PRACTICAL WIRELESS

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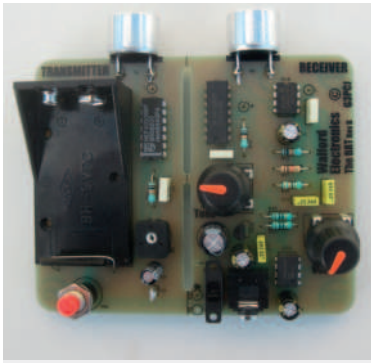
JANUARY 2021 THE UK'S NUMBER ONE AMATEUR RADIO MAGAZINE SINCE 193

START ON A BUDGET | Getting into amateur radio without breaking the bank

FIELD TRIP

We see if the new portable IC-705 and accessories cut it outside



Building a Bat

Great project to introduce newbies to the hobby

Latest new gear

2021 products from the UK's leading retailers

WIN Bantenna's £96 sleeve antenna

As reviewed by the editor in last month's issue of PW

BUILD Festive antenna project

A fun Christmas challenge that favours QRP stations

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Readers' letters

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Video Channel

We now have a regular YouTube TV Channel with technical features and equipment reviews. Just type in 'watersstanton' into the YouTube search band to watch the latest editions. We are approaching 6,000 subscribers so it is worth taking a look regularly. if you press the free 'Subscriber' button, you will be alerted to every new video. Keep in touch.

Peter Waters G3OJV

ELECRAFT — Brought to you by W&S!

GO HF PORTABLE with the BEST!

Elecraft KX2 Portable HF Transceiver

2 Year Warranty

Mic & paddle key are optional extras

Elecraft's KX2 'stealth' transceiver can go wherever your imagination takes you! A rear tilt-foot angles the KX2 for use on any surface, from desktop to park bench to rock.

- 12W Out 80m-10m
- Fits into a coat pocket
- Built-in microphone
- Variable selectivity
- CW audio filter
- On screen data decode
- Very low current drain
- PSK31 and RTTY send
- Backlight can be turned off
- Internal ATU option
- 2 Channel SSB Recorder
- 3 Channel CW Data Recorder
- 2.8"H x 5.8"W x 1.5"D
- Weight: 13 oz (less options)

£959.95

Elecraft KX3 160 - 6m, 15W

Mic & paddle key are optional extras

There is something very special about the KX3. It out-performs any similar transceiver and almost all of the base stations. You can run it at 100mW or increase to any power up to 15W (a bit less above 20m). You can add 2m or 4m, Add a narrow roofing filter or auto ATU. No other rig can match it.

- All modes
- 3.4"H x 7.4"W x 1.7"D
- 18 oz (less options)
- Rear tilt feet fold up for transport
- Custom high-contrast LCD
- Current drain as low as 150 mA in receive mode

Built: **£1349.95** Kit: **£1299.95**

Add a 100W Amplifier

to: KX2, KX3, FT-817/8 and IC-705

This amplifier is great for use with the above radios and has a switched input selectivity for 5W or 10W drive. That enables you to turn your QRP portable station into a 100W base station. Works with any QRP radio. Just needs RF input and PTT input. Band-switching is RF sensed.

- 100W Output
- 160m - 6mV
- 11V - 15V
- Solid state T/R
- Fast QSK
- 'Silent' Heat Sink
- MOSFET Output
- Compact size
- Auto ATU option

SELF BUILD
Why not self-build? Elecraft kits are designed to be easily built at home. No soldering is involved and there is no complicated alignment. The manuals offer step by step instructions with illustrations. A screw driver and several cups of coffee (not included!) will get the job done.

KXPA100 100W Amplifier .....Kit: **£1199.95**
KXPA100 100W Amplifier ....Built: **£1249.95**
Optional Internal Auto Tuner

PX3 Panoramic KX3 Display

A great companion for the KX3. Similar spec. to the P3 above
Kit: **£789.95**
Built: **£829.95**

T1-A QRP (20W) Auto

Ideal for FT-817/8. 160m - 6m. Handles coax and most end fed wires!
Built: **£249.00**

ICOM IC-705 160m - 70cm 10W

£1299.95

It's the latest radio from Icom. It is at home as a base station, mobile, or portable radio. This all-mode radio has many great features. The menu system is very similar to that of the IC-7300, easy to reach and easy to adjust. The full colour touch screen is bright and clear. Receiver current is low at around 250mA. The supplied battery is 1.8Ah and is charged by the external 12V supply. You can also charge from USB and the same socket will power the radio on receive only. You get a keypad microphone and D-Star capability. CW is full break in and both TX and RX have EQ controls. The front facing speaker delivers good punchy audio or plug in the second mic connecor for true speaker mic operation. Of course you have up to 1MHz of spectrum display and large metering display option. If you need an ATU we suggest the Elecraft T1-A. And for a great pocket AC supply, check out the KX-33. Wideband RX includes Airband and FM broadcast. Check out our video links on our website.

Adonis AM-UD1 *in stock now!*

- Unidirectional eletret condenser desk microphone
- NORMAL/LOW-CUT sound quality selector switch
- Adjustable output volume (microphone sensitivity)
- UP/DOWN switch and transmission indication lamp (LED)
- Output jack (8-pin) mic connector
- Power supply voltage – AA batteries x 2 (DC3v) or microphone conversion code supply (DC 5 to 9v)
- Output impedance : 500Ω to 100 Ω
- Output voltage : 0-30mv (rms)

£119.95

KX-33 Pocket QRP AC Supply

The KX-33 is a 4 Amp very low noise supply with auto 230/115V switching. Ready terminated for Elecraft LX2 or KX3. Adaptor leads for other radios below.

£69.95

33-120...Adaptor for FT-817/FT-818..**£12.95**
33-140...Adaptor for IC-705.....**£12.95**

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FREE Headset worth £116

IC-7300

A superb Heil PMD-IC worth £116 is yours for FREE when you buy the IC-7300

The IC-7300 has quickly become a piece of ham radio history. A marker by which the competition is judged. The fastest selling radio of 2017 and still going strong, replacing all those old radios that many hams gave clung to for years. It's a great performer and great value. 160m - 4m. 100W Max. **£1195.95**

IC-7610

The new IC-7610 transceiver is now a reality. Few can fail to be impressed with the advanced technical promises. And nobody should be disappointed once their new radio arrives. We have good orders in for this radio and so will be happy to bring your dreams to reality. And if you need any additional items to go with your new radio then we are sure that we can delight you. 160m - 6m. 100W **£2999.95**

IC-9700

The IC-9700 brings together the three popular VHF bands and puts them into one very high tech. box. The large screen, packed with information, will be a welcome addition and copies their HF range in presentation and flexibility. Top of the feature list is SDR employed on both 2m and 70cms, with all the benefits that go with this. And there is no extra charge for the 23cms down converter which will be the icing on the cake for many. The recent trade demonstration showed us just what a great radio this is. Call us today for a quote. **£1795.95**

Icom IC-7100

HF-70cm (inc 4m)

It's a great all-mode, all-band, transceiver and one of the few that covers 4m as well. The detached head (which also contains the speaker) makes it and ideal radio that fits in the domestic scene. It allows you to place the main radio out of site next to your 12V power supply. Great price as well **£999.95**

Icom IC-R30 All-mode Scanner

Some scanners have complicated menu systems that make operation difficult. The IC-R30 is different. Its user friendly. Its ICOM!

- 100kHz - 999MHz
- Big, clear display
- GPS and Band Scope
- 2000 'Name' memories
- AM, FM, SSB Digital
- 8 hours + battery life
- RF Gain and Attenuator
- Tone Squelch

£569.95

Professional Scanning & Monitoring from AOR

AR-DV1

Multimode digital demodulation receiver featuring wideband reception, D-STAR, Yaesu Fusion, DMR and much more. **£1199.95**

AR-5700D

New!

- 9kHz - 3.7GHz
- Multi-Mode
- Digital
- Video Out
- I/Q Out

Professional communications receiver that offers a level of versatility and capability, beyond that of any similar receiver. See our website for full spec! **£4,595.00**

AR-DV10

The AR-DV10 is the most advanced digital handheld receiver covering 100kHz - 1.3GHz. The latests firmware upgrade now adds comprehensive trunk monitoring. **£939.95**

Yaesu FT-DX10 Transceiver 160m - 4m

New!

Great PX Deals
Call Today for a Deal
£1549.95

100W all modes

- Colour touch screen
- SDR Hybrid
- Remote ready
- External screen ready

It's the exciting transceiver from Yaesu based on the FT-DX101 but with single receiver. Dual superhet front end and SDR back end. It promises to be a leader in its class. Full details on web site with links to our Great Videos!

Top Station Accessories

CX-SW2PL
2-Way Antenna coax switch
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AV-2025D
Analogue PSU
Fully variable and very low noise, 30 amps
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Diamond BU-55
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Super accurate VSWR Power Meter
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YAESU Part of our Range

FT-3DE Digital Handheld

The Yaesu 3D is one of our top sellers. The touch screen makes it so much easier to get up and program. Its a smart phone performance for ham radio!
High resolution screen with bandscope display. Digital and analogue operation on 2m & 70cms. Features wide band receive and has GPS reception. A great travel radio. **£399.95**

FT-991A HF - 70cms 100W max

This is a real top seller. It's the one radio that you can put on the desk and enjoy HF and VHF. Includes ATU. **.....£1239.95**

Yaesu FT-dx101D

Now top of the Sherwood list for SDR HF Technology. When you buy from us you get a 3-Year Yaesu UK warranty. Full SDR technology with a selectable superhet front end to provide optimum dynamic range and front end selectivity. Full colour touch screen offers variable bandwidth up to 1MHz, clever screen presentation options and a rear panel HDMI output for an external display. **£3149.95**

Yaesu FT-dx3000

- All Modes 160m-6m
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- Wide Receive 30kHz-56MHz
- RTTY PSK31 Decode Encode
- Auto ATU
- USB PC Connection
- TFT Colour Screen

£1299.95

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

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

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We regret that due to Editorial timescales, replies to technical queries cannot be given over the telephone. Any technical queries are unlikely to receive immediate attention so, if you require help with problems relating to topics covered in PW, please either contact the author of the article directly or write or send an email to the Editor and we'll do our best to reply as soon as we can.

WARNERS GROUP PUBLICATIONS PLC

Keylines

Another month, another lockdown! One of the great things about our hobby is that we (or most of us, at least) can participate from home. We might miss club meetings, portable operation and the like but at least we can stay on the air and chat with fellow enthusiasts. And just think of all those projects that we have been waiting to get on with – no excuses now! That said, as you'll see in this month's issue, I have been reviewing a couple of antennas from Moonraker and, wouldn't you know it, the weather was atrocious for much of the time I wanted to be out in the garden playing with them. Not to worry, the job got done eventually.

Books

I have been thinking about the role that books play in our hobby now that the internet is so all-pervasive. You'll see a book review in this issue and (shameless plug coming up!), the RSGB have just published my own latest book – *The Magic Bands*. This is a major update of my previous books about the 6m and 4m bands, the last version appearing some seven years ago, well before the explosion in the use of data modes, as well as all the other developments of recent years. The new book will, of course, be available from the *PW* Bookstore

I have a very substantial collection of radio books and enjoy nothing more than reading through them, particularly antenna books. Yes, the internet is indeed a great source of up-to-the-minute information about any number of subjects, but much of the underlying theory doesn't change and I value having the information available in printed form. It may, of course, be a generational thing but our Bookstore (see p.57 of this issue, for example) does appear to remain popular. I've also, over the years, collected quite a few historic radio books, including several volumes of *The Services Textbook of Radio*. These are absolutely fascinating.

Apropos of which, the publishers of *PW* did very well during the war years, with several volumes by **FJ Camm** (original editor of the magazine and brother of **Sidney Camm** who designed the Hurricane fighter) selling in very substantial numbers to the armed forces for training purposes.

Magazines

Magazines have, unfortunately, taken more of a hit from the internet. The amateur and professional radio markets were served, when I first came into the hobby, by titles such as *Wireless World*, *Short Wave Magazine*, *Radio Constructor*, *Radio Active*, *Amateur Radio* and *Ham Radio Today* and there were others that were well before my time. Sadly, most have now disappeared, perhaps reflecting not only the internet but a downturn in home construction. The good news is that *PW* continues and subscriptions have increased significantly during lockdown. I do find it fascinating to look through old magazines and reflect on how the hobby has changed and yet, in some ways, has stayed the same (look at the *Letters* pages to see, for example, how some of the themes recur over the decades!).

Specialist Organisations

Having said all that, specialist groups such as G-QRP, UK Six Metre Group, CDXC (the UK DX Foundation), the UK Microwave Group, Worked all Britain, International Short Wave League and the like seem to remain viable and most produce excellent magazines or newsletters of their own, despite most having some sort of online presence these days. Maybe their success is a reflection of the broadening of the hobby into a many sub-specialisms, each with their own following?

Don Field
Editor, *Practical Wireless Magazine*

Newsdesk

Have you got something to tell our readers about? If so, then email **practicalwireless@warnersgroup.co.uk**

Just in at ML&S

100W Amplifier for Icom IC-705 & FT-817/8: A very compact and powerful 100W HF-6m Linear Amplifier ideal for QRP transceiver with 1-5W of output. The new XPA-125B has its own built-in Auto ATU with back-lit LCD display showing Power, SWR, Current etc.

It is in a solid metal housing and works very well alongside the Icom IC-705, (even the same height!) Yaesu FT-817/8, Elecraft KX7 and other QRP transceivers. Available from stock for £469.90: **www.HamRadio.co.uk/XPA125B**

New Yaesu FTDX10

Yaesu have announced the FTDX10, a long-awaited compact HF/50MHz SDR transceiver and the latest member of the FTDX101 family of Hybrid SDR transceivers. Like the FTDX101 series, the FTDX10 uses the same Hybrid SDR configuration of narrow band SDR and Direct Sampling SDR. The narrow band SDR receiver provides excellent receiver performance with the Direct Sampling SDR providing the real time spectrum scope. The Narrow Band SDR receiver uses a down-conversion superheterodyne receiver configuration with a 9MHz first IF. This makes it possible to incorporate three excellent narrow bandwidth crystal roofing filters (500Hz, 3kHz and 12kHz selectable by mode) that have the desired 'cliff edge' shape factor.

Thanks to the 250MHz HRDDS (High Resolution Direct Digital Synthesiser) exceptionally low noise local oscillator based on the one in the FTDX101 family, the FTDX10 RMDR (Reciprocal Mixing Dynamic Range) reaches 116dB or more and the close in BDR (Blocking Dynamic Range) achieves 141dB or more, and 3rd IMDR (third-order Intermodulation Dynamic Range) reaches 109dB or more (14MHz band at 2kHz separation).

The 5in TFT Full Colour screen shows the 3DSS (3-Dimensional Spectrum Scope) of the FTDX101 providing not only a frequency display of the signals being received but adds a time domain to the display, enabling a better understanding of the band conditions at the time. Touching the frequency display enables a numeric keypad, permitting frequency data to be entered.

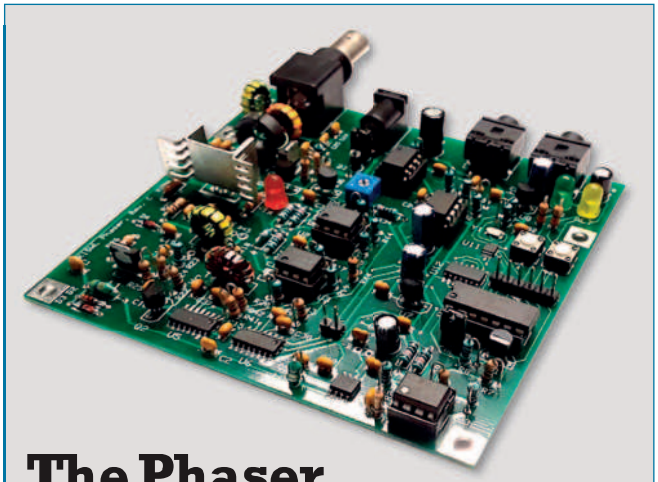
Similar to the FTDX101, the main Receiver and Transmitter menu parameters can be displayed and configured using the TFT touchscreen. The front panel includes the MPVD (Multi-Purpose VFO outer dial) large ring around the outside of the VFO dial enabling control of a number of receiver functions selected by buttons arranged around the dial.

Remote control and operation is possible using the optional SCU-LAN10 unit and remote SCU-LAN software not only enables remote operation of the radio but allows monitoring band conditions remotely by connection to the home LAN network.

Some key features of the FTDX10 are: 15 separate bandpass filters • Effective QRM rejection using IF DSP (Shift/Width), IF Notch, DNF, DNR and CONTOUR) • RF and AF Transmitter monitor • High Quality and super stable 100W HF Power Amplifier using MOSFET RD70HUP2 • Aluminium Heat Sink with 80mm low noise Axial flow cooling fan • High Speed ATU with large capacity 100 channel memory • Microphone Amplifier with three-stage parametric equaliser (SSB/AM mode) • QMB (Quick Memory Bank) and Band Stack Function • Optional Speaker SP-30 designed for the new FTDX10 • Optional Narrow band 300Hz CW Roofing filter XF-130CN.

The new FTDX10 is now available. Contact your local dealer for pricing and availability.

Read more radio news and reviews at www.radioenthusiast.co.uk/news



The Phaser

The Phaser is an 'All Digital Mode' transceiver kit designed by Dave K1SWL, capable of anything that WSJT-X (and other digital mode software) can do, as well as RTTY. With 4W and single-board construction, it's available in versions that cover 160, 80, 60, 40, 30, 20 or 17m. Over the 11 production runs, they've shipped more than 1,000 kits, and the 12th run will be the last of the original Phasers.
The Phaser-II, for 10 and 15m, is also available.
https://midnightdesignsolutions.com/phaser

IC-705 Antenna Mount

Nevada Radio have announced the arrival of their NEVADA RC-105 antenna mount bracket for the Icom IC-705.
This is an Aluminium alloy CNC-machined bracket with a beautiful finish, that enables a PL259 base antenna to be used with the radio. The bracket comes complete with BNC-to-SMA patch lead and mounting screw. A separate terminal is supplied for attaching radials or ground connection to a screw or banana plug connection.
The RC-105 sells for £34.95 and is available from either of the following:
www.nevadaradio.co.uk
www.hamradiostore.co.uk

Remote Exam Invigilation

Opportunities to take the US licence exams in the UK are fewer than in the past so we were pleased to hear the following from reader Ian G3ZHI: *"I have just had a QSO with **Norman K6YXH** in Los Angeles. He is involved with a remote session examination group. The group provide remote testing for any class of American ham licence to any person who qualifies to hold an American call, no matter where they live in the world. The exams are conducted over the internet and can be in English or Spanish. His email is: Norm@Goodkin.net or check out the following website":*
https://glaarg.org/remote-sessions

UK Coast Radio Service

Larry Bennett G4HLN writes: *"Just a quick favour to ask – following my successful book about Portishead Radio, I am currently writing a follow-up about the history of the UK Coast Radio MF/VHF station service (Niton, Land's End, Wick, Stonehaven, Humber etc.). I'm planning for this to be a companion to the Portishead book, similar in size, design and style.*
"Obviously there will be great deal of historical content, written in time order, with many photographs and diagrams, but I'm hoping to break this up with personal recollections and memories from staff members, Radio Officers, and also some recollections from radio amateurs who took their Morse tests at these stations. I plan to get the draft manuscript completed by the end of February 2021 with a view to publishing the book later in the year.
*"To this end, I'd be grateful if you could put a small appeal in the magazine for anyone with stories about any of the stations, any unusual events, memories of the staff who worked there, or anything about the stations that would be of interest to others. Any items used will be credited and acknowledged. I have set up an e-mail address specifically for this project, which is: **coastradio@btinternet.com** – it's monitored daily and I will respond to all items sent".*

January KW Days

The first weekend in January is now well established as a time that KW owners put their classic radios and accessories on the air. This relaxed operating weekend marks the anniversary of the original company's founding in 1956 by **Major Roly Shears G8KW** and **Ken Ellis G5KW**.
Every year the numbers of restored and rediscovered KWs grows thanks to the active support group **KW-Radios@groups.io** some of whose contributors worked for the company at various locations, producing the famous Vanguards, Viceroys, Vespas, KW2000s and Atlantas plus a complete range of station accessories and antennas.
This year the group has received more requests for help from overseas in Spain, Canada and the USA as more equipment re-emerges. GB8KW will be active for the whole of January from the stations of G0UKN and G3ZPS.
KW also had strong links with Swan and Ten-Tec in its later years.
UK and overseas stations will be using the non-WARC bands, SSB 1977, 3775, 7177 and 14.277kHz AM and CW on the VMARS frequencies ±QRM.
CVRS member **Guy Roberts G0UKN** maintains the growing international list of known KW equipment and is hoping to record more details/serials and provenance of gear. If you have any piece of KW equipment, know its serial number, age or provenance – get in touch.

Cycle 25 a Big One?

Below is the link to the presentation by **Dr Scott McIntosh** on the upcoming Solar Cycle 25. It's a fascinating look at how using 22-year Hale Cycles and their terminators we can better predict an upcoming solar cycle intensity like cycle 25, which could be in the top five since records began.
Passcode: z7qCn@3G
https://tinyurl.com/y2nslema

1

Richard Constantine G3UGF
practicalwireless@warnersgroup.co.uk

Practical Portable with the Icom IC-705 and Other Radios

Richard Constantine G3UGF goes out and about with the IC-705, reviewed last month.

Last month I reviewed Icom's IC-705 transportable transceiver. This month I'm exploring some of the first-generation accessories from Icom and third parties plus a few universal items I've found for myself, that can be used with the 705 or other equipment.

Backpacking

The 'Field Operations, multi-function Backpack' is a strong feature of Icom's advertising encouraging operators in their words to, *"Be Active"* – licensed listeners (those with licences but largely inactive) take note.

While some radios may only see the occasional excursion, the LC-192 backpack will doubtless appeal to many EmComms (USA), Raynet and SOTA operators. It might just inspire more couch-potato amateurs to take to the great outdoors, who knows?

The IC-705 definitely needs weather protection, for outdoor use. However, I was somewhat sceptical about the need to spend significant money on a dedicated backpack.

Nevertheless, knowing that a serious camera bag typically costs much more and as I love travel and /P operating, I thought the LC-192 was worth a closer look.

Read more radio news and reviews at www.radioenthusiast.co.uk/news

Fig. 1: The author, out and about with backpack.
Fig. 2: The backpack antenna mount.
Figs. 3 & 3a: inside of the mAT-705 Auto Tuner.
Fig. 4: Alternative battery packs.
Fig. 5: One alternative for a desk stand.
Fig. 6: Using a photographic desk stand.

It was immediately clear that it's been specifically designed for radio with its rather unusual composite strengthening plate on one side – more on that later.

There are cunningly concealed cable access points above and below the side plate. You have to dig around a little to discover them as the bag only comes with a minimal diagram. There's a more obvious top edge flap for either a cable entry or a whip antenna.

Both upper and lower compartments have separate, top quality, weather protective zips. The lower flap has inbuilt multiple pockets for small items such as connectors, cables, tools, notebook, pens and similar.

The upper radio compartment has two shock absorbing pads on which the radio sits and there's a small securing strap and ¼in screw arrangement that fits to the underside of the IC-705 to hold it in place. There's also a small pocket inside the top compartment to store the fixing screw when not in use – nice touch.

There are four hook and loop, movable, padded inserts in the lower compartment. The most rigid of these must be fitted centrally to support the radio above. When not needed for further vertical divisions, two of them can be used to support each side of the bag. The fourth and softest pad fixes laterally to hold items in place.

Externally and to the right there is a net bag that also has an upper fixing strap. This can easily secure a lightweight collapsible pole or antenna parts.

The shoulder straps are padded with fixings for things such as pens and torches, etc. There's a waist strap, top carry handle and air vented padding for the wearer's back. While carrying out a splash test ensuring that rain easily runs off the special fabric and it does, I was pleasantly surprised to discovered a hidden, full height pouch between the back padding and the bag itself, making it practical to store a tablet for data mode operation, APRS or logging, a wire antenna, coax or perhaps a map.

Verdict

Having now used it I wouldn't want to be without it. It's practical, well-made and reasonable value for the flexibility it provides. Having one compact, radio specific, grab-and-go package is excellent. I particularly like the top grab handle for easy carrying and stowage but wish the base had rubber feet or bars to prevent excessive fabric wear on the underside. Priced at **£156.00**, from me 4.8 stars. (could make a great gift item. Maybe leave your *PW* open at this page. **Ed**)

2

3

Backpack Antenna Mount

Having only seen illustrations of antennas mounted on the backpack side plate, I looked at using a car boot lip mount but found that the securing grub screws were on the underside of the plate, making reliable securing difficult. Obtaining a Q-80 boot lip, mount bracket (eBay) and by simply removing two small angle adjustment screws, then moving the

antenna base part 90°, the problem was solved. It's a cross between a traditional Bulldog clip and a lever clamp. Its insulated, non-damaging jaws have both clamp depth and tension adjustment and the whole assembly can be easily removed.

Choice of antenna is perhaps for another time, but for VHF/UHF expect to use a lightweight, open phase coil type collinear of some sort, such as a Diamond NR-770HB, to keep the weight as low as possible. HF is only really practical by using counterpoise wires or an earth connection to the bracket and this may even be needed at VHF/UHF.

Verdict

A Problem solved. Durability of materials, springs and shiny metal remains to be seen. Will likely require some maintenance, but easily replaced at a low cost (circa £12.00).

Warning! Don't expect any antenna to simply plug-and-play with any backpack – as you need to achieve and maintain an acceptable VSWR by experimentation.

mAT-705 Auto Tuner

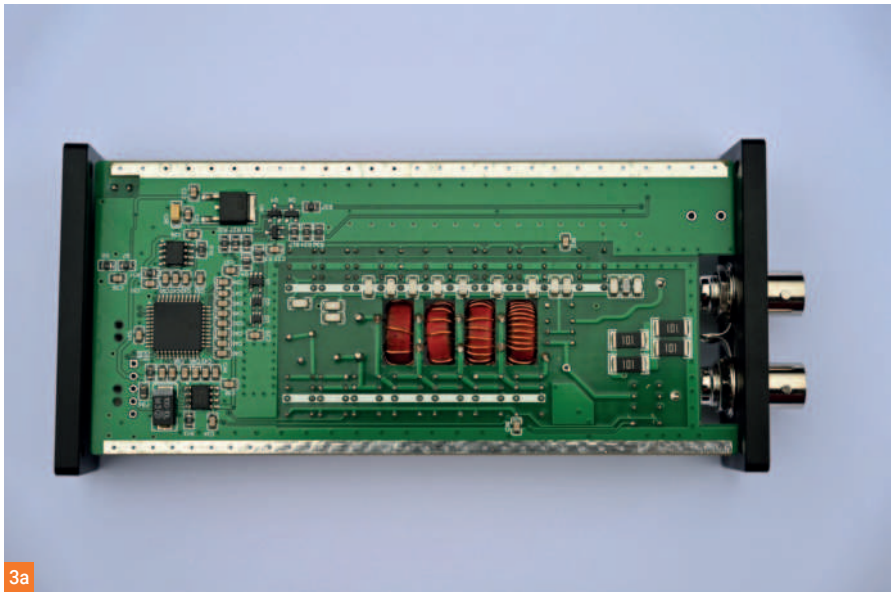
The Chinese maker has been quick to market a solidly housed, compact, IC-705 specific auto-tuner, ahead of Icom's own AH-705, due out soon.

The mAT-705 covers 1.8-54 MHz, is supplied with a 1m transceiver control lead and uses latching relays to save energy.

Power is provided by an internal 9V Alkaline battery and there is a battery-low warning LED. Unfortunately, there's no external supply input option. Battery change is by removing four rear-panel Allen screws and carefully sliding out the main board, Standby current drain is typically 7mA and up to 31.4mA when tuning. No power handling data is given on the downloadable instructions but I would guess 20-25W to be around the maximum, looking at the relatively small relays.

A first tune cycle on any band takes around five seconds. Shifting frequency within the same band, re-tuning takes less than a second on first press of the PTT. The processor system boast 16,000 memories and impedance range is from 5 to 1500Ω.

How well it works is all about the antenna, critical for QRP operation. It worked well with loaded verticals but short wire antennas on low frequencies were, as to be expected, beyond its matching range. For 160-80m or higher impedance antenna set up, the Emtech ZM-2 is well worth a look.



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The Emtech ZM-2 is available as a kit or ready built. The mAT-705 provided reasonably good results with both a doublet and also with an 8m wire using a BNC plug to twin terminal adapter. (obtained separately)

Verdict

I like the solid feel of the construction plus it's lightweight and very portable. Although the maker states that battery lifetime is good, it's not ideal. I wouldn't want to change the battery in the field. Removing the rear panel as instructed, the board jammed and I was in danger of pulling the BNC wire connections from the circuit board, solved only by also removing the front panel. Now cured by silicon grease on the board edges. Priced competitively at £219.94. From me it's 4 stars

Power

Key to successful portable activity is power availability. The IC-705 is supplied with the tried and tested 1880mAh BP272. The more costly, higher capacity 3150mAh BP307 is now separately available. It's not bulky and clicks neatly in place, weighing only 36g more than the regular item.

Charge time is approximately 3.5 hours with the radio switched off and provides more than 65% more run time in a compact package.

Occasional users contemplating more than one battery, might like to also consider a second BP272, plus rapid desk stands charger BC-202IP2 as a possible cost-effective alternative

I dismissed the idea of carrying a heavy, sealed lead acid battery in the backpack, as I was able to easily find a suitable lightweight, alternative. I purchased a 5000mAH Li battery, commonly used in the CCTV industry. It arrived from Amazon complete with AC charger and cost £45.00. I carefully removed the 2.1mm, plug, extended the fly lead, added an in-line fuse and 2.5mm right angle plug to fit the IC-705.

I sourced extra 2.5mm pro plugs and weatherproof, mini automotive blade fuses and holders from the CCTV and automotive pages of eBay to make additional power leads for home and car use. DIY leads cost me less than half those appearing online, some of which appear to have no in-line fuse protection.

Verdict

Genuine Icom batteries are excellent performers, if a little costly. You do get what you pay for, but I would suggest not to ignore possible alternatives, according to your needs. BP307 is priced at £90.00 and for that reason only, from me it's 4 stars.

Desk Stand

Icom have now confirmed that a dedicated desk stand MBF-705 is on the way and I'm looking forward to testing it soon.

Chinese suppliers were quick to provide a machined alloy bracket with an integrated antenna socket, plus an earthing point. Simple enough to mount, while giving a choice of antenna terminations SO239 or BNC. When not in use the fixing screw stows neatly underneath the back platform.

It disappointingly didn't quite sort out the stability problem, as expected. The viewing angle was much improved, but the

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radio still tended to be unstable on smooth surfaces. Photographs often show the bracket with a sturdy Comet HFJ-350M base loaded, tapped coil whip attached. I've only ever seen this in the USA so I tested with a lighter weight version from my FT-817. It helped to stabilise the radio, but not fully. The heavier Comet antenna will most likely work better.

Verdict

A neat way to reduce strain on the radio's antenna socket giving a choice of connector plus an improved earthing point, if a little ungainly. Priced between £25-£35.00 according to source, from me for convenience factor it's 4+ stars.

Z Mounts

Still seeking a desk mount solution, I tried a low-cost plastic type photographic Z mount as an experiment. It definitely gave the much-needed adjustable angle but was still prone to sliding. A heavier, professional grade, Neewar Z mount proved a much better solution. The metal alloy construction and rubber foot pads ensured that it sat firmly on the desk while providing a range of adjustment and choice of viewing angle.

Verdict

The radio is now firmly planted, it no longer falls over. The display is at last, easy to see. Priced at £25.00. From me it's 5 stars… Result!

Conclusion

Last month I predicted that the Icom IC-705 marked something of a change in commercial amateur radio equipment and operating as urban environments fill up with electrical noise. I can already see the aftermarket moving in this direction and I'm looking forward to what comes to market next.

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The Festive Antenna

Mark Foreman G7LSZ/SA6BID
practicalwireless@warnersgroup.co.uk

Mark Foreman offers a fun Christmas project, with a set of challenges to readers. Why not give it a go?

I can imagine many of you preparing for Christmas, a time to celebrate, rest and reflect. A time to be happy. Some of you may want to switch on the radio and enjoy the festive season with fellow radio amateurs. Last year I brought you the idea of Morse anagrams.

Something Different

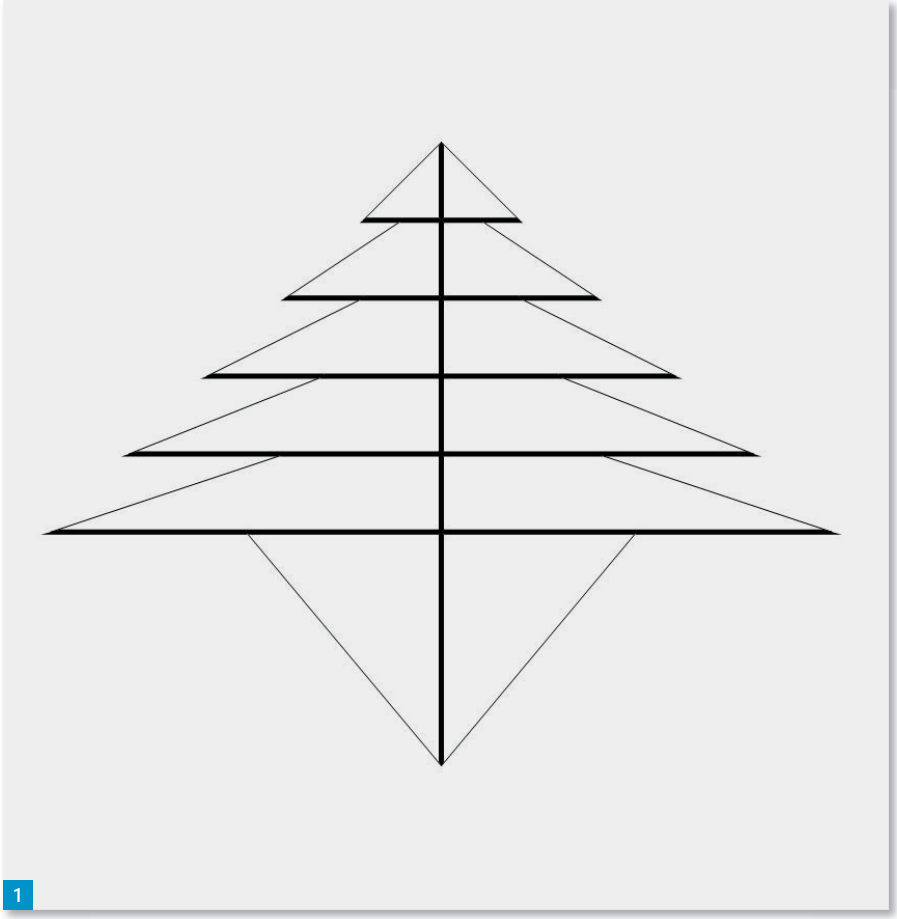
I would like to present to you something different this year. It is a festive antenna designed to bring happiness and joy to all. There are several different ways in which you can enjoy this antenna. The prototype was made using a long narrow plank of wood and PVC conduit pipe, which was fixed to the plank with steel brackets and some epoxy glue. Next, the wire was attached to the conduit pipe to create the antenna. In the diagram, **Fig. 1**, the wood and plastic pipe is shown in bold while some of the wire can be seen as non-bold lines.

Table 1 suggests some dimensions to enable you to build the antenna. As the frequency of operation of an antenna is inversely proportional to the length of the parts of the antenna and as I am unable to know what frequencies you want to use, I hold the view that you are free to scale the antenna up or down to suit your needs.

The second diagram, **Fig. 2**, is a view of the antenna showing both the wire and the wood/pipes that support it. The wire is in narrow lines while the wood/plastic is in bold. **Fig. 3** is a drawing of the antenna without the branches made of plastic pipe. The shape of the wire is easier to see.

What you do is to start at the top of the tree and fix the wire to point C, next bend the wire so it goes back along the pipe BC until it is at a point half-way between B and C. Now from this half-way point the wire goes to point E. We continue in this way to the bottom branch of the tree. From half-way along branch JK we bring the wire to the very bottom of our tree.

After building your antenna you have almost complete freedom as to how you orientate it and feed it. You can place it above a ground plane and then connect both wires at L together and use it as a Marconi type antenna. You can connect one of the wires at L to the ground plane and the other to the core of the coax and use it again as a Marconi type antenna or you can connect each of the wires at L to a balanced feeder. For this final suggestion I don't think a ground plane will be needed, but if you very much feel the urge to, you can still have a ground plane below the antenna. I would suggest using a 1:4 balun at point L. You could connect a broadband transformer wound on a ferrite ring such that the ground connection goes to the ground plane and the braid of the coaxial cable. One of the two ends of the transformer goes to both the core of the coaxial cable and one of the wires at L and the final connection to the transformer goes to the other wire at L.



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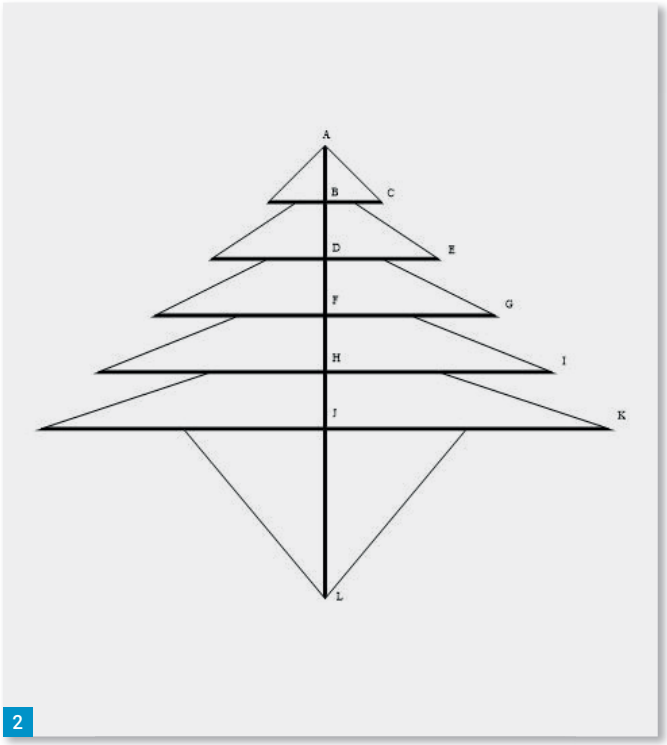
For those of you who like Christmas or are traditional I suggest you put the antenna in a vertical manner with point A at the highest point. Those of you who are indifferent to Christmas or want to use horizontal polarisation should have all parts of the antenna the same height above the ground. If the unrepentant version of **Ebenezer Scrooge** was to build the antenna, I imagine he would invert it putting point L at the top and A at the bottom as a protest against Christmas. I sincerely hope that he would see the error of his ways and then reinvert the antenna. Those of you who just want to be awkward can keep points A and L at the same height above the ground and turn the central plank such that pipe BC is vertical. If you can imagine other ways of orientating the antenna, then please feel free to do as you wish.

Enjoying Your Antenna

Now we get to how you can enjoy this antenna. There are three different ways of doing so:

First, you can calculate or measure the impedance of the antenna over the



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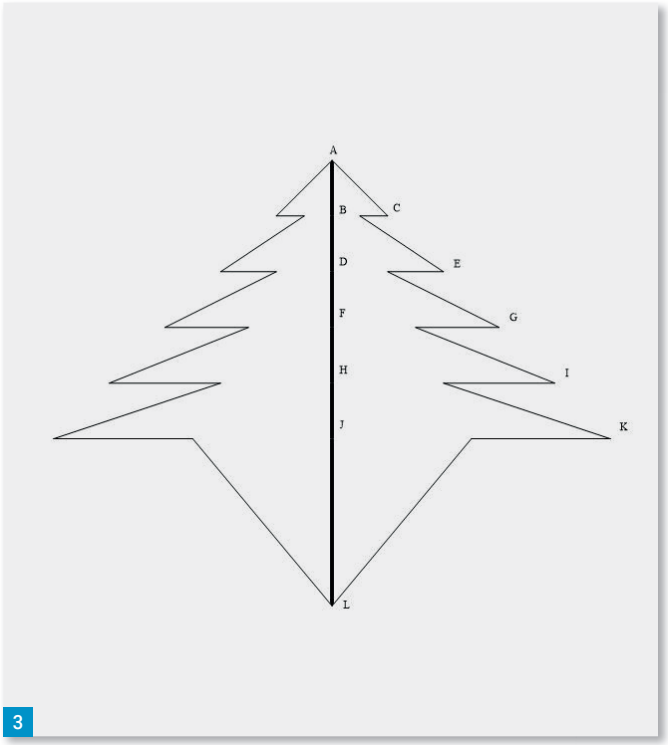

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range 1 to 100MHz. You are free to build a physical model of the antenna and then connect it to any equipment you see fit to use. If you scale the antenna up or down, then please show both the frequency of the measurement and the scaled frequency. For example, if you build a one-tenth model, you will have to divide all the frequencies by ten. You are free to calculate the impedance of the antenna using a spreadsheet, your own software or commercial software. When judging the competition, I will favour people who do not use commercial software.

Alternatively, you can build the antenna and connect it to your radio and make contacts. Any contact made with another radio amateur will be judged using the following equation. The total number of points should be added up: Points = d $\div \lambda P_1 \sqrt{P_2}$ where P_1 is the power used by you (in watts PEP), P_2 is the power used by the other station, lambda (λ) is the wavelength in metres and d is the distance in kilometres. If both stations are using the festive antenna, then double the number of points as a special bonus. If by some miracle you manage to use the antenna for moonbounce (EME) then you can claim the circumference of the triangle formed by the moon, yourself and the other radio station's location!

The formula might look complex, but it is designed to favour QRP stations. In general we will do this part of the contest on trust, but if you make an extraordinary claim like EME using 1mW on 250GHz, we may want to see logs or other evidence!

Parts	Length (mm)
AB, BD, DF, FH and HJ	400
BC	250
DE	500
FG	750
HI	1000
JK	1250
JL	1400

Table 1: Some dimensions to get you started.

Contacts via the internet, repeaters and satellites will be allowed. If you were to access a repeater with the antenna, then only the distance from you to the repeater can be claimed. Also, you can only claim points for one contact through a given repeater. Contacts made via satellites are to be counted in a similar way to the repeater. You need to use the lowest height of the orbit of the satellite as the distance. Also, you can only claim one contact via each satellite. For contacts made via the internet the only distance that counts is the distance that radio waves travel from the festive antenna that you own or built.

As a third option, you can build the antenna, decorate it and then take a photograph of it. The author and the *PW* editorial office will judge the most impressive!

In all three cases, do send your results to the editor (e-mail at the top of this article) and we will feature the best and/or most entertaining in a future issue of *PW*, as well as rewarding the leading effort in each category with a £20 voucher to be used in the Radio Enthusiast Book Store. The photo, **Fig. 4**, shows my own efforts, to the dimensions in the table, and I'll share my measurements (corresponding to the first of the three challenges) at the same time.


4

Fig. 1: A diagram of the antenna. Fig. 2: The antenna with supports shown in bold. Fig. 3: A further illustration, showing only the wire plus central support. Fig. 4: The author's completed antenna, to the dimensions in Table 1.

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AMPRO-20 Slim line design 14MHz 2m approx. 3/8th fitting..... **£22.95**
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PRESENT & FUTURE CUSTOMERS

Two Antennas from Moonraker

PW editor **Don G3XTT** tries out two versatile antennas from Moonraker.

Don Field G3XTT
practicalwireless@warnersgroup.co.uk

Antennas are an endless source of fascination and experimentation for radio amateurs and I am not one to turn down an opportunity to try out some alternatives, especially as I no longer have my tower and multiband beam.

So, I was more than happy when **Chris Taylor** of Moonraker offered me not one but two antennas for review. Both are sold as multiband wire antennas suitable for both home and portable use. One is a well proven design dating, believe it or not, from 1936, while the other is an amateur radio version of what is described as a 'civilian military systems' antenna.

The W3EDP

Let's start with the familiar one, the so-called W3EDP antenna. The first description of it appeared in the ARRL publication *QST* of March 1936 in the *Experimenter* section under the title *An Unorthodox Antenna*. It was written by **Yardley Beers W3AWH** about the experiments that his friend **H J Seigel W3EDP** had undertaken.

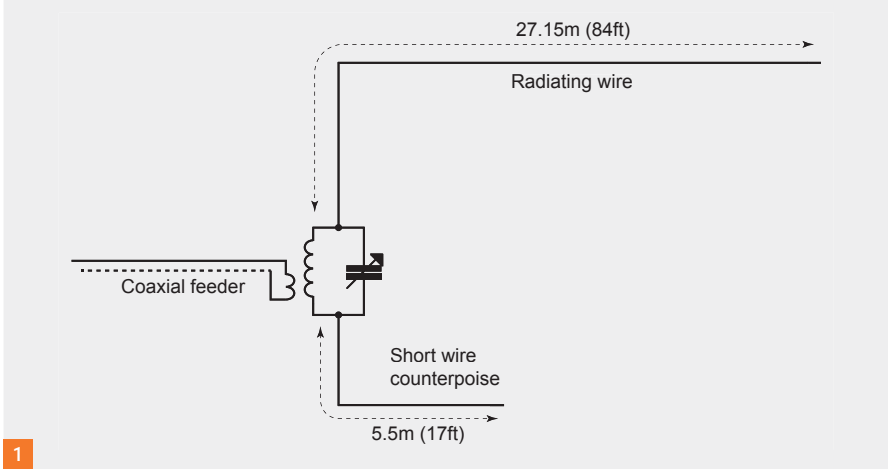
The W3EDP antenna is a development of the early Zeppelin or Zepp antennas that were used before the Second World War. They obtained their name from the fact that end-fed wires were required for use on Zeppelin airships.

The original W3EDP configuration is shown in **Fig. 1**. The antenna was designed for the then amateur bands of 160, 80, 40, 20 and 10m. There was, of course, no software available to W3EDP to design the antenna so the design was very much a case of 'cut and see'. And it would feed directly from the pi-tank of a valve transmitter, which was able to handle a wide range of impedances.

Although the 84ft radiating element remained the same for all bands, W3EDP found that the 17ft counterpoise worked well on most bands while on 20m, a length of 6½ft seemed to work best.

The modern take on the W3EDP antenna, designed to work with the current crop of solid-state transmitters, is shown in **Fig. 2**. It's sufficiently different that it probably shouldn't be described as a W3EDP antenna at all, but it retains this designation in all the literature.

In essence, the W3EDP is simply an end-fed wire antenna, with the length chosen as a suitable compromise for the various bands and, in the modern version, with the twin-wire feeder and balun or more accurately a Unun (unbalanced to unbalanced transformer) acting to transform the what would otherwise be a high end impedance to something that the rig can handle (albeit, through an ATU).



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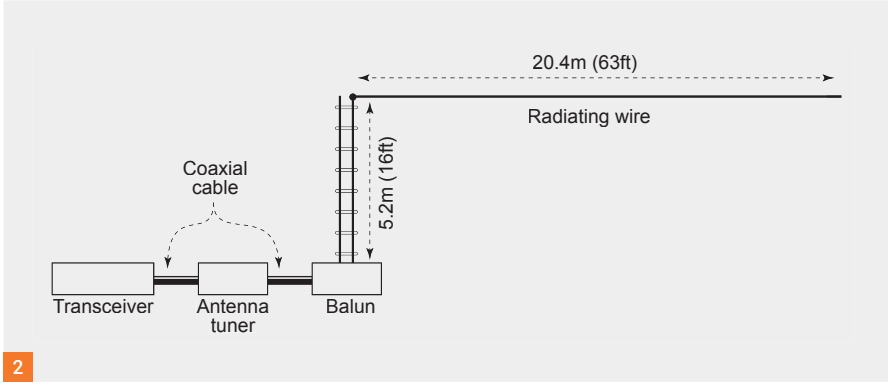

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The Moonraker W3EDP

Which takes us nicely to the W3EDP as sold by Moonraker. The photo, **Fig. 3**, shows what arrives: a 67ft length of Flexweave wire for the top (horizontal) section, a 17ft length of 300Ω twin-feeder (air spaced) for the vertical part and a 4:1 balun to match to the coaxial feeder. The antenna is rated for 400W.

The description on the Moonraker website is fairly sparse - *Works well on 80m and 40m, Length: 67ft, Requires ATU*. On the paperwork that comes with the antenna, there is a little more: *80-10m with a good quality ATU, the ribbon feeder must be hung in free space or mounted on a non-metallic mast, ideal for the smaller garden and great for portable operations.*

In my case, I put up two 20ft fibreglass poles to support the antenna. This leaves the balun a convenient couple of feet above ground, which makes it very simple to connect the feeder.

The problem with any compromise antenna (and using a single length of wire on several bands is bound to lead to compromise, albeit it makes for a simple all-band solution) is that the impedance at the feedpoint will vary from band to band. This means that the feeder will not be seeing 50Ω and will act as a transformer, the transformation between feedpoint and shack end depending on the length of feeder. Hence the need for an ATU (ideally, the ATU

Fig. 1: The original W3EDP design.
Fig. 2: The 'modern' take on the W3EDP.
Fig. 3: The Moonraker W3EDP unpacked.
Fig. 4: SWR curve (2 to 30MHz) at the antenna.
Fig. 5: SWR curve (2 to 20MHz) in the shack.
Fig. 6: The J-Pole unpacked.
Fig. 7: SWR curve of J-pole at shack end.

would be at the feedpoint but that's inconvenient for most situations, unless you have a remotely-controlled ATU). To illustrate the impact of this, **Fig. 4** shows a plot of SWR as measured at the base of the antenna and **Fig. 5** the same frequency range as measured in my shack at the end of maybe 50ft or so of coax. So, it doesn't really make sense to show a table of SWR – it depends on how long your feeder run is.

In my case, I generally like to run with resonant antennas and my IC-7610 doesn't like to tune an SWR above about 3:1. However, my Elecraft K3 can manage SWRs of up to 10:1 and, even better, I have an Elecraft KAT500 tuner, which, with the Elecraft KPA500 amplifier, allows me to run 400W out into SWRs of, again, up to 10:1.

So, running with my Elecraft setup and playing in the LZ DX Contest in November, I was able to put the antenna through its paces and work all over Europe and beyond with no difficulty. Incidentally, and I have written about this before, if you are restricted antenna-wise, I see no reason not to make up for it by using as much power as our licence allows and it's good that the Moonraker W3EDP is rated at up to 400W.

Conclusions

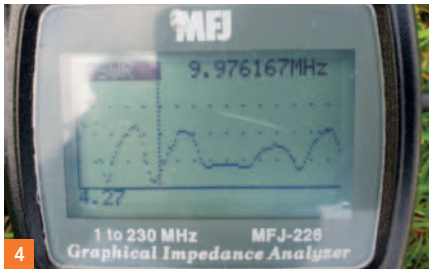
The Moonraker W3EDP antenna is certainly not unique to them – anyone can build one of these, albeit with the purchase of a suitable balun/unun. But the benefit is that the Moonraker version comes with the wires ready terminated, an end insulator, indeed all you need other than supports (fibreglass fishing poles are fine). And a single support would be fine for portable operation, with the top run out as a 'sloper'.

This is a lightweight antenna that does, indeed, lend itself to portable operation. I was a bit worried that damp might get into the balun but Chris assures me the toroid is enclosed in potting compound so that shouldn't be an issue.

I would also, to be on the safe side, advise against running 400W of CW or data modes into the antenna – a different situation to running 400W PEP on SSB.

The Moonraker W3EDP antenna sells for £49.99, which certainly won't break the bank.

3



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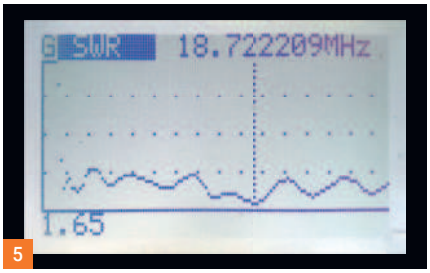


5

The Alpha J-Pole Sr

The description for this unusual antenna says *"The Alpha J-Pole Sr Antenna is only 60ft in length. The unique design characteristics of this 10-160m HF J-Pole antenna enable it to approach resonance on the major HF bands (10/12/15/17/20/40/80m), all of which presents an SWR that is low enough for external tuners to achieve a near perfect match, including 160m.*

"Configuration: End-fed configurable as Sloped or Horizontal

"Frequency Coverage: 1.8-29.7 MHz (160-10m). An external tuner is needed for a few bands.

"Power Rating: 500W PEP SSB (200W CW or 50W Digital).

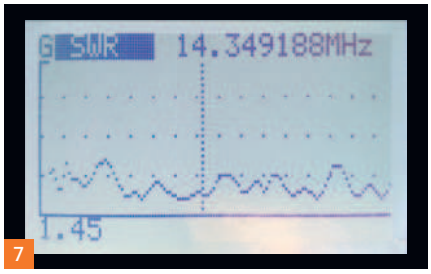
"An optimum installation would be where the antenna is deployed as a sloper with the high (feedpoint) end at 30ft or higher and the low end at 10ft or higher. We do not recommend installing this antenna as a Vertical due to users experiencing high noise (RFI) and unpredictable radiation patterns due to proximity of coax, which also allows for common mode feedback to increase".

In Use

This antenna intrigued (and continues to intrigue!) me, if only because it's not at all clear how it works, although it claims to draw on experience from wideband military antenna systems. It basically consists (see photo, **Fig. 6**) of two lengths of wire in parallel, one of 60ft and one somewhat shorter, connected separately to output terminals of what can only be described as a 'black box' (because I have no idea what is inside it). Actually, it's described as a balun but that doesn't explain the two (non-balanced) outputs.

The 'black box' is fed directly with coax and it is recommended that the feedpoint is elevated but the remainder of the configuration is down to the user (depending on what supports are available, what sort of QSOs you want to make – local, DX, etc – and so on).

In my case, I hung the antenna between the same two 20ft poles I had used for the W3EDP antenna, feeding the coax into the 'black box' at the top of the nearest pole. A check of SWR at the shack end showed



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nulls on pretty much every amateur band, a result I wasn't really expecting because I had assumed this was some sort of wide-band antenna. The curve can be seen in **Fig. 7**. The actual SWR varied from 1.5:1 on 20m to 2.6:1 on the 12m band. Bear in mind this was measured at the shack end this time (because the feedpoint was inaccessible once installed), so includes any transformation effect from the feeder. What this meant was that my IC-7610 would happily work into it on all bands. The same, unfortunately, wasn't true of my Expert linear amplifier (which is only really happy with SWRs of 2:1 or less) but, as before, reverting to my Elecraft line-up enabled me to run full power on all bands.

Again, and still during the LZ DX Contest, I was able to work very successfully throughout Europe and beyond (for example, into the US and Canada).

This antenna is significantly more expensive than the Moonraker W3EDP, at £199.99, but 'felt' to me to be more substantial and better suited to home station use.

Summary

The antennas reviewed are just two from the wide range available from Moonraker (see below). Both gave acceptable results and, in a sense, both are similar in that the radiating element is 60ft or so of wire. It can be argued that the only substantive difference is the way that wire is fed and matched. But the main differences are in the construction and the J-Pole is significantly more substantial than the W3EDP, which presumably accounts for much of the difference in price. Personally, I would think in terms of the J-Pole as a long-term home-station antenna, while the W3EDP would serve well for portable operations.

Incidentally, I hadn't really looked at the antenna pages on the Moonraker website before. I was blown away by the enormous selection of antennas that they stock and sell. There really does seem to be something for all bands and all purposes – you just need to work hard on finding the right one for you!

www.moonraker.eu
http://AlphaAntenna.com

6

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The Magic Bands

A Guide to 6m & 4m Amateur Radio

By Don Field, G3XTT

The Six Metre (50MHz) and Four Metre (70MHz) bands are known as the 'Magic bands' by radio amateurs. This book provides a comprehensive guide to these fascinating bands and why they are so popular.

The 'Magic bands' attract a special kind of enthusiast, someone who is prepared to put in long hours on a seemingly dead band, waiting for a fleeting opening or finding ways to make QSOs by means of meteors or even by reflecting signals off the Moon.

The 6m band is now almost universally available across the amateur radio world, while in recent years 4m access has been granted to many more countries, often on a permanent basis. So why miss out on the 'Magic bands'? *The Magic Bands* is recommended for anyone who wants to try these bands out.

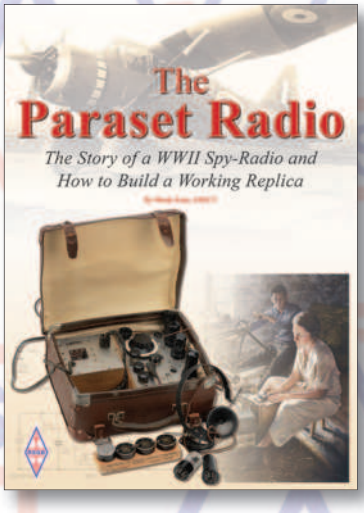
Size 174x240mm, 208 pages, ISBN: 9781 9101 9397 6
Price: £15.99

Also available on amazonkindle

The Paraset Radio

The story of a WWII Spy-Radio and How to Build a Working Replica

By Hiroki Kato, AH6CY



This book describes the gripping story behind the Paraset – a unique spy-radio, dropped behind enemy lines in the dark days of WWII. This radio being both light weight and state of the art for the time was concealed in a suitcase, making it ideal for use by the spies of SOE. This book describes how the Paraset was used, the technical specification and even how you might build your own replica.

This book was inspired by the epic stories connected to this radio. These radios were first made in workshops in England at Whaddon Hall and then at Little Horwood, near Bletchley Park.

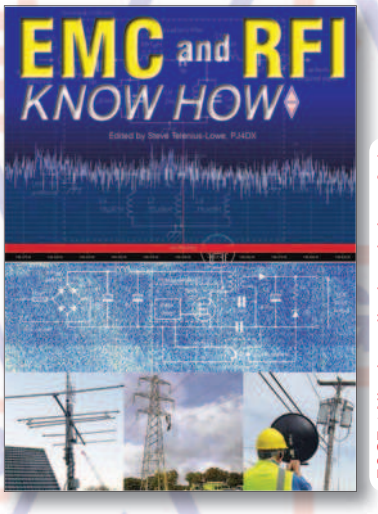
The Paraset Radio is a rare insight into a radio that provided vital spy communications in WWII. It may also provide the inspiration for you to build your own working Paraset radio.

Size 174x240mm, 88 page, ISBN: 9781 9101 9395 2
Price: £8.99

Also available on amazonkindle

EMC and RFI *Know How*

Edited by Steve Telenius-Lowe, PJ4DX



Many radio amateurs have Electromagnetic Compatibility (EMC) issues or, as it is more commonly referred to in the US, Radio Frequency Interference (RFI). As a scourge of our time there has been much written about this topic as to cures, identifying the problems and much more. *EMC & RFI Know How* sets out to draw this material together and provide valuable insight into an area that is considered by many to one of the most important problems facing amateur radio today.

The average home contains numerous electronic devices that can potentially cause interference in the amateur radio spectrum. *EMC & RFI Know How* takes a detailed look at how this interference can occur -- and how it can be defeated. If you suffer EMC and RFI problems or not, this an essential book for every radio amateur's library.

Size 174x240mm, 208 pages, ISBN: 9781 9101 9396 9
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www.rsgbshop.org

Radio Society of Great Britain 3 Abbey Court, Priory Business Park, Bedford, MK44 3WH Tel: 01234 832700

Tim Kirby GW4VXE
longworthtim@gmail.com

Transequatorial Propagation on 144MHz

Tim Kirby GW4VXE reports on some interesting propagation on the 2m band, and also on a picture net using D-STAR.

I'm always interested to learn about VHF/UHF propagation in other parts of the world. Over the last month or so, there have been some very interesting contacts taking place from the Caribbean, into South America, on 144MHz.

Transequatorial propagation (TEP) takes place when there are ionising bands in the F layer on either side of the geomagnetic equator. 50 and 144MHz are usually affected, although TEP has been recorded on 432MHz. EA6VQ records some useful observations about TEP on the website below but the most important points are that a moderate level of geomagnetic activity seems to improve the chances of openings.

www.dxmaps.com/tep.html

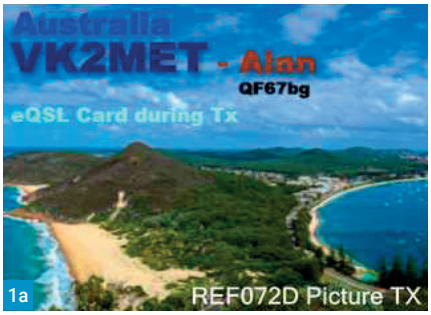
Some QSOs have been reported when the A index is over 30 as well as Solar Flux being lower than 70. Signal strengths are often high but there is typically a lot of fast fading and sometimes a surprising amount of Doppler shift. Openings usually occur around the equinoxes (February to April and September to November). The best time of day is usually one to three hours after sunset. The receiving station and transmitting station should be located at roughly equal distances from the geomagnetic equator and the path should be as close to North/South as possible (variance of up to around 15° has been noted).

In early October, **Burt FG8OJ** in Guadeloupe worked PY2PAL in Sao Paulo. FG8OJ posted a nice video on Twitter that he had received from PY2PAL showing his signals in Brazil. The distance was 4455km. Then at the start of November, PJ2BR in Curacao worked LW2DAF in Buenos Aires over a distance of 5312km. Once again, there's a video – on LW2DAF's Twitter stream – of PJ2BR's 2m signals as heard in Buenos Aires. There is a lot more 'warble' on the signals than was noted on the FG8OJ/PY2PAL contact.

PJ2BR went on to work several other stations from Argentina, including LU2EPO, LU7DW, LU5BE, LU1DL and LU4DIR during the opening, which took place on November 3rd around 0000UTC.

Because of the warble/distortion introduced by TEP, all contacts that I am aware of have taken place on SSB. I suspect FT8 would not decode. Marvellous contacts and I am grateful to **John EI7GL** for highlighting them on his blog:

http://ei7gl.blogspot.com



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John EI7GL also reported another interesting contact from the Southern Hemisphere, this time on 70cm between **Tom ZS1TA** in Plumstead, South Africa and **Garry ZD7GWM** on St Helena on October 16th 2020. The distance is around 3135km and it was made on FM using modest equipment of around 35W to a vertical. Apparently, the path between ZS1 and St Helena opens fairly regularly on 2m, but as far as I know, this is the first time that a 70cm QSO has been reported.

The D-STAR Picture Net

Jef Van Raepenbusch ON8NT writes, with some information from **Lewis Maxwell KB5HPT** about the D-STAR picture net:

"Every Thursday at 0130UTC there is a D-STAR Picture Net on REF072D with REF055D as a backup. The RS-MS1A Android App (available in Google Play) can be used by operators with the ID-31A PLUS, ID-51A PLUS (anniversary model) and ID-51A Plus2. IC-705, ID-4100, ID-5100, and IC-7100 radios will need the OPC2350LU data cable. If the Bluetooth module is installed in the 4100 and 5100, then the cable is not needed. The RS-MS1I App (available in iTunes Store) for iOS users can also be used with the ID-4100 radio only. IC-9700 users are welcome and encouraged to join too. We will be exchanging pictures, text messages, and positional information.

"The Kenwood D74 handheld will work with the RS-MS1A Android App. First, pair the handheld with the Android device via the radio's Bluetooth. Start the App and go to the Application Settings. Tap to select a transceiver model. Select Other (Bluetooth) then close.

"There is a free Windows app, ST-4001W from Icom and ST-4001A (available on Google Play) that processes any .jpg or .png picture to the right pixel size and can add a signature or label to the edge. You can use the ST-4001 app to send the formatted picture over ethernet to the radio or just copy it into the /IC9700/Pictures folder on the IC-9700 formatted microSD card or to the Android device. Once the photos you want are copied, you can just plug the microSD back into the 9700 radio. The new pictures are then available to send from the choices that are available when the PICTURE menu is opened on the radio.

"Here is how we rate the pictures on the net. It depends on how many blocks are missing in the received picture.

P-1= Perfect picture
P-1 Minus= 1-5 blocks missing
P-2= less than 25% of blocks missing
P-3= less than 50% of blocks missing
P-4= less than 75% of blocks missing
P-5= No picture

"After the picture has been sent the net control will poll each check-in by voice to get a picture report at their location.

"The format for this net is much like a

voice net in that check-ins will be taken and then the NCS will direct when the stations will send their pictures".

Jef says that the net is in the early morning on Thursday for him, but he leaves his transceiver on overnight and then in the morning discovers all sorts of pictures.

Outside of the net, Jef has exchanged pictures and had D-STAR voice QSOs with KB5HPT, KL0YO, N0BF, DJ7FG, DL5OCD, N4JAP, VK1FLEX, VK2MET, W0AAS, KE0KIS, VE7VIB, WB6DJI, OE6SDG, M0SDF, M5BOP, WM3M, ON8DSW, WM6H, PD2V, ON4PN, WI3B, M0JMO, CT2CVW and ON4ARV.

Jef writes, "*I also exchanged pictures with ON4PN on 144MHz simplex over a path of 22km, with 10W and 58 Signals both ways and with 100% copy of the pictures".*

The photo, **Fig. 1**, shows a couple of the pictures Jef has received via the net.

More on the Flowerpot Antenna

It was good to hear from **Andy Dunbar G6OHM** who mentions that he is the originator of the Flowerpot antenna design, which is shown on his website at: https://tinyurl.com/y42y4d8o

Andy says that he has built flowerpot antennas for 28, 50 and 70MHz along with the short 144/432MHz design. He also says that a 144/432MHz flowerpot antenna is used on the MB7IAD Hubnet node in Cambridgeshire

The 6m Band

Colin Fawcett G8YIG (Stalybridge) took part in the 50MHz UK Activity Contest making a number of QSOs: G0CER (IO82), GW4ZAR (IO83), G8ZRE (IO83), G8AQA (IO82), G0XBU (IO83), G4JLG (IO83), G8BUN (IO93), G8REQ (IO83), GW8ASD (IO83), G4BEE (IO83) and G3TDH (IO83). Colin has been busy refurbishing his shack, which looks great, **Fig. 2**.

Here at **GW4VXE** (Goodwick), I caught a Sporadic E opening on October 25th, which seemed to go on for most of the afternoon, although I was only on for a few minutes, working OE6JCG (JN76), HA2NP (JN97) and EA4C (IM68).

The 4m Band

Gordon Smith GW6TEO (Castlemartin) says that with the incessant strong winds on the coast, his tower has spent more time luffed over than vertical! On October 17th Gordon worked SP9HWY (JO90) and DF5SF (JN39) on 4m meteor scatter using MSK144. On November 7th, SP9HWY was worked again as well as ON4IQ (JO20) on meteor scatter although his signals were visible by aircraft scatter towards the end of the QSO.

Figs 1a and 1b: Two pictures received on the D-STAR picture net by Jef ON8NT.
Fig. 2: Colin G8YIG's neatly refurbished shack.
Fig. 3: Steve G4AQB's 4m flowerpot antenna
Fig. 4: Out on Route 66 with Patrick WD9EWK at the intersection of grid squares DM54 and DM55

Steve Macdonald G4AQB (Bolton) writes, "*In this month's* PW *you mentioned the Flowerpot antenna. I have been using one on 4m for the last couple of months and it works really well, giving a good SWR throughout the band. It is very easy to make, consisting of a length of RG58 coax partially stripped with a few turns wound on a former at the base as a choke. I ran the wire up a 2m length of plastic conduit and the whole thing cost me less than £5!"* (**Fig. 3**)

The 2m Band

Simon Evans G6AHX (Twyning) took part in the RSGB 2m UK Activity Contest on November 3rd, making 23 contacts in 12 squares with the best DX being G8PNN/P (IO95) at a distance of 357km.

Gordon GW6TEO worked PE1OBX (JO22) on tropo on October 16th and TM75ONY (JO10) the next day, both on FT8. Yuri UT1FG/MM was worked from HN74, HN95 and IN05 by meteor scatter on October 18th, 19th and 20th. Unfortunately, due to strong winds, Gordon wasn't able to work Yuri in some other wet squares, which would have been possible. On November 6th, Gordon worked S51AT (JN75), IV3/HB9CAT (JN65) and YT3N (KN04), all on meteor scatter, with PA5M (JO21) on tropo. IK0BZY (JN61) was worked next day on meteor scatter using JTMS mode.

During late September, Steve G4AQB worked DG3TF and OZ2ND on 2m FT8 during a short lift.

At GW4VXE the highlights of the 2m log have been QSOs with UT1FG/MM in some wet squares as he crossed the Atlantic in the *MV Goldeneye*, sailing from Charleston to Rotterdam. I made meteor scatter (FSK441) QSOs with **Captain Yuri** in HN84 and HN95 and FT8 QSOs in IN47, IN48 and IN89. At the time of writing, Captain Yuri is heading across the Atlantic again, this time in a westerly direction although I have not yet worked him from any unusual squares.

The 70cm Band

Simon G6AHX took part in the UK Activity Contest on November 10th, making 18 contacts in 11 squares with the best DX being GM3SEK (IO74) at a distance of 339km.

Steve G4AQB worked OV3T (JO46) on 70cm FT8 at the end of September.

The 23cm Band

Simon G6AHX writes, "*I attempted to do the 23cm UKAC in October and had absolutely no contacts! On investigation, my IC-9700 had stopped putting any RF out on certain parts of the band, particularly around the SSB section. I then discovered a software update issued in May this year that I'd missed [1.24]. It corrected the problem but by then I'd removed my 23cm beam. So, I've built a bi-quad antenna for 23cm to test the 9700. Thanks to* ***Steve G4NZV****, in Tewkesbury, I have been able to prove SSB on 23cm works again*".

Steve G4AQB writes, "*23cm FM seems to be becoming more and more popular here in the North West. We have had an FM net on 1296.500MHz every Wednesday evening at about 8.15pm.* ***Ross G6GVI*** *is one of the founder members of the net and shared some information that he has collected over the last year or so. During the months we have had 25 callsigns that have called into the net from all over the North West. There have been up to eight stations in the net at any one time. Most stations are using horizontal antennas, but a few have used vertical antennas. Some stations are using commercial transceivers such as the Icom IC-9700, while others are using SG Lab Transverters. Everyone is welcome to join the net*".

Here in West Wales too, there is a growing interest with **Peter Harston GW4JQP** and **Mike Probert GW4HXO** encouraging local stations on to the band. Peter and Mike are regularly active on the band and welcome sked requests. They are both active during UK Activity Contests.

Satellites

Jef ON8NT received a number of SSTV pictures during the ISS ARISS event scheduled to run between October 4th and 8th, although Jef says it started a day early, so he missed some of the pictures

Kevin Hewitt ZB2GI (Gibraltar) took part in the SSTV event between October 3rd and 8th and received the complete set of 12 images. Kevin received the daytime passes from the top of the Rock at Signal Hill and the night-time passes from either Mid Harbour Marina or Eastern Beach. Kevin used his FT-817, a manually tracked 2m/70cm log periodic, a data interface and a Windows 7 Notebook running MMSSTV.

Graham Jones G3VKV (Cheltenham) writes, "*On November 11th* ***Christian F5UII*** *was transmitting video on the QO100 satellite asking if anyone wanted a duplex contact, either video to video or SSB to video using both transponders. I gave him a call on 10489.830MHz SSB and had a QSO*".

4

My thanks **to Patrick Stoddard WD9EWK** (Phoenix) who tells the story of some rare satellite grid activity in the USA. *"Summer has finally given way to autumn here in Arizona. The rare grid DL88 at Big Bend National Park in Texas was activated in late October, making many satellite operators around North America very happy. Others have been venturing to grids not heard often on satellites.*

"For North American satellite operators, the rarest grid in the continental USA – DL88 – was heard in late October. Most of DL88 lies in Mexico, south of the Rio Grande River, but a sliver of the grid falls just inside US territory, at Big Bend National Park. Most of the park had been closed due to COVID-19 restrictions, but day trips to some remote parts of the park have been allowed since early October. This meant the DL88 activation was not on the air as long as it had been originally planned, but still enough to make many satellite operators happy. ***Doug N6UA*** *and* ***Ron AD0DX*** *drove to Big Bend and used the special callsign K5Z for their DL88 activation. A few operators were able to make contact with DL88, completing their quest to work all 488 grids in the continental USA (similar to the Fred Fish Memorial Award ARRL offers for 6m operators).*

"Without hamfests here in Arizona, my road trips away from home have focused on radio. I made one day trip to southern Arizona in the middle of October, operating from a few locations along two freeways on the way to the USA/Mexico border in grid DM41. During one of my stops, about a mile north of the border fence in southern Arizona, I had a visitor watching me and the area around me... a US Border Patrol agent. At that location, on a hilltop, I – and the Border Patrol agent – could easily see the border fence and into northern Mexico. The Border Patrol agent didn't bother me, and I apparently didn't bother him, as the agent didn't come over to ask me what I was doing there. The Border Patrol agent was on the highest part of the hill, but where I parked was still very good for satellite operating – higher than most of the surrounding area.

"Early in November, just before the first snowfall in northern Arizona, I made a road trip out to the DM54/DM55 grid boundary. The spot I used is on the old Route 66, the famous US highway that ran from Chicago to Los Angeles. Sections of the old highway still exist in Arizona, even after the construction of freeways, which now carry traffic across that part of the state. I was able to park along the old highway, just east of a nearby freeway exit and west of Petrified Forest National Park, **Fig. 4**. *I spent the day working passes in FM, SSB, and even tried packet via FalconSat-3. An afternoon storm forced me to sit in my car for about an hour, but the rest of the day was productive on the satellites. Both of these grids were rarely heard on the satellites, with no resident operators living in either of the grids. DM54 and DM55 are a little less rare now".*

Merry Christmas ßsand a Happy NewYear

That's it for another year! Very many thanks to you who have sent in news and information and especial thanks to those of you who buy the magazine and read the column. I wish all readers and your families a great Christmas and New Year. I'm looking forward to reporting 2021's VHF/UHF happenings for you. Thank you.

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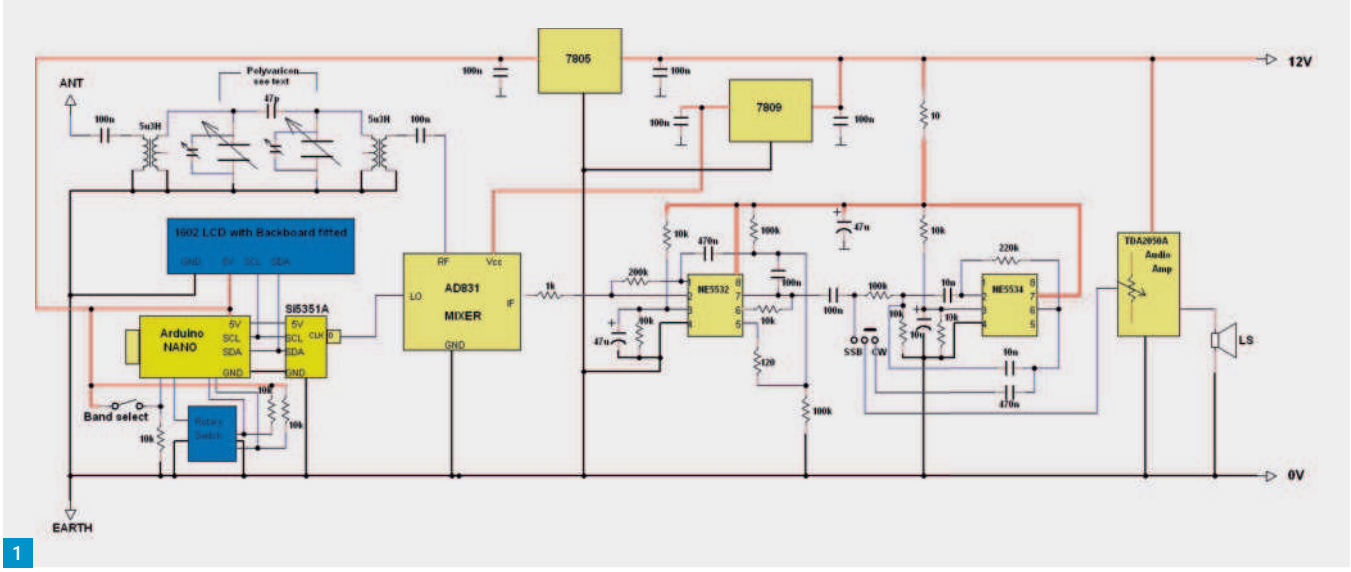
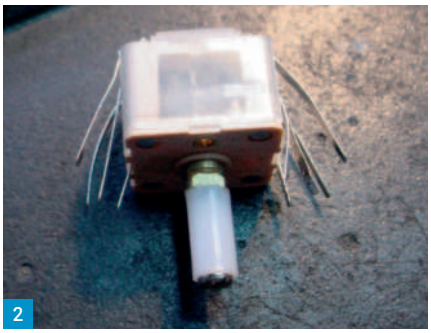


1

Eric Edwards GW8LJJ
ericgw8ljj@outlook.com

A Modular DC Receiver

Eric Edwards GW8LJJ describes a 3.5MHz to 14.35MHz Modular Direct Conversion Receiver.



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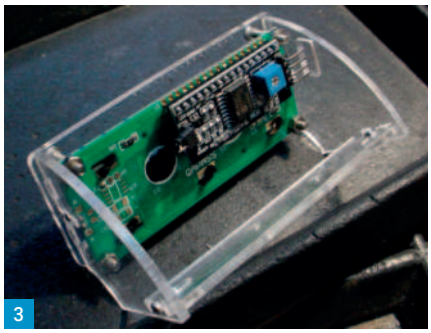


3

This design has three fixed 'starting' frequency bands. The lowest is 3.500000MHz with the next one set at 7.000000MHz and the third starts at 14.000000 and ends at 14.350000MHz. There is an RF preselector that covers all frequencies between 3.5MHz and 14.35MHz by turning the preselector control from fully anticlockwise to clockwise. This eliminates the need for switched bandpass filters to cover several bands. The project is configured to simplify construction and allow changes to the design by choosing different 'parts' of the circuit that you may already have or prefer to use. The audio amplifier, for example, can be one already built, perhaps using the popular LM386 or similar. You may want to use your own antenna tuning unit as a bandpass filter, although the one in this design works very well on my half-wave 80m ladder-fed dipole, bypassing the shack ATU.

The Circuit

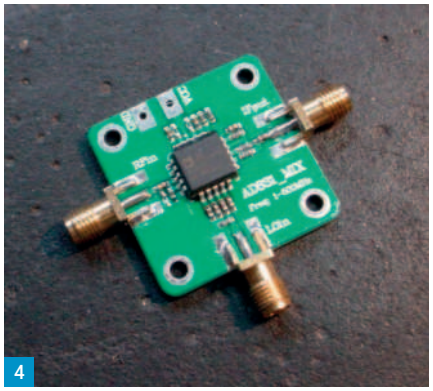
The circuit, **Fig. 1**, is shown complete with a mix of commercial and home-made units. The antenna is connected to the bandpass filter via a 100nF capacitor and enters the first coil (transformer), which is the first part of the tuned preselector. The two transformers are the same and are equivalents to the once readily available TOKO 10mm KANK 3334R coils. The ones used in this design are 5u3H (5.3µH) types. Across each of these coils is a variable capacitor and trimmer that is housed in a 4-gang polyvaricon capacitor block. The values used are 280µF as the main tuning for both sides and 20pF trimmers. The polyvaricon has connections on both sides and it is one side that is used for the bandpass filter. The PCB allows the correct fitting of this unit. The pins should be bent towards the front (spindle end) as shown in **Fig. 2**. It can only fit one way as there are four pins on one side and five on the other.

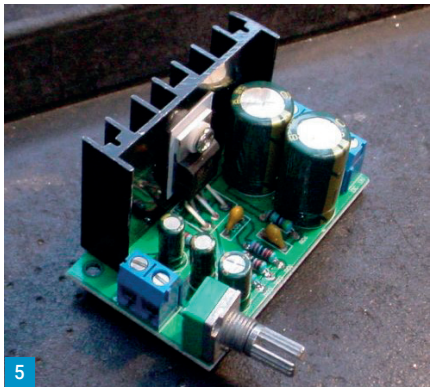
The VFO

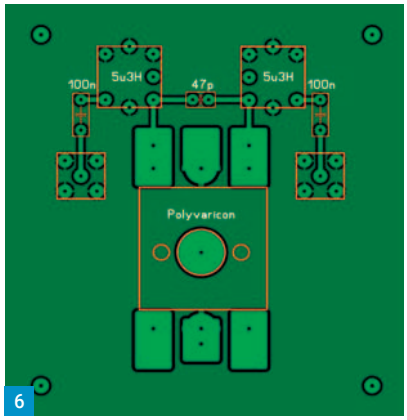
The VFO is built on a PCB and houses an Arduino NANO and a Si5351A clock oscillator. The Arduino has been programmed with the software required for the clock oscillator and the LCD (liquid crystal display). There are three preset bands, each with their starting frequency, and the tuning is also variable, from 3.5MHz right through to 14.35MHz. The bandpass filter can follow the tuning frequencies by adjusting the control from anticlockwise to clockwise. Whichever band is preselected, the tuning is continuous in steps of 10Hz, 100Hz, 1kHz, 10kHz or 100kHz with the indication shown by an arrowhead on the bottom line of the LCD pointing directly under the zeros on the top line.

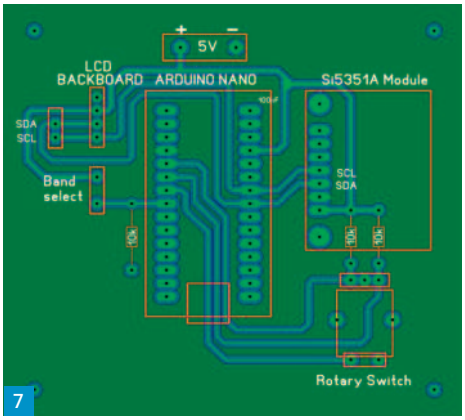
Band select is by momentarily pressing a button switch and it cycles from 3.5MHz stepping to 7.0MHz and 14MHz and back again to 3.5MHz where the operation is repeated. The output of the VFO is taken to the LO_{in} (Local oscillator in) marked on the Mixer module. There are also four pins on the VFO board that connections are to be made to, on mating four pins on the back board fitted onto the LCD.

Fig. 1: Circuit diagram. Fig. 2: Bending of the pins on the ploy varicon. Fig. 3: LCD and backboard in plastic holder. Fig. 4: The AD631 mixer module. Fig. 5: Audio amplifier. Fig. 6: Bandpass filter PCB. Fig. 7: VFO PCB. Fig. 8: Audio filter and preamp PCB. Fig. 9: The complete receiver.









LCD

The display used in this project is a 1602 type HD44780, 16 x 2 character display. This has two rows. The top row is used for the frequency readout and the bottom row indicates the rate of change in steps from 10Hz to 100kHz. There is a serial backlight board attached to the LCD allowing all information sent to the display by using the I²C serial interface. In my unit the LCD and backboard are housed in a plastic holder, **Fig. 3**, for easy fitting to the base of this project.

Mixer

The mixer module is a commercial unit employing an AD631 surface mount integrated circuit ready fitted, **Fig. 4**. There is no insertion loss and it has RF and LO inputs between 0.1MHz and 500MHz with an IF output between 0.1MHz and 200MHz. The power supply for this module is 9V to 11V. As this project uses a power supply of 12V (13.8V), a 9V regulator is used to supply the correct voltage for this mixer module.

Audio Preamp and Filter

The IF output from the mixer module is routed to an audio preamplifier and filter. The NE5532 is a low-noise dual op amp (operational amplifier) and the first part is used as a preamplifier with a gain of 200, which is set by the ratio of the input resistor (1kΩ) connecting between the IF output of the mixer module and pin 2 (inverting input) of the op amp and the 200kΩ resistor connected between pin 2 and the output at pin 1. The non-inverting input at pin 3 is biased at half power supply voltage. Op amps usually work with a split supply (plus and minus voltage with 0V connected to ground) but it is often practical to power op amp circuits from a single polarity supply. The problem is that an op amp is a dual-supply device so some type of biasing, using external components must be used to centre the op amp's output voltage at mid-supply. This bias voltage is supplied by the two 10kΩ resistors, one connecting to the positive supply rail and the other to ground. This is a potential divider and provides the half voltage at pin 3 producing the bias, which allows the maximum input and output voltage swing for a given supply voltage.

Two Filters

There are two filters employed, one for SSB and AM reception and another for resolving CW. There are three pins on the PCB that are used for selecting SSB or CW. A linking plug (same as on PC mother boards) is used to select the mode. The SSB filter is made up on the second part of the first op amp (NE5532) with the main components 470nF and 10nF. This is a lowpass filter and the output is connected to one of the 'filter select' pins on the PCB so that it can be routed to the audio amplifier or connected to the second filter, which is a CW bandpass type employing an NE5534. There is a bias arrangement on the second part of the NE5532 to provide the half power supply needed. The CW bandpass filter also has the half supply voltage for the same reason as on the other op amp. The bandwidth of this filter is governed by the two 10nF capacitors and the 220kΩ resistor on pin 2 and pin 6 along with the 10kΩ resistor connected between the two 10nF capacitors and ground. Making this 10kΩ resistor variable the CW band filter can be changed. I found the 10kΩ fixed resistor provided good filtering for CW.

Audio Output

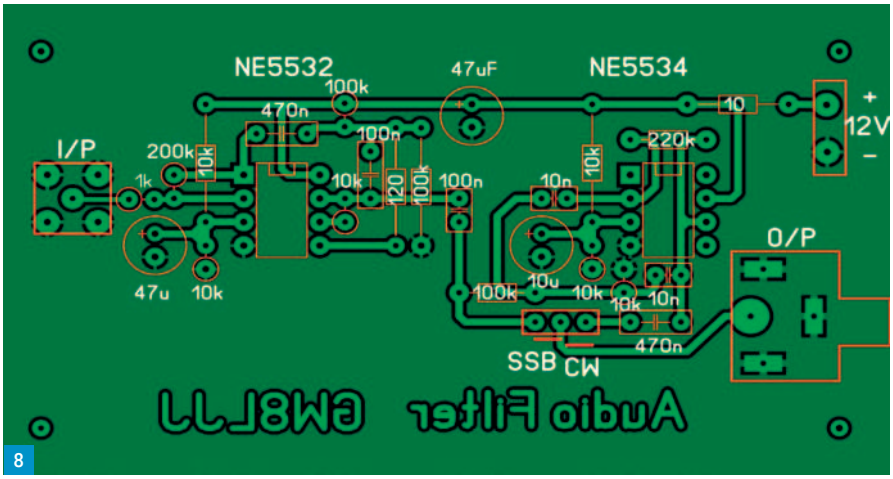
The audio output, **Fig. 5**, uses a ready-made commercial audio amplifier requiring only a power supply and speaker. The output from the filters is connected to this audio amplifier that has a volume control pre-fitted. The power supply for this amplifier is between 12V and 24V. While this project uses 12V (13.8V) with a good level of audio into the speaker, there will be a significant output level if it is used at 24V and the neighbours will be able to hear the signals as well! The output power at 12V is 10W and at 24V is 30W.

PCBs

There are three single-sided FR4 PCBs. **Fig. 6** shows the antenna bandpass filter and the sockets used are SMA types. **Fig. 7** shows the layout of the VFO, which contains the Arduino and clock oscillator modules with the band select and frequency tuning control that also contains the frequency step tuning. The clock oscillator module has an SMA socket pre-fitted for the output. **Fig. 8** is the audio preamplifier and filters. The sockets used are SMA for the input and a phono type for the output socket.

In Use

This project can be made up on a base board as shown in the photo, **Fig. 9**, for demonstration or as a building block for future changes, or the individual modules can be arranged to suit your own requirements. The LCD can be fitted onto a front panel along with the antenna preselector and the



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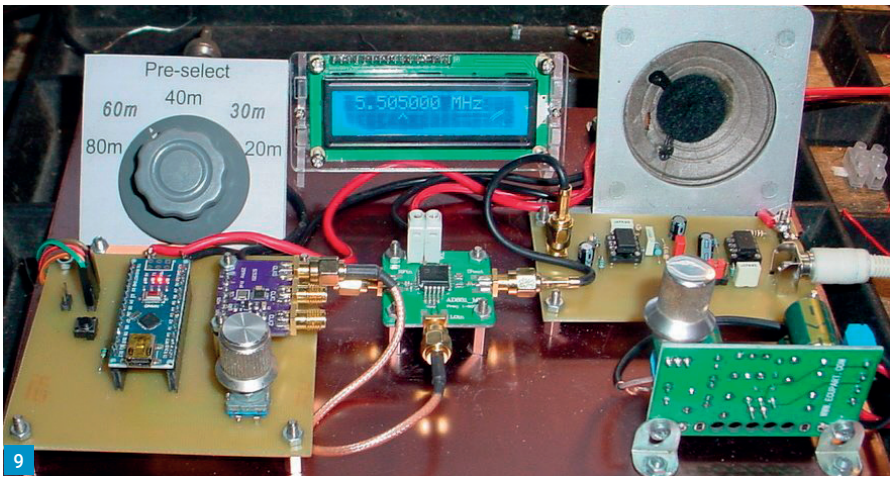

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audio amplifier with a suitable speaker.

The only alignment is minimum and is the antenna pre-set calibration. Turn the polyvaricon control anticlockwise and if a signal generator is available, connect a low level 3.5MHz signal into the antenna socket. Set the cores on the coil so that they are flush with the top of the can. Turn on the receiver, allow it to initiate and show 3.5MHz (with all the following zeros) on the LCD. A signal (tone) should be heard in the speaker. Adjust slowly with a plastic (nylon) core-adjusting tool until the signal increases. Adjust both coils, which should be approximately the same level of adjustment. When the loudest signal is heard, turn the signal generator level down so the signal is just audible and adjust the cores again for maximum tone output. Turn the preselector fully clockwise, set the signal generator for 14.35MHz and press the band select button to show 14MHz. Turn the frequency control until 14.35MHz is seen on the LCD. Check the coil for maximum tone output level heard in the speaker. If any adjustment is needed, go back again to the 3.5MHz settings and check for the strongest signal. If a signal generator is not available then plug an antenna into the receiver, tune to an 80m station and with the preselector turned anticlockwise, adjust the cores for maximum signal level. Do the same at 14MHz and it will be set for all the frequencies.

This is a general coverage receiver so other frequency bands can be received. Set any on the preset bands and continue tuning up the band and adjusting the preselector as well for maximum signal. When the filter is set in the SSB position, to resolve an AM signal tune until a centre tone is heard, then with a low setting on the step frequencies adjust until the tone is nulled out. The 10Hz step setting is probably best for this adjustment. The CW setting is very effective for resolving CW stations.

Is there a Kit?

I can supply my usual 'picking list' of available parts upon request from me at ericgw8ljj@outlook.com

Acknowledgement

VFO Arduino programming: **Ray G7BHQ**. (Please note: This is not available as a download). The Arduino and clock oscillator modules are supplied as a pair.

Radio Round-up

ANYTONE DUAL-BAND MINI MOBILE RADIO: The Anytone AT-779UV Dual band Mobile radio is a compact rugged 25W mobile radio. Factory preprogrammed with the Moonraker code plug, including all UK repeaters, 2m Simplex, 70cm Simplex, PMR446 (TX disabled), Marine Band (TX disabled). Memory Default power set at 10W, making it an ideal Foundation licence radio. In stock at £89.95 inc. VAT.
https://tinyurl.com/y4z7qjug

RCF LOOKING TO SUPPORT SCHOOLS AND UNIVERSITIES: The Trustees of the Radio Communications Foundation have noted the increase in newcomers to amateur radio since lockdown. Newcomers may not be aware that RCF is a charity that is committed to supporting radio clubs in schools, colleges and universities. If any readers need help in establishing, resurrecting or improving a school, college or university amateur radio club they should contact the RCF:
https://commsfoundation.org/contact-the-rcf

FIBRE MAST ANTENNA: As a follow-up to his *Fibre Mast Vertical* project (*PW*, November), Jonathan Hare G1EXG says, *"I have just put a web page on my site about the fibre mast experiments:*
https://tinyurl.com/y2zfurtv
"I will be 'topping this up' with extra info/experiments as I go along.
"On another topic (but still science and electronics), I have a new website dedicated to my online workshop (mainly for kids but also for A-level students etc.)":
www.zoomscience.co.uk

HISTORIC RADIO BOOKS: (from *ICQ Podcast*) **Iulian Rosu YO3DAC/VA3IUL** has made available some PDFs of radio books from the 1920s, 30s and 40s. Among the titles available are: *The Wireless Experimenters Manual* (1920), E.Bucher; *Radio, Miracle of the 20th Century* (1922), F.Drinker, J.Lewis; *Principles of Radio* (1934) - 2nd Edition, K.Henney; *Automatic Frequency Control Systems* (1937), J.F.Rider; *D/F Handbook for Wireless Operators* (1942), W.E.Crook
https://tinyurl.com/ycfnavhr

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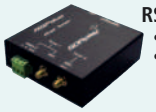

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- Power: 0.1-120W

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Colin Redwood G6MXL
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Getting Started (Part VI)

Colin Redwood G6MXL looks at eQSL and compares it with Logbook of the World. He also recommends a downloadable book to help those struggling with the maths for the Full Licence.

A couple of months ago, I looked at Logbook of the World (LoTW) and described various techniques for producing adi log files to upload your contacts. At the time, I suggested readers kept their adi log files so that they could be used elsewhere. This month I am looking at one of the other uses of adi format log files – uploading them to eQSL.

eQSL has similarities to LoTW, but there are some notable differences. Like LoTW, eQSL is based around stations uploading their logs to a central server and automated routines identifying matching contacts and marking them as virtual QSLs, **Fig. 1**. Unlike LoTW, eQSL also includes a facility for stations to produce hardcopy eQSL cards from their matched contacts, and also delete contacts once uploaded. eQSL also incorporates a number of awards that registered users can apply for.

Registration

Unlike LoTW, registration is very straightforward, **Fig. 2**, and completed using an internet browser. A second page, **Fig. 3**, captures information about your station, including locator, CQ Zone (14 for the British Isles), ITU Zone (27 for the British Isles) and IOTA (EU-005 for mainland England, Wales and Scotland). You'll also need to provide a postal address and e-mail address. At the bottom of the second page you can select under what circumstances you wish to receive e-mails from eQSL.

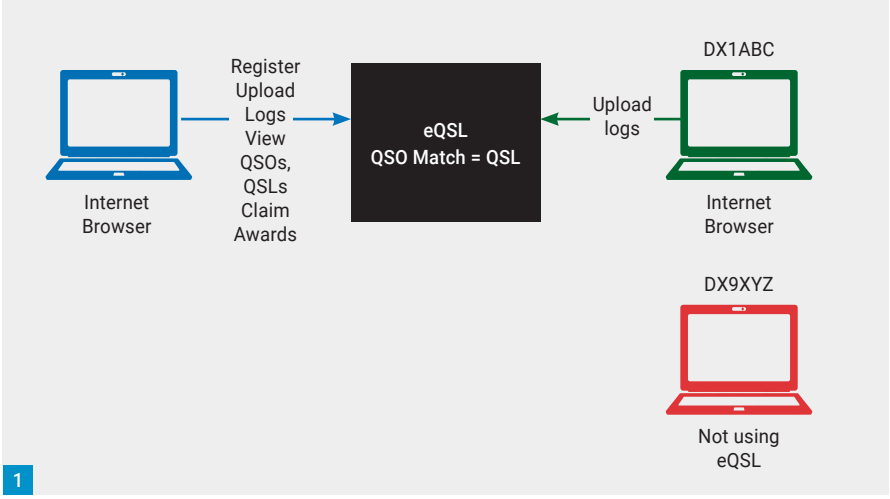
Membership Levels

Unlike LoTW, which has a single membership level, eQSL has four levels of membership. Basic membership is free of charge and provides for the uploading of ADIF logs or manually entering log information. It also provides an option to select one of two different eQSL card designs and a variety of card graphics. Basic membership can be configured to send you notifications of new eQSLs arriving and the ability to print incoming eQSL cards on your local printer.

Bronze membership requires an annual donation of at least US$12. If you fail to do so, you are downgraded to basic membership. The benefits of Bronze membership (in addition to the Basic membership) are that you receive a deluxe Public Member Profile, you can participate in the eAwards program (eWAS, eDX100, eZ40, etc.), upload your own custom graphics for your eQSL (Style 3 or 4), use an eQSL Designer Tool for a custom layout (Style 4), use premium graphics from the eQSL image library, and have eQSL cards printed with 'handwritten' fonts and posted to you.

Silver membership requires an annual US$30 donation. Gold membership is effectively a lifetime membership requiring US$200 to have been donated. The main payment methods are PayPal or Credit/Debit Card.

I'd suggest starting off with either Basic or perhaps Bronze level membership.



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Uploading

Unlike LoTW, with eQSL you can use any internet browser to upload your logs in adi format. At busy times it may take a while before an uploaded log is visible, but usually this is a matter of a few minutes at most.

No .adi File

If you don't have your contacts on an .adi file, maybe in an old paper log, then eQSL includes a facility to manually enter contacts, **Fig. 4**. This might also be useful if you have worked a few contacts while at an alternative location. I noted that despite being based in the US, it supports bands such as 4m (which is not available in North America) and a good range of digital modes.

Benefits

To my mind, if you don't want to participate in the eQSL award schemes, the main benefit of eQSL is knowing with some confidence that some specific contacts you've made are actually in the other stations' logs. There is also a range of awards. You need to be at least a Bronze level member to participate in the award schemes.

Paper QSL Cards

You can request a paper QSL card for a contact through eQSL. You print it on your local printer, **Fig. 5**. Alternatively, you can have the card printed by eQSL and posted to you. For those outside America the current cost for cards printed by eQSL is US$3.00 per card including postage, which is charged to your eQSL postage account. Payment into your postage account is by PayPal or credit card (minimum deposit is US$5).

Before printing the card, you can view it online and can even choose whether it will be one-sided or double sided. I get the impression that cards are printed in batches and posted from the States. Even allowing time for international post, this seems to be a slow process, from my experience. Don't forget to allow for time in the international post.

Fig. 1: An overview of eQSL.
Fig. 2: The first page of registration.
Fig. 3: The second page of registration where you enter details of your station.
Fig. 4: Adding contacts manually without a .adi file is straightforward.
Fig. 5: A typical eQSL QSL card.
Fig. 6: A typical eQSL award. This one confirms contacts with 52 European countries using SSB.

eQSL Awards

Unlike LoTW, eQSL has a built-in range of awards that members with Bronze or higher levels of membership can apply for, **Table 1**. Many can be earned in increments of 25 or 50 confirmed contacts, making it easier to meet the requirements of some of the initial awards compared with many other award schemes. This may be particularly attractive to newcomers. In many cases it is possible to have the award endorsed for a particular band or mode.

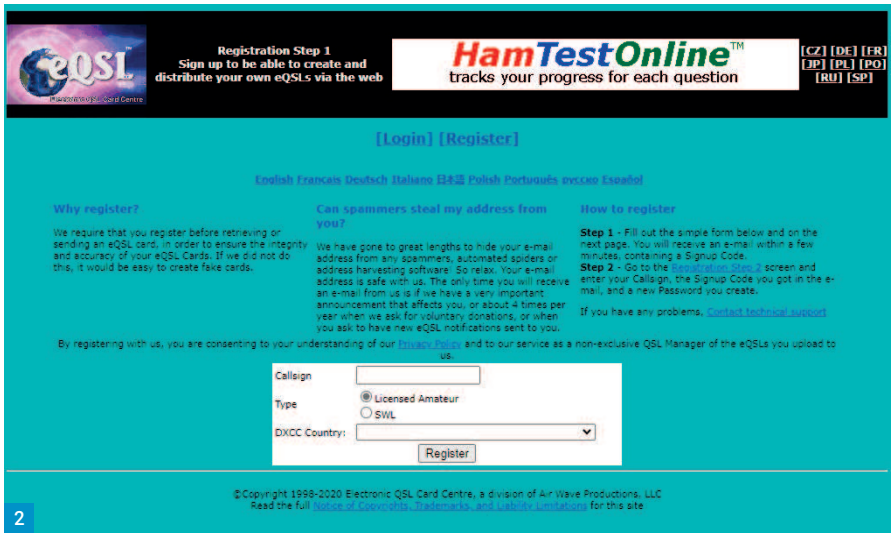
Besides having at least a Bronze level membership to participate in the award schemes, you'll also need Authenticity Guaranteed (AG) status (see below). Unlike awards issued by national societies such as the RSGB and ARRL, there is no charge for eQSL awards. Usually within an hour or so of claiming the award, a certificate is available to download and print at your leisure.

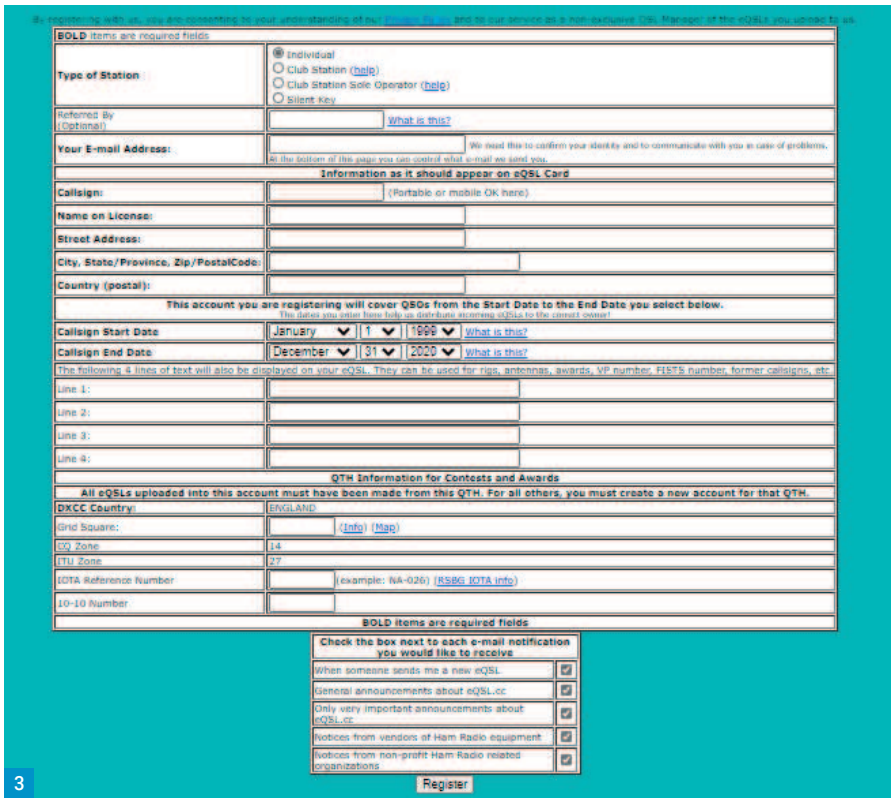
Authenticity Guaranteed

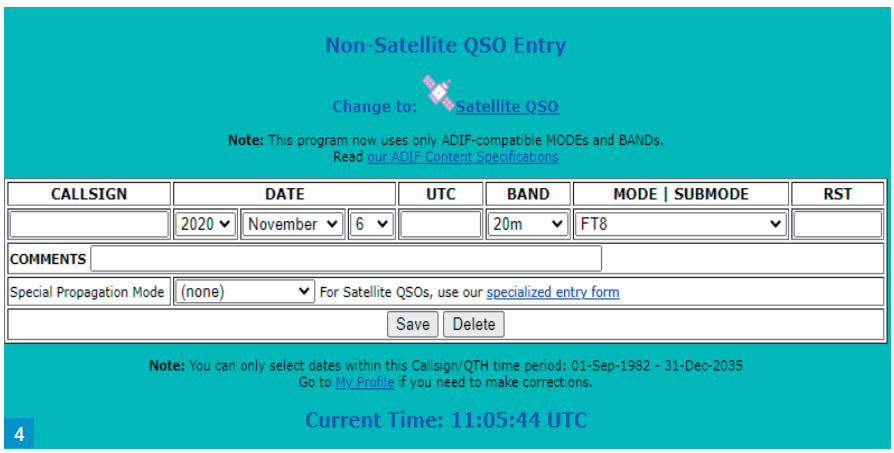
Authenticity Guaranteed (AG) is the way that eQSL certifies that they believe that any eQSLs bearing your callsign were in fact posted by the authorised licensee of that callsign. Authenticity Guaranteed (AG) can be obtained if you are already registered with the ARRL's Logbook of The World (LoTW). Alternatively, AG status can be obtained by scanning your licence document and uploading it. Within a few hours I had an e-mail confirming my AG status. The vast majority of my matching contacts on eQSL are from AG status stations. To my mind

Africa	Japan
Antarctica	N America
Asia	New Zealand
Australia	Oceania
Canada	Prefixes
DX (countries)	S America
DX100	Satellite
echolink	UK
Europe	Continents
From (Mainland France & overseas dependencies)	Continents – Honors
Grid (locators)	US States
	CQ Zones

Table 1: The main awards offered by eQSL.







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there seems little point in signing up for eQSL without also applying for AG status.

Drawbacks

Unlike with LoTW, eQSL works on an honour basis unless you have AG status. Consequently, eQSL cards are not accepted for awards from most national societies such as the RSGB and the ARRL. The German National Society (DARC) is a notable exception, while the Australian National Society only accepts eQSL from those with Authenticity Guaranteed status.

Portable Operation

eQSL allows the creation of additional linked accounts for operations made using a different callsign such as operating from portable sites.

If you are a keen Worked All Britain (WAB), Summits on the Air (SOTA) or other 'away from home' award scheme operator who activates more than one location on the same day, there is a significant problem with eQSL. Every time you operate from a different location (even one that you have used previously), then you need to design a new eQSL card if you want the relevant details of the operation to appear on the QSL card. Changes to location are based on date. While tedious, this does work with the exception of the situation where you activate multiple locations on the same day. In this case you'd find it impossible to produce an eQSL card that shows the correct location activated. Having said that, the WAB and SOTA award schemes don't require proof of contact (unlike RSGB locator-based awards), so for many amateurs it won't be a deal-breaker.

Conclusion

Overall, I have mixed feelings on eQSL. At the very least it provides a useful way of knowing that some contacts are in another station's log. This could save time and postage requesting a normal QSL card direct or via the QSL Bureau. If you like chasing awards, then for a small 'donation' each year, you can participate in the eQSL award schemes.

Comparison

Over the years I've uploaded the same logs to both eQSL and LoTW. I was therefore interested to compare the number of DXCC entities confirmed by the two systems. In early November 2020 I had 94 countries confirmed in eQSL, compared with 118 entities in LoTW. While there may be small differences between eQSL's definition of a country and the ARRL definition of a DXCC entity (used in LoTW), I really don't think these differences can go anywhere close to fully explaining the difference.

I think it shows that keen DXers worldwide tend to use LoTW as their prime way of confirming contacts for award chasing purposes. Regardless of whether you prefer eQSL or LoTW, I think it is a good idea and in the amateur spirit of co-operation to upload your logs to both, so that other amateurs can apply for the awards offered by eQSL and facilitated by LoTW.

Maths for the Full Licence

I know that for some amateurs studying for their Full Licence, the maths can be a real challenge. **Keith Williams GW4OKT** has produced a well-illustrated 60-page book that can be downloaded from the Chester and District Amateur Radio Society's website.

Keith has many years of experience of teaching radio amateurs at the Mold & District Radio Society. He is also one of the 'online' tutors for the Bath-based Distance Learning course. The book is really practical, taking candidates through each of the calculations step-by-step with a scientific calculator.

https://tinyurl.com/y2r7v6b4

Antenna Maintenance

By the time you read this, we will be rapidly approaching Christmas. Much of the worst of the winter weather is still to come. After the storms of early autumn, you may wish to give your outside antennas a visual check to make sure that their supports are solid and connections are watertight, so that there are no nasty surprises during the long winter nights.

Radio Round-up

MAJOR SERVER UPGRADE ON VOACAP ONLINE: **Jari Perkiömäki OH6BG** reports: *"A few weeks ago, VOACAP Online for Ham Radio, was moved to a new web platform, and this change forced me to re-factor the majority of the code in the back-end. I have now completed this task, and am continuously fine-tuning it, but I am pleased to inform that the coverage area maps and point-to-point prediction graphs are now much cleaner and neater than before, using a different mapping library. In addition, most of the codebase has been optimised and hopefully is more robust than ever. Especially the Propagation Planner, the propagation planning tool for HF contests (e.g. CQWW) & DXpeditions, should now be faster and also, as a bonus, offers the predicted values as CSV files for a more detailed analysis. All the same changes have also been implemented on the site of the VOACAP DX Charts".*

VOACAP Online for Ham Radio is a free HF propagation prediction service for the global ham community, running for more than ten years now, with integrations to the DX Summit and Club Log sites, for example. No registration required, no tracking on the site by Google Analytics, no ads on the pages, and no subscription fee for the service. Follow and subscribe to the latest VOACAP developments on Twitter.

www.voacap.com/hf
www.voacap.com/dx
https://twitter.com/VOACAP

RADIO AMATEUR OLD TIMERS' ASSOCIATION: The winter 2020 of RAOTA's quarterly magazine (*OTNews*) will be arriving on members' doorsteps in the near future. As usual the content covers a wide range. Accounts of how members discovered the hobby are a regular feature, as are aerial experiments & suggestions for 'postage stamp' gardens. G4JCP submitted an interesting article indicating that reflected power does not only happen at RF, it is present at DC too, with G3MCK weighing into the debate about whether reflected power is real, from a chemist's viewpoint. G0DHZ re-purposes a couple of old rheostats as variable inductors for ATUs and G4OWY outlines some of the unexpected ways he has come across antique QSL cards.

The Radio Amateur Old Timers' Association (RAOTA) aims to maintain the traditions and spirit of amateur radio. Although they are passionately interested in the history and traditions of amateur radio, and are fortunate that they can get a lot of this first-hand from their members, they are equally passionate about the future of our hobby. One of the magazine covers demonstrates this quite succinctly, having a cover showing a picture of communications in WW1 next to one of a DDS synthesiser kit. An article about each is contained in that issue.

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Joe Chester M1MWD
m1mwd@gmx.com

Questions, and more Questions

Joe Chester ponders the problems of local noise and how to get round them.

In case you can't spare the time to read this piece, I can say at the outset that I'm on the 80m nets, regularly, and on one particular net every day. But I should also confess that I'm a frequent user of the Hack Green, and other online SDRs (see references for web addresses) when I am working 80m. I do this because reception here, on 80m during daylight hours, is plagued with background noise.

In an earlier piece (*PW* August 2020) I said that in order to build a better 80m station, I needed to address two issues – transmission and reception. I'd not say that I have the transmit side sorted, but it's working better than it was when I started. Reception, however, is a whole new ballgame. I can say with certainty that on the many nets I earwig day after day, the number one topic is probably the background noise level. Many operators have been saying for some time that the Openreach implementation of xDSL is a major source of some (most?) of that noise. *RadCom* did a major piece on this recently (May 2020), and there is ongoing work to try to address the problem.

Where I live, my station has tall houses on two sides, I would assume with fixed line xDSL broadband, and WiFi routers on every floor. Add the noise from poorly made switched mode power supplies, and it's hardly surprising that I have high background noise levels. And this is why I listen on Hack Green and the other SDRs. But a thought struck me recently that this way of working is not new, or unusual. I suspect many of you will remember the days of separates – a transmitter and a receiver, with changeover relays. In those days it was not uncommon to use two separate antennas. Modern transceivers have the changeover relay buried in the internals, and a few now have two or more antenna connections. So, it's not unrealistic to use separate transmit and receive systems.

The advantage is that the receive antenna can be a low noise type. One often cited solution is to use a loop for reception. The Wellbrook loop is one example of a well regarded, highly efficient, low noise, receive antenna. This has the advantage that it can be rotated to reduce the noise level. Situated away from the house/shack would seem to be the correct place to mount such a loop, up a couple of metres if possible. There are lots of reviews of the Wellbrook about. There is also a DIY group making

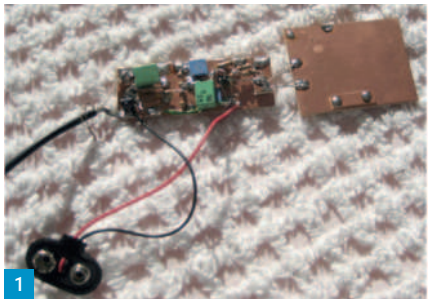


Fig. 1: E-field probe by PA0RDF, taken from G3XBM's comprehensive website: https://tinyurl.com/y6y7qko4
Fig. 2: Complete probes (even one in a film can), from the PA0DRF document.
Fig. 3: E-field probe (mounted on a plastic pole), also from the PA0RDF document.

homebrew versions of this design – called the Wellgood loop. Note that these loops differ from the Alexloop or the MFJ 1795 loops, which are also transmitting loops.

A loop receive antenna is only one possible solution. This antenna captures the magnetic component of the arriving signal. There is another approach, by capturing not the magnetic component, or H-field, but the electric or E-field component, which is orthogonal to the magnetic field. This can also be a low noise antenna, and can be easily built. It's much, much smaller than the loop, but just as effective at signal reception. At least that's what its proponents say. Now a slight detour into licensing conditions, before getting on with the practical stuff.

What is a Valid QSO?

Setting up a WebSDR is a popular activity among licensed operators. There are WebSDRs all over the world. These can be very useful for assessing propagation conditions. I use one in the Netherlands frequently to check my signal. I don't see any administrative issues with this. And it's entirely legal for anyone to listen to a WebSDR. And this includes licensed amateurs. To understand the question I want to ask, let's start with a separate transmit and receive system at the licensed amateur's registered address. There are clearly no issues here. But what then if one or more of the components is not at the amateur's registered address? There are two broad categories here – one is to have a distant receiver, the other is to have both transmitter and receiver at a distant location, as in remote operation.

Let's start with the first category – a distant receiver. The tricky question is the validity of a QSO using a distant WebSDR as receiver, and a transmitter at the registered address of the licensed amateur. Now if I want to put up a specialist receive antenna at some short distance from my station, surely it's only a minor stretch to imagine that receive antenna being a few metres away, or a few hundred metres even, or even a few (hundred) kilometres (over the internet)! And is that not what a WebSDR is? So, the question to those steeped in the administrative conditions of our operations is this – is a QSO using my transmitter and a distant WebSDR for reception a valid QSO? An example? *"Callsign 1 you are 53 with me direct, but 59+ on the SDR, Callsign 2 I'm not hearing you, you are S0 direct, but 59 on the SDR"*. Is this a 'valid' QSO? I think it's time to throw some specific expertise at this question. Your help would be appreciated.

Now drifting into the other category briefly, remote operation is a bit of a grey area at the moment. Some jurisdictions clearly allow it, some don't. I seem to recall being told that Ofcom is looking at this currently in the UK. The questions posed by remote operation are many – but I will concentrate on just one here. Is a QSO made by a licensed amateur via a remote station operated in accordance with the local regulations, a valid QSO, for example, in claiming DXCC?

Back to Separates

Sorry, this piece asks more questions than perhaps answers. But I want to come back to what I know is perfectly legal, in terms of the UK operating licence, a 'separates' system, with a receive side and a transmit

side. I'm quite certain that a separate low noise antenna, connected to a really low noise receiver is the way to go here. I have, in effect, two choices – an E-field probe, or a H-field, (or magnetic) loop. Let's start with the E-field probe. You could also call this an active mini-whip antenna. Extensive searching has turned up limited information about using these on the amateur radio bands. Essentially an E-field probe is a short piece of conducting material (the 'antenna') connected directly to a low noise amplifier. Some people have put the entire probe inside a piece of conduit pipe to provide weatherproofing. They are reported to work very well on the lower bands, even down to VLF frequencies. I want to use it on 80m – so this is possibly a bit higher in frequency than its use lower down. But the theory is good at least.

The most popular of these seems to be the one designed by **Roelof PA0RDT**, from Middelburg, in the Netherlands (lovely place!). **Fig. 1** shows the complete antenna. Nothing extra, no trailing antenna wires across the garden, is needed. You can find Chinese copies on eBay for a few quid but I contacted Roelof directly. I've also contacted a few of my more energetic soldering experts to see if any of them are up for a build. You might ask why I'm not doing in myself; to which I can only reply age (eyesight, wobbly hands etc). Roelof replied immediately, and said he would make one for me, for a small fee. Thanks Roelof.

So, while waiting for this to arrive, lets briefly move on to the other alternative, the magnetic loop. Everyone talks about loops, some build or buy, but I rarely hear reports of these breaking the laws of physics performance-wise. There is one exception. I'm not talking about transmitting loops – these have their own following. Where receiving loops are concerned, there seems to be only one real contender – the Wellbrook, mentioned above. There was a review by **Steve G0KYA**, in *RadCom* in January 2012. He was impressed by its performance in reducing local noise levels. Now, a little bit of a theoretical discussion. Steve explains the role of the magnetic loop in terms its rejection *"of electrostatic noise and electric fields"*. At first sight, this makes sense. The loop is sampling the H-field and ignoring the E-field noise. But wait a minute. Roelof, in a report on his development of the E-field probe (**Ref. 1**) says that he spent a long winter making various loops, and he reports that they did not reduce his noise levels. He then went on to make measurement of noise both inside and outside his house, using an analogue voltmeter. These tests convinced him of two things. The first was that the H-field of the noise was both inside and outside his house. And secondly, the E-field component was inside, but very much reduced outside the house. So back to Steve's review. What he says the loop does is provide a much better signal to noise ratio (S/N) than a wire antenna, like a doublet. Roelof says that his E-field probe does exactly the same, provide a better S/N response.


2

And in the end, it's about increasing the local signal-to-noise ratio. So, a decision needed to be made. The E-field probe was very inexpensive, and I suspect many operators might find the loop a bit on the expensive side. Hence my e-mail to Roelof. My E-field probe is due next week. Of course, there is a bit of systems work necessary before I can test any of this. Principally, I need to make, borrow (or buy) a changeover system, so that I don't blow the front end on my separate receiver and low noise antenna when I transmit. Any ideas, please?

So, one final question to end – will it work, and if not, why not? Of course it will!!

References

1. Roelof PA0RDT article:
https://tinyurl.com/mv6tqes

Useful SDR websites

(there are a great many more worldwide)
Hack Green:
http://hackgreensdr.org:8901
Stafford:
http://160m.net
Weston-Super-Mare:
http://websdr.uk:8060

(***Editor's comment:*** *I can't let Joe's questions go without providing at least some of the answers! As far as DXCC is concerned, the rules are clear and can be found on the ARRL website:*

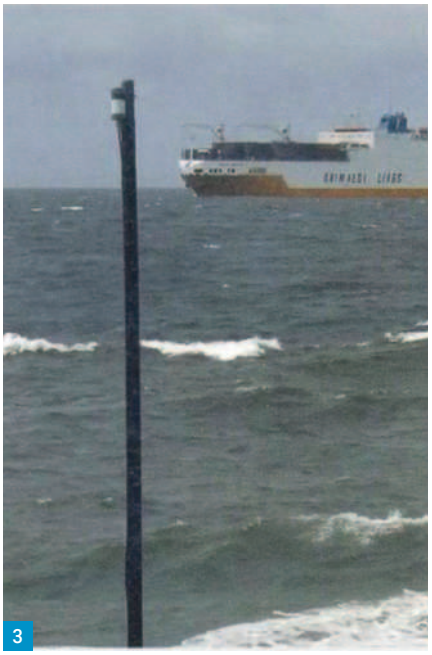
a) All stations used to make contacts for a specific DXCC award must be located within the same DXCC entity.

b) All transmitters and receivers comprising a station used for a specific contact must be located within a 500m diameter circle.

c) QSOs made with legally licensed, remotely controlled stations are allowed to be used for DXCC credit.

I believe the above answers both the remote station validity question and the remote receiver validity question. For other awards and for contests, you would need to read the specific rules to get an answer to Joe's questions. But for a day-to-day QSO where you are not applying for an award or taking part in a contest, frankly a QSO can be whatever you want it to be!

As for using a separate receive antenna, do note that higher-end transceivers have a connection for one, so there is no need for 'separates' in such cases. And for the popular IC-7300, there is an add-on kit to achieve the same result.)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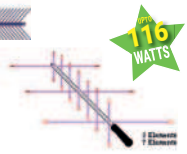

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Keith Rawlings G4MIU
keith.g4miu@gmail.com

Practical Antenna Models (Volume I)

Keith Rawlings G4MIU recommends another antenna book for your radio library.

In the January 2020 edition of *PW*, I described the **Marcel De Canck ON5AU** book *Advanced Antenna Modelling*.

This excellent book covered modelling techniques for use with the software package EZNEC from **Roy Lewallen W7EL** and also the additional package of AutoEZ (Automated use of EZNEC) from **Dan AC6LA**.

Needless to say, when I became aware of a new book from Marcel entitled *Practical Antenna Models Volume One* I was very interested to see what was within.

Description

This new book is of some 216 pages and comes in a slightly smaller format than the previous publication.

Its content is taken from the series of columns that Marcel wrote for the *AntenneX* online antenna magazine between 2009 and 2017 and this volume concentrates on the various forms of the dipole family.

As well as the hard copy, owners can download a pdf version of the complete book, which has colour illustrations, and this is ideal for those wishing to read the book on something like a phone or tablet.

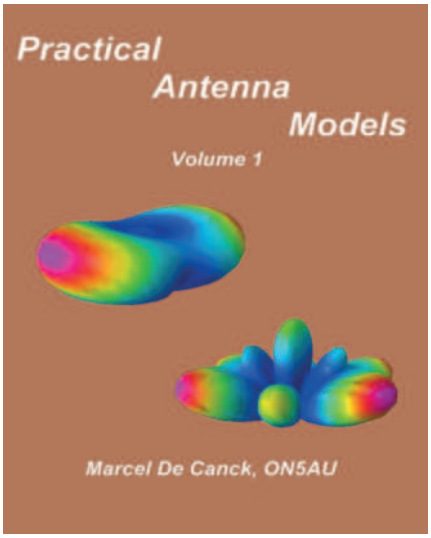
Also, the many associated files for each section of the book are also downloadable. These consist of pre-built EZNEC models, Excel spreadsheets, Auto EZ files and neat little .exe files called Wizards, which are animated diagrams demonstrating how parameters can change as designs are altered. These files are accessed from Marcel's website.

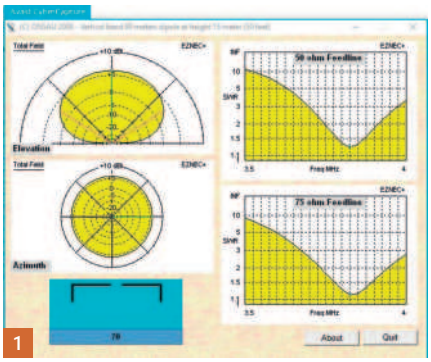
Practical Antenna Models Volume One is effectively written in two parts. The first part, Chapter One, is termed Antenna Fundamentals and takes the reader through the very basics of antenna theory in a series of 'Episodes'.

With generous use of use of diagrams, the reader is introduced to subjects such as the Electric and Magnetic fields and also the Induction and Radiation fields associated with every antenna.

Basic calculations are included and, naturally, subjects such as Impedance, Resistance and SWR are described in detail. Also included is a detailed discussion on the decibel along with a very useful 'quick reference' decibel/power ratio chart.

Chapter Two (the second part) gets to grips with the dipole in its many forms. From the basic horizontal dipole through versions such as inverted, OCF (Off Centre Fed), folded, multiple, doublet, bent dipoles, making a dipole fit into available space and more, just about every configuration is covered.





Based on the use of EZNEC and AutoEZ, with diagrams, charts, and text the reader is taken through a detailed design stage and analysis of the results.

I mentioned Wizards earlier and as an example, in the case of the bent dipole, a wizard has been produced of an 80m dipole at 15m/50ft, which animates the predicted SWR, Elevation and Azimuth Polar plots as the elements position is changed, **Fig. 1**.

Many readers will be interested in the in-depth study of the OCF and also the doublet, with both the G5RV and ZS6BKW variants compared.

Fig 1: Animated Wizard of a Bent 80m Dipole.

Conclusions

I thought that like *Advanced Antenna Modelling* the book was detailed, well laid out and informative.

Like the previous book, there is a heavy reliance on diagrams, and these go a long way towards making the descriptions understandable.

To be honest I found that even without taking the modelling aspects into consideration, the book alone is a wealth of information because the text and diagrams give a good insight into what can be expected from the variations of the dipole family. If you couple this with the extras that go with the book, such as pre-built models, animations, spreadsheets and so on, then the book represents excellent value and, I think, deserves a place on any antenna experimenter's bookshelf.

Availability

The book is available from Amazon and at the time of writing is priced at £17.99 for the paperback edition and £7.62 for the Kindle Edition:
https://tinyurl.com/y5yvuqde
It is also available from the author:
https://tinyurl.com/y4tczafw

References

EZNEC:
www.eznec.com/index.shtml
AutoEZ:
https://ac6la.com/autoez.html

Lots to report this Month!

Mike Richards G4WNC has a few extra FT8 tips plus some inside details on the new Pi 400 and the RX888 32MHz 16-bit direct sampling receiver.

Mike Richards G4WNC
practicalwireless@warnersgroup.co.uk

This month I have a few more operating tips that may improve your FT8 success. Let's start with filtering and signal processing. While many rigs have sophisticated noise reduction, noise blankers and filters to tailor the audio response, it's best to try to avoid these when you start FT8. This is because they have the potential to reduce the decodability of data signals. The ideal audio signal, to begin with, is a clean, 'brick wall' filtered, audio spectrum from around 200Hz to 3kHz. Selecting the Data output in older rigs and selecting Data Modes USB in a modern rig is often a good start point. I suggest you check the operating manual for your rig, because some models reduce the receive bandwidth when selecting data modes and you'll need to modify that. On the transmit side, you need to make sure the speech processor is not being applied to your signal.

While the settings I've just described make a good start point, you may have specific local problems that might benefit from some filtering or noise reduction. That's fine, and you should go ahead and experiment. It's just important that you start with a clean setup and then make considered adjustments from that reference.

Those with SDR-based rigs can often make use of their excellent customisable filtering to overcome reception problems. For example, if you have a powerful local station that's swamping part of the band you may be able to improve your result by pulling the filter side in to exclude that station.

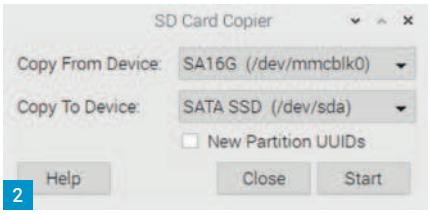
Next month I'll run through Fox and Hounds operation plus how to make the most of FT4.

Pi News

I have two significant Raspberry Pi items this month. First up is the all new Pi 400, which is an integrated keyboard and Pi 4 (4GB) computer. You only need to add a display, mouse and a microSD card for the operating system, **Fig. 1**. This makes for a remarkably compact and tidy computer installation. As a bonus, the processing power has been given a boost through a higher clock speed. To build the Pi into the profile of a standard keyboard, the Pi team have developed an entirely new PCB and used an updated Pi 4 processor. Those of you that have been using a Pi-4 will be aware that it gets quite hot when it's working hard or housed in a case. As a result, it is common practice to add a fan or large heatsink to stop the processor throttling back. The Pi team have solved this issue by including a large metal heatsink that runs the full width of the keyboard. The heatsink is so effective that they have been able to boost the standard processor speed to 1.8GHz and there is still scope for further overclocking. I've been using a Pi 400 for a few weeks now and I can confirm that the heatsink does a great job.

1

Another helpful goodie in the Pi 400 is the provision of a soft power button. This uses the Function + F10 key combination. When you press and hold these two keys for more than two seconds, the Pi will gracefully close down. I've checked my Pi 400 and it appears to be a real power-down because all voltages are removed from the GPIO port, including the 3.3V and 5V supply lines, thus leaving the GPIO safe to work on. To power-up, a short press of the same two buttons does the job. The new Pi 400 would make a great radio computer for the shack or to take on holiday. It is also ideal as a main computer for students that are studying at home and don't have access to an expensive Windows laptop or PC. The price is just £67 for the Pi 400 or £94 for the kit that contains the Pi 400, mouse, preloaded microSD card, power supply and a copy of the *Pi Beginner's Guide*.



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Another important Pi-4 update, that slipped through the news, was the release of the much anticipated 'boot from USB' firmware. While the use of a microSD card for the operating system is perfect for experimenters, those using the Pi as a general computer or as a radio terminal have wanted the speed and reliability of a hard drive for the operating system. While there have been some workarounds, we have been waiting for the Pi Foundation to release the official USB boot firmware into the main distribution. That has now happened, and the new firmware has been released for both the Pi 4 and 400. You should note, though, that the Pi3B already supported boot from USB. You can update your existing system for USB boot by entering the following in a terminal session:

sudo apt update && sudo dist-update -y

As SSDs (Solid State Drives) are currently so cheap, I suggest you use a USB3 SSD to replace the SD card. I've recently been using

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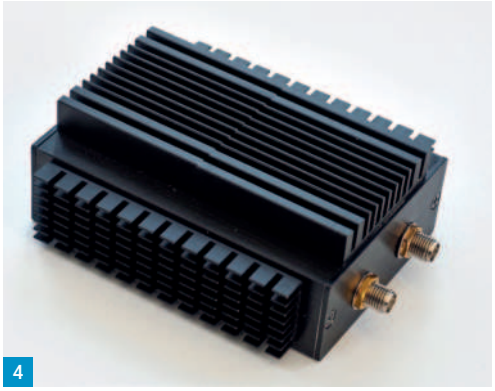
Fig. 1: The new Pi 400 computer – ideal for the shack. Fig. 2: 120GB Integral SSD and a 500GB Sandisk SSD. Ideal for the Pi. Fig. 3: The Pi SD Card Copier set to clone the SD card to a SSD. Fig. 4: The new RX888 direct digital sampling receiver. Fig. 5: Simplified block diagram of the Decimation block in the ExtIO.dll. Fig. 6: Set back mounting of the SMA antenna sockets in the RX888. Fig. 7: RX888 32MHz wide spectrum shot. 7a is without ground bonding and 7b is with bonding.

3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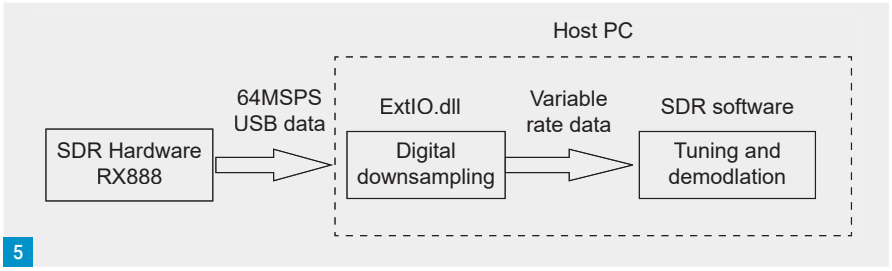

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a £30 Integral SSD and it's working well with the Pi, as has a much larger Sandisk 500GB unit, **Fig. 2**. The use of a fast drive only affects loading times, so you should notice that the Pi boot is a bit faster and programs will load quicker. Unless your software does a lot of disk interaction, the operating speed will be much the same as when using the SD card.

If you want to transfer an existing SD card to a new hard drive, the tools you need are already available in the Pi operating system. The ideal tool is Pi SD Card Copier that can be found in the Accessories menu. This tool makes a direct clone of the source disk. To safely transfer your system without affecting your SD card, follow these steps:

Begin by booting the Pi with the SD card you want to transfer

If you've not already done the upgrade, enter the following in a terminal session and reboot the Pi: sudo apt update && sudo dist-update -y

When the system is running, plug the SSD into a spare USB3 port (Blue)

Go to the Pi menu and select Accessories - SD Card Copier

In the SD Card Copier window set the Copy from Device to /dev/mmcblk0

Set the Copy to Device to /dev/sda, **Fig. 3**

Hit Start to begin the transfer

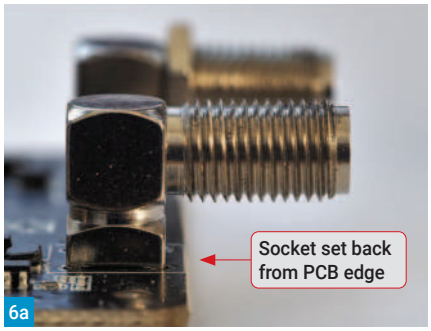
The transfer will take quite a while so just let it take its time. When the transfer is complete, you can remove the SD card and reboot the Pi, which will automatically use the external SSD as the boot drive. One particularly helpful feature of the SD Card Copier is that the file system on the copied-to drive is automatically expanded to use all the available space.

RX888 Direct Digital Receiver

I mentioned the new RX888 receiver a couple of months ago, but I now have my hands on one and have been playing, **Fig. 4**. Mine was ordered from eBay in early September and arrived at the end of October. The total cost was £148. The most exciting feature of the RX888 is the fact that it uses an LTC-2208 16-bit ADC to digitise the entire 100kHz-32MHz band, but doesn't use the typical FPGA to downsample the data for the host PC. Instead, the RX888 uses a Cypress super-speed USB driver to send the raw ADC data to the PC for processing. Thanks to recent developments in USB technology, most modern PCs have high-speed USB ports that can handle the raw data rate. Of course, you will need a reasonably powerful PC and suitable software to manage the data.

Thanks to a healthy SDR developer community, SDR software is already available for the RX888, including **Simon Brown G4ELI's** SDR-Console. I was able to run the RX888 with SDR Console on a 4th Gen i5 quad-core processor-based PC. This PC just about coped with the full 32MHz bandwidth, resulting in a processor usage of around 70% and the GPU (GTX660Ti) at 75%.

While it's clear that you're going to need a reasonably fast PC for this receiver, you can reduce the processing demands by selecting lower sample rates, and the following are currently available: 1, 2, 4, 8, 16 and 32MHz. These lower bandwidths are created in the PC by decimating or down-sampling the incoming raw data before application to the main SDR software. I've shown a simple diagram of the software processing in **Fig. 5**. Although the PC is still processing the full 32MHz bandwidth, this technique produces a much lighter overall load. For example, the i5 PC I mentioned before shows a processor and GPU load of around 35% when using the 16MHz bandwidth. This load reduces further as you select lower bandwidths.



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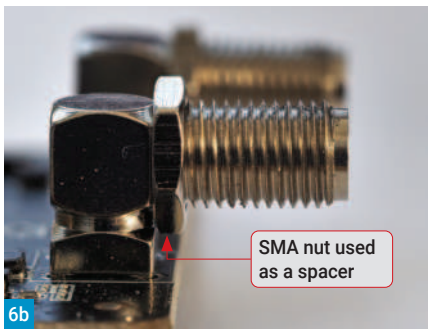

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As you can see from the photo in Fig. 4, the RX888 is supplied in a smart black metal box with lots of heatsinking. This is required because the ADC chip gets quite hot when working at full speed. While the metal box is excellent, I quickly discovered that the grounding is not so good.

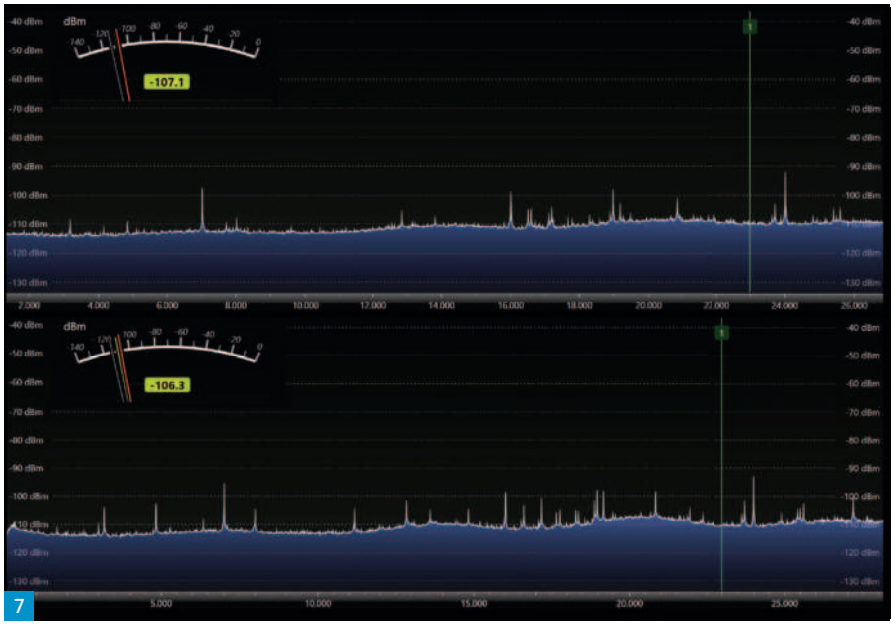
The black powdered finish of the RX888 looks good but is also a good insulator! As supplied, there was no electrical connection between the ground line of the receiver and the case. I fixed this by scraping away the finish around the SMA

antenna socket and the contact points where screws secured the end panels to the body. I also found that the SMA sockets were set back from the edge of the PCB, **Fig. 6a**. As a result, tightening the SMA nuts would probably damage the PCB. The solution was to use the supplied nuts as spacers and wind them fully onto the SMA connectors, **Fig. 6b**.

I then used new star washers and nuts to secure the SMA sockets to the panel. In **Fig. 7** I've shown two 32MHz wide spectrum displays from the RX888 while running SDR-Console. I terminated the SMA sockets with 50Ω loads, so the spectrum shows the no-signal spurious responses. The bottom display shows the RX888 as supplied, while the top display shows the results after fixing the ground bonding. As you can see, improving the bonding was worth the effort.

A key difference between the RX888 and the earlier Dragonfly RX666 is the inclusion of an RF preamp ahead of the ADC. This provides 20dB of gain and improves the sensitivity. The RX888 also has a Rafael 820T2 set-top tuner included to give access to the VHF bands as far as 1.2GHz. However, this is with reduced performance and limited to about 8MHz bandwidth. The software for this series of receivers is under active development by **Oscar Steila IK1XPV** and others. To keep upto date with developments, take a look at Oscar's blog at: **https://sdr-prototypes.blogspot.com**

The NextGenSDRs group on groups.io is also worth joining.



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Bob Whelan G3PJT
practicalwireless@warnersgroup.co.uk

A Simplified Directional 40m Antenna (Part II)

Bob Whelan G3PJT completes his design for a 40m directional antenna system.

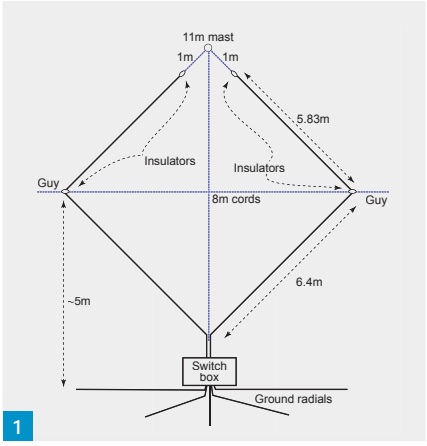
For the past two years I have been experimenting with parasitic vertical beams for 40m. I described a three-element triangular array with some of the thinking behind it in Part 1. As part of the computer modelling work associated with that antenna a number of alternative arrangements of two elements were investigated. The antenna to be described here is a further simplification of the basic concept of a vertical beam with a common earth system and consists of two elements with a single support mast. It is a pretty low profile design.

Modelling

One of the simplest forms of a multi-element directional antenna is one of two elements spaced at between 0.1 and 0.5 of a wavelength. One element, the driven element, is driven directly from the transmitter while the other, excited through mutual coupling, is called the parasitic element. If the relative RF currents flowing in these elements are in a particular amplitude and phase relationship then a directional radiation pattern results. Depending on the relationships then the parasitic element can be tuned to behave as either a reflector or as a director.

The relationship between antenna gain, beamwidth and element driving impedance is complex, which means that computer modelling is essential to shorten the time taken in developing a design and in any subsequent practical performance tuning. The approach taken here was to fix the approximate dimensions of the antenna and to vary the loading in the elements to get an optimum RF current relationship and radiation pattern. Computer modelling with EZNEC seems to be good enough such that local environmental factors do not take any practical design outside the range of reasonable adjustment. **Fig. 1** shows the basic dimensions of the chosen arrangement arrived from the experiments in Part 1. The parasitic element was tuned to be a director.

The azimuthal pattern at 20° elevation of this antenna is shown in **Fig. 3**. This shows a useful gain of about 5.9dBi or about 3.9dBi over a ground mounted vertical. The main forward lobe is 137° with the parasitic element tuned as a director. The parasitic tuning capacitor would be about 170pF and the driven element impedance about 16Ω and inductive, though this will vary with the precise setting of the parasitic capacitor. Although the antenna radiation direction could be reversed by tuning the parasitic element as either a reflector or a director, it's simpler to use a switch box, which just swops the two elements from driven to parasitic.



1

Orientation

Many of us do not have much choice as to the orientation of our antennas. However, for those who do it is worth considering what might be the best orientation for this antenna. The −3dB width of the forward lobe is about 135° and the width of the maximum front-to-back (F/B) is about 60° and for better than 10dB F/B about 110°. You may choose to orient the antenna such that the maximum F/B is oriented to Europe so that when beaming to USA etc. you have best rejection of Europe. Or you might, for example, have an area of local noise which you would like to attenuate. In my case I decided to orient the antenna such that its plane was 80 – 260°. This attenuates Europe when beaming west but also places the forward lobe over the Far East and SP Australia when beaming east. I found that I have a local noise source to the west of my QTH so at least it is quieter when beaming East.

Frequency, MHz	Gain at 20° elevation, dBi	Front-to-back ratio, dB
7	5.1	12
7.05	5.5	17
7.1	5.9	33
7.15	6.2	13
7.2	6.0	6

Table 1. Bandwidth estimations.

Construction

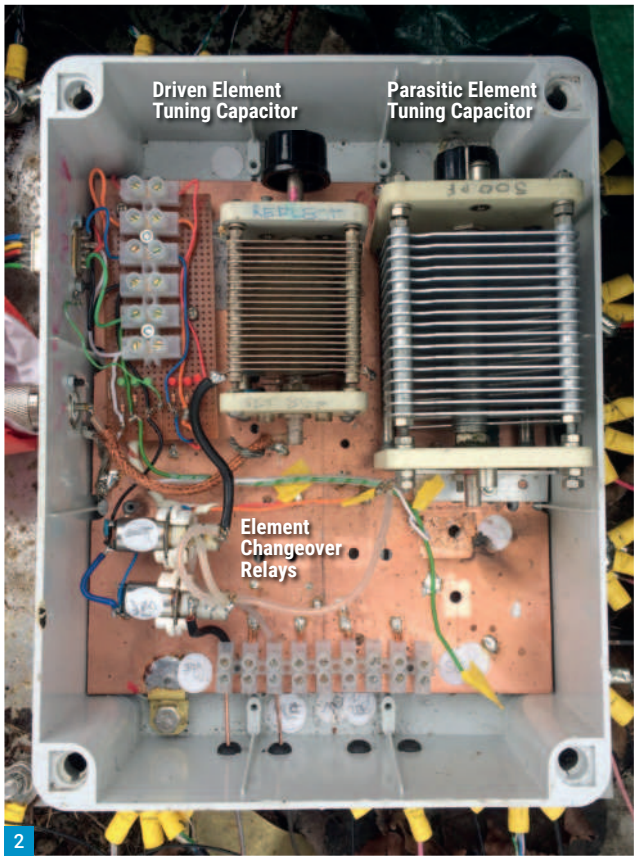
Two identical lengths of 2mm enamelled wire 12.23m long were fitted with a insulator (a) at 5.83m from one end and a second insulator at one end (b). Each of the two elements were hung from the top of an 11m mast with around a 1m length of cord. An 8m length of cord was fastened between the two elements to fix the element spacing at 8m when the elements were spaced apart. The height of the insulators (a) was about 5m above ground. The lower lengths of the elements were brought back to the switch box and the ground radial centre.

Ground Radials

All verticals need a ground radial system in order to work. As described in Part 1, the ground radial system comprised 50 radials of insulated thin wire varying in length from 5 to 8m long (30 of ~5m would probably have been enough). These were pinned into the grass surface using best bent wire and large paper clips. The radials were terminated at the centre with crimp terminals and bolted to an aluminium plate with stainless steel set screws.

Switch Box

The switch box, **Fig. 2**, allows the elements to be tuned and the direction of radiation reversed. The circuit is shown in **Fig. 4**. The relays are 26V vacuum relays but open frame 10A contact rating relays would work just as well. At 400W about 5A of current flows and voltages are only about 100V. Capacitors were wide-spaced trans-



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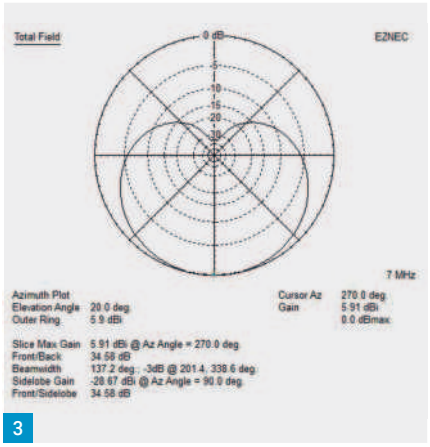

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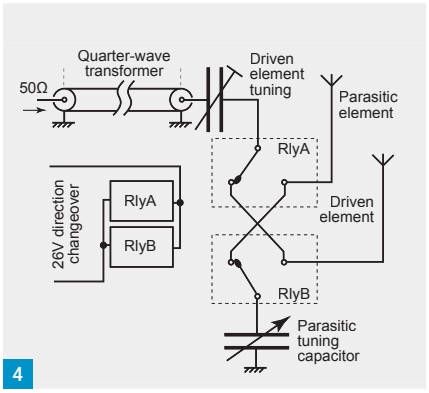

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Fig. 1: Basic dimensions of 2-element antenna. Fig. 2: Azimuthal pattern at 20° elevation. Fig. 3: Switch box showing relays and capacitors. Fig. 4: Circuit of switch box.

mitting air variables found at various junk sales.

Tuning

Symmetry is important so each element was measured for self-resonance and impedance at resonance. The elements both measured 5.9MHz at resonance with an impedance of 26 to 30Ω (ELNEC modelled 6.1MHz and 26Ω).

Initial tuning of the parasitic element was undertaken by nulling the signal from a vertically-polarised low power signal in line with the antenna. This was a quick and easy way of getting close to the optimum setting. As my antenna is orientated 80 – 260°, then I could null out some signals from Europe too. Taking advantage of the ARRL CW contest in February, I was also able fine tune the parasitic element tuning to null out some of the stronger East Coast stations (K3LR, K1RX, etc.)

Using my digital phase and amplitude meter, the readings of current magnitude and phase differences for this setting were 1-2dB and −162°, which compared well enough with ELNEC figures of 1dB and −156°.

The matching of the driven element to the 50Ω feedline was done by first nulling out the inductive part of the input impedance making it 22Ω resistive. This was then transformed to 50Ω using a quarter-wave impedance transformer made from a paralleled pair of 75Ω transmission lines [2]. The matching of the driven element did not affect the parasitic element tuning even though the tuning of the parasitic element did affect the driven element impedance.

Performance

The availability of WebSDR receivers means that some qualitative measurements can be made of performance. Although I had used the Twente WebSDR in 2019, I tried to use some of the more distant ones in the USA and Russia.

The results were only qualitative, going from audible to inaudible when I changed the direction of beaming.

With the stronger signals from Europe I have measured the front-to-back (F/B) on a range of signals and, given the vagaries of propagation, the rejection of signals from most of Europe is impressive. And consistent with the azimuthal pattern, central parts of Europe (OK, DL, SP, etc) range from 10-20dB. For EA and F, which are more off the side of the antenna, the F/B falls to 0-6dB as expected.

Bandwidth

Table 1 shows the result of modelling the gain and front-to-back bandwidth of this antenna.

Measurements showed that the current amplitude did not change over 7.0-7.2MHz but the phase difference varied from −158° at 7.0MHz, −162° at 7.020MHz and −178° at 7.1MHz as could be concluded from Table 1.

So, depending on your operating preferences you might want to set the centre frequency to suit.

Summary

The antenna described here could readily be scaled for 30m. It represents a very simple antenna design, which is inexpensive to build and offers good performance, certainly better than any simple quarter-wave vertical on 40m.

I do not have a support tall enough for an 80m version but it should be a good performer on there too. For more background, readers are encouraged to look at Part 1 and the references.

References

1. *An HF phase detector*. G3PJT, *RadCom* April 2019.
2. *ARRL Antenna Book*, 18ed., p.24-12. And: https://tinyurl.com/ya9y5wpl
3. RSGB List of WebSDRs at: https://tinyurl.com/y6c3ymok

Geoff Theasby G8BMI
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High SQ (Silliness Quotient) Projects

Geoff Theasby G8BMI starts with a "silly" project and follows up with a more serious programming cable!

In these days of high uncertainty in the Coronavirus lockdown, a comedic antidote often brings a smile.

Monitoring the voltage produced by solar cells for another project, I realised that as the reading varied with the cloud cover, it made a useful overcast-meter. This is of course how a photographic exposure meter works. It might be calibrated in 'Octas' (of cloud cover, or eighths of the sky), even to making a meter scale to suit. A meter should not be connected to solar cell without a load because it shows unrealistically high voltages. In this case, the LED lighting was the load.

Thinking about this further, a Very Silly project would be to use a different meter scale, showing the difference between day and night... *"The silliness is terrific"* as 'Inky' Singh didn't say in the Billy Bunter books.

Not only that, but a more subtle idea would be to make a moonphase detector. The SQ is still high but it works! It can detect the major phases of the moon, and in a cloudless sky, can detect the intermediate phases too. Calibrating the meter could be complex, as the intensity of reflected light from the Moon does not change linearly, nor is it constant, depending on the time of year (background light affecting contrast) and on atmospheric pollution. But, this is for fun!

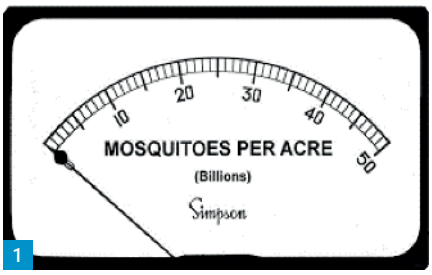
Useful meter face design programs are here (by W4ENE, $55 for the full program):
www.tonnesoftware.com/meter.html

Or check out the W3HWJ site:
http://w3hwj.com

These may be modified in graphics programs, (Beyond my pay grade though)

Make your own Radio Programming Cable

I bought a tiny dual-band VHF/UHF mobile transceiver, with which I am most impressed. The Moonraker MT-270M is a notably compact radio, and it does its job. However, it is not easy to run from the front panel as it is 'menu-driven', with most functions set up remotely via a computer. To this end, a programming cable is required, and these can be relatively



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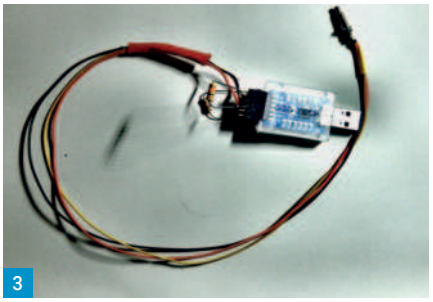
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Fig. 1: An improbable meter dial found in Google
Fig. 2: A meter from my spares box calibrated in phases of the moon, as redrawn by Deborah Theasby.
Fig. 3: The USB module, before I tidied it up.

expensive, and are not compatible with all radios (it says here). Well, 'up to a point, Lord Copper'. The special cables almost all contain a USB to TTL serial converter chip, the CP2102 (aka PL2303), which is cheap and easily obtainable from the usual suspects.

I recommend the packaged module, SH-U09A, which is still only about £5. This is wired to a 3.5mm stereo jack plug, which needs to be slim, to fit in the recessed socket at the rear. I obtained my plug from a redundant MP3 player. That's it! No programming skills required, only modest soldering ability and three wires. What can go wrong...?

Well, identifying the rig can be a problem. Mine says it is a Moonraker MT-270M, but it is more usually known as a WACCOM Mini 8900, itself a variant of a QYT KT8900. There are a number of clones like this, notably the Juentai JT 6188 Mini. In total, according to the CHIRP software wiki, there are six such clones in the QYT section, plus others 'Badge Engineered' under different names.

The module, from DSD Tech, via Amazon, is prepared by connecting three wires to the jack plug, and then to the USB module, pins GND, Rx and Tx. Details on the website below. Then, opening the CHIRP software, (Google it if you don't already have it), from the toolbar, choose 'Download from radio', trying the likely types from the list provided. If the equipment is not faulty, you will eventually hit the right type. It takes a couple of minutes to download the data, and even longer to upload it afterwards. Internal LEDs will flash during this period. When finished, the power to the rig is briefly cut off and that's it! If it doesn't work, reverse the connections to Rx and Tx. If you still have problems, some rigs like the signal lines to be connected to GND with a 10kΩ resistor each.

www.miklor.com

German Fighter Radio

Bernard Nock G4BXD
military1944@aol.com

Bernard Nock G4BXD has an interesting addition to his collection and also trawls the Museum for equipment that works on the microwave frequencies.

A warm welcome to the *Valve & Vintage* column from the Military Wireless Museum in Kidderminster once again. The museum has been closed since the first lockdown and it's unlikely to reopen for quite a while. It would be impossible to socially distance and I could not clean down every set after each visitor. However, the time has been used to sort out one or two jobs that were waiting to be done and I have also been preoccupied with working on the microwave bands and learning quite a lot of new stuff about these frequencies, as you will have read here in *PW*.

I used the time to thin out the herd of duplicates and tried to free up space for new acquisitions that I know will inevitably come. Indeed, it seems that as fast as I can make a space on a shelf or table, something arrives almost immediately to fill it.

German Fighter Radio

While trawling through various military sale sites on the internet a very nice radio caught my attention. Expensive but as I did not have an example in the collection and it was too far to Christmas, I treated myself. The radio is a German WW2 set used in fighter aircraft and the like and would have served in a similar role to the British TR1196 and US SCR-522 sets.

During WW2, the German Luftwaffe relied on an increasingly diverse array of electronic communications, IFF (Identification Friend or Foe) and RDF (Radio Direction Finding) equipment as avionics in its aircraft and also on the ground. Most of this equipment received the generic prefix FuG for Funkgerät, meaning 'radio equipment'. Most of the aircraft-mounted Radar equipment also used the FuG prefix.

FuG 16 Z, ZE and ZY: These sets were airborne VHF transceivers used in single-seat fighter aircraft for R/T and W/T communications, and were also used for ground fixes and DF homing on ground stations when used in conjunction with the FuG 10P or FuG 10ZY. Installed for Bf 109G-3/G-4 and later, Fw 190A-4 and later subtypes. Frequency Range was 38.5 to 42.3MHz.

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The FuG 16ZY was also used for Y-Verfahren (Y-Control), in which aircraft were fitted up as Leitjäger or Fighter Formation Leaders that could be tracked and directed from the ground via special R/T equipment. Aircraft equipped with ZY were fitted with a Morane whip antenna array. Principal components: Transmitter, Receiver, Modulator in one case, S 16 Z Tx, E 16 Z Rcvr, NG 16 Z Modulator Dynamotor U 17 Antenna Matching unit AAG 16 Z Modulator Unit MZ 16 Homing Unit ZVG 16 Indicator AFN - 2 [**Ref. 1**].

The Z in FuG 16 Z stands for 'Zielflug' or Directional flight. This means that with a DF adaptor (the ZVG 16), the receiver could be used to fly in the direction of a beacon. When the FuG 16 Z was introduced in 1941, Kammhuber asked if the Fug 16 Z could be used for the so called 'Y- jagd Verfahren' or Y fighter system.

The Y-system is essentially a transponder system in which a ground station sends out a pulse that is received by the aircraft. The aircraft resends this pulse on a different frequency, allowing the ground station to determine its direction and distance.

From this request, the FuG 16 ZE was developed with 'ZE' standing for 'Zielflug Entfernung' or Directional flight/Distance. Because of difficulties making this system work in the FuG 16, the Directional flight capability could not be maintained, the ZE could only be used for the 'Y-jagd Verfahren'; the 'Z' function was disabled.

Further development work led to a version of the FuG 16 in which the Directional flight capability was reinstated. This became the FuG 16 ZY. This is also the final version of the FuG 16. 'ZY' stands for Zielflug Ypsilon or Directional Flight/Ypsilon and it was capable of both Directional flight and the Y-system.

Fig. 1: German Fug16 set. Fig. 2: Rear of the Fug16. Fig. 3: Inside the Fug16. Fig. 4: Location in fighter. Fig. 5: TS-69A meter. Fig. 6: The tuning counter. Fig. 7: Calibration chart, low. Fig. 8: Calibration chart, high.

Whereas the Fug 16 and 16 Z used the AD 18, which has a switch to operate the 'Fern/Nah' relays, the FuG 16 ZY used the AD 18 Y and AD 18 Ya. The AD 18 Y was for installation in larger aircraft such as the Ju 88 while the AD 18 Ya was used in single seater fighters. In the AD 18 Ya the switch was used for switching between normal transceiver mode, and DF or Y-system mode. Internally the different versions of the AD 18 box are identical, just the lettering on the lid is different [**Ref. 2**].

The aircraft is equipped with a FuG 16ZY radio, a specially-designed airborne VHF transceiver. The FuG 16 can be used for in-flight communication as well as for IFF identification and DF homing. The set operates in the frequency range between 38.4 and 42.4MHz.

The FuG 16ZY can also be set to Leitjager or Fighter Formation Leader mode that allows it to use a special Y-Verfarhen ground tracking and direction via the normal headphones. The AFN2 component of the radio set allows easy navigation to ground-based homing beacons, showing both direction and range on one simple dial.

Microwaves

Having recently formed an interest in the microwave bands I looked around the museum shelves to see if I had anything that could be of use at these frequencies. I have several receivers that tune up to about 900MHz or so, for example a rather nice Nems Clarke 1302A receiver and converters, 50 to 900MHz coverage, AM/FM, used by NASA to track Russian satellites and such, and I have a rather swish US-made APR-4 receiver.

This equipment was a Search Receiver for use on aircraft or naval vessels. When supplied with all the various plug-in tuning units the set needed, the system was used to:

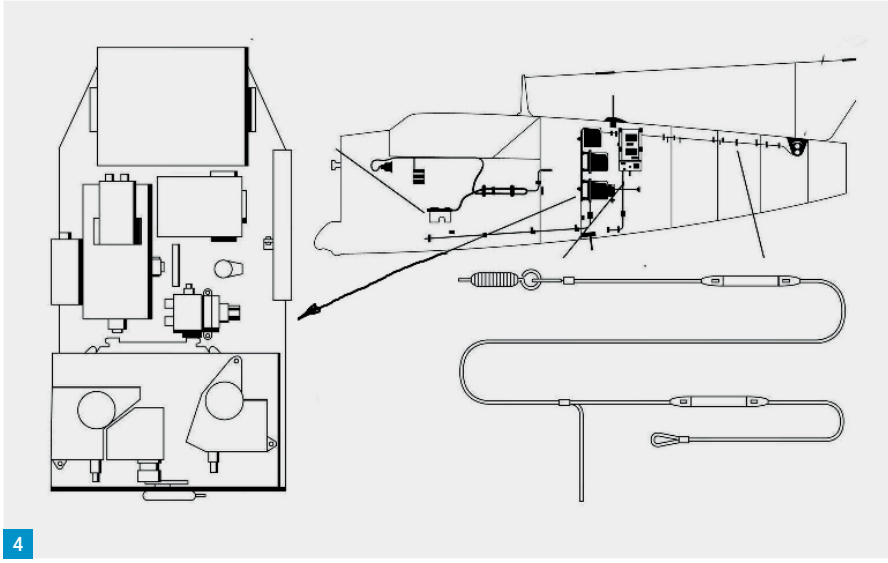
Determine the presence and measure the frequency of any radar or radio signals within the frequency range of 38 – 4000Mc/s.

Determine what modulation may be present on these signals.

Give an indication of the relative field strength of these signals.

Monitor a transmitter.

Although I have several of the plug-in tuning units, I was not quite sure what their highest frequency was and as I have not yet got around to trying or testing the receiver that set would be of no use.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I then noticed I had a frequency meter, TS-69A/AP, a US Army Signal Corps unit. This is a cavity type meter, a sealed silver-plated cavity that is tuned by moving a plate inside the cavity. The instrument is used as a transmission type of wavemeter. When used in this way, the unknown signal is coupled into the circuit by means of the input socket. When the cavity is tuned to the resonant frequency of the signal, energy is coupled through a coupling loop to the microwave crystal diode rectifier where it is rectified and indicated on the meter.

This version is tuned using a crank handle, which is stored in a clip on the front panel. It is inserted in the base of the case where there is also a counter that determines the tuning point. A printed calibration booklet is stored in the lid of the meter, which gives the counter reading for the various frequencies.

The calibration book details that the set is calibrated from 341 to 1000MHz. Originally the unit would have been used for various radar sets and the like. I noticed that the counter for the lowest frequency was 4396, which decreased in number as the frequency increased. At 1000MHz the counter would read 1503. I also noticed that the lowest the counter would go was down to about 400 or so, which made me wonder just how high in frequency the unit could be used and indeed, some other owner had marked a counter reading at 1296MHz although it had partially rubbed out.

The top of the case has an SO239 socket for connection to equipment or a short

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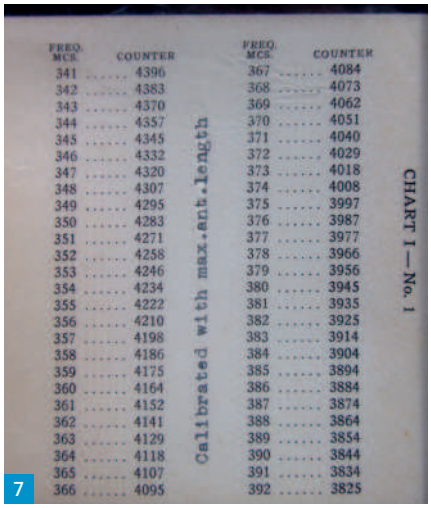
telescopic whip, again held by a clip on the front panel, that can be inserted to allow the unit to act as a field strength monitor. I connected the frequency meter to the attenuated output port of a directional coupler, which I then inserted between my 2.4GHz transmitter and a suitable dummy load.

I was amazed to find at a counter setting of about 600 or so a response on the meter, which was clearly from the 2.4GHz signal. Subsequent research on the web seems to indicate the top of the tuning range is around 3GHz.

I recently acquired a very accurate signal generator capable of going to 2.6GHz so when I get the time I will fill out the calibration chart for the 23 and 13cm amateur bands more accurately and I'm



Calibrated with max.ant.length — CHART I — No. 1

FREQ. MCS.	COUNTER	FREQ. MCS.	COUNTER
341	4396	367	4084
342	4383	368	4073
343	4370	369	4062
344	4357	370	4051
345	4345	371	4040
346	4332	372	4029
347	4320	373	4018
348	4307	374	4008
349	4295	375	3997
350	4283	376	3987
351	4271	377	3977
352	4258	378	3966
353	4246	379	3956
354	4234	380	3945
355	4222	381	3935
356	4210	382	3925
357	4198	383	3914
358	4186	384	3904
359	4175	385	3894
360	4164	386	3884
361	4152	387	3874
362	4141	388	3864
363	4129	389	3854
364	4118	390	3844
365	4107	391	3834
366	4095	392	3825

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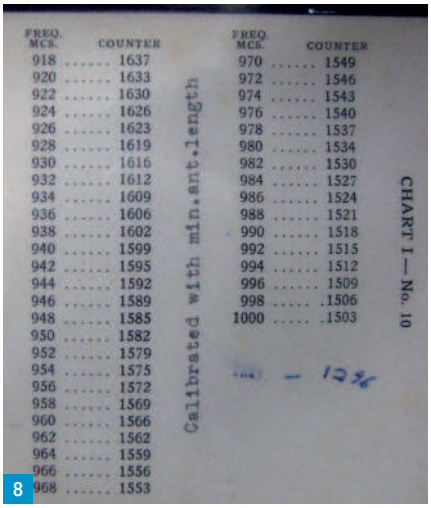

Calibrated with min.ant.length — CHART I — No. 10

FREQ. MCS.	COUNTER	FREQ. MCS.	COUNTER
918	1637	970	1549
920	1633	972	1546
922	1630	974	1543
924	1626	976	1540
926	1623	978	1537
928	1619	980	1534
930	1616	982	1530
932	1612	984	1527
934	1609	986	1524
936	1606	988	1521
938	1602	990	1518
940	1599	992	1515
942	1595	994	1512
944	1592	996	1509
946	1589	998	1506
948	1585	1000	1503
950	1582		
952	1579		
954	1575		
956	1572		
958	1569		
960	1566		
962	1562		
964	1559		
966	1556		
968	1553		

8

betting the original calibration numbers will still be relevant. It's rather a large lump for daily usage on the bench but it's amazing to think something made back in the 1944 era can still be used today at such high frequencies.

And Finally

I hope you have enjoyed these few words and I shall be looking forward to the day we can safely receive visitors at the museum again. More pictures on the website (below) and I hope to see you here soon. A very Merry Christmas and here's to a jolly good New Year. Cheerio and stay safe.

www.militarywirelessmuseum.co.uk

References

[1] Wiki
[2] Remco Caspers, Normandy.

Tim Walford G3PCJ
Geoff Budden G3WZP
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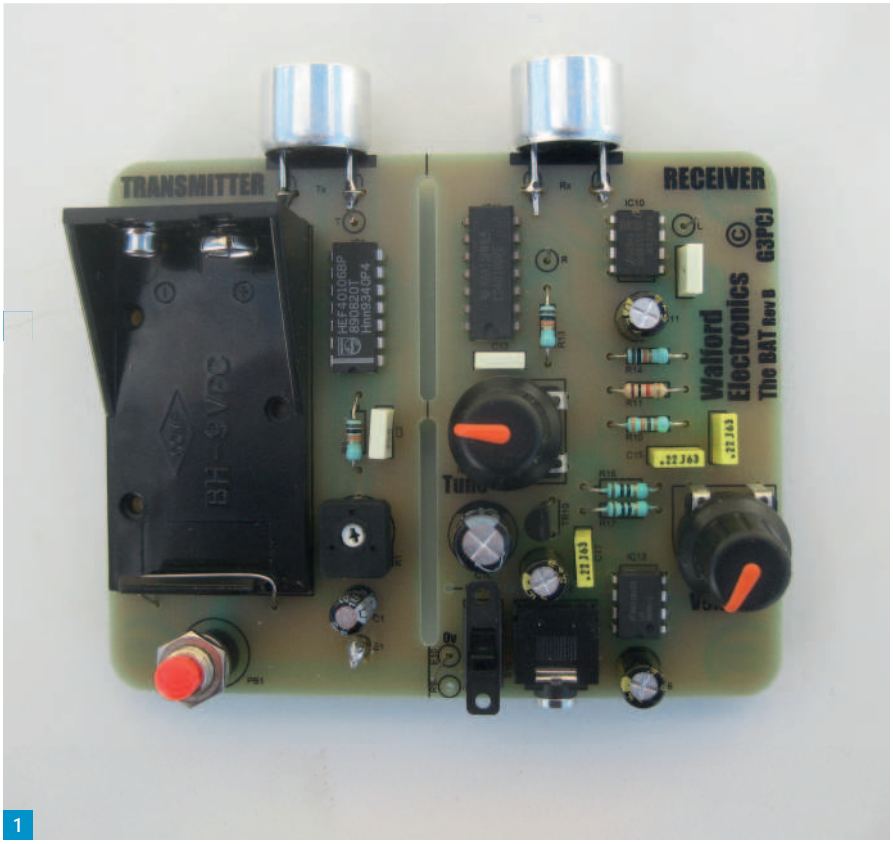
The Bat

Tim Walford G3PCJ and **Geoff Budden G3WZP** introduce a project that can be used by an individual or clubs to introduce youngsters (or oldies!) to the concepts of communication.



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This project has its origins in work done by the authors over several years with **Steve G0FUW** of the RSGB and Bath Buildathon Group, working with the Radio Communications Foundation, to introduce practical electronic construction projects to teenagers – as well as a few older people! Throughout 2019 several group events were held, often with the assistance of schools as part of British Science Week, and at the National Radio Centre at Bletchley Park. They ranged from communication with the International Space Station to the building the Spaxton radio receiver. The Spaxton (as reported in June 2020 *PW*) was a four-transistor radio specially designed by G3PCJ for the broadcast stations in the Medium Waveband. It used a short wire antenna feeding modern headphones. The Bat, **Fig. 1**, builds on that experience, which revealed the keenness of young people for such projects and the desire for licence-free operation. It is a small 40kHz ultrasonic transmitter and receiver that can send and receive Morse messages over distances of more than 50m.

Early Experiments

Achieving reliable radio reception inside modern reinforced concrete buildings with simple antennas had proved to be quite challenging due to Faraday Cage screening from the structural reinforcing bars, and it was also obvious that licence-free operation would be very attractive. We felt that a change from discrete transistor simplicity to an integrated circuit project would improve the robustness of the design despite a loss of understandability. Using infra-red TV remote controls was one possibility but the lack of a viable receiver wrecked that approach! We considered standard ultrasonic range measuring or sensing kits but none was quite right, hence G3PCJ designed very simple transmit and receive circuits running off a 9V battery that could use the available standard 40kHz transducers. At this frequency, the transmitter can use a capacitor with adjustable resistor to set the frequency of a digital Schmitt gate oscillator, with the other gates in the chip driving the transducer; so it only needed a push button to complete the transmitter!

The receiver has to be a bit more complicated with tuning in order to obtain a beat note just as in radio-based CW reception. This led to the direct-conversion receiver approach using the well-known SA602 device for the detector, feeding into an audio gain potentiometer and then the high-gain LM386 audio amplifier for driving a loudspeaker or headphones. The receiver local oscillator was most easily arranged with another Schmitt gate like the transmitter so that it could also be tuned by a variable resistor.

Early experiments were most encouraging but what we had not anticipated was how strong the leakage around the transducer edges would be, so it was necessary to add a gain-reducing FET to limit the sidetone audio when transmitting. The resulting circuit is shown in **Fig. 2**. Although just a simple transmitter and receiver pair could be used for Morse messages just like a Morse practice tone oscillator, two-way messages across a large room or in a playing field would need two Bats, which would not be so attractive for individual builders. Accordingly, we designed the PCB so it could be split into transmit and receive sections for separate use.

The working prototypes featuring locally etched PCBs were assembled and fully tested by the authors. It transpired that our gardens were not really large enough to determine maximum communication range! We knew that a professionally made PCB was necessary for easy assembly by inexperienced constructors so, following the successful involvement of Alfatronix Ltd with the RCF-funded Spaxton project, once again they offered to design the production PCB and seek out

Fig. 1: Photo of the Bat.
Fig. 2: Circuit of the Bat.
Fig. 3: Typical assembly instruction photo.

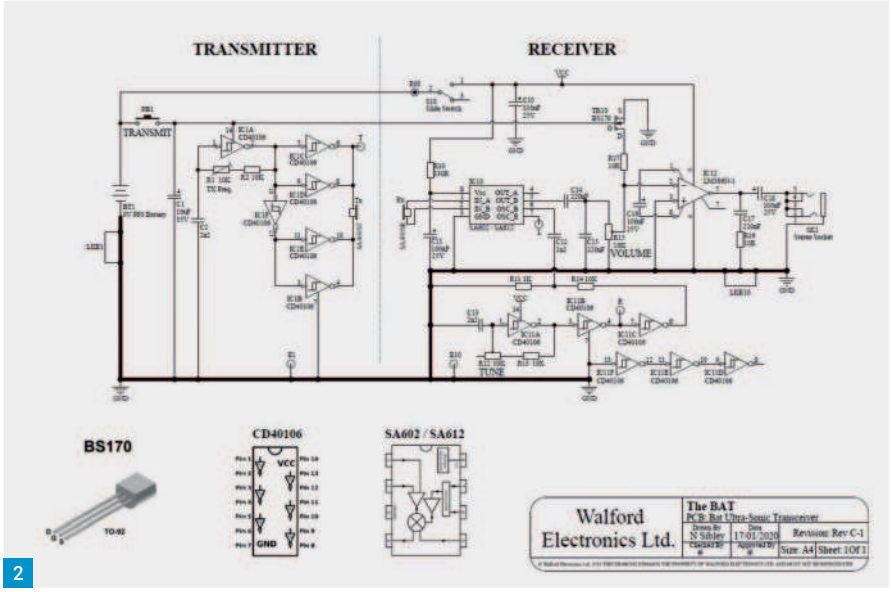
a PCB manufacturer for the Bat. The PCB was re-laid out to minimise the amount of copper that had to be etched (to reduce cost) and the finished tracks were covered in photo–resist, to reduce problems with solder bridges, with component location markings to help find the correct part locations. They also persuaded their normal PCB suppliers (ALR Circuits Ltd) to produce ten pre-production PCBs for evaluation – these arrived quickly and were assembled for final comprehensive testing. **Chris Black**, the Technical Director of Alfatronix Ltd, together with ALR Circuits Ltd, both realise the importance of encouraging young people into the electronics industry, so they were very happy to arrange for the subsequent supply of 100-off PCBs to help reduce the kit price.

Buildathon Experience

The Spaxton building instructions had shown the benefit of a very detailed step-by-step approach but we felt that more use could be made of photographs with superimposed arrows at each stage to help resolve uncertainties or important points like the polarity of electrolytic capacitors.

The photo, **Fig. 3**, shows an example of the many photos in the Bat instructions that might otherwise have been a rather daunting set of words! Many years of kit production have shown the benefit of a 'build a small section, & then test it before proceeding further' approach, which greatly enhances the chance of the device working properly when finished. The instructions could also be put into Powerpoint format so that groups can view them on their own laptop or smartphone, or even be projected on to a screen for larger groups as part of their introductory briefing. We needed to simplify the process wherever possible and to make assembly as straightforward as possible with less chance of errors so that constructors end up with a professional looking product to reward their efforts.

To assist the running of group Buildathons we have produced an Instructor's pack for group-build projects based on our practical experience in running such previous events. The pack contains relevant Health & Safety advice and explains the need for Risk



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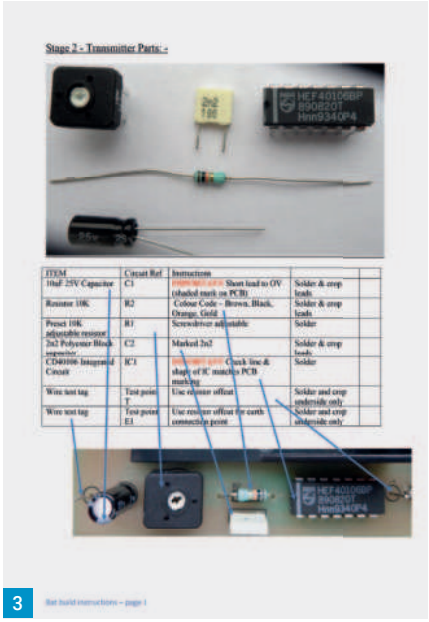
Assessments, which your Public Liability Insurance will require. A list of recommended hand tools and test gear is included, together with the suggestion that low voltage soldering irons be considered to avoid the possibility of electric shock if mains leads are damaged. Naturally we would recommend that all mains operated appliances, test gear and mains distribution sockets have current PAT certificates to maintain safe working conditions. (A standard Risk Assessment guidance form can be obtained from Wessex Safety Services if help is needed.)

We also found that different arrangements for the actual event proved advantageous dependant on the age group of the participants. With younger constructors we found it preferable to set up a soldering table where the kits were brought to be soldered under close supervision, then a separate table for testing before returning to the next stage of assembly.

This minimises the risks of hot soldering irons being waved around by excitable participants, and the need for multiple sets of test gear and soldering irons. The layout of working areas for older age groups could be around the edge of the room facing inwards with the supervisors/instructors in the centre being able to oversee the group and their progress more easily.

Another point that we soon found out was that younger participants have a low tolerance to heat so that freshly soldered components can cause problems. A source of cold, running water is advisable with a simple first aid kit. In the absence of fume extraction, think about adequate



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ventilation to reduce exposure to soldering fumes and, although not mandatory, safety spectacles might be advisable for younger constructors.

Fun with the Kits

On completion of the kits, it is always useful to quickly summarise the origins and uses of Morse Code and how interrupting a light, radio or ultrasonic signals from a Bat for different lengths of time is the easiest and simplest way to pass messages compared with conveying information by speech. The earlier CQD distress signal from the Titanic and SOS are good examples that show how shortened phrases and abbreviations have

Continued on page 56

Mobile Phone Frequencies

Steve White G3ZVW looks at the characteristics of the different frequencies used by mobile phone operators.

1

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How many people that have an interest in radio, such as *PW* readers, ever think about the radio frequencies that mobile phones use? Not very many, I'll wager. Among members of the general public it will be even less. Indeed, there are some who don't even realise the mobile phone part of their smartphone is a radio transceiver.

Until I thought about writing this feature I certainly didn't think about the differing characteristics of the frequencies, but mobile phones work on different frequency bands and those bands don't all have the same characteristics. Consequently, not all of those bands are suited to the same kind of environment.

Before we start though I want to explain why I am going to quote all frequencies in this feature in Megahertz (MHz), because frequency is usually quoted in Gigahertz (GHz) when we go above 1000MHz. Using GHz certainly makes for less digits in large numbers, but I don't want anyone to get confused between, say, 4G and 4GHz because they aren't the same!

Different Frequency Bands

In the UK there are several bands of frequencies that the four mobile phone operators use. **Table 1** shows which operator uses which band and the services carried. If you have a mobile phone from a supermarket or any of the myriad of other companies who sell phone packages or SIM cards, your service will be carried by one of these four.

Access to the frequencies was auctioned by the government, who knew a good thing when they saw it. They knew that if someone stopped using a frequency it could be auctioned again. Even better, licensed access could expire after a certain time, so exactly the same thing could be re-auctioned.

Characteristics of The Bands 800/900MHz

These two frequency bands are in the Ultra High Frequency (UHF) portion of the frequency spectrum. The 900MHz allocation was the first of these bands to be used.

Along with other frequencies immediately lower in the spectrum, 791-862MHz used to be used for TV broadcasting in the UK. Channel 61 was centred on 795MHz and channel 68, the

Fig. 1: Mobile phone base station mast with three antennas.
Fig. 2: Separate areas of coverage from three antennas at one base station site.
Fig. 3: From a hilltop site, 800/900MHz covers into neighbouring valleys.
Fig. 4: Two base stations, located in valleys, each covering one valley.

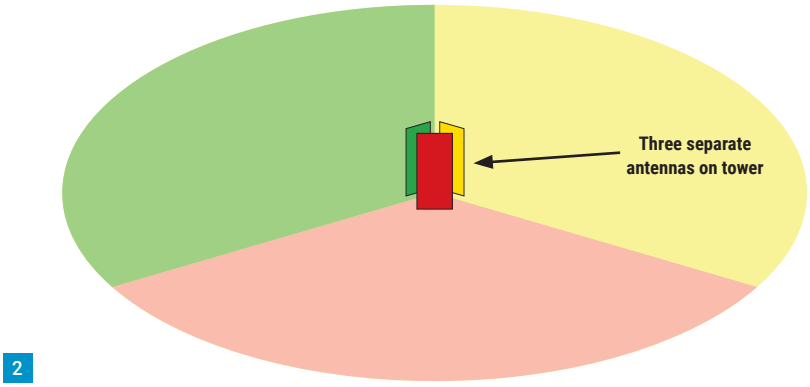
highest frequency UHF TV channel, was centred on 850MHz. These eight channels weren't used for main TV transmitters, only for low power infill transmitters. They ceased being used for TV after digital switchover was completed in October 2012 and were subsequently reallocated for mobile phone use.

These frequencies offer some penetration into valleys and buildings, and therefore the greatest coverage areas. The total allocated bandwidth is 140MHz. This may seem a lot, but there are a couple of things that need to be thought about. Parts of it are for base stations to transmit, parts are for phones to transmit, and parts of it are intentionally not used (so-called Guard Bands). Also, nobody gets all of it because it is shared between all the mobile phone operators. When you consider the potential coverage area of UHF in combination with the explosion of mobile data usage, it adds up to not being able to support large numbers of simultaneous users, even though many base stations divide their coverage into three beams. Some masts are shared and have antennas from more than one operator, but **Fig. 1** shows a mobile phone mast for a single operator. The antennas are protected under covers that are transparent to radio waves. What's 'under the hood' is complicated and beyond the scope of this feature, but there will be antennas for 800/900MHz and higher frequency bands. Note that the antennas point out at 120° intervals. There is little overlap between the coverage of the three antennas, so as **Fig. 2** shows, a network operator can effectively make the cell work into three separate areas.

These days the base stations on these frequencies tend to be away from cities, i.e. in places where the population is well spread out and the number of users is relatively small. In thinly populated areas the base stations are often located on hilltops, to give coverage into neighbouring valleys, **Fig. 3**.

1400-2600MHz

There are five separate bands in the 1400 to 2600MHz range, all in the lower microwave part of the frequency spectrum.



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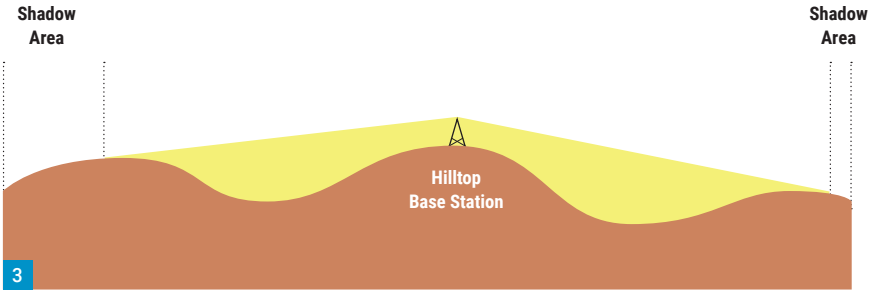

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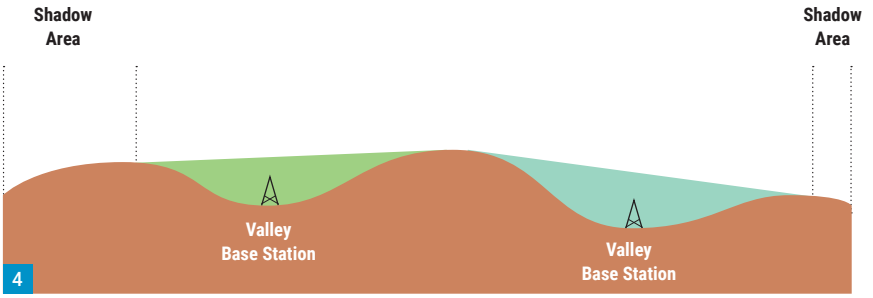

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With greater bandwidth, larger numbers of simultaneous users can be supported. Use of these frequencies results in less coverage, so these frequencies work better in more populated areas where the network designers want to provide more than one cell, each with limited coverage. Microwaves don't penetrate well into valleys, so network designers exploit this characteristic and intentionally limit coverage by not locating base stations on hilltops, **Fig. 4**.

Note that in Fig. 4 the shadow areas at the edges of the illustration are larger than they are in Fig. 3. The shadow areas would likely be catered for by base stations further away, but for clarity I do not show them.

These days there is a great deal going on in this part of the frequency spectrum. You can find out everything by downloading a document from the Ofcom website, but because it is very long and complex I am just going to give some highlights here.

Above and below the 1450-1496MHz allocation is where navigational satellite systems (GPS, Glonass and Galileo) transmit.

At one time WorldSpace satellite audio was broadcast around 1500MHz.

Have you ever heard of DECT? It stands for Digital Enhanced Cordless Telecommunications. Modern domestic cordless telephones are DECT and operate on 1880-1900MHz.

Communication with spacecraft takes place on 2110-2300MHz. For example, the Voyager spacecraft that was launched in 1977 is still in communication with Earth on 2114MHz (uplink) and 2296MHz (downlink).

In North America digital radio is broadcast from satellites on 2320-2345MHz, so the 2300MHz allocation for mobile phones isn't relevant there.

Bluetooth works at 2400MHz. Some radio-controlled models and devices such as garage door openers do too.

Frequency	Three	EE	O2	Vodafone
800MHz (791-862MHz)	4G	4G	4G	4G
900MHz (890-960MHz)	-	-	2G & 3G	2G & 3G
1400MHz (1450-1496MHz)	4G	-	-	4G
1800MHz (1710-1880MHz)	4G	4G	2G & 4G	2G
2100MHz (1920-2170MHz)	3G & 4G	3G	3G & 4G	3G
2300MHz (2300-2400MHz)	-	-	4G	-
2600MHz (2500-2690MHz)	-	4G	-	4G
3400MHz (3400-3600MHz)	5G	5G	5G	5G
3600MHz (3600-3800MHz)	5G	-	-	-

Table 1: The frequency bands currently used in the UK for mobile phones.

Depending on which channel you use, wireless local area networks operate on 2400-2450MHz.

Microwave ovens operate on 2450MHz.

3400/3600MHz

3400 and 3600MHz are the two bands on which 5G operates (or will operate, if you don't already have it in your area). They are the two highest frequency mobile phone bands… at the moment!

Coverage becomes very limited at these frequencies. Even some types of glass can present a barrier to signals. This means that the number of users connected to any particular base station tends to be very limited.

This in turn means that lots more base stations are needed to provide network coverage, but because not so many people connect via any given base station it means users can get fast data. These bands are best suited to urban environments and enclosed spaces (e.g. a large hotel, a mainline railway station or a stadium).

Typically, the antennas used for 5G are different to those used for 4G.

The Bigger Picture

As I mentioned earlier, most mobile phone base stations operate on more than one frequency band. Switching between bands is seamless and can take place while a call is being made, so users don't know which band their phone is operating on at any given moment. The base stations operate by constantly trying to balance the calls and data throughput, while the phones try to conserve battery power by maintaining communication at the lowest possible power.

As regards 5G, there's a way around the distance/penetration limitation of 3400/3600MHz. Another frequency band will soon be coming along for 5G. It is at 700MHz, the exact allocation being 703-791MHz. These frequencies (formerly UHF TV channels 49-60) were also cleared as a result of the digital TV switchover. The coverage is roughly the same as the 800/900MHz bands. The logistical problem for the network designers is that the sites you would choose to use for 700MHz base stations are not the kind of sites you would choose to use for 3400/3600MHz.

The Future

You might think that 2G and 3G mobile services are ancient and ought to be on the way out, if not already gone, but in fact 2G is likely to be around for quite some time. This is because 2G is used for smart metering and various other activities that need a limited throughput of data but must have reliable, country-wide coverage.

The development of 6G mobile phones is already underway. If you want to know what 6G is likely to be capable of, it is useful to learn from history.

Just as when 3G was the norm, we looked forward to faster data with 4G. Now 5G is being introduced and we are looking forward to even faster data with it. Although some years away it will be the same again when 6G comes along. 1Tb (terabit) data transmission rates have been mentioned.

Remember that for faster data throughput you need more bandwidth. This in turn means operating at higher frequencies, where more bandwidth is available. Expect 6G to operate on frequencies over 4000MHz. Frequency bands around 5000MHz, 26000MHz, 40000MHz and 66000MHz have been quoted. We are talking well into the microwave part of the frequency spectrum here.

Just as is the case with 5G, using higher and higher frequencies means less and less penetration by the radio waves, so for 6G even more cells will be needed. It will be a really big infrastructure for the network providers to build.

Continued from page 53

been in use for almost a century, predating text speak by many decades! The instructions with each kit include a Morse Code list and some easy abbreviations that are in common use nowadays. The group Instructors pack has many references for further reading on the web.

Once the Bat is working, you can do many simple things to explore communication techniques that are widely used in radio communication – make them informal or serious science lab experiments as you wish! Explore how the received audio signal strength drops with separation between transmitter and receiver or explore the directional properties of the transducers in much the same way as antennas have radiation patterns.

You can also explore how reflections occur and what devices cause interference. It is leakage around the transducer edges (or what is normally called sidelobes for an antenna) that produces the signal for the receiver beat note when sending.

The Bat receiver uses the direct conversion approach that is often used for simple analogue radios and increasingly in the very early stages of software defined radios. It involves mixing the received signal with a locally produced signal so that a much lower difference frequency is generated and more easily processed by the following stages and humans!

In the simple direct conversion process, there are two tuning spots where a useful low frequency beat note can be heard and this can be explored with the Bat. The SA602, which uses the Gilbert cell internal circuit architecture, has been the backbone of low power simple receivers for several decades now. Look it up on the web!

Availability

The Bat can be ordered from the Walford Electronics Ltd website (below) using their Paypal facilities for payment. Single units cost £20 and the website will automatically add £5 for post and packing. For group event organisers wishing to order for several builders, with five or more units, please quote PWBat for a discounted price of £19 each plus the usual p&p charges. Please allow plenty of time for large orders and consult me, Tim G3PCJ, at **electronics@walfords.net** because the Covid virus is disrupting the supply of parts.

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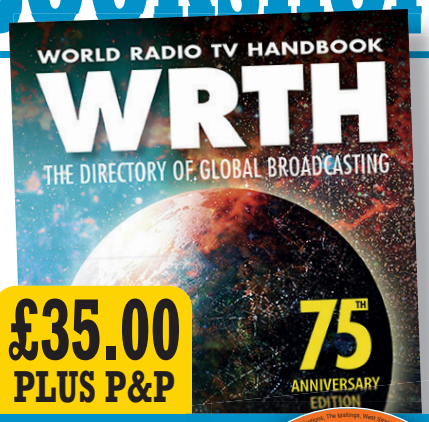

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Amateur Radio on a Budget (Part I)

Daimon Tilley G4USI introduces a new series focusing on how you can get started in the hobby on a budget.

Daimon Tilley G4USI
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Welcome to a new series of articles for *Practical Wireless*. In it I am going to be taking an in-depth look at how you can build a complete and well-equipped amateur radio shack without breaking the bank.

We have a great hobby, unique in its ability to allow us to communicate with strangers, as friends, all over the world in a huge variety of modes, using the power of radio. Like many hobbies, especially technical ones, over the years a significant industry has become established in designing and selling great quality equipment. Of course, given our hobby is relatively niche, production volumes are never going to reach that of the ubiquitous mobile phone, or laptops, for example. As a result, the price of new commercial equipment remains quite high in many cases, as commercial manufacturers are having to cover the cost not only of the equipment, but all the overheads of production, including research and development. This is one of the reasons that traditionally we don't see many new rigs come to the market each year – manufacturers need to make their products cover their costs before launching a new one.

Anyone new to the hobby, or even those a bit longer in the tooth, like me, would be forgiven for scanning through the advertisements in *PW* and coming to the conclusion that the hobby is, or at least can be, very expensive. Entry-level HF rigs from the 'big three' manufacturers Kenwood, Yaesu and Icom, start at around £600, rising to £1200 or so for mid-range equipment. This actually compares quite well with the cost, say, of a good laptop, but for newcomers, or those on a reduced budget, it could be a barrier.

Good News

There is some good news though. There is the start of some market disruption, as the marketeers would call it, from our friends in China. Chinese manufacturers have been present in the VHF/UHF market for some time now and have massively driven down prices, to the extent that even the large traditional manufacturers have started to offer more 'budget' models, in order to maintain a foothold in this segment of the market. We have now started to see a similar trend emerge in HF transceivers, with a number of Chinese players. This has to be good news for competition, quality, and prices in the long-term. As the quality of these Chinese brands continues to improve, I predict that the main players in the market will start to see a bigger threat and will hopefully respond with keener pricing and better products. It remains to be seen how this plays out, but increased competition is usually good for the consumer in the long term.

1

Encouraging Youngsters

At a time when there is a reviving interest in entering our hobby, due to recent COVID-19 impact, I for one, don't want newcomers put off on the basis of cost. Additionally, I want the hobby to encourage many more youngsters. I myself, entered the hobby at the age of 13. My 14-year-old son is licensed, and my 11 year old wants to study for the Foundation exam. The cost for youngsters

Fig. 1: Kenwood TS-700 2m multi-mode with BNOS 180W linear, SWR meter and Kenwood VOX unit. Fig. 2: Yaesu FT-70D handheld and Raspberry PI Zero hotspot. Fig. 3: QRP Labs QCX 40m CW transceiver. Fig. 4: Xiegu X5105 transceiver, PSU, Trio TR-2300 FM rig, MFJ antenna tuner. Fig. 5: The shack, with operating position on the left and workbench on the right. Fig. 6: PSU, HF SDR transceiver, attenuator and HF 50w linear amplifier, alongside Kenwood R-1000 receiver.

like mine to enter the hobby will, typically, be borne by parents, so needs to be in reach of birthday and Christmas present budgets.

Of course, it wasn't always like this. Trace the hobby back to its early days, and much equipment was home made using basic, often scavenged components, making cost a bit less of an issue. Or, for those coming into the hobby post-war, there was a wide selection of government-surplus gear available. Despite the (very welcome) range of brand new and high-end equipment, though, it is still possible to achieve a good shack for relatively low cost.

But there are other reasons for operating on a budget. It can be rewarding and fun! There is also a spirit of recycling, giving renewed life to old equipment that might either just sit around under a shack desk somewhere, be broken for parts, or worse still, find its way to landfill.

Take my own shack, as an example. I am fortunate enough to live comfortably and, if I wished, I could spend a lot more money than I do on shiny new equipment, and on a couple of occasions I succumbed. But as it stands at the moment, I have a shack capable of operating well on all bands from 160m to 70cm, on voice, CW, digital modes and satellites with only one 'new' commercial transceiver (a handheld) purchased by me, and every antenna home-made. Most of the gear is second-hand, some of it vintage, and some of it home-built from kits or scratch.

So, in this series I want to cover the following areas:

- VHF/UHF transceiver/transverter options.
- VHF/UHF antennas – home made.
- Getting on HF with 100 watts – good used rigs and where to buy.
- Getting on HF with 10 watts or less – QRP options, commercial, kits and home made.
- HF antennas that are simple and cheap to make
- Antenna Tuning Units – do we need them? Buy, build or make from scratch?
- A general coverage receiver – used, SDR units, the worldwide web.
- Shack accessories – Power supplies, SWR meters, antenna analysers and switches.
- Computing power! A new lease of life for your old machine, second-hand units and the Raspberry Pi.
- CW keys – buying used or build your own for free.
- Round-up and summary. What new options have presented themselves since the series started? What have we learnt?

2


3

4

Sources of Budget Equipment

There are three main routes into budget equipment. First, you can buy new, cheap equipment, with basic facilities but more than adequate to get you on the air. Second, you can buy used, older equipment. I find that there is often little savings on used equipment just a year or two old. Residual values seem quite high, so I tend to look for equipment a decade or more old. Often this will not have the bells and whistles, but may, depending on age and brand, be of better, more robust quality than cheap new equipment. Finally, you can elect to build your own, perhaps from a kit of parts, or by assembling ready-made boards into a case.

We will examine all of these options over the course of the series, but let's start by taking a quick peek inside my own shack, and my son's, **Josh M7JOT** – what have we got, and what did it cost?

The G4USI/M7JOT Shack

What I propose to do here is list the main equipment that Josh and I use in the same categories I have listed above. This will allow me to set out, quickly and easily, what is possible in these categories, to give an overview, and then in the following articles go into greater depth and more options.

So, briefly, by category:

VHF/UHF Transceivers

- Kenwood TS-700 all-mode 2m transceiver – used, £80
- Yaesu FT-1802M FM mobile transceiver – Josh, used £80
- Baofeng GT3-TP 2m/70cm handheld – Josh, new £32
- Yaesu FT-70D 2m/70cm handheld with C4FM – new £170
- Trio TR-2300 FM portable rig – owned for over 40 years – about £50 now

VHF/UHF Antennas

(all home made)

- 2m 5/8-wave ground plane antenna from a cheap mobile whip and scrap, £10

5

- Dual-band Slim Jim made from spare 450Ω window line and PVC waste pipe, Free!
- Handheld dual-band Yagi for satellite work, about £35

Getting on HF with 100 Watts

Nothing at the moment! I did have a Yaesu FT891 – previously my most expensive item of equipment at about £600. It was good performer, but I got really frustrated with how all the things I wanted to change were buried in menu structures, so I moved to the SDR below, allowing me to access pretty much any frequently used setting with a single click of the mouse.

Getting on HF with 10 to 45 Watts or less

- A home-made SDR transceiver covering 160m to 6m, with 10 watts out, built to his own design by a local amateur, £250
- If I want to up the power a bit, I have a good Chinese design amplifier for 80m through 10m that will put out 45 watts from a 5 watt input – the MX-P50M – new £125
- A 3dB attenuator, to drop the SDR power to 5 watts for the amplifier. Home-made, cost about £10
- The Xiegu X5105 QRP transceiver – an excellent field radio or for use at home – all HF bands 160 through 6m, and modes, 5 watts out, internal battery and internal auto ATU, used for £300
- Homebrew uBitx HF transceiver (version 4), 10 watts out on 160-10m, new kit £100 approx. from HF Signals.
- Home-brew QCX 40m CW rig, from QRP-Labs, new kit £50
- A variety of simple and cheap home-brew CW rigs

HF Antennas

- A homebrew G5RV antenna, cost about £30 for the wire and insulators
- A homebrew multi-band vertical for 80m, 40m, 30m, 20m and 15m, made from a 10m fishing pole and wire (with some help from nearby trees), cost around £50, including wire.

Antenna Tuning Unit

- MFJ-949D Deluxe Versa-Tuner. Used (from a charity shop) £50

General coverage receivers

- Kenwood R-1000 Communications Receiver, used £60
- Nooelec RTL-SDR dongle and free SDR software, new about £20
- Ex-military 50s/60s vintage Racal R-210 receiver, brought as surplus by me and converted from 24V to 240V – can't remember what I paid – had it about 40 years!

Shack accessories

- Sharman 30A PSU, new £70
- Sharman 50A PSU, new £125
- Altai 5A PSU – owned from new by me (40 years?), now very cheap!
- Antenna Switch, used £10
- SWR/power meter, used £20

Computing power

- Refurbished Windows 10 desktop, i5 processor and SSD – from an auction site, £90
- Numerous Raspberry Pi's – new from £10 to £80
- Lenovo laptop, given to me free and given a new lease of life with Linux Ubuntu – free

CW keys

- Kent paddle – used iambic paddle, £50
- Home-made (3d printed) travel iambic paddle, free

6

In Summary

So, in this brief tour of what I have planned, what have we learned so far? Well, we have seen it is possible to get on the air for just over £30 with a new transceiver, and to work through satellites for just £35 more and a bit of DIY. That is the two main VHF/UHF bands covered. At HF the choices become a bit wider, and typically more expensive, and we delve into both of these areas in the coming months, plus more.

But the key bit of information to take away is that the hobby can be as cheap, or as expensive, as you wish – there really is a route into the hobby for all budgets. In my case, everything you see listed above comes to less than £1,800. Now I appreciate that, totalled up, that will not be everyone's idea of a budget setup, but there is a lot of redundancy here. There are two or three of most things, and they have been accumulated over time. Bear in mind that a single top-flight HF rig from the 'big three' will set you back more than £3,000. If I pared my gear back to a single capability on HF/VHF/UHF, then I hope you can see that a well-equipped shack can indeed be delivered on a budget.

Where to buy? Well there are many options here. If you want to buy new cheap equipment from China for VHF/UHF, then you can choose from some of the advertisers in this magazine, or from online shopping and auction sites.

Second-hand gear can come from a number of sources. This might be word of mouth through friends in the hobby and local clubs or from the small ads of radio magazines.

Alternatively, many of the larger (and some smaller) dealers have a range of used equipment, or when restrictions are eased, you can shop at rallies. Other sources include online auction sites and social media.

I have personally brought quite a bit of used gear through Facebook, either through special interest groups, e.g. the Xiegu groups, or through Facebook Marketplace. There are two or three specific UK-wide Facebook groups for buying and selling used amateur radio gear too. The internet is really your friend here.

Clearly if you are buying from a reputable dealer, you can usually buy with confidence. If you are buying privately, just be careful. In my experience, amateurs are generally honest folk and will tell you the 'warts and all' of what they are selling. Just be a little wary of people selling gear who are not amateurs. In many cases they will be genuine, but they are likely to be selling untested equipment that they don't know how to use – these might include people doing house-clearances or relatives of deceased radio colleagues. It never hurts to ask a seller for their callsign when making an enquiry.

I hope you join me for the next instalment in two months' time, when we will take an in-depth look at getting on the air on VHF/UHF. Until then, start looking for a bargain!

Radio Round-up

BIG ANTENNAS: Justin Johnson G0KSC reports: *"Every now and then, a really special antenna system gets installed and usually it is a result of desire, commitment and dedication of the station owner.* ***Kari OH2BC*** *is one of these guys.*

"Several years ago, Kari installed 8 x 18el X-pols (9v/9h) for 144.146MHz. Impressed by their stability and being able to use them in all weathers, he asked InnovAntennas to produce similar, this time for 50MHz.

"The photo shows his new array. InnovAntennas supplied the antennas, cabling and power dividers. The H-frame and guying were all prepared and installed by Kari and his team.

"The system looks impressive but once you factor that those booms are 10m long and on a cross boom of over 21m wide, you begin to realise the work that had gone into this system.

"Congratulations Kari, another Big Gun joins the 6m band party!"

https://tinyurl.com/y38ay4l9

GET ON THE AIR FOR CHRISTMAS: As part of the *Get on the air to care* campaign that the RSGB has been running with the NHS since April, it is launching a new focus for Christmas. Called *Get on the air for Christmas* and shared on social media with the hashtag #GOTA4C, it will bring together a few activities that radio amateurs can participate in over the holiday period. It will run from Saturday December 19th to Saturday January 9th.

Christmas can be difficult for many at the best of times, but with the extra restrictions due to Covid-19 the RSGB wants to make sure that every radio amateur feels part of a caring amateur radio community.

Various activities are being planned and further information will be added to the campaign web page over the coming weeks:

www.rsgb.org/gota4c

Read more radio news and reviews at www.radioenthusiast.co.uk/news

SFI of 93!

Steve Telenius-Lowe PJ4DX notes a significant increase in solar flux, reports on some personal milestones and has news of a Silent Key.

Steve Telenius-Lowe PJ4DX
teleniuslowe@gmail.com

Seasons greetings to all readers. There was a distinct upturn in propagation in October which continued into November. Conditions during the CQ World Wide DX Phone contest at the end of October were great on 7 to 28MHz (although very poor on 3.5 and 1.8MHz), with 10m open from here to eastern Europe and Africa to the east through to Hawaii in the west. Quite remarkable at this stage of the solar cycle.

So, could the improvement in propagation be caused by the first stirrings of Sunspot Cycle 25? Well, maybe. It is normal for the Solar Flux Index (SFI) and Sunspot Number (SN) to rise sharply after solar minimum and decrease gradually after the maximum. But it's also normal for propagation to improve around the autumn equinox and then deteriorate as winter comes along. So, it's too early to tell whether this is the beginning of the long-awaited sustained improvement that Solar Cycle 25 will certainly (eventually) bring.

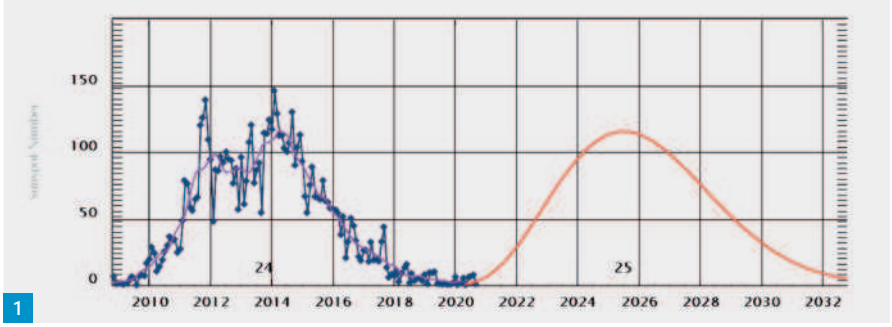
As a reminder, the SFI is a measure of the sun's radio emissions at a wavelength of 10.7cm (2.8GHz). The SN is a measure of the observed sunspots and sunspot groups: one sunspot group 'scores' 10 and each individual sunspot 1. The minimum SN value, other than zero, is therefore 11 (one sunspot and so only one group).

I thought it would be interesting, as a new feature for this year, to compare the SFI and SN month by month on the deadline date of this column, the 11th of each month. See **Table 1** (the SFI actually rose as high as 93 and the SN to 35 on November 7th, the highest levels they have been for three or four years, before falling back again by the 11th). The SFI and SN can vary considerably from day to day, so little should be read into the absolute levels on any particular day, but it will be interesting to see the upward trend as Solar Cycle 25 progresses.

Why is all this important? Well, the higher the solar flux or sunspot number – and there is a distinct correlation between the two – the better the propagation on most of the HF bands, and especially the higher-frequency ones. Signals will be stronger than at present, openings will last longer, and there will be openings that simply do not exist at the moment, such as from western Europe to the central Pacific on 28MHz, when the SFI or SN eventually rise above a certain level.

Fig. 1 shows the SN progression throughout Solar Cycle 24 and the predicted levels for Cycle 25. The twin peaks of Cycle 24 can be clearly seen and note that for much of 2020 the SN was 0 (and the SFI was around 68, which is about as low as it gets). There is far more on these subjects at:

en.wikipedia.org/wiki/Solar_cycle
en.wikipedia.org/wiki/Wolf_number
https://tinyurl.com/yyc7pj4k



1

	Nov '20	Oct '20	Difference
SFI:	86	73	(+13)
SN:	27	26	(+1)

Table 1: Solar Flux Index and Sunspot Number on November 11th 2020 compared with the previous month.

Personal Operating Milestones

I was first licensed as G8FEO in 1971 at the age of 16. This year will therefore mark my 50th year as a licensed radio amateur. I know many amateurs, including some regular contributors to this column, have been licensed far longer than that, but to me it seems a milestone worth celebrating!

As with most amateurs, my level of activity has waxed and waned over the years but I have never been as active as I am now and in October I achieved a second milestone: 100,000 QSOs as PJ4DX. According to *Club Log*, overall 98% of those contacts were on SSB and 2% on CW, although in 2018 very nearly 10% of my QSOs were on CW (a statistic that surprised me as much as anyone else!).

I normally operate the CQ World Wide contest in October as part of a multi-operator team. In most recent years this has been as PJ4Q although in 2019 I joined PJ4K, the new American-owned contest station here on Bonaire. Sadly, Covid-19 meant there was no repeat of this operation in 2020 so I entered CQWW as PJ4DX from my own rather more modest station. I took part in the 'Classic' section for single operators using a single radio and without any form of assistance such as DX Cluster. It also limits the operating time to 24 of the 48 hours of the contest weekend. The unexpectedly good conditions allowed me to make over 3400 contacts and it was this that pushed the PJ4DX QSO total over the 100,000 mark.

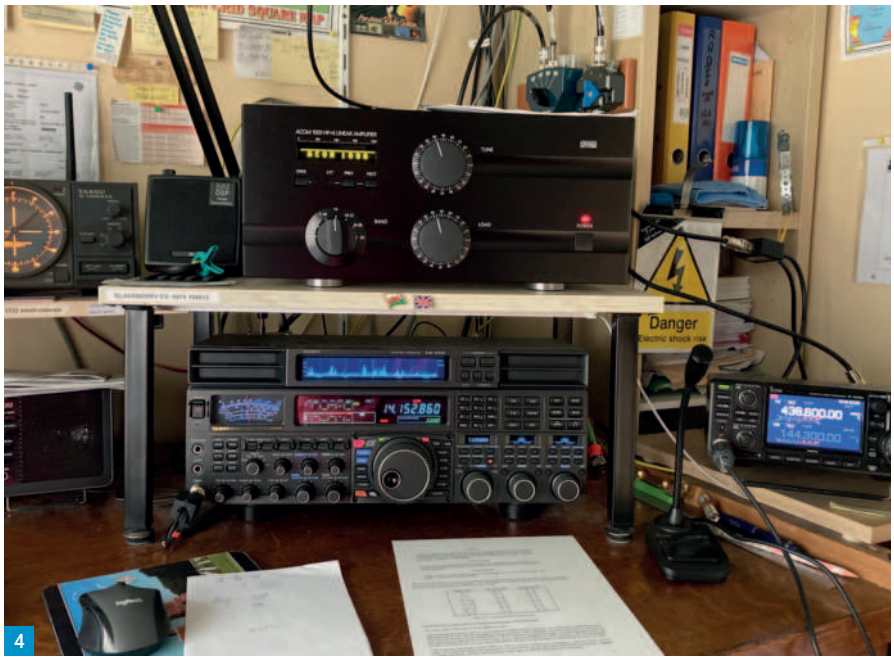
Have you had any personal operating milestones recently, or are any coming up this year? Please let us know!

Sad News

One of the world's best-known radio amateurs, **John Devoldere ON4UN**, became a Silent Key on November 9th. John was a top DXer on 80m and 160m and literally wrote the book on the subject: his *ON4UN's Low-Band DXing*, **Fig. 2**, published by ARRL, has sold in the tens of thousands and a well-thumbed copy of the 585-page tome has pride of place on my bookshelf. *RIP ON4UN*.

Readers' News

Owen Williams G0PHY wrote that *"Nearly all the activity this month was over the weekend of the CQ World Wide Phone contest. It was great to have significant activity on both 21MHz and 28MHz during the contest. On 7MHz I was able to work into the east coast of the USA and the Canary Islands. 14MHz was open to the USA, Canada, Caribbean*



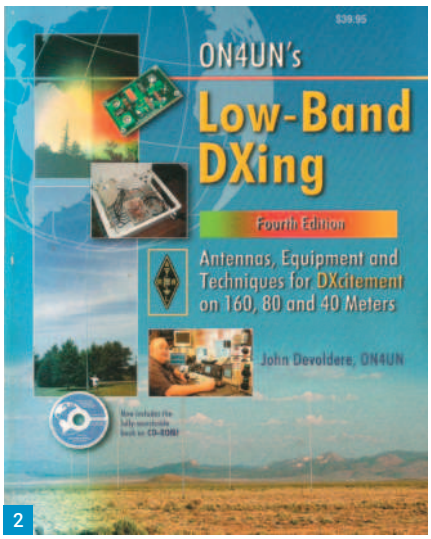


Fig. 1: Sunspot number progression throughout Cycle 24 and predicted levels for Cycle 25. The black marks and line show the monthly values, the purple line the smoothed monthly values and the red line the predicted values. (Image: Space Weather Prediction Center, National Oceanic and Atmospheric Administration).
Fig. 2: *ON4UN's Low-Band DXing* is an amateur radio classic. Fig. 3: John MW1CFN and his daughter Ella MW6PYS with their 12m LFA Yagi. Fig. 4: The new Acom 1000 amplifier at the station of Etienne ON8DN/OS8D. Fig. 5: G3JNB's FT-818 and Miracle Whip take the sea air! Fig. 6: Screenshot of 2E0BWX WSPR spots. Fig. 7: Martin PJ4/DL6KL working the European pile-up from Bonaire.

and Asia and gave me a new one, ***Robert T6A*** *in Afghanistan. This together with 4U75UN gave me two new ones in a month, just like old times when I was starting out collecting DXCCs. Most of the US stations worked on 14MHz were in New England but I did manage K0BBC in South Dakota. However, despite generally good conditions I did not hear any west coast USA/Canadian stations, but that could have been because I was listening at the wrong time. 21MHz was open to the same parts of the world as 14MHz with the best DX being ZS6CCY in South Africa. 28MHz was full of Europeans but I did manage QSOs with EA8RM in the Canaries and KC1XX in New Hampshire. I managed contacts with KC1XX on 7, 14, 21 and 28MHz. I'm sorry I didn't hear PJ4DX though I did hear PJ4X but as he said he was suffering heavy line noise I did not spend too much time calling him."*

Tony Usher G4HZW is another who took advantage of the higher solar flux and improved propagation on the higher bands. *"I had a bash on 21MHz using the 7MHz vertical; it works but not too well from looking at what others are working... During the current period the SFI rose to 91, mirroring the increase in cycle 25 sunspots and I was delighted to work my first 28MHz FT8 VK (VK6APK) on October 22nd at 0920UTC. Also new on the band were 5Z4VJ, 9M2TO and EY8MM, bringing my total this year to 111. I now have 142 worked (124 confirmed) on 28MHz FT8 since September 2017. On 7MHz Alaska was a new one and the highlight. On 21MHz I was pleased with RW0 and 9J2BS."*

It's always good to greet new contributors to this column, so a warm welcome to **John Rowlands MW1CFN** who was enjoying the good conditions on 12m: *"I'm active most days on 12m, with a 3-element LFA* (**Fig. 3**) *from Anglesey... Late October has been very good on 12m, with daily openings to Asiatic Russia (UA9CGL, UA9YK, UA9CK), Africa (ZS1SC, 5Z4VJ), South and Central America (countless PY stations, VP8NO, LU4FYF, XE1GZU), and the whole of North America (countless, including N5NMX, W4DAS)."* We look forward to getting more 12m reports from John in future.

As reported last month, **Etienne Vrebos OS8D/ON8DN** had to send his Acom 1500 amplifier away for repair. He wrote to say *"I just received my new Acom 1000* (**Fig. 4**) *today, ordered two days ago from WIMO in Germany – great service! Working great. No news from the Acom 1500 sent back to Bulgaria by my favourite dealer. Of course, I expect it to be repaired under warranty but it could take weeks. I'll have a PA in reserve, in*

case of being unlucky again."

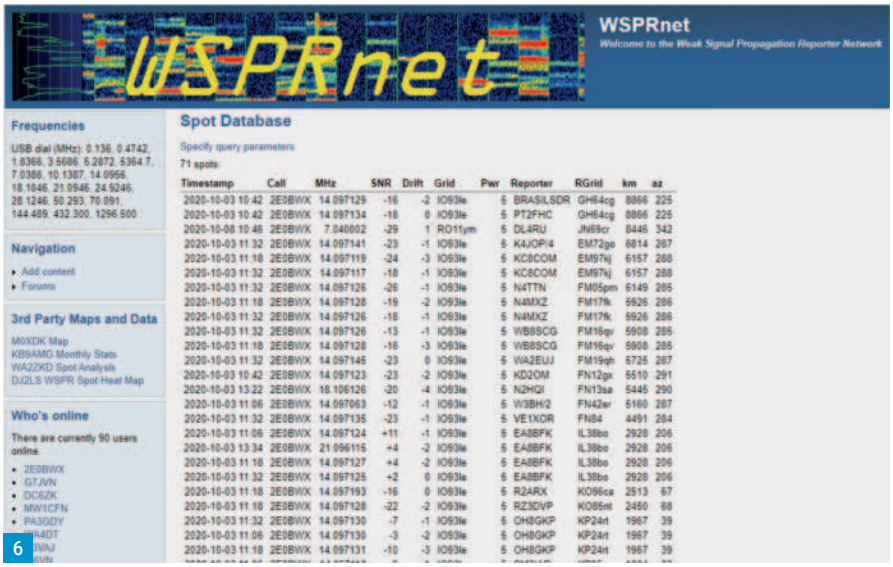
Having been in virtual lockdown for six months, come the first week of October **Victor Brand G3JNB** and his wife **Audrey** went down to Brighton for a much-needed holiday. The FT-818/Miracle Whip QRP combo was packed with the idea of just short sessions (or, if wet, long ones!) *"Certainly, the possibility of operating from the sixth-floor balcony of our venerable Victorian hotel, looking straight out to sea,* **Fig. 5***, was an attractive prospect. Setting up was simple and I could hear good CW signals on 20/30/40m. But the little rig simply refused to transmit! Battery charge? Close proximity of iron railings? Or had 'Murphy' joined the party? Not risking damage to the PA, there was nothing for it but to revert to the SWL /P mode and I started to log callsigns. EUs abounded on 20/30m but 40m sounded the most promising. I enjoyed short sessions copying the EUs but really I was seeing if any DX was discernible with just a 52-inch whip antenna... On the Saturday, during the Oceania Contest, VK2IM in NSW came through on 40m very well. 20m yielded 4U75B, the UN Global Services Centre Radio Club in Brindisi, Italy and, on the Sunday, W9SN, VE2WK and K3CT were good signals.*

"Certainly, the listening took me back to my teenage SWL days on the homebrew 1-V-2 breadboard receiver (2V valves). And I recalled that enigmatic slogan displayed across the front of those huge, century old, long wave plug-in basket coils: 'Hear what the Wild Waves are Saying'. Quite!

"Back home and no 'Murphy', no problems and my first DX QSO was with ***Tom W0WP*** *in Cedar Rapids, Iowa, followed by VE2CSI Sept-Isles, both on 17m, and a 'QRP Hat Trick' with Z66DX on 20, 30 and 40m."*

Bill Ward 2E0BWX says he worked *"lots of European stations"* during the month, though his highlight was a contact with KZ9DX on 14MHz FT4. He added, *"I've also been playing on WSPR this month with some surprisingly good reports."* Bill attached a screenshot, **Fig. 6**, of some of his *WSPR* spots, which were achieved with 5W to an end-fed wire.

Kevin Hewitt ZB2GI reports that on October 10th he achieved Digital modes DXCC using Logbook of The World (LoTW). During the month the ZB2TEN WSPR transmitter at the top of the Rock fell silent. On inspection the coaxial cables had been pulled [by the Barbary apes? – ***Ed***] until they snapped. **John King ZB2JK** promptly repaired the cables and normal service was resumed. Kevin operated portable from Camp Bay, known locally as 'El Quarry', with John three times in October. They used a



Lafayette 2400FM modified by John for 10m to 8m of wire wound on a 5m fishing pole and connected via a 9:1 balun.

Around the Bands

Owen G0PHY: 7MHz SSB: EA8RM, KC1XX, N2NT, W3LPL. **14MHz SSB:** 3V8SS, 4L0G, K0BBC, P49Y, T6A, VE9CB. **21MHz SSB:** EA8RM, CO6HLP, N3RD, P40W, PR4T, VA2WA, VE3EJ, VY2ZM, W3LPL, ZS6CCY. **28MHz SSB:** EA8RM, KC1XX.

Tony Usher G4HZW: 7MHz FT4: 8P2K, AC2OC, AJ4OA, CU5AM, HI3CMM, JW9DL, KB8TXZ, WP4JMN, YV5DRN. **7MHz FT8:** 7Z1IS, CN5VAY, KL7TC, OA4AI, RM9M, VK2IZI, VO1BE, W5E, W0GJ. **21MHz FT8:** 9J2BS, OY1OF, RW0AR, TA2AFA, VE2GCE. **28MHz SSB:** 4U1A, 8S8S, CE3CT, K1KI, VE9CB, WW2DX. **28MHz FT8:** 3B8CW, 4X0AAP/40, 5Z4VJ, 9M2TO, CE2SQE, CX3AL, EY8MM, HQ1JBR, K2HJ, KN4JSF, LU1HW, PU2MXU, VK6APK, VP8LP, VU2OY, VU3WEW, WA6YOU, XR33M, YF1DO, ZR1ADI, ZS1F, (plus many more South Americans).

Etienne OS8D/ON8DN: 14MHz SSB: 4L1BB, 6W1QL, 9K2TV, JE1RXJ, JW/LB1QI, K6JO, S79KW, S79VU, UN6LN, VK2BY, VK2CR, VU2DSI, W7ZB, YB0MWM, YI9/IU5HWS, Z66DX, ZL2SDX. **18MHz SSB:** 4A50CRH, 9Z4FE, JA8COE, PJ4/DL6KR (**Fig. 8**), S01WS. **21MHz SSB:** 9Z4FE, BD7BM, CO8LY, CR2X, CX3AT, EX8VI, EY7AD, LU1JHD, P49Y, PJ4/W1MD, PY2JY, PY5QW, TI2JS, VK2PH, VU2ATN, VU2XO, XE1CQ, YB0IBM, ZD7FT, ZS6CCY, ZS6HA, ZS6TVB, ZT1T. **24MHz SSB:** 9Z4FE, ZD7FT. **28MHz SSB:** 7Q6M, CX2DK, FR4QT, ZS6TVB.

Victor G3JNB/P SWL report (using indoor whip): **40m CW:** 4U75A, VE2CSI (Zone 2), VK2IM. **20m CW:** 4U75B, K7GT, VE2WK, W9SN.


7

Bill 2E0BWX: 7MHz FT8: LX1HD, OZ1JVX, PE9EK. **7MHz FT4:** SP7JKX. **14MHz FT8:** 5B4AMM, HF4U, OE4KSF. **14MHz FT4:** KZ9DX, R7IW, RW1CW. **14MHz PSK31:** UB3YAO. **18MHz FT8:** RU6M, SV5DKL. **21MHz FT8:** IK3FUS. **28MHz FT8:** EA3OR.

Kevin ZB2GI: 5MHz FT8: PY4OY, TA4AEI, TF2MSN, W1NG. **7MHz FT8:** 5B60ALJ, A45XR, AB1EP, AG9S, CT3MD, PA75DKM, WO2T. **21MHz FT8:** BH4QYX, JH1ECG, JL1IEO. **24MHz FT8:** AI9T, CX4AD, FG8OJ, HC6PE, HI8RD, HK3W, K0QC, LU6FOV, PT2ZM, VE2RO, YB0DJ, ZS1DX. **28MHz FT8:** C31CT, HF6W, LX2SM, PU2SWR, TF2CT, ZS1DX.

Kevin ZB2GI/P: 28MHz SSB: CE7WCQ, CR9ABS, LU1JHD, PT2GTI, PZ1EL, plus many other LU and PY stations.

Signing Off

Thanks to all contributors. Please send all input for this column to telenius-lowe@gmail.com by 11th of each month. Photographs would be particularly welcome. For the March issue the deadline is January 11th. 73, Steve PJ4DX.

Learning/Improving your CW with CWops & CW Academy

Daimon Tilley G4USI
practicalwireless@warnersgroup.co.uk

Daimon Tilley G4USI recounts his experience of improving his CW under the tutelage of CWops.

Regular readers will recall that although I got my Class A callsign back in the early 1980s, it wasn't until nearly two years ago that I had actually ever had a CW QSO! This article is aimed at those who want to learn the Morse code for the first time, or to take their existing Morse skills onto the next level. It describes only one of many methods, but I was so pleased with the results from the method I chose that I felt it was worth sharing with readers.

Having made the decision to return to the mode, I was both surprised and pleased that I could still remember all the letters and numbers after more than 35 years.

Of course, it is one thing to remember them, but another thing entirely to put that into (effective) practice, so with the support of a local friend and along with a couple of members of the Taunton club, I embarked on re-learning CW. We had some practice sessions on-air, but mainly (due to our proximity and conditions) on Skype.

I soon became reasonably comfortable with an approximate 12 wpm (again!) and set off on my first proper forays into regular CW. My confidence began to grow and my speed picked up to about 15 wpm and stalled. I needed to get to the next level, but how to go about it?

I began to search around on the internet and look at various tutor apps for my mobile phone and other methods, when, almost by chance, I stumbled across the website of CWops, an organisation formed in 2010 and with over 2,500 members (I am member 2496). To be a member you have to be capable of sending and receiving at no less than 25 wpm, and be sponsored by three other members. When I first read that, it sounded a bit exclusive and I was very nearly put off. I am glad I wasn't and would encourage you to read on, as there is no need to be intimidated by that, whatever your ability at the moment.

The organisation is designed to be inclusive for all people in all countries, whether your preference is ragchewing, contesting or chasing DX. A key feature of the club is weekly on-air activities, called CWTs. These activities are like a contest for members and non-members alike, with a simple exchange of name and either location or membership number. The events run for just one hour three times a day (to suit different time zones) and run on the non-WARC bands. I have found them to be quite busy and a great way of building confidence and speed of copy.

CW Academy

But most importantly, for me at the time, in 2012 the organisation formed a section called CW Academy.

The CWops CW Academy is designed for you, and for everyone! It has been created to cater for complete beginners, for people who want to improve, re-gain proficiency or for those just looking for the next challenge.

The best part of all, is that you can benefit from completely free, highly structured and effective training. So how does it work?

CW Academy courses are held over eight weeks, three times a year. In each of the eight weeks, you have prescribed daily online tasks, and twice a week, on a Monday and Thursday evening, you meet online via Zoom or Skype with your CW Advisor and the rest of the delegates on your course, to talk about progress against the tasks and issues plus further practice with each other.

In each of the eight-week blocks, four separate courses are run. There are courses for complete beginners, those with basic proficiency, intermediate courses for those operating at about 10 wpm and advanced courses for those at 15 wpm currently.

Full details of the objectives for each course are available on the website.

When you have decided to sign-up, there is no need to agonise about which level is the right one to join at. Having made the decision, you can listen to a number of short (one minute) CW audio clips online. Your ability to copy them, or otherwise, helps place you in a suggested class level.

Signing Up

I signed-up and took the test, and was somewhat surprised when it was subsequently recommended that I join the advanced class – I took a pretty big gulp! I did think about downgrading to intermediate, but decided to trust the process. This advanced class was designed to get you confident at 25 wpm, increase your on-air skills and your contesting skills up to above 30 wpm, along with achieving the level required for joining CWops.

I know it sounds intimidating, and it felt it to start with, but persistence paid off, ably assisted by the patience of your advisor and the resources provided to learn from.

Structure and Resources

I think the programme worked for me for two main reasons – structure and resources.

In relation to structure, the eight weeks are divided into two online sessions with your advisor and classmates. In between these sessions, six days of the week have one or more tasks to perform on your own. This structure, along with checking from your advisor, keeps you motivated and on track. The structure is both a blessing, and at times a bane. By committing to the structure, you are giving yourself the best chance of success, but at times, it can feel quite overwhelming – some days I spent well over an hour on the tasks. The issue, for me, was that I was spending so much time on the listening tasks, that I had reduced opportunities to actually get on air and practice in live QSOs. After a while I noticed that sending speed was not keeping pace with my listening speed, and I had to devote extra time to this.

The resources provided to support you are excellent. There are some software programs to download that simulate contest reception and operating, which really sharpen up your speed on callsign and number copy. Additionally, there are a large number of online audio files provided. These contain short stories, QSO practice files, and mini-contest practice files. In each category there are 16 'chapters' corresponding to the 16 advisor sessions you have in each of the eight weeks. Within each category and chapter, the same audio file is provided in a

wide range of speeds, and the course guide tells you which speed to use for which practice session. In addition to this you are encouraged to get involved in the CWTs, the mini contests, to sharpen up your speed and skills.

One of the most effective techniques used, in my view, was getting you to listen to short stories by 'head copying' (nothing other than brief notes) at speeds far in excess of your capability and just trying to grab as many words as you can. You then listen again at a slower speed to fill in the gaps. This really helped me.

On my course, there were half a dozen or so students, mostly from the UK but with a Russian colleague too, a main CW Advisor and an Assistant Advisor. We would spend our hour together twice a week discussing the preceding tasks and our progress, along with a number of exercises between us. These included taking it in turns to send sections of text, taking part in QSOs, and a 'round-robin' memory game, where we would 'go shopping' and each buy an item. The next member then had to recount all of the items brought by others before them, and add a new one. Those of you with kids might recall this game!

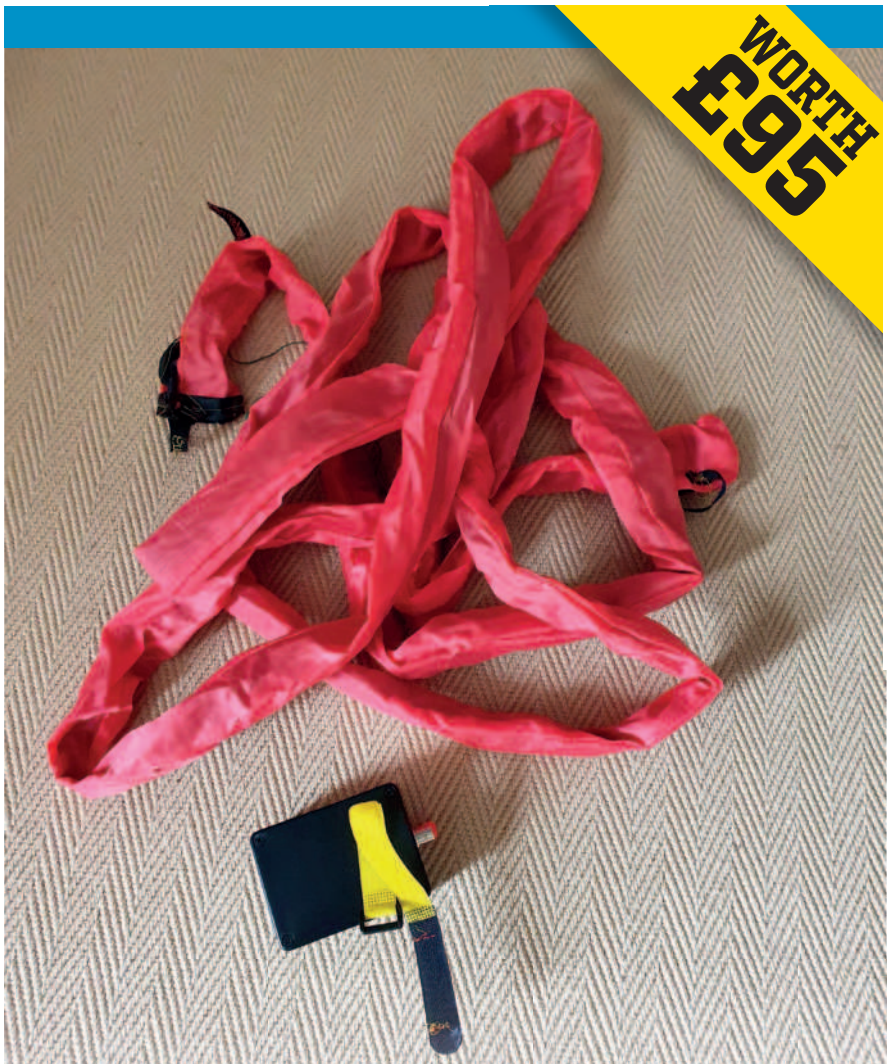
In Summary

In summary, this is not a light-hearted undertaking and you should not under-estimate the amount of effort required to train daily for eight weeks, often for an hour or more. At times, it felt a little overwhelming and close to becoming a chore. However, I am pleased to say that I stuck at it and began to reap the rewards. I no longer write down CW word for word in order to copy it, doing it in my head instead (essential at faster speeds) and can comfortably converse at 25 wpm. In addition, if I am working contest stations, I can usually copy callsigns, reports and serial numbers at up to 35 wpm – a vast improvement on where I started.

Is it hard work? Yes it is, but isn't anything that is worthwhile? If you are prepared to work hard for eight weeks solid, then no matter what level of CW you have now, I promise you that you will have improved significantly by the end of the course. The programme clearly works for a lot of people, as most people on my course had come up through every preceding stage.

With band conditions as they are, CW is a great conversational tool that will add another tool to your armoury. Why not give it a go yourself?

More information can be found at: www.cwops.org



Win a Bantenna Sleeve Antenna

Win the Bantenna, as reviewed last month by Don G3XTT.

Thanks to our friends at bantenna.co.uk, we are able to offer the review antenna as a competition prize. See below for details of how to enter. The first correct answer will win the Bantenna sleeve antenna, worth £95.

To be entered into the draw to win this antenna, all you need to do is answer the following question correctly on our website **www.radioenthusiast.co.uk/competitions**

Which of the following is an alternative colour for the Bantenna?
a. Blue b. 'Emergency orange' c. Green

Entry is only via our website. Entries close at midnight on 11 January 2021. To enter you must answer the question correctly and answers received after the end date will not be accepted. The winner will be notified by email by 20 January 2021. Warners Group Publications Plc standard competition terms apply, to view visit warners.gr/compterms. For information on how your personal data is processed, secured and your rights, our Privacy Policy can be viewed here – warners.gr/privacy or available in hard copy upon request. The winner will also be announced in the March 2021 issue of Practical Wireless

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CWops

Dear Don,

In his **Morse Mode** column of December 2020 **Roger G3LDI** states *"..the requirement for becoming a member of CWops has changed from being able to conduct conversational Morse at 25 wpm to just taking part in these (the CWT mini contests) activity periods."* This is incorrect – there has been no change implemented or even considered and the phrase referred to remains in the Bylaws as a membership requirement.

This misunderstanding has arisen due to the way it has been interpreted. Some, including myself, saw this phrase as stipulating at least one on-air ragchew type QSO must be conducted before being able to consider someone for membership. This will always be preferred and aimed for but the actual wording in the Bylaws indicates that a member wishing to propose someone need to satisfy themselves that the person *"...should be capable of carrying on a conversation in English using CW"*. In other words, it doesn't necessarily mean such a conversational QSO in the strict sense must have taken place. OK this is semantics and is far from ideal but it's an important and deliberate distinction. How many top-class CW contesters or DXpeditioners do you know, have worked but never had a ragchew with? You may admire their skill in the way they handle difficult contest situations or a raging pile-up but they never seem to ragchew; or maybe you've heard them in a rare ragchew with someone but still never managed that QSO yourself. It's clear there are other ways of gauging competency and deciding if someone would be comfortable in a 25 wpm ragchew, especially in these times when the classic CW extended conversational QSO is becoming less common. Do we exclude such talent?

The board considered at length alternative and more specific wording but never came up with anything simple that would remain relevant and open to the CW community as a whole. Additional wording has been added to the Sponsorship page to remind sponsors to consider overall proficiency (i.e. not rely solely on a couple of robotic contest exchanges). Members have the integrity of CWops at heart and we rely on the Nomination/Sponsorship system to maintain membership standards and the Academy and others to support those aiming to reach those standards.

Stewart Rolfe GW0ETF
(CWops Board Member)
Bangor, Wales

Standards

Dear Don,

I wonder how various countries made technical decisions such as what frequency to use on their mains electricity supply, and who made them. It is interesting to look at the various decisions made in the USA. They use a 60Hz supply frequency. This has advantages over our 50Hz, as transformers are 20% smaller and hence lighter and cheaper. (Though with the modern switched-mode power supplies this is now less important). They use 110V mains, and at that voltage you would have to be unlucky to be electrocuted, unlike the lethal 230V.

The downside with the lower voltage is that the conductors have to be of a bigger gauge in order to carry the higher current, but this is partly offset by the lack of the third (ground) conductor and less stringent insulation needed. In several UK power stations that I visited years ago, they used mostly 110V test equipment etc, and they said it was for safety reasons! Building sites also use a lot of 110V equipment.

In the UK with 230V mains there is the requirement for the third wire unless the appliance is double-insulated, but all plug tops still have to have the provision for the third conductor, whether it is used or not. The UK plug tops are fused, putting the price up on millions of them, but that only protects the flexible lead. It would be cheaper to put the fuse in the equipment, if necessary. In practice, the fuse in the plug hardly ever blows – I don't recall changing one for years. The UK also allows the plugs to be sold with a 13A fuse in them. Why? There must be a very large percentage of over-fused pieces of equipment, as a 5A or 3A fuse would be much better for most applications. The UK 13A plugs and sockets are the most expensive in the world, as far as the 28 other countries I have visited would indicate.

While on the subject of mains, why do we Brits have 'down' for on, when everyone else uses 'up'? That way, anything accidentally falling and hitting a switch will not turn the connected item on, but off, which is generally the safer option.

Now on to television. In the UK the old black-and-white sets had positive modulation on their display, so that any interference from car or motorcycle ignition, for example, produced 'snowstorms' of white speckles. The US employed negative modulation, so the speckles were black, and much less intrusive.

To cap it, the UK used vertical polarisation, which picked up the ignition interference far more than the US system, which used horizontal. (Remember the big old 'H' aerials?). In the UK, some sets had an IF of about 14MHz – ideal for any poor radio amateur who happened to quite legally push out 100W or so of RF, with irate neighbours knocking on their doors. Why was that decision made, and by whom?

Robert Dancy G3JRD
Gillingham

RF Earths

Dear Don,

Referring to the letter from **Godfrey Manning G4GLM** (November), I would exercise extreme caution when giving advice on TN-C-S (PME) systems. It is my understanding that it is prohibited to export the PEN conductor outside the equal potential zone, in a domestic PME installation.

★Star Letter★

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Valve & Vintage

Dear Don,
Thank you for December's issue. I am impressed by the quantity of letters you've published; an active *Letters* page indicates to me that the magazine has a very active readership.

I think I have noticed some typos or transcription errors in the article about G6YL.

1. *"Dunn's interest in wireless communication was enhanced in 1923 .. enjoyed listening to the newly established British Broadcasting Corporation's (BBC) transmissions .."* (p.46, top of centre column).

In 1923 the BBC was the British Broadcasting Company. It became the Corporation in 1927.

[I think the Company was formed in 1922 in which case the BBC may be commemorating its centenary in 2022.]

2. *"In the 1930s .. Provincial District Meetings of 'The Society' that would later become 'The Radio Society of Great Britain' .."* (p.47, foot of left column).

The Radio Society of Great Britain came into existence in 1922.

3. The Old Old Timers Club (p.47, right column).

This one intrigues me. If membership of the OOTC was limited to those who had made two-way wireless communication in 1907 or earlier, then I doubt anyone would have had membership number 910 and the OOTC would die out when the last such member passed away. I doubt the 910 because the RSGB's *Amateur Radio – the first 100 years* says there were about 250 licences in force in 1912, nearly 1,000 in 1913 and about 1,600 in 1914 and I assume there'd be fewer than 250 licences in 1907.

There seems be an inconsistency here because the RSGB's *The Bright Sparks of Wireless* includes the *Gamage's Directory of Experimental Wireless Stations, March 1914*, which has around 400 entries (it consists of 17 pages each with around 25 entries).

I am wondering if these licensing numbers are irrelevant if membership of the OOTC was limited to those who had *"made two-way wireless communication"* rather than to those who held a licence.

If membership was open to those active in or before 1907, then I wonder how G6YL became a member when she was licensed in 1927? Might it be that membership of the OOTC was actually open to those who had been experimenting in wireless for at least 40 years. This would permit G6YL to become a member in 1967 and I think that would tie in better with her membership number.

Ian Brothwell G4EAN
Nottingham

*(**The author responds**: Thanks for this insightful response. On your first point, yes, agreed, British Broadcasting Company became the British Broadcasting Corporation on January 1st 1927. On point (2) my source was the tribute to **Barbara Dunn G6YL** on the K8CX Ham Gallery:*
http://hamgallery.com/Tribute/G6YL

"In the 1930s, ladies rarely attended PDMs. Provincial District Meetings were localised meetings of 'The Society', later to become RSGB. There were two important exceptions. Barbara Dunn G6YL was the first exception. Being of a quiet and retiring nature, few of the hundreds who contacted her efficient and intensely active low power station at Stock in Essex knew the operator was a lady. **Gerry Marcuse G2NM**, President of The Society 1929 to 1930, did know, however, and it was he who was probably responsible for persuading Miss Dunn to come to the 1930 Convention.

A few weeks earlier, G6YL had been awarded the newly donated 1930 Committee Cup for outstanding work in the first series of 1.7Mc/s tests. Her presence at the Convention Dinner caused quite a stir as did the fact that when G2NM made the presentation she became the first lady to become the holder of a Society trophy. Barbara Dunn, who was licensed in 1927, remained Britain's only YL transmitting amateur until 1932 when **Nell Corry** (the second exception) of Tadworth, Surrey, doubled the number by becoming **G2YL**."

On point (3), my source was again the K8CX website. The site does not say she became a member in 1947. Only that the OOTC was established in 1947 by a group of amateurs who had played a part in laying the foundations of electronic communications. The requirement for membership was two-way communication by wireless 40 or more years prior to 1947. At that time the members were 'spark' operators in 1907 or earlier when there was no licensing authority. The requirements have continued to this day. The current requirements are two-way wireless communication by amateur, military or commercial means 40 or more years ago. Barbara was member #910.)

The Equal potential zone is generally the four walls of the property and the PEN conductor should be connected to every conductive part within the installation. Technically, an outside tap or a steel heating oil tank connected with copper pipes should have an insulated section where it enters the house. The only services connected from outside the property should be the water and gas mains, for other reasons.

So, I would say no, the RF earth should not be connected to the main earth terminal on a PME installation. I know an amateur who did this and was instructed by the distributor to remove it.

If it was permitted to connect the RF earth to the mains earth, I would say the cable would need to withstand the full fault current on the system, which would depend on the type and size of the protective device on the distributor's transformer, not the fuses in your house. So, undoubtedly, something much larger than a 10mm^2 CSA earth conductor would be necessary. This would also require the RF earth electrode to have a low enough impedance to operate the distributor's protective device within the required time and the cables to your house from the network to withstand the fault current, both unlikely.

The notion that RCDs or isolation transformers would give any protection against this type of fault, as I have read on social media, is nonsense. The hazard is

caused by the distributor's earth potential rising to a potentially lethal voltage above that of real earth.

The distributor's earth is permanently connected to the installation so even if the main isolator and all of the trips are turned off in your house, the potentially lethal voltage would still be present.

The neutral return path is shared by all the houses on your circuit and the magnitude of the fault voltage would depend on the impedance of the fault, the load and the phase balance on the system.

Fortunately, this type of fault is rare because, without causing alarm, the chances are most properties have this type of earthing arrangement. G4GLM correctly highlights the possibility of potential difference between the mains earth in the house and the RF earth imported from outside the house. He has overlooked, though, the reverse. If the RF earth in the garden is connected to the main earth terminal and the impedance is not low enough to operate the distributor's trips, the chances are the antenna system will have lethal voltages and you could well be standing on wet ground in the rain when you find this out.

Another but quite important point is that of the unintentional and unknown 'RF Earth'. Many PSU manufacturers connect the negative terminal to earth, which in turn is connected to the chassis of your rig. A typical installation of, say, a collinear fed with coax on a scaffold pole strapped to a fence post.

So the board's earth goes high as does earth in the ring main, the PSU, the negative to the rig, the rig, the coax outer and the scaffold pole, and anyone who happens to touch the scaffold pole will complete the circuit to ground. This means the PEN conductor is exported unintentionally. Obviously, this also goes for mains powered radios.

You may think your RF earth is excellent and assuming your property had big enough cables to support the fault current, if your earth is not of low enough impedance to operate the distributor's trip, the hazard of voltage gradients can then occur, as voltage decays with distance from the earth stake. This can be particularly hazardous to four-legged animals because voltage difference between front and hind legs results in current through the animal's heart. Hence never install safety earth electrodes in a paddock.

Incidentally, if your RF earth to the scaffold pole is excellent on the typical installation, the fault current would probably melt the earth wire in the mains lead to the PSU.

From a radio amateur's point of view, TT systems are great because we have sole ownership of the earth arrangement, but TN-C-S and TN-S should be handled with great care because even with TN-S the earth is shared with other households. Once again, these faults are very rare but with just a high impedance crimp on an overhead, if you had been on PME and that crimp was nearer the transformer, you would have been in this situation.

My advice if I were to give any is, make sure you know what type of earthing arrangement you have, be aware of the risks in the way you set up your station and take steps to minimise these risks as much as possible.

Mike Lane G1SCT
Spalding

The MRF300

Dear Don,

In *Electronic Design & Test Magazine* October 29th (you can see it online) there is a detailed article on the MRF300 power LDMOS power device. It is for frequencies of 1.8-250MHz in the hundreds of watts. It is produced by NXP Semiconductors power range and there are sample modules that can be used for whole frequency ranges 1.8-250MHz.

It may be of interest to readers of *PW* for their perusal.

Dick Joyce G3WLM
Luton

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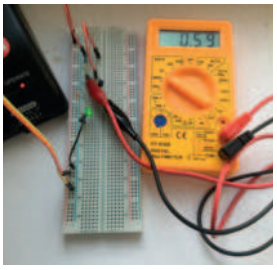

FREQUENCY COUNTER: John Dunton G1RXC constructs a frequency counter that is cheap but good to 30MHz.
TRISTAN DA CUNHA: Steve Taylor G4EDG relates the tale of his trip to Tristan da Cunha.
IN THE SHOP: Harry Leeming G3LLL closes out his long-running series with a look back at his illustrious career.
70MHz CONTEST RESULTS: The results of last September's PW 70MHz Contest.
TECHNICAL FOR THE TERRIFIED: Tony Jones G7ETW discusses the fundamentals of transistors.
VALVE & VINTAGE: John Adams G3ZSE tells the story of Pop Blundell.

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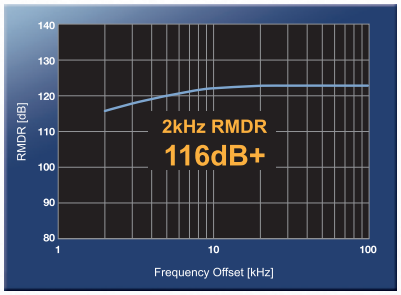

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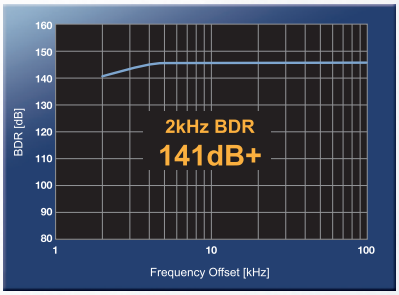

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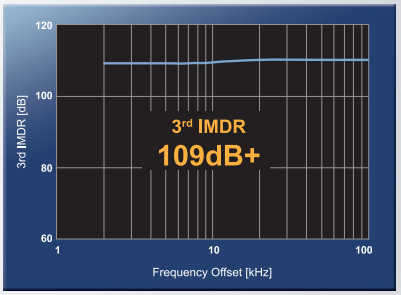

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