by **Marian S. Anderson WB1FSB**, published by the ARRL (1978)

[2] Page 9-41, *Antennas and Techniques for Low Band DXing* by **John Devoldere ON4UN**, second edition (1994), published by the ARRL.

[3] In an article published in the *Low Band Monitor*, George K8GG says that Chapter 7 of the book *Transmission Line Transformers* by Jerry Sevick W2FMI (2nd edition, published by the ARRL) has several examples of 9:4 ratio ununs. George adds, *"These make nice 50:22Ω transformers, which can be attached to the feedpoint and feedline for a good match... The Battle Creek Special uses one of these on 160m to avoid shipping an antenna tuner."*

[4] *Making antenna traps from coaxial cable* by Robert Sommer N4UU, *QST* December 1984

[5] *DXing On The Edge - the thrill of 160 Meters* by Jeff Briggs, K1ZM (2nd edition, published in 2016). It is available from the RSGB bookshop for £15.99.

• E-mail: geofftheasby@gmail.com

Frequency Counter & Crystal Tester Kit

Geoff Theasby G8BMI responded to the Editor's Keylines request for experiences with kit building. Here he describes a handy and cheap kit for testing oscillators and tuned circuits.

Fig. 1: 'Light Vader'.

Fig. 2: The completed kit.

This little kit, costing only about £5, is a quick, easy and accurate way of testing crystals, RF oscillators and simple tuned circuits. It does at very low cost what radio amateurs have been doing for years at some expense or by trial and error. Based on a PIC16F628 microcontroller, it measures the frequency of quartz crystals and external oscillators up to 50MHz. Offsets are available, which make it usable with mixer VFOs to give a true digital frequency readout, for example in conjunction with my old but quite serviceable Yaesu FT-101B. The PIC doesn't need programming because it comes pre-loaded but if you need an offset not provided for, or you buy a kit from another source, this may not be the case. Five seven-segment displays are used, which would benefit from a red filter to improve the contrast, with autoranging detection and display of the frequency. Mine, by TOOGOO, was bought through Amazon and supplied by SODIAL, direct from China.

Overview

No circuit diagram or building notes are provided but several suppliers list this kit. Some provide a circuit online, and build instructions are not required because the PCB is silk screened very clearly with component locations and values. By all means Google the PIC type number for detailed information but please note that the Data Sheet is 180 pages long! All items are through-hole mounted, with the PIC in an 18-pin DIL package, which should be installed last and in static-free conditions. Having had a recent cataract operation, I found my close-up vision was now very poor so I bought a head-mounted magnifier, which worked beautifully, leading to no further problems. Mine was Toolzone branded, costing £7. Other types are available, at this price or higher, from a variety of outlets. Even my wife said the soldering was very neat. She also said I looked silly in the headgear, which, since it has two battery-powered LEDs mounted on it, and although I'm not as tall as Luke Skywalker's Dad, we have christened Light Vader, **Fig. 1**. The header photo shows me in a more normal state!

This circuit was devised by **Wolfgang Büscher DL4YHF**, including the software, although kit suppliers do not always acknowledge his work. See his page on www.qsl.net, which notes many modifications, programming notes and other details. However, he doesn't offer a help service.

Assembly

Assembly was straightforward, with no missing parts, and after carefully checking the PCB, power was applied (5-9V DC from a PP9 battery). It worked immediately! Provision is made on the FT-101B for a pre-driver stage, low-level RF output intended for a transverter or linear amplifier. According to my ALL-M Products power meter, this was at a level of 100mW.

Rather than solder crystals direct to the PCB or use the rudimentary socket supplied, I added a pair of short wires ending in alligator clips (Not black or red, to avoid confusion with the power leads). Consumption is 10 mA at rest, rising to 15 mA when measuring a crystal or other circuit so a PP3 type battery can be used but fitting a switch to disconnect the battery completely would be wise. No battery connector or RF input connector is supplied but a small coaxial power connector is, so a redundant 'wall wart' mains power unit may be used. Do, though, check that the secondary output is less than 9V, of the correct polarity and properly isolated from the mains for safety reasons.

Modes of operation are selected by a SPST switch, from a step-through menu reading out in one-word detail via the display, which can be aborted at any time. This includes a power saving option. The completed kit is shown in the photo, **Fig. 2**, although the displays are 'strobed' to reduce current consumption, which my camera shutter did not always detect, so some appear not to be illuminated. To the eye, however, they all appear to light up. It was also tested using a small two-transistor homebrew signal generator running at about 5MHz, for use with simple receiver building. I checked several crystals. An HC-6U marked 8.092MHz displayed as exactly that. An HC-18U marked 33.575 gave an 11.194MHz readout so was clearly a third overtone crystal. It's also thrilling to connect a simple tuned circuit in place of the crystal under test, making adjustments to achieve the right frequency swing child's play.

Steve White G3ZVW • E-mail: g3zvw@pwpublishing.ltd.uk

Making Waves

Fading & Multipath

Steve White G3ZVW looks at fading and multipath reception.

Those of us who used to listen to Radio Luxembourg on 1440kHz Medium Wave know exactly what it was like to be on the receiving end of fading and multipath reception, even if we didn't really understand at the time all that was involved. The English service from Radio Luxembourg is now long gone so you can no longer experience exactly what reception of it was like.

The Mechanism

In previous instalments, when a signal was being received off the ionosphere I always showed it in the illustrations as a single refraction. In the real world the ionosphere doesn't always behave in such a considerate or predictable way. The layers of the ionosphere are not uniform in thickness and the levels of ionisation are not uniform in density. To a certain degree layers of the ionosphere are likely to be transparent and it is an everyday occurrence for signals to be refracted back to Earth from more than one layer of the ionosphere at a time, **Fig. 1**. To make life even more interesting the situation is constantly changing.

All these variables would seem to make it practically impossible to nail down what is going on but we can all experience the effects of fading and multipath reception and thereby come to an understanding of the subject.

Real-Life Demonstration

A way for all of us to hear a radio station that is suffering from fading and multipath reception is for everyone to listen to a frequency I suggest at a time I suggest and all on the same receiver. Impossible? No, not these days. Thanks to online Software Defined Radios (SDR) it has never been easier to do exactly that.

This is what to do.

First, go to web site of the SDR at The University of Twente (in the Netherlands): http://websdr.ewi.utwente.nl:8901

Now input the frequency 1458kHz and select AM as the mode. The station you should hear on this frequency is Lyca Radio (an Asian station in London), which is about 500km from Twente. Harking back to Radio Luxembourg, this is very similar to the distance between Luxembourg and London. 500km means it's beyond the normal range of Ground Wave propagation on Medium Wave, so you can be certain that if you hear this station at night it is being refracted by the ionosphere.

It shouldn't be long before you notice the signal fading up and down. Indeed, the S-meter of the SDR receiver is likely to fluctuate continuously. The fluctuations in signal level are caused by the ionosphere not being of uniform density. The mechanism isn't hard to understand. The parts of the ionosphere that are weaker allow more signal to escape to space, so less gets refracted back to Earth. **Fig. 2** shows how at different moments in time a signal radiated at any given angle can be refracted by different amounts. In this illustration the F layer refraction is stronger, but at a different moment in time the situation may be reversed.

It shouldn't be long before you hear distortion of the signal too. This is likely to come and go but not necessarily in time with the fading. Sometimes the signal will sound perfectly clear, while at other times it will be so distorted you won't be able to understand spoken words. The distortion is due to multipath propagation. In **Fig. 3** a transmitted signal reaches the ionosphere and is refracted back to Earth from two layers. This means the two signal components arriving at the receiver have travelled different distances, which in turn means they arrive at slightly different times. The difference in path lengths might result in a delay in the order of only a millisecond so don't expect to hear an echo. If the two returned signals arrive at the receiver in phase (the waveforms go up and down at exactly the same time), there will be no distortion when they combine in the receiver, **Fig. 3a**. However, if the two returned signals arrive at the receiver out of phase (the waveforms don't go up and down at exactly the same time), one will tend to cancel the other one out when they combine, **Fig. 3b**. Although I show the refractions as having the same amplitude (size) in both parts of the illustration, this is unlikely to be the case in

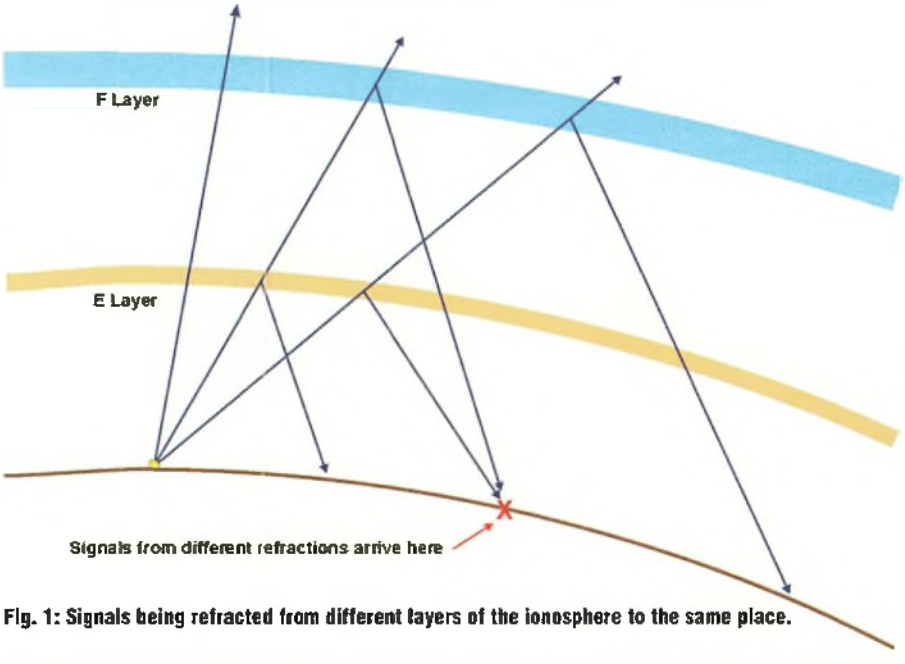


Fig. 1: Signals being refracted from different layers of the ionosphere to the same place.

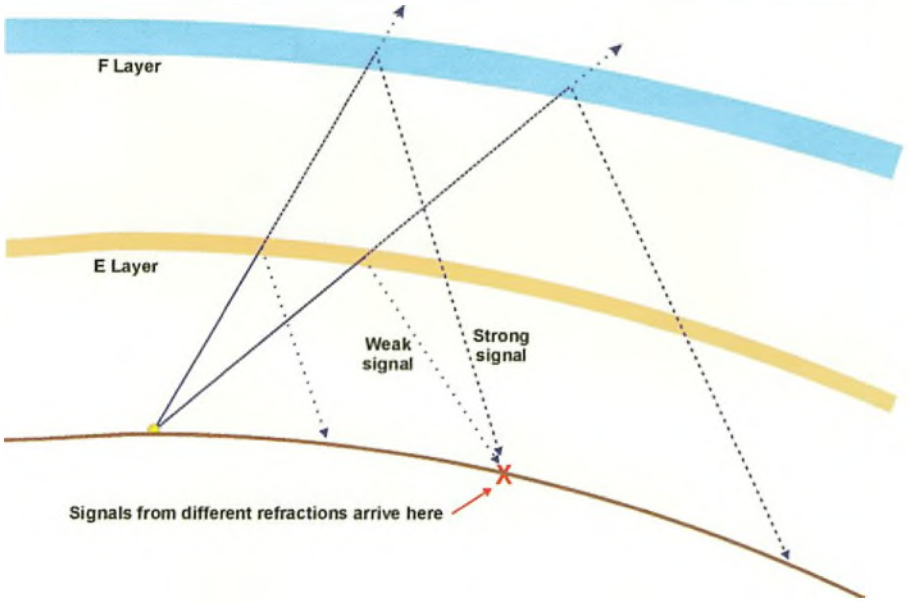


Fig. 2: Fading caused by changes in the strength of ionisation.

practice. Consequently, they are unlikely to cancel one another out completely but what the two signals will do is interact with one another. Phase Distortion is a characteristic of Amplitude Modulation, the modulation system used for Medium Wave and Short Wave broadcasting. It barely affects SSB or CW but it can affect PSK (Phase Shift Keying) data modes badly.

In the real world there can be more than two paths, which complicates matters even more. At times when there are multiple signals arriving, one will be much stronger than all the others and overwhelm the weaker ones but if out-of-phase signals arrive at about the same strength, you will hear what is known as Phase Distortion – and as the phases change relative to one another, the sound of the distortion changes.

Of course, you can experience all this with a conventional Medium Wave or Short Wave AM receiver if you have one.

In spite of absorption by the D Region (see the May 2016 instalment of *Making Waves*) you might still hear a weak signal from Lyca Radio in the middle of the day. This is because it is uses a very powerful transmitter (125kW) and an antenna designed to radiate a very strong Ground Wave signal (see the July 2016 instalment of *Making Waves*). If you do hear Lyca Radio in the middle of the day, reception should be more stable (less fading and no phase distortion) because of the lack of signals coming off the ionosphere.

Multipath Effects

Multipath reception doesn't only affect Medium Wave and Short Wave AM broadcasts. Its effects can be wide reaching.

The microwave signals from Global Positioning System satellites have to pass through the ionosphere on their way to Earth from space and at times they too can be affected. The signals themselves are little more than extremely accurate time signals that a GPS receiver uses to calculate its position but multipath reception can distort and delay the arrival of a signal and thereby affect navigational accuracy. And don't forget that the signals can bounce off the ground and back up to the GPS receiver!

For those of us who use a Satnav in the car or a GPS for hillwalking, the effects of multipath reception on the signals are insignificant. That's because GPS receivers monitor signals from several satellites simultaneously and they are all at different points in the sky. The likelihood of signals from up to 12 satellites arriving by multipath at the same time is tiny. Also, for a Satnav we don't need accuracy to any better than a few metres but multipath on GPS signals can cause errors if you are looking for extremely accurate navigation. Having said that, problems with the accuracy of GPS signals caused by disturbances in the ionosphere don't occur in mid-latitudes such as Britain.

Multipath reception can also take place at VHF and UHF. Let's say Station A wants to communicate with Station B, **Fig. 4**. They both have beam antennas so the normal practice would be for them to beam straight at one another but let's say there is a hill between them that blocks nearly all the signal. They might be able to communicate better if they both beam at something like a big hill off to one side that they can both 'see'. When they do, although the signal strength increases, there is likely to be flutter on the signals. This will be due to the effects of multipath reception (some signal reflected off the hill, some signal direct). A hill used as a reflector will be a lot less than perfect. It will scatter signals all over the place, so despite the useful reflection the signal received by Station B is not likely to be strong. I attempt to show this in Fig. 4 by colouring-in the arrows appropriately – paler colour = weaker signal.

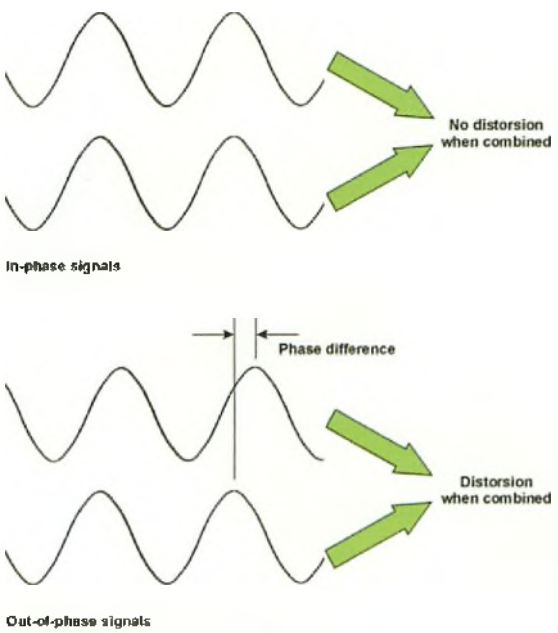


Fig. 3: Multipath signals arriving in phase (top) and out of phase (bottom).

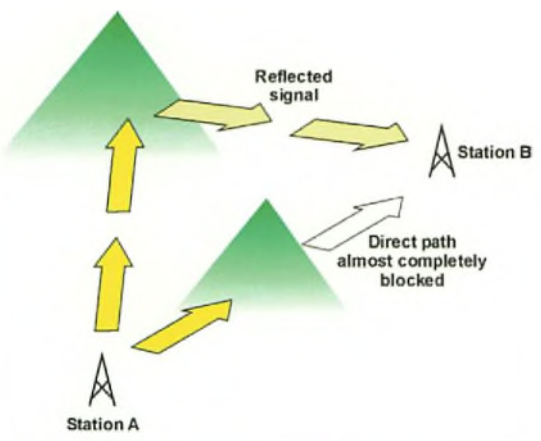


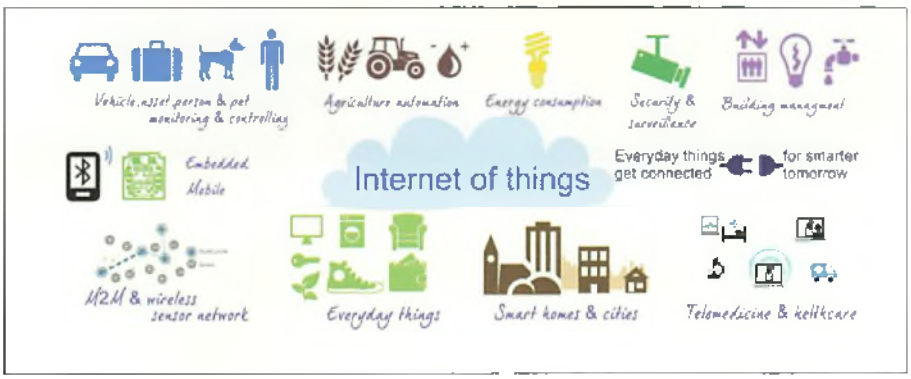
Fig. 4: Bouncing VHF signals off a hill to overcome the blocking effect of an obstacle.

• E-Mail: chris.lorek@pwpublishing.ltd.uk

What's happening and what's about to happen – you read it here first!

Emerging Technology

Chris Lorek G4HCL shows how our amateur radio transmissions may be powering other transmitters and muses on a wirelessly connected world.



Ultra Low Power IoT Radio Links

The emergence of the Internet of Things (IoT) – an interconnected population of devices, vehicles and other smart objects – is changing the way we live. Connecting all our belongings, however, is a considerable task and remains impractical in many respects. Most IoT systems are linked using radio sensors. These radios consume most of the devices' battery power and limit their usability because smart devices are drained of power rapidly. In order to tackle this problem, researchers at Disney Research, the research and development branch of The Walt Disney Company, set about creating an ultra low-power system that transmits data by harnessing the ambient radio waves already bathing most office and home environments.

Using these signals – generated by commercial broadcasting systems and mobile phones – enormously reduces the power requirements of the devices. 'Ambient backscatter' detects existing radio signals and converts these into tens or hundreds of microwatts of power. This is then used to modify and reflect the signal, which can in turn be picked up by other devices using antennae. *"Our idea is to reuse all the radio signals that are around us as a medium for transmitting data, much like sending ripples across a pond,"* said **Dr Alanson Sample**, leader of Disney Research's wireless systems group.

Previous attempts to use ambient backscatter for communications have suffered from low range, making the method impractical for IoT devices. To address this limitation, the researchers created an ultra-wideband (UWB) ambient backscatter system. This system backscatters all ambient sources, boosting signal-to-noise ratio, and as a result extending the range to 22-50m, depending on which ambient radio signals are used. The system can be powered by just a solar cell, optimised for low-light conditions. *"The promise of the Internet of Things is that wireless sensors will be ubiquitous, allowing devices to sense their environments and talk to each other,"* said **Markus Gross**, vice president at Disney Research.

"As we move towards connecting the next billion wireless devices to the internet, however, the use of batteries to power these devices will become unworkable. UWB ambient backscatter systems, which potentially could be deployed in any metropolitan area, hold great potential for solving this dilemma." The researchers presented details of the new system at Infocom 2017, a computer communication conference in Atlanta, USA, and demonstrated the system using ambient signals from radio towers and two mobile phones. Because the hardware doesn't need to be tuned to a specific frequency, instead using all available radio sources, the system can be used in almost any metropolitan area, the researchers say. It looks as though even our amateur radio transmissions could well be powering two-way radio devices in the very near future!

A Wirelessly Connected World

We radio hobbyists have been used to being in contact over the air, firstly using large valved base stations, then mobile, then transportable radios (such as the Trio TR-2200GX 'over the shoulder' radio) and now tiny multi-band portables and HF/VHF/UHF transportables for worldwide communication. But now, emerging radio technology has opened up the world of communication to many others. Even primary school children are walking around with smartphones. We'd never have imagined this around ten years ago. It's almost impossible not to be in touch using radio technology nowadays and right now we have more opportunity to be connected than at any time in human history. It's almost impossible not to be wirelessly connected in towns and cities today, as well as in many areas of the countryside. Even on a remote island you can use a handheld satellite phone, as I recently detailed in this column, or a small battery-powered HF transceiver, maybe with a solar cell charger to keep the battery pack topped up in the way that many aid agencies use throughout the world. Nothing stands still and new wireless technology is still emerging and

The Trio TR-2200GX was once a state-of-the-art portable communicating device.

Are we moving to a life as depicted in The Matrix?

will no doubt carry on emerging over the coming years.

The following is an extract from **Julia Hobsbawm's** book *Fully Connected*:

"The very first cables of contemporary connectedness were laid in 1857, underwater between Newfoundland and Ireland: a core of copper wire, encased in gutta percha and 'wrapped in jute yarn which had been soaked in a composition consisting of Stockholm tar, pitch, boiled linseed oil and common beeswax'.

"These early telegraph cables were the start of an era that led ultimately to all modern connected life: the telephone, the car, the railway, the electric lightbulb, the aeroplane, the refrigerator and, of course, the computer. The global technology giants that we now rely on to connect people or objects with each other – Google, Facebook, Samsung, Amazon web services, LinkedIn, Twitter – are all direct descendants of the 19th century, not newly born in the 20th or 21st. Mobile, social media and the internet – what the social scientists ***Barry Wellman*** *and* ***Lee Rainie*** *call 'The Triple Revolution' – make up the background hum in every corner of the planet. Today they are faster and more continuous than ever before, via an exploding mix of platforms and mediums. The World Economic Forum notes that, by 2020, there will be 50 billion connected devices in circulation. Well that's rather a lot, so welcome to the fully connected era!*

"On one level, we connect with each other in the modern world in much the same way as we ever did, with language, images and stories. "Our stories", *asserts the writer* ***Elif Shafak***, "and therefore our destinies, are interconnected". *When Facebook officially reached over a billion users on a single day in 2015, its founder* ***Mark Zuckerberg*** *posted online,* "It's just the beginning of connecting the whole world". *But how healthy or desirable is this, really?*

"In May We Be Forgiven, *a contemporary novel, the character of George, a TV Network executive who commits mayhem and murder announces* "I am ever aware, 24/7". *There's an edge of madness creeping in to all of this connection and it is called something: Overload.*

"Connection is like early industrialisation: the sweep of progress (from smartphone banking in Africa to wholesale revolutionary farm-to-table apps in China) nevertheless has its own belching factory smoke, its own unhealthy consequences. Humanity is beginning to choke on the fumes of excess. Most of us lack a coping strategy or tangible tactics. We fall upon the idea of 'digital detox' or of temporary disconnection as if it is some kind of novelty, like being coated in seaweed at a health spa, and not as an everyday routine."

E-mails, texts, 'feeds' of news, mobile phones, the list goes on and on. It's now difficult to use a bank, board a plane, jump on a London bus or tube train, or pay a bill without using some form of connected technology. Mobile banking, e-tickets on our phone and other payments can easily be done using a wireless equipped device, whether this be a Wi-Fi equipped laptop, mobile phone or whatever.

We've come to entering a possibly strange virtual era when almost everything exists electronically. First we pay with our 'cashless' card, sometimes using contactless (wireless) down at the pub, we're tracked via embedded apps, and we absorb adverts that use algorithms that are beginning to know us far more accurately than we might like, although there may always be some irritating or even comic exceptions. Even my local Weatherspoons pub/restaurant on the Whitby harbourside allows me to wirelessly order from my table using an 'app'. Humans have been around a long time but we are now living side by side with another species entirely. We're living with emerging technology.

So where does all of this connectedness lead us? The advances and benefits of networked technology in the advanced and developing worlds can't be overstated. Of course, I love being connected. I take it for granted. Don't we all? When I misplaced my smartphone in my house yesterday, I must admit I felt lost. When I make a travel booking, it automatically appears on my diary on my smartphone, complete with an appropriate reminder. My Icom D-STAR handheld allows me to communicate, free of charge, with other like-minded people throughout the world, either directly or through discussion groups, just like an HF net or roundtable but with no geographical limits. Some may say this has taken the fun out of amateur radio but technology doesn't stand still. You can easily escape it by just using HF CW, for example, and to many this simple method of communication is the 'fun' aspect of amateur radio. I certainly like my valve-era amateur transceivers, of which I've managed to get a small collection and regularly use on the air.

Going back to a public wirelessly-connected world, we now have Skype-based medical consultations, webinars, conference calls, the facility of sharing and posting clips from YouTube or uploading documents to cloud-based document sharing apps such as Dropbox or Slack. Added to this is E-mail, LinkedIn,

Instagram, Twitter, Facebook, FaceTime, WhatsApp and Snapchat – the list is endless and so are the possibilities. I have several amateur radio 'apps' on my smartphone, and I use the freeware version of Ham Radio Deluxe to remotely control my Yaesu FT-847 back at home for HF/VHF/UHF contacts when I'm out and about. Getting our information and relaying it to others in this way has become second nature. Technology companies sell us limitless possibility and 'finite' sometimes equates to 'failure'. The blue sky of online storage always beckons – yes, the 'Cloud' comes to my mind here! There may be convenience, that's the thrill of innovation, but with it also comes a significant reshaping to factor in of the way we live, work and relax today, including our hobby of two-way radio communication.

Despite the potential great benefits of this connected age – the medical, mechanical, cultural and commercial advances – it can also complicate, accelerate and infiltrate our lives, sometimes creating more problems alongside the many solutions. Many of our lives today lack at least some harmony, often based around some of the tensions that happen when you put human beings, with their natural limits, in a computerised social world that is literally programmed to be without limit and never switched off. I for one would never like to live in a busy city centre that 'never sleeps', although others relish the idea.

Unlike computers, we humans don't have limitless storage, nor do we have unlimited time. We still only have 168 hours in the week, a number that hasn't changed fundamentally since the Sumerian calendar first began to express time in terms of cycles. Much of my own time each week is spent looking at my e-mail inbox, including checking the otherwise very handy 'clutter' folder. However, this still manages to pull in e-mails that I would otherwise need to look at because computer algorithms are certainly no substitute for the human mind. This feels like a necessary cost of modern living, even if our mind feels, as the 19th century romantic poet **John Keats** described his 'teeming brain', too full of things to express and too time-poor to get them all out, before *"I cease to be"*.

Try to find anyone working in an office, a school, a call centre, a warehouse, a parliamentary chamber, a public front line service such as the emergency services, a Non Government Organisation (NGO) such as the RNLI or St John Ambulance, or a university that doesn't struggle with overload, who doesn't admit that much of daily life is not working well or indeed properly. Individuals and institutions share many of the same problems: we're already full to capacity. We're fully connected. Many years ago I often joked with my work colleagues about a serial interface being attached to the back of my head. Then the film *Matrix* came along, with real-time wireless visual and audio connectivity of the people involved. What will be next for us? I'm sure we're going to live in 'Interesting Times' (as the Chinese curse says) in the wirelessly-connected future.

See you soon as I explore the future on behalf of PW readers. Chris G4HCL.

Feature by Mark Bryant M0UFC

• E-mail: m0ulc@btinternet.com

The Siren 6cm WBFM Station

Part 1

Mark Bryant M0UFC describes a 6cm WBFM station that has been trialled extensively at Bolton Wireless Club and has proved its worth in microwave contests.

The author operating the *Siren* 6cm WBFM station.

Getting started on the microwave bands is getting easier as more kits, modules and surplus equipment become available. My enjoyment of VHF started as a teenager in the late 1960s when I built the *PW VHF Explorer* and listened to the background music of television test card broadcasts. My introduction to the microwave bands is much more recent and with the encouragement and loan of equipment from members at Bolton Wireless Club (BWC), website below, I have found there is activity to be enjoyed in locator square IO83!

www.boltonwireless.org.uk

Fortunately in this project, the specialist microwave RF knowledge and the skills required for home construction are avoided thanks to the ready built antennas and video sender modules used at the heart of this system. The idea of repurposing the Airwave video modules (see first URL below) was originally developed by **John Owen MW1FGQ** and **Ross Wilkinson G6GVI** (see second URL below), and they have made several QSOs over a distance of 62km using this kit. The first working prototypes **Fig. 1**, were built by Ross and myself back in June 2012, and proved with a contact across the car park at a BWC meeting.

www.active-robots.com/radio/data-video-audio/5-8ghz-av-modules

www.qsl.net/g6gvi/6cm.html

There are now four complete stations at BWC, all with slight variations in design but with similar performance and used with great results in the RSGB SHF UK Activity Contests. The *Siren* version presented here has been tested to a range of over 40km but our intra-Club DX currently stands at 54km, **Fig. 2**, from Staffordshire to Lancashire. With the new scoring system of points per kilometre, there is an even greater incentive to achieve a distance record.

Fig. 1: The first BWC station built by Ross Wilkinson G6GVI using a pair of borrowed Wi-Fi antennas.

Design Features

There is no commercially available amateur radio equipment like this for sale, so The *Siren* has been developed for ease of construction with readily available parts and with separate transmitter and receiver, for simplicity of operation, especially when out portable. Modular construction allows for flexible assembly and ease of testing.

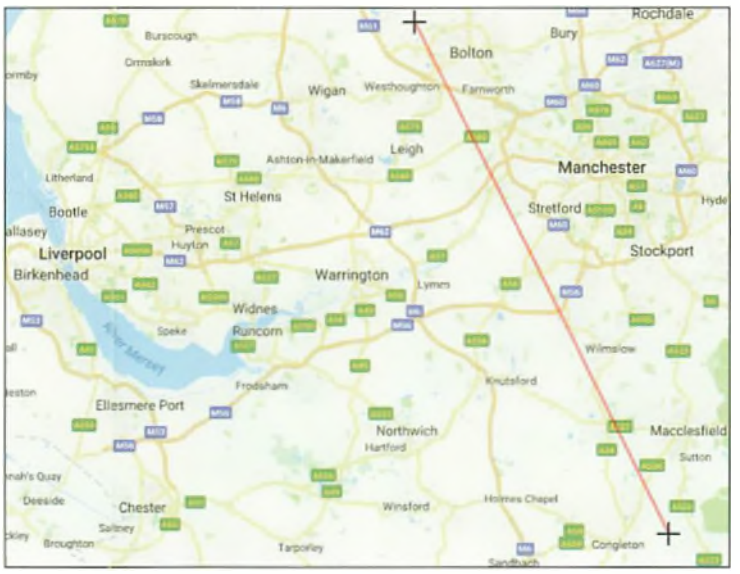


Fig. 2: Current BWC DX of 54km across Manchester from G4JLG/P on Winter Hill IO83RD to M0UFC/P on the Cloud IO83WE.

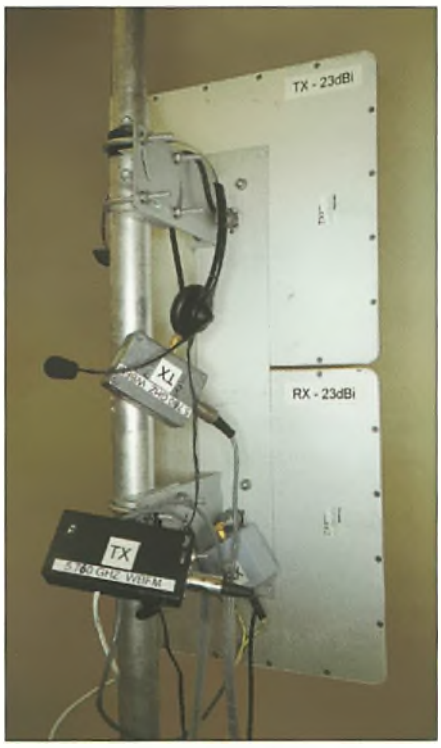


Fig. 3: Station built by John Marsden G8PEF with modules supplied by G6GVI.

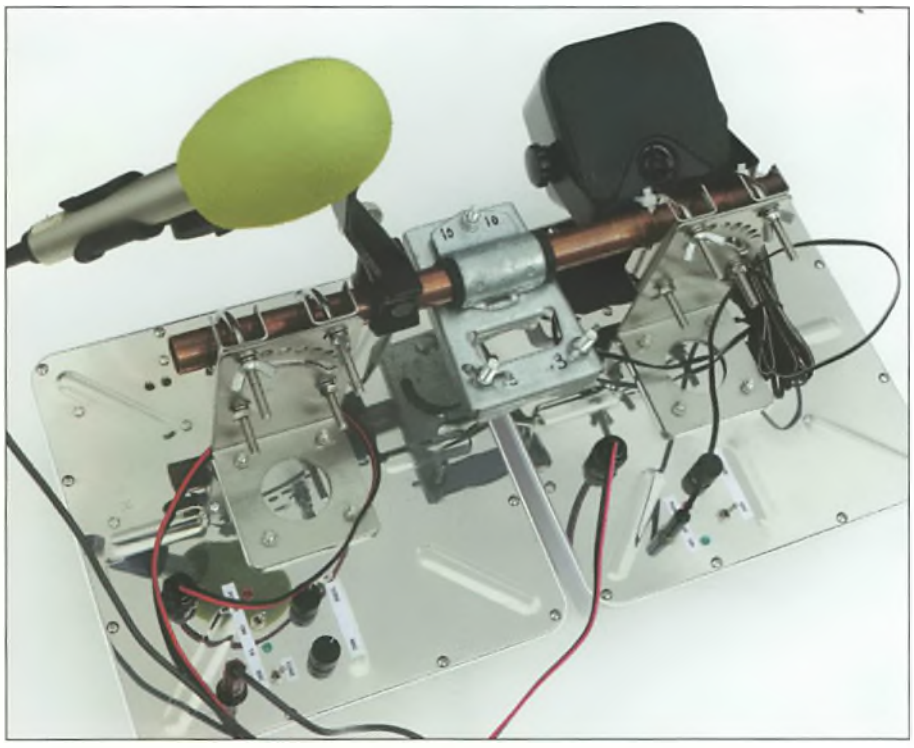


Fig. 4: Mark's first 6cm station shows the modules fitted inside the antenna panels.

This makes the project ideal for a club, where construction and operation can be done by any Intermediate or Full licensee.

One thing that should be considered from the outset is that while these wideband FM (WBFM) transmitters and receivers can be built by an individual constructor, at least one other licensee will need to be involved in two-way operations. It is possible to build the transmitter and receiver entirely separately to be operated one-way at different locations but in a club activity, much more fun can be had where several complete transceivers enable two-way contacts.

The *Siren* is useable at an indoor window or outdoors, handheld or stand-mounted with a potential range of 100km. When using high-gain antennas to make contacts at some distance, the transmission is projected in a narrow beam. Some means of antenna alignment with the other station is required and the usual way of doing this is by sending a continuous identifying tone. However, our receivers are WBFM and we're operating in a segment shared by a plethora of Wi-Fi and ISM signals, so there are often a number of heterodynes that make identifying the other station very difficult. We learned that a single line-up tone was difficult to identify and that a pulsating or two-tone alignment signal was easier to identify, thus assisting the nulling of unwanted tones. We also found that the best signal was not always line-of-sight but a reflection instead. It could be advantageous in built-up areas to have an arrangement for separate alignment of the transmit and receive antennas to help with nulling out of interfering signals.

Initial contacts are best supported by pre-arranged talkback, a map and a compass. At BWC we use 70cm FM analogue and DMR handhelds, which enable us to communicate cable-free, although interference problems have occurred at a portable location close to an active telecoms mast!

Antenna Choice

The type and availability of antenna will probably decide the constructional approach. If you have a competitive aim and seek DX, then a higher gain antenna in excess of 20dB like a dish or large panel, **Fig. 3**, will be required to boost the 500mW output power. Most serious microwavers are renowned for their metal bashing skills and this has afforded the wide availability of antenna designs to suit all levels of DIY ability. I have listed (below) a number of links to suitable designs and sources.

www.msdist.co.uk
www.solwise.co.uk/wireless-outdoorantenna-58-sector-ant5812sn.htm
www.broadbandbuyer.com/products/15259-tp-link-tl-ant5823b
www.wifi-stock.co.uk/details/itelite_pan-5g-23rsll.html
http://buildyourownantenna.blogspot.co.uk/2014/07/double-biquad-sector-antenna-for-5-ghz-wifi.html

For simplicity all BWC stations now use two commercially available patch panels mounted side by side for separate transmit and receive. Slim panels allow the electronics to be mounted on the rear but in my first station, **Fig. 4**, there was sufficient space within the enclosure to mount the modules inside. The slight disadvantage of this arrangement is that additional mounting metalwork adds to the weight. The panels can be mounted together on a lightweight loudspeaker or lighting tripod stand and raised to head height for operating.

Also available from the Airwave module supplier is a cheap and simple stub antenna that could prove very useful for local testing of the separate transmit and receive boxes. However a directional antenna is preferred so that the receiver is better able to differentiate between co-channel interference and the desired signal.

Circuit Description

The complete receiver circuit, **Fig. 5**, shows the AW receiver module, which is

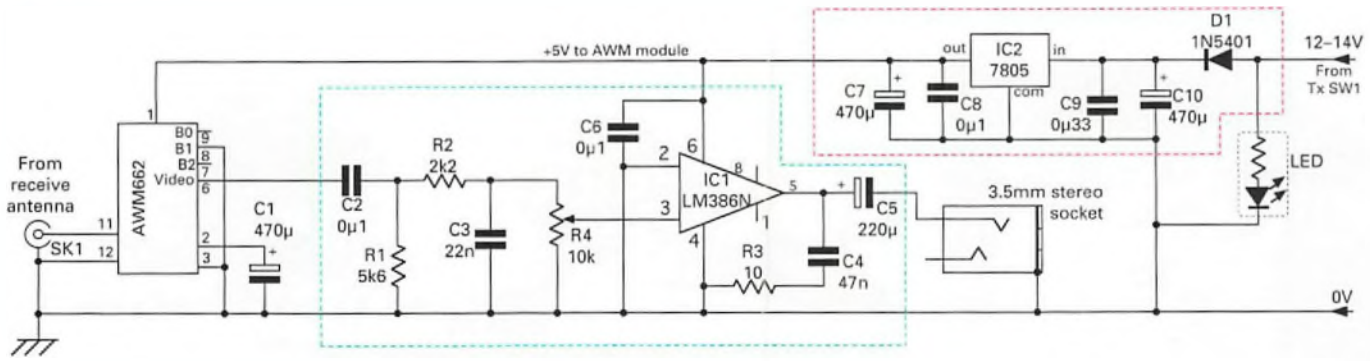


Fig. 5: The complete receiver circuit.

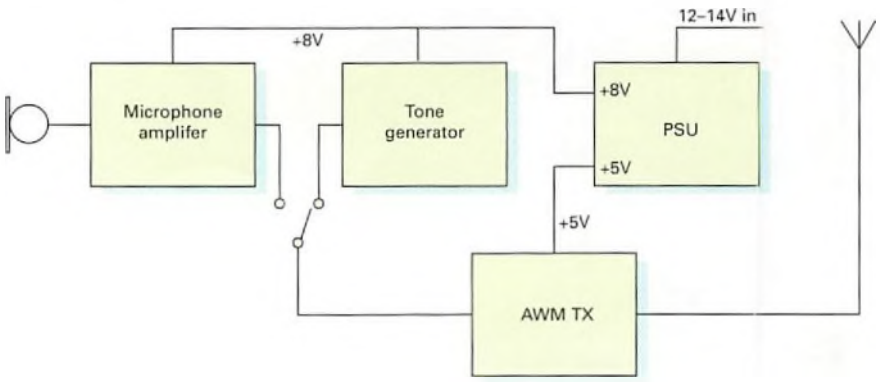


Fig. 6: The transmitter block diagram.

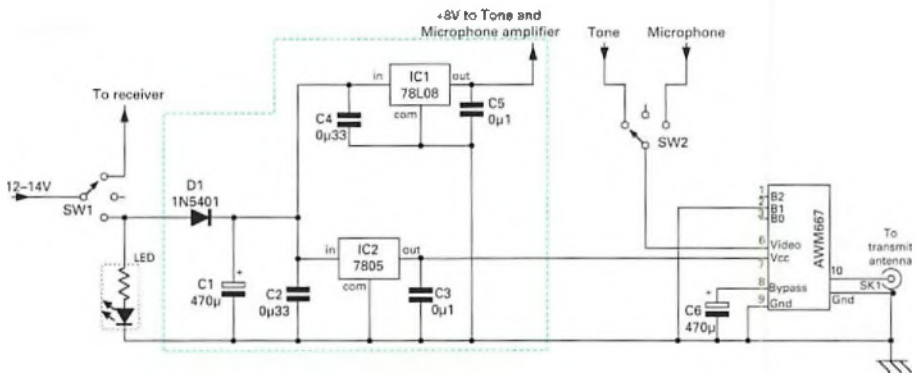


Fig. 7: The transmitter RF section and power circuit.

described by the manufacturer in slightly broken English: *"Using of the most popular 5.8GHz ISM band... is compliance with the criteria of FCC and R&TTE which can receive a wide band audio and video signals... uses down conversion concept to convert the 5.8GHz RF Signal to 480 MHz IF signal, and then obtain base band via PLL FM demodulation IC by Airwave AWI5822."* A more detailed application note and block diagram of the receive and transmit modules is found on the data sheet on the active-robots website (see previous URL).

Note that although these modules are designed to send video on their main WBFM carrier and stereo sound on two lower-power subcarriers, we're using main carrier for our voice, so lowpass filtering is used at both ends to restrict the bandwidth.

The video output is fed into a lowpass filter and then to an LM386 amplifier circuit, familiar to regular *PW* readers. The 5V power supply for the AW module is also used for the audio amplifier because the more common LM386-N-1 version will operate down to 4V. Even with this low voltage, the amplifier gives a smooth control of volume to the headset or if preferred, enough power to drive a cheap unpowered personal loudspeaker.

Transmitter

The transmitter, **Fig. 6**, consists of four interlinked boards. The AW transmitter module uses a PLL to generate the transmit carrier signal and the module I have specified has +27dBm RF output power, the highest in the range. Pins 1-3 on the module, **Fig. 7**, provide an option to select different channels at 20MHz intervals between 5740 and 5860MHz. Channel 6 at 5840 MHz (pin 2 grounded) is chosen because, allowing for the 6MHz audio sub-carriers, the transmitted signal will fall within the amateur segment for this band – see the URL below for the bandplan.

http://rsgb.org/main/operating/band-plans/microwaves/5-7-and-10ghz

You should be aware that these frequencies may also be used by others for satellite downlinks. An external centre-off toggle switch SW2 gives a choice of *Siren*/Carrier only/Microphone. The power circuit incorporates simple diode protection from accidental reverse polarity connection to a 12-14V source. IC1 regulates the 8V line to the microphone amplifier and tone generator. IC2 delivers 5V at a higher current required for the AW module. Switching between transmit and receive is simply achieved by turning the power on and off. A centre-off toggle switch SW1 gives a choice of receive only/all off/transmit only. Red and Green LEDs confirm these functions.

The transmitter is designed for 1V pk-pk video signals, so for our purposes, a microphone preamplifier and compressor is required.

The microphone amplifier circuit, **Fig. 8**, was designed by **John Fielding ZS5JF** who describes the circuit as an *"Audio speech clipper and low-pass filter suitable for a simple transmitter...when the emphasis is on intelligibility rather than quality"*. The circuit is taken from the RSGB book *Circuit Overload*, and is reproduced with their kind permission.

Transistor Tr1 is a medium gain amplifier stage suiting low to medium impedance microphones with R13

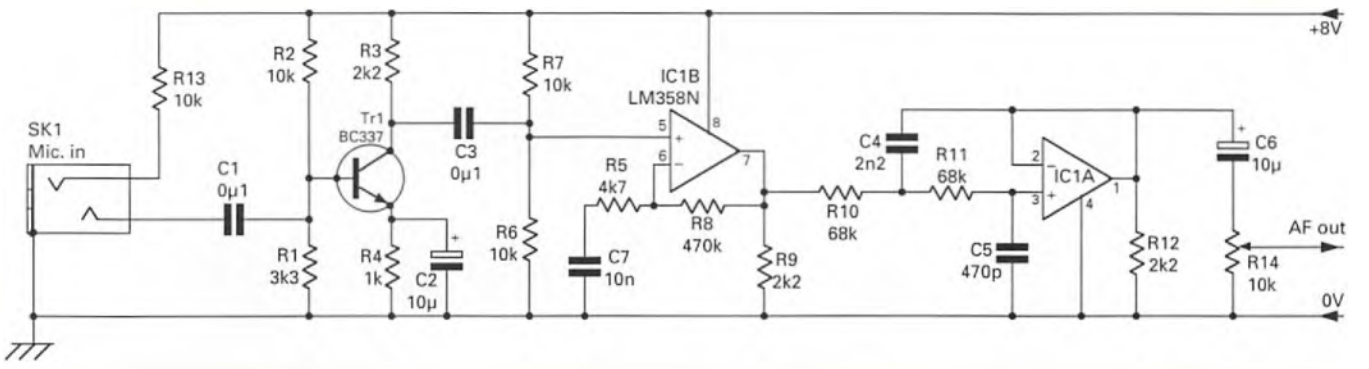
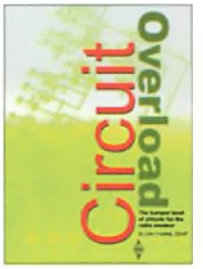


Fig. 8: The circuit of the microphone amplifier, compressor and LPF from the RSGB publication *Circuit Overload* (copyright RSGB, reproduced with permission).

supplying power for an electret microphone/headset. When the input from the microphone exceeds a certain level, the high-gain first op-amp output swings rail-to-rail, giving a clipped signal of constant amplitude. With a large input from the microphone this is a square wave of approximately 5V pk-pk at audio frequencies. Because this clipped signal is rich in harmonics, a lowpass filter is used to reduce the harmonic content, leaving a near sinusoidal waveform. The audio level to the transmitter is set by R14 and is fed not into the stereo inputs but directly into the module's video input to take advantage of its additional power.

The tone generator, **Fig. 9**, is based on the UM3561, a low-cost, low power CMOS



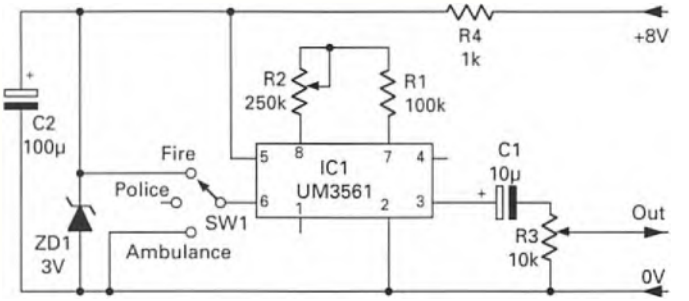


Fig. 9: The tone generator circuit.

LSI designed for use in toy applications. It contains a programmed mask ROM to electronically reproduce alarm sounds. Since the chip only requires 3V, a simple Zener regulator is included taking power from the +8V rail. SW1 switches between different sound effects while R2 enables you to adjust the alarm tone pitch and speed to your liking – a signal that will uniquely identify you to other stations.

This completes the description. Next month I will turn to the actual construction.

Component List

Receiver
All resistors 5% ¼W
R1 5.6kΩ
R2 2.2kΩ
R3 10
R4 10kΩ log Omeg
PC16ECO10KA
C1, C8, C10 470µF 16V
C2 100nF polyester
C3 22nF polyester
C4 47nF polyester
C5 220µF 16V
C6, C7 100nF polyester
C9 330nF polyester
Airwave module AVM662
IC1 LM386N
IC2 7805
D1 1N5401
LED 3mm 12V Multicomp PPOP-119R
8-pin DIL socket
Sk1 Jack SMA Bulkhead Multicomp 19-16-3-TGG
Sk2 3.5mm jack Multicomp MJ-074N
Veroboard 2.54 pitch 18x12 hole (amplifier) 10x5 (regulator)
Box Hammond 27134PSLA Die Cast Aluminium 111x60x31mm
5.8GHz antenna and SMA adapter (see text)

Tone Generator
R1 100kΩ
R2 250kΩ preset trimmer
R3 10kΩ preset trimmer
R4 1kΩ
C1 10µF 16V
C2 100µF 16V
IC1 UM3561 (Spiratronics, Rapid)
ZD1 3V 500mW
8-pin DIL socket
SW1 Miniature PC mount toggle or slide switch on-off-on
Veroboard 2.54 pitch 15x9 hole

Microphone Amplifier
R1 3.3kΩ
R2, R6, R7, R13 10kΩ
R3, R9, R12 2.2kΩ
R4 1kΩ
R5 4.7kΩ
R8 470kΩ
R10, R11 68kΩ
R14 10kΩ preset trimmer
C1, C3 100nF polyester
C2, C6 10µF 16V
C5 470pF ceramic
C7 10nF ceramic
IC1 LM358N
Tr1 BC337, BC107-9, 2N2222 etc
8-pin DIL socket
SK1 3.5mm jack Multicomp MJ-074N
Veroboard 2.54mm pitch 26x10 hole
Terminal pins
Screened audio cable

Transmitter
C1, C6 470µF 16V
C2, C4 330nF polyester
C3, C5 100nF polyester
Airwave module AWM667
IC1 78L08
IC2 7805
D1 IN5401
Sk1 Jack SMA Bulkhead Multicomp 19-16-3-TGG
SW1/SW2 Miniature panel 5A SPDT On-Off-On
LED 3mm 12V Multicomp PPOP-119G
Nylon cable gland 4-8mm
Power cable, Figure 8 red/black, 6A
Inline 500mA fuse and fuseholder
Battery connectors
Veroboard 2.54 pitch 13x5 hole
Box Hammond 29830PSLA Die Cast Aluminium 120x95x34mm
Thermal paste
2mm and 3mm screws
Solder tags
Computer Headset
5.8GHz Antenna and SMA adapter (see text)
Mast mount Blake JC3 (www.blake-uk.com/85-clamps-and-cradles)

• E-Mail: mike@pwpublishing.lld.uk

Fig. 1: Bodenar GPS referenced clock.

A Warning, A Calibrator and a Talking PI

Mike Richards G4WNC has news regarding the JTDX software, revisits last month's calibrator project and introduces a Voice kit for the Raspberry Pi.

This month I'm continuing to develop the RF calibrator I introduced in the previous column but first an important note about JTDX.

JTDX – Beware

Regular readers will recall that I recently covered the JTDX mode along with details on how to get started. This was done in good faith following a reader's request. However, **Richard G4DYA** recently dropped me a note to make me aware of **Joe Taylor K1JT's** view on the software. Joe developed the WSPR modes but is not at all impressed by the JTDX variant and makes several points that I'll summarise here. In Joe's view, JTDX is a knock-off of WSJT-X with a name change and a few rearrangements. Probably 99% of its code and features come directly from WSJT-X so it's inappropriate for the title bar to show UA3DJY as the author. Joe advises not to be fooled by the claimed performance because the JTDX decoders have only minor adjustments over those in WSJT-X while using much of the WSJT-X code, a notable difference being that JTDX produces a higher number of false decodes. There are also several JTDX features that are irrelevant or don't work.

Finally, Joe clarifies that WSJT-X is free for everyone and the source code is open and can be used in line with the GNU General Public License (GPL) Version 3. Conversely, the author of JTDX asks for donations!

If you would like to see Joe's full message, it is available on the wsjtgroup on Yahoo and Joe's original post was sent on December 31st 2016. My thanks to Richard for the update.

RF Calibrator

Last month I described a self-contained RF calibrator that was an update of an original design by **Bob Kopski K3NHI** that was first published in the Jan/Feb 2004 edition of *QEX* magazine. As a further development, I thought it might be interesting to produce a modified version of the calibrator that uses the excellent **Leo Bodenar** GPS Referenced Clock as the source, **Fig. 1**. This particular reference source is proving very popular because it offers a highly accurate, twin output, reference that can be programmed for any frequency between 450Hz and

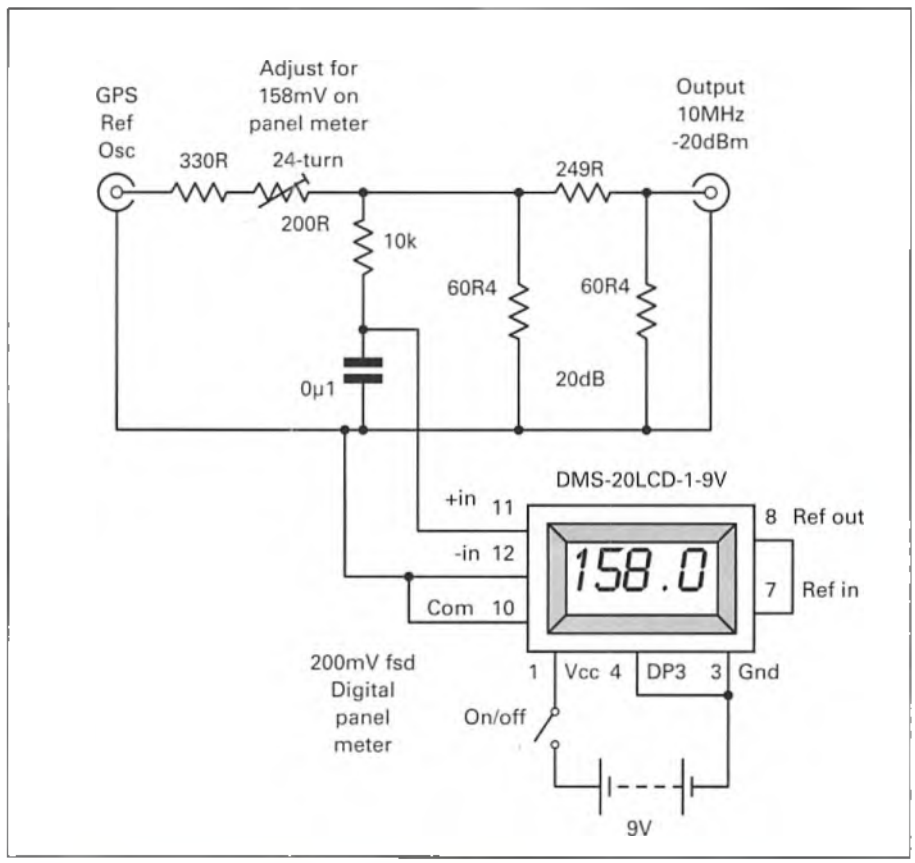


Fig. 2: Modified RF calibrator for use with the GPS referenced clock.

800MHz! The clock delivers a CMOS level square-wave output so is ideal for use with the calibrator. I've shown my Mk3 version of the calibrator in **Fig. 2**. Looking at the right-hand side of the circuit, you will see that this is unchanged from the previous versions. The main change was to reduce the value of the input resistor from the GPS clock input. This was done to attenuate the signal level ready for fine adjustment with the 200Ω multi-turn trimmer. I also used a slightly different panel meter from the muRata range. The meter model operates directly from a 9V battery, thus avoiding the need for a 5V regulator and reducing the power consumption.

Using the RF Calibrator

The principle at the heart of the calibrator is that a square-wave signal generated by a reference oscillator has a DC value that is half the peak-to-peak (pk-pk) value of the square-wave. That means we can accurately measure the amplitude of a high frequency square-wave simply by measuring the residual DC voltage with a multimeter. As discussed last month, accurate DC measurements are very easy to achieve. In Bob's design, and my modified versions, the output from the reference oscillator is attenuated to give a reading of 158mV DC at the measurement point. This indicates that the square-wave is 316mV pk-pk. This signal is then applied to the 20dB output attenuator thus producing a final output of 31.6mV pk-pk. To use the square-wave to calibrate other test equipment and receivers, we need to understand how the square-wave will be interpreted. My original power meter design used the AD8307 device, which is a logarithmic amplifier based power measurement device rather than a true thermal power measurement. It turns out that all log amplifier based power meters display a power that is twice (3dB) the value of a sine-wave of the same pk-pk value. So our 31.6mV pk-pk square-wave is equivalent to a 63.2mV pk-pk sine-wave or 22.3mV RMS, which is −20dBm in 50Ω.

So what happens if we connect the calibrator to a true heat measuring power meter? The heat value is Vpk-pk/2 = 15.8mV which equates to −23dBm. As a result, the calibrator can be used with both types of instrument but the output level will be −20dBm for log amplifier based systems and −23dBm for true power meters. We can also use the calibrator with spectrum analysers and receivers, even though the output is a square-wave. The formula for calculating the sine-wave pk-pk equivalent of a given harmonic from a square wave is:

Sine-wave pk-pk = (4 × square-wave pk-pk) / (harmonic number × π)

So, for our 10MHz fundamental the value is (4 × 31.6)/(1 x 3.142) = 40.2mV pk-pk = −24dBm

Continuing this for subsequent odd harmonics gives the results shown in **Table 1**.

You can use the completed calibrator to set up the power meter I described back in August 2015 as follows. In addition to the calibrator I've described here, you will need a 20dB, 50Ω attenuator. A simple solution is to build one using the attenuator section of the calibrator design, **Fig. 3**. The first step in the calibration is to connect the calibrator to the power meter and measure the output voltage from the AD8307 circuit. Make a note of the reading and use the 20dB attenuator to reduce the level of the calibrator signal. Make a note of the new AD8307 voltage reading. Take the difference between these two readings, which should be in the region of 0.5V. Now divide the attenuator value (20dB) by the voltage change. That should give you a number close to 40 and this represents the slope of the AD8307 log amplifier. The next step is to access the Arduino power meter software, locate the line that holds the slope value (float slope = 40;) and change it to your calculated value. Now you can reapply the calibrator and check the readout. If it is not correct, you can adjust the value of the intercept variable (float intercept = 44.0;) to trim the reading.

Talking Pi

The Raspberry Pi team are always delivering nice surprises and the latest to arrive here is their AIY (Artificial Intelligence Yourself) Voice kit, **Fig. 4**. This is a collaborative project with Google and

Table 1 – Harmonic power readings for spectrum analyser and receiver calibration

Square-wave harmonic	Receiver/Spectrum analyser display
Fundamental	−24dBm
3rd	−33.5dBm
5th	−37.9dBm
7th	−40.9dBm

Table 2 – GPS Clock Calibrator Components List

Quantity	Component
1	330Ω 0.125W 5%
1	200Ω trimmer 24 turn
1	10kΩ 0.125W 5%
2	60.4Ω 0.125W 1%
1	249Ω 0.125W 1%
1	0.1μF capacitor 50V
1	MuRata panel meter DMS-20LCD-1-9V

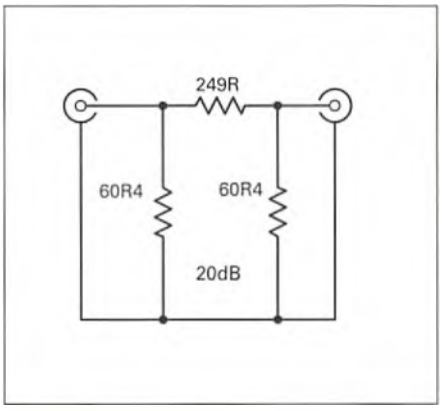


Fig. 3: 20dB attenuator.

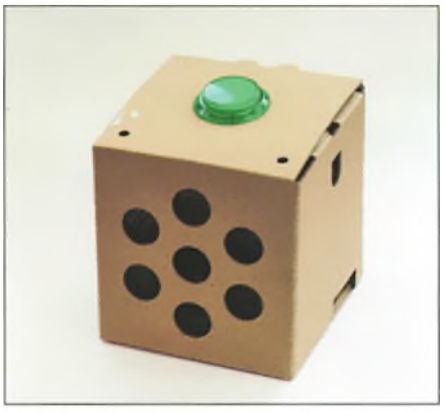


Fig. 4: Raspberry Pi Voice Kit.

is intended to make it easy for makers to add voice control to their projects. The Pi team have always been good at giving away free stuff and the Voice kit is no exception because it has been supplied free of charge to all who subscribe to the print edition of their *Magpi* magazine. The voice kit comes as a kit of parts that can be put together in under an hour including the software. Included in the Voice kit is a ready-built speech processor PCB in the form of a Pi HAT (Hardware Attached on Top) along with a stereo microphone board, speaker, illuminated push-button and a cardboard case to hold it all! The printed instructions in the magazine and on the internet (URL below) were very clear and easy to follow and I had mine working in under an hour.
https://aiyprojects.withgoogle.com/voice

The project makes use of Google's advanced speech processing engine and part of the set up procedure is to configure a Google Cloud account. The cloud account has a generous free usage tier that should be more than enough to allow plenty of experimentation without incurring any charges. One part of the setup process is to download an SD card image that has been configured with example applications so it's quick to get started. The initial example application turns the Voice Kit into a Google Assistant that you can use to search for information and ask silly questions. In its default setup, the big button on top of the kit puts the Google Assistant into listen mode ready for a command from you. I was amazed at how well this worked – the Assistant was giving me immediate answers to my simple questions and didn't have any trouble understanding me. Here's the sort of thing I was asking: *"How many millimetres to the Moon? What's the weather in Ringwood? How far away is Pluto? What's the square root of 179? What is cricket?"* That last question returned a description of the insect. Changing the question to what is the sport cricket produced a spoken summary description of the sport from Wikipedia. After I'd had some fun, I moved on and found that you could set the kit to automatically load the Google Assistant on boot and respond to a clap rather than having to press the button. I found that you could also alter the volume by saying *"volume down"* or *"volume up"*.

While the performance of Google Assistant is very good for impressing friends and family, it doesn't have much practical application in amateur radio. The next example was much more useful because it replaced Google Assistant with Google's Cloud Speech API. This is a voice recognition platform that takes the speech it hears via the microphone and converts it into text that is returned to the calling program. This is very powerful because you can write simple programs in Python that will run selected code when a trigger word is received. In the examples provided, I could set the trigger words 'light on' and 'light off' to toggle the state of one of the GPIO (General Purpose Input Output) pins on the Pi. From this it would be quite easy to get the Pi to switch all manner of devices on/off using voice commands. The voice to text capabilities could also be used to supplement the keyboard input on data modes software. That way you could run the QSO using a range of key words! Once you understand what can be done, there will be countless applications. There are just a couple of points to note about the service. The first is that you have to be connected to the internet because it's the online engine that does all the hard work. You also have to have a Google Cloud account. The account is free and very easy to set up using the supplied step-by-step instructions.

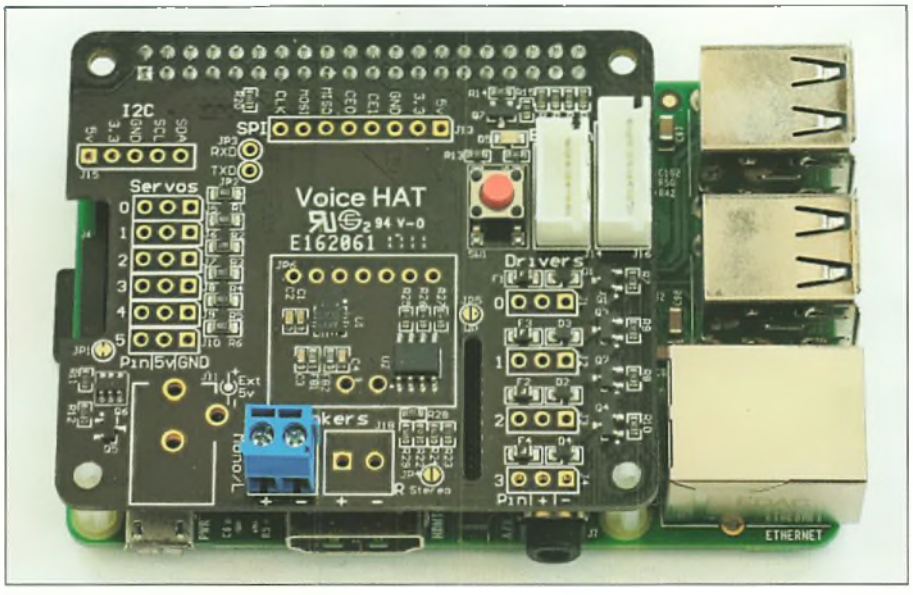


Fig. 5: Speech HAT mounted on a Pi 3.

Voice HAT Hardware

In addition to handling the audio in and out for the Pi using I2S, the Voice HAT module, **Fig. 5**, is a very useful general interface board. It has six servo driver outputs that are linked to GPIO ports and can source 25mA each. For higher current applications, there are four more drivers that can handle 500mA each. The board also has all the common communication ports extended to sockets and these include SPI, I2C and the serial port, **Fig. 6**.

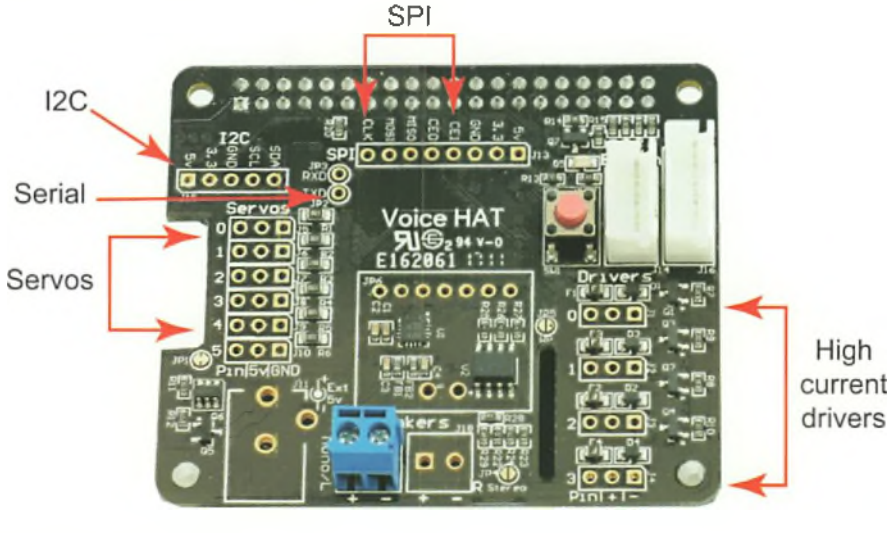


Fig. 6: Speech HAT connections.

WANTED

GOOD QUALITY

USED EQUIPMENT

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

Satellite Activity from Algeria

Tim Kirby G4VXE reports on satellite activity from Algeria, a low cost headset suitable for handhelds and software for the MD-380.

VHF/UHF activity from Algeria is always interesting. Distances from most of Europe are very achievable but there is often low activity. I was delighted to hear from **Abdel Mesbah MONPT** about his recent activity from 7X2ARA and 7X3WPL. Abdel writes, *"I had planned to visit my parents in Algiers (JM16) from April 7th to 23rd. Before I went I was invited by **Driss 7X3DL/7X3WPL** to give a talk on amateur satellites to about 25 students (Engineers, Masters and PhD) from the University of Laghout in the Algerian Sahara and the four corners of Algeria. I was delighted and accepted the invitation. I thought I may as well try to activate Algeria on the FM satellites for the first time ever and was planning to work mainly through SO-50 in holiday style.*

*"On Friday 7th I arrived in Algiers and had no issues getting through customs with the Baofeng and the Arrow II antenna. I put the Arrow antenna together and planned the passes and skeds. I made my skeds via Twitter & WhatsApp with my radio friends and I was delighted to make my first contact with **Peter 2E0SQL** followed by **Adam MU0WLV, Fran EA1JM, Olivier F5RRO, Jerome F4DXV, George MI6GTY, Peter G0ABI, Neven 9A5YY, Colin MU0FAL** and many others.*

I set off to Laghouat on the 13th because the training was planned for April 14/15th. After a seven hour trip by coach, I arrived at the Sahara DX Radio Club, 7X3WPL and was met by Driss 7X3DL. I reassembled the Arrow antenna ready for some action the next day. The training session started promptly and we planned all the passes that were possible, so as to show how to operate satellites using a Baofeng (5W) with the Arrow II. I was delighted to work Fran EA1JM, Peter G0ABI, Olivier F5RRO and many others from the Algerian Sahara

"I enjoyed the experience of running the training session and I am looking forward to going again when I will hopefully activate the SSB satellites and also have my own station setup once I get my Algerian callsign, 7X2TT, issued. The Sahara DX Radio club 7X3WPL is in the process of installing a satellite station for FM/SSB. Keep your ears open – you may hear them soon!"

A Low Cost Headset for Use with the MD-380 and Baofeng UV-5R

Terry Martin M0CLH writes to say that he has been playing around with the TYT MD-380 DMR radio and a Shark RF OpenSpot on the digital voice modes. Terry reports that he has been using a very comfortable half-headset priced at £20.90, including VAT and postage. Terry says it works really well with good audio reports. If it works on the MD-380, then I'm pretty certain it will work on a Baofeng UV-5R because I have found that the MD-380 and UV-5R seem to have the same headset connections and interface. The headset is available through CPC – search for Actarvis Overhead Boom Mic Headset K1 Plug (it looks as though several different types of connectors are available for other handhelds). It could be a worthwhile budget addition for your MD-380 or UV-5R.

More on MD-380 Tools

Regular readers may recall that I mentioned the firmware 'hack' pioneered by **Travis Goodspeed KK4VSZ** a few months ago. This hack gives the 'budget' TYT MD-380 DMR rig (and variants) some useful new functionality, such as the ability to display names and callsigns when receiving stations as well as monitoring across all talkgroups on a repeater or hotspot. When I last wrote, the means of updating the rig was to employ a Linux based script, which I used from a Raspberry Pi. This method worked well but I discovered that the version of the MD-380 tools that it delivered was not necessarily the most up-to-date (and interesting) one. It seems that the majority of users are using the **Warren Merkel KD4Z** toolkit, so I decided to experiment and find out more.

The KD4Z toolkit uses a Linux based script as well but by using Virtual Box, this can run successfully on a Windows-based machine or a Mac. The first thing is to download Virtual Box and the Virtual Box Extension Pack for whatever platform (PC or Mac) you are using and install them. The installs are very simple. Then you can download the actual KD4Z toolkit from the site below:
https://github.com/KD4Z/md380tools-vm

The instructions (which are excellent) are at:
http://tinyurl.com/maerwmw

They are quite detailed, so it is actually a much quicker process than it might first appear. You will also have to download the 'Virtual Appliance', which is an image file of the computer operating system, programs and file system that you are going to run in Virtual Box. This can be downloaded from:
http://tinyurl.com/ljybm9c

Simply follow the instructions to import the Virtual Appliance into Virtual Box, connect your USB to MD-380 programming lead and start up the Virtual Machine (it's all in the instructions in plenty of detail). The first thing you will do is to run a command 'glv' that gets the latest version of MD-380 Tools and downloads it to the Virtual Machine you have created. Once that's done, you can flash the latest software and user database onto your MD-380.

Once set up, it works very well and I've been updating my MD-380 every week or so. I first tried this approach on my Windows PC and found that it worked fine. I then wondered whether I could make it work on the MacBook. It worked perfectly there too.

If you have an MD-380, I highly recommend that you upgrade it with this firmware because it does add plenty of useful functionality. Although I have not

Dick G0LFF's neat portable dual band satellite antenna, mounted on a camera tripod.

encountered any problems, it's probably worth a quick disclaimer to say that neither *PW* nor I will be responsible for any issues resulting from an attempted upgrade of your MD-380's firmware. If you do encounter problems, there is excellent support in the TYT MD-380 Tools group on Facebook.

The 6m Band

Jef Van Raepenbusch ON8NT (Aalter) has been continuing his WSPR experiments running 4W to a vertical on the 6m (50MHz) band. He is regularly heard in the south east of the UK in locators JO01 and JO02 as well as some more distant spots. He had reports on April 9th from G8ALS (IO92), DK8NE (JO50) and G8XWR (IO91).

Mark Marment CT1FJC (Algarve) says that the Es finally arrived and he got stuck in! Mark caught his first opening on May 3rd, working IK1DPA (JN33), IW1QN (JN44) and I3VJW (JN55) on JT65A. The next day, May 4th, Mark found a good opening, with GM4FVM (IO85) and GI4OWA (IO64) being the highlights, all on JT65A. May 5th saw a good opening to mainland Europe, working DL, HB9 and F, again on JT65A. Finally on May 6th, Mark worked DK6SQ (JN58), HB9SHD (JN37), M0EMM (IO82), MW0BYS (IO71) and MW1CFN (IO73).

David Bowen MW0UAA (Brecon) made some contacts into Portugal on May 4th and says it seems a long time since the Christmas openings! David now has a new 5-element (M0PNN) antenna so is hoping for even better results this Es season.

Dick G0LFF says that he has worked 28 DXCC entities on the band so far this year, all in pre-Es-season meteor scatter (MS) using MSK144.

It's great to hear from **Jim Edgar GM4FVM** (Eyemouth) who reports plenty of MS activity, starting on April 15th when he worked S59A (JN76), OZ1JXY (JO46) and OZ2OE (JO45). The next day, Jim worked ON5PU (JO21). On April 23rd Jim worked PA0TCA (JO21) and then the next day worked EI7BMB (IO63) on tropo using JT65A. Jim saw his first Es on May 1st, working OE5OLL (JN68), and since then it has been Es all the way, with another opening on May 4th, working EA4WU (IN80), CT1FJC (IM57) and F6ECI (JN05). Although most people seemed to find Es on May 5th, it was not good at Jim's place, with only one QSO, albeit a nice one, with UR5WCE (KN29).

At G4VXE, I caught my first Es on the band on May 5th, working EA5UB (JM08) on MSK144 and EA7HG (IM87) on CW, followed by SM0NKZ and OF1KH (KP01). Although I think the propagation was Es rather than MS, I worked SM0NKZ and OF1KH on MSK144. The contacts went through very quickly with almost continuous copy. I worked OF1KH using 15 second periods and then saw him call CQ again, this time using five second periods. I couldn't resist calling again when he had no other takers and, of course, the QSO again went through very quickly.

The 4m Band

Simon Evans G6AHX (Twyning, Gloucestershire) says that he participated in the RSGB 4m (70MHz) UK Activity contest on April 20th, running 50W into a 3-element beam. He worked 31 stations with the best DX being GU6EFB at a distance of 289km.

Jon Joyce GM4JTJ (Arbroath) writes of his first forays into using the MSK144 mode on 70MHz, using his IC-7100 and a homebrew 5-element Yagi. Jon worked SP9HWY (JO90), OZ3ZW (JO54), OZ1JXY (JO46) and OK2BRD (JN99). Jon says that each contact took around 15 minutes and assumes (as do I) that the contacts were made by MS because there were just short 'rasps' of data. Jon used the MSHV software and says that he had felt a bit nervous before embarking on the QSOs but that he needn't have worried because each contact was completed without embarrassment. He remarks that he can see himself using this mode in the future on the lower VHF bands during the Tuesday night UK Activity Contests.

Jim GM4FVM reports some nice contacts, with OK1DIG worked on April 16th followed the next day by SP9HWY (JO90) and LA9BM (JP40), all worked by MS on MSK144 mode. On April 18th, Jim worked OK2BRD (JN79), with the antennas at 10m elevation, reasoning that a lower antenna height should encourage higher radiation angles for shorter paths. On April 20th, with the antenna wound down to just 5m, Jim worked OZ3ZW (JO54), with the predicted elevation for that path being 11°. On April 23rd, Jim worked SP9HWY on MS and GM4VVX (IO78) via Aurora.

The 2m Band

During the RSGB 144MHz UK Activity Contest on April 4th, Jef ON8NT made some good contacts including G4FEV (IO92), M0VXX/P (IO82), G5BBL/P (IO81), M0CGL (JO03), 2E0NEY (IO81) and M0GAV/P (IO93). On April 9th, Jef operated on WSPR, with the best DX being OZ7IT (JO65) at just under 800km, when Jef's antenna was beaming south. On April 22nd, with the antenna vertically polarised, he got a report from G8TTI (IO81) at a distance of 390km. These are some interesting reports showing the power of WSPR. Why not give it a go and see what happens.

Kevin Hewitt M0GTD reports that that **Peter M0PLG** and **Andy M0HLG** took part in the May RSGB 144MHz UK Activity Contest operating from the Bredhurst (BRATS) club shack in Rainham, Kent. They made 48 contacts around the UK with the best DX being MM0GPZ/P (IO85) at a distance of around 550km.

Martin Mills M0MLZ (Plymouth) sends an update on his activity during the RSGB 144MHz Activity Contests from Kit Hill near Callington. He says that he has been delighted to find more stations beaming south-west to find him. Totals have been gradually increasing and Martin has worked some good DX including MM0GPZ/P (IO85) as well G0AJJ (JO02)

and M1CJN/P (IO93). Hopefully, with some regular activity from Martin and others in the south-west, beams will keep turning in that direction.

Jim GM4FVM reports a couple of nice MS contacts on the band, OH6KTL (KP02) on April 16th and SM0EJY (JO89) on April 17th, which took 108 minutes to complete. Every time Jim says he decided to give up and lower the antenna, there was another burst!

The 70cm Band

Jef ON8NT took part in the RSGB 70cm (432MHz) UK Activity Contest on April 11th with the highlights being G4CLA (IO92), G7LRQ (IO91), M0SAT (IO91), M0GHZ (IO81) and G4RUL/P (JO00). M0GHZ was the best DX at just under 400km.

Jef also writes, "*Every day PI2NOS, the Dutch super repeater, transmits a bulletin in the Dutch and sometimes English languages at 0830 and 1700UTC. At the end of this bulletin an SSTV picture is transmitted in different SSTV modes. This repeater with the output on 430.125MHz is very strong here at my place! I can even receive it with a portable transceiver and a rubber duck antenna.*

"*There is more info at (including a link to podcast of the bulletins):* **www.pa0ete.nl**

"*Reception is also possible in the UK, as mentioned in PW recently, and they even have a special input for UK stations. The Breskens UK input is active at 438.625MHz. No CTCSS required. See also (in Dutch):* **www.hobbyscoop.nl/status/pi2nos**

On April 13th Jef was able to decode the picture using his PC and the RXSSTV program written by ON6MU (URL below) but also uses the method of recording the signal on the SD card in his ID-51 and decoding it from the SD card later on his Android tablet.

http://users.belgacom.net/hamradio/rxsstv.htm

Satellites

Jef ON8NT monitored three different schools contacts from the ISS: April 14th with a contact in French to a school in France, with another French contact on April 27th and then finally a contact in the Greek language on April 29th. Jef was also active through AO-85 working ON4BCV (JO21), DB2TK (JO52) and DO3EXE (JO42).

Kevin M0GTD also monitored the ISS contacts on April 14th and 27th, using

The Sporadic E season has arrived! A 50MHz Es plot on the evening of Sunday May 14th, captured from the dxmaps.com website by Don G3XTT. Three quite distinct centres of intense E layer ionisation are apparent.

his Baofeng UV-5RE and a homebrew 2-element Yagi made from two Poundstore 'rabbit ears' TV antennas. Kev says that the 2m downlink was S8-9 and fully quieting for most of the pass during the contacts.

It was great to hear from **Kelvin Crocker G1ZSE** (Poole) for the first time. Kelvin says that he has returned to the hobby after some time away and that he lives in a house where there is limited space for antennas so that VHF portable is the best option. Kelvin has got very interested in satellite operating and has bought an Elk log periodic to give it a go. He says that after a few weeks of trying, he made a contact with OH5LK on May 2nd through SO-50 as well as another contact with a station in Belarus on May 6th. Keep up the good work, Kelvin. As you start out, you may find the lower, northern passes a bit quieter and perhaps easier to make contacts, especially if you can find somewhere with a low horizon to the north.

Mark CT1FJC sends a really interesting satellite log with 86 contacts over the month, so I've picked out the highlights. Mark made a number of transatlantic contacts using FO-29: VE3HLS (FN03), WP4T (FK68), K8YSE (EN91), WB8RJY (EN72), WB2SIH (FN31), NS3L (FN26) and UT1FG/MM (FN89, IN19 and IN41). Mark says he was particularly pleased to work **Captain Yuri UT1FG/MM** because some years ago, Mark had worked him in nearly every square across the Atlantic on 50MHz.

Dick G0LFF writes to say that he has just succeeded in working **Fraser OK1JKU** who was using a Baofeng UV-5R and a 40cm Diamond whip. Fraser had also worked DL4ZAB prior to the contact with Dick. Dick also listened to the Greek language QSO from the ISS.

Patrick Stoddard WD9EWK (Phoenix) writes, "*The ISS digipeater is back on 145.825MHz. For a few days over Europe and North America, the frequency was clogged with stations trying to be seen through the digipeater. The volumes have eased but passes can still be busy. The challenge for satellite operators is trying to work through the stations that aimlessly transmit their position and other comments, without any interest in engaging with other operators for QSOs. Automatic or unattended operation by ground stations on 145.825MHz is not permitted under the FCC rules for US hams but this exclusion is not seen in the regulations for many other countries. Unfortunately, some feel it is their right to transmit on that frequency, even if it just adds to the clutter. In the past couple of weeks, there have been more stations trying the ISS digipeater and even looking to make QSOs using exchanges of APRS messages, which are readable by any APRS station, including the Kenwood and Yaesu APRS-ready radios*".

Patrick makes a good point and it's a lot of fun to try to swap APRS messages with other stations – I always enjoy catching **Dave Boult G7HCE** (Exeter) on both the ISS and NO-84. Dave is often active, as is **David Ryan M0GIW**, swapping messages with other ISS digi users. Unattended beacons don't help!

Here at **G4VXE**, I decided to try using my FT-8900 on the FM satellites, following a suggestion from **Mike AI6GS** on Twitter. Although it will run up to 50W, I have backed it off to 10W for satellite use. The full duplex capability works well for both SO-50 and AO-85. Using the FT-8900 and the Elk antenna, I have been very pleased to find that I can use AO-85 much more easily than before and was rewarded by a QSO with TF/NJ7H (HP83, HP84) as well as EA4DST, F6DLJ, EI5EV and EB1AO. The same setup seems to work well with SO-50 too, making QSOs with DL4ZAB, ON4BHM, M0JFP, CT1FJC, CT2GPY, 2M0SQL, F0DIH, G0LFF, F5RRO and R3THA (LO15)

That's it for this month. Thanks for all your news, please keep it coming. This is usually an exciting time of year for VHF/UHF operators so it will be great to share your stories.

FULL RANGE OF ANTENNAS @ ML&S

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

ML&S ARE PROUD TO BE THE SOLE IMPORTER OF AUSTRALIA'S FAMOUS BUSHCOMM ANTENNA RANGE.

These wire antennas are made from high strength steel wire, designed to withstand the harsh outback weather and built to last for a reliable HF communication solution. No tuner required.

click! www.HamRadio.co.uk/swc100

Bushcomm HF Antenna Systems

Bushcomm Horizon 2040 Centre Fed Two Band Antenna. *20/40m simple dipole for efficient operation. Only 13 metres in length.* **£105.00.**

Bushcomm Horizon End Fed 3 Band - 10m 20m 40m. *This antenna is designed and manufactured in Australia and is intended to offer simple and very efficient operation. Only 12 metres in length.* **£118.14.**

Bushcomm HORIZON 4080 Centre Fed Two Band Antenna. *40/80m simple dipole for efficient operation. Only 13 metres in length.* **£105.00.**

Bushcomm Horizon Loop 20/10. *Designed to be used portable or as a small space permanent set up.* **£299.95.**

Bushcomm Horizon Loop 40/10. *Designed to be used portable or as a small space permanent set up.* **£329.95.**

Wonderwand Wonderloop Antennas

WonderWand Antennas U.K.

WonderWand Widebander 1.8-460MHz with 1.3M Whip!.....£129.95
Wonder-TCP 40-10m Tuneable Counterpoise £59.95
or buy both together for only £169.95!

WonderLoop 4010 40m -10m Portable Loop for direct rig mounting. ML&S Only £99.95

The UK's favourite rig-mounted antenna system!

click! www.HamRadio.co.uk/wonderloop

Hustler Antennas

HUSTLER

Hustler are one of America's oldest manufacturers of Ham Radio antennas. The famous "White Whips" have been seen on many cars operating HF mobile. Their HF base range of 4, 5 or 6-BTV antennas are probably the easiest to assemble and get going and of course are ground mounted, operating with just an earth spike mounted close to the base.

Base Station Range
Free standing, max 7.3m tall, 1kW

4-BTV	40/20/15/10m	£189.95
5-BTV	80/40/20/15/10m	£239.95
6-BTV	80/40/30/20/15/10m	£279.95

click! www.HamRadio.co.uk/hustler

CIRO MAZZONI PROFESSIONAL LOOPS

In Two Sizes. Baby Loop & Midi Loop.

An Italian manufacturer **Ciro Mazzoni** has perfected the design and is able to offer two versions covering the entire 80m-10m range built to ultra-professional standards.

BABY LOOP £1299.95
6.6MHz-29.8MHz with Mk2 Controller.
With RS-232 Rig Control interface.

MIDI-LOOP £1349.95
3.5MHz-14.5MHz with Mk2 Controller.
With RS-232 Rig Control interface.

RS232 Control your new Ciro Baby or Midi Loop via either a Yaesu or Icom transceiver. As you change bands the loops follows automatically, no need to enter the frequency used via the keypad. **£79.95**

click! www.HamRadio.co.uk/ciro

DIAMOND ANTENNAS Huge selection always available

click! www.HamRadio.co.uk/diamond

Base Antennas

CP-VU8	60-70cm 200W Compact HF Base, only 2.7m Long!	£419.95
X-30	2/70, 3/5.5c3, 1.3m Long	£44.95
X-50N	2/70, 4.5/7.2dB, 1.7m Long	£60.95
X-300N	2/70, 6.5/9dB, 3.1m Long	£89.95
X-510N	2/70 Fibre glass 8.3/11.7dB gain, 5.2m long 'N'	£124.95
V-2000	6/2/70, 2.15/6.2/8.4dB, 2.5m Long	£114.95
X-7000	144/430/1200MHz (2m/70cm/23cm) 8.3dBi (144MHz), 11.7dBi (430MHz), 13.7dBi (1200MHz) 5m Long	£169.95

Mobile Antennas

NR-770RSP	100W, 2/70, 3/5.5dB, .98m long, spring loaded	£36.95
NR-7900	2/70, 3.2/6.4dB, 1.46m long	£59.95
MR-77	Magnet mount antenna combination. Includes 13' RG58 coaxial cable with BNC or SMA connector	From £25.95
SG-7500	2m/70cm, GAIN 3.5/6.0, 41" long	£65.95
SG-7700	1/2wave C-Load radialless(144MHz), 2x5/8wave radialless(430MHz). 3.5dBi(144MHz),6.0dBi(430MHz). 1.06m long	£79.95
SG-7900		£89.95

Duplexers/Triplexers

MX-72N	1.6-153/400-460MHz Duplexer	£38.95
MX-62M	1.6-56/140-470MHz Duplexer	£59.95
MX-610	HF/6+2-70 (for FT-891/0)	£69.95
MX-2000	6/2/70 Triplexer	£79.95
MX-3000N	2/70/23 Triplexer	£69.95

Switches

CX-210A	2-way, SO-239 Die Cast	£46.95
CX-210N	2-way, 'N'-Type, Die Cast	£54.95
CX-310A	3-way, SO-239, Die Cast	£59.95
CX-310N	3-way, 'N'-Type, Die Cast	£89.95

YAESU YA-30

The Yaesu YA-30 is very simple to use. Just open the box, roll out the antenna outside where you want to erect. Snap in the supplied spreaders, connect the high quality coax cable assembly (terminated with PL-259's so you don't even have to fit any plugs). **ML&S £229.95**

click! www.HamRadio.co.uk/ya30

Super Antenna MP1DXTR80 Package

A complete portable antenna packaged based around the world's best selling SuperStick

MP1DLR Package includes:

- MP1B antenna (SuperSlider Coil, SW1 SuperWhip, 2 extension rods and nut)
- MR1C Counterpose
- TM2 SuperPod Tripod
- UM2 Super Mount
- GB1 Go Bag
- FG1 Frequency Guide
- MC80 80-meter coil

All for only £229.95
Plus £10.35 post & packing

NEW IMPROVED VERSION

Super Antenna Features:

- Ham bands: 40m-30m-20m-17m-15m-12m-10m-6m-4m-2m-70cm
- Frequency Range: HF 7MHz–30MHz continuous
- Frequency Range: VHF 48 to 144MHz continuous
- SWR: 1.5 : 1 or better
- Rated Power: 500W SSB; 300W CW / DIGITAL
- Antenna Weight: < 2 pounds (1kg)
- Also configurable for up to 450MHz
- Standard 3/8"-24 male thread for mounting
- TM2 SuperPod tripod included with carry bag
- MC80 80m coil included for 80m band
- Optional MR series radial sets available
- Optional MC80 80m coil for 60m band

click! www.HamRadio.co.uk/superantenna

MC2 2m Coil for MP1

2m Coil for MP1 series SuperSlicer Antennas. Adds 2m 144MHz ham band. For use with current generation MP1 series vertical antennas. **£89.95**

LFA Antennas built to a high specification re-engineered using quality materials

The Famous EAntenna Range from Spain

click! www.HamRadio.co.uk/eantenna

The new EAntenna 59+ is a 5 band, 10 element beam antenna with superb performance for a boom length of only 5.75 metres. Computer optimized design to attain the best performance from an antenna of this size. Start chasing DX now!

V/U Beams

R2010105	144LFA5 5 ele 2m beam	£89.95
R2010109	50LFA3 3 ele 6m beam	£119.95
R2010121	70LFA3 3 ele 4m beam	£84.95
R2010139	432LFA15 15 ele bea	£125.95
R2010251	ea270zb9 4/5 ele 2m/70cm beam	£74.95
R2010253	ea642zb7 2+2+3 ele 6m/4m/2m beam	£114.95

V/U Verticals

R2010600	ea270j dual band vertical j pol	£39.95

HF Antennas

R2010013	dbz40 double bazooka 7mhz wire antenna	£54.95
R2010048	ea101520408odxs 5 band HF dipole	£119.95
R2010904	5 band cobweb 500W antenna	£284.95
R20109043	5 band cobweb 3kw antenna	£369.95
R2010050	ea101520dx dipole 3band HF dipole	£72.95

SEE THE INSIDE BACK COVER FOR SOME OF OUR YAESU RANGE. ML&S - YAESU'S OFFICIAL UK DISTRIBUTOR

• E-mail: 2e0sdv@gmail.com

A Five-Way Coaxial Switch

Jamie Williams 2E0SDV, a young but enthusiastic amateur, wanted a remote coaxial switch that wouldn't break the bank. Here's his solution.

This project came to me when a friend of mine purchased an Array Solutions RatPak remote antenna switch (see website below). I wanted one! But being a student in college I didn't have the spare money. Instead, I got to thinking about how I might make one of my own. Now, those who know me will be aware that I struggle greatly with the technical aspects of electronics, the irony being that I am happy to take on a technical project. So after having a chat with one of my locals, Bob G3PLP, about how to make one, I got to work.

www.arraysolutions.com/ratpak-so

I went in search of the components that I would need and bought the majority from Cricklewood Electronics online. I ordered an aluminium diecast box (115 x 90 x 55mm) to house the switch along with six SO239 Sockets (N-type can be used if you prefer), a 6-way rotary switch and five SPDT 12V relays.

Starting on the aesthetics of the box, I got a ruler and marked with a pen on the metal the location on the SO239 sockets. I did this by drawing the shape of the socket and lining three up on each side of the box. Using a centre punch (a Philips screwdriver will also work) I put a small dent in the centre of where I would drill. I drilled each hole in stages – 3mm, 10mm and then 15mm for the sockets to fit on the box, **Fig. 1**. I then drilled some 3mm holes where the screws hold the socket in place and inserted some 2.5mm screws and nuts to secure the socket. Then, using a label printer, I labelled the first five sockets ANT1 through ANT5 and the sixth I labelled SHACK. Again, not necessary but a nice touch, I thought.

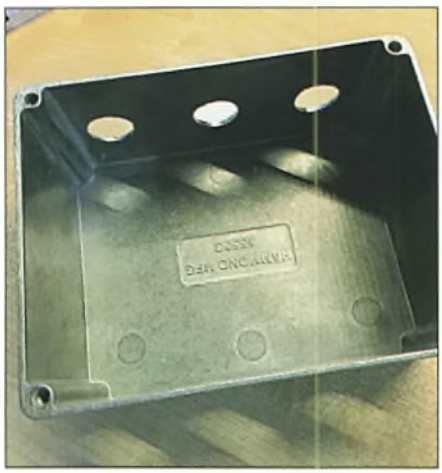


Fig. 1: The diecast box with three holes drilled for the SO239 sockets.

Then it was on to the relays. I used 12V 10A SPDT relays. Being a 2E0, I have no reason to have anything higher rated but with slight adaptation this design can be used on mains relays too. Given my lack of technical knowledge mentioned above, I wanted a drawing that would be simple enough for people similar to myself to easily picture how to assemble to switch. That is what I made, **Fig. 2**, again with the help of G3PLP.

Next Steps

I took a length of 15A rated wire and connected all of the 'normally closed' pins on the relay together, **Fig. 3**. I then attached them to the aluminium box to provide an earth for the antennas. The benefit of this is that any antenna that is not in use is earthed. I then copied this on the 'Normally Open' pin but rather than attaching to ground, I soldered directly

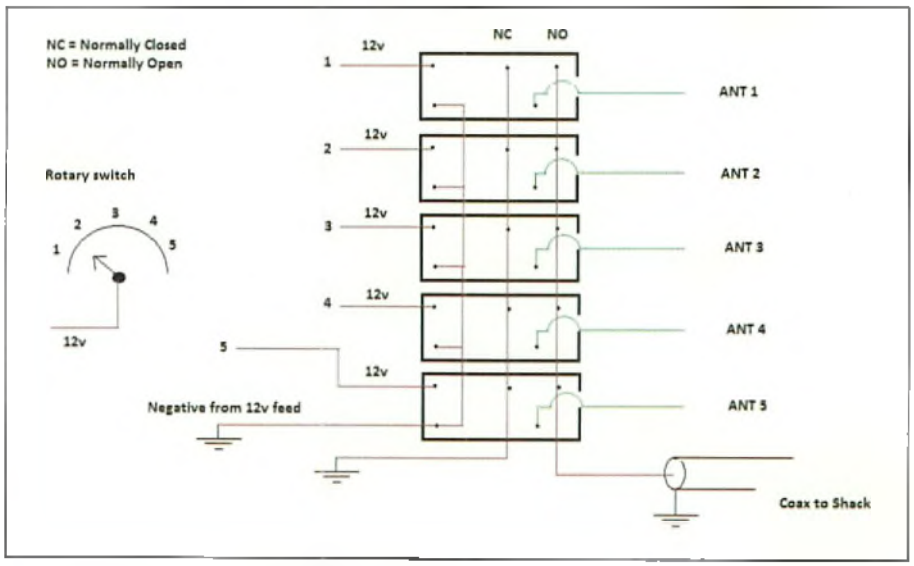


Fig. 2: Wiring arrangement for the switch and relays.

to the SO239 socket labelled SHACK. I attached the negatives of the 12V feed together to run back to the power supply. This way I got the negative of each 12V supply all on a single wire back to the shack.

Now the antenna selection comes into play. Each of the middle pins (green lines shown on the diagram) is for a different antenna. Off I went with the soldering iron attaching each middle pin to an SO239 socket, for antennas 1 through 5. That was the main body of the switch complete.

Power Supply

The next piece to the puzzle was the 12V supply to the relays. I decided to take this from my shack PSU. Given that the switch will only be in use when the radio is switched on, it made sense to use the same 12V feed. Six cores of wire are needed from the switch to the shack, one for each relay and one for the negative return. I used CAT5 network cable.

Taking one core for each relay, I attached the wire inside the box. (Tip: Write down which colour wire is to which antenna to save confusion later!) I then soldered them on to the rotary switch in the shack. I started with ANT1 on switch position 2. This gave me a buffer to have all relays turned off when not in use. I housed the switch in a small plastic box. All that was left to do was to attach the 12V feed between the rotary switch and the PSU. This was easily done with two wires down the back of the desk.

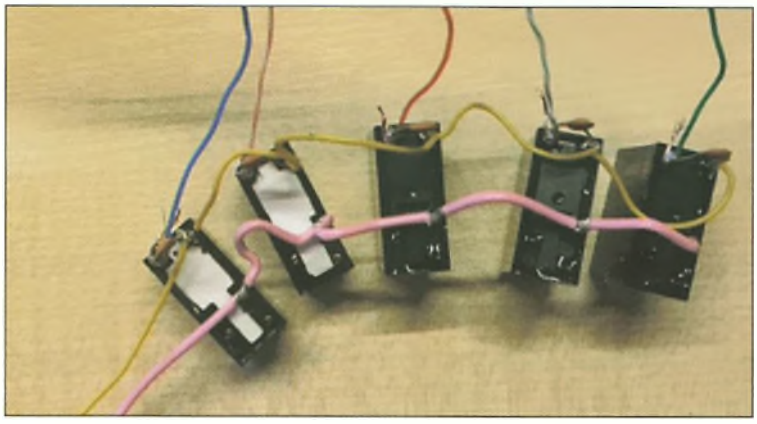


Fig. 3: The relays wired together for testing prior to installation in the box.

And now the switch was basically complete.

Final Thoughts

As an optional extra you can solder a 0.01µF capacitor across the +/- on each relay to reduce the risk of RF travelling back up the 12V line. I did this to be safe. You can also add some LEDs on the rotary switch to show which antenna you are using.

This project took less than three hours and was very easy. A nice little evening project for you to get on with. And it only cost £35! If I were to do it again, the only thing I'd change is the size of the diecast box to make it slightly bigger.

So there we have it. A five-way remote antenna switch, inspired by an Array Solutions RatPak but built by you! And it doesn't have to stop there. You can modify this design to make it your own and include the features that you want.

• E-mail: charles.jones125@yahoo.co.uk

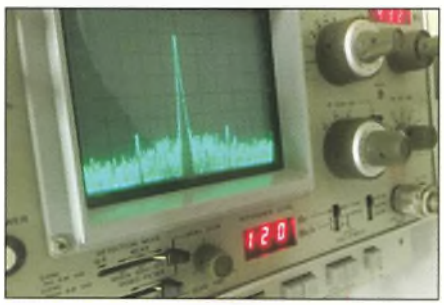
Retevis RT22

Tony Jones G7ETW has been playing with a pair of cheap UHF handhelds that turn out to be surprisingly good.

The Retevis RT22 with associated headset.

This is a review of a Retevis RT22, a Chinese UHF handheld radio. With an inbuilt antenna, just 16 channels and no keypad, the specification may sound rather limited but I liked the look of it and bought it for no better reason than that.

USB cable and software disc.



A clean spectrum on the Marconi analyser.

Retevis supply these radios in pairs. In the box were two RT22s with batteries already fitted plus chargers, USB leads, belt-clips and over-ear headsets but no instructions. Mine came from a UK eBay supplier on the south coast, for £26.99, including postage. For £50 I could have had four! At the same time I bought a programming lead for £6.99.

The RT22 is a sleek device in matt black plastic, solid and comfortable in the hand. The general impression is expensive and professional, with a hint of 'James Bond'.

An RT22 weighs 113g and is 135mm tall (base to tip of antenna triangle), 55mm wide and 21.4mm deep. It has Volume/On/Off control on top and PTT, Channel-Up and Channel-Down on the left-hand side. On the right-hand side are covered sockets for audio in and out (Kenwood standard) and a mini-USB (next size up from a telephone one) charger socket. The battery is a mobile-phone 3.7V Li-Ion type of 1000mAh capacity.

The charger is a UK-mains-plug type and provides 5V via a USB socket. This is a de-facto standard and I have been using my iPad charger to charge the radios with no ill effect.

Beware! My RT22s arrived fully programmed but on some odd frequencies such as 462.925MHz with a D025N DCS code. This means that an 'ordinary' buyer could just use them, unlawfully, and potentially cause interference.

Programming

I downloaded the free programming software from the Retevis website (below), where there are PC, Mac and Linux versions. The USB lead came with a mini CD-ROM with required driver programs for various operating platforms .

www.retevis.com

Installing the programming software on a Windows 7 laptop went without incident and the radio connected first time, probably because the aptly-named 'Prolific' USB driver (present on the supplied disk) was already on my PC from previous programming of other radios.

Channel setup is done by entering receive and transmit frequencies plus CTCSS code (if needed), deviation ('Channel spacing') and power into an Excel-like grid. Squelch level (and 'Beep off' – highly recommended!) can be set in 'Optional features'. To communicate with the radio the software has two arrow-icon buttons. This is all very straightforward.

The only difficulty that may arise concerns the software's COM port setting, **Fig. 1**. On starting up, the software is looking at COM port 6. The radio is connected via a USB to COM port 3, and from a Windows point of view, all is fine, **Fig. 2**. The software can't see the radio, though, and a read request of the RT22's configuration data fails, **Fig. 3**. When I change the software to look at COM port 3, **Fig. 4**. the read (screenshot printed on the fly) works perfectly, **Fig. 5**. Close inspection of Fig. 1 reveals that the software knew where the radio was the whole time, because COM port 3 is not greyed out!

Note that every channel must be programmed. The radio literally howls when stepping 'empty' channels. I filled mine up with PMR446 channels (for listening only, naturally – the output power exceeds the 500mW limit!)

Bench Testing

To test the RT22, a Marconi 2955 was used. To make the test fair, all test radios were stood on the desk a similar distance from the Marconi's antenna. On receive, reducing the Marconi's output signal until it was no longer readable, the RT22 came out just over 5dB more sensitive than my old Yaesu VX-5R and a friend's Baofeng BF888. On transmit, two small spikes, probably mixer

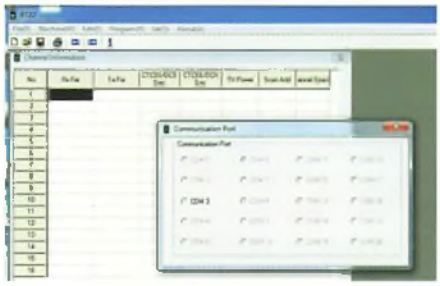


Fig. 1: Getting the COM ports set up – radio is on COM port 3 but software is looking at COM port 6.

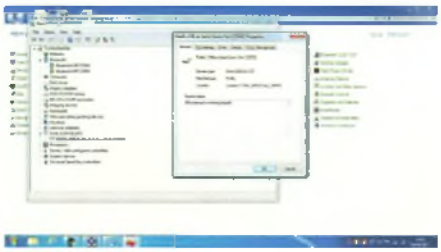


Fig. 2: The radio now correctly assigned to COM port 3.

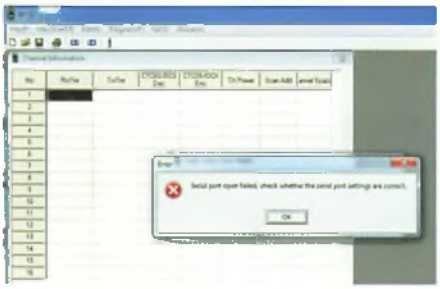


Fig. 3: Software still showing an error (see text).

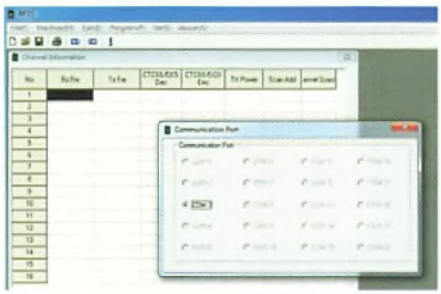


Fig. 4: Getting closer!

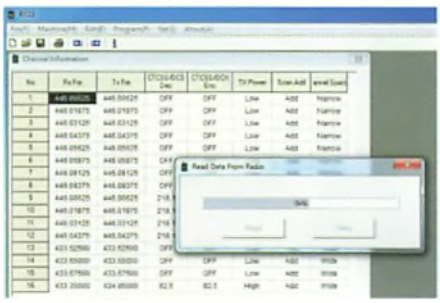


Fig. 5: All now working correctly.

products, were visible nearly 50dB down from the carrier. This was better than either of the other radios.

The RT22's FM deviation was 4.5kHz.

RT22 in Use

The RT22 is gloriously simple to use. Channels are announced in English, with a bit of an accent. 'Six-teen', mine says when I am tuned to GB3HR, my local repeater. There is no visual display, so I need to remember each channel's frequency.

Receive audio is loud and clear, better than many handhelds I've had. My transmitted audio, despite me having a quiet voice, has been consistently described as very good. I have tried the radio at the 2W and 1W levels, mainly using GB3HR, and for my needs, 1W is usually perfectly sufficient and gives me a longer battery life.

Conclusion

The Retevis RT22 is a very pleasing radio and I use mine daily. The build quality and performance are excellent and would do justice to much more expensive handhelds. An RT22 has its limitations, for sure, but if 2W and 16 channels are adequate for your routine 70cm needs, I totally recommend this radio.

• E-mail: military1944@aol.com

Ships & Aircraft

Ben Nock G4BXD is back in military museum mode and discovers two interesting sets, one for use in ships and one for aircraft.

A very warm welcome to my *Valve & Vintage* column coming to you once again from the Military Wireless Museum here in Kidderminster. It's certainly been an interesting few months with many changes to the museum, several new additions and some space created by disposing of unwanted or duplicate items. I must say a big thank you to all those who visited during 2016 and in the past few months and the generous donations – it all helps to keep the lights on.

Royal Navy Set

A recent find of an ex-pat set located abroad was a substantial transmitter and antenna tuner that saw service in the Royal Navy from about 1948 onwards. Transmitter 5AH (Admiralty Patt. 59517) was made by the Standard Radio & Telefon AB company and formed part of a larger unit. To say the unit is 'rugged' is an understatement, **Fig. 1**. There are some 26 heavy bolts just to hold the set in its case.

Wikipedia tells me that the Standard Radio & Telefon Company was established in 1938 as a subsidiary of Standard Telephone & Cables Ltd, London (STC). STC was founded in London as International Western Electric in 1883. In 1925 it was purchased by International Telephone and Telegraph (ITT), which owned it until mid-1982. The company was then listed on the London Stock Exchange and at one time was a constituent of the FTSE 100 Index. Nortel bought it in 1991.

The radio business formed an independent company under the name Standard Radio Systems AB, which itself has been taken over by Raytheon Marine. The company produced equipment for maritime mobile communications and later became the main supplier of Swedish Armed Forces communications equipment, supplying shipboard and coastal radio equipment.

The 5AH transmitter covers 1.5 to 13MHz, AM or CW, with a power output on AM and MCW of 12 to 20W depending on frequency and on CW of around 20 to 40W. The transmitter forms part of the Marine Wireless Station 612E, 612F and 612EF. It was usually operational with the following components: Modulator/DC Power Supply Adm. Patt. 65169; Aerial Tuning Unit Adm. Patt. 65168; AC Supply Unit Adm. Patt. 66199; Remote Control Unit Adm. Patt. 58408.

The Royal Navy designated 612 equipment was used as follows. Type 612E: emergency equipment in destroyers, replaces TCS and 607/608. Type 612EF/612F: emergency equipment in cruisers and flotilla landers, replaces 60EQR. Type 612ET: used as temporary shore station in landing operations, replaces 52ERT. A typical 612E system consists of the 5AH, modulator/power supply, aerial tuning unit, the HF receiver B46 and the VLF receiver, B47. The weight of the transmitter and antenna tuner is 75lb or, pre-Brexit (!), 34kg. Size-wise, the transmitter is 23 x 17 x 15in or 565 x 432 x 381mm.

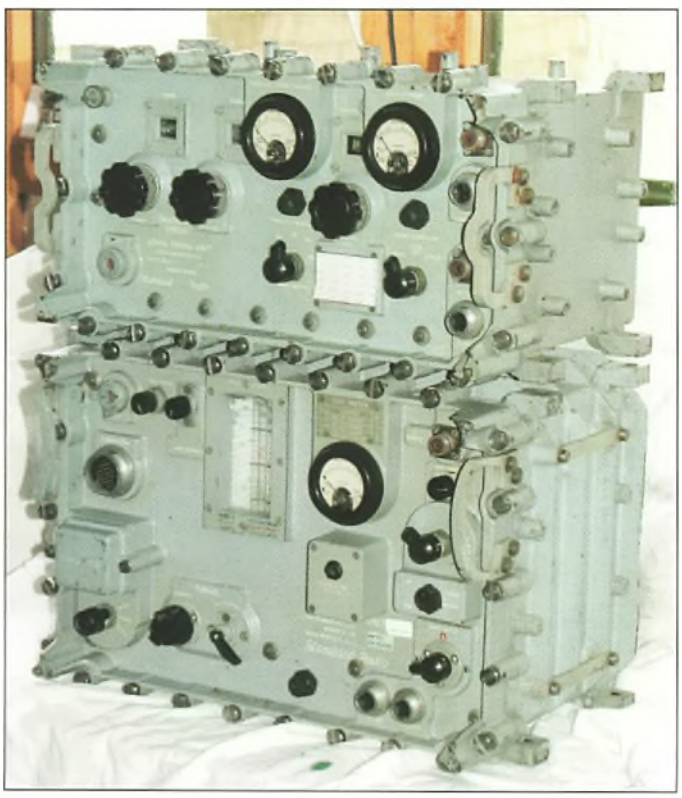


Fig. 1: The transmitter and ATU together.

Configuration

Basically the 5AH uses three of the famous 807 valves, **Fig. 2**, one as oscillator and

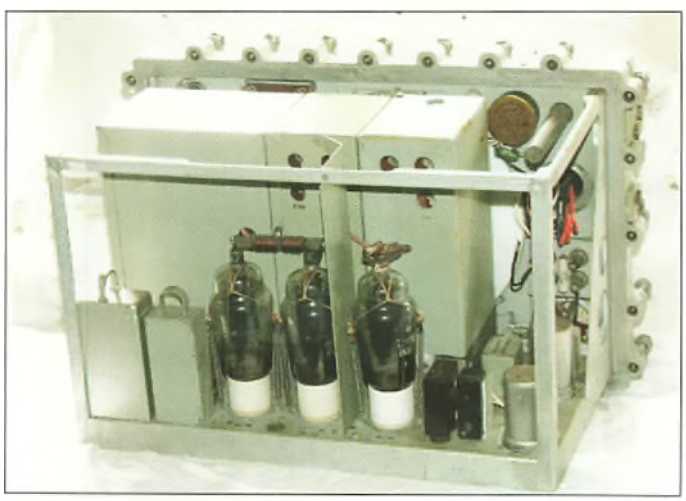


Fig. 2: The 3-valve line up.

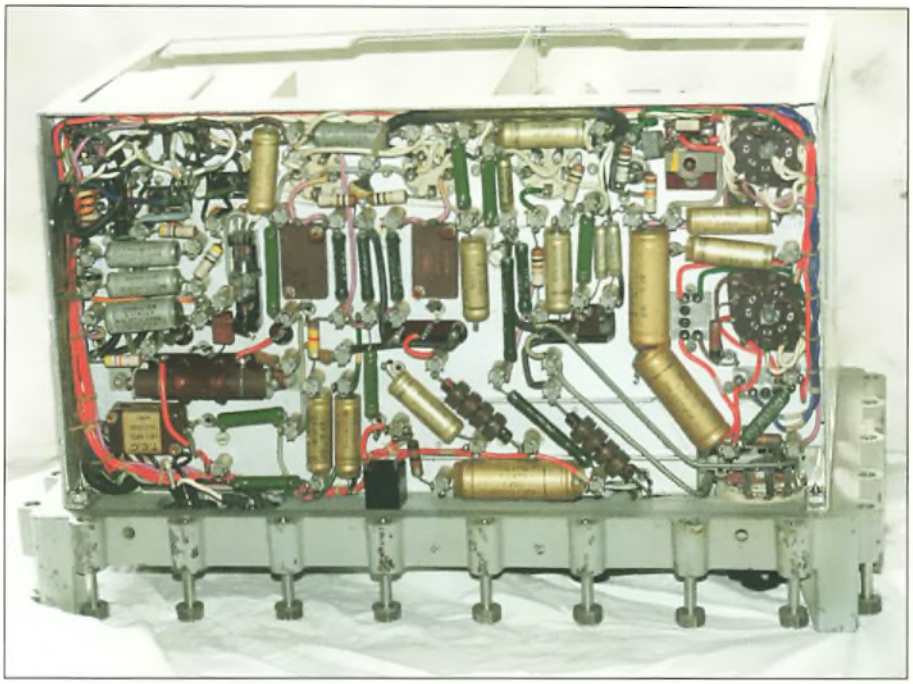


Fig. 3: The underside of the transmitter.

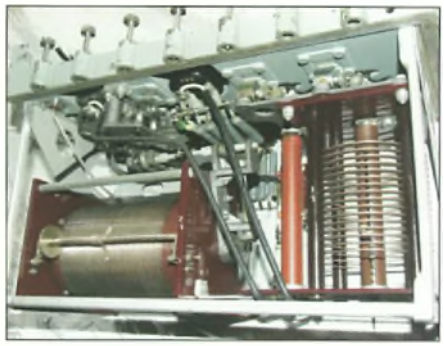


Fig. 4: The high-powered ATU components.

Fig. 5: The aircraft set.

a pair in parallel in the output stage. The modulator is, as indicated above, not built into the transmitter but housed in the DC power unit. There are also a couple of EF50 valves, one of which is used as a crystal oscillator mixer. This produces a beat note between the 100kHz crystal and the output of the VFO while a second EF50 acts as an audio amplifier feeding audio to a front mounted headphone socket.

At Switch On

When switched on, a beat note is heard in the headphones when the VFO is tuned to a harmonic of the calibrator, allowing the operator to check his dial calibration and hence his transmitted frequency to a reasonable degree. An additional diode, CV1092 or EA50, is connected to the antenna output, **Fig. 3**. It rectifies some of the signal and then feeds the recovered audio via a small transformer back to the receiver for modulation monitoring and sidetone when using MCW (Modulated Continuous Wave in which a modulated tone is keyed rather than keying the carrier). MCW is handy because Morse can then be sent and received without the need for a BFO in the receiver.

ATU

The antenna tuning unit (ATU) is equally rugged with large coils and high power capacitors, perhaps slightly too big given the modest RF output of the transmitter. A nice touch is the fact there are two RF meters to aid tuning. You know it's a good design when there's one meter but to have two, well, that makes it a super unit to my mind. There are two large roller coaster coils, **Fig. 4**, with one of them having a second variable connector that can be adjusted from the front panel, making the whole unit very versatile indeed.

Aircraft Set

Another gruelling session of shelf reorganisation revealed a large black box that had been pushed to the rear of a shelf. Dragging it into the light, I found it was another aircraft set, the ARC-52, a UHF band beast of considerable weight at just under 22kg (50lb). Looking up the details on the web, I found that I even had the correct control box for the set sitting on another shelf but alas, more importantly, I am missing the cables that go from the set to the control box via another box entitled the Connector Box. So, another project for the list.

The ARC-52, **Fig. 5**, is the grandfather of a family of UHF transceivers that were fitted in military aircraft. One in particular was the British Canberra bomber. The basic design from Collins is present in every member of the family, 618W and PTR175, like the numerous wheels that distribute motion to all RF, IF, and oscillator modules.

The ARC-52 has 1750 channels, spaced 100kHz apart and tuning from 225 to 399.9MHz, with AM modulation and 20W RF output. The chassis includes a separate receiver on what's termed the guard frequency of 238 to 248MHz.

Fig. 6: Modular construction.

Fig. 7: Gears aplenty.

The 400Hz AC version is the TR4/ARC52 and the 27V DC-only version is the TR5/ARC52. The ARC52 was apparently updated during its lifetime, the first version having 4J6 triodes in the RF stages while the last version had seven 7077 planar triodes.

The set's construction is basically a pressurised housing, a main chassis and 13 plug in units, **Fig. 6**, for the various circuits. The set uses 43 valves, 49 including rectifiers and voltage regulators, with a 4X150D, a 26V heater version of the 4X150A, in the transmitter output circuit delivering the paltry 20W to the antenna – the 4X150D is actually rated at 140W up to 500MHz.

The first local oscillator runs 200 to 370MHz in 10MHz steps and the first IF is tuneable between 20 and 30MHz. The second local oscillator runs 21.85 to 31.75MHz giving a second, fixed IF of 1.82MHz. The signal is then further mixed to give the final 500kHz IF that is then demodulated to recover the audio and AGC.

The two oscillator outputs along with a crystal oscillator on 1.85MHz are then mixed together to give the required transmit frequency, which is fed to the amplifier and amplitude modulated to produce the final transmitted signal.

Though a Collins design, it seems the set was UK made as well by Plessey at their Ilford plant. A web search throws up interesting comments on the ARC52, such as those from **Ron Camp** who worked there: *"Plessey, Ilford, 1969, some of the older engineers used to enthuse about the ARC52 as one of their great successes. I understand that Plessey had a steady income from renovating old sets that had been sold to third world governments long after they had ceased being used by the UK's armed forces"*.

The set's construction is little short of awesome. The various tuned circuits are connected with a myriad of cogs and gears, **Fig. 7**, and must have been a nightmare to assemble, let alone service. The internal dynamotor, **Fig. 8**, clearly shows the Ilford connection. I am yet to find the connecting box and the cables that go from it to the set and control box. If I do find them, it will be interesting to see whether the set works but, of course, its frequency range is somewhat limiting in its use. A real 'boat anchor' if ever there was.

Fig. 8: The Ilford Dynamotor.

RGHQ

While searching the web for information on the set I came across a nice site (URL below) about Regional Government Headquarters (RGHQ) stations to be used in the event of an all-out strike against the UK. One passage read: *"To communicate with aircraft, a rack mounted, mains operated, version of the radio (ARC-52) fitted to all front line RAF planes in the 1960s was installed at RGHQs. This radio was connected to a UHF Biconical Monopole antenna, which was mounted on the main communications lattice mast. These were a common sight at RAF and Navy land based communications sites and ships masts. At Bawburgh RGHQ, the aerial was mounted on a wooden pole"*. Clearly it was a well-used set in its day. www.ringbell.co.uk/ukwmo/Page235.htm

And Finally

That's about it for this outing in the *V&V* shop. I trust the sets have been of interest and, of course, there are plenty more pictures to view on the museum's website, below. For those interested in visiting, the museum would be happy to see you. Visits are by prior arrangement and contact details are on the website so do get in touch. Cheerio.

www.militarywirelessmuseum.co.uk

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!

60m in the Antilles

Steve Telenius-Lowe reports that there is now a 60m allocation in what was the Netherlands Antilles and recommends two July contests.

Fig. 1: Members of the Riviera Amateur Radio Club under perfect spring skies at their special event station for Airfields on the Air.

There's rarely any amateur radio news from here in Bonaire so, when there is, I do like to bring it to you! On April 26th the Agentschap Telecom Branch Manager / Senior Inspector for the Dutch Caribbean sent an open letter to all radio amateurs in Bonaire (PJ4), Sint Eustatius (PJ5) and Saba (PJ6), granting class A, B and C amateurs permission to operate on the 60m band on a Secondary basis. Frequencies permitted are 5351.5 – 5366.5kHz, with a maximum power of 25W EIRP.

I have just modified my transceiver to operate on that band and have put up a quarter-wave vertical antenna. I would be interested to receive any reports on 60m activity (particularly if anyone hears or works any PJ4, PJ5 or PJ6 stations!).

July Contests

There are two international HF contests in July that always attract a good following. The first is the IARU HF Championship, on the second full weekend of July (this year July 8/9th). The contest starts at 1200UTC Saturday and runs for 24 hours. There are separate categories for single operators and multi-operators, and single operators may enter on CW, SSB or mixed modes. The 'exchange' is an RS(T) report plus your ITU zone number. The UK is in zone 27, so a typical sent exchange would be '5927' or '59927'. The full rules are on the ARRL website at:
www.arrl.org/iaru-hf-championship

The other event is the Islands On The Air (IOTA) contest, which is organised by the RSGB. This contest takes place on the last full weekend in July (July 29/30th, 2017), again from 1200UTC for 24 hours (although in this contest single operator entrants may opt to operate for 12 hours). As with the IARU event, single operators may use CW, SSB or mixed modes; multi-operators enter the mixed-mode section. In this contest the exchange is a report and serial number while stations on islands must additionally send their IOTA reference. This is EU-005 if you are on the mainland of Great Britain, or EU-115 for the island of Ireland, so a typical sent exchange would be '59001 EU005'. There are different references for other islands around the coast and, of course, throughout the world: Bonaire, for example, is SA-006. If you are unsure of your IOTA reference, you can look it up at www.rsgbiota.org and the full rules of the IOTA Contest are at:
www.rsgbcc.org/hf/rules/2017/iota2017.shtml

Readers' News

As promised last month, **Steph Foster G4XKH** (Torquay), Secretary of the Riviera Amateur Radio Club sent in a report and photos of the club's special event station for Airfields on the Air 2017, **Fig. 1**. GB4AOA operated on April 8th from Little Haldon near Teignmouth. *"We were blessed with beautiful blues skies and no clouds with a slight breeze"*, Steph wrote. *"Using the trusty Kenwood TS-590S and an inverted-V at approximately 30ft we worked 40 and 20m. We worked well into Scotland, Northern Ireland and the Republic of Ireland. Our furthest European contacts were into Italy and Switzerland. A thoroughly enjoyable day was only made better by Phill and Debbie organising bacon butties and hot drinks all round!"*
www.rivieraarc.org.uk

Carl Gorse 2E0HPI (Hartlepool) wrote on April 16th saying, *"Yesterday* ***Steve 2E0EFP*** *and I decided to tackle an 8-point SOTA in Northumberland's highest peak of The Cheviot, ref G-SB-001, which is 815m above sea level and three hours of walking to get to the top. We both did very well on HF. I was using the Super Antenna MP1B on 40m SSB, while Steve managed to work around 32 contacts on 20m with his best being VK4FW while using his KX3. The weather on the summit was not good with hailstones and very high winds... I have bought the SOTAbeams WSPRlite, which I have been using, and it's amazing how far the signal goes at only 0.2mW but I plan to run it as low as 0.02mW by the water's edge."* In March Carl entered the Worked All Britain 80m SSB contest and has just

received a certificate, **Fig. 2**, for his first place in the low power section while running only 5W.

Carl wrote again on April 21st to say that he *"had an excellent day operating portable on the rocks at Seaham GFF-0332,* **Fig. 3**, *with 103 logged and even worked a few on 17m with the Super Antenna MP1B. I also worked VK4FW again on 20m with the Super Antenna: get an excellent location and use the counterpoise kits and this antenna can bring excellent portable results."*

There's no DX report from **Etienne Vrebos OS8D** (Brussels) this month though he wrote to say that he had bought a Spiderbeam but then decided it was too big to put up at his location. He traded it in for *"an ancient, never-used Kenwood TS-830S,* **Fig. 4**,*... a collector's item, with full documentation from 1984... The rig works as new, I made several QSOs with it and it's a pleasure to use old gear. It just needs time to warm up and the load, plate and drive controls need delicate fingers to get adjusted."* Etienne added that he found my article *Improving Your SSB Audio Quality* in the May *PW* useful, saying it's *"important for all of us, even if you have a top-of-the-range rig, as my Icom IC-7851... I decided to follow your advice and got to work a TF guy for 30 minutes... and finally we got the best sound coming out of the Icom 7851... Those basics you wrote down on three pages should be read by all."* Etienne ended by saying that in his opinion when adjusting the audio settings it's important to get critical comments from another station and not just rely on listening to your own voice with your rig's Monitor facility. I agree, but using the Monitor is still useful because it can quickly rule out the use of definitely unacceptable audio settings and flag up problems you might not be aware of such as RF feedback or a dodgy microphone connection.

Fig. 2: Certificate awarded to Carl 2E0HPI for his win in the WAB 80m SSB contest.

Mike Clark M0ZDZ (near Chichester) has antenna restrictions at home so normally only operates portable. But he wrote, *"I thought I would have a go at PSK.*

I've never tried any digimodes before, so it's all new. I put a dipole in the loft for 20m on a N-S alignment and made a few contacts into Europe but it was hard going. I thought maybe I was not set up correctly. I had a portable outing today and set up for PSK31. Not sure if it's a mode for me: I worked into NA and Europe but still tough going on a mode that I thought was supposed to be still good when the going gets tough. I was hoping to be able to use PSK from home with limited antennas. I'll see how it goes. I'm out again on Monday – will probably stick to SSB though."

It's true that while some find digimodes relaxing after what can be the 'cut and thrust' of SSB or CW operating, others find RTTY and particularly PSK too slow for their liking. As with many things, it's all down to personal preference.

Not until April 4th did **Victor Brand G3JNB** (Shefford, Beds.) find any DX, due to the continuing poor conditions. *"OA1F was calling on 20m from Peru with few takers but did hear my first call, unlike a Chilean who was oblivious to the many EUs calling him. NL7G in Alaska was*

Fig. 3: 2E0HPI/P on the rocks. Carl stresses the importance of an excellent location close to the sea for his QRP portable operations.

Fig. 4: The as-new Kenwood TS-830S from 1984 takes pride of place in the shack of Etienne OS8D.

Fig. 5: James 9V1YC operated as 4W/N1YC from Timor-Leste in April.

also putting in a fine 30m signal but not hearing many replies. With the continuing odd propagation on the band, it took me days to work **James 4W/N1YC**, **Fig. 5**, *in Timor-Leste, 4S7VBG in Sri Lanka and 3B8MM Mauritius. A whole week passed with deplorable DX conditions before* **Douglas ZP6CW**, *with his huge antenna, was worked at bedtime on 30m. Three more days of DX drought until, late night on the band, I logged HI3T in the Dominican Republic and the Canadian Vimy Ridge Centennial station VX3100 operated from Ontario by* **Garry VE3XN**. *Next day, mid-morning, a weak 3D2AG/P on Rotuma was heard and worked on 20m: my best DX for April and, at 10,000 miles, a nice surprise."* Victor then worked the S79Z team in the Seychelles and 7X3WPL in the Algerian Sahara on 20m and RW1AI/MM off Argentina on 30m. The two Czech operators working from 5V7P in Togo were logged on 17m and 15m. **Gilbert ZD7BG** on St Helena was logged on 17m despite deep QSB. On 30m, **Vlad 8Q7VB** on the Maldives was worked and the British A25UK team in Botswana heard Victor's call as he slipped past the colossal pile-up by transmitting '6 up' using his fishing rod vertical. *"To round off a most unpredictable month, and despite a big crowd calling, the customary 'first call' response from* **Nigel G3TXF** *operating CW simplex from Fårö in Sweden as SG3TXF/1 made my day!"*

Terry Martin M0CLH (Wantage) said, *"Propagation not brilliant this month with the occasional bright spots such as 5V7P on two of the higher bands. It was also good to get Tom in Kenya* [5Z4/DL2RMC] *on 17m CW. Not such an extensive log this month because I have been playing a bit with DMR (another digital mode to add to the collection!). Little evidence yet of Sporadic E but hopefully that will pick up in the month to come."*

Owen Williams G0PHY (Biggleswade) says, *"Plenty of activity but not much DX. Most of the contacts this month were with various special event stations commemorating the 20th anniversary of the Mediterraneo DX Club*, **Fig. 6**, *all within Europe apart from 7Y20MDC (Algeria). Conditions improved mid-month with OD5ZZ (Lebanon) worked on 20m. On the 16th signals were heard from the Caribbean and USA and I managed QSOs with 6P6NW in Barbados and W0N celebrating the 150th anniversary of statehood for Nebraska. I had two contacts with J5W (Guinea-Bissau) on 20m and 15m… It must be said that Núria* [EA3WL, operator of J5W – *Ed*] *was a veritable 'QSO machine', churning out the QSOs for hours at a time."*

Fig. 6: The Mediterraneo DX Club celebrates its 20th anniversary this year.

David Smith M0OSA/M (Huddersfield) has *"not spent much time on HF this month, mainly due to poor conditions. Managed to work SX20MDC and IR9MDC, both celebrating the 20th Anniversary of MDXC* [Mediterraneo DX Club]. *Highlight of the month was working* **Amir 4X6TT** *operating as 4X69TT celebrating the 69th anniversary of Israel's independence. Also worked R25SRR celebrating 25 years of the Union of Radio Amateurs of Russia, and R75GAK, celebrating the 75th anniversary of* **Galina Alexeyevna Kulakova**, *four-time Olympic champion cross-country skier."* David adds that all these were worked on 20m SSB while running 50W mobile from near Huddersfield.

In April **Kevin Hewitt ZB2GI** (Gibraltar) operated both from the Rock and from near Chatham Dockyard using his UK callsign M0GTD. From Gibraltar he used 5W of JT65 to work stations all around Europe on 20, 17 and 15m using his aluminium window frame as an antenna, connected via a 9:1 balun. He describes his April highlights as *"Operating on 80m and working two special event stations."*

As we're moving towards summer, **Martin Burch VK4CG** (Brisbane) wrote to say it had started to cool down there *"with day temperatures being around 26 – 27°C and at night down to 11 – 12°C."* Doesn't sound too bad to me, Martin. *"Just as a matter of interest for the readers of your column that might not be aware, here in Australia licence holders can vary the VK prefix for an AX prefix at certain times of the year, these being January 26th (Australia Day), April 25th (ANZAC Day) and May 17th (World Telecommunication Day). HF band conditions here in suburbia are mixed, not much luck on 20m with S5 –S7 static and overall the bands above this being dead except for occasional bursts of life. I am looking forward to conditions lifting down the track. 40m is still workable with windows opening up on a regular basis for contacts abroad. The jumpy solar activity does not help."* Once again, Martin's log would be the envy of any DXer in Europe (see band reports)!

Band Reports

Carl 2E0HPI/P operated from several locations in the north-east to work, on 40m SSB: DL1EKO, EA2CKX, F4FMU, OK1DVM, ON4UP. 20m SSB: 4Z4DX, 9A4KI, 9H1FL, CU3AA, EB1FNS, HZ1QZ, I7PXV, N9MM, OH8JGG, RW3XZ, S57T, SV2HJW, YT6M, VE1WT, VK4FW, Z62FB. 17m SSB: OK2VK, R7GR, UR1MI, ZA/DL4KM/P.

Mike M0ZDZ operating from home with an indoor antenna worked, on 20m PSK31: 4Z5NN, ER3MM, JY5IB, KC9JBU, VE3JDF. Operating portable, also using 20m PSK31: 3A2NL, 3V8CB, 4L7D, 4X5EB, EP5MKN, H91IT, J5W, KW7Y and many other US stations, SY8PEH, TA7AMF, VA3TTB, VK2CIA, VK4NBX, WP4TM, XE3D, YB0JS, YB6UAK.

Terry M0CLH reports the following. 40m PSK31: SQ7NLG. 30m RTTY: DS4AOW. 30m JT65: R2FAQ. 20m SSB: HB0/M1PTR/P. 20m CW: Z37M. 20m RTTY: HZ1SK, SV1EQU/8. 20m PSK63: RK6ART. 20m JT65: AC8SM, R9CQ, SV8NAJ, VE6XMB, VK2IE. 20m JT9: 4Z5BF, KS4S, OD5PY. 17m CW: 5Z4/DL2RMC. 17m RTTY: CX2AQ, RO25KO. 17m JT65: JH4ALY, KP4ED, UN7LZ. 15m CW: 5V7P, JT1CO. 12m CW: 5V7P.

Kevin M0GTD used 50W to a 10m wire connected via a 9:1 balun to work: 80m SSB: TM100VIMY (Vimy Ridge centenary). 40m SSB: DM500RT (500 years Reformation anniversary). 20m SSB: EA7GX, EA9KB, LZ1WDZ, ZB2JK.

Martin VK4CG used an Icom IC-730 at 100W to a 53-foot wire fed through a 9.1 balun to work, on 40m SSB: AX5PAS/P (Tolderol game reserve, VKFF-1752), H44MS (Malaita I OC-047), HK4L, HP3AK, JH7MQD, N6KN, T32AZ, VK9JA (Norfolk I), YC7TUU.

Signing Off

Thanks to all who sent in their reports. Please send all input for this column to **teleniuslowe@gmail.com** by the first of the month (July 1st for the September magazine, August 1st for the October issue). 73, Steve PJ4DX.

• E-Mail: tony@pwpublishing.ltd.uk

A Modern Discrete Crystal Calibrator

Tony Nailer G4CFY develops a crystal calibrator, while explaining the history and evolution of this useful piece of shack equipment.

A piece of apparatus that was quite common back in the 1970s was the crystal calibrator. It produced a selection of fundamental outputs in decade steps all referenced to a single quartz crystal. The versions up to 1970 were usually a transistor or valve unit referenced to a 100kHz crystal and were used as a signal source for the calibration of analogue receivers.

Early Logic Circuits

It was only in the early 1970s when the first Transistor Transistor Logic (TTL) integrated circuits (ICs) became available that the famous 7490 device was adopted as the heart of a whole new generation of crystal calibrators.

Unfortunately the TTL devices were low impedance, being, in effect, grounded base devices with drive to the emitters. They ran on a supply rail strictly between 4.75 and 5.25Vand the current consumption of each device was really rather high. The 7490 decade divider drew a supply current of between 30 and 40mA.

This device contained a divide-by-five stage where for every five input pulses just one pulse came out, hence there was a gap equal to four pulses followed by a single pulse. It also contained a bistable flip-flop giving one pulse out for every two pulses in, a divide-by-two. So the mark to space ratio of the divide-by-five was 4:1 and mark to space of the divide-by-two was 1:1.

By configuring the device with the divide-by-five followed by the divide-by-two, the output was divide-by-ten with a 1:1 mark-to-space ratio. My Texas Instruments *TTL Databook* specifies the minimum operating frequency at zero and the maximum at 32MHz for the divide-by-two stage and a maximum frequency of 16MHz for the divide-by-five section. In practice, they would reliably achieve one tenth of the rated maximum.

Experimenters in those days would make calibrators with 5MHz or 10MHz crystals and try devices from different manufacturers or ones with different date codes to find one that worked reliably. Driving the devices was not easy because the drive current required could be as high as 16mA. This meant the crystal oscillator would need a substantial buffer in order to reliably trigger the decade counter. One solution was to use one or two nand gates from the quad package 7400 with the inputs strapped as a more sensitive buffer between oscillator and the first decade counter. Alternatives were one or two inverters from the hex package 7404, or the Schmitt-Trigger inverter from the hex package 7414.

As a result, a crystal calibrator using a crystal oscillator on, say, 1MHz, followed by a 7404, then a 7490 to give 100kHz, another to give 10kHz and another to give 1kHz, would draw somewhere between 120mA and 160mA from a 5V supply.

Next Generation Logic

By the 1980s the introduction of logic devices using Schottky transistor technology enabled the ICs to achieve their maximum frequency ratings while drawing significantly lower supply current. These devices were designated as Low power Schottky (LS) TTL with codes such as 74LS90 and were plug-in compatible with the TTL devices.

The 74LS90 would run reliably at close to 30MHz while drawing only between 9 and 15mA. A crystal calibrator previously using a 1MHz crystal could now have it changed to a 10MHz one and the logic devices changed to 74LS04 and 74LS90 and the supply current would be between 36 and 60mA.

CMOS Technology

The next generation of logic devices developed in parallel with the LSTTL in the early 1980s used field effect transistors (FET) with insulated gates, referred to as IGFETS. A version of these was the metal oxide silicon FET, or MOSFET.

By using P-channel and N-channel devices in a sort of push-pull arrangement between supply rails, switching one on when the other is switched off creates a very effective means of producing a rail-to-rail square wave with very small currents. Hence was born the complementary MOS logic ICs, or CMOS. These are usually referred to as the 4000 series although they also come as 4500 devices.

The MOSFET devices could work effectively from voltages as low as 3.5V or as high as 18V, which lent them perfectly as substitutes for TTL and LSTTL devices and with supply currents of only 1 or 2mA. Unfortunately, the insulated gate technology created a fairly large capacitance, which limited the operating frequency back to that of the early TTL.

Since then there have been a number of alternative versions of CMOS devices, some of which were designed for 5V operation and as plug-in replacements for TTL devices. We are now spoiled for choice with a plethora of devices to meet various technological demands and most of them I have never used. A version most useful to us is the high-speed CMOS series of the form 74HCxxx, which are TTL compatible in some cases and unique in others.

One device is particularly notable – the 74HC390 that I first

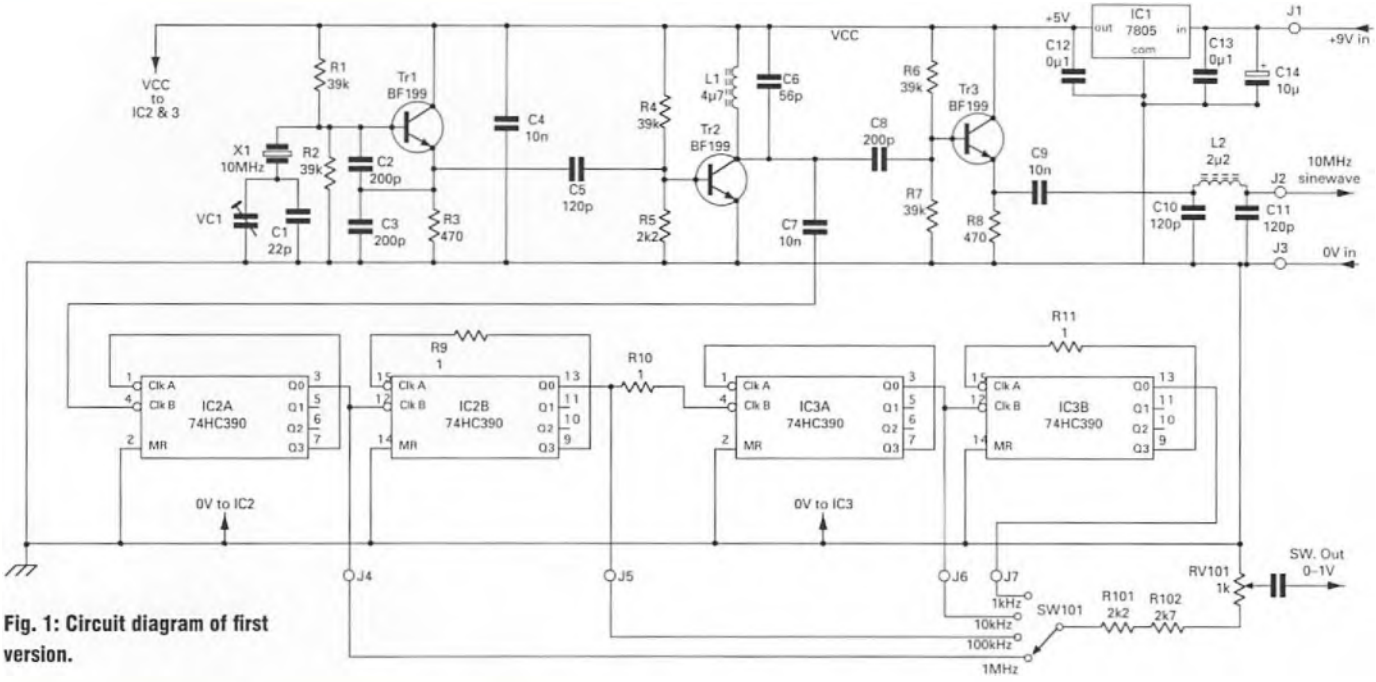


Fig. 1: Circuit diagram of first version.

came into contact with in the *PW Robin Frequency Counter*. It contains two divide-by-five and two divide-by-two sections in a single 16-pin dual-in-line (DIL) package. This means it can be configured as two complete decade dividers, each with a 1:1 mark-space square wave output. A four-decade divider chain following a crystal oscillator now requires just two IC packages.

A New Crystal Calibrator

A few weeks ago I received a call from **Robert Riddington G4IHT**, for whom I had created some coils for his valve superhet receiver, the subject of *Doing it By Design* in March 2017 *PW*. He wanted a crystal calibrator to use with his analogue receiver with greater accuracy and stability than his analogue signal generator. That's how this article came about.

It didn't seem like a very difficult project because much of the technology I had used before in my *Off-Air Frequency Standard* (OAFS), also referenced to a 10MHz quartz crystal. The scheme was to use a transistor Colpitts oscillator followed by a transistor buffer to make the signal swing large enough to reliably trigger the first divide-by-five stage in a 74HC390.

As with my OAFS, I chose to have a dedicated very pure 10MHz sine wave output together with switched square wave outputs of 1MHz, 100kHz, 10kHz and 1kHz. The suggested operating voltage for the HC series is 6V so I chose to use a 78L06 100mA three-terminal supply regulator and drive this from a standard 13.5V bench supply.

The circuit was drawn up and was immediately laid out as a printed circuit as the quickest and easiest way of producing a prototype. I was sufficiently confident of success that this would be the quickest route to subsequent production of a kit for other readers. The circuit is shown in **Fig. 1**.

First Version

The circuit shows a conventional Colpitts crystal oscillator where VC1 plus C1, in series with C2 and C3 make up the required loading capacitance of the crystal of around 30pF. Adjustment of VC1 allows the crystal to be pulled a few hundred Hertz onto its correct frequency.

Output taken from the emitter of Tr1 is mainly the fundamental crystal frequency but also contains a high level of even order harmonics. This is caused by the high *Q* of the crystal causing quite large positive and negative peaks, where the negative one switches the transistor off, giving a flattening of the negative peak of the output signal.

The signal here is about 1.5V pk-pk and probably insufficient to reliably trigger the input of the first divider IC2a. Another transistor is employed with a tuned circuit in its collector to create a rail-to-rail swing sufficient to trigger IC2a. The signal at the collector of Tr2 is an amplified and inverted version of that at the emitter of Tr1 and contains a lot of harmonics.

A further transistor was employed as an emitter follower together with a lowpass filter to provide a very clean sine wave output at 10MHz with amplitude of 4V pk-pk. This was a spin-off from a modification used in my OAFS.

Thereafter each of the blocks IC2a, IC2b, IC3a and IC3b have the signal fed into the divide-by-five section followed by the divide-by-two section. Daisy chained together in this way, they generate selectable 6V pk-pk square wave outputs of 1MHz, 100kHz, 10kHz and 1kHz. Two series resistors totalling 4.9kΩ feeding a 1kΩ potentiometer provide 0-1V pk-pk output.

The 74HC devices are specified to run on a nominal 6V supply rail so I decided initially to power the unit from an external 13.5V source and use a 6V 100mA 3-terminal regulator to feed all the sections of the circuit.

When the board was built and tested it worked straight away without any modification although the output was extremely high. I had inadvertently fitted the 78L06 the wrong way round and the supply rail to all devices was over 12V. Nothing overheated and all the devices worked as expected even on double the rated supply.

The PCB with the 78L06 refitted the correct way round is shown in **Fig. 2**. The total consumption was about 24mA so I decided that it could likely be powered from a PP3 but not while still using the 78L06. Instead I fitted a series resistor and 6.2V zener diode in place of the regulator because I couldn't find a low drop-out regulator of 6V in a similar package.

A picture of the interior of the boxed unit, **Fig. 3**, shows the board now with the regulator missing and the zener and resistor in its place. The photo, **Fig. 4**, is of the front panel of the first unit as supplied to Robert, who is delighted with it.

Second Variant

My second thoughts on this unit were to replace the zener stabiliser with a discrete voltage regulator as used in several of my products, using an LM393 comparator, a pass transistor, several resistors and a reference diode.

This was quite a complex solution so I searched my supplier catalogues for an alternative and found the LP2951, an 8-pin DIL package requiring just two resistors to set the output voltage. The device is low drop-out, claiming an input/output difference as low as 150mV. I haven't shown the new regulator section as it was also used in the third version and the final versions.

I also thought I could do away with the emitter follower and lowpass filter of the first version and just use a Spectrum 10mm coil in the collector of Tr2 with a second coil bandpass coupled to it. The circuit of this part is shown in **Fig. 5**.

I next added an emitter follower after the output level potentiometer to enable the circuit to feed into low impedance circuits without them loading down the level further.

I didn't build the second variant because I reasoned that I had been mistaken in trying to clean up the 10MHz signal because a crystal calibrator should, as a matter of course, produce lots of harmonics.

Third Variant

The third variant included the new regulator but reverted to the original Tr2 section followed by a pair of back-to-back diodes and a common emitter amplifier. This would have the effect of squaring off the signal from the collector of Tr2 and then providing relatively a low impedance output rich in harmonics. The circuit of that section is shown in **Fig. 6**.

This variant included the new regulator and the emitter follower for the switched output. I did produce a full circuit and PCB artwork but didn't etch a board and build it because my reasoning had moved on again.

Final Version

In my final iteration, I changed the collector circuit of Tr2 to a resistor instead of the tuned circuit to retain the distorted 10MHz signal rich in harmonics. The fixed level output at 10MHz was abandoned in favour of including it with the switched and level controlled outputs.

This posed another problem because I think that the emitter follower after the output level potentiometer would roll-off quite considerably in the low megahertz region. So I changed the output buffer into a common emitter stage with an un-decoupled emitter resistor the same value as the collector. This means there is power gain relative to the input of the device but not a voltage gain. The output impedance is considerably higher than the emitter follower but the stage voltage gain of just under unity would be flat to maybe 70MHz. The circuit of the fourth variant is shown in **Fig. 7**.

I laid out and quickly etched, drilled and cropped a PCB. The circuit, being relatively simple, was built up in about half an hour and put through its paces. The only change I made was to increase the value of R8 from 2.2kΩ to 4.7kΩ. A picture of the final version PCB built is shown at **Fig. 8**.

The output signal on 10MHz viewed on my oscilloscope was a sawtooth wave of about 350mV

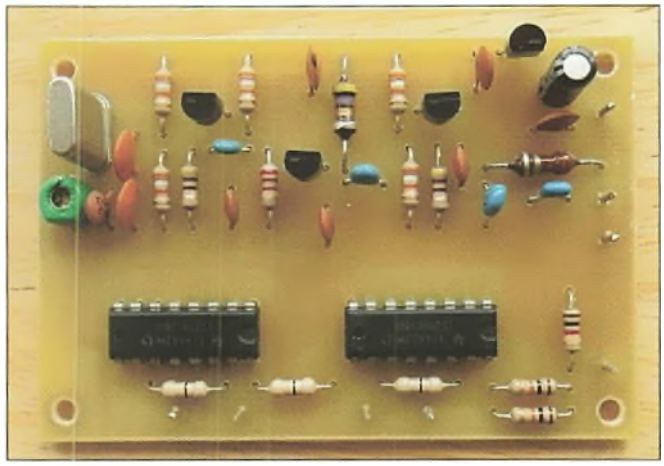


Fig. 2: Built PCB of first version.

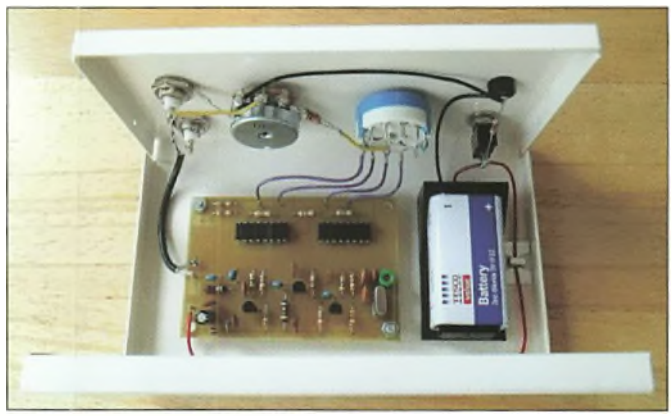


Fig. 3: Interior of boxed built first version.

Fig. 4: Front panel of first version.

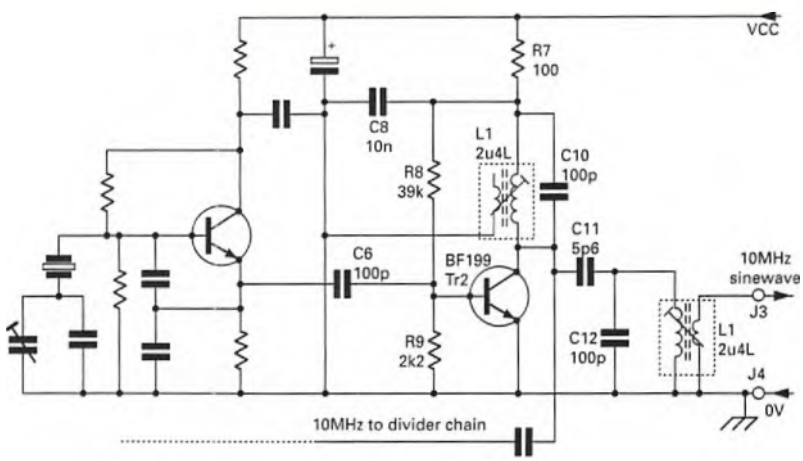


Fig. 5: Bandpass filter section of second version.

pk-pk. When connected to the spectrum analyser, the second, third and fourth harmonics of 10MHz dropped by about 10dB consecutively to about 3mV and thereafter stayed at that level to well beyond 100MHz.

The other switched outputs were all just under 1V pk-pk and fairly respectable square waves.

Viewed on the spectrum analyser, the 1MHz and 100kHz outputs gave fir tree forest images while the 10kHz and 1kHz outputs had a similar shape but at the resolution viewed were just a solid green display.

Measurement of the supply rail showed that it stayed constant at 6V until the input voltage dropped below 6.35V. The supply current was just 13mA so I am satisfied that the unit can be powered from an internal PP3 battery that will last a very long time before needing to be replaced.

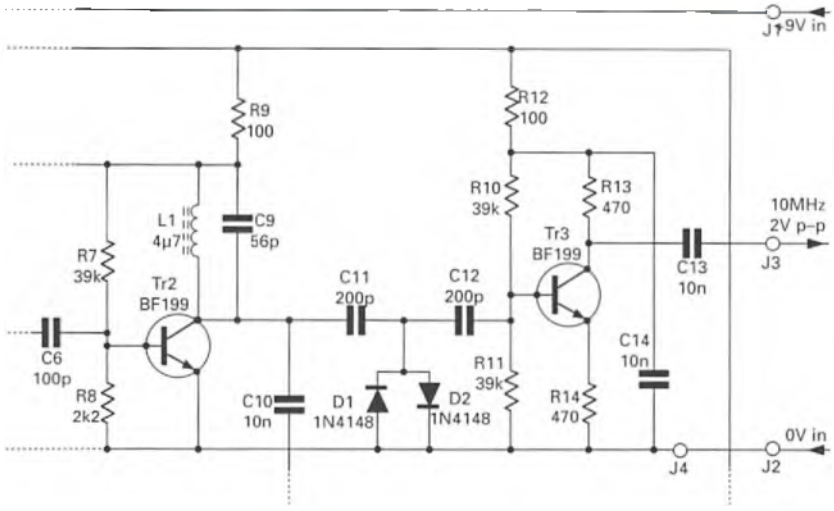


Fig. 6: Clipper and amplifier of third version.

Final Remarks

I am happy now with this fourth and final variant and it is different to the original supplied to Robert. That version was housed in a two-part painted aluminium box 150x100x75mm that is nice but expensive.

I haven't decided yet whether to supply the calibrator as a kit in that metal box to keep all the numerous harmonics from escaping or whether it would be better to put it in an ABS box so that simply by switching it on, no connection would be needed for it to be heard in a nearby receiver. Maybe both options would be popular.

I have a box now being used for a Morse practice oscillator and also for an external audio CW filter and amplifier. The box is made by Evatron and measures 125x100x61mm. It is quite attractive and about £10 cheaper than the two-part box.

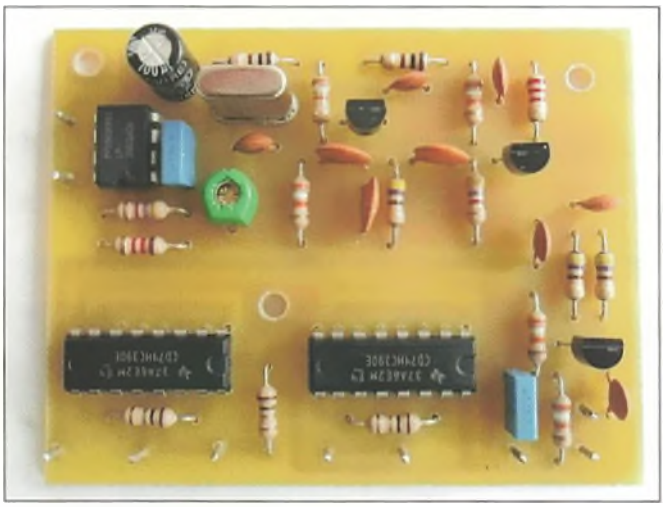


Fig. 8: Built PCB of final version.

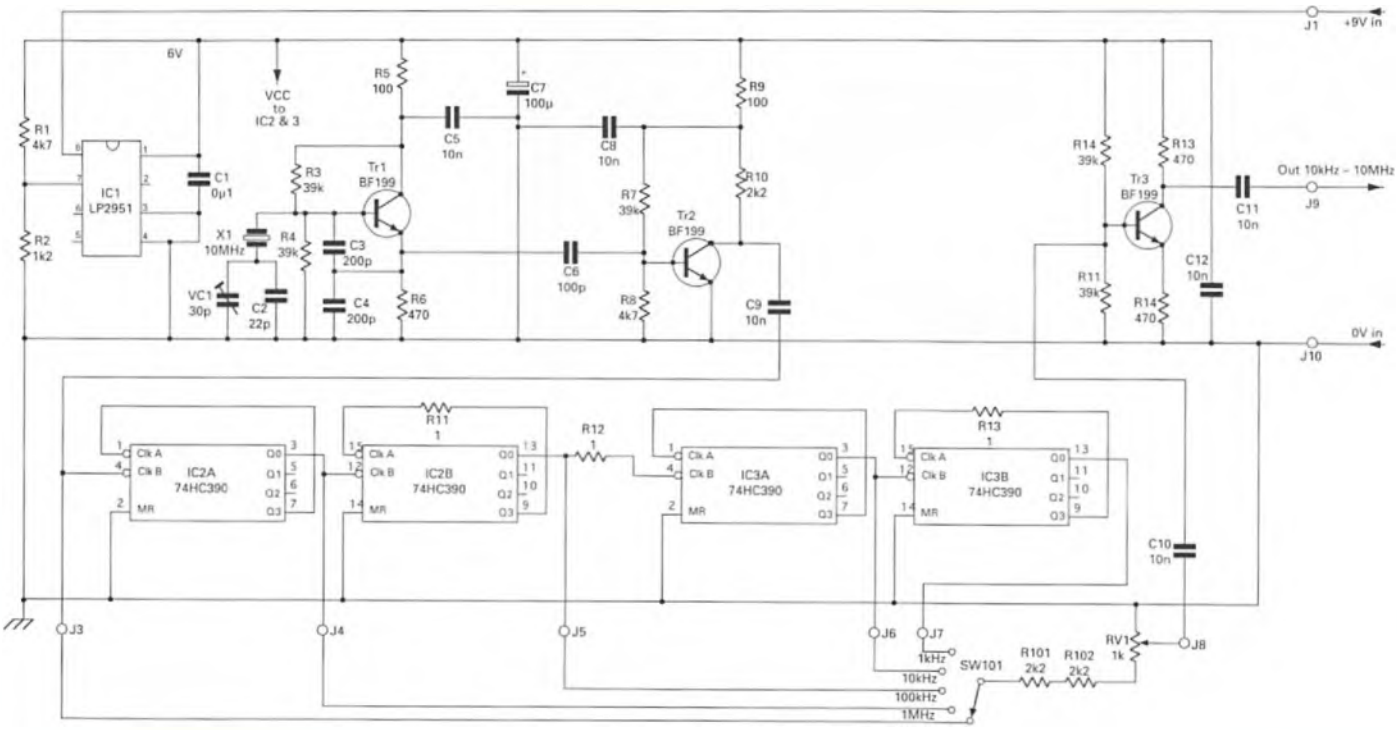


Fig. 7: Circuit of final version.

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

CNC Produced Printed Circuit Boards

One of Colin Redwood's friends has recently purchased a CNC Router to make printed circuit boards. So this month, Colin is handing the What Next author's spot to Paul Warman GOODP to tell readers of his experiences.

Fig. 1: Unpacking the CNC machine.

There are a number of ways of producing printed circuit boards (PCBs): photo-etch techniques, painting tracks and then etching with ferric chloride solution, 'dead-bug', Manhattan or 'island' techniques.

With the advent of 'cheap', small, Arduino-based computer boards, coupled with readily available external device control circuits, the commercial world of computer numerical control (CNC) machines has become more affordable and opens up a different way of producing PCBs. This article aims to uncover some of the mystique of this 'world' and highlights the pros and cons of setting up a small hobby CNC machine for PCB production. It is only fair to point out that I am still very much a novice – after a few weeks of study there are lessons I still have to learn!

Taking the Plunge

A quick search on one of the purchase sites (AliExpress.com, Banggood.com, Ebay.com) will reveal many CNC machines being sold by a variety of merchants. Use the search criteria '***CNC machine pcb***'. Over the years, I have purchased many items this way from China and have never had a problem; you'll see that the sites offer a very good satisfaction guarantee.

In making my choice I wanted a CNC machine that was both within my budget and had a reasonable work-area. The machine's name often conveyed the size, the model 2418 being 24cm by 18cm was my choice. Watch the prices for a week or so and you'll see that several merchants periodically offer substantial discounts. I waited too long for one machine, missed the discount so e-mailed the merchant whereupon they promptly reintroduced it at the discounted price!

YouTube

I've found YouTube videos on the subject extremely useful and have included a small selection in **Table 1**. The videos started to give me an understanding of the technology and I urge readers to thoroughly research the topic before making a purchase.

Extras

Although the machine was bundled with some standard router bits, I ordered a number of drill bits and some milling cutters too. I also included in my purchase a 2500mW laser option. This is not sufficiently powerful to 'burn' the copper but I have seen videos of using the machine to burn away paint from a spray painted board and then etch the exposed tracks in the traditional way with extremely good results. I figured if I couldn't make a success of the cutting process, at least I'd have a back-up method. Finally, I ordered the ER11 chuck option with a standard 1/8in chuck. It added a few more dollars but I'd caution against skimping here; tool change becomes much quicker.

That was it – a few buttons pressed and promised delivery by DHL in 10-14 days. Delivery took just over five days and included on-line tracking.

Unpacking and Assembly

I pressed the kitchen table into action and quickly unpacked the box contents, **Fig. 1**. I don't think I was quite expecting so many parts. It took me back to the Meccano days of my youth.

I quickly found the mini-CD and loaded

Table 1: YouTube Links

https://youtu.be/z_v3WOBekdg	Great double sided work. No narrative
https://youtu.be/XDCu3cgOjCY	OpenCNCPilot – used to correct Z axis – thru uneven PCB thickness
https://youtu.be/5-MLEEphX2k	Levelling the sacrificial work-surface – no narrative.
https://youtu.be/0xVSntT4c58	2500mW Laser work, drawing butterfly on wood.
https://youtu.be/11HUw2CCmCQ	Autolevelling with grblControl.
https://youtu.be/tK5Amg-Ye58	Autolevelling with grblControl (slightly better video).
https://youtu.be/gpzLhL944-U	Using a Laser to burn spray paint from pcb
https://youtu.be/DVKAV7udp3Y	Setting up PCB_GCODE

it in my Windows 10 computer to check the files included. I cannot comment on machine compatibility with other operating systems. The folder labelled 'Assembly Instructions' with '2.5.02 Assembly instructions.doc' looked promising and printing out the 10-page document gave me a set of step-by-step plans. I'd emphasise plans rather than instructions. Much is left for you to deduce but with great care and attention it shouldn't prove too difficult. Having said that, I found myself in 'I know better' mode several times only to have to unscrew the parts and start that bit again after thoroughly examining the plans. The only tools needed to assemble the router are a screwdriver, an Allen key and a ruler marked in millimetres to accurately position brackets in the correct place along aluminium slots.

The complete build took me a day, and careful alignment of the parts probably the same again. I would say alignment is critical because any unevenness here will cause strain on the stepper motors and presumably shorten their life. Some of the corner pieces had slight moulding protrusions that I smoothed out with a small file, **Fig. 2.** .

I found that some of the nuts on the CNC machine worked loose with the vibration. Once you're happy with the mechanical alignment, it might be prudent to use Loctite glue on them.

Connections

I connected up the bespoke Arduino control board, which comes preloaded with a program, GRBL version 0.9j. This was straightforward. There are three stepper motors for the x, y and z axis and three identical 4-wire cables. The CNC motor has a separate red/black cable to the control board and there are side sockets for the 24V power supply (provided) and USB2 connection to your computer. I decided on using a small extension socket here and secured it to the side frame of the machine. Miniature USB sockets are, in my experience,

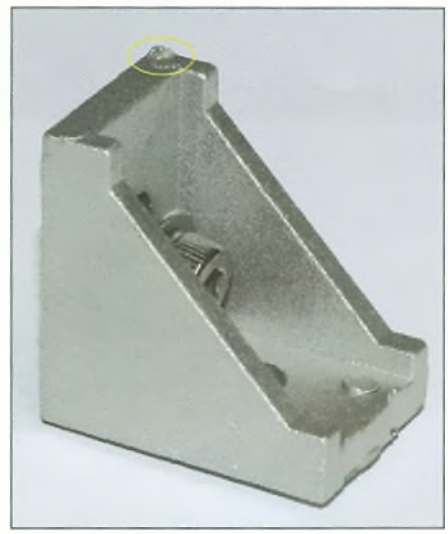


Fig. 2: Smoothing out the protrusions.

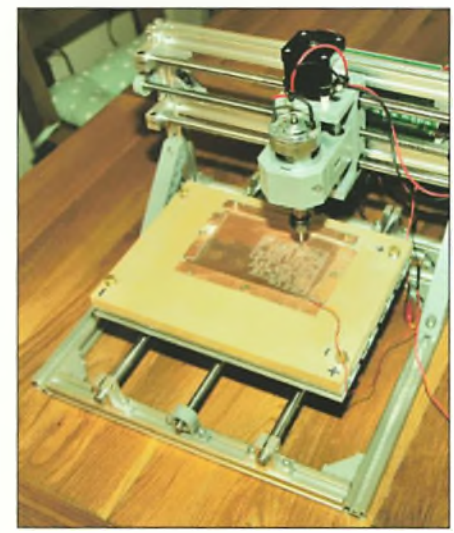


Fig. 3: The completed CNC machine.

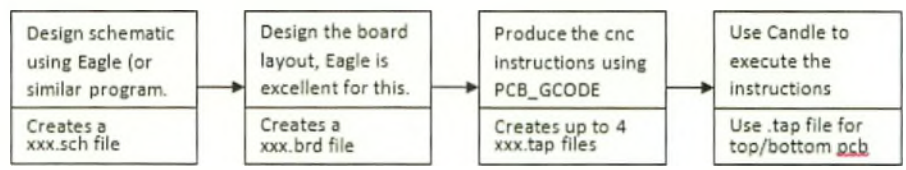


Fig. 4: The overall process.

quite flimsy and could prove a source of problems. I'd suggest making some sort of case to enclose the control board to prevent accidental damage – I've been 'eyeing-up' one of my wife's 'Tupperware' containers for the job (shhh!).

Power supply to the router is by means of a mains power supply unit, which can operate with 100/120V 60Hz or 220/240V 50Hz mains. The one supplied with the router kit came fitted with an American standard mains plug, which I replaced with a UK-standard fused mains plug top.

How Do You Make It Work?

If I thought assembling the machine was tricky, the next stage of actually operating the CNC machine and getting it to do useful work proved a real challenge and one I'm still trying to perfect. What follows will give readers an overview of my findings.

To summarise the overall process, we have to get from a schematic design (circuit diagram) through to a completed, drilled and etched, circuit board, **Fig. 4**.

Eagle

I used the Eagle program to both design the schematic diagram and then from that produce a board layout. After two weeks of hard slog (for me) I mastered the program and can now complete these stages reasonably quickly. A free version of Eagle along with many component libraries can be downloaded from: www.autodesk.com/products/eagle/overview

There are restrictions on board size (80sq.cm) but most of the functions you require are free, including a certain amount of automatic board layout, although I prefer to do this manually. Again I'd emphasise double-checking the schematic drawing and your subsequent board layout very carefully. Check three times and produce once!

You'll also need to download a User

Library Program (ULP) for Eagle called PCB_GCODE to produce the CNC machine instructions (GCode). I used version 3.6.0.4 of PCB-GCODE, stated to be for Eagle version 5 and 6 but which proved perfectly happy with Eagle version 8.1:

http://pcbgcode.org/list.php?12

Open the downloaded .zip file and copy pcb-gcode.ulp and PCB-gcode-setup.ulp to a folder you can easily refer to. Finally, from within Eagle with your board layout open and visible, click on **File**, then **Run ULP**, then find and select pcb-gcode-setup.ulp that you have just downloaded.

There is an excellent, albeit fast paced, YouTube video that describes the various parameters you'll need to set up in this program: thickness of copper layer, thickness of laminate, tool width and the like. I'd urge readers to watch this carefully, pausing at various stages to take notes. Much may be confusing at first but you'll soon get the hang of it.

https://youtu.be/DVKAV7udp3Y

Double Sided

When you are happy with the set-up parameters, press 'Accept and Make my Board'. Then, depending on the complexity of your board and the speed of your computer, you'll wait a 10-30 seconds and a top and bottom layout will be produced by Eagle, **Fig. 5**, along with two files (single-sided board) or four files (double-sided board), **Fig. 6**.

GCode

Older readers may remember the television programme *The Golden Shot* with **Bernie the Bolt**, where a blind-folded chap had to aim a crossbow and then shoot it at a target while being given instructions by a contestant….. *"up a bit, left a bit, down a bit, down some more,…. FIRE"*. I found it helpful to think of GCode as those instructions to the CNC machine. The instructions are sent to the machine over a serial/USB connection by a program called grblControl (on the CD) but I'd recommend upgrading to Candle version 0.9, as it seems to work better:

https://github.com/Denvi/Candle

Candle

The Candle program provides several primary functions. It sends the GCode to your CNC machine and shows you the progress against an image of the intended cuts. It also gives you direct control of each stepper motor and the tool, so you

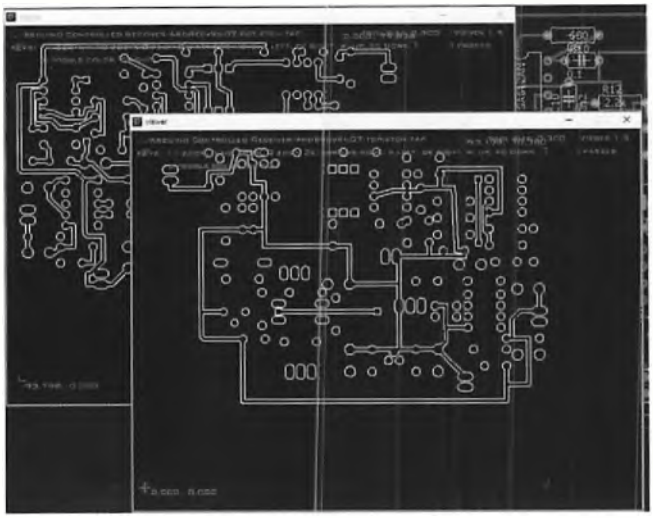


Fig. 5: Board layout – 'Etching' path from Eagle.

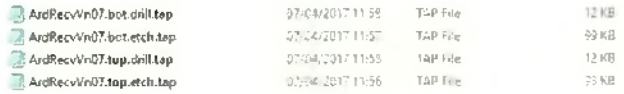


Fig. 6: GCode '.tap' files.

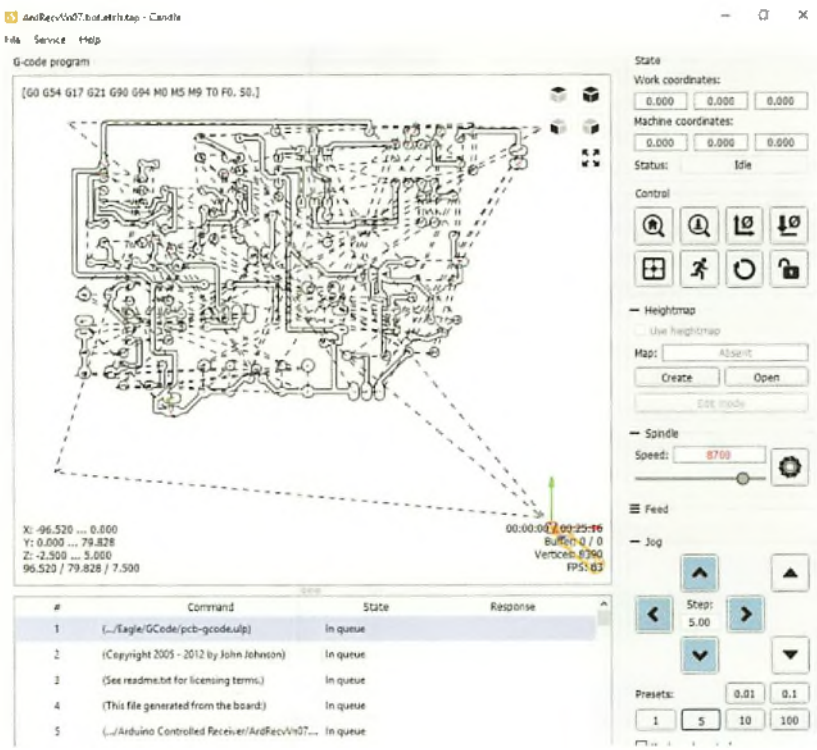


Fig. 7: Candle screen.

Table 2: Some examples of code from the .bot.etch.tap file produced by the pcb-gcode-setup.ulp program.

Code (.bot.etch.tap file)	Action by CNC machine
G21	Interpret following instructions in Metric
G90	Use addresses below relative to x=0,y=0
G00 X0.0000 Y0.0000	Use rapid positioning of the tool
M03	Start the tool motor.
G04 P3.000000	Dwell interval (not sure this is needed)
G00 Z3.0000	Lift the tool 3mm high
G00 X-32.3557 Y39.4422	Go to this relative position
G01 Z-0.1778 F76.20	Lower the spinning tool to −0.1778mm
G01 X-32.2066 Y39.5418 F254.00	move the cutting tool to this new position,
G01 X-32.0410 Y39.6104	then this position,
G01 X-31.8651 Y39.6454	then this position, all the time cutting below surface.

Connecting Normal opened (NO) end switches to Woodpecker PCB with GRBL v1.1 or later

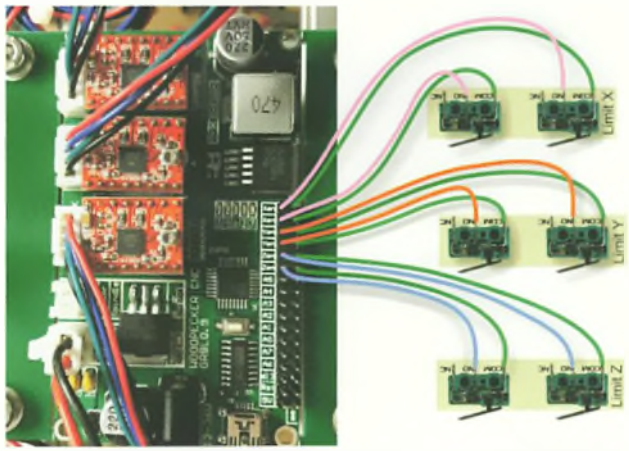


Fig. 8: Limit detection switch connections.

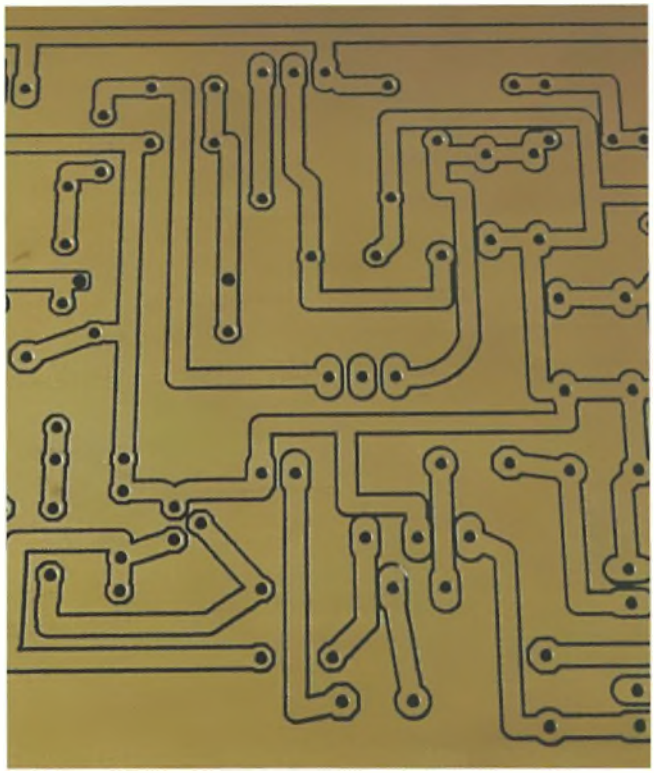


Fig. 9: An 'etched' and drilled PCB – note the gaps between the copper islands produced by the router.

can move the tool in any direction, **Fig. 7**.

Although it is beyond the scope of this article to provide a full course on GCode, I think readers would find it helpful to gain a basic understanding of some of the functions because it may help unravel problems if your machine starts doing strange things.

Look at the first few instructions, **Table 2**, taken from the .bot.etch.tap file. All of this is produced by the pcb-gcode-setup.ulp program.

Calibration

Copper laminate board, at least the stuff I buy, isn't of uniform thickness and this, combined with any imperfections of the sacrificial medium density fibreboard (MDF), that you'll need to supply, give rise to tiny 'hills and valleys' across the copper. You won't notice these with the naked eye but consider you're cutting the copper to a depth of a few thousandths of a millimetre to create an insulated gap between two copper islands, so there is a need for great precision. If it isn't cut deep enough, then there will still be an electrical circuit between two copper islands. Hence the need to measure the true depth to the copper at various positions across the board and modify the standard cutting (etch) depth (the z axis) accordingly.

The Candle program has a function to do exactly this. You will need to connect a signal wire to pin A5 on the controller board with a crocodile clip to the tool bit. The other part of the circuit is completed by connecting another signal wire between the controller ground and the PCB copper surface. Candle then has a function that will sample a matrix of points across your PCB and modify the z-axis accordingly.

Safeguards

Returning to the Bernie the Bolt analogy, there were safeguards in place to stop the blindfolded Bernie firing his crossbow at the audience and camera crew. With the CNC machine as supplied, no such safeguards are included. If you send instructions to move 3m to the right, the Arduino controller will pass these to the stepper motor and the result will be a loud crunching sound as the motor strains against the sidewalls. Equally, instructions to drill to subterranean depths will also be blindly obeyed!

Fortunately there is a solution. The Arduino and its firmware, grbl, provide for the detection of six limit switches, two for each axis, x, y and z on pins labelled Xen, Yen and Zen on the controller board. I haven't implemented these yet so I can't recommend the best positions for the microswitches but with some ingenuity it should be accomplished easily. I would advise great caution in positioning the growing number of wires connected to the controller board. Given the moving parts, it would be easy for the wires to become trapped and pulled from their sockets at precisely the wrong time – yes, it's happened to me! **Fig. 8** shows the connections of the switches to the controller and it is described within this internet correspondence:
https://github.com/gnea/grbl/issues/123

Safety Considerations

The bits supplied with the router are very sharp, so you'll need to be careful when handling them to insert them into the drill motor. When drilling PCBs, be careful not to breathe in the dust, particularly if you are drilling glass fibre boards. I would suggest wearing a suitable facemask.

Conclusion

I hope readers find this article useful. Out of necessity it skims over the surface of the subject and doubtless misses much. I'm enjoying using the machine and when I get things right it's immensely satisfying completing a design in Eagle and producing a neatly finished and drilled board in a very short time, **Fig. 9**. Of course, if you require more boards it'll take just a few more minutes with no messy chemicals but it will not stand up to any sort of commercial use.

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

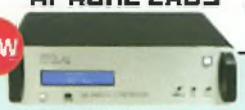
- HF/50MHz 100W SDR Transceiver

GENEROUS PART EXCHANGE on your old radio

£3599.95

APACHE LABS

NEW



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

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

ACOM

NEW ACOM A600S - Just Arrived!

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

~~£2399.95~~ **£2289**

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

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

Call for other Elecraft accessories

STEPPIR Antennas

2 Element Yagi	(20-6)m 3kW	£1548.95
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

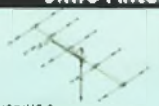
CREATE Japanese High Quality!

Rotators

RC5-1
Medium Duty
£509.95

Rotators		
RC5-3	Medium Duty Plus	£609.95
RC5-83	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

SIRIO Antennas



SY50-5
5 element
50MHz 10.5 dBi
£129.95

HF/VHF/UHF Beams		
SY50-3	3 el 50MHz 8.5dBi	£99.95
SY68-3	3 el 70MHz 7dB	£79.95
SY27-3	3 el (26-28)MHz 10.65 dBi	£84.95
SY27-4	3 el (26-28)MHz 13.15 dBi	£99.95
SY-400	6 el 70cms (wide band) 11.0 dBi	£79.95
WY-140	3 el 144MHz (wide band) 10.5 dBi	£89.95
Base Antennas		
SA-270LN	Dual Band 5.35/7.95 dBi 2.79m	£99.95
Mobiles		
HP-2070R	Dual Band 1.00m	£34.95
HP-2070H	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-40AL Ultra-lite Expedition antenna
Dipole covers. 40, 20, 17, 15, 12, 10.6m..... £109.00

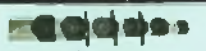
Fibreglass Telescopic Poles

12mtr Heavy Duty	£99.00
18mtr Standard	£299.00
22m 'Long John' NEW	£399.95
26mtr Standard	£499.95
Base Plate for Fibreglass Poles	£28.95

Aluminium Telescopic masts

10.metre Standard	£279.95
10 metre Heavy Duty	£299.95
12.5 metre	£319.95
14.5 metre Heavy Duty	£399.95

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

MOSLEY Antennas

New shipment just arrived!

TA-33MWSP	3 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 (14,21,28MHz)	£399.95
TA33JR	3 el. Beam (14,21,28MHz)	£549.95
Mini 33AW	Compact 5 Band Beam	£699.95
RV-6C	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

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

PSW-50 Switch Mode

- 50A (max) with meter
- Voltage: 9.0-15V DC
- Cigar adaptor output

£129.95

PSW-30 Switch Mode

- 30A (max) with meter
- Voltage: 9.0-15V DC
- Cigar adaptor output

£79.95

PSW-30H Switch Mode

- 30A (max) with meter
- Voltage: 9.0-15V DC
- Cigar adaptor output

£69.95

PS23-SW1 Switch Mode

- 23A (max)
- Voltage: 13.8V DC
- Lightweight: 1.6kg

£59.95

PSW-07..7A (max) 13.8V DC switch mode..£29.95
PSW-04..5A (max) 13.8V DC switch mode..£24.95

ALINCO

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

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

DX-SR9

HF Transceiver + SDR capability

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

£599.95

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

DM-330FXE

Communications grade 30A Power Supply Standard version

- Low Noise - Switch Mode
- Patent noise offset circuit
- Voltage & Current meter
- Variable Voltage output
- Car Cigar socket output
- 2.5kg (with AC lead)

£119.95

DM-330MWMkII

Deluxe version
Spec as above with extra filtering

£129.95

DM-30E

Lightweight Switch mode power supply

- Output: 9-15 Volts
- Digital Volt/Amp meter
- Noise offset circuit
- Triple protection circuits
- Weight 1.6kg

£89.95

More Alinco

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

ALINCO

DJ-MD40

Digital/Analogue UHF Handheld

- DMR tier 1 & II
- Power: 5/2.5/1/0.2W
- 1000 memory channels

- Voice recorder • Call logs • Text messages
- Scan facilities • IP54 Commercial Grade
- Free programming for your area...plus lots more!

£179.95

DJ-V57

VHF/UHF Handy

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

£129.95

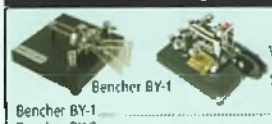
INRAD

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		£189.95
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

Purchase with the INRAD RX-7300 2nd RX antenna option at £49.95 and we will fit FREE OF CHARGE!

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 transce ver	£829.95
IC-7410	HF+6m 100W DSP Base TX + ATU	£1449.95
IC-7600	HF+6m twin DSP base transceiver	£2599.00
IC-7851	HF/6m all mode, output: 5-200W	£9999.95
IC-9100	HF+VHF+UHF transceiver	£2699.00
IC-2730E	145/433MHz large screen	£269.95
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
UT123	DigitalGPS unit E7820 etc	£249.95
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
SP34	Filtered speaker 7800/7700 etc	£239.95
IC-R6	1300 ch H/H scanner 1-1300MHz	£209.95
HM151	Multi-function hand microphone	£49.95

INRAD RX-7300

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

Easy to install plug-in mod, requires no soldering, simple to instal and easily reversible. Can be used for the insertion of accessory items into the receiver chain, like receive-only 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 2kW differential antenna tuner
Covers 6-160m
Output: 2000W PEP
Metering: Active cross needle
£579.95

AT-500 600W PEP manual antenna tuner
SAVE £30
Covers 6-160m
Built in 4:1 balun
SPECIAL OFFER!
~~£529.95~~ **£499.95**

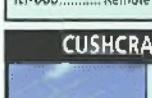
AT-5K	3.5kW manual tuner	£1249.95
AT-4K	2.5kW manual tuner	£1024.95
AT-2KD	2kW Differential manual tuner	£599.95
DL-1500	1500W high power dummy load	£199.95
BK4C/1:1	4kW 1:1 ratio current balun	£99.95
BK4C/4:1	4kW 4:1 ratio current balun	£99.95

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



A50-5S
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
MA5-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 + SP10 Speaker
- 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		£3399.00
FT991A	160-6m Transceiver	£1299.95
FT857D	Multiband HF/VHF/UHF mobile	£699.95
FT817ND	All mode multiband portable	£529.95
FT450D	100W all mode HF/6m+ATU	£599.95
FT891	Mobile	£599.95
FT7900E	Twinband 145/433MHz mobile	£229.95
FT1DE	Ipx5 digital handy	£269.95
FT2DE	C4FM/FM 144/430MHz digital H/H	£399.95
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 145/433MHz handy	£159.95
G2800DXC	Extra heavy duty rotator	£899.95
G5500	Azimuth/elevation rotator	£644.95
G1000DXC	Varispeed heavy duty rotator	£489.95
G450C	Rotator + 25m cable kit	£389.95
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!

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	£89.99
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	£89.99

TYT - UHF DMR Radio!

MD-380
- 70cm UHF band
- 1W or 5W output
- 1,700 mAh Li-ion battery
- Easy to programme
- Includes FREE lead and software

~~£149.95~~ **£129.95**

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

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 mob le/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 transceive	£1279.95
TM-V71E	Twinband 145/433MHz with APRS	£299.95
TM-281E	High power 2m 148MHz 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 Analyser	£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 Tuner 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	£149.95
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 Tuner 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	Noise canceller/signal enhancer	£209.95
1026	QRM eliminator + 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 (P)	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
1706	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	£64.95
1799X	9 Band vertical	£479.95
1868	Discone antenna with cable	£94.95
2980	Wire vertical (40m-6m)	£99.95
4416B	Super battery booster	£174.95

Nevadamasts

NEW RANGE

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

SDRplay

RSP-2
Enhanced SDR receiver
- Covers: 1kHz (VLF)-2GHz
- Supports HF & VHF antennas 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

1kW - End Fed Wire Antennas

MyAnt EFW 80-10
Resonant on 80/40/30/20/17/15/10m. NO ANTENNA TUNER REQUIRED! Length: 130ft
£159.95

MyAnt EFW 40-10
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 £19.95

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
GP98	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 Needle	£199.95

Accessories

CBL-2500	Balun 2.5kW (CW) 1.8-56MHz	£44.95
CBL-1000	Balun 1kW (CW) 1.7-30MHz	£39.95
CF-30MR	Low Pass Filter 1.8-30MHz 1kW CW	£59.95
CF-360A	Duplexer 1.3-30/49-470MHz	£49.95
CF-4160B	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: pw@pwpublishing.ltd.uk

PW Interview
RSGB Director, Steve Hartley GOFUW

The RSGB recently launched its 5-year strategy, a blueprint for the years to 2022. Some PW readers will read about it through the pages of RadCom but we felt it important to bring it to our readership as a whole, given that what the RSGB does has a significant impact on UK amateur radio.

PW: Steve, first of all how come you are no longer the RSGB Chairman?

My three-year term as a Director came to an end in April and I was unable to commit to another three years so I could not continue as Chairman. I have been co-opted back onto the Board to complete a couple of projects, including managing the next stage of the strategy development.

PW: Fine, so tell me why the RSGB needed a new strategy.

The previous strategy was developed around 2011 in a rather different climate and the world has moved on. The RSGB is in a much stronger financial position and is looking forward to where it would like to be in another five years' time.

PW: How did you set about reviewing the strategy?

First of all we sought professional advice. All of the Directors have some experience in business, as well as being radio amateurs, but none claim to be experts in strategy development. Luckily, member ***Chris Deacon G4IFX*** *makes a living doing exactly that and he answered our request for help. He freely gave up his own time and guided us through the process and we are really grateful to Chris for that. In essence we started from scratch, asking basic questions about why we exist, what we are trying to achieve, and so on. We looked at surveys and feedback to determine what we were seen to be good at and what we needed to do better.*

PW: Was it just the Board Directors doing this work?

Far from it, the Board took its ideas out to the Regional Council, the Committee Chairs and Headquarters Staff and once we had consolidated that work, we consulted via a web-survey, which attracted hundreds of responses. Some of those responses were extremely helpful and the final strategy included some fine-tuning using input from the consultation.

PW: You say some of the feedback was useful but was it all positive?

No but the draft strategy was supported by around 90% of the respondents, which was really encouraging. There were some very negative comments, mainly relating to things that happened in the past. In one case the respondent cited something that happened in the 1970s as a reason for never re-joining the Society. I would encourage ex-members to look again at what is on offer now and look forwards not backwards.

PW: Tell me more about the strategy itself.

It has four main parts: Purpose, Values, Goal and Priorities. The purpose was very hard to pin down because the Society has many strands to it but we believe the statement does capture the essence of what we are about. The four values are the things radio amateurs hold dear or maybe what makes amateur radio special. The goal is a clear statement of where we want to be in 2022 and the priorities are the eight things that we believe will get us to that goal.

PW: Seeing it set out on a single side of A4 does not allow for much detail. Is this all consultant speak and fine words that will never see any action?

If it is, we have failed miserably. You are right, there is little detail, but that is the nature of a strategy. Did President Kennedy say how the USA would put a man on the moon? No, the detail followed the big idea. Following the launch of the strategy at the AGM in Cardiff we are working with all the various parts of the RSGB, volunteers and paid staff, to identify what we currently do that will deliver the priorities, where there is a need for new projects/initiatives and, maybe, what we stop doing. So you will start to see reports of things happening in the not too distant future.

PW: What do you see as the biggest challenge in making it happen?

There is no doubt that we need members

http://rsgb.org/main/about-us/board-of-directors/rsgb-strategy

to get involved. The vast majority of the RSGB's work is done by volunteers and we are always on the lookout for new people to join in. It was great to see four candidates competing for one Director post this year, especially as none of them had served on the RSGB Board before. That is not to say we do not welcome returning volunteers but there is a view out there that the RSGB is some kind of 'London old boys club' with the same folk being elected over and over again. That ***Sara McGarvey 2I0SSW*** *was elected as a Director shows there is an appetite for change.*

PW: How will you know if the strategy is working?

The various projects and initiatives will be captured in the Operational Plan and the Board will be monitoring progress. Should something happen that we did not foresee, the Board may need to take action but that is what any good management team does, isn't it? If we can sit here in 2022 with amateur radio still going strong, with lots of activity on the bands and the RSGB supporting further development, that will be a pretty good indicator that the strategy has worked.

PW: Is there a website where readers can find out more?

Isn't there always? (See the URL above – ed.) *But if you pop in 'rsgb strategy' to your favourite search engine it should be close to the top of the list. And look out for the RSGB Strategy 2022 logo that will identify events, articles, reports that go towards implementing the strategy.*

PW: Thanks for your time. It's great to have an overview but I feel sure our readers will be watching carefully to see how this all plays out in practice. I suspect we all share the same desire, which is to see the hobby survive and prosper. Perhaps we can revisit this topic from time to time to check on progress!

RSGB 2022 Strategy

Radio Society of Great Britain

Advancing amateur radio since 1913

OUR STRATEGY 2017–2022

Our purpose – why we are here
The RSGB exists to protect, promote and enhance the use, understanding and enjoyment of wireless communication.
Our values – the things that underpin everything we do
Enjoyment – of learning about and using wireless communication
Progression – through life-long learning, experimentation and the use of new technology
Community – of diverse but like-minded people where there is mutual respect and strength in numbers
Service – delivered with honesty, integrity and reliability by volunteers and staff
Our goal for 2022 – where we want to be
To have an active and thriving amateur radio community, supported by a strong, representative and influential RSGB.
Our strategic priorities – how we will reach our 2022 goal
Growth – grow and develop amateur radio
Spectrum – maintain and enhance radio amateurs' ability to use the radio spectrum
Participation – support and encourage active participation in amateur radio
Research – promote active involvement in research and technical development
Diversity – encourage and respect the full range of amateur radio activities, in all its diversity
Membership – increase the proportion of radio amateurs who are members of the RSGB
Recognition – support, encourage and recognise our volunteers and staff
Organisation – ensure that the RSGB is an effective, efficient and flexible organisation that works with and listens to our members, clubs and special interest groups to meet the changing needs of the amateur radio community

Footnote: The RSGB represents radio amateurs within the United Kingdom of Great Britain and Northern Ireland, the Channel Islands and the Isle of Man, both nationally and internationally.

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

Memories

Dear Don,
This month's (May) *PW* was ideal reading. In particular, **Ben Nock G4BXD's** feature on KW sets of bygone years brought back many memories. I started in amateur radio in the early 1960s as an interested enthusiast while still at school. I enjoyed science very much and it became my best subject.

I left school after passing the Royal Society of Arts School Certificate in General Science. When I started work, I was very fortunate that across from my work was an amateur radio emporium so that's where I spent my lunchtimes. I got the 'bug' as you might say. I wanted to know more about this new world at my fingertips and, in time, bought an ex-RAF receiver for £9, the R107, a very good radio for the beginner to access the amateur bands and other frequencies. I used to listen to the Trawler Band on 2MHz by way of Humber Radio, which was located at Trusthorpe on the East Coast. There were others such as Niton Radio, Cullercoats and Scheveningen Radio on the Hook of Holland – all very interesting to the new shortwave listener.

Many of my amateur radio friends used the KW range of equipment for both fixed station and mobile work, mainly the KW2000A as I recall. I also remember the KW600 linear amplifier. For mobile operation, the majority used base loaded whips, which were very effective on the 160m band, although 80, 40 and 20m were also popular for mobile work.

It's really good to see high quality photographs of this early equipment. Many amateurs at that time also constructed their own equipment (separate transmitter and receiver) with homebrew antenna tuning units feeding longwires or dipoles as base station antennas. The most popular HF Yagi was, as I recall, the Mosley TA33 3-element Yagi, typically on a 30ft lattice mast.

Those were very exciting days for a newcomer to the hobby, starting with a crystal set, then the R107 and passing the Radio Amateurs Examination some 20 years ago. At the moment I run an Alinco DX70 to a home made centre-fed dipole for HF and a loaded discone for 6m. I also have an AR88 receiver built by RCA in the 1940s – it weighs a ton!
Martin Briddon M1ANW
Chesterfield, Derbys.

Editor's comment: *Careful Martin, you're in danger of getting me started on my own nostalgic tack! I started by broadcast station DXing (thanks to a friend at school whose father had bought him an AR88 from a local surplus shop). I built a Codar Mini Clipper one-valve regenerative receiver, which used plug-in Denco coils, then inherited an old broadcast receiver from my grandparents that also had Trawler Band, where I discovered amateurs using AM. I too was hooked and my next construction project was a Lafayette KT-340, which worked reasonably well when aligned (thanks to the amateur who was to become my mentor,* ***Dave Sellars G3PBV****). I was living in Northampton at the time and there were three radio clubs, all with stations accessible to local amateurs – the Northampton Radio Club (still around) and ones at British Timken (who manufactured bearings) and Paignton Resistors (later part of Plessey). And I do recall those topband mobile setups – it was always entertaining to go to the mobile rallies at places like Woburn and Longleat and see the amazing mobile antennas for 160 and 80m. Anyway, enough, but I know many of us recall those years with affection.*

In the Shop & AM

Dear Don,
As always, I look forward to reading **Harry Leeming's** meanderings, if only for their nostalgic value. He always manages to bring forth some tales about this or that amateur radio gem that once upon a time I owned, repaired or got rid of (but in hindsight, wished I'd kept) because the 'newest-kid-on-the-block' radio looked better and did more amazing tricks than my previous one.

In his April article, Harry mentions that, *"you turn the tap on and clean drinkable water appears"*. Now, I wouldn't dare to disagree with him on his skills with a soldering iron or his considerable acumen in curing the most elusive electronic equipment fault but perhaps he would like to know that almost all drinking water that appears out of a tap is compromised with pharmaceutical residues. Without going into specific details here, these chemical residues include benzodiazepines, various forms of tranquillisers and so on. The complete list is a long one.

So, with respect, maybe one of my favourite authors should desist from drinking tap water from any UK tap? Depending on the manufacturer, bottled water is safer. After all, I'm sure we all want Harry to carry on producing many more of his excellent articles well into the future!

On another subject, I have just caught up with reading **Eric GW8LJJ's** *A Return to AM*. Then I had a brainwave. Why not embrace another large dollop of nostalgia? But this time, I thought I'd revive the calling channel on 2m FM – 145.500MHz. You never know, doing so might just start a new trend. After all, for all us oldies who may have a stack of analogue 2m rigs gathering dust in the loft, it might be a way to bring them back to life again. Perhaps relive all those marvellous memories of yesteryear when 145.500MHz FM was the place to be.

So, in that regard, each morning between 8.30 and 9.30am I put out a call on the 2m FM calling frequency. To date, I have been greeted with an eerie silence. But I won't let that disappoint me because I'm sure that sooner or later someone will hear my plaintive CQs and put me out of my misery. Here's hoping.

And lastly, the 'End of Amateur Radio'. What? Perhaps **Paul Burgess G3VPT** (*Letters*, June 2017) had a bad day? Or maybe that solar panel installation he refers to has clouded his judgement on this issue?

Well, he may like to know that the demise of amateur radio has been greatly exaggerated since its inception. I well remember back in the 1960s in most amateur radio magazines that amateur radio had reach its 'zenith'. That our hobby was destined to be a non-hobby within a few years and so on.

And, of course, not unsurprisingly, each and every time something appears on the horizon that might affect the long-term viability of our common hobby (such as solar panels), the doomsayers within our community predict dire consequences. Yes, I can understand why some people think this way. It is so easy to fall into the trap of your own particular circumstance.

The good news is that amateur radio will continue for the foreseeable future. But let's not confuse the constant ebb and flow of technological progress in all things electronic and digital for the end of amateur radio as we know it. After all, for all problems there is always a solution.
Ray Howes G4OWY/G6AUW
Weymouth

Loop Antennas

Dear Don,
The only time I had experience with a loop antenna was the Bellini-Tosi loops when I was at sea – we used them for Direction Finding (DF). For HF working I use a longwire. Due to there being a restriction on antennas at my location, given that the Foreign Office spent so much time showing us how to conceal antennas when my intake were instructed on the Mark 123, it seemed a shame to waste that training. As a result, my 23m wire is hidden along the inside edge of the outermost part of my plastic gutters. It works fine – a couple of

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**

Amateur Radio and Hearing Loss

£20 STAR LETTER

Dear Don,

I read **Harry Leeming G3LLL's** comments in the June issue with interest. I have had poor hearing (and tinnitus) all of my life. In spite of very sensitive low frequency response, my high frequency response has never been above about 4kHz, even when a child. Now my hearing tails off between 1 and 2kHz. So two years ago I saw an NHS audiologist and had my first hearing aid for my worst ear.

This helped but I found that I could still improve SSB intelligibility on my FTdx1200 by using the contour control. The front panel control allows a centre frequency to be picked while two menu settings allow adjustment of the bandwidth around that frequency and whether you lift or cut those frequencies. I found, by trial and error, that for me, lifting frequencies around 1.5kHz helped enormously. On a follow-up appointment with the audiologist I explained what I had done and asked if extra lift might be programmed in to the hearing aid at 1.5kHz, which he did. I've found it quite beneficial.

However, my second area of experimentation has been with our two TVs and car audio systems, which are all programmable for bass and treble. What I found was that cutting the bass, rather than lifting the treble, was even more beneficial to intelligibility. I revisited the FTdx1200 contour settings and now cut the frequencies around 500Hz, which has proved better.

I hope this encourages more hard-of-hearing amateurs to experiment a bit. By the way, I use an infrared hearing loop system on my main TV to put the sound directly in to my hearing aid and it works brilliantly. Also, simple round-the-neck loops were made for the Olympic audiences in 2012 and the surplus units are available on eBay at about £15, around half their initial retail price. I saw some (brand new) at a recent rally for just £1! These just plug into any 3.5mm stereo audio jack and work reasonably well, putting the signal direct to the aid. Like Harry, I don't know why hearing aids are so expensive if you go to the high street for them. The digital NHS ones are good, free and are now fairly small.

John Adams G3ZSE
Kettering, Northants

The Star Letter will receive a voucher worth £20 to spend on items from our Book Store or other services offered by *Practical Wireless*.

years ago I worked South America but poor propagation has stopped that although I have received non-directional beacons from Buenos Aires on HF a few times but they are using a lot of power.

On medium wave (MW) the band was a bit noisy on this antenna so I obtained an Eton AN 200 loop, a small loop antenna only 9in in diameter. This cleared up the noise problem.

However, I often listen to Navtext on 518kHz. It was good a year or so ago but conditions now mean I cannot get a good copy and sometimes cannot even hear stations like Niton Radio, which is only 88 miles away. With the Eton loop, however, I get solid copy of Niton and at night time can receive Ostend, Hamburg, even Cullercoats Radio and last night Rogaland (Norway), which is 705 miles away. So a loop antenna can improve your MW and Navtext reception, even a tiny loop like the Eton AN 200.

Ross Bradshaw G4DTD
Roche, Cornwall

Editor's comment: *Thanks Ross. Interestingly, our last talk at the Reading Club was by* ***Prof Mike Underhill G3LHZ*** *about loops. He is very much an advocate of the double-loop arrangement, which has a more appropriate Q factor and efficiency for transmitting purposes. Loops, of course, make great receiving antennas but are generally much less effective for transmitting for reasons that* ***Tony Nailer G4CFY*** *has explained in recent articles (for receiving, it's not efficiency that matters, but signal-to-noise ratio while for transmitting, efficiency is everything). As for working South America, you pretty much sum up your transmit situation when you say "a couple of years ago I worked South America ..." I'm not sure what band that would have been on but I would expect to be able to work South America pretty much any day on any HF band with a resonant dipole antenna and certainly on the 'money' bands of 20, 30, and 40m.*

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.

JUNE

June 10th (Saturday)

Antrim & District ARS Bring & Buy Surplus Sale
The Antrim & District Amateur Radio Society Bring & Buy Surplus Sale will be held at Muckamore Community Centre, Ballycraigy Road, Antrim, Co. Antrim BT41 2DH. The doors will be open between 12.30pm and 5.00pm and admission will cost £2.00. Sellers will have access to the venue from midday and tables will cost £5.00. In addition to the Bring & Buy Surplus Sale, there will be a raffle and refreshments will be available to purchase.

June 11th *** New Venue ***

The East Suffolk Wireless Revival
The East Suffolk Wireless Revival (Ipswich Radio Rally) will be held at Kirton Recreation Ground, Back Road, Kirton IP10 0PW, which is just off the A14. The doors will open at 9.30am and admission will cost £2.00. There will be free parking, trade stands, a Bring & Buy, a car boot sale, special interest groups, an RSGB bookstall and on-site catering. GB4SWR HF station will be in operation.
Kevin G8MXV
Tel: 07710 046846
www.e8wr.org.uk

June 11th

The Junction 28 Amateur Radio Rally
The Junction 28 Amateur Radio Rally organised by the South Normanton, Alfreton & District Amateur Radio Club will be held in the Bowls Hall at Alfreton Leisure Centre, Church Street, Alfreton, Derbyshire DE55 7BD. The doors will be open between 10.00am and 4.00pm. For more information, please contact the Rally Secretary
Tel: 01159 307322

June 15th (Thursday)

The SBARC Summer Table Top Sale
The South Bristol Amateur Radio Club Summer Table Top Sale will be held at Novers Park Community Centre, which is at the rear of 124 Novers Park Road, Filwood, Bristol BS4 1RN. It is described as, *"A chance to clear some items from the shack and pick up new items or fill that wish list. Please bring equipment, cash and your bartering skills."* The event is associated with a regular club night, which starts at 7.30pm and is open to all, not just club members. The sale will take place between 8.00pm and 9.00pm – no trading before 8.00pm.
www.sbarc.co.uk

June 17th (Saturday)

The SLARC Summer Rally
The South Lancashire Amateur Radio Club will be holding its Summer Rally at Bickershaw Village Community Club, Bickershaw Lane, Bickershaw, Wigan WN2 5TE. The doors will open at 9.30am and admission will cost £2.50. There will be car parking, trade stands, a Bring & Buy, displays, special interest groups, a licensed bar, catering and facilities for the disabled. A limited number of pitches will be available (£8.00 if you bring your own tables, otherwise £10.00) and stallholders will have access to the venue from 8.00am.
Jason G0IZR
Tel: 01942 735828 (Bookings)
E-mail: rally@slarc.co.uk
www.slarc.co.uk

June 18th

The Newbury Rally
The 30th Newbury Radio Rally will be held at Newbury Showground, Priors Court, Hermitage, Thatcham, Berkshire RG18 9QZ (next to M4 J13). This event is organised and run by the Newbury and District Amateur Radio Society and is themed around a 'boot sale'. The gates will open to buyers at 9.00am and admission will cost £2.50 (children under 16 free, no other concessions). There will be talk-in on S22 (145.550MHz) using GB4NR, free car parking, trade stands, a demonstration marquee (with amateur radio stations, exhibitions and special interest groups), catering and facilities for the disabled. Sellers and traders will have access to the site from 8.00am. Car boot pitches (5 x 5m) will cost £10.00 each if booked in advance or £12.50 on the day.
E-mail: newburyrally@nadars.org.uk
www.nadars.org.uk/rally.asp

June 25th

The West of England Radio Rally
The 14th West of England Radio Rally will be held at the Cheese & Grain, Bridge Street, Frome, Somerset BA11 1BE. The doors will be open from 10.00am to 2.00pm and admission will cost £3.00 (accompanied children under 14 free). There will be free car parking, full access and facilities for the disabled, trade stands (indoors and outdoors) and The Grain Café Bar will be serving hot and cold snacks and refreshments.
Shaun G8VPG
Tel: 01225 873098
E-mail: rallymanager@westrally.org.uk
www.westrally.org.uk

JULY

July 1st (Saturday)

The Bangor & District ARS Rally
The Bangor & District Amateur Radio Society Annual Rally will be held at Donaghadee Community Centre, Parade, Donaghadee, Co. Down BT21 0HB. The doors will open at 11.30am and there will be trade stands, a Bring & Buy, an RSGB bookstall, on-site catering and a raffle.
Harry Squance GI4JTF
Tel: 07775 942174
E-mail: gi4jtf@gmail.com

July 1st (Saturday)

The Houghton-le-Spring ARC Rally
The 1st Houghton-le-Spring Amateur Radio Club Rally will be held at Dubmire Royal British Legion Club, Britannia Terrace, Fencehouses, Houghton-le-Spring DH4 6LJ. The doors will be open between 10.30am and 3.00pm and entry is free. There will be trade, club and private stands. Table space is limited (and free) and will be allocated on a first come, first served basis. Refreshments (tea & coffee) will be available and there will be a licensed bar from 11.00am.
Ken M6ELL
Tel: 07951 460290
E-mail: m6ellken@aol.com

July 2nd

The Barford Norfolk Radio Rally
The Barford Norfolk Radio Rally will be held at Barford Village Hall & Green, Chapel Street, Barford, Norwich NR9 4AB. The doors will open at 9.00am and admission will cost £2.00 (under 16s free). There will be talk-in on S22, free car parking, trade stands, a car boot sale, a Bring & Buy, repeater groups, a raffle and catering will be available. Traders will have access to the venue from 8.00am. Indoor tables cost £10.00. Car boot pitches cost £8.00.
E-mail: radio@dcpmicro.com
www.norfolkamateurradio.org

July 8th and 9th (Saturday/Sunday)

The Finningley µWave Round Table 2017
The Finningley Amateur Radio Society will be holding a two-day µWave Round Table at The Hurst Communications Centre, Belton Road, Sandtoft, Doncaster DN8 5SX. The entry fee is £10.00 per day, which includes all the tea, coffee and biscuits you can consume, along with a buffet lunch. The main focus of the event will be an SMD build project, the Finningley Optical Transceiver Mkll. In addition to traders, other activities will include antenna range, demonstrations and talks on various topics. For more information, please see the Finningley ARS website.
www.g0ghk.com

July 8th (Saturday)

The LAMFEST Radio Rally
The LAMFEST Radio Rally will be held at Elsecar Heritage Centre, Wath Road, Elsecar, Barnsley, South Yorkshire S74 8HJ. Admission to the Elsecar Heritage Centre and car parking are both free. The doors will be open from 10.00am to 4.30pm. Admission will cost £2.00 and proceeds will be donated to the Yorkshire Air Ambulance. Traders tables will be provided free of charge.
Claire Marsh
Tel: 01226 361700
www.hamradio-shop.co.uk

July 8th (Saturday)

The Stockport Radio Society Rally
The Stockport Radio Society Rally will be held at Walthew House, 112 Shaw Heath, Stockport SK2 6QS. The doors will be open from 10.00am to 3.00pm and admission will cost £2.00. There will be talk-in on 145.550MHz using G6UQ, trade stands, special interest groups, an RSGB bookstall, a raffle held on the day, on-site catering and facilities for the disabled.
Heather Stanley M6HNS
Tel: 07506 904422
E-mail: info@g8srs.co.uk
www.g8srs.co.uk

July 9th

The Cornish Radio Amateur Club Rally
The Cornish Radio Amateur Club Rally will be held at Penair School, St Clements, Truro, Cornwall TR1 1TN. The doors will open at 10.30am and admission will cost £2.00. There will be car parking, trade stands, a Bring & Buy, special interest groups and catering will be available.
Ken G0FIC
Tel: 01209 821073

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, only assistance dogs.
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

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.

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.

For Sale

CTCSS ENCODER AND DECODER KITS. DTMF kits and modules. Pic development kits. https://cstech.co.uk

NEW N3 USB RTL-SDR FROM THUMBNET Optimized for low noise. Linear regulators, better decoupling, improved heat dissipation, +/-0.5ppm TCXO, 5V input etc. For more information on this, our other SDRs and accessories go to www.technofix.co.uk or 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. Our thanks for his support of *Practical Wireless* and condolences to his family and friends at this very sad time for them.

Repairs

REPAIRS TO RECEIVERS, TRANSMITTERS ETC. New/old, valve/transistor. Call 07903 023437 for details. Web: www.kent-rigs.co.uk

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/P.O. 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

KENWOOD TS-680S It is working but has some wear-and-tear £300 + P&P (£23). Tel: 07903 672035 (Cheshire)

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)

QRP OPERATORS – Limerick Sudden Z-match ATU, in mint

condition with manual £25 post paid. Tel: 07757 952703 (Kendal)

SOLDER STATION N78AR, £12, Solder station temperature controlled, £28 (Silent key sale), AOR AR-3000A receiver £60, Antex soldering iron 30W £5, Gwintek oscilloscope £60 (as new), universal receiver M-800 – offers, all plus P&P. Tel: 01697 351504 (N. Cumbria)

SONY ICF-2001D receiver in excellent condition with manual and original carry-case and strap £140 post paid. Tel: 07757 952703 (Kendal)

YAESU FT-50R, Wouxun KG-UVD1P plus extras, Samlex RPS1215 15/20A regulated power supply, Samlex SEC1223 switch-mode power supply, MFJ-948 Versa-TunerII, offers please. Buyers to inspect/collect. Tel: Geoff G4TXM 07952 547680 (Kettering)

YAESU FT-1000MP MkV, 200W – former Yaesu flagship transceiver with dedicated PSU, manual and microphone. A silent key sale, all in perfect condition £850 + P&P. But it is a heavy rig. Tel: Tony 01621 928817 (Chelmsford area)

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

CAPCO ANTENNA TUNER in good working order, your price plus P&P paid. E-mail: william.rabbitt@btinternet.com

PHOENIX TELEPHONES, anything made by this company, what have you? Tel: Godfrey G4GLM 020 8958 5113. 63 The Drive, Edgware, Middlesex HA8 8PS. E-mail: cgmm2@btinternet.com

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

PW & RU ☐

PW ONLY ☐

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)

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. Albrecht AE75H-**ED**..300ch AM/FM handheld scanner.....£89
2. Albrecht AE125H-**ED**..500ch AM/FM scanner close call.....£125
3. Albrecht AE6110-**ED**..micro-size mobile CB radio.....£49
4. Albrecht DR850-**ED**.. DAB radio with colour screen.....£75
5. Alinco DJ500-**ED**..145/433MHz twinband handy.....£89
6. Alinco DM30E-**ED**..NEW 20-30A power supply.....£85
7. Alinco DR135UK-**ED**..28MHz all modes mobile.....£149
8. Alinco DR138H-**ED**..high power 145MHz FM mobile.....£139
9. Alinco DRB185-**ED**..85w 145MHz FM mobile transceiver.....£149
10. Alinco DR638H-**ED**..high power 145/433MHz mobile.....£235
11. Alinco DX-R8E-**U**..all mode HF communications receiver.....£329
12. Alinco DX-SR9E-**ED**..hybrid SDR/100w HF transceiver.....£499
13. Alinco EDX2-**ED**..automatic HF antenna tuner.....£269
14. Antex 690D-**ED**.. pro-style digital soldering station.....£175
15. Antex TCS-**ED**..soldering iron with temp control.....£64
16. Anytone AT588-**ED**..50w 70MHz mobile transceiver.....£149
17. Anytone AT588-**U**..145MHz FM mobile transceiver.....£99
18. Anytone QHM-02-**CL**..DTMF hand microphone AT5189.....£19
19. AOR AR8200MkII-**U**..wideband all mode handheld scanner.....£295
20. AOR 8600MkII-**U**..wideband all mode scanner/receiver.....£499
21. Bearcat UBC125XLT-**ED**..500ch AM/FM handheld scanner.....£119
22. Comet CFR400-**U**.. high power 400w current balun.....£59.95
23. Eton Turbodyne Road Torq-**CL**..self powered roadside torch.....£19
24. Fody Tempus-**ED**..home weather station.....£55
25. Fody Tempus Pro-**ED**..Bluetooth (BLE) weather station.....£89
26. Icom IC718-**U**..classic 100w HF transceiver.....£399
27. Icom IC-7000-**U**..multibander HF to UHF all modes.....£699
28. Kenwood MC90-**U**..deluxe base microphone.....£145
29. Kenwood TS850S-**U**..classic HF with PSU/speaker/MC85.....£699
30. Midland Arctic-**ED**..waterproof marine handheld radio.....£85
31. Midland D200-**ED**..digital/analogue PMR licence free radio.....£125
32. Midland G7Pro-**ED**..latest style licence free handhelds.....£79
33. Midland ER300-**ED**.. handy emergency radio/flashlight.....£44.95
34. Midland M Mini-**ED**..ultra-compact mobile CB radio.....£64.95
35. Nevada PS30M-**ED**..30amp variable voltage power supply.....£90
36. Nevada PS40M-**ED**..40A variable voltage linear PSU.....£105
37. Nevada PSW50-**ED**..50A switch mode supply.....£119
38. Palstar AT2K-**ED**..2Kw manual antenna tuner.....£579
39. Palstar AT500-**ED**..600w differential antenna tuner.....£509
40. President Grant II-**U**..top of the range CB radio all modes.....£169
41. President Himalaya-**ED**..base station antenna 26-30MHz.....£85
42. President Jackson II-**ED**.. all mode CB mobile radio.....£239
43. TTi TSC100R-**ED**..200ch AM/FM handheld scanner.....£59
44. UR6QW-**ED**..8-band EQ with compressor – 8 pin Icom.....£129
45. Whistler TRX-1-**U**..handheld digital/analogue scanner.....£359
46. Yaesu FT450D-**U**..100w HF transceiver with ATU etc.....£499
47. Yaesu FT990AC-**U**..classic 100w HF transceiver.....£699
48. Yaesu FTdx5000 + SM5000-**U**..excellent condition.....£2695
49. Yaesu FRG8800-**U**..classic communications receiver.....£395
50. Yaesu FT8900-**U**.. quadbander mobile transceiver.....£24

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
KENWOOD TS-480 SAT.....£450
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-R20.....POA
ICOM IC-R75.....£550
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 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
PS30 PSU.....£65
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 G4LQI (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 G8ATD (RSGB)	192	£12.99

HISTORICAL

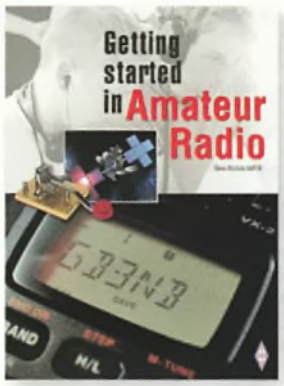
● **NEW** THE VINTAGE RIG GUIDE Steve White G3ZVW	80	£5.99
● **NEW** RESTORING OLD RADIO SETS Phillip Lawson G4FCL	80	£8.99
● THE LONG SILENCE FALLS VOLUME II The Life & Times of a Merchant Radio Officer 1900-2000	376	£25.00
● **OUT OF STOCK** LONDON'S PIRATE PIONEERS Stephen Hebditch	322	£14.95
● **OUT 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

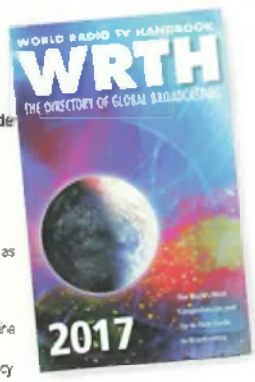
If you want to know something about the hobby or are newly licensed, or are even just looking for something different, *Getting Started in Amateur Radio* provides the answers. What about receiving digital images from the International Space Station? Or talking to friends around the world via satellite? 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.

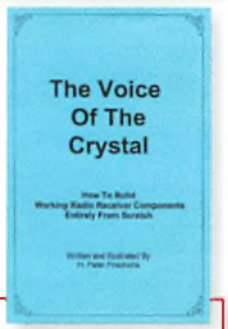
£25.00

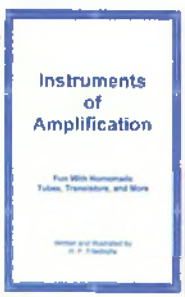
The previous volume, which is now out of print, was extremely successful and sales far exceeded wildest expectations. From the very earliest days of radio, ships carried Radio Officers. However, with the onward march of technology this post has become redundant and since 2000 ships no longer carry specialist 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





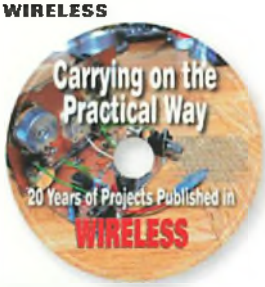
INSTRUMENTS OF AMPLIFICATION

£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 bushel! Armed with the book an interested constructor can literally build a radio from scratch anywhere! Perhaps a better title could have been Desert Island Radio for the Shipwrecked because everything from simple earphones, detectors and mechanical amplifier 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's long 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 transceivers, 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 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

07/17

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

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!

- 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**

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

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.

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

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: .....

DON'T MISS THE ML&S BIG SUMMER PICNIC ON SATURDAY 24th JUNE 8am – 4pm

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'S OFFICIAL UK DISTRIBUTOR

YAESU FTdx9000MP

click! www.HamRadio.co.uk/ftdx9000

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.

ML&S: £7499.95

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: £1429.95

NEW YAESU FT-991A + SP-10 SPEAKER

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

AFTER £85 CASH BACK ONLY £1314.95

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

AFTER £170 CASH BACK ONLY £3229.95

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

AFTER £45 CASH BACK £899

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

AFTER £45 CASH BACK £554.95

YAESU FT-450D

With MyDEL MP-30 & Yaesu MD-100 microphone

ML&S: £699.95

click! www.HamRadio.co.uk/ft450d

YAESU FT-70DE

click! www.HamRadio.co.uk/ft70de

NEW PRODUCT

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

NEW PRODUCT

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

click! www.HamRadio.co.uk/ft65e

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 £589.95 or with an ATAS-120A Auto-tune antenna only £799.95

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: £519.95

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!

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: After £17 Cash Back £172.95

With new digital C4FM (Fusion).

click! www.HamRadio.co.uk/ftm3200

HAM RADIO TRAINING ACADEMY NOW OPEN BOOK NOW! FOR FURTHER INFORMATION Click www.HamRadio.co.uk/training

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 Clear Voice — 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