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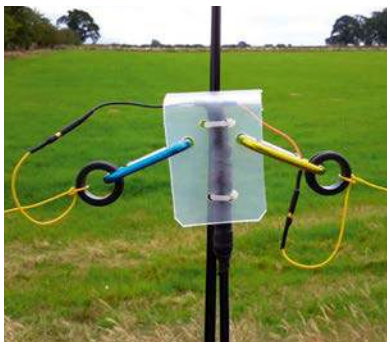
# Make better front panels

## How to get a higher quality finish




### Michael Lindsay

His pioneering work with the Chinese guerillas



### Portable antenna

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Presented by myself on a regular basis, its a good way to keep in touch. Alerts to new videos are posted on Facebook and Twitter. Check it out now! You can use Smart phone, data pads or PC's.

Peter Waters G3OJV

## ELECRAFT — Brought to you by W&S!

## Elecraft K4 SDR Transceiver


The new K4 transceiver steps forward into the world of SDR. Not new territory for Elecraft, of course, for both their KX3 and KX3 feature SDR. However, the K4 will now set a new standard of performance by which others will be judged. Again nothing new for for Elecraft, who have been at the top of the performance list of analogue designs.

Contesters, DXers and DXpeditions rely on the performance and reliability of Elecraft. This will continue with the K4. A design that now adds dual receive, and dual spectrum display. You won't need extra filters but you can add auto ATU, Diversity Reception, a Superhet front end for ultimate receiver performance, and to come a dual 2m and 70cm 15W module. Deposits now being taken.

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Performance at the top end of the Sherwood Engineering list. Its compact form and light weight make it at home on a DXpedition or on your operating desk. It's Elecraft's answer to those who want top end analogue performance.

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600W up to 10:1 1kW up to 3:1. Can be used with any transceiver or amplifier.

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A great companion for the K3 series. It gives you a live view from 2kHz to 200kHz ollus waterfall.

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Ideal for FT-817/8. 160m - 6m. Handles coax and most end fed wires!

Built: **£189.95**

## The New AX1 Antenna System

The AX1 antenna was designed by Wayne N6KR, co-founder of Elecraft. Whilst designed with the KX2 and KX3 in mind, it will equally appeal to all QRP operators. Handling up to 30W and covering 20, 17 and 15m, this telescopic whip fits easily into a pocket. Each antenna also includes a counterpoise wire. Additional accessories are also available as below.

**£109.95**

- Bands: 20 - 17 - 15m
- Power: 30W
- Radial: 13ft counterpoise
- Build: Corrosion resistant
- Collapsed: 15cm
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**AXT1** Tripod Adaptor **£29.95**

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**AXE1** 40m Coil

The AXE1 is a 40m add on coil that sits above the base of the AX1 and below the whip. This brings the system up to 4 bands, whilst retaining the pocket size of the system. The coil is 15cm long and because of its high'Q' an ATU is needed. (KXAT2 or KXAT3).

**£62.95**

## The KX2 offers a LOT MORE!

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Mic & paddle key are optional extras

- 12 Watts Out 80m-10m
- Fits into a coat pocket
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## IC-7610

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## 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**

**Other Transceivers**

| | | |
|---|---|---|
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| **IC-R8600** | 10kHz - 3GHz Comms. Receiver | £2489.95 |
| **IC-R30** | Handy All Mode Digital scanner | £569.95 |
| **ID-4100E** | 2m / 70cm D-Star & FM Mobile | £295.95 |

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22m & 70cm

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- Free Downloads
- GPS Receiver
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**Peter Waters G3OJV,** operates the first FT-dx101 to come into the UK.

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# Contents


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**Warners Group Publications plc**
The Maltings
West Street
Bourne
Lincs PE10 9PH
**www.warnersgroup.co.uk**
**Tel 01778 391000**

**Editor**
Don Field G3XTT
**practicalwireless@warnersgroup.co.uk**

**Designer**
Mike Edwards
**mike.edwards@warnersgroup.co.uk**

**Advertisement Manager**
Kristina Green
**01778 392096**
**kristina.green@warnersgroup.co.uk**

**Advertising Production**
Nicola Lock
**nicola.lock@warnersgroup.co.uk**

**Publisher**
Rob McDonnell
**robm@warnersgroup.co.uk**

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**Practical Wireless Subscriptions,**
Warners Group Publications plc
The Maltings, West Street
Bourne, Lincs PE10 9PH
**Tel: 01778 395 161**
**subscriptions@warnersgroup.co.uk**

**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.

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

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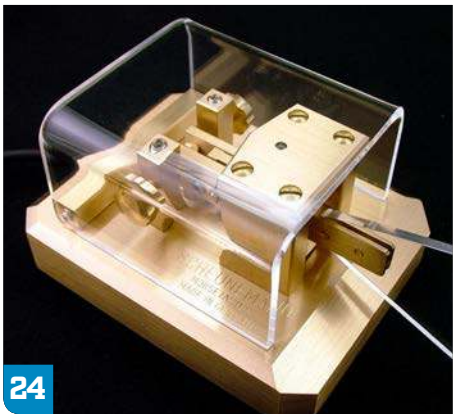


# Keylines





I was amused recently while watching a TV programme about model railways and their history. It turns out there are essentially two types of model railway enthusiast – those who enjoy building and those who get the most satisfaction from operating. Ring any bells? And, funnily enough, one aspect of the operating side that has changed in both hobbies is the use of computers. Most amateur radio stations where operating is the main aspect have the PC linked to the transceiver nowadays. Similarly, the railway modeller will use a PC to control the trains, points and other aspects of the track and signalling. I daresay there are plenty of other hobbies that fall into builders and operators too. Meanwhile, here in *PW*, I will do my best to cater for both aspects.

## The EFHW

One branch of amateur radio where we can all get involved in construction is antennas. All it takes, for the HF bands at least, is a reel of wire, a tape measure and a few ancillaries (string, insulators and the like). So, I am pleased this month to have a couple of features on the end-fed half-wave antenna (EFHW), with a further article to follow next month. It's hard to believe that anything new can be said about antennas when the physics have been known for decades and, seemingly, every possible configuration has been explored. But modern modelling software has introduced new possibilities and the EFHW is a good example of how this has enabled an old design to be given a new lease of life.

## Dip Meters

In this month's *In the Shop* column, **Harry G3LLL** talks about using a dip meter for various jobs around the shack, including setting up antennas. I too had a TE-15 Tradiper for many years (actually, it's still sitting my cupboard) for exactly the reasons that he describes. What has changed, in my shack at least, is that there are now some excellent antenna analysers available, not just showing a resonance (as a dip meter does) but also information on reactance, a swept SWR curve and more. I have a miniVNA, which is great for bench testing of cables, chokes and more. However, my preferred tool 'in the field', is the MFJ-226 that I reviewed some time ago in *PW*. It recently went with me to the Gambia and proved invaluable in setting up **Alan G3XAQ's** 20m Moxon antenna and my various single-band dipoles (resonances were not exactly as calculated because of all the rebar and other metalwork in the building) as well as cutting a quarter-wave stub for the 20m band (you cannot simply assume the published figures for velocity factor of coax because batches vary slightly). But, as Harry says, a dip meter can still be a useful tool for making quick measurements on antennas and unpowered resonant circuits.

## 70MHz Contest Results

Our long-time contest manager **Colin G6MXL** has the 70MHz Contest results for you in this issue. It's clear that the atrocious weather put off many potential entrants but, nevertheless, it is disappointing to see entries well down given that so many new rigs have the 70MHz band fitted as standard. You don't have to go out and about – we are happy to receive entries from non-portable stations. But if you feel the contest could be 'tweaked' in some way to encourage you to participate, then do please drop Colin a line. More participants means more fun! Meanwhile, I'd like to add my own congratulations to all who took part and endured the downpours!

**Don Field**
Editor, *Practical Wireless* Magazine

Enter our competitions at www.radioenthusiast.co.uk/competitions

# Newsdesk

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

## New from Moonraker

PRACTICAL WIRELESS BREAKING NEWS

Moonraker have introduced the SenHaix 8800 Bluetooth programmable dual-band handheld radio. This is the first dual-band handheld radio to allow programming from a phone by Bluetooth. The price of the SenHaix 8800 is £64.99.

In what they say is another first, the Vero Telecom VGC VR-N7500 is a brand new 50W VHF/40W UHF Headless transceiver with a solid build quality. It is very different in design compared to any other radio used mobile or base.

The VR-N7500 uses a smartphone as a control panel. The body is installed in the car boot, the mobile phone is connected to the body through Bluetooth, and the automatic horizontal screen state is fully intelligently connected.

Car hands-free intercom can be utilised through the vehicle Bluetooth and PTT is by the supplied Bluetooth PTT. The prices is £169.99. Full details of both can be found at: www.moonraker.eu



# Radio News

**2018 PROPAGATION VISUALISED ON 11 BANDS:** Jari Perkiomaki OH6BG says, "I am happy to announce a new service that offers 18,000+ propagation charts for you to explore how signals propagated between two user-selected ITU zones in 2018. The raw spot dataset was received from HamSci, including approximately eight billion FT8 spots that were collected from sources such as PSK Reporter during the entire year of 2018. There are data from 6m to 160m. The heavy-lifting, i.e. data processing (incl. pre-processing such as data validation) and data visualisation for the charts, has been done by Alex Shovkoplyas VE3NEA". https://voacap.com/visualprop

The charts show the scaled number of spots in different colours over the 24-hour period over the 12 months. Also plotted on the charts are the sunrise and sunset timelines, calculated for 'the centre of mass' of the callsigns in each ITU zone. This will make it easier, for example, to distinguish enhanced periods of propagation on low bands at sunrise/sunset, something which VOACAP is heavily underpredicting. Furthermore, on the top part of the charts, you will see the development of the planetary A index (Ap) over the year of 2018 and how increased Ap indices will affect propagation – higher Ap indices are not always a sign of decreased conditions!

It is hoped this unique set of charts will give the amateur radio community all over the world new and surprising insights into HF propagation. If you have questions, please write to pe@voacap.com

**ORLANDO HAMCATION RETURNING FOR 74TH YEAR IN 2020 :** The Orlando Amateur Radio Club is hosting the 74th Annual Orlando HamCation February 7th-9th 2020 at the Central Florida Fairgrounds and Expo Park. HamCation is the second-largest ham radio convention in the United States, with the inaugural event dating back to 1946. Since the first event, HamCation has continued to grow in size. The 2019 convention saw 23,700 attendees, a record for the event.

The HamCation website has undergone several updates for this year, with more easy-to-use features and ticket purchasing system. Those who want to attend can purchase tickets, SWAP tables, tailgate spaces and make RV reservations online. The user-friendly site also provides more information on HamCation activities, vendors and hotel partnership discounts.


# New Radio Station for Newbury

Amateur radio station GB4GCT was formally announced 'On the Air' at Greenham Control Tower recently by Dave Wilson M0OBW, RSGB President, and Deputy Mayor Cllr Billy Drummond.

Describing the new station to the assembled party, Jeremy Willis G4DOQ, Chairman of the Newbury And District Amateur Radio Society (NADARS) explained that the project will allow its members to use the latest technology to transmit Voice, Morse code and Data modes around the world on the HF bands. Included in the station will be a satellite terminal to receive and transmit through the QO-100 geostationary satellite and a DR1XE UHF Fusion repeater station donated by Yaesu UK. Jeremy said, "NADARS has been looking for a location to set up a permanent station for some time and the location of Greenham Control Tower exactly fits our criteria. The site was built to house radio and having a cafe on the same floor is a real bonus. We are very grateful to Greenham Parish Council and Greenham Control Tower Limited for their help and support in allowing the project to materialise. We hope to have the station open to the general public, operating on some Saturdays during each month".

NADARS have equipped the station with a Flex-6500 and Maestro and the members will be building the satellite transmitter as a club project. The UHF Fusion repeater will be accommodated in the radio room and is expected to be issued the callsign GB7NT by Ofcom.

Planning permission had to be gained to erect suitable poles on the roof of the building and an inverted-V 80m doublet is in situ along with an 80cm satellite dish and VHF/UHF collinear antenna.

David Wilson thanked the NADARS committee for the invitation to attend the formal opening of the station and congratulated them on the foresight and level of technology that the station had been equipped with.

Details about NADARS and when the station will be operational are available at: www.nadars.org.uk

The photo, courtesy of Newbury Weekly News, shows Michael Samson G0POT, Richard Jolliffe G3ZGC, Cllr Billy Drummond, Dave Wilson M0OBW, Phill Morris G6EES and Neil Hutton M0NJH. Seated is Jeremy Willis G4DOQ

# Radio News


**ML&S HOG ROAST:** The annual ML&S pre-Christmas Open Day and Hog Roast, co-sponsored by Icom UK and JVC-Kenwood, was well attended as usual. A number of vendors were in attendance (the photo shows Graham Somerville of PW advertiser bhi demonstrating some of his products), while CDXC (the UK DX Foundation) had a stand. PW was represented by publisher Rob McDonnell. As always, Martin Lynch himself was there and enjoying meeting so many of his customers.


**THE WORKED ALL COUNTIES OF THE UK IS A NEW PROGRAM:** Noting the Most Wanted DX Plaques program http://dxwanted.net

Charles M0OXO says there will be plaques available for Worked All Counties of England, Ireland, Scotland, Wales and all territories of the United Kingdom. More information at the website below with further details to be released soon. https://tinyurl.com/sb52t65

# New from Nevada

PRACTICAL WIRELESS BREAKING NEWS


Nevada Radio have announced the release the Alinco DJ-VX50HE Dual-Band Handheld. This is a low cost, but high specification, rugged transceiver, meeting IP67 Dust and waterproof standards. It features a three-colour selectable display, with keypad entry and semi-duplex dual-band operation. The receiver section also covers VHF Airband and FM Broadcast bands. The radio gives 5W (VHF) and 4W (UHF) output using a high-power Li-Ion battery, with charging stand and belt clip included. Features include, Internal Vox, 200 memories and Auto repeater shift. Priced at £89.95, Nevada believe it will prove popular.

Nevada Radio have also announced a new 'SUPER YAGI' from DUAL antennas of Serbia, for the 144MHz and 432MHz bands. This is a competition grade, low noise, EME-capable antenna, that behaves as two separate, extreme gain, monoband antennas. It has 12 elements on 144MHz, with gain of 15.6dBi, and 25 elements on 432MHz, with gain of 18.4dBi. Boom length is 6.7m with each band having its own feedpoint and balun. The antenna sells for £289.95 and available from Nevada Radio and Waters & Stanton.

www.nevadaradio.co.uk
www.hamradiostore.co.uk

# TX Factor milestone celebrations

The TX Factor team celebrate an important milestone with the release of episode 25. In this episode Bob G0FGX gets the lowdown on the new Elecraft K4 Transceiver from Elecraft founder, Eric Swartz WA6HHQ.

Mike G1IAR tackles the subject that Brits like discussing the most, the weather! He finds out about WQ Weather Radar by Weatherquest, the company founded by TV meteorologist Jim Bacon G3YLA.

With recent severe weather events around the world we are reminded of how easily our 21st century communications infrastructure could be taken offline. There are also many other possible threats to the power grid, the internet and mobile networks that could pose a problem for emergency communications using repeaters that rely on those technologies. Mike and Bob met a team of radio amateurs who are working with their local emergency planning officer to make their repeaters resilient by using point-to-point RF links using off-the-shelf kit. They demonstrate how easily other repeater groups could adopt the same ideas.

DMR is now widely used but one downside is the dreaded codeplug! The RFinder B1 offers a world without codeplugs or repeater lists and Bob talks to the guys that designed it.

TX Factor is sponsored by ML&S and the RSGB. Episode 25 is viewable in HD on all devices from smartphones to smart TVs and is available at:

www.txfactor.co.uk

# Radio News

**LATEST ICOM SDR RADIOS SUPPLIED TO RSGB NATIONAL RADIO CENTRE:** If you have recently visited the Radio Society of Great Britain's National Radio Centre (NRC) at Bletchley Park you will have noticed two new radio additions. Icom has provided the IC-7300 and IC-9700 SDR transceivers to the Centre to allow it to promote amateur radio with the latest cutting edge Icom radio technology.

The NRC, which opened in 2012, has a primary goal to promote amateur radio as an integrated technical hobby and encourage people to become radio amateurs. Its other remit is to help increase awareness of the hobby so that (for example) neighbours might be more informed when a planning application or EMC issue arises. On a broader level, the Centre plans to demonstrate that amateur radio can be part of a wider STEM (Science, Technology, Engineering and Maths) application and that a career in engineering (particularly radio communication engineering) is very worthwhile.

The NRC has been immensely successful. In 2017 it welcomed 23,000 visitors and this increased in 2018 to more than 55,000 visitors. By September of 2019, the Centre had given just over 80,000 visitors the opportunity to see amateur radio in action.

Icom UK has supplied two of its latest SDR radios to the Centre in addition to the GB7BP D-STAR repeater that is situated on site. The IC-7300 is being used (with transmit disabled) for visitors to tune around the amateur bands, giving practical hands-on experience of using a high-grade modern SDR transceiver. The IC-9700 is the NRC's flagship VHF/UHF transceiver for 2m/70cm operation, running CW/SSB/FM simplex and D-STAR digital amateur radio.

Martyn Baker G0GMB, RSGB National Radio Centre Coordinator, said, "Both the RSGB, and in particular the NRC, are most appreciative of both the IC-7300 and IC-9700, as, without them, it would be much harder to inspire visitors and potentially recruit new interest in amateur radio".

www.rsgb.org/nrc
https://icomuk.co.uk

**Michael Jones GW7BBY**
michael@internalfire.org

# Making Professional Front Panel Artwork

**Michael Jones GW7BBY** explains his methods for achieving a high-quality finish on equipment front panels.

There is tremendous satisfaction in building a piece of equipment, but it is often difficult to complete the project with a professional looking front panel with lettering and graphics. Unless you are exceptionally neat, hand-produced panels are rarely satisfactory, rub down lettering, such as Letraset with perhaps a clear lacquer to resist wear can work for lettering, but doesn't provide a range of other graphics (See **Figs 1** & **2**). I have seen on the internet methods using waterslide transfers. The panel artwork is printed onto special transfer paper and then applied to the panel. It seems fine for individual controls but will leave an edge where the transparent transfer ends. It would be tricky to use transfers to apply to a complete, large, panel. Even if successful, the transfer will need a clear coating, as with Letraset, to guard against wear.

## An Alternative

The method I shall describe here overcomes all of these issues and provides an accurate template for drilling thus ensuring that the graphics and panel drillings are in perfect alignment. As with any project that is worth doing, certain equipment will be needed and a methodical approach to implementation. First of all, you will need a graphics package on your computer. This could be a desktop publishing package, a drawing or CAD package. Suitable packages supplied as standard with Windows include Microsoft Paint. In addition, there are many other available on the internet, either free or for a modest charge. You will need a printer, preferably colour, paper (standard cheap paper is very good); a laminator and laminating pouches and a digital camera. You will also need a range of usual workshop and office tools such as a sharp knife, measuring tools – a good ruler at least while a digital vernier is better – drills and suchlike that you would need for any panel production.

## Examples

We'll take a look at two projects, the first is a two-tone tester. It has a fairly small front panel (203 x 73mm). It requires mainly round holes, but also three rectangular apertures for rocker switches: Power, Tone 1 and Tone 2.

I usually start with a freehand sketch to fix in my mind what controls are required and where I would like them placed on the final panel. Actually, placing the controls on the physical panel helps to get a feel for their final positions, **Fig. 3.**

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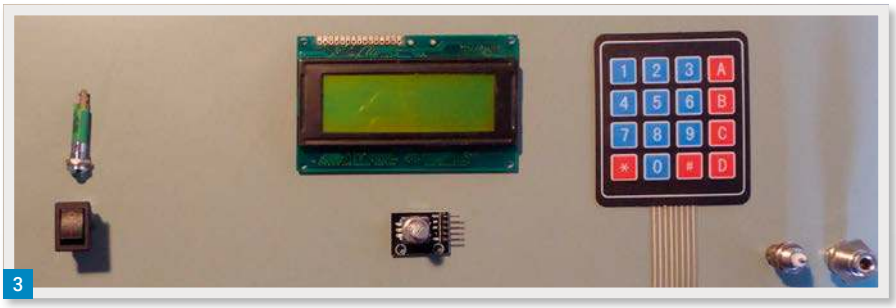
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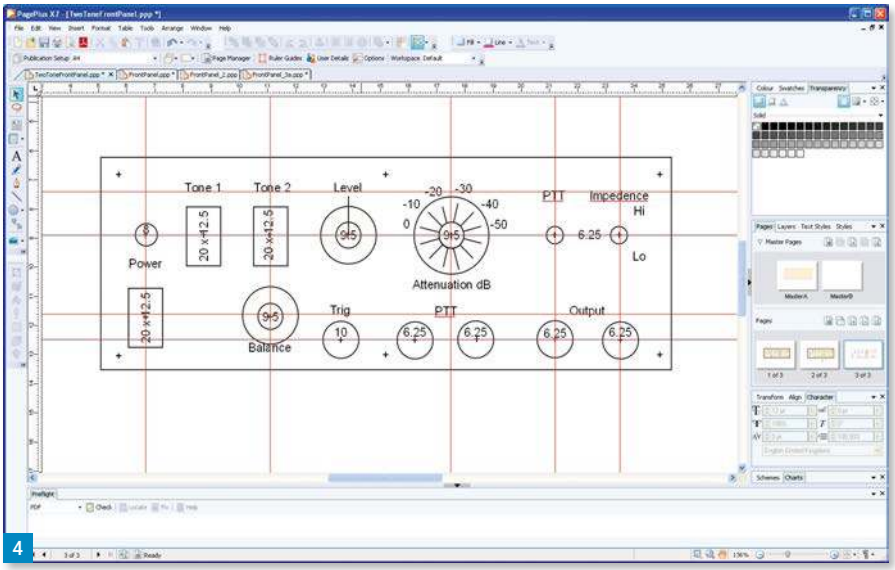
I then re-draw the freehand sketch full size on my desktop publisher. You may choose to bypass the freehand sketch – that's up to you. Start with a rectangle the exact size of your front panel, in this case 203 x 73mm.

Measure the fixing hole diameters for your controls. Also measure the size and shape of the control body so that you know how much space is required behind the panel. Create the control in the desktop publisher/CAD package to include the body of the component and place it on your drawing. After a while you will accumulate a library of frequently used controls so that you don't have to generate them for every project.

When you've placed all your controls approximately where you want them, use guidelines, if available in your package, or use temporary straight lines to make sure that your controls are laid out neatly, **Fig. 4**. Guidelines ensure that a) the image is square to the outline of the panel and b) controls are positioned symmetrically. The '+' in the middle of the control circles marks the centre for the drill holes, the solid circle, which will be deleted later, shows the outline of the body of the control to ensure that when finally assembled the components do not foul.

Print a draft copy on plain paper. This will be your drilling and cutting template. Cut it out and stick to your panel. Use double-sided tape, contact adhesive or whatever you prefer, **Fig 5**.

You should then centre punch all the crosses where holes are to be drilled. I usually drill all the centre-punched holes fairly small to start with, say 2.5 to 3mm,



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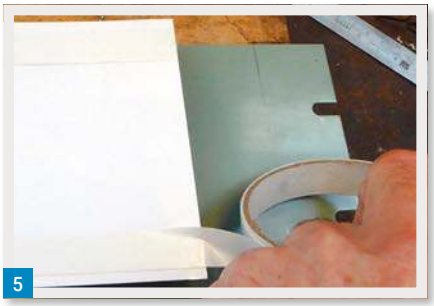
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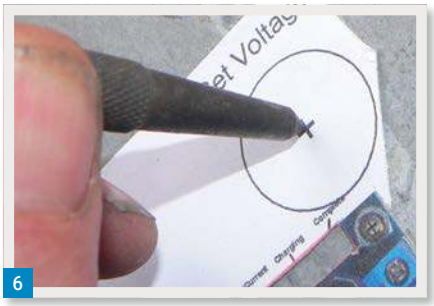
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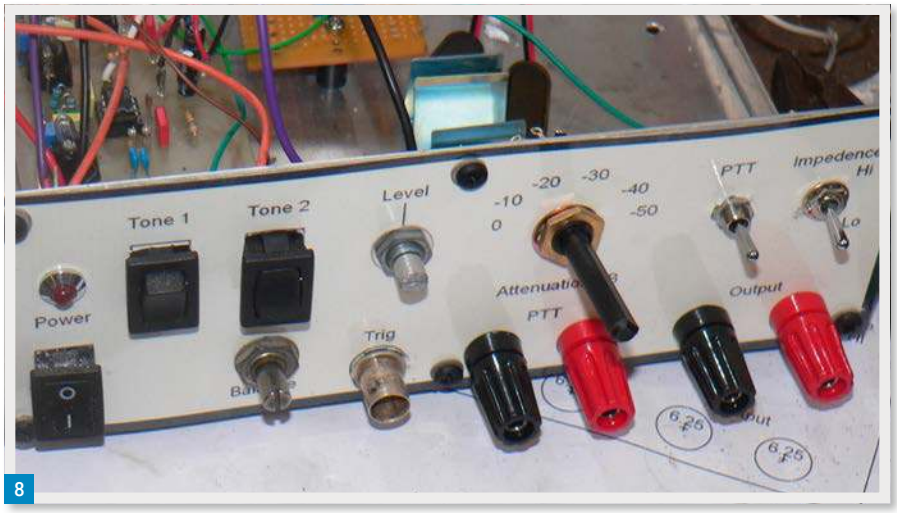

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and then open them out to the final size, **Figs 6** & **7**. Once you have the final size, just 'touch' the hole with a much larger drill or a countersink to deburr the hole.

When all the holes and apertures are finished do a trial fitting, **Fig. 8**. Adjust the holes if necessary, and once you are satisfied with the fit, remove the paper template and clean up the metal face.

## Final Artwork

For your final artwork, make a copy of your draft 'cutting' template and save it in case you want to make another. On the original, delete anything you don't want to appear on your final artwork; all your markings out, and guide lines. Double check all spelling. There is nothing worse than a brilliant panel except that every time you look at it, there is a glaring spelling mistake!

I usually add a colour wash to the background. It doesn't look as stark as a plain white background and, in my opinion, enhances the appearance.

A border helps to give a professional finish and tidy up the edges, such as the display on my Signal Generator, **Fig. 9**. A border or outline can be used to good effect to group related controls together such as power, audio and RF.

You now need to make a good quality print of your final artwork and pass it through your laminator, **Fig. 10**. You might have to experiment with different papers. I originally thought that high quality printer setting on glossy paper would be best. However, I found that bubbles formed as the paper was fed through the laminator, spoiling the finish. I suspect that the surface of the paper was lifting when heated. Paper from other manufacturers might behave better, also perhaps a lower laminator temperature might help. In the end I found that ordinary copier paper gives

**Fig. 1: Leteraset followed by a clear finish. This was done in about 1982 and it took a long time, with more than one complete sanding off and restarting! It's stood the test of time quite well but I had 30 years off the air so the radio did not see continuous use. Fig. 2: The front panel of this replica IFF (Identification Friend or Foe) unit was done by hand with a white paint marker. It properly represents the early units and is fine as a museum exhibit but I'm not sure that the lettering would withstand a lot of handling. Fig. 3: Components laid out on panel. Fig. 4: Screenshot showing use of guidelines to ensure layout is square to panel and symmetrical. Fig. 5: Use double-sided tape or other adhesive to fix temporary template to panel prior to drilling. Fig. 6: Centre punch all hole centres to ensure accurate drilling and prevent drill from skating over the panel. (N.B. pictures are from different projects, hence the lack of continuity!) Fig. 7: Drill carefully. Fig. 8: Trial fit all front panel components.**

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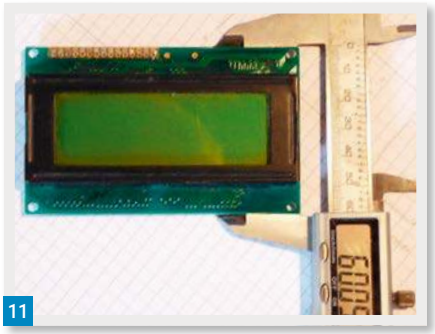
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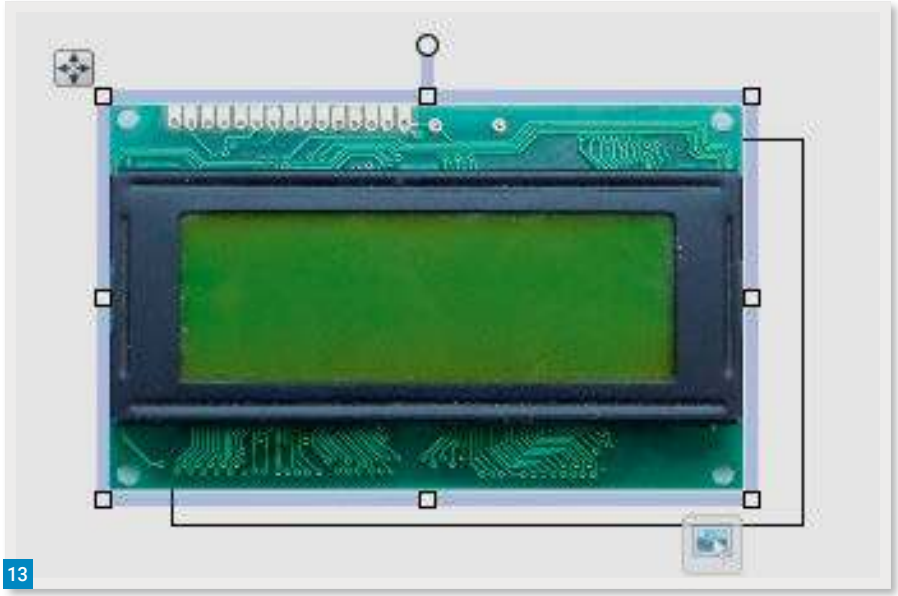
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perfectly good results. Once it is laminated the gloss finish leads to a very acceptable appearance. Incidentally, I use an inkjet printer.

## Another Project

The second project is a signal generator, of which more in a future issue of *PW*. Most controls are similar to those on the two-tone tester described above. The main differences are the size and the LCD display.

Start by taking pictures of all the components to be placed on the front panel. Take pictures as 'Square on' as possible to avoid distortion due to perspective.

The display module, **Fig. 11**, requires 4 x M3 fixing holes and a cut-out for the screen. I don't need to know the size of the screen or the positions of the fixings because all will be relative to the overall dimensions of the module. Measure the outer dimensions of the module. It works out as 60 x 98mm.

1. In your Drawing package draw a rectangle to the size you have just measured, in this case: 60 x 98mm.
2. Import the picture you have taken of the module, **Fig. 12**.

**Fig. 9: Use borders to tidy edges and give a professional finish. Fig. 10: Laminate final artwork. Fig. 11: Measure modules. Digital verniers are cheap and more than accurate enough for this work. Fig. 12: Rectangle drawn to measure dimensions of module, and module imported to desktop publisher. Fig. 13: Adjust size of module in desktop publisher to exactly match the rectangle you have just drawn. Fig. 14: Mark mounting hole with a '+' or 'X'. Draw a red rectangle to show cutting size for display aperture.**

**Fig. 15: Signal generator artwork split into two to fit on two A4 sheets; they join at the 'central' border. If any white shows, just run down the join with a black marking pen. In this case most of the joint is underneath the keypad. Fig. 16: Drill large hole for hacksaw blade. Fig. 17: Cutting out display aperture – in this case with Abra-File. Fig 18: Bracket needed for this motor. It would take a while to mark out and drill accurately. Fig. 19: Motor and bracket now in place. Fig. 20: Laminated panel for drill charger showing transparent window.**


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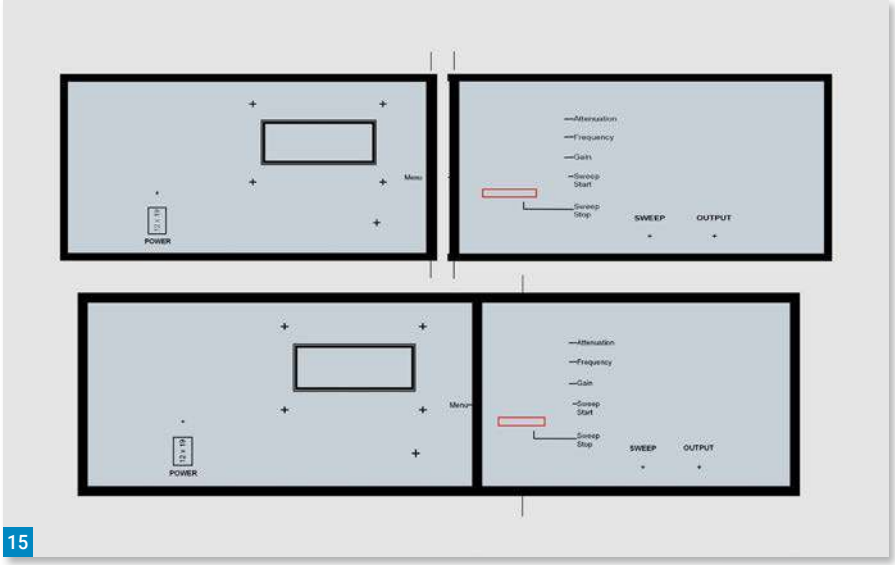

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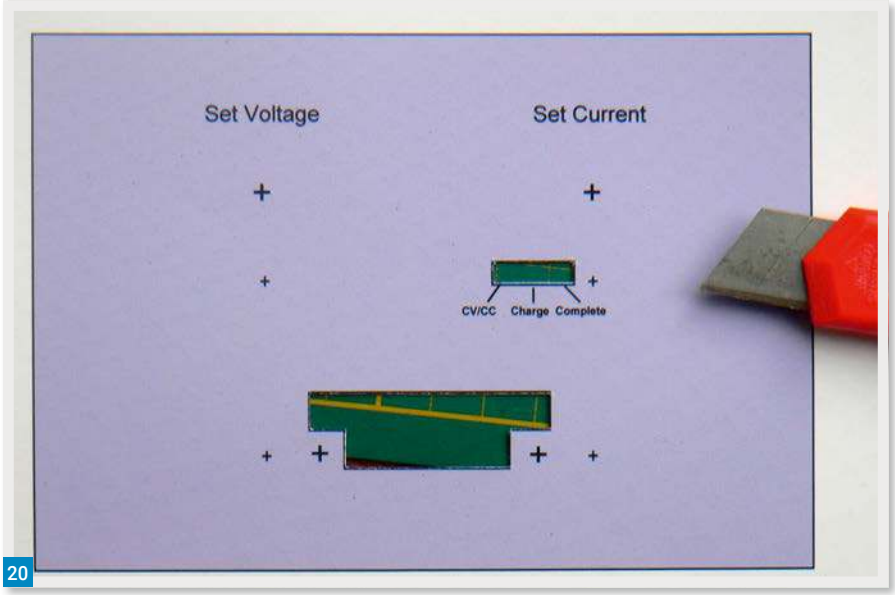

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3. Now superimpose the picture over the rectangle and adjust the size of the module picture until it fits exactly to the rectangle you have drawn, **Fig. 13**. Your image of the display module is now exactly the right size and all the salient features are in their correct positions.
4. Mark out the holes with a large 'X' or '+', using a colour to make sure your markings stand out. Then draw a rectangle to outline the display area, **Fig. 14**.
5. You will now need to 'lock' all the elements, picture, hole positions and display aperture, to ensure they don't move when you cut and paste the completed image. In PagePlus, for example, you select the individual elements and the program locks them together. Other packages may group the elements or convert them to an object or a new picture.

You can now paste the image where you want it to appear on your front panel. Repeat the process for your other components until you have placed all your components.

Make a big hole in the middle of the aperture to allow you to get a saw cut started, **Fig. 15**. I won't tell you how to cut out the aperture because you will use whatever tools and skills you have to achieve the desired result. In the picture, **Fig. 16**, I am using an abra-file. This fits in a hacksaw frame in place of the normal blade and can be used to cut out intricate shapes. You can use a normal hacksaw blade, a nibbler, air shear, jig-saw or whatever you prefer.

The only thing I will say is to initially cut a bit on the small side and then open the aperture out with a file to get the exact dimensions. Having got the required size, run a fine file around the hole at an angle of about 45° – 60° to deburr the edges. The main proviso is to be careful and methodical. Don't rush and you will get a nice neat finish.

The front panel for this project is for a standard 19in rack so will not fit on a single sheet of A4 paper (8.27 x 11.69in), nor will it fit on A3 (16.53in long). I tried printing as big as possible on A3 with a border to make the edges look better but it wasn't really right. In the end I decided to print the artwork in two halves with a border where the two halves join, **Fig. 17**.

## Motor Template

This method can be used to produce disposable templates for complex shapes such as the motor in **Fig. 18**. You will see that the drive shaft is off centre and there are 6 x M3 fixing holes. Now you could measure all this up or get the dimensions from the manufacturer's website, if possible, and then mark out your metalwork accordingly. I don't know about you but I find that no matter how carefully I measure, an error creeps in somewhere and I end up having to file out one or two holes to get everything to line up properly.

What you need to do is take a picture as square-on to the fixing face as possible. Measure the outside diameter as accurately as you can: a vernier calliper is ideal but you can get by with a ruler.

Using your drawing package produce a circle to the diameter you have just measured. Import your picture. It is not essential to crop the background out but it does make it a bit easier. Place your picture over the circle you have just drawn and adjust the size of your picture to exactly fit the outline of the circle. Put a '+' or an 'X' at the centre of the fixing holes and the centre of the output shaft and you're done, **Fig. 19**!

Print out the template, use glue or double-sided tape to stick it to your metalwork and you're ready to centre punch and drill.

## Display Window

Display windows can be created by cutting out the required window in your artwork, **Fig. 20**. Then when the artwork is laminated a clear window will be left. The effect is not perfect, but adequate for items such as the workshop drill charger shown here.

## Taking Photographs

Just a quick word about pictures. I have stipulated that pictures should be taken 'square on' This is to avoid distortion due to perspective. Some photo-editing packages can correct perspective. Even so, it's better to start with as accurate an image as possible. Also, it is better to take the pictures at a reasonable distance, say 1 to 1.5m (3 to 4ft) and zoom onto the subject rather than move the camera closer. This will avoid wide angle lens distortion where straight lines converge inwards. This is more difficult to correct. If you have one, a tripod can help to get accurate images but it's not really necessary with a modern digital camera.

Now you can enjoy gazing upon your completed works with pride. Of course, you may also create graphics for your rear panel as well!

# Radio Round-up

## FUNcube-1 Celebrates 6th Birthday

(from ICQ Podcast website) Thursday November 21st 2019 saw the sixth birthday of the launch of the amateur radio CubeSat, FUNcube-1 (AO73)

A very short time after the launch from Yasny in Russia and within a few minutes from deployment, the very first frame of data from the low power transmitter on board was detected and decoded by ZS1LS in South Africa. He was able to relay the data over the internet from his Dashboard to the Data Warehouse and the numbers, appeared, as if by magic, at the launch party being held at the RSGB National Radio Centre at Bletchley Park.

After a very brief check-out, the FUNcube team were able to switch the transmitter to full power and were quite amazed at the strength of the signal from the 300mW transmitter on 145.93 MHz. The transponder was then switched on and successfully tested.

The team finished the day with a request to AMSAT-NA for an Oscar number and were delighted to receive the AO73 Oscar 73 designation!

Since then, FUNcube-1, with a launch mass of less than 1kg, has operated continuously with only a very few interruptions. In excess of 32000 orbits, 750 million miles travelled, and with more than seven million data packets downloaded and stored in the Data Warehouse.

## Happy Birthday, GB3BS

(from RSGB website) Repeater GB3BS is celebrating its 10th year at the Lansdown site, IO81TK.

After more than 30 years of continuous operation at Cossham Hospital, it was moved on December 19th 2009 to make way for a multi-million-pound refurbishment of the Grade 2 listed hospital building that had been its home for so long.

GB3BS is also celebrating its 43rd year of operation serving Bristol and surrounding area.

The GB3BS repeater group believe it was either the second or third UHF repeater to be licensed in the UK, so happy birthday GB3BS!

## RSGB Spectrum Forum

The annual RSGB Spectrum Forum was held on November 30th, with representatives from a number of RSGB committees but also from independent national clubs. The various reports can be found at:
www.rsgb.org/sfmeeting2019

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# TOP TITLES


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## World Radio TV Handbook 2020

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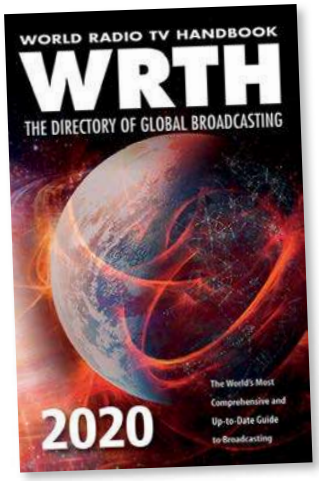
Now on sale! The 74th edition of the World Radio TV Handbook, on sale 5 December 2019. The World Radio TV Handbook is the world's most comprehensive and up-to-date guide to broadcasting on LW, MW, SW and FM, with details on national TV. It is an extensive guide full of information on national and international broadcasts and broadcasters, clandestine and other target broadcasters, MW and SW frequency listings, Terrestrial TV by country as well as a detailed reference section.

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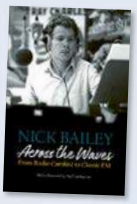
## Across the Waves

This autobiography gives a an count of Nick Bailey's life with Radio Caroline, other radio stations and finally with Classic FM. Reviewed in September's RadioUser, this is "an extremely entertaining and very readable book..."

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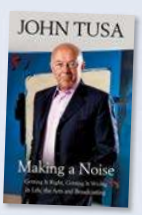
## Making a Noise

John Tusa looks back over a long and varied career in radio, television and the arts. In this autobiography, Etched with candour, this is an entertaining memoir of Tusa's life.

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## Hart Reviews

For 35 years Peter has been writing amateur radio equipment reviews for the RSGB's journal RadCom. These reviews are real world testing of performance and analytical reporting of how amateur radio antennas, radios, amplifiers, etc. really work.


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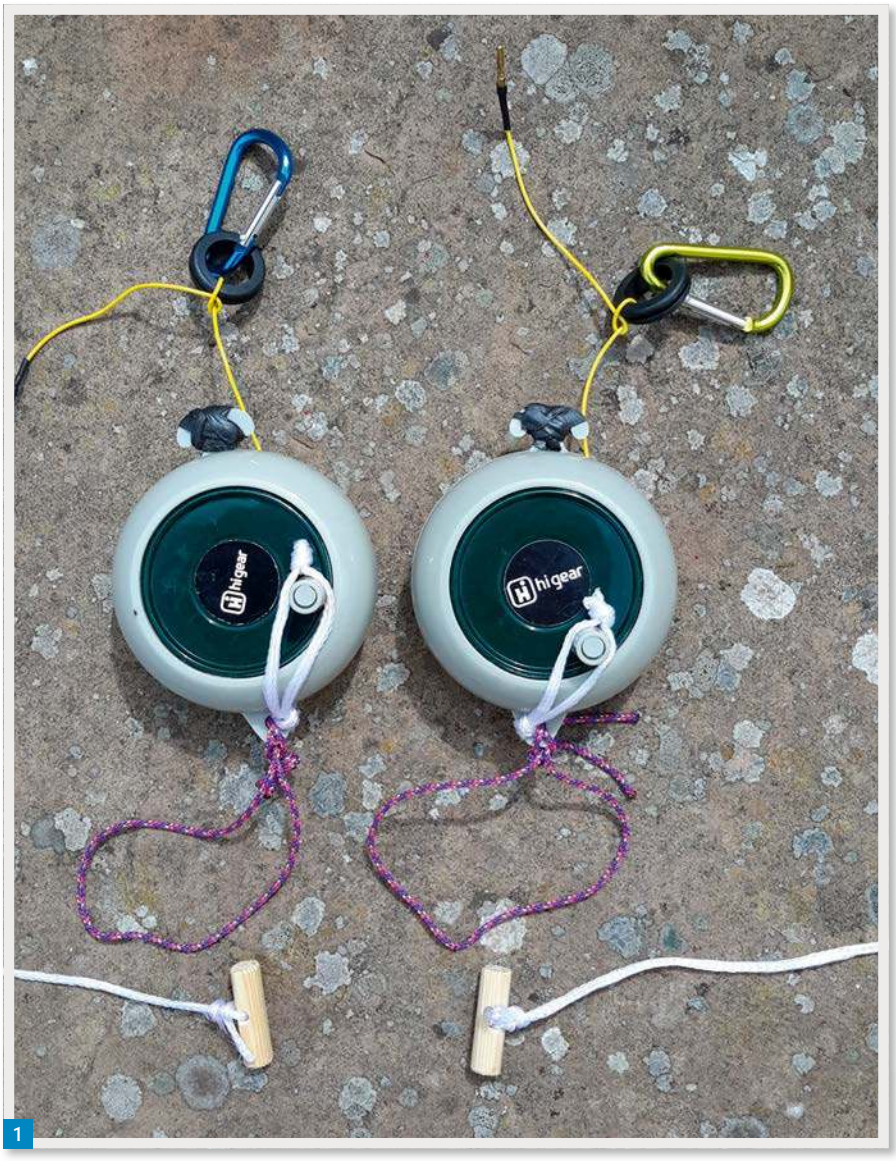
# An HF Multiband Portable Antenna

**Ron Taylor G4GXO**
ron.g4gxo@gmail.com

**Ron Taylor G4GXO** describes a multiband antenna suitable for lightweight portable operations.



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With the availability of compact low power HF transceivers, portable operation has become increasingly popular in recent years. One of the key considerations influencing choice of equipment and operating location is weight. In this respect 'lighter is better', allowing the operator to reach remote locations while carrying a portable station in addition to essential survival equipment. The type of antenna is also an important consideration. Verticals offer low-angle radiation and only require a single support but are dependent upon a good ground plane to be effective (which needs to be laid out and packed away afterwards). In contrast, a balanced antenna, such as a dipole rigged as an inverted-V, has a higher radiation angle, still only needs a single support but is free of radials. And then there is the question of tuning. Restricting operation to a single band may be one way of reducing weight and complexity, but which band? What if conditions turn out to be poor on that band?

How about a radial-free, portable antenna that can be optimised on each band from 80m to 10m? While not claiming to be the last word in ultra-light equipment, the design presented here offers fully agile tuning across HF, omni-directional coverage with low angle radiation on the higher bands, a 'go anywhere' antenna.

The antenna I describe was built using parts to hand and is not presented as a concise step-by-step design to be replicated precisely. If you don't have the same materials to hand then don't be afraid to improvise!

## The Military Approach

The concept is simple and will be familiar to military radio operators where adjustable length dipoles have been used for years. In fact, it was at a recent radio club BBQ where **Michael G0TNF** demonstrated this technique with his Clansman mast and PRC320 (it took me back many years to my 'Q' course at Blandford...sigh). Seeing how easy it was to change bands I wondered about building a lighter, more portable version of the Clansman antenna using a 7m fibreglass fishing pole bought from a Decathlon store. Instead of adjustable elements made from heavy duty antenna wire on cable formers, I envisaged using plastic reels, perhaps of the type that carry fishing line. There is nothing new under the sun (allegedly) and it was on a friend's website that I spotted the perfect solution. **Martin G8JNJ** describes using small plastic reels with winders sold as camping washing lines to carry wire for a portable antenna (Link below, thanks Martin!). At my local camping superstore they had a shelf full of these (funny, when I used to camp I never had the need for a washing line, hmmm...). https://tinyurl.com/tf2r9em

## Putting it all together

The reels are available under various brand names but in the UK the most common seems to be Gelert. As supplied, they have several metres of white nylon washing line wound onto them. While this can be repurposed as guy line, it is prone to tangle and is best discarded. Use nylon

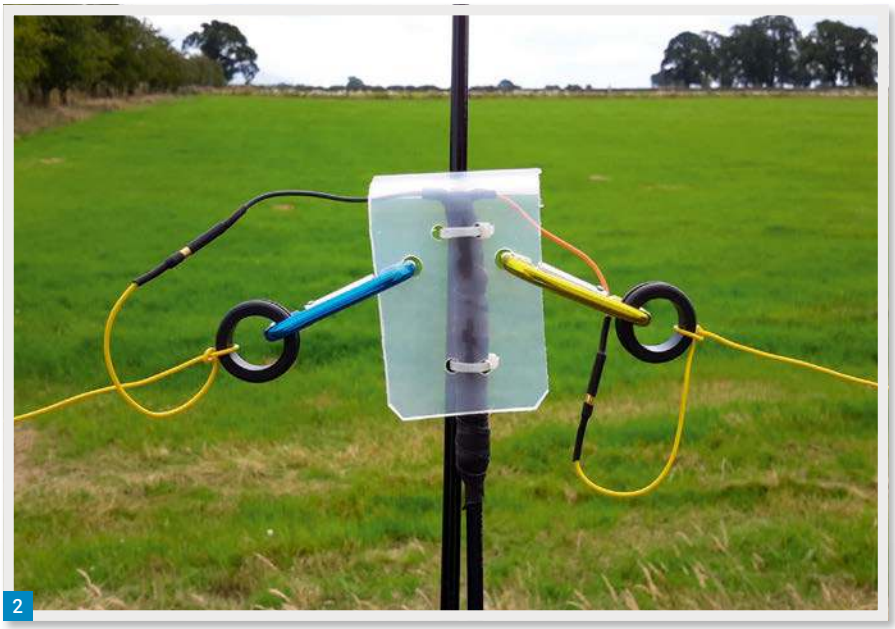

**Fig. 1: Antenna reels detail. Note the locking and guy loops, grommets, snap links and guy toggles. Fig. 2: Dipole centrepiece with elements connected. Fig. 3: The complete antenna showing (L to R) feeder and centrepiece, reels with guys and pegs, three mast guys with pegs and bottom the pole with length marker.**

'parachute' cord or similar for the guys. This is usually available from DIY and camping stores sold as nylon cord and is well behaved. The reels are opened by unscrewing the two shells, which part to reveal the plastic reel capable of carrying a little over 30m of 7 x 0.2mm PVC-coated wire.

A 100m reel of yellow 7 x 0.2mm PVC wire will cost around £11. If money is no object, try to use a PTFE insulated wire at around double the price. The PTFE sheath is more durable than PVC and 'slippery', reducing the risk of cable tangles.

Each dipole end is tied around a cable grommet for strain relief, **Fig. 1** (a bit of shock cord would do just as well if not better). A small alloy snap link (camping store again) is used to secure the grommet to the dipole centrepiece. Each element is terminated in a 2mm bullet plug designed for use as motor connectors in electric models. These are found in abundance on eBay and are usually supplied as plug/socket pairs in quantities of ten complete with heatshrink sleeving. The bullet sockets are soldered to short wires attached to the coaxial cable centre and screen and the joint is covered with something suitable such as Hellerman sleeving, heatshrink sleeving or self-amalgamating tape.

The dipole centrepiece **Fig. 2** is cut from an old polythene sandwich box, which gives a nice 90° 'L' piece measuring about 60mm high, 40mm deep and 50mm wide. The short side of the L is drilled in the centre to fit over the mast top section (I used 4mm for my Decathlon 7m pole). A 9.5mm OD rubber grommet is passed over the end of the pole's top section (which is too fragile to carry any load) and pushed down, stopping just above the next section. The hole in the centre mount short side rests against this. The long side is drilled to carry a pair of cable ties that support the coax. Be sure to provide plenty of 'packing' in the form of self amalgamating tape around the coax to provide a grip for the ties and, importantly, to prevent the coax from being crushed. Although not tried, a lightweight balun could also be fitted to the centrepiece.

A small loop of cord attached to the lug on each reel is adjusted such that it can pass tightly over the reel winder to stop it turning. This is the brake mechanism.

A second longer loop made from about 20cm of cord, is passed through the lugs to make an attachment point for the guy lines. The two guy lines are terminated in toggles made from 6mm dowel. These fasten through the larger loops on the reels and the ends are secured into the ground with tent pegs.

A second set of three guys is used to form 120° guying for the pole. For the pole end of each guy line, I made an adjustable loop with a running knot (Double Overhand Sliding Loop). To prevent the knot closing when the loop was not around a mast, I added an Alpine Butterfly to serve as a stopper, which also gave a convenient loop to pull the sliding loop open. (A Google of both these knots will show you how to tie these and many more besides). The adjustable loop is twisted and folded over on itself to make a double loop and then passed over the pole to the joint of the second and third sections. When the guy line is pulled tight the loop tightens around the pole and will stay put at a section joint.

## Rigging and Raising

The antenna is best assembled while laid flat on the ground. Fully extend the pole and attach the three pole guys before sliding the centrepiece over the top section to sit flush onto the grommet. Unreel the elements and attach them to the centrepiece, plugging in the bullet connectors. I marked a 1m point on the base section of my 7m pole, **Fig. 3**, which is used as a rough measure to unwind the length of one of the elements for a given band. The second element is wound out to match. The reels are then locked off. Run the coax and elements over the guy lines to the base of the pole.

To raise the pole, peg out two of pole guys and tighten their loops around the top of the second section. Pull the loops tight to jam against the joint and while holding the element wires and coax against the pole, prop it against the two pegged guys at about 45°. Peg out the third guy and

**Fig. 4 Portable testing of prototype at Port William, Dumfries and Galloway.**

raise the pole vertically, adjusting all of the guys to secure it upright. Run out and loosely guy each element taking care not to sideways load the pole too much.

You will be very lucky if you see a low VSWR at this stage. Some adjustment of element length by winding or letting out wire will be necessary. Adjustable tensioners, as used with tent guy lines, will simplify the reel guy adjustment. Alternatively, just move the pegs. Once you have found the right spot, mark the element wire where it meets the reel with an indelible pen for future reference. A Morse code numbering scheme of dots and dashes works well here. Repeat for each band you set the antenna up for.

With single guy line, the reels may sit close to the ground causing some detuning and a higher VSWR. If you have a pair of walking poles these could be used to elevate each reel by rigging the guys as a 'V' secured with two tent pegs and with the apex of the V's (and antenna reel guy loops) attached to the walking pole handles to lift the antenna ends.

To simplify tuning I use a simple VSWR sweeper with sounder that allows me to quickly adjust element length (on this or any other HF antenna) for an entered frequency, in real time. I hope to be able to describe how to build this in a future article.

## Higher Bands

Some of you may have spotted a flaw. With the dipole raised on a 7m pole how do you reach the reels for adjustment on the higher bands? For example, on 10m, each element will be only around 2.5m long, placing the reels out of reach. While you could tune the antenna by repeatedly lowering, adjusting, raising and measuring, the quickest way is to use 'harmonic responses'. A wire dipole not only supports resonance at its half wavelength frequency, it also will support odd multiples. For example, for operation on 21MHz you can set the dipole for around 7MHz and then adjust the legs for lowest VSWR on 21MHz. Instead of a half-wave dipole, it becomes a three half waves dipole. (For the inverted-V you will need to increase the element length slightly over that of the one third frequency). The length at 7MHz places the reels comfortably within reach. The radiation pattern, while still predominantly omni-directional, will show slight nulls broadside on to the antenna. However, with the exception of a minor central vertical 'bump' in the radiation pattern, the radiation angle is lower than a half-wave inverted-V with the main lobes being along the axis of the antenna.

With practice the antenna is quick to put up and pack away and has proved itself so far on 60, 40 and 20m handling up to 100W without any signs of stress.

# Radio Round-up

## History Site

Station builder and propagation guru Frank Donovan has been turning his hand to amateur radio history. He writes, *"I gave a presentation on the history of transoceanic radio communications to the Frankford Radio Club a few days ago."* https://tinyurl.com/tglos5r

*"The presentation covers radio technology development from the Maxwell's mathematical description of electromagnetic waves in 1860-1865, Hertz's development of a crude spark transmitter and spark receiver that proved the existence electromagnetic waves in 1886-1888, Fessenden's heterodyne receiver patent in 1901, Marconi's development of two way transoceanic high power radio spark communications from 1901 through 1907, the development of multi-hundred-kilowatt spark, arc and electron tube transmitters from 1906 through the 1930s, Armstrong's development of regenerative and superheterodyne receivers from 1913-1918, ARRL's very successful one way transatlantic test in 1921 at about 1 MHz, the development of military and commercial HF receiver, transmitter and antenna technology from 1921 through the 1970s, and the development of early operational satellite communications capabilities from before 1960 through the 1970s.*

*My presentation closes with a brief description of recent Armed Forces Day operations on the site of the original NSS station".*

## Dayton 2020

The theme for the 2020 Dayton Hamvention will be Amateur Radio, The Future.

Hamvention General Chair **Jack Gerbs WB8SCT** invited Hamvention attendees to celebrate amateur radio's past, present, and future.

*"As amateur radio operators, we enjoy many modes of operating"*, WB8SCT said. *"We also enjoy challenges such as satellite communications, moonbounce, meteor scatter, and more. What truly excites me about our hobby is the diversity of these modes and the fact that, as we move to the future, we still enjoy the technologies of the past.*

*"The theme acknowledges the role that amateur radio has always played and will continue to play in future communication developments, noting the contributions of the many hams who actively work on new ideas, equipment designs, and software to improve electronic communication".*

Hamvention 2020 takes place May 15th to 17th in Xenia, Ohio. It's many years now since *PW* organised a trip to Dayton but many UK amateurs attend each year and enjoy the heady mix of talks, commercial stands, flea market and social events.
https://hamvention.org

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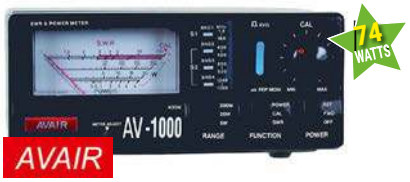


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Antenna Switches

Tuners

Morse Keys

Headphones


Antennas


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Restricted space spoiling your operating fun? MFJ Cobweb puts your call back on the map!

This six-band (20, 17, 15, 12, 10, 6 Meters) full half-wave Cobweb Antenna is perfect for restricted space or portable operation. Sky-gray fiberglass spreaders and nearly invisible wire elements (flat 9x9x1/2 feet square. 8 pounds), blend in with your surroundings while standing tough against nasty weather. Outstanding performance! Horizontally polarized for less local noise pickup plus solid gain over verticals will allow you to work DX easily -- even on QRP. Omni-directional. No radials needed! Works great at low heights. Low SWR is due to MFJ's exclusive Spider-MatchTM broadband network

**MFJ-1836** 300W version.....**£319.95**
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**MFJ-1234 RIGPI BASE JUST £299.95**

# Happy Morsey New Year

**Roger Cooke G3LDI**
roger@g3ldi.co.uk

**Roger Cooke G3LDI** has his bi-monthly roundup of Morse-related news, including a look at non-English Morse characters.

It's probably a bit late for those introductory wishes but as there is no January copy, I use that as my excuse. 2019 was quite a successful year CW-wise. Lots of people complain about lack of activity and moan that CW is dying. Well, if you listened or took part in the CQWW contest, it should have confirmed the very opposite! CW was well into the mixed mode section and above on most bands, and despite being at the bottom of cycle 24, there was a huge amount of DX to be worked. The LF bands, of course, are prominent during sunspot minimum, so 160/80/40m were producing a DX-fest, and lots of band slots were filled. I just wish that my antennas were in good enough condition to take part. Next year, if I am still about!

Bootcamps are gaining in popularity too, which can only be a good thing. At our April one, three people passed the Proficiency Certificate, and the proof of the pudding can be seen in **Fig. 1**.

**Fig. 1: Robert G4TUK, Mui M0MUI and Tony G0OOR showing off their new certificates make it all worthwhile. Fig. 2: Telegram Works Morse key from around 1900. Fig. 3: Scheunemann Dirigent single-paddle key. Fig. 4: Gerald G3MCK.**

## Keys Old and New

Alex GM4TAL sent in a couple of pictures of a really old Morse key he found in a book entitled *Modern Electric Practice* by **Magnus Maclean** and published in the early 1900s. The key has this wording on the side: TELEGRAM WORKS SILVERTOWN LONDON.

The key is a double current model with a send/receive switch next to the Morse key, **Fig. 2**. Dating back a century, it makes you wonder exactly what purpose they were used for.

I came across an advert on the internet for a paddle I had not seen or even heard of before. It is the Scheunemann Morse Dirigent and is a successor to the Profi 2. They are a bit like the Chevron, designed and built by **Kevin Gunstone M0AGA**, excellent engineering and a high-end key. The one I fancy is the Einhebel 3, a single lever paddle, **Fig. 3**.

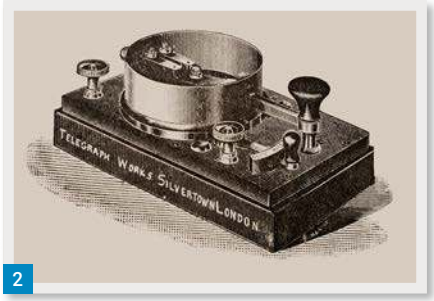
Their adverts claim it could be the very best single-lever paddle in the world. Separate lever tension for left and right movement is a feature, together with large adjustment knobs for contact spacing and spring tension allow precision adjustment. It also comes with a tilt-open dust cover.

No, Santa did not bring me one to try I am sorry to say! However, at $350, which would translate into £350, it is not cheap to buy only to find you don't like it after all! Take a look at them at the website below and see what you think. I must admit I like it though!

www.morsex.com/scheun

*(Some Scheunemann keys are now available from a couple of PW advertisers. The range includes straight, single- and double-paddle keys – **ed.**)*

Looking at paddles and keys in a glass case is not the way to buy one. We have a CW Forever evening at our club, the Norfolk ARC at which there are lots of different keys and paddles to try before you buy. This is the only way to select a paddle that has, after all, supposedly got to last a number of years.




## The big P-word!

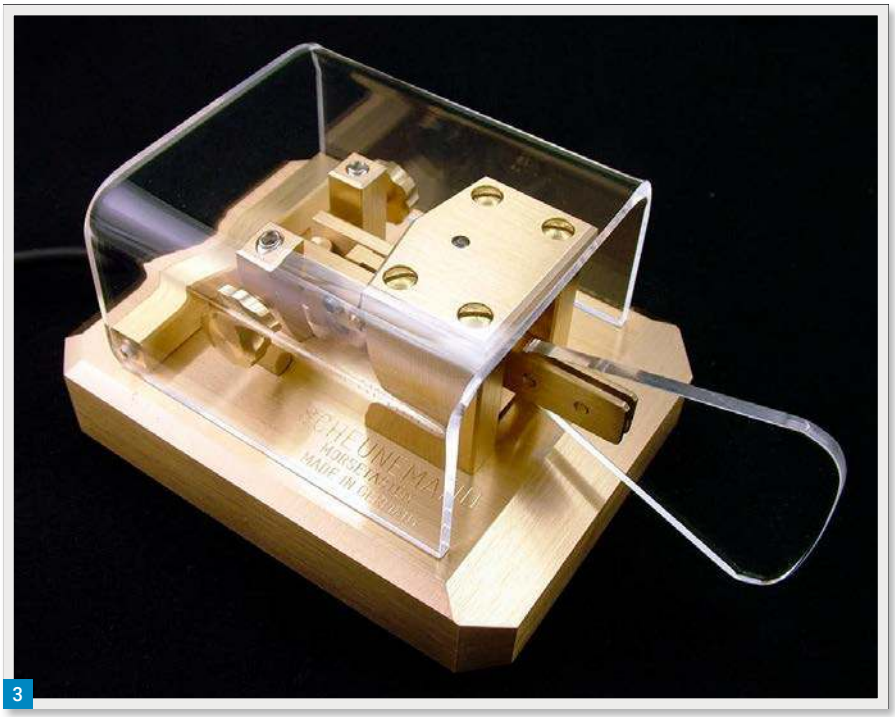
Yes, on about it again! There really is no substitute for practice, so I hope you made a suitable New Year resolution! If so, this is a good place to spend some time:

www.smrcc.org.uk/Morse/morse.htm

This site is run by South Manchester Radio and Computing Club, G3FVA, G3UHF and G8SMR, and here you will find hours of fun to keep you in practice! There are lots of MP3 files together with the accompanying text file to check your copy. Please do send feedback as requested on the site, because they have gone to a lot of trouble to set this up.

## Non-English Morse

Perhaps some of you would like to send accented letters when conversing in another language. I sometimes think it would be nice to include the Umlaut when having a QSO in German. That might be being pedantic but even so, it might be appreciated! Well, **Donard M0KRK** thought the same when trying some Swedish. He found this table, **Table 1**, on the internet. Crikey, something else to learn now!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4

## Old Friends

I am always pleased to meet up with old friends at Newark, and I use the term 'Old friends' in the best possible taste. One that I see almost every year is **Gerald G3MCK**. We usually embark on a CW discussion, most of which seems to be about protocol and procedure. This year was no different! We were both brought up with adherence to a certain protocol that was both normal and expected.

His first point relates to calling CQ. Once the normal CQ call has been made he expects at least a one by two call with a K at the end. Gerald objects to dropping just one callsign and leaving it at that. I can see his objection to that.

His next objection is 'QRL?' quickly followed by a CQ call. The procedure he agrees is correct, but a certain amount of time should be allowed for a *"yes"* response.

His third point is more of a suggestion. Amateurs should learn the Q code properly, inferring that there are two meanings to a Q code, one of which is followed by a question mark. (In other words, the code can be used as a question or a statement). He has, for example, heard QRS15 (meaning please slow down to 15WPM), which he does agree is a sensible use of QRS.

Gerald, **Fig. 4**, it's always a pleasure to hear from you, and I look forward to seeing you at Newark again this year!

Have you sent me anything yet? Why not? Please keep the input coming. 73 and May the Morse be with you. Roger G3LDI.

**Table 1: Non-English Morse characters.**

| Morse | German++ | Norwegian/Danish | Spanish |
|---|---|---|---|
| ·–·– | Ä | Æ | - |
| ––– | Ö | Ø | - |
| ··–– | Ü | - | - |
| –––– | Ch | - | Ch |

The two or three first German letters are used in many other languages also, e.g. Swedish, Finnish, Turkish, Hungarian etc.

Note that the Ö/Ø Morse code is an O (---) followed by an E (·), usually written as OE. OE also happens to be how the letter is written if the proper symbol isn't available. That also shows the relationship with the French Œ, but that's a digression that has little to do with Morse code. Likewise, the Morse symbols for both the Ä/Æ and the Ü start with the non-accented letter and are AA and UT respectively.

All other characters use five symbols. These are the ones that I have been able to find:

| Morse | Norwegian/Danish/ Swedish/Finnish | French | Spanish | Polish | Icelandic |
|---|---|---|---|---|---|
| ·––·– | Å | À | - | - | - |
| ·–··– | - | È | - | Ł | - |
| ··–·· | - | É | - | Ę | - |
| –·–·· | - | Ç | - | Ć | - |
| –·––· | - | Ê (also /) | - | - | - |
| ––·–– | - | - | Ñ | Ń | - |
| ····· | - | - | - | - | - |
| ––·–· | - | - | - | - | - |
| ·–––· | - | - | - | - | - |
| ––·–– | - | - | - | Ż | - |
| ··––· | - | - | - | - | Đ |
| ·––·· | - | - | - | - | Þ |

Here also there is a nice pattern for how many of these symbols are formed. Take Esperanto as an example, where the symbols are all formed by appending a short letter to the original one: Ĉ is CE, Ŝ is SN (which also happens to be the prosign for 'understood'), Ĝ is GN, and Ĵ is JE. The Polish Ł and Ż follow the same convention and are LT and ZT respectively, and so does the Nordic Å which is AK.

There are also six-symbol combinations in Polish: Ź which is ––·· ·– (ZN) and Ś which is ··· ·–·· ·· (SB).

The German Wikipedia even lists a Morse code for the double : ß, ··· ·––·· ··· or SZ, but I believe two consecutive S's work well or even better.

**John Seager G0UCP**
jseager2009@btinternet.com

# The Story of Michael Lindsay

The British amateur who worked with Chinese guerrillas and enabled the first intercontinental broadcasts by the Chinese news agency.

**Michael Lindsay** (1909-1994), **Fig. 1**, was a British academic who from childhood built radios and experimented with circuit design. In 1937, just before World War II, he was invited to Yenching University in Beijing to introduce the English tutorial system and lecture in economics. The Japanese army had seized part of China in 1931 and in July 1937 they had occupied Beijing. Michael was deeply moved by what he saw of the arrogance and arbitrary cruelty of the invaders. Visiting the countryside with other western colleagues in the summer of 1938, he realised that the communists were the only effective force fighting against the Japanese occupation. Determined to help, he was able to use his protected status as a foreign national to deliver medicines and surgical supplies. He soon realised there was an urgent need to improve the army's radio equipment and teach the operators how to use it. The story of how he and **Hsiao Li**, a Chinese student he married in 1941, **Fig. 2**, smuggled home-built radios and spare parts and then spent four years with the army is remembered in China to the present day. There is a way-marked route from the city to the Western Hills called after Michael who, years later, inherited his father's peerage as the 2nd Lord Lindsay of Birker.

In her extraordinary book *Bold Plum: with the Guerrillas in China's War against Japan* [1] Hsiao Li Lindsay makes it clear that she and Michael were not communists or members of the communist party of China. Their inspiration was the thought of a free united China once the invading forces had been driven out.

## Self-Taught

Michael had no formal training in radio and in the amateur tradition was entirely self-taught. He was able to get parts from Hong Kong and Shanghai and through contacts with the British embassy where he had briefly worked as Press Attaché. The Professor of Physics at Yenjing was **William Band**, a graduate of Liverpool University and his Department had an amateur radio licence listed in the Fall 1934 'Flying Horse' Call Book as AC2RT.

This will have helped with building and testing, but Michael would work with components and soldering iron in his own small rooms in the University President's house. His wife Hsiao Li commented that when they moved to their own larger house on the campus *"... after Michael had spread out all his radio parts it seemed quite full.."*

## Morse Code

Between their academic work and Michael's radio activities, he and Hsiao Li would practice Morse code. Others brought in to help included **EK Smith**, an 18-year-old American student with an interest in amateur radio.

By 1941 the amateur prefix for China had been altered from AC to XU. In addition to the Physics Department's own call of XU2RT, two others; XU2CK and XU2YH gave the department at Yenching as their postal address. Whether these amateurs contributed to the undercover work is uncertain.

## Supplying Radios & Materials

Over more than a year Michael and Hsiao Li made journeys through Japanese lines, with technical books, radios and spare parts. On one trip Michael took a prototype transmitter and kits to make another nine. His foreign status and Hsiao Li's ability to translate and explain carried them through where others would have faced arrest. One trip was timed for the Autumn Festival so guards would assume that like most Chinese they were simply out to eat moon cakes and contemplate the moon.

## Pearl Harbour

All this ended with the Japanese attack on Pearl Harbour. On the morning of December 8th 1941 the daily Shanghai news broadcast was unexpectedly absent. Looking for a reason, Michael heard by chance a German news report of the attack. Faculty members at Yenching had a degree of independence because of the university's links with America. Realising this protected status had now ended, Michael and Hsiao Li, within minutes of hearing the news, filled a car with food and radio equipment and fled the university campus, leaving their personal possessions behind. Chinese colleagues had advised them on the safest gate and they drove out at high speed. Subsequently they learned that the Japanese secret police, entering through another gate, had come to arrest them and had ransacked their house less than ten minutes after they left. It took nearly three weeks of arduous journey on foot and horseback to reach the

forward headquarters of the Chinese army in the hills just West of Beijing.

## A New Role

Michael was appointed technical adviser to the forward area communications department, where his duties included teaching radio engineering to the army technicians. He started to rebuild the old-fashioned communications equipment [2], which was unsuitable for guerrilla warfare in several respects. The cumbersome transmitters were just single-stage Hartley oscillators but they had front panels some 60cm square. These were completely rebuilt with a more frequency stable 'master oscillator-power amplifier' (MO/PA) circuit and antenna matching was improved by logarithmic tapping of the output coil, **Fig. 4**. With size down to 25 x 20 x 15 cm. they could be carried as part of a backpack.

The receivers comprised an oscillating detector followed by two transformer-coupled audio frequency stages; a widely used design in the mid-1930s. These were also rebuilt much smaller, but the circuit was not changed. In *The Unknown War* Lindsay states that receivers were battery operated and most transmitters got their power from a hand generator. The best had an output of around 25W. Operating distances varied from local to several hundred miles, so it was an advantage to have a wide frequency range, typically 2.5 to 10MHz. This contrasts with American and British field sets at the time, which often covered only 6 to 9MHz. There is no doubt that Lindsay was a charismatic teacher, whether on economics or practical aspects of radio.

A photograph, **Fig. 3**, shows him in army uniform smoking a professorial pipe and watched by attentive army 'students'. The multimeter that accompanied him through thick and thin sits on the table. The glass valves in the little sets are recognisable as the triodes or pentodes available in Britain in pre-war years. These had delicate directly-heated filaments rather than cathodes. The more modern indirectly-heated types widely used in American equipment drew much more current and needed a heavy power supply. Apart from being as fragile as light bulbs these glass enveloped valves needed almost exactly 2V for the heater circuit,

**Fig. 1: Michael in China. Fig. 2: Hsiao Li. Fig. 3: Lindsay working with one of his students. Fig. 4: One of the 'new' MO/PA transmitters. The rotating switch and coil assembly at the upper left has been removed from one of the original transmitters and neatly grafted into the new small panel. The loop of wire and plug would short out unused turns as required. Fig. 5: Hsiao Li looking on intently as an operator reads a message and sends it via the key. It also shows how the transmitter and receiver units were mounted one above the other in a protective wooden frame suitable for transport in a backpack. Two rather untidy wires diverge up, presumably to a dipole antenna.**

usually from a lead-acid accumulator. Any less and they were inefficient, a bit more and they would glow brightly and expire.

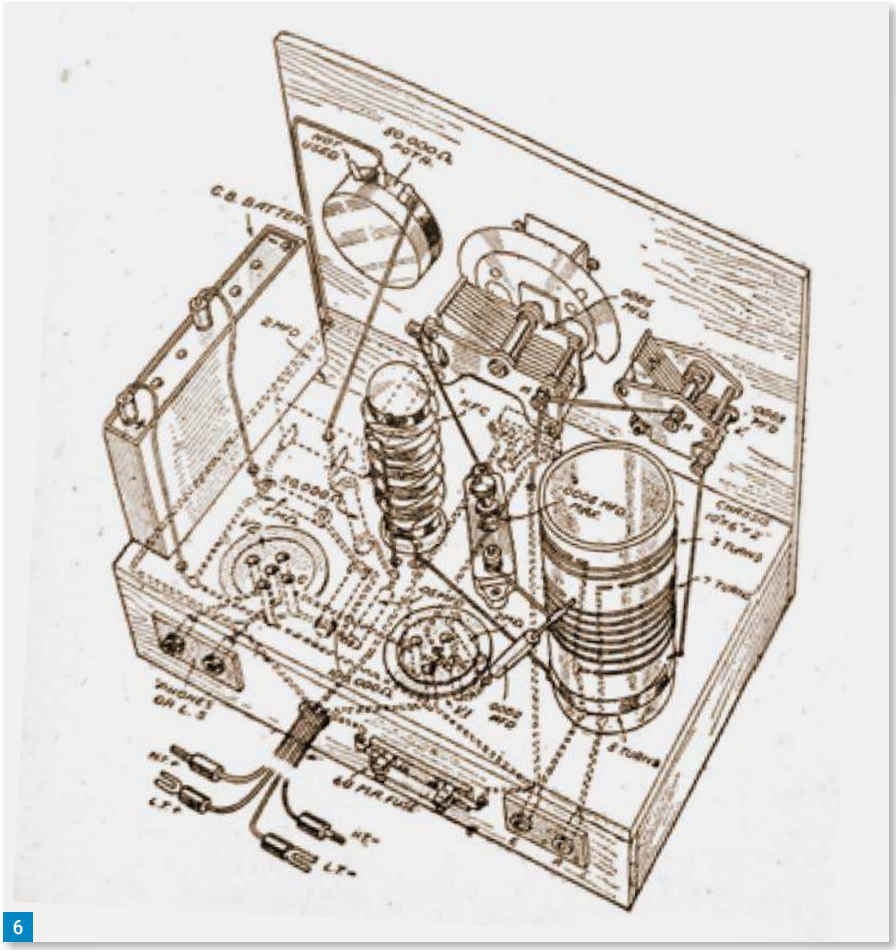
Behind the receiver that Michael is adjusting are some Ever Ready 1.5Vdry cells. Two of them in series would require some form of dropper resistor to prevent disaster. The source for the 120V or so of high tension (HT) is not clear. The receiver is a regenerative detector with 'reaction', rather than a superheterodyne. Regenerative receivers were highly sensitive but needed a fair amount of skill (and 'two-handed' operation) to use, unlike the 'superhet' W.S.18 (0.25W) and W.S.38 (0.2W) field sets then available to the British Army, which made few technical demands on the operator. The transmitter being studied with evident delight by Michael's Chinese colleague is one of his new designs. Output of these sets must have been below 200mW, so careful matching to the antenna was all-important and a panel meter was essential to monitor anode (plate) current during 'tuning up'.

With very low power transmitters it was an advantage to use 'continuous wave' (CW) telegraphy, so the power amplifier could operate in the most efficient 'Class C' mode. This maximised the range of the transmitter and kept down battery drain, but it also meant that operators had to use Morse code. As there was no suitable Chinese code they all had to learn some English.

## Hsiao Li's Role

Hsiao Li explained how, as well as giving birth to two children, the first in a remote mountain village and the second in a cave hospital in Yenan, she gave regular English lessons to the radio students. A Radio Teacher's Training School [3] had been set up at the front line headquarters in March 1942 and from the start included more than 20 students whose university course had been interrupted or who were waiting to start when war intervened, **Fig. 3**. Larger groups of soldiers from diverse backgrounds were given training in wireless procedure. Michael taught radio theory and **William Band** ran courses in physics and mathematics, including advanced calculus and vector analysis. Several of their students held senior positions in industrial and academic fields in the post-war period.

By January 1944 Michael had rebuilt nearly all the sets for the front line units and there were not enough parts to make more, **Fig. 6**. All students with sufficient maths to understand it had been taught basic radio engineering.



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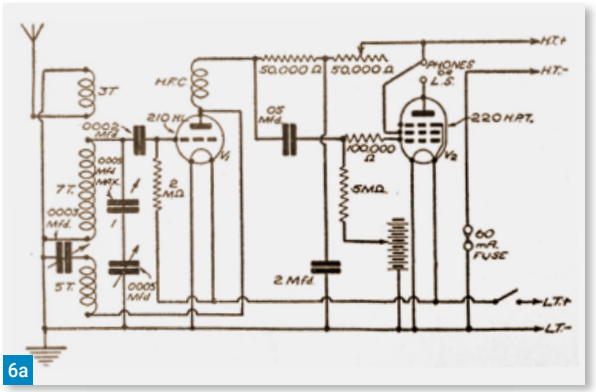

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**Fig. 6: Lindsay liked to modify and improve amateur designs of the day. This receiver circuit published in March 1940 by PW founder FJ Camm offers some scope. Construction is similar to that of the new field sets.**

He knew that the Communist leadership in Yenan, 500 miles to the West, and the Nationalists in the Southern capital of Chongquing, were unable to make regular radio contact. He believed that if they could do so there might be better cooperation between the two. He also saw the benefits to Yenan in getting the point of view of the communists out to China's allies, Britain and America.

Even in Yenan they still had only low power transmitters but Michael was sure he could make them more effective. In particular he wanted to put up a 'V' beam antenna to provide directional gain, **Fig. 7**.

## Transfer and Evasion

Michael's transfer was agreed and he made the hazardous journey taking few possessions apart from his test meter and slide-rule. Together with his wife and child and a small army escort they were pursued from village to village by enemy troops and were lucky to escape an ambush on a mountain pass. On arrival at Communist Headquarters in Yenan in May 1944 they were treated as honoured guests. At a welcoming dinner they sat at table with **Chairman Mao** and **Zhou Enlai**. Although it was the army headquarters, conditions in Yenan were basic. Indeed, the majority of

officials, including the leaders, were living in caves hollowed out of the impacted yellow earth of the Loess plateau.

## A New Role

As before, Michael was asked to improve radio communications. Curiously he was also asked to study their banking and financial system to see whether it could be improved. He set to work to build a transmitting station that could be received in America or by British Intelligence in India. Two senior members of the radio department had some technical background, so tact was required. They had a generator driven by truck engines and some transmitting tubes, though these were less powerful than Michael had hoped. He calculated it should be possible to achieve a power output of around 600W. For broadcast purposes, much would depend on the directional antenna. He designed the new transmitter and supervised its building. His notebook had dimensions taken from **CE Terman's** *Radio Engineering* for both the 'V'-beam and the more elaborate rhombic, **Fig. 8**.

Each leg in a 'V'-beam can be up to six wavelengths long, giving a narrow arc of gain up to 10-12dB over a dipole. A rhombic antenna of the same overall length will have even more gain, but the beam will be narrower still. Unlike the 'V', the rhombic can be made mono-directional if a terminating resistor is used. One commentator referred to the huge antenna as being 'diamond shaped', raising the possibility that a rhombic was put up at some stage. Michael had difficulty convincing some in the radio department that the alignment of the antenna, as taken from a Mercator projection map, would not be correct. Using a book on spherical trigonometry he worked out the true bearings and verified them himself by direct observation of the Pole Star.

It turned out that the optimal direction lay across a valley between two hills: An ideal situation for the 'V' beam, which needs only three large posts for support. There was no shortage of space and captured Japanese telephone line provided plenty of wire.

The plan was a success and despite its relatively low power the station established links with San Francisco and India as well as allowing radio contact with the Nationalist army in Chongquing. Weather reports and details of enemy troop movements were of particular interest to the Allies. It is remarkable that the very first intercontinental news broadcasts by Xinhua, the Chinese news agency, went out in 1944 from this 'home built' amateur-designed system. Because of his special position of trust Michael was also consulted on what form the news should take and what would interest journalists and correspondents from abroad. He even briefly persuaded the broadcasters to give up the careless Chinese habit of routinely adding epithets (Dog, dog-face, dog meat) to the names of generals or public figures whose politics differed from theirs.

**Fig. 7: V-beam antenna design from the 1944 ARRL Radio Amateur's Handbook. Fig. 8: V-beam and rhombic designs from Terman's Radio Engineering.**

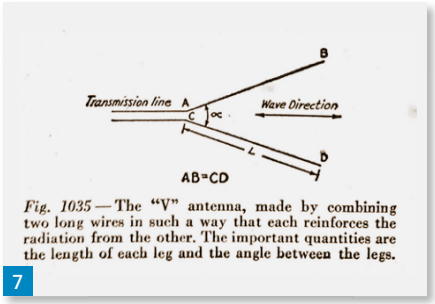
## Time to Leave

As time went on it became increasingly clear that when Japan was defeated there would be no happy ending, but the two Chinese armies would turn on each other again in civil war. By 1945 Michael and Hsiao Li now had two children and with regret they decided to leave the country and travel to Michael's family in post-war England. Before leaving they had a private dinner with Mao and his wife and were able to speak directly of their concerns for the future, though Mao claimed that he still hoped for a peaceful settlement with the nationalist government. With hindsight and knowing more of the background to the communist headquarters at Yenan it is easy to see the Lindsays as naive and perhaps deceived. Their presence clearly reassured many visiting American observers, but it is timely to recall a moment in history when by force of circumstance Britain, America, Russia and China and much of the world besides were united to a single purpose. That a brave and altruistic foreigner should have made such an unusual contribution is worth remembering in Britain and America as well as in China, where his story is still widely known.

## Later Life

Michael had never hesitated to criticise communist bureaucracy and continued to do so in following years. He and Hsiao Li returned as interpreters with a delegation led by **Clement Atlee** in 1954 but although delighted at the huge achievements in public health and engineering he despaired over the many schemes, crackpot and worse, which flowed from what he saw as the needless application of Marxist-Leninist dogma. In the 1970s he was barred from entering China but was welcomed back after Mao's demise.

Following a University appointment in the UK, he and Hsiao Li had moved to Australia.

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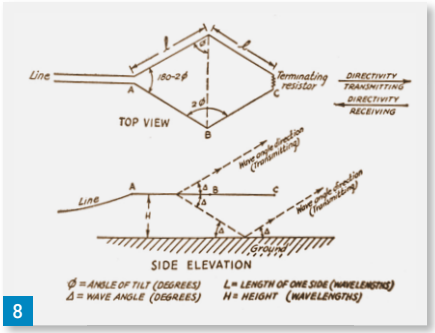


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Their son **James**, third Lord Lindsay of Birker, and a retired Australian diplomat recalls his father in Canberra in the 1950s *"his work room ... full of radio parts, valves, transformers, resistors, etc. and Dad sitting there with a soldering iron"*. Moving to Washington in 1960 as a Professor of Far Eastern Studies, there was a similar room full of parts in the basement. A successful transition was made from valve to transistor design, the ultimate project being a state of the art HiFi amplifier.

## References

[1] Hsiao Li Lindsay. *Bold Plum: with the Guerrillas in China's War against Japan*. **www.Lulu.com**. ISBN 978-1-4303-0292-6

[2] Michael Lindsay. *The Unknown War: North China 1937-1945*. Bergstrom & Boyle. London 1975 (Now out of print. Copies may be found online from second-hand book sellers.)

[3] Band, Claire & William. Dragon Fangs. George Allen & Unwin Ltd. London 1947.

## Acknowledgements

Alan Lee, Wirral Chinese School, for historical information.

Black and white photographs are reproduced by courtesy of James, 3rd Lord Lindsay of Birker.

The source for diagrams is indicated in the text.

I am grateful to Louis Meulstee, author *Wireless for the Warrior* (**www.wftw.nl**) for his encouragement and for improving the definition of Fig. 4, the clearest known picture of one of the 'new' mobile transmitters.

# Radio Round-up


## Yorkshire Operators Brigade

The Yorkshire Operators Brigade (YOBS) is a group of like-minded friends who are interested in operating amateur radio. Their virtual meeting point is in Huddersfield, West Yorkshire but they welcome members from any QTH.

They say, "We don't sit in a club talking about radio. We operate. We were formed on Yorkshire Day (August 1st) 2019, with inspiration from an article in RadCom about the future of radio clubs. We are not a traditional radio club; we don't hold formal meetings. However, we do compete in contests and operate. We enjoy setting up and operating special event stations as well as contest stations and aim to be ambassadors for amateur radio to the general public. We are an open and friendly club and always available for help and advice when building or optimising your station for contests. We embrace modern technology and are firm believers that a computer is as vital to operating as a radio. As we have no meeting place, our main method of interaction with each other is via social media. We have a Facebook group, but this is currently only visible to members as this is where we discuss operating strategies in contests – Hush Hush. This lack of meeting room also keeps our overheads, and subsequent membership fees, very low. We welcome members who like to operate with any class of licence and are adamant that it is the class of the operator that matters, not the class of the licence held. We are affiliated to the RSGB and hold a club callsign M0YOK. Our goals for 2020 are to make an impression in the club calls series and enter at least two of the major international contests too. 'Operators' is the centre of our name and it is also at the centre of what we do. If this sounds like something you would like to get involved in then please drop us a line at: **yobsradio@gmail.com**"

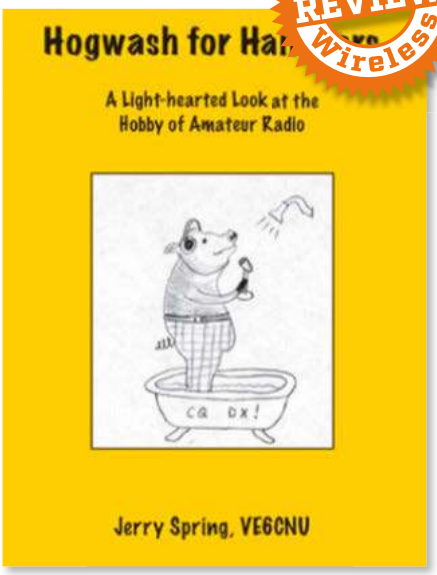
Book Review

# Hogwash for Hamsters

## by Jerry Spring VE6CNU

**Chris Colclough G1VDP** recommends some light reading to counter the seriousness with which some of us address the hobby!

**Chris Colclough G1VDP**
chrisg1vdp@btinternet.com




When I first discovered and read this book a few years ago it was through the recommendation of one of the guys from the Finnish Contest group. He had read the book and knew how I had a sense of humour and liked funny entertaining stories. So, I ordered the book direct from Trafford publishing for my library: https://tinyurl.com/uwr9t2l

Having now read the book I can honestly recommend it. Jerry has a similar background in the hobby to myself and many others. He took his test at a similar time to me, and through the fact of getting married and moving homes he put the hobby on a back burner for a similar period. So, I thought maybe this guy is seeing the hobby from a similar angle to me.

The book itself is a light-hearted and humorous look at the hobby with some very funny stories, poems, limericks and jokes. There are too many people who take the hobby way too seriously these days, not that this is a bad thing but sometimes it is better to look at the hobby from a funny side too, and I think Jerry has got this balance just right.

Once the British reader gets past the Americanisms and the American/Canadian sense of humour – remember the author is Canadian and we all find things funny in different ways in the many differing countries – it is a very funny book. I found it hard to put down, especially one night when I got in bed at 22:00 and started reading it, looking at the clock only to see it was almost midnight and I had to be up for work at 05:30!

Jerry starts the book off by introducing himself, which as I said earlier is a very similar history to me, and then leading with a story where I am sure we can all relate to about that elusive DXpedition and that starts off the tone of the book.

We find jokes such as *"What do you call a CW operator equally good at sending with his left or right hand?" "AmbiDXterous"* (one that I had to read twice before getting the joke).

There are takes on the Nursery Rhymes we knew as children:

*Little Bo Peep,*
*Has lost too much sleep,*
*Chasing DX until three,*
*Too many nights,*
*As she kept on the lights,*
*Trying for DXCC.*

Jerry has also come up with his own Murphy's Law for hams, a page full of true statements of *"Remember When"*, which again most of the readers who have been licensed for a few years will relate to while the new guys will have heard similar stories at the local club. Adverts for equipment for sale, questions from the Foundation exams written in Jerry's own way and many other sideways looks at the hobby.

Would I recommend it? You bet, but it would be nice to be able to get the book from say the RSGB/PW Bookstore in the UK rather than ordering and waiting, as each book is printed to order so I am led to believe. Some of the stories and jokes will be heard at many of the conferences and meetings around the world, each being told by the orator in their own way. In fact, I am reading my copy once again for this very reason.

Footnote: Since I wrote this review the book has become available direct from Amazon in Kindle format for £11.99.

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**New 200W version** **£4199.95**


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**Full coverage HF/VHF/UHF Transceiver**
- 100W HF/6m, 50W 2m & 70cms
- Touch screen colour display

**£1189.95**

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**100W Classic HF/50MHz Transceiver**
- DSP noise reduction • Built-in keyer
- Auto Tuner

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**£1399.95**

**Yaesu Radios**

| | | |
|---|---|---|
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| **FTDX1200** | HF+6m 100W Transceiver | **£919.95** |
| **FT450D** | HF+6m 100W Transceiver +ATU | **£599.95** |
| **FT857D** | HF/VHF/UHF Mobile | **£739.95** |
| **FT818ND** | HF/50MHz | **£599.95** |
| **FT891** | HF/VHF/UHF 5W portable Transceiver | **£599.95** |

**Digital Transceivers**

| | | |
|---|---|---|
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| **FT2DE** | 5W C4FM/FM Dual Band, H/H | **£289.95** |
| **FT70DE** | 5W C4FM/FM Dual Band, H/H | **£169.95** |
| **FTM3200DE** | 65W C4FM/FM 144MHz mobile | **£189.95** |
| **FTM400XDE** | 50W C4FM/FM Dual Band mobile | **£369.95** |

## ALINCO

### Alinco DX-SR9

**100W HF Transceiver with SDR feature**
- QRP option: 100mW-2W output
- CW Keyer + filters built in

GREAT VALUE!
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**50W VHF/UHF with 'rainbow' display**
- Duplexer allows single Antenna
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- Programmable with downloadable software

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- GPS built in • Vox built in
- Selective call
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- Software & lead supplied

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*Note: These radios require programming for DMR operation*

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- Good dynamic range
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- Software upgradable
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- Smith chart, TDR , Cable length
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**70MHz FM Transceiver**
Complete with DTMF Microphone

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- Optional 4:1 Balun for balanced wire feeders

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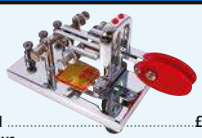

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Linear

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- 1.5-15V DC
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**Aluminium Telescopic masts** *German engineered!*
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**High Performance Beams using Professional 3D EM modelling**

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| **PA70-6-4** | 4m 6 element Yagi 6m boom | **£219.95** |
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| **PA144-432-13-1.5-2C** | 2m 5 el 70cms 9 el 2 connectors | **£134.95** |
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| **PA144-432-19-3-2C** | 2m 7 element 70cms 12 element | **£199.95** |
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| **PA144-6-2** | 2m 6 element Yagi 2m boom | **£119.95** |
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| **PA144-11-6BG** | 2m 11 element guyed 5.72m | **£199.95** |
| **PA144-12-7BGP** | 2m 12 element Yagi | **£259.95** |
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| **PA432-23-6** | 70cms 23 element Yagi 6m boom | **£199.95** |
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| **PA1296-70-6UT** | 23cms 70 el 6m Teflon Balun | **£239.95** |

## ALINCO

SPECIAL OFFER!

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**Communications receiver**
- 150 kHz-34.99 MHz
- 600 memories
- IQ output for PC decode
- Removable Front Panel - (requires optional EDS17 remote kit)

**£469.95**

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**Multi-Mode 28MHz Transceiver**
- Power: 25W SSB, 12W AM/FM/CW
- Multi-colour display

**£169.95**

NEW

### DJ-VX50HE
**Dual Band Handheld - IP67 rated**
- Compact rugged body
- CTCSS, DCS, DTMF
- 5W VHF/4W UHF
- 200 memories
- RX Airband, FM Broadcast

**£89.95**

FINAL REDUCTIONS While stocks last!

### Alinco DMR/Analogue Radios
Commercial Grade Handhelds - with basic code plug and program lead (Win 10)

**DJ-MD40** UHF DMR Handheld
Has vocoder for better audio clarity, IP54 rated, 1000 memories..... ~~£189.95~~ **now £99.95**

**DJ-AXD4** UHF DMR Handheld
Rugged IP67 Waterproof & Dustproof, 1,000 channels..... ~~£189.95~~ **now £99.95**

**DJ-AXD1** VHF DMR Handheld
Rugged IP67 Waterproof & Dustproof, 1,000 channels..... ~~£189.95~~ **now £99.95**

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**1.2kW Solid State Amplifier**

- Covers 1.8-54 MHz
- RF sensing for auto band changing or CAT interface for full rig control.
- Interfaces with AT-04 Auto tuner/Antenna switch

**£2895**

### Acom 700S
**700W Solid State Amplifier**

NEW

- Covers 1,8-54MHz
- RF sensing for auto band changing or CAT interface for full rig control
- Interfaces with AT-04 Auto tuner/Antenna switch

**£2399.95**

### Acom 1500
**Quality amplifier using 4CX1000A tube**

- Power: 1.5kW PEP
- Frequency: 1.8-54MHz
- Drive: 60-80W for full output
- Virtually Silent QSK keying

**£3099.95**

### Acom AT-04
**1.5kW Auto ATU and 4 way Antenna Switch**

- Covers 1.8-54 MHz
- Designed to work seamlessly with the Acom A600S or A1200S
- Uses main coax for all control signals – no extra cables required
- Fully weatherproof
- Mounting brackets supplied

**£1099**

**Acom Valve Amplifiers**

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|---|---|---|
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| **Acom 1000** | 1kW PEP (1.8-50) MHz | **£2299.95** |
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In good condition c/w box and manual
Ref: SHR-11982
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Fitted with 4 optional filters, box, manual, mic
Ref: SHR-12021
**£999**

**Icom IC-7600 HF/6m Transceiver**
Twin DSP radio c/w box, handbook, microphone
Ref: SHR-12015.....Price **£1499**

**JRC NRD 545 DSP Communications Receiver**
Classic receiver with VHF/UHF adaptor fitted
Ref: SHR-12014.....Price **£1099**

**Kenwood TS-590SGE 100W HF/50MHz Transceiver**
With original box, manual and microphone
Ref: SHR-12017.....Price **£999**

**Yaesu FT2000 HF/6m 100W Transceiver**
No Box but good condition, manual, mic.
Ref: SHR-11967.....Price **£899**

**Icom IC-7300 100W HF SDR Transceiver**
Excellent boxed condition, as new
Ref: SHR-12018.....Price **£899**

**Icom IC-7100 HF+6m+VHF+UHF 100W Transceiver**
Boxed and in good condition
Ref: SHR-12001.....Price **£799**

**Uniden Bearcat SDS-100E Digital Scanning Receiver**
25 – 1300MHz - requires activation licence for digital B Grade .....RRP £649.95 Price **£549.95**

**Yaesu FT-450D HF/6m 100W Transceiver**
No original box, all accessories incl. SCU-17 + software
Ref: SRH-12022.....Price **£549**

**Yaesu FT-817ND HF+ VHF+UHF Transceiver**
Boxed and complete in excellent condition
Ref: SHR-1209.....Price **£379**

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USB lead, manual, original ant and disk missing
Ref: SHR-11966.....Price **£299**

## Comet

NEW

### CAA-500 MkII
**Commercial Grade Antenna Analyser**
- Frequency: 1.8 - 500MHz
- Colour TFT display shows: Frequency, SWR, Impedance, Resistance, reactance, SWR graph
- Auto Sweep Mode

**£389.95**

### H-422
**4 Band Dipole**
- Power: 1kW
- Use as V or straight
- Vee: 7.4m
- Straight: 10.3m
- Covers 7/14/21/28MHz

**£289.95**

| | | |
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| CWA-1000 | Multi Band dipole 3.5/7/14/21/28MHz | 124.95 |
| **VHF/UHF FIBREGLASS BASE ANTENNAS** | | |
| GP-15N | 50/144/430MHz, length 2.4m N Type | 99.95 |
| GP-1M | 144/430MHz length 1.2m (SO239) | 49.95 |
| GP-3M | 144/430MHz, SO-239 Lgth 1.78m (SO239) | 59.95 |
| GP-6M | 144/430MHz, SO-239 Lgth 3.07m (SO239) | 99.95 |
| GP-93N | 144/430/1200MHz, Length 1.78m N Type | 99.99 |
| GP-9M | 144/430MHz SO-239 Lgth 5.15m (SO239) | 149.95 |
| **VHF/UHF BEAMS** | | |
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**Tim Kirby**
longworthtim@gmail.com

# More on Open GD77

**Tim Kirby GW4VXE**, with a new location and prefix, starts his column with an update on the Open GD77 project.

After several months of uncertainty, **Julie** and I have moved to our new home in Pembrokeshire, West Wales. I'd forgotten how exciting it is to 'explore' a new location from the perspective of RF! Despite not having any permanent antennas up at the moment, even with handhelds and portable antennas, I'm starting to get a feel for what will be possible from the place. It's always fascinating to discover paths that you hadn't expected to work so easily.

I've found the Ham Air inflatable antenna that I reviewed in last month's *PW* quite useful for testing things – just propping it up on a windowsill and making some initial QSOs to get a sense of how things are working.

## The Open GD77 Project – an Update

Readers who have been with us for the last two editions will know that I have been following the progress of the Open GD77 firmware project for the Radioddity GD-77 dual-band DMR/FM handheld.

Following the items in *PW*, it was really good to hear from the lead developer, **Roger Clark VK3KYY**, who gave some background and news on the project. Because of how quickly things are moving, it's fair to say that by the time you read this, things will have developed even further, but it gives you a sense of the progress that is being made with the project.

Roger writes, *"I've just released an update to the Tier 2 version, with a modified version of the Simplex Hotspot functionality in the Tier 1 version. But as I expected, some people are having problems with it..."* Actually, although some people have had problems with it, here at GW4VXE I've found the hotspot functionality has been pretty stable and have been able to use it successfully with both the MMDVMhost and BlueDV for Windows programs controlling the hotspot.

Roger continues, "*I also took the decision at the beginning of the week to register* **www.openGD77.com** *to host a forum, because it was getting difficult to manage feedback from people via my blog, as people would post comments related to one feature to an unrelated blog post*

*"Also, although there is an 'issues' tracker on GitHub, where the source code and firmware downloads are hosted. It's a bit of an alien environment to most ham radio operators, so a forum is usually the best option.*

*"I've basically been the sole developer on the project since July. However, recently two new developers* ***Alex DL4LEX*** *and* ***Daniel F1RMB*** *have started to assist by adding new features, and it looks as though more ham radio operators who are developers may be pitching in as well, which may take the load of me a little. However, I still have to verify and test any submissions sent to me, which takes a lot of time.*

*"The general plan is to simultaneously add new and missing features, and at the same time fix the bugs in the current version. This is mainly because it's easier for new developers like Alex and Daniel to add new features than to bug-fix things like the DMR core or Hotspot mode, which requires a lot more knowledge of DMR and the OpenGD77 codebase.*

*"I think that Zone-based scanning and some form of Dual Watch along with adjustable levels of DMR filtering (also known as Digital Monitor mode), are probably the next bits of functionality that will be added.*

*"However the entire DMR subsystem still needs bug fixing, as there is a dearth of data available for the HR-C6000 DMR DSP chip which the GD-77 uses, and I think my only option is to take one of my old GD-77s to pieces and attempt to solder some tiny wires onto the CPU or the DMR chip in an attempt to capture what commands the official firmware sends to the chip, in order to get a bit more information about how the chip should be used.*

*"In theory the OpenGD77 firmware could be 'ported' to any number of other DMR radios that use the same basic chipset, which would include most of the TYT range of radios such as the MD-380, and also to some Baofeng radios like the DM-1801 and also the RD-5R.*

*"The DM-1801 is actually a pseudo clone of the GD-77, but unfortunately although Baofeng use the same chipset and same display and similar case (with two extra buttons), they have not used the same internal connections between the CPU and anything else. So, the OpenGD77 firmware can't simply be copied into the DM-1801."*

It's a really fascinating project and I'd like to put on record my thanks to Roger, **Kai**, **Alex** and **Daniel** for all their efforts so far. The GD-77 was always a very useful little radio, available at modest cost, but with the revised firmware, it's become even more flexible and useful. It's also great to have radio amateurs behind the development of the firmware because they are working with amateur radio in mind rather than commercial use of DMR, which, of course, is a little bit different.

## The GMT Contest

Readers may recall an item in the column regarding an initiative from the Solihull ARS, which was then called 'The Midlands Inter-Club GMT Award'. The aim of the award was to increase activity on 2m and other VHF/UHF bands.

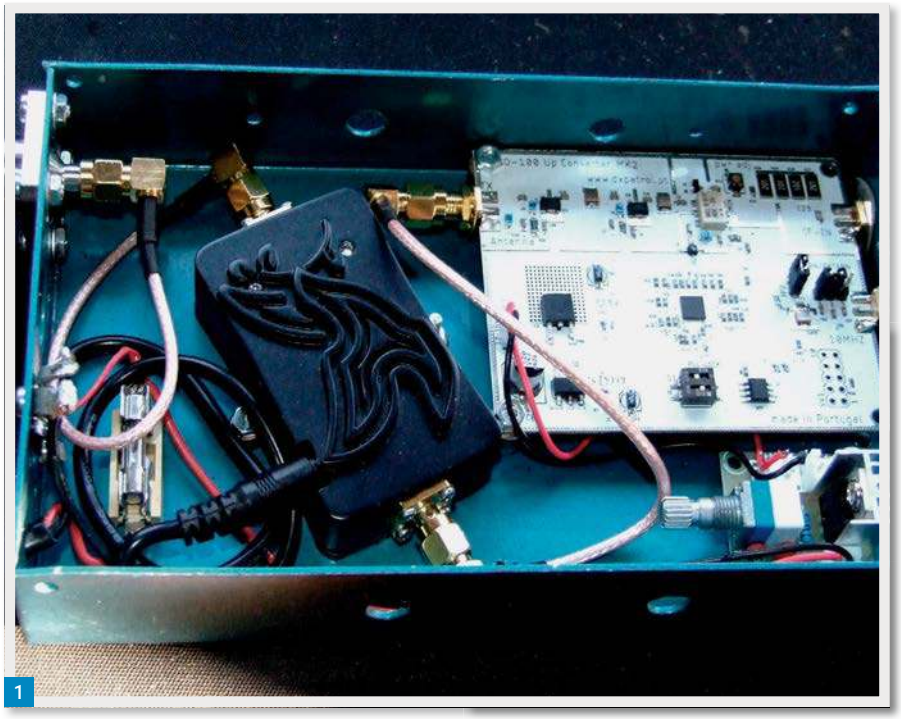
**Stu G4KUR** kindly took the opportunity to update me on progress and writes, *"Three months in, 'The GMT Contest' as it is now referred to, has become very popular with 23 local clubs participating. I'm also delighted to report that Martin Lynch is sponsoring this initiative and has very kindly donated a Wouxun KG-UVN1 handheld DMR/FM radio for the overall winner. This is to be presented at the Wythall Hamfest in March. The Contest runs until the end of January so there's still time for more to join in. All the rules and information can be found on our website"*:

**www.solihullradioclub.co.uk/award**

Clubs who are participating include: Wythall (WYT), Rugby (RATS), Dudley (DAD), Tamworth (TAR), Wolverhampton (WOL), Gloucester (GLO), Central (CRAC), Telford (TEL), Salop (SRT), Solihull (SOL), Midland (MARS), South Birmingham (SBRS), Bromsgrove (BROM), Stafford (SAD), Leicester (LRS), Cheltenham (CARA), Mid Warwickshire (WAR), Stratford on Avon (SOA), Sutton Coldfield (SCR), Bolsover (BARS), Worksop (RCW), Coventry (CARS) and Nuneaton (NRC). If your club is in the Midlands area and you'd like to take part, have a word with someone on your club's committee.

Suggested activity times are on Sunday

**(Photo 1) Bernard G4BXD's QO-100 system based on the DXPatrol UpConverter and WiFi amplifier.**



mornings between 10-12am around 145.450MHz FM.

You can read more details on the website mentioned above.

## The Yaesu FT-3DE and the Military Airband

In my review last month of the Yaesu FT-3DE, I commented that I'd not found a way of getting the rig to receive AM on the military airband. **Ian Connor G7PHD** kindly wrote and said that he'd found a way to do it. Ian suggests:

**1.** Press the DISP button (middle button)
**2.** Press the TX/RX soft button in red at the top/middle
**3.** Select 1: MODE
**4.** Select 3: RX MODE
**5.** Use the top rotary control to switch between: AUTO-FM-AM and select AM.

Ian says *"and it works!"*. He does comment that the audio isn't as clear as some other Yaesu rigs have been on airband, but nevertheless, if you have an interest in the area, it's worth giving this a go. Thanks, Ian for your helpful e-mail, which is much appreciated and I am sure others may well find it useful too.

## The 4m Band

**Simon Evans G6AHX** (Twyning) is back on 4m with a vertical at the top of the mast. He says it's pretty quiet, which he feels is surprising considering all the IC-7300 rigs that are around. Simon has installed an old Storno rig in his car for the band as well. So, if you're on 4m FM, remember to call CQ from time to time,

## The 2m Band

It's great to hear from **Phil Oakley G0BVD** (Great Torrington) who is now the proud owner of a new IC-9700. He has been trying out 2m FT8 for the first time, using his vertical antenna. So far, he's worked GW1JFV (IO71) and has heard other stations but has yet to work them. Although Phil is using a vertical on FT8, he's hoping to put up Yagis for both 2m and 70cm shortly.

Simon G6AHX writes, "*on 2m SSB on Sunday December 8th I worked three French stations who were taking part in a French contest. This contest immediately preceded the RSGB AFS contest. My best DX was F8KHO/P in JN29HA at a distance of 582km from me. It's well worth checking the French contest calendar here:*" https://tinyurl.com/tfnhacc

**Jef Van Raepenbusch ON8NT** (Aalter) has been operating as OR8NT and lists his contacts over 400km. During the UK Activity Contest on November 5th, Jef worked G0LTG (IO81) on SSB and then lists some nice contacts on November 20th/21st on FT8: GW8ASA (IO81), G0RQL (IO70), F6APE (IN97), GW4MVA (IO83), G4ALY (IO70) and F1NZC (JN15).

The antennas came down at G4VXE on November 16th (with some sadness, I might say!), but just before the QRT I worked F6APE (IN97) as well as GW1JFV (IO71) and F5BZU (JO10) who had been two of my most regular FT8 tests from Longworth. I'm looking forward to being active on FT8 as GW4VXE before too long and seeing what's possible from here in St Nicholas. Already, I have noticed good signals from the Mount Leinster APRS digipeater on 144.800MHz as well as more distant repeaters from Southern Ireland on 145.650MHz and 145.675MHz, the antenna being the inflatable 2m Ham Air antenna located inside on the window sill.

## The 70cm Band

Jef ON8NT worked G4ODA (IO92) during the UK 70cm activity contest on November 12th.

Here at GW4VXE, I'm pleased to find that the Mount Leinster repeater, EI7MLR on 430.950MHz, is a big signal even on a handheld in the house. It runs fairly high power, so although I can usually open it up with 5W to a rubber duck, my signals are obviously noisy. I am sure with a better antenna or better conditions, this can be improved upon.

## The 23cm Band

**Steve Macdonald G4AQB** (Bolton) writes, "*In the Manchester area the Wednesday evening 23cm FM Net is still going strong. It was started back in February and now it is very active with stations trying out 23cm for the first time with their Icom IC-9700s and SG Labs transverters. The net starts about 8.15pm on 1297.50MHz. Most stations are using horizontal polarisation and everyone is welcome to join in*". It's great to see 23cm FM being tried more here in the UK. I was aware a couple of years ago of some experiments being made with the use of 23cm FM mobile, particularly in Japan, with some very good results being achieved in urban areas. It will be interesting to see if the greater availability of equipment sees any similar experiments being made in the UK. If you've been trying 23cm FM and are reading this, please drop me a line. It would be really good to hear from you.

## Satellites

**Patrick Stoddard WD9EWK** sends a shorter than normal report but says that he has attended a couple of hamfests in the last month, representing AMSAT and giving demonstrations on how to use the low orbiting satellites. He and **Endaf N6UTC** (MW1BQO) were planning to be operating from the *Queen Mary* again, which is always popular with other satellite operators.

**(Photo 2) One of the SSTV images transmitted from the ISS as received by Kevin ZB2GI.**


**Graham Jones G3VKV** (Cheltenham) writes, *"QO100 satellite reception of DATV is working well with my 1.6m dish using the MiniTiouner receiver. It's all a bit different from my slow-scan TV transmission and reception on 14MHz in 1974 using a 5FP7 radar cathode ray tube (special permit required from the Home Office to transmit)"*. Funnily enough, one of the first meetings that I attended at the Cheltenham Amateur Radio Association way back when was a talk given by Graham and **Dave G8MGD** on Amateur Television and I remember Graham demonstrating SSTV using a long persistence tube. It's a while ago now!

Graham continues, *"Also, I've been on the narrow band transponder using SSB; quite a few rare callsigns operating. I worked **Wahhab YI3WHR** from Babylon, Iraq, **Satish 9N1AA** from Kathmandu, Nepal, **Khalid A41ZZ** from Muscat, Oman and **Rasto A75GR** in Doha, Qatar"*.

**Bernard Nock G4BXD** writes, *"Wanting to free up my SG Labs station for 2.3GHz use, I obtained the DXPatrol Up Converter and a small WiFi amp, now all boxed nicely. It's running just under 2W and I'm getting 59 reports with my 1.1m offset dish and patch feed. Contacts include R7, 4Z1, ST2, 9K2, E77 and UA9"*. Bernard continues, *"My interest in microwaves has now been expanded to the 9cm band with receiver and transmitter units already purchased."*

**Kevin Hewitt ZB2GI** says, *"There was SSTV from the ISS on December 4th to 6th during times that coincided with ISS passes over Russia. Transmissions were on 145.800MHz FM in PD120 mode. None of the low audio problems that had dogged the last few SSTV operations from the ISS were present this time. I set up in Alameda Botanic Gardens using an FT-817 with a homemade 2-element 'Rabbit Ears' Yagi and MMSSTV running on a WIN 7 Notebook PC"*.

Steve G4AQB has been following the progress of FOSSA SAT-1, which was built by 16 year old students and launched in early November. It will send back telemetry in RTTY and also LoRa (similar to those used in high altitude balloons). FOSSA SAT-1 has a downlink on 436.7MHz and will eventually become a relay/repeater to send LoRa packets from home via the uplink for others to receive at ground stations. The satellite itself is tiny, measuring only 5cm!

More information can be found on the FOSSA website:
**https://fossa.systems/fossasat-1**

and there is also an interesting video at:
**www.youtube.com/watch?v=tdj7fka4b_w**

Here at GW4VXE, I was pleased to try out some low passes over the Atlantic, with my first QSOs being made on AO-91 with F4DXV (JN04) and ON5PU (JO21), using a THD-72 and Elk log periodic antenna. I'm hoping that, in due course, with the low horizon, some interesting satellite contacts will be possible.

Well, that's it for now. I'm especially grateful to everyone who's been in touch this month with news for the column as I've felt rather disconnected with being off the air. Hopefully by next month I shall have something basic working, but just in case, please drop me a line with any news you may have – it will be very much appreciated.

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# Power Supply Rebuild & RF Ammeter

**Geoff Theasby G8BMI**
geofftheasby@gmail.com

**Geoff Theasby G8BMI** has two more cheap and cheerful projects for the shack.


**Fig. 1: PSU front panel before rebuilding. Fig. 2: The 'spatchcocked' unit open for access. Fig. 3: The RF ammeter seen from the front. Fig. 4: Internal view showing construction.**

In reorganising my workbench to make it more versatile, I resurrected an old homebrew power supply, **Fig. 1**, 30V x 1A, based on an L200 IC, which is very good and still available. On testing it, I found that the negative terminal was 'live' at 100V! Suspecting the transformer, (I wished to save the elegant case and meters) I stripped out the rest, **Fig. 2**, and built a 0-30V power supply kit in it (Notes from Banggood, who supply a suitable board for DIY construction) using a brand new, hefty, Altai EI-76 0-30V tapped transformer I have had for years and which had a bent lug. (A feeling not experienced since my schooldays!) As with all kits, check and measure each component supplied. The little component tester M328 (*PW* April 2019) is ideal for this. The one component I didn't measure as I proceeded was the large, white 0.47Ω power resistor, R7, used as a 'sense' resistor for the current limiter. If I had, I would have saved myself a lot of time and grief, because a 47Ω resistor was in the kit! 100 times greater! No wonder it went into current limit mode at more than a few milliamps. Apart from that it worked first time. The 18V AC tapping gave up to 24V DC out from the completed kit. Any higher and the ratings of the op-amps would be exceeded.
https://tinyurl.com/rnw99nr

D1047 is a 200V NPN pass transistor rated at 12A. It may be replaced with a 2N3055 if desired, and needs a heatsink, which is not supplied. I bolted it to the case, insulated with kapton tape. Two resistors and two capacitors were left over and two resistors missing, which were replaced from stock.

A 24V fan is recommended, and a two-pin Molex socket is included. I bought one at a rally, cutting through the rear panel where it was mounted, and drilled the opposite end of the case with a matching number of holes as used for the fan. This ensured a good airflow through the unit, keeping it cool. LEDs were added for an 'On' indication, and to note the onset of current limiting.

## RF Ammeter

Seen in a QRP publication, and subsequently elsewhere (see the link below, for example), this is a very simple RF ammeter, **Fig 3**. At one time, thermocouple meters were used for this purpose by amateurs but are now very rare. There is no need for an SWR/Power meter, just tune the ATU for maximum RF current because this coincides with lowest SWR. It doesn't even need calibrating, though this can be done if required.

The RF energy is picked up by a wire between input and output sockets, which is passed once through a ferrite toroidal core, an Amidon FT50-43. Also on this core are wound 20 turns of fine wire. 36SWG is suitable but not critical. More turns give greater sensitivity, heavier gauge wire will cope with higher power. For QRP operation this will handle 10-20W of RF. The winding is terminated in a 47Ω resistor. One side is taken to chassis and the other to a 1N4148 diode, or similar, **Fig. 4**. The 10nF capacitor removes any remaining RF, and then a 47kΩ potentiometer, to a 100µA meter, which will show about half scale on 10W on the 40m band. The variable resistance acts as a sensitivity control.

It has been suggested that UR67/RG8 coax inner be used for the primary winding, but I found that it would not fit through the hole in the toroid. I tried lubrication, but none had any effect, Cider, Gin, Scotch, nothing! A larger ferrite core, such as the Jaycar would suit, but the Amidon core is quite acceptable.

Do not discard the removed coaxial outer braid, it will be useful for a low impedance flexible connection in some future, as yet unspecified, project.
www.spirat.com.au/vk5zvs/pic53.htm

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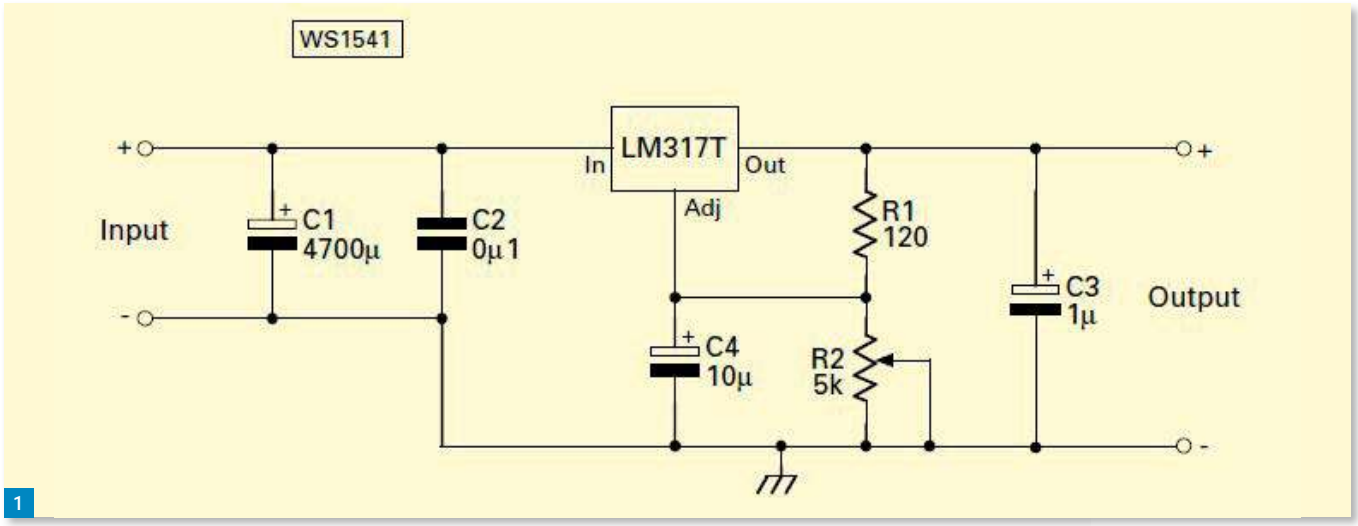

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# Warts & All Revisited

**Lee Aldridge G4EJB** returns, this time with a series of articles based on the PW contributions of the late **George Dobbs G3RJV**.

**Lee Aldridge G4EJB**
leeG4EJB@outlook.com

Having purchased a copy of the *Carrying on the Practical Way* CD-Rom from the *PW* website (below) a while ago, I knew there would be numerous gems to be found. The index gives links to each month's article but sadly there's no index of contents.

**www.radioenthusiast.co.uk**

Anyone who is a member of the G-QRP Club and has purchased a copy of Sprat-on-DVD is aware of the great work by **Bill Hulley K7WXW** in compiling and updating the comprehensive index. Inspired by that, I started to put one together for the CotPW CD. It was a shame I hadn't read something else properly on the G-QRP website. There's a link to **Tim Ostley G0MZP's** website where there is a very good index based on text by G4EFE for CotPW. So, my index came to a halt but I had an appreciation of just how much George had contributed to *PW*.

**www.m0czp.uk/copw.php**

It was obvious that numerous articles by George would readily improve my station. I have chosen a project, built it using currently available components and added what else I did, for better or worse. So, let's revisit some of the great work done by George, as a small tribute for so much given.

*Warts and All* was published in *PW*, February 2001. George covered power supplies and fixed regulators (well worth a read) and then went on to describe his take on an article originally by **Fred Bonavita W5QJM**. The idea appealed to me because my home-built variable power supply suffered from transformer hum (probably the transformer laminations and it may have been primarily intended for 60Hz supply), made worse by being enclosed in a metal case. The metal case was quite a bit larger than required for the power supply and I really wanted the case for another project. Salvage is a speciality at the G4EJB station.

George wrote in his article, *"The diagram,* (**Fig. 1** here), *shows a suitable regulation and filtering circuit for a WW* (Wall Wart - **ed**.) *supply. I used a 12V DC, 1A, version in this circuit.*

***"Warning:** Remember to check that the unit **does give out a DC voltage** as a few of them deliver AC voltages.*

*"Additional smoothing is provided by a 4700µF electrolytic capacitor. (My unit was sealed so I did not know what capacitive smoothing was already provided). The 4700µF choice proved to be very adequate and I have used it in a variety of applications without any apparent hum.*

*"The regulation is provided by the LM317T as already described in this article. This allows for adjustment of the output voltage to the level required. Adjustment is by way of a 5kΩ preset type of variable resistor. I bypassed the control with C4 to provide additional smoothing and C3 provides better regulation across a variety of loads".*

I found an old 19V 3.43A power supply, **Fig. 2**, in my box of wall warts and supplies. (Well, actually it's not quite a Wall Wart but it wasn't earmarked for any other projects). I thought it was a switched-mode supply and probably an old laptop battery charger. First, I visually checked the case of the supply and mains lead before plugging in. Then I checked with my DVM that the supply provided DC. It showed 19.2V. Then, with the DVM on the lowest AC range I checked there was no detectable AC present. I then put my old scope (with probe) across the supply again looking at very low voltage levels for any unwanted output. There didn't appear to be any unwanted products present on a 20m receiver connected to the 20m dipole in the garden. (With hindsight, my MW and SW receivers with their integral antennas would probably have been a better choice in the shed).

## A word of Caution

Do make certain the supply used has a current rating in excess of that required for your variable supply requirements. The last thing you want is the supply overheating or worse.

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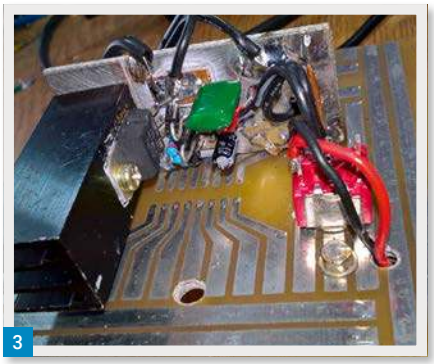
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**Fig. 1: Circuit diagram from G3RJV's 2001 article. Fig. 2: Old PSU used by the author as a basis for experimentation. Fig 3: Regulator board and heatsink without 4700µF capacitor. Fig. 4: Variable supply with voltmeter panel.**

I salvaged the Manhattan-style regulator board out of my old power supply, **Fig. 3**. I added a 4700µF capacitor across the input of the board just as George recommended. The board also had reverse voltage protection courtesy of a couple of diodes see:

**https://tinyurl.com/hueyurs**

The LM317T is directly bolted to the heatsink and fixed to the regulator board. Note that the heatsink is isolated from the ground plane because the tab on the regulator is the same connection as the regulator output pin. The reason for the heatsink is that, particularly at low voltage, the LM317T has to dissipate a fair amount of heat effectively derived from:

Dissipated power (as heat) = (Input voltage – Output voltage) x current drawn

Note the LM317T IC can handle up to 1.5A current.

## Further Notes

Some further notes from George's original article: *"In use the LM317 IC has a voltage drop of 1.8V, so the maximum available output voltage is the input voltage less 1.8V. A 0.1µF capacitor, wired close to the input of the regulator is essential if the device is mounted further than 150mm (6in) away from the smoothing capacitors. It can also be useful, in the interests of stability, to mount a larger capacitor, say 1µF, across the output of the regulator chip".*

In my version, I'd fitted a 10µF 50V capacitor across the output. I can't remember why. I also added an LED as the input supply indicator. It was connected to the input of the regulator via a series resistor derived by:

R (in ohms) = (Input voltage – LED operating voltage) ÷ LED current (say 10mA)

19.2V – 2.2V (for the blue LED used) = 17V

17 (V) ÷ 0.01 (A) = 1700Ω

I used two 3300Ω 1/4W resistors in parallel. (One 1/4W resistor would have been sufficient as the power dissipated, V x I = 0.17W).

The unit was built and the output voltage range checked with the DVM, from under 2V to over 17V DC. Finally, I looked at the output on my old oscilloscope. It appeared clean, ready to use. I even put some pencil marks on the front panel for approximate output voltages although it's a good idea to re-measure the voltage after an adjustment. I decided to order one of those 3-digit voltmeter panels for about £1 from far-away. A few weeks later it arrived and was fitted very simply on to the front of the unit with a couple of sticky pads and self-tapping screws. I connected the panel to display the output voltage before the isolation switch, **Fig. 4**. I checked its accuracy against my DVM. It was good enough for me. But do note, I didn't carry out any further tests – this would come back to bite me.

On reflection, the three-wire option 3-digit voltmeter panel may have been better than the two-wire I purchased because I could have powered it from the regulator input and not have had issues with the panel's display and very low voltages. It's called delayed intelligence.

## And a Postcript

As for the testing issue with the panel fitted, everything appeared fine as I had tested numerous boards using the variable supply without any apparent issues. Then one day I connected my 40m Pixie CW transceiver to the variable power supply. I switched the supply on and there was a squeal coming from the headphones. I wondered why the audio appeared unstable. Anyway, after dismantling the little radio, checking all kinds of possible avenues for instability, even (I embarrassingly admit to) removing components, I tried a 12V wall wart supply that was to hand. The sound emitting from the headphones changed – that was a surprise. Time for the old Maxon linear regulated power supply. No strange noises, the Pixie receiver was fine. Yes, the receiver is as wide as a barn door and I should have known better. My oscilloscope showed very low-level high frequency pulses on the output of the variable supply. This appeared to be generated by the voltmeter panel. I've tried to lessen the HF with capacitors and a ferrite ring but to no avail...so far. So even after the fun and games, the variable supply does regularly get used for circuit testing but I'm more aware of its limitations.

A couple of days after the initial project build, one of my neighbours – knowing I collect recyclable artefacts (junk) – kindly gave me an old laptop power supply. It was exactly the same as the one I'd used in the project – I just couldn't believe it. (I think George would have).

Anyway, the final words from G3RJV: *"The idea has been around for a long time before I got round to trying it...but I will make more of these modified Wall Warts. Have a go yourself!"*

# A Bridge to the Revised Advanced Licence

**Tony Jones G7ETW**
Charles.jones125@yahoo.co.uk

**Tony Jones G7ETW** addresses the gap between the old Intermediate and new Advanced licence syllabuses.

The target audience for this article is very specific: amateurs who got their Intermediate licences under the old syllabus and now want to study for and take their Advanced.

(As in my previous articles, I'm using 'Foundation', 'Intermediate' and 'Advanced' as shorthand to refer to syllabuses, exams and amateurs as the context requires.)

In essence, Foundation and Intermediate have become harder in order that Advanced could become (relatively) easier. How? The new syllabus gently introduces advanced concepts at Foundation and Intermediate, better preparing students for their Advanced.

Which is fine, except for old-syllabus Intermediates. These amateurs learned the required syllabus and passed their exams, fair and square. No fault of theirs, they've fallen behind because the new syllabus assumes Intermediates know things these amateurs weren't even taught.

That's where I come in. By doing a bit of self-learning Intermediate readers can catch up. This article does not try to cover everything – my aim is to tell you what to study.

## Digital Signals

The treatment of digital signals is the biggest change in the new syllabus. I covered this level by level for teachers in an article in the July 2019 issue, but here are the bare bones of it.

Analogue waveforms, when sampled by computing devices, become digital data.

Digital devices perform mathematical operations called Fourier transforms to sift the incoming waveform into component frequencies. Time and Frequency domains are graphical ways of representing this.

An Analogue-to-Digital converter (ADC) measures amplitude values at a constant sampling rate and produces a stream of discrete values that get stored in binary. For minimally accurate reproduction there is a minimum sampling rate (the Nyquist rate), which is just over twice the highest frequency in the input.

A Digital-to-Analogue converter (DAC) takes stored binary values and creates analogue values. These are close approximations to the original analogue values. The rate needs to be the same as the sampling rate.

Direct Digital Synthesis is the term for how computing devices can generate analogue signals from scratch. A look-up table of sample values is used. See **Fig. 1**, which shows a pretty rough sinewave created this way.

Filters in digital radios are pieces of computer code and can perform much better than 'real world' analogue filters because it's all essentially just maths.

One last thing - when digital data is transmitted and received, the actual RF is produced by analogue processes. It has to be – a power amplifier is an analogue device!

See **Fig. 2**, a simplified block diagram of a Software Defined Radio.

## Wide and Narrow Deviation

Despite being in the Intermediate book, Modulation Index is not in the Intermediate syllabus. An FM signal of 3kHz audio bandwidth with less than 2.5kHz deviation (for example, a 12.5kHz channel on the 2m band) is called 'Narrow band' and one on 70cm (25kHz channels) with 5kHz deviation is 'Wide band'.

## Tuned Circuits: Resonance, Selectivity (*Q*), Cut-Off frequencies and Bandwidth

At resonance, capacitance and inductance result in same value but 'opposite' reactance values, which cancel each other out resulting in a circuit that is purely resistive. See **Fig. 3**, which shows the response of a filter. At resonance the impedance peaks, so this is a parallel-tuned circuit.

From the resonant frequency, if we come down the (power) curve on each side, the amplitude falls steeply away. At points A and B the amplitude has dropped by 3dB – these are known as the 'cut-off frequencies', and the 'bandwidth' (or '3dB bandwidth') is the difference in frequency of these points.

The 'selectivity' of a tuned circuit is its ability to pick out a narrow range of frequencies. This filter has a narrow peak so its selectivity, denoted by '*Q*' is high.

Selectivity is defined as bandwidth divided by resonant frequency. This is Hertz divided by Hertz so it has no units.

Anyone who has ever used a magnetic loop antenna, **Fig. 4**, already knows the effects of *Q*. When tuned to resonance these are very sensitive, but the bandwidth is very narrow. This is an example of a high-*Q* application.

## Isotropic radiators, dBd and dBi

An 'isotropic radiator' is a point in space radiating energy equally in three dimensions. It's a concept only; you can't build one. A dipole radiates off the side of the wire, **Fig. 5**, but not off the ends. So, compared to an isotropic radiator a dipole has modest 2.15dB of gain, expressed as 2.15dBi to include the base (isotropic) reference.

A dipole obviously has no gain over a dipole, so the gain is 0dBd. A Yagi with 8dB gain compared to a dipole has 8dBd of gain, which can be expressed as 10.15dBi.

Antenna manufacturers like dBi – the numbers are bigger!

## Switched Mode Power vs Linear Power Supplies

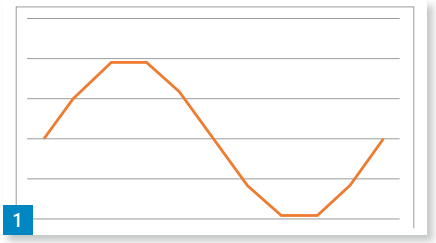
Switch mode PSUs are smaller, lighter, more efficient (so run cooler), and more flexible in terms of input mains voltage, but they can generate RF interference.

Traditional (or 'linear') power supplies are more robust and RF-free. Having repaired a few PSUs in my time, I know which I prefer!

## Yagis: Front-to-Back Ratio and Beamwidth

We think of Yagi antennas as forward-looking things, but they also receive and transmit backwards along their axis – just not as well. The ratio of the forward to backward gain is the 'front-to-back' ratio.

This is confusing. Say an antenna has forward gain of 9dBd and backward gain of 3dBd. 9dBd divided by 3dBd gives us a front to ratio of 3.



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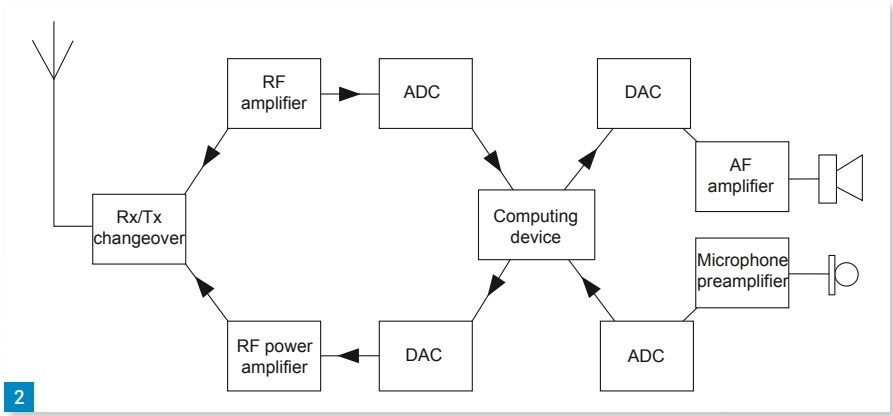


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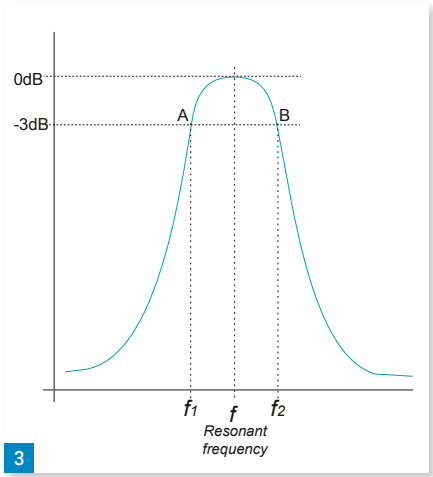


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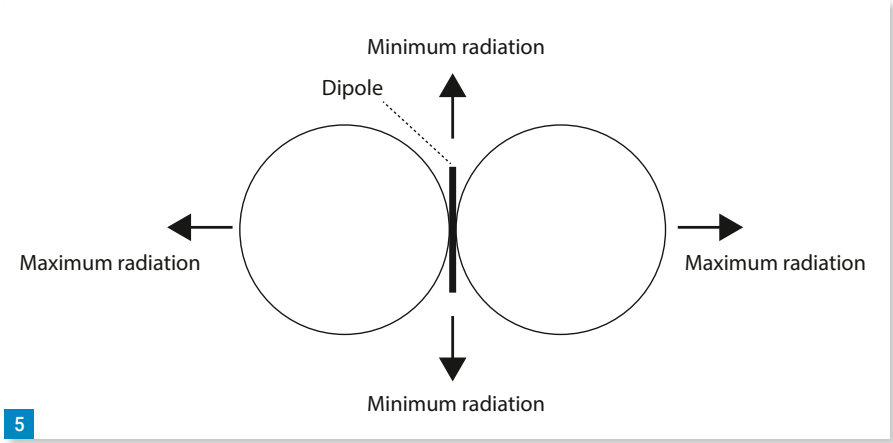


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Really? Er...no. That's spectacularly not right. Decibels are a logarithmic measure, so they add and subtract rather than dividing.

9dB equates to a gain of 8, and 3dB is a gain of 2. So, the ratio of the gains is 8 divided by 2, which equals 4.

To do this without converting to 'real' numbers, we subtract the dB gains. 9dB minus 3dB is 6dB (equals 4 times gain). I have not missed out the 'd' incidentally – this is a pure ratio.

Yagi 'beamwidth' is another new concept. The power radiated can be measured at different angles from a central axis. The −3db points can plotted on a chart. The beamwidth is the angle between them, **Fig. 6**.

## Antenna placement on vehicles

Under EMC– not Safety, nor Propagation – this is a new feature. Depending on where on a vehicle an antenna is sited, the electrical field strength inside the vehicle may be more than the vehicle's electronics can cope with. This interference (from the car's point of view) could cause problems to essential electronics such as engine management computers and braking systems.

## Integrated Circuits

Since the 1950s silicon devices and other components have been implemented as whole circuits on a common substrate making up 'Integrated Circuits'. Put simply, the modern world could not exist without them.

The photo, **Fig. 7**, shows an LM386 circuit. With very few external components, a complete audio amplifier can be built.

## Use of'general coverage receivers'

When investigating transmitters – bearing in mind that Intermediates may legally build transmitters – sometimes it's necessary to hunt for harmonics. General coverage receivers are a good tool for this job, the syllabus says.

The syllabus must have HF in mind here because 'general coverage' receivers don't routinely cover the spectrum above 30MHz. To find the harmonics of a UHF transmitter I'd need a receiver reaching into the gigahertz region – hardly a 'general' piece of equipment.

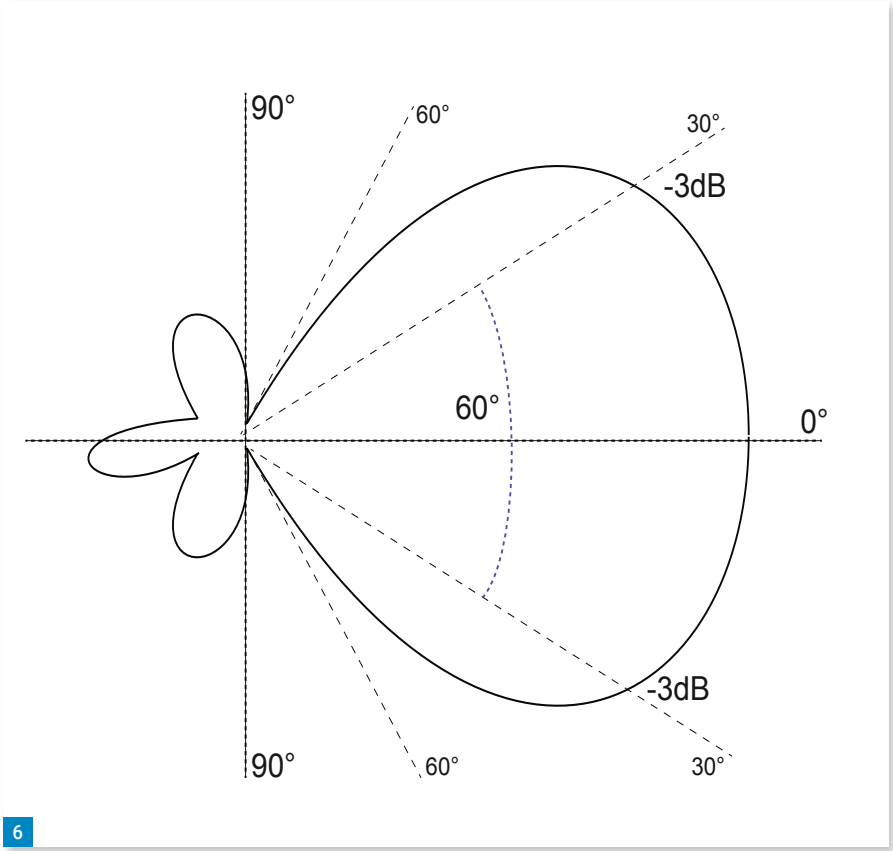
## Lightning Arrestors

Protection to antenna systems can be provided by using lightning arrestors. These usually have an ionisable gas link, which passes a current only when lightning strikes, providing a low-resistance path to earth and so protecting equipment.

## Batteries

Vehicle batteries are a hazard because they can provide huge currents and potentially start fires. I can attest to this: I had some gardening tools fall on my Mini estate's battery once, and had to put out a small fire!

**Fig. 1: A rough sinewave generated from digital sampling. Fig. 2: Block diagram of a software defined radio. Fig. 3: Response of a parallel-tuned circuit. Fig. 4: Typical magnetic loop antenna, this from PW advertiser G4TPH. Fig. 5: Radiation pattern of a half-wave dipole antenna.**

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When under charge 'explosive hydrogen' (is there any other kind?) is given off, so good ventilation is required.

## Conclusion

There you have it. Digital signals aside, I think many pre-2019 syllabus Intermediates will find they've already have learned most of the new Intermediate topics from their activities in the hobby.

So please don't let the change in the syllabus hold you back. With a little bit of revision, 400W awaits...

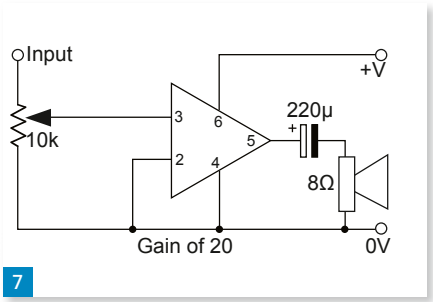


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**Fig. 6: Beamwidth of a Yagi antenna. Fig. 7: An LM386 integrated circuit audio amplifier.**

# News Extra

**BEETHOVEN CELEBRATION:** German special event station DL250BTHVN is active until December 17th 2020 to honour the 250th anniversary of the birth of famed composer Ludwig van Beethoven. The Beethoven anniversary year will take place under the auspices of Germany's Federal President Frank-Walter Steinmeier. Beethoven was born in December 1770 in Bonn, Germany, and lived there for the first 22 years of his life. The anniversary event is aimed in part at highlighting Beethoven's extensive oeuvre as a composer and to boost Bonn's reputation as a 'Beethoven city'. QSL via direct or by the bureau.

**OPS-SAT:** The European Space Agency (ESA) is challenging radio amateurs (or anyone with appropriate receiving equipment) to hear the first signals from ESA's OPS-SAT space software laboratory. The spacecraft was set to launch on December 17th into a low-Earth orbit from French Guiana. Once in orbit, the satellite will deploy solar panels and a UHF antenna and begin transmitting.

OPS-SAT will begin transmitting 15 minutes after deployment and after UHF antenna and solar array deployment has been confirmed. The OPS-SAT flight control team has developed open-source software that allows anyone to receive and decode the UHF beacon on 437.2MHz, 9.6kB GMSK. An OPS-SAT UHF beacon reception form is available to report. See the OPS-SAT Amateur Radio Information Bulletin page additional details:
https://tinyurl.com/ttuke8k

**IC-705 QRP SDR TRANSCEIVER UPDATE:** Icom UK have provided more information about the availability of the recently announced IC-705. Their press release says: There has been massive interest around the world about the new IC-705 QRP SDR transceiver since a concept model was shown at the Tokyo Hamfair 2019.

This new portable HF/VHF/UHF has many great features. Some of these are: an SDR platform, internal battery, GPS, Bluetooth and D-STAR, all in a compact and lightweight body. The Icom IC-705 uses the same 4.3in colour touchscreen display as in the IC-7300 and IC-9700 featuring real-time spectrum scope and waterfall display. Ian Lockyer, Marketing Manager of Icom UK said, *"We promised to keep everyone up to date with the latest news about this much anticipated radio. Yesterday Icom put a statement on their website with a projected home market release date of April 2020. At present, we have not had a production schedule for this model for outside of Japan but we expect it follow very soon. We anticipate a price of around £1000.00, excluding VAT, but that is subject to confirmation"*. He added, *"If you want more information about this model, please click on this downloadable pre-release leaflet:* https://tinyurl.com/y4mrnvk6 *"There is also a video about the 705, which we published earlier this year on our YouTube channel. You can view this by clicking on the following link":* https://tinyurl.com/yx42om2v Ian finished by saying, *"Demand for this model is proving to be exceptionally high, so get into contact with your authorised Icom Amateur radio dealer now to get your name down and avoid disappointment"*

# 4U1UN Active Again

Despite variable propagation, **Steve Telenius-Lowe PJ4DX** reports that the HF bands were buzzing with activity in late 2019.

**Steve Telenius-Lowe PJ4DX**
teleniuslowe@gmail.com

Welcome to the February *HF Highlights*. The big news this month is that the United Nations Headquarters Amateur Radio Club station at UN HQ in New York, 4U1UN, **Fig. 1**, is back on the air. Other than a few short bursts of activity the station, and thus this DXCC entity, had been off the air for many years because the room where the station was located was no longer available for amateur radio activities. 4U1UN counts as a separate DXCC entity due to the very special status of UN HQ in New York. As far as I am aware recent activity by 4U1UN started on November 27th on 40m SSB and thereafter they have been on the air regularly. So far I have been lucky enough to work 4U1UN on 40m SSB and CW and on 20m CW. The operator has frequently been looking specifically for contacts with either Asia or Europe, so listen to the operator's instructions and a contact with this unique DXCC entity should be quite easy once the initial pile-ups have died down.

## Look Out For...

As well as 4U1UN, look out for E44C from Palestine from February 5th to 17th. The F6KOP team will be active from Bethlehem with 15 experienced European operators using 10 to 160m on CW, SSB and various data modes. The F6KOP team is the group that operated as 9LY1JM from Sierra Leone in January last year, making over 50,000 QSOs, so you can expect a good show from Palestine.

palestine2020.wordpress.com

The Italian DX Team is also on its travels again in February. Look for them signing 5I5TT on SSB, CW and RTTY, and 5I4ZZ on FT4 and FT8 from Zanzibar island (IOTA AF-032) in Tanzania between February 4th and 18th.

## Solar Cycle 25

On December 9th an international panel co-chaired by the US government's National Oceanic and Atmospheric Administration (NOAA) and NASA released a new forecast for Solar Cycle 25. See **Fig. 2**: the forecast is for the new cycle to peak in July 2025 (plus or minus eight months), with a smoothed sunspot number (SSN) of 115. The panel agreed that Cycle 25 will be average in intensity and similar to that of Cycle 24. The panel concurred that the solar minimum between Cycles 24 and 25 will occur in April 2020 (plus or minus six months), which ties in closely with the Australian prediction reported in this column last month. If the solar minimum prediction is correct, this would make Solar Cycle 24 the seventh longest on record at 11.4 years.

https://tinyurl.com/sv52bds

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## Readers' News

**Reg Williams G0OOF** wrote *"I have worked very few stations this month... My best DX was the VK9CZ DXpedition on the Cocos (Keeling) Islands* (**Fig. 3**)*, towards the end of their time there, a good time for less-embellished stations to work a DXpedition. I had the DX Cluster on the PC screen during an early afternoon, not taking much notice as I was doing other things. Came back some time later and VK9CZ was being spotted by stations in Europe. This was on 14185kHz SSB, split. Not very strong with me but thought I would give it a try. Wow, just a few minutes of calling and a contact was made. 150W to a 20/40m wire dipole. As always a 59 report exchanged but in reality at best my report to the operator would have been 53 with some QRN. The following day I checked the Club Log site for the DXpedition's log and the contact was confirmed. I have only worked two other stations of note... 9G5W [on] 20m SSB, ZD7FT [on] 17m SSB."*

HF DX conditions proved so bad in early November, that on the 5th, **Victor Brand G3JNB** resorted to his long-neglected PSK31. After sorting out the inevitable soundcard and port number snags, he wandered around EU on 40m just chatting. But, on the 6th, checking out 20m, Victor saw **HS0ZJK** Thailand calling CQ. It took four tries to connect with his 20W and vertical but a splendid 'ragchew' with **Eric** was logged eventually. *"I stayed with PSK and on the 8th **RW9OB**, another **Victor**, and **Alex UA9YIY**, both in Asiatic Russia came back strongly,"* he said. *"With the approaching CQWW contest came a host of DX stations and I was delighted to work 5N7Q, 9G5W and PZ5W on 17m, and on 40m YD1SDL/2 in Java, PJ5/SP6EQZ, D4Z and 5N7Q. I queued on 20m for ZD7W St Helena but he changed bands before I got through. But, on both days of the actual contest, the 'A' index jumped from 2 to 12 and I lost the ability to connect to audible DX stations, including BY3GX, FR4NT, PX4A and 5N7Q. Monday morning and those peculiar conditions prevailed until mid-afternoon, when on 17m, I could copy Mauritius where **Dave Sumner**, ARRL's retired CEO, was operating as **3B8/K1ZZ**. Fortunately, he heard me before going QRT. But, by 5pm, the giant diode in the sky was back and I was receiving strong CQs from PZ5W on an otherwise silent band and, yet again, they were hearing nothing from any caller. Thankfully, the 'A' index dropped to 5 on the 26th and 9G5X responded to my first call on 20m, as did JT1CO on 40m. Somewhat reluctantly, on the 30th I downloaded WSJT-X for FT8: if you can't beat 'em, join 'em!"*

**Kevin Hewitt M0GTD**, better known to readers of this column as ZB2GI, says *"I spent all of November in England, returning to the Rock yesterday. I only operated HF to get a few familiar callsigns in the log."* Using a Kenwood TS-570 at 100W to a 20m dipole Kevin worked ZB2BU and ZB2JK on 20m SSB and ZB2BU also on 20m WSPR.

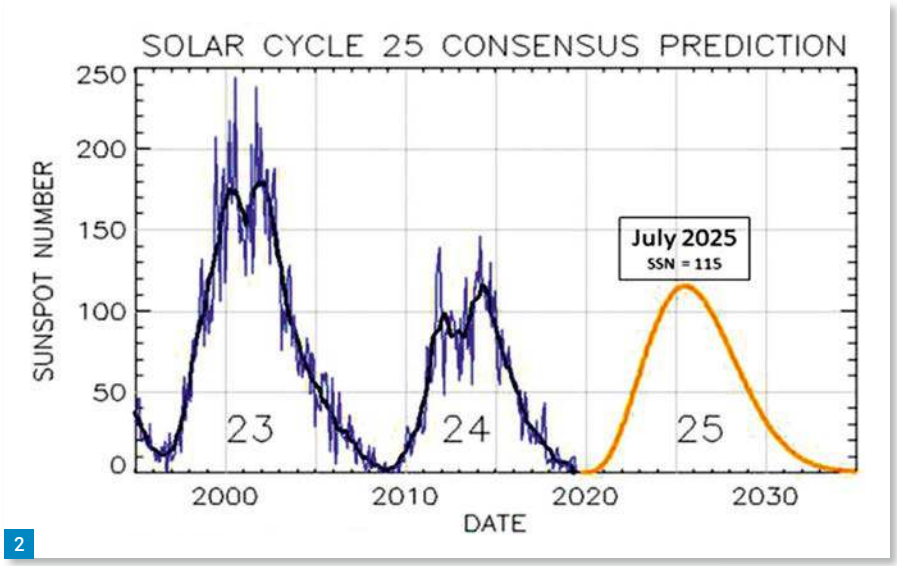
**Etienne Vrebos OS8D & ON8DN** recently had a problem with his Icom IC-7851 and has traded it in for a new IC-7610 and a Yaesu FTdx5000MP. He also has an FT-891, which he uses portable: *"Today I went outside as OS8D/P with my FT-891 and 50W and the vertical antenna in a world-wide very well known place, the Atomium in Brussels,* **Fig. 4**. *Bad conditions, only a few QSOs made, but the place was great, controlled three times by the police, and a lot of tourists from Indonesia and Japan were very eager to know what I was doing. It took me more time to explain HF radio than*

**Fig. 1: The DXCC entity of United Nations New York made a welcome return to the airwaves in November in the form of 4U1UN.**
**Fig. 2: Joint NOAA/NASA prediction for solar cycle 25 (courtesy NOAA Space Weather Prediction Center).**
**Fig. 3: Oceania House, the Victorian mansion on Home Island in the Cocos (Keeling) group in 1988. In the background, to the left of the house, can just be seen the 70ft tower that supported the antennas of resident operator Cressett Thursby-Pelham VK9YC in the 1980s.**
**Fig. 4: Etienne OS8D/P on the air from the well-known Brussels landmark of the Atomium.**

*making QSOs."*

**Tony Usher G4HZW** reckons that *"Ten metres was as bad as I've known it for much of the period, with no responses to CQ calls. However, it opened up on November 30th and December 1st when a multitude of EU stations appeared* (**Fig. 5**). *No DX for me but I noticed VK stations working as far as the Netherlands... At around 1500GMT [on December 1st] 10m opened up to North America and I worked four American stations. Apart from that the only excitement came on November 17th when 5R8VX came back to a CQ call. We swapped reports successfully before he vanished... In the quiet periods on 10m I had a look on 40m and found the band to be open 24 hours a day. I even managed some JAs with the vertical but its limitations are becoming apparent. Other, obviously better-equipped, G stations were working KL7 and KH6 with good reports; I couldn't even 'hear' them! Still, it's only ham radio – no-one dies!... I see there are moves to offer a beginner's licence to try and encourage more younger people into the hobby. Good luck with that, it's the same in amateur ornithological circles!"*

**Chris Colclough G1VDP** reckoned that *"Conditions were variable, some days I could hear and decode just about anywhere on 20m with both USA and Asia being heard, then others it was as though the band had been turned off. When on FT8/FT4 I mostly call CQ and get surprising replies, sometimes with rare DX stations calling in before they get their own pile-ups. Another bit of personal fun has been chasing my guilty pleasure of special event calls, and this time round it has mostly been the Belgian 18th birthday stations for Princess Elisabeth. A lot of the CW contacts were for new band slots, or new DXCC on that mode, especially around the Caribbean and Africa... I guess the real highlight of the month was 10 and 12m opening on November 30th and then again*



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Enter our competitions at www.radioenthusiast.co.uk/competitions

**Fig. 5: Who says 10m is dead? Contacts made by Tony G4HZW on November 30th using FT8.**
**Fig. 6: Platinum certificate awarded to Paul G1OVK for gaining 110 points in the Belgian special event celebrating the 18th birthday of Princess Elisabeth.**

*on December 1st. Not great DX but it was nice just to work a few on these bands... A couple of new IOTAs for me too."*

**Terry Martin M0CLH** contributed *"A fairly lengthy log this month as it contains my small foray into the CQWW CW contest"* and he observed *"The propagation is there if the stations are!"* – exactly as I found in the CQWW Phone contest a month earlier when 21MHz, apparently 'dead' much of the time, was filled with literally thousands of stations.

**Carl Mason GW0VSW** reported that *"There has been a good deal of DX around, especially on 20m, but unfortunately for me not so strong. I have managed a few more interesting contacts this month and even a few with just 1W. I even had a 55 report from Northern Ireland when I forgot to up the power a bit. I don't use SSB often!"*

**Paul Beard G1OVK** has *"had fun chasing the Belgian OR18 awards* [to celebrate the 18th birthday of Princess Elisabeth, Duchess of Brabant, the heir apparent to the Belgian throne – *Ed*] *and this morning I received my Platinum award,* **Fig. 6**. *It may not be DX but it was an enjoyable challenge to do. In order to get the final few points I needed, I had to take the plunge and set up FT8, and I'm so pleased that I did because FT8 has not only helped gain the OR18 award but also several new countries in the first few days (Japan, Cuba and Belize). San Marino was another highlight on 40m SSB."*

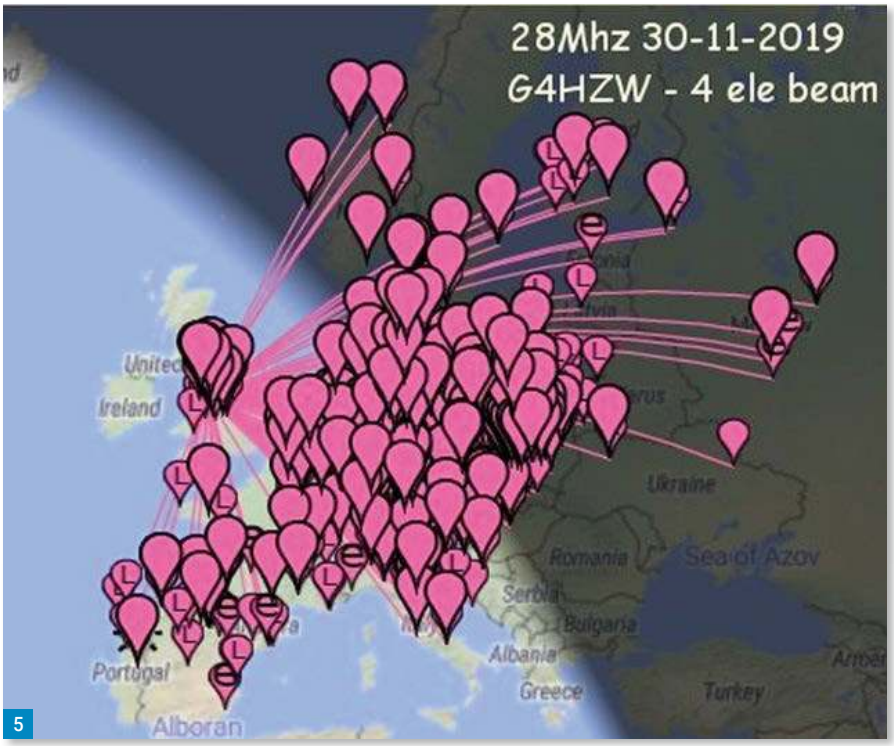
## Around the Bands

**Etienne OS8D & ON8DN** made *"about 130 QSOs this month"*, **7MHz SSB:** PJ5/SP6IXF, VY0ERC, W7WA. **14MHz SSB:** 4U1WB, 5N7Q, 5T0AA, 8P5AA, 9G5W, JA3AOP, KP4WQ, UN7ZAF, VK9CZ, YS/HR4GOO/P. **18MHz SSB:** 5R8KU, 6W1PZ, 9Z4Y, PJ5/SP6IXF, TI8II.

**Tony G4HZW – 7MHz FT8:** 9Y5DG, A60ND, CO8RCP, HC2AO, HI3CMM, J69DS, five JAs, LU6PK, N7TR (NV), P40C, PJ5/SP6IXF, TF5B, UK7AL, W7AL (ID), ZA/IK2RLM. **28MHz FT8:** 5R8VX, KK8X, NF1G, W2MGF, WA2HMM.

**Chris G1VDP** sent in a log of no fewer than 546 stations, of which this is by necessity a much-edited selection: **7MHz SSB:** OR18RSX, PJ5/SP6IXF. **7MHz CW:** 3B8M, 9Z4Y, C6AGU, LY2019XMAS, MU2K, PJ2T, T6A, TA0/R7AL, TA0/RK8A, TI7W, W1WEF, ZF1A. **7MHz FT4:** 9Y4DG, KX1X. **7MHz FT8:** HC2AO, J88HF, PP5ZP. **10MHz CW:** C6AGU, TM33EUDX. **10MHz FT4:** JA3FYC, JJ2LPV. **10MHz FT8:** C4XMAS, OD5ZF, T6AA, VK3FT, YV5KAJ. **14MHz SSB:** ZS9YOTA. **14MHz CW:** 6V7A, 9G5W, C6AGU, D4CC, K7BX/VP9, PJ2/NA2U. **14MHz FT4:** XT2BR. **14MHz FT8:** JA6EKM, K6JDC, NP4JL, PJ5/SP6IXF, R9CS, T6AA, TO9W, UN7FU, VA3LKI, VK6GC, VK9CZ, YC2SBO, ZL3IN. **18MHz CW:** 3B8/K1ZZ. **18MHz FT4:** XW4XR. **18MHz FT8:** 8P2K, 9G2HO, A41KB, AA8WZ, E2OH, FR5DZ, HI8S, OX3HI, PJ5/SP6IXF, UN8PC, XT2AW, YB9AY. **21MHz CW:** DR1A. **21MHz FT8:** 5N7Q, WO2T. **24MHz FT8:** HF9D, ZS1DX. **28MHz FT8:** Numerous Europeans.

**Terry M0CLH – 7MHz CW:** 4L8A, HF50MOON, UP0L. **7MHz FT8:** 5H3UA, UK8AEA. **10MHz CW:** S01WS, TM33EUDX. 10MHz RTTY: 5N7Q. **10MHz FT8:** LZ365BM, N1NK, T6AA, TA9J. **14MHz SSB:** LZ4408SPA. **14MHz CW:** 3V8SS, 5H3UA, C56XA, C6AGU, FM5BH, K0ZR, LZ4408SPA, PJ2/NA2U, PJ2T, PJ4K, PJ5/SP6EQZ, RZ9YI, T6A, TC0F, V26K, V47T, VE3EJ, VK9CZ, XL3A. **14MHz FT4:** AA4M, K0IR. **14MHz FT8:** KY0R, PJ5/SP6EQZ, PJ5/SP6IXF, PY7XC/PY0F, TO9W (=PJ7), VK9CZ. **18MHz SSB:** 5N7Q, PJ5/SP6IXF. **18MHz CW:** PJ4/K4BAI, VE3EJ, YN2CC. **18MHz RTTY:** 5N7Q. **18MHz FT8:** 5H3UA, 9Y4DG, K6BY, VE3EK, WP4G. **21MHz CW:** 3B8M, CN3A, CT9/OM2VL, EA8/IK1PMR, HI3CC, NR4M, PJ4K, PZ5W, TC0F. **21MHz FT8:** K0DEQ, PZ5RA, XZ2D.



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The log from **Carl Mason GW0VSW** is all QRP, using 1 to 5W: **3.5MHz CW:** LY110A, OH1NAVY. **7MHz SSB:** DC8YZ/P (SOTA DM/BM-374), MI0YBH (1W QRPp). **7MHz CW:** 9A01GPPVC, EA8/DL2DXA/P, OZ/DL6AP/P (LH DEN102). **10MHz CW:** LZ4408SPA, SX2I. **14MHz SSB:** T77LA. **14MHz CW:** 4Z5AD, 5B4AMM, 7X4AN, EA8/HB9FIH, TC0F, ZB2FK. **18MHz SSB:** LZ365BM. **18MHz CW:** 9G2HO, CT9/DL5AXX. **21MHz CW:** SM5COP. **24MHz CW:** OE4VIE.

**Paul G1OVK – 7MHz SSB:** 4Z5UN. **7MHz FT8:** 5B4AGU, JF1OCQ, KG4JOK, V31MA. **10MHz FT8:** 5T5PA. **14MHz SSB:** EA9KB, T77LA. **14MHz FT8:** CO8LY.

## Signing Off

Thank you to all contributors. Please send all input for this column to teleniuslowe@gmail.com by the 11th of each month – photographs of your station or activity would be particularly welcome. For the April issue the deadline is February 11th. 73, Steve PJ4DX.

# The Eleventh Practical Wireless 70MHz Contest: Results 2019

Contest Manager **Colin Redwood G6MXL** has the results of the 2019 contest.

**Colin Redwood G6MXL**
practicalwireless@warnersgroup.co.uk

Poor weather greeted those who ventured out portable for the 11th Practical Wireless 70MHz Contest on Sunday September 22nd 2019. The 24 (41 in 2018) entrants made a total of 505 (895) contacts with 125 (153) different stations in 21 (29) different squares, **Fig. 1**.

## Low Power Section Winner

**Steve Clements GW1YBB/P** operated from the 800m summit of Pen-Y-Gadair in the Black Mountains in IO81KW. He is the winner of the low power section. He used a Yaesu FT-817 with a UT5JCW transverter running 8W to a homebrew 6-element Yagi antenna.

## Open Section Winner

The winners of the open section are **Pauline** and **Chris Kirby G8HQW/P** in the Yorkshire Dales National Park in IO84WK. They used an Icom IC-7300 + Gemini 4m amplifier feeding a 7-element Yagi antenna.

Full details of the results can be found in the tables in this article. As usual certificates will be sent to all the leading stations and leaders in each square.

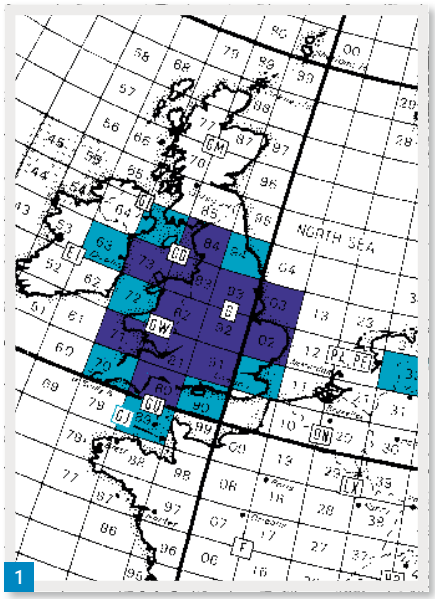
## RF Conditions

Several stations commented on the poor RF conditions. **Keith Le Boutillier GU6EFB,** who sent in the only checklog this year, says that if was not for the ON4KST chat room, he wouldn't have made any contacts.

## Weather

Like last year, the forecast of rain, wind and storms no doubt put off a number of stations from operating portable. Nevertheless, there were still some hardy souls who ventured out in what proved far from ideal conditions.

**Brian Jones M6OXO** left home in the Wirral at 07:00 BST in torrential rain for the 180-mile journey to Lincolnshire. By 15:00 an electrical storm was so close



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that he wisely threw the coax out of the car window. The storm lasted for two hours. It was 19:45 BST before the rain let up, and the field was flooded. He managed to get the antenna down and into the car in under a minute. No sooner had he done this than the rain started again. It was only when he got as far as Barnsley on the way home that the rain stopped. He got home 01:30 BST!

**Steve Clements GW1YBB/P,** who won the low power section of the contest this year, **Fig. 2**, wrote a detailed report: "*This year I was determined to operate from the 800m ASL summit in the Black Mountains to maximise my square count. The trek up was done in very low cloud (which extended all the way down to the car) but at least it wasn't raining. I got to the summit, put carry items down and took my backpack off. Then the heavens opened and it absolutely hammered down for ten minutes, easing off to just normal rain for the rest of the set-up. This was my first summit outing on 4m so no fence to rest the mast on while I built up the 4m Yagi. For 2m I can use my rucksack as it's taller than half a 2m element. I reached back into one of my old hobbies and had re-purposed a fishing bank stick and rod rest, which worked well and wasn't too much extra weight. As usual I'd over allowed time to get set up, and was ready to go three hours early. Some of this time I spent eating, some calling CQ and the odd QSO.*"

Steve continues, "*Once the contest started, initial activity was good and then slowed down to reasonably steady. Shortly into the contest the completely noise-free site developed noise to the East, which caused a little problem until the last half hour. In the last hour I noticed the clouds had cleared quite a bit and I could now see my direction aiming landmarks and that the beam had been about 15° out. Luckily a 6-element has a nice fat lobe. The last hour was quite slow going. My ethos is to never give up before the end. I was rewarded with the only non UK call from a PA in JO32 in last three minutes. On so many occasions I have got a couple of new multipliers in the last five minutes of a contest.*" Steve was the only station to work a PA station.

**Richard Constantine G3UGF/P,** having participated in the *PW* 2m contest earlier in the year, decided to give the 4m contest a try. He described conditions at his location as "*atrocious*". There was so much water in the atmosphere that the signals came and went all the time. **Fig. 3**. He suffered from poor visibility and very damp conditions! Nevertheless, he enjoyed the contest and is looking forward to making plans for next time. He concludes by saying that he likes short contests.

## Lundy Island

I don't recall ever having previously had a contest entry from Lundy Island (IOTA EU-120) in the Bristol Channel. This year **Brian Woodstock G4CIB/P** operated from the island, giving entrants a chance to work IO71 square for a useful multiplier.

## Equipment

Just over half the entrants used transceivers capable of 70MHz operation without a transverter. **Tony Wallbank G4CIZ** used a home-made 4m transceiver, a home-made 80W PA and a home-made dipole antenna.

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## Callsigns

One station lost a number of points for missing the /P off the end of callsigns for almost a third of their contacts. Otherwise logging accuracy was generally good with just a few points deducted during adjudication.

## 2020

The 12th *PW* 70MHz Contest is provisionally booked for Sunday September 20th 2020. I am expecting the rules to appear in the September 2020 issue due in the shops mid-August 2020.

## Congratulations & Thanks

Congratulations to the 2019 winners and on behalf of all entrants a big *"Thank You"* to all stations that participated.

**Fig. 1: Map showing locator squares of stations that entered (in dark blue) and other stations worked (light blue).**
**Fig. 2: Steve Clements GW1YBB/P operated from the 800m ASL summit in the Black Mountains.**
**Fig. 3: Richard Constantine G3UGF/P enjoyed the contest despite atrocious conditions.**


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| Description | Name/Team | Callsign |
|---|---|---|
| Low-Power Winner | Steve Clements | GW1YBB/P |
| Open Winner | Pauline & Chris Kirby | G8HQW/P |
| Leading Single Operator | Steve Clements | GW1YBB/P |
| Leading Multi-Operator | Pauline & Chris Kirby | G8HQW/P |
| Leading English Station | Pauline & Chris Kirby | G8HQW/P |
| Leading Welsh Station | Steve Clements | GW1YBB/P |

**Table 1: Leading Stations.**

| Square | Name | Call | No. entries |
|---|---|---|---|
| IO71 | Brian Woodcock | G4CIB/P | 1 |
| IO73 | Dafydd Ellis | MW0CHZ/P | 1 |
| IO80 | SADGITS | G4RLF/P | 1 |
| IO81 | Steven Clements | GW1YBB/P | 5 |
| IO82 | Simon Pryce | G0EIY | 2 |
| IO83 | Jeff Snowling | G1DYN/P | 1 |
| IO84 | Pauline & Chris Kirby | G8HQW/P | 1 |
| IO91 | Tony Wallbank | G4CIZ | 2 |
| IO92 | Geoff Suggate | G3NPI | 3 |
| IO93 | Ossett Amateur Radio Operators | M0ORO | 5 |
| JO02 | Fred Handscombe | G4BWP | 1 |
| JO03 | Brian Jones | M6OXO/P | 1 |

**Table 2: Leading Stations in Each Square.**


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**Fig. 4: Donna Buck M7DON operated from home – a wise move some might think!**

| Pos | Call | Name | QSOs | Squares | Score | Locator | Transceiver | Antenna | Ht. m asl |
|---|---|---|---|---|---|---|---|---|---|
| 1 | GW1YBB/P | Steven Clements | 66 | 18 | 1188 | IO81KW | Yaesu FT-817 + UT5JCW TVTR | HB 6-ele | 800 |
| 2 | G4RLF/P | SADGITS | 25 | 11 | 275 | IO80WX | Icom IC-7300 LNA | 5-ele Yagi | 260 |
| 3 | M0ORO | Ossett Amateur Radio Operators | 23 | 9 | 207 | IO93EQ | Yeasu FT-847 | 5-ele Yagi | 110 |
| 4 | G3UGF/P | Richard J Constantine | 16 | 9 | 144 | IO93AS | Icom IC-7300 | 3-ele Yagi | 450 |
| 5 | M7DON | Donna Buck | 18 | 6 | 108 | IO93KD | Yaesu FT- 847 | 9-ele Dual Band | 109 |
| 6 | G0EIY | Simon Pryce | 14 | 7 | 98 | IO82OR | Yaesu FT-897D + TVTR | 5-ele LFA yagi | 77 |
| 7 | G7WHI/P | Dave Page | 11 | 6 | 66 | IO92MN | Icom IC-7300 | dipole | 150 |
| 8 | 2E1SKY | Paul Staerck | 6 | 6 | 36 | IO93KH | Yaesu FT-847 | 4M beam | 66 |
| 9 | G4CIB/P | Brian Woodcock | 7 | 4 | 28 | IO71QD | Yaesu FT-817ND, MM TVTR | Three half wave dipole | 100 |
| 10 | M6OXO/P | Brian Jones | 5 | 4 | 20 | JO03AE | Yaesu FT-817 + TVTR | Delta Loop | 100 |
| 11 | M1AEA | Mark Waldron | 5 | 2 | 10 | IO82WM | Icom IC-706 + Spectrum TVTR | 1/4 wave mobile vertical | 219 |
| 12 | G8ZAX | Guildford And District Radio Society | 3 | 3 | 9 | IO91RF | Elecraft K3S + HB TVTR | Moxon | 100 |
| 13 | M0PJA | Paul Archer | 7 | 1 | 7 | IO93II | Icom IC-7100 | 4m vertical dipole HB | 137 |
| 14 | MW0CHZ/P | Dafydd Ellis | 2 | 2 | 4 | IO73VC | Yaesu FT-817 + Spectrum TVTR | 2-ele HB9CV | 1 |
| 15 | 2E0POE | John Williams | 3 | 1 | 3 | IO81UT | Anytone AT588 | Vertical Mobile Antenna | 30 |

**Table 3: Low Power Results Table.**

| Pos | Call | Name | QSOs | Squares | Score | Locator | Transceiver | Antenna | Ht. m asl |
|---|---|---|---|---|---|---|---|---|---|
| 1 | G8HQW/P | Pauline & Chris Kirby | 69 | 13 | 897 | IO84WK | Icom IC-7300 + Gemini 4m Amplifier | 7-ele | 672 |
| 2 | G0LGS/P | A G Stewart Wilkinson | 44 | 15 | 660 | IO81XV | Icom IC-7300 | 5-ele PowAbeam | 6 |
| 3 | G3NPI | Geoff Suggate | 41 | 13 | 533 | IO92MA | ANAN10 + Trans4M + HB MOSFET PA | 6 over 6 LFA Yagi | 113 |
| 4 | G2HX/P | Gloucester Amateur Radio & Electronics Society | 36 | 12 | 432 | IO81WU | Icom IC-7300 Linear Amps Amplifier | 5-ele LFA Yagi | 273 |
| 5 | G3LVP | Ken Eastty | 25 | 11 | 275 | IO81WV | TS850 + Meon TVTR + 4CX 250 PA | 6-ele Yagi | 46 |
| 6 | G4BWP | Fred Handscombe | 23 | 10 | 230 | JO02FH | Yaesu FTdx101D | 7-ele | 18 |
| 7 | G1DYN/P | Jeff Snowling | 25 | 8 | 200 | IO83WH | Icom IC-7300 | OWL 3-ele Yagi | 400 |
| 8 | G3RIR | Neil Ackerley | 20 | 9 | 180 | IO92JL | Icom IC-7300 | 5-ele | 100 |
| 9 | G4CIZ | Tony Wallbank | 11 | 7 | 77 | IO91FG | HB 4m rig + HB 80W PA | HB Dipole | 130 |

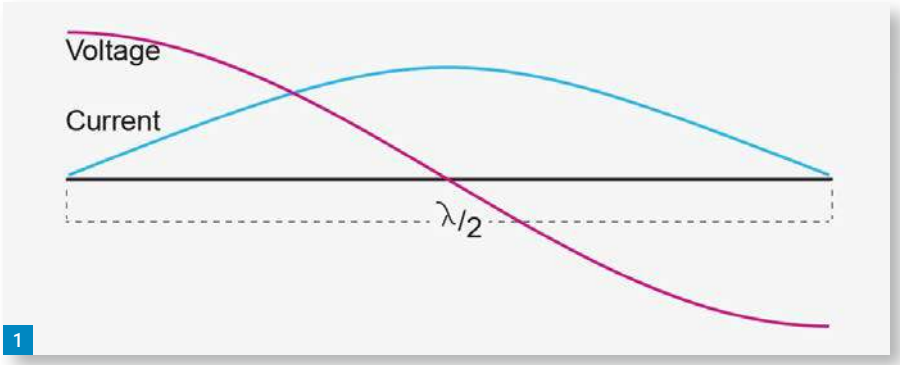
**Table 4: Open Section Results Table.**

Enter our competitions at www.radioenthusiast.co.uk/competitions

**Don Field G3XTT**
practicalwireless@warnersgroup.co.uk

# The EFHW

**Don G3XTT** takes a look at the end-fed half-wave antenna, a design that has recently come into prominence once again.



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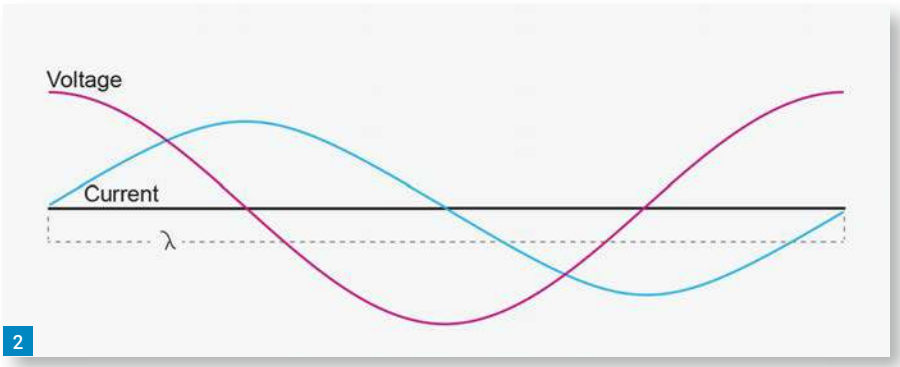

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Antennas are a constant source of interest to radio amateurs and usually because we end up having to make compromises due to space limitations, planning constraints and the like. Every home and garden is different, as are our operating interests – local ragchews, DX chasing, the bands we particularly enjoy and so on. Is it possible to find a single antenna that does everything? The popular G5RV design is often thought to do so, but was developed long before several of our HF bands were granted to us and, in any case, the impedance at the shack end of the feeder can be quite reactive, even on the bands it is intended for. This wasn't a big deal in the days of valve PAs with pi-tank output circuits that could handle a wide range of impedances. But many solid-state rigs are much more fussy and need to be protected from high VSWR by using an external antenna tuning unit.

## The End-Fed Wire (EFW)

One solution to multibanding of antennas that has become popular in recent years is to end-feed your longwire antenna (longwire implies a somewhat random length, not necessarily resonant on an amateur band) through a 9:1 UNUN (unbalanced-to-unbalanced transformer). The benefits of end-feeding an antenna are obvious. The main one is that there is no feeder to be supported half-way along. Thinner (invisible?) wire can be used.

Given that we are looking for a 50Ω resistive (no reactance) load at the transmitter, the use of a 9:1 UNUN implies that we are expecting to see a resistive load of 450Ω at the feedpoint of the antenna. I can't think of any circumstances in which this is likely. An end-fed half-wave antenna, for example, will have an impedance of several thousand ohms at its ends, while a non-resonant length of wire could have almost any impedance (combination of resistance and reactance) you care to mention. The use of a 9:1 UNUN, therefore, is very much a compromise and has largely given end-fed antennas a bad name. At the very least, the mismatch, and resulting voltages, at the transformer mean that its use is usually limited to QRP power levels.

## Recent Developments

So, what has changed? In recent years a number of radio amateurs have looked at whether a better solution can be found to matching a resonant half-wave (or multiple half-waves) length of wire. One of the benefits of our main amateur bands (and this goes back to the early days when the 160, 80, 40, 20 and 10m bands were first allocated for amateur use) is that they are harmonically related. A half-wave on 160m is a full-wave (two half waves) on 80m, four half waves on 40m and so on.

The diagram, **Fig. 1**, shows the current and voltage distribution on a half-wave of wire, while, to further illustrate the point, Fig. 2 shows the same but for twice the frequency. Not surprisingly, on any length of wire, the current is zero at the ends (it has nowhere to go!) and the voltage therefore peaks at the ends.

What this suggests, on the face of it, is that if we can find a way of feeding a resonant wire at the ends, it will work on multiple, harmonically-related bands. Simples! Not so, though. The problem comes down to what's called 'end effect'.

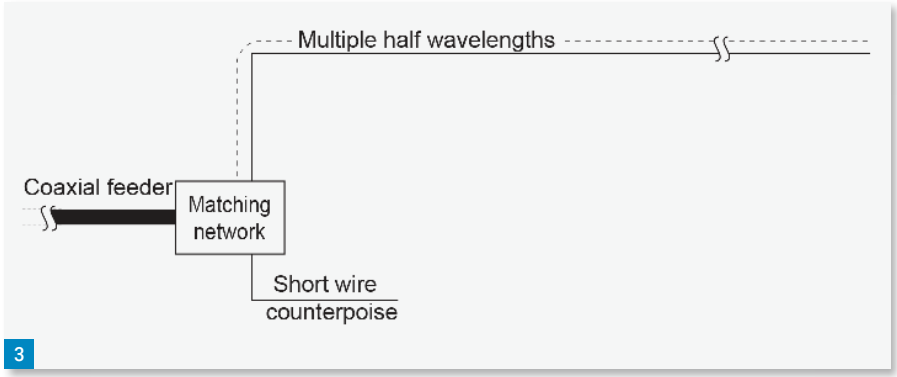
End effect results from a decrease in inductance and an increase in capacitance towards the end of the antenna (as a result of its interaction with the air around it – an antenna in space would not suffer the effect). The impact is to effectively lengthen the antenna so that a resonant length of wire will need to be slightly shorter than simple theory would suggest.

There are various problems that arise in practice when we want a wire to resonate on multiple bands. The first is that end-effect varies with frequency and the second is that it varies with the ratio of length of wire to its thickness. A third factor is that supporting insulators, feed systems and surrounding objects (trees, buildings and the like) also impact electrical length and their impact will vary with frequency.

## Back to Square One?

Does this all mean that we are back to square-one – no solution for a single wire that will cover our HF amateur bands with a low VSWR? Fortunately, no. A modern end-fed half-wave (EFHW) takes a different

**Fig. 1: Current and voltage distribution on a half wavelength wire. Fig. 2: As Fig. 1 but a full wavelength. Fig. 3: Basic configuration of EFHW antenna. Fig. 4: The MyAntennas EFHW-8010-1K. Note the lumped inductance (which is close to the feedpoint) to mitigate end effects.**





approach. The first thing to note is that it is still fed by a transformer (UNUN) but this time the ratio is typically 49:1 (by using a 7:1 turns ratio – the transformation is proportional to the square of the turns ratio). This is a much better match to the feed resistance likely to be found at the end of a wire that is a one half-wave (or a multiple thereof). 50 x 49 = 2450Ω.

That largely takes care of matching the feedpoint resistance. We now have to take care of any reactance due to end effect. Typically, some reactive components are also included, either in the matching box or close to it but embedded in the antenna, the purpose being to counter the end effect that I described earlier. By careful choice of capacitor (or inductor) values and of the ferrite material for the transformer (the popular MyAntennas EFHW uses 52 mix ferrite, for example, more expensive than 43 mix but capable of handling higher powers), the result can be an antenna system that gives a very acceptable VSWR on the main HF bands.

The basic configuration is shown in **Fig. 3**. The MyAntennas EFHW (see their website, below, and the March 2016 *QST* review of their EFHW-8010-1K, second link), though, uses a small inductor in the wire itself, **Fig. 4**, to counter the end effect (this has a significant effect on the higher bands but less so on the lower bands). What the various solutions have in common is that they allow the antenna to exhibit a low VSWR on the main HF amateur bands, something that a simple EFHW or, indeed, compromise designs such as the G5RV, are unable to do. The plot, **Fig. 5**, is from **Peter Waters G3OJV** of Waters & Stanton. Peter has been doing a lot of work recently on a 100W EFHW design and the plot shows how successful this is proving to be.

https://myantennas.com
https://tinyurl.com/vj927nr

## Learning More

This article is intended to be no more than an overview of the EFHW concept and an introduction to a couple of other EFHW-related articles, one of which appears in this issue. Next month there will be an article by **Ian Dilworth G3WRT** who has modelled the radiation pattern of an EFHW at its various resonances. There is also a growing body of material on the internet, which you can find easily using the usual search engines. **Steve Ellington N4LQ**, for example, is another who has been working on the idea. You can find one of his YouTube videos on the link below. He has, as part of his work, been experimenting with the best configurations for an EFHW, which leads him to suggest that the best way to maximise antenna current is to ground at the transformer box. This avoids current on the outer of the coax.

https://tinyurl.com/wmcxyyz

And here is a video from Peter G3OJV:

https://tinyurl.com/s5op6ge

Other YouTube videos, for example, explain how to wind your own toroids (UNUNs) and build your own EFHW. There are also a couple of Facebook groups.

Finally, do bear in mind that an EFHW is intended to work on multiples of a half wave: 3.5, 7, 14, 21 and 28MHz if the length is a half-wave on the 80m band. It cannot reasonably be expected to match as well on the WARC bands, which came much later in the history of our hobby and are not in any way harmonically related (although the VSWR may be low enough to match through your rig's internal ATU). However, an EFHW cut as a half-wave on 80 or 40m (depending on the space you have available) will give you access to several bands without the need for an external ATU and may just be the antenna you need for your QTH.

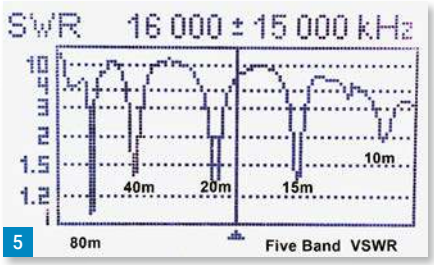



**Fig. 5: VSWR plot by G3OJV of an experimental 100W-capable EFHW antenna. The length is a half-wave on 80m. VSWR is below 2:1 on 80, 40, 20, 15 and 10m.**

# Using an EFHW Antenna

**Daimon Tilley G4USI**
practicalwireless@warnersgroup.co.uk

**Daimon Tilley G4USI** discusses the use of End Fed Half Wave Antennas for portable and home operation.

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When I first was researching the best antenna for my portable QRP work I wanted an antenna that was light, compact and effective but, at the same time, I wanted to be able to connect it to the rig with the minimum amount of coax possible (to reduce bulk).

## Use of the End Fed HalfWave (EFHW) antenna

I came across a useful article on the End Fed Half Wave (EFHW) antenna by **Richard, G3CWI**, who runs SOTABEAMS, a company dedicated to providing equipment and kits to QRP operators. The article can be found in full at the link below and Richard has kindly given me permission to reproduce parts of that article here.

www.sotabeams.co.uk/efhw

In the article, Richard describes a survey he carried out in 2014 of over 300 portable radio operators as to their preferred antenna of choice. The results were as shown in **Table 1**.

Clearly, there is an interesting spread of antennas being used for portable work, but the EFHW is more favoured than any other and that is where I started for portable work.

## A Little Theory

The article usefully goes on to describe a summary of how these antennas work. Readers interested are advised to refer to the original article but, in summary, the EFHW, because of how current and voltage is distributed along its length, radiates mostly from the centre portion and demonstrates a very high impedance at both ends, often between 3,000 to 5,000Ω, giving rise to the issue of how to match this high impedance to a low impedance, 50Ω transmitter.

There are also a variety of views on the use of a counterpoise with these antennas. Richard's article and instructions recommend a counterpoise of 0.2 of a wavelength.

A variety of methods of matching the high impedance of this antenna have been developed over the years, with the most common being to use a tapped or link-coupled tuned circuit.

When I was first looking to address this, I bought a SOTABEAMS Mountain Tuner kit, which consisted of a toroid and a polyvaricon capacitor. This was capable of tuning a resonant EFHW for 40m to 17m. It was easy to build and worked well. It was also helpful that an EFHW for 40m can be used as a full wave on 20m with an appropriate tuner. Unfortunately, the Mountain Tuner is no longer in production because Richard can no longer source the appropriate polyvaricons.

## The Pico Tuner

I wanted to build a dedicated antenna for my QCX kit transceiver that I recently described in this magazine. The QCX I built is for 40m so I needed a half-wave of wire (approximately 20m) and a suitable tuner. I could use the original Mountain Tuner but I wanted something dedicated to the QCX that would live with it permanently and always be available.

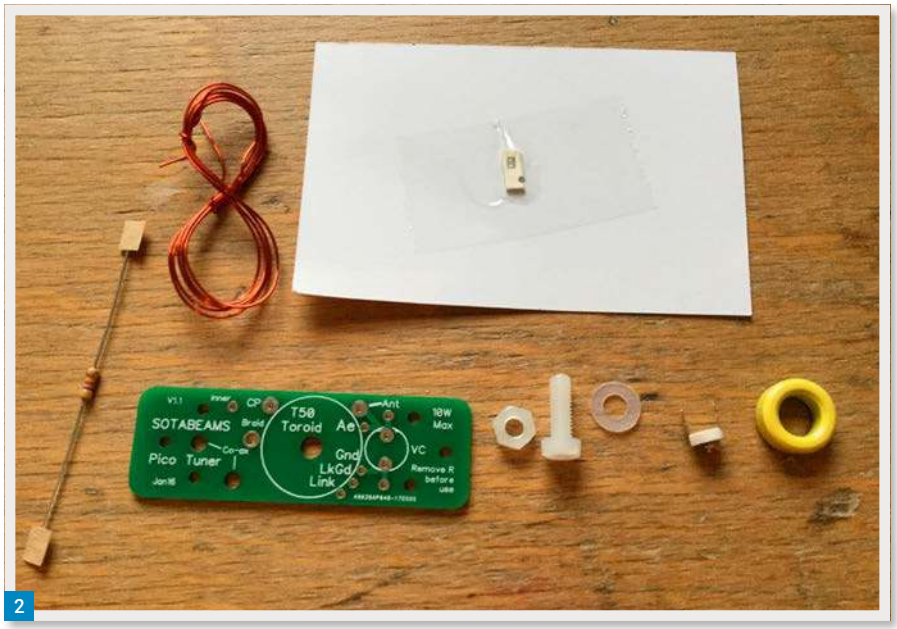
Fortunately, SOTABEAMS sells a tuner kit called the Pico Tuner. This is an EFHW tuner that is small and compact, can be built for any single band between 40 and 10m and is rated at 10W. It is also very reasonably priced at £7.50, including VAT. I ordered one, which arrived a few days later.

The Pico Tuner is, as the name might imply, small and compact, with a PCB size of only 57 x 18mm and a weight in the order of just 3g. It comes with the PCB, a toroid core, wire to wind the toroid and two capacitors, a small trimmer for fine tuning and a tiny SMD capacitor forming part of the circuit. Additionally, it comes with a plastic nut and bolt for mounting the toroid to the PCB and a test resistor. To complete the unit, the builder needs to supply their own wire for the radiator and counterpoise and a length of RG174 coax and connector.

## The Build

The kit came in a small plastic bag. No instructions are provided with the kit, but

**(Photo 1) SOTABEAMS Pico Tuner Kit. (Photo 2) Kit contents. (Photo 3) Installed SMD capacitor (tweezers for scale).**



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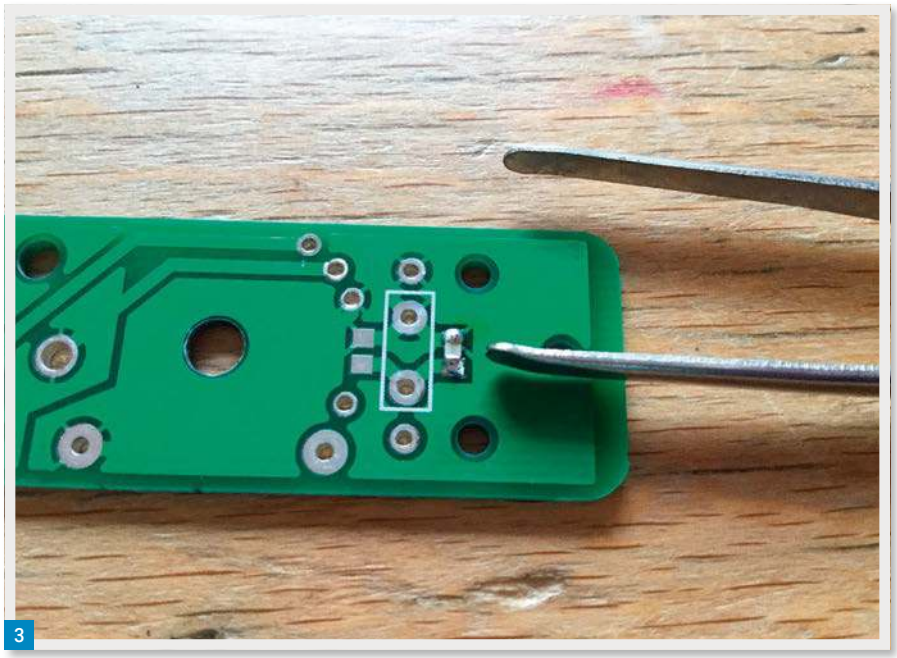
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are available on the SOTABEAMS website. They are up to the usual SOTABEAMS standard, very clear, easy to follow and with helpful photographs.

I have never soldered SMD components before and the SMD capacitor supplied is so tiny it is sellotaped to the back of a business card so you don't lose it! You can see from the pictures just how small this is, next to the tweezers I used to help attach it.

On a suitably wet afternoon, I fired up the soldering iron and set to work, having the whole thing built and tested within 45 minutes. The instructions give a useful tip on soldering the SMD capacitor, which includes tinning one pad of the PCB, then holding the capacitor in place with tweezers while completing that joint. Having done that, the other side is easy.

The longest part of the build consisted of winding the toroid, which for 40m had 31 primary turns and three secondary. Initially, however, you just add the primary windings. The instructions then suggest using a link of insulated wire through the toroid connected to an antenna analyser and checking for a dip in SWR (not the actual SWR reading) at the desired centre operating frequency. This can be adjusted by squeezing or separating the primary turns on the toroid. However, as I don't own an analyser, and as the turns almost filled the toroid making alterations to turn spacings next to impossible, I skipped this part.

I added the three secondary turns and, once the toroid and two capacitors were installed, I then fitted the coax (I used just 3ft of RG174 and a BNC connector). At this stage, before adding a counterpoise and radiator, you temporarily add the 4.7kΩ resistor on the rear of the board. This is designed to mimic the typical impedance of an EFHW.

Again, the instructions suggest using an antenna analyser to adjust the trimmer for best SWR. Fortunately, my latest addition to the shack, a Xiegu X5105, has a really useful, if basic, antenna analyser function. By setting the rig to 7.020MHz and using the Xiegu I was able to trim the trimmer for really good SWR with the test resistor, which I then removed.

Next, I secured the toroid to the PCB using the supplied plastic bolt and washer and measured out my radiator and counterpoise elements. The instructions helpfully suggest starting lengths for each, which in my case for 40m were 20.38m and 6.79m respectively. Strain relief holes are provided on the PCB for both elements and the coax. Again, the photographs help with this.

Finally, it is suggested that you waterproof the tuner, either by fitting inside a case or by using liquid electrical tape, both of which can be purchased at the same time. However, I dislike being out in the rain and have no intention of mine getting wet while operating, so I skipped this (I know, I am a complete lightweight!).

The next part of the build for me, was to 3d print a wire winder for the antenna that I could fix the Pico Tuner to. In the photographs you can see I printed something suitable and I used two cable ties to fix the Pico Tuner to the winder, using the holes in the winder I created to reduce the amount of plastic used and save weight. The radiator had a 3d-printed insulator attached to the far end, and both elements were wound on the winder for later use.

## Testing the Deployed Antenna

Because of the fact the EFHW's radiate predominantly from the centre, operators try to elevate this part of the antenna the most. The usual methods apply here, for example tree limbs, fishing poles and the like. However, the antenna can be deployed effectively as a horizontal length, a vertical, or as an inverted-Vee (my usual portable

**(Photo 4) Wound toroid (for 40m). (photo 5) The completed Pico Tuner. (Photo 6) Tuning for SWR using the test resistor and Xiegu X5105. (Photo 7) The 3d printed antenna winder and completed tuner. (photo 8) A 49:1 UNUN design for a multiband EFHW.**

configuration using a 6m fishing pole for support).

To make the final tests, I deployed the antenna in the garden in the inverted-Vee format and connected the Xiegu to use the SWR analyser function. I switched the internal transceiver ATU out of circuit and, by tweaking the trimmer capacitor, was easily able to achieve a very good SWR.

## What about High Power use at Home?

There is a growing interest in using EFHW's for permanent high power use from a home location. One of the issues here is the voltages involved. Assuming an impedance of 4,700Ω (an accepted assumption), then at 5W the voltage at the ends of the antenna will be 153V RMS. At 100W this increases to 686V and at 500W 1.5kV. So don't touch the wire!

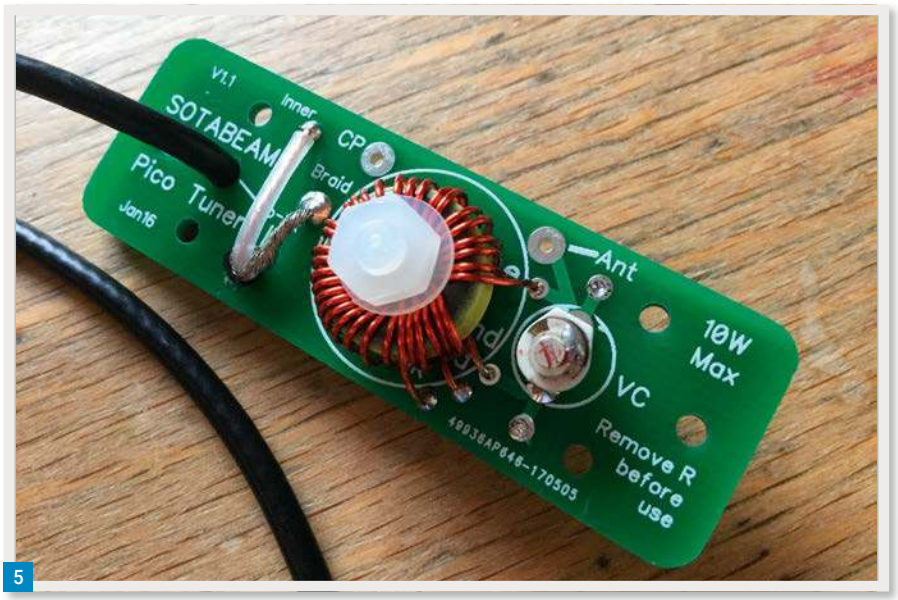
By definition, the EFHW can only be a resonant half-wave at one particular frequency. However, an increasing number of amateurs, and manufacturers are now using the EFHW for multi-band use. So how is this possible (*see also this month's*

| Antenna | Number of responses | Percentage |
|---|---|---|
| EFHW | 53 | 17.5% |
| Linked Dipole | 44 | 14.57% |
| Single band dipole | 35 | 11.59% |
| Random length end fed | 35 | 11.59% |
| Ground-plane | 33 | 10.93% |
| Other | 32 | 10.6% |
| Doublet | 28 | 9.27% |
| Multi-band loaded dipole | 19 | 6.29% |
| Magnetic loop | 18 | 5.96% |
| W3EDP | 5 | 1.66% |
| TOTAL | 302 | |

**Table 1: Antennas used by portable operators (G3CWI survey)**

| Original band | Harmonic (cut length, MHz) | Resulting freq | Amateur freq (MHz) |
|---|---|---|---|
| 3.57 | 1 | 3.57 | 80m |
| 3.57 | 2 | 7.14 | 40m |
| 3.57 | 3 | 10.71 | 30m |
| 3.57 | 4 | 14.28 | 20m |
| 3.57 | 5 | 17.85 | 17m |
| 3.57 | 6 | 21.42 | 15m |
| 3.57 | 7 | 24.99 | 12m |
| 3.57 | 8 | 28.56 | 10m |

**Table 2: Use of EFHW on higher bands.**



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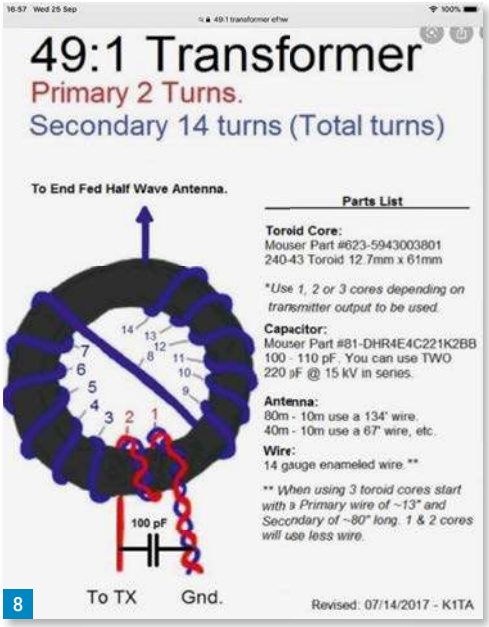

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Technical Topics – ***ed***.)?

What many radio amateurs are doing is building (or buying) an EFHW for a frequency that their garden can accommodate and matching it using a 49:1 UNUN. For example, an EFHW for 80m matched this way will also have low SWR on all higher bands, including WARC, up to 10m. Often, no tuner is needed to achieve a good match, but the 'touch-up' tuners in many modern rigs are sometimes used to improve this match yet further. These UNUNs look very easy to build, using one (usually two or more) FT240-43 toroids super-glued together and with 2 and 14 turns of wire, plus a 100pF high voltage ceramic capacitor. See picture.

Multi-band use is achieved because the harmonics of an EFHW, cut for 3.57MHz, are either in, or close to, each of the higher bands. A presentation by **Steve Dick K1RF** (Google K1RF EFHW) shows this as in **Table 2**.

So, a single antenna resonant as an EFHW on 80m can cover all higher HF amateur bands. Of course, used in this way, the radiation pattern is different at different frequencies, which will affect the gain in different directions.

Typically these antennas are fed quite low close to the ground in a sloper or inverted-Vee configuration, elevating the centre section, which has maximum current, and use a short counterpoise, either the outer of the coax with a choke balun next to the rig (not the antenna) or a counterpoise of less than a quarter-wave laid on the ground.

I have not built one of these antennas myself, although it is on my 'to do' list, so I am no expert. However, these do look very interesting antennas and I recommend the following resources if you wish to learn more and have a go at building one:

Facebook Group = End Fed Half Wave Antennas with 9,000 members

Facebook Group = Real End Fed Half Wave Antennas with 6,000 members

There are also a good number of videos on YouTube.

Why not have a go at building an EFHW yourself and seeing what it can do? Alternatively, a number of manufacturers are offering commercial versions.

# Antenna Supports (Part I)

**Colin Redwood G6MXL**
practicalwireless@warnersgroup.co.uk

In the first of a two-part mini-series, **Colin Redwood G6MXL** looks at antenna supports.

Fig. 1: A small domestic TV antenna mounted on a fascia. Fig. 2: Using a chimney to support a rotator and VHF antennas. Fig. 3: A VHF and UHF antenna mounted on a gable end wall. Fig. 4: A common arrangement for fixing a pole to a brick wall. Fig. 5: One way to keep a wire antenna under tension when supported by a tree.

Unless you operate exclusively using a handheld or a mobile, you'll need to consider how to support your antenna. Your antennas may be anything from a single wire to an array of multi-element beams. The way you support them is likely to vary depending on the type(s) of antenna you use. You may also need multiple supports.

## House Fascias

Fascias are the vertical wood or plastic face that is located behind the gutter. Provided these are sound, they can be a suitable location to fix the end of a wire antenna to. The fixture can be a screw eye, with the antenna attached via an insulator and some string. Almost without exception, fascias are not deep enough to allow more than a single antenna bracket to be fixed, which limits the loading that can be applied to just a small antenna. If you look around, you may see small domestic television antennas that have been installed on short poles on to fascias, **Fig. 1**. In far too many cases those TV antennas are too large and heavy for a fascia and tend to succumb to the wind after a few major storms. I would therefore advise avoiding using fascias for anything larger than a small 2m or 70cm vertical antenna or a wire antenna.

## House Chimneys

House chimneys are often used to support VHF/UHF domestic television and radio antennas. If you have an unused chimney that is sound, then this can be a good location for an antenna. As the chimney is usually the highest point of a building, it gets the antenna high up and in the clear. It also makes the antenna seem smaller than if mounted lower down, so can be more visually acceptable to neighbours. The extra height will also provide a better angle of take-off for antennas and often allow a longer wire antenna than one fitted to a fascia lower down. Chimneys can also support small Yagis for the HF/VHF/UHF bands along with a rotator, **Fig. 2**.

## Safety

Clambering around on a roof at chimney height is not something that everyone will feel comfortable doing. If you have any doubts, then I'd suggest getting your local specialist aerial contractor in to do the job. The good ones will already have some familiarity with amateur radio antennas and may be radio amateurs themselves. This is the bread and butter of a contractor's business.

## Wall Mounting

A good choice for a gable end is to use a pair of wall brackets to hold a vertical pole with an antenna system on the top, **Fig. 3**. Make sure that the wall brackets are sufficient to get the pole clear of gutters. The two wall brackets should be well separated vertically (at least five courses of bricks as an absolute minimum, and at least a few courses of bricks below the top of the wall, **Fig. 4**). Make sure that the clamps and wall brackets are suitable for the diameter of the pole you are proposing to use.

As with chimneys, if you don't feel comfortable to do antenna work up a ladder, get a specialist contractor in to do the work.

## Trees

A tree can be a good place to tie-off one end of a wire antenna. The problem with a tree is that it can move with the wind and over a year grow leaves and shed them. Longer-term it will grow in height (probably no


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bad thing for amateur radio purposes). To overcome movement in the wind, you can put the wire under some tension by using a pulley and a weight, **Fig. 5**.

## Poles

Poles can be a good choice for an end of a wire antenna or a small vertical (HF or VHF/UHF). The poles can be buried in concrete in the ground or attached to a sturdy fence, **Fig. 6**, or brickwork of a house or outbuilding such as a shed or garage. For taller poles, you'll need to consider guying them, particularly with larger antennas or in locations exposed to strong winds.

## Free-Standing Poles

One approach I used for a number of years at a previous address was to partly bury two 3m poles in concrete (1m below ground and 2m above ground) separated by about 30 or 40cm (like a ladder without any rungs). I then clamped two short pieces of old-style metal electrical conduit between the two poles as if they were a bottom and top rung. I loosely clamped a 20ft scaffold pole in the middle of the bottom rung and could swing it up and clamp it to the top rung, **Fig. 7**. I found this worked quite well with a couple of lightweight VHF/UHF beams and small rotator.

## Materials

If you need to purchase suitable brackets and other fixings for antenna supports, then I'd first suggest checking out your local aerial contractors. Some are happy to sell to radio amateurs. If not, there are a few companies that supply the amateur market by post, although the postage can be significant because brackets, poles and the like can be heavy and large. I've listed a few in **Table 1**. If you are putting up an antenna in a location that you cannot readily access, I would strongly recommend buying really good quality brackets, pulleys and other hardware. The additional cost of well galvanised materials over cheap materials that are prone to rusting will quickly exceed the cost of getting a contractor in for a subsequent visit or to make good damage to your property. *(**Editor's comment:** I personally prefer stainless steel hardware for long-term use. Many hardware stores and marine chandlers sell high-quality hardware that is ideal for antenna work).*

## Masts

If you decide that none of the approaches that I've already discussed meet all your needs, inevitably your thoughts will turn to masts. Installing a mast is not something to be taken lightly. They're certainly not cheap if bought new. Consideration also needs to be given to where to place a mast, planning permission, tilting arrangements, rotators, antennas, feeders and other factors.

You need to consider how you will support the mast, and how you will tilt it over for maintenance work. There are a number of mast suppliers, including Tennamast who advertise in the Specialist Dealers section of *PW*. I strongly recommend looking at their website and contacting them to get all the information you can before making a decision.

Probably the most popular type of mast is one that can be tilted over for maintenance, and when vertical has one or more sections telescoped inside, which allows the height


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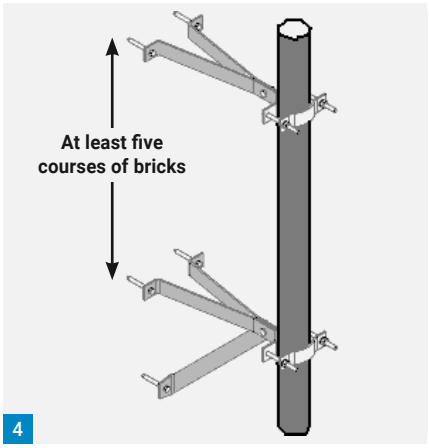

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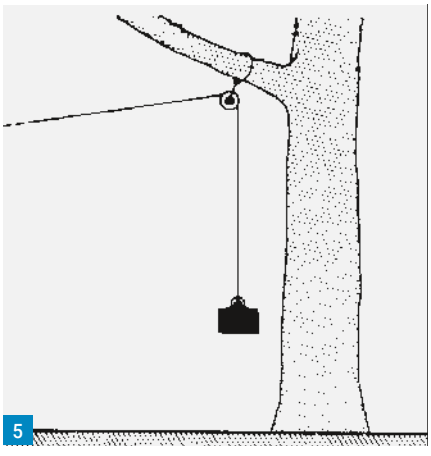
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to be increased. Tilting over (luffing) needs to be done in a controlled manner, so that the mast and antennas do not come crashing to the ground. The higher the mast is when it is luffed, the harder it is to control. This is why most tilt-over masts are telescoped in some way. The great advantage is that antenna work can be done safely at ground level.

## Support

There are broadly two ways that masts are supported. One is to mount them close to a building and tilt them either parallel to an outer wall or at 90° away from the outer wall. The mast is supported and hinged at the base. When raised vertically a second bracket arrangement secures it to the building. The other way is to mount the mast free-standing away from a building with the base in a large block of concrete.

Which of the two options you choose may well be dictated by the particular circumstances of the property in question. If there is a choice, remember that the further away from the building, the greater the length of feeder that will be needed and, at VHF and above, feeder losses could become a significant factor. In contrast, the closer to the property the mast is located, the greater the RF fields and the potential for EMC problems to occur. Before considering the purchase of such a mast, I suggest trying out the proposed location with a temporary arrangement; perhaps with some aluminium scaffold poles or a portable mast.

When tilting over a mast with a large antenna, the antenna will take up a lot of space near the ground. So, you'll need to consider this in choosing where you site the mast. If considering a mast close to a building, this may prevent the mast being in the centre of a wall, unless you luff away from the wall rather than parallel to the wall. Even this may not be possible because many masts when luffed stick out at the back. When I put a mast up at a previous home, I forgot to consider a newly-planted bush near the base of the mast. The bush was only 1m tall at the time. 20 years later the bush had grown to over 2m and had to be pruned quite drastically in order to tilt over the mast, **Fig. 8**.

Having decided where you'd like to locate the mast, you'll need to find a suitable mast. Contact the mast suppliers and ideally visit them with a plan of your proposed location. Discuss the options available to you. Make sure that you get a full specification of the product you are considering. Head loading (weight of rotator plus antennas) and wind loading are the two key aspects. As with other materials, don't skimp on quality. I'll look at some practical considerations on installing a mast next month.

**Fig. 6: A swaged aluminium pole attached to a fence post.Fig. 7: A simple arrangement for a free-standing tilt-over scaffold pole. Fig. 8: The bush needed drastic pruning to lower the antenna mast.**

## Rotator

If you are considering a mast where you may wish to rotate an antenna, you'll need to consider arrangements for mounting a rotator and the stub mast (the short pole above the rotator that goes around with your antennas). Rotators that can handle a large array are heavy, and you'll need to consider this in choosing your mast. I'll return to rotators next month.

## Ground Sleeve

One of the options available when buying a mast is a ground sleeve. In essence this means that the bottom post slides into a sleeve that is concreted into the ground rather than the post being concreted directly into the ground. If you are likely to move house, then a sleeve is certainly a good idea.

## Planning Permission

Without doubt, anyone considering an external antenna should obtain an up-to-date copy of the 19-page RSGB *Planning Permission Guide*. This can be downloaded from the members part of the RSGB website. It contains a lot of very wise words of guidance, hints and tips and examples of letters and plans. Bear in mind that the RSGB *Guide* deals almost exclusively with antennas in domestic situations. If you are considering antennas for other types of premises (such as your club's meeting hall), you'll need to make further enquiries. Likewise, you'll need to make further enquiries if you live in a National Park, Area of Outstanding Natural Beauty (AONB) or similar or live in a listed property. If you are not a member of RSGB, then I would strongly urge you to join in order to obtain an up-to-date copy of the guide. The cost of RSGB membership will seem cheap in comparison with the cost of a failed planning application! One key point made in the booklet is to get your neighbours onside and resolve any existing EMC issues before applying for planning permission.

## Next Month

Next month I'll look at rotators and some practical aspects of installing a mast.


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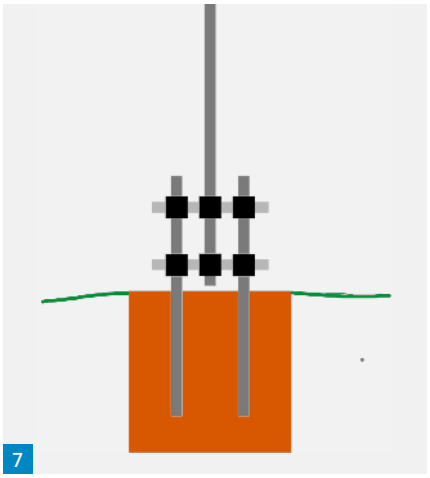
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Aerial Parts of Colchester
**http://aerial-parts.co.uk**
Aerials & TV
**https://www.aerialsandtv.com**
Barenco
**www.barenco.co.uk**
CUG Masts
**www.mm0cug.co.uk**
Goodwinch
**www.goodwinch.com**
Tennamast
**www.tennamast.com**

**Table 1: Some suppliers of masts, brackets and related hardware.**

# Hints & Tips Time Again!

PW brings you some handy hints and tips.

**Compiled by Don Field G3XTT**
practicalwireless@warnersgroup.co.uk

Here is another short selection of hints and tips as it's been far too long since we last ran some. The first two are from **Rob Dancy G3JRD.** Several of the remainder are from our old friend and regular correspondent **Bob Houlston G4PVB,** although Bob credits fellow Verulam club member **Norman Fisher G8ATO** with a number of the suggestions. Others are from a variety of internet and related sources.

## Using Drills

After using a drill, whether electric or manual, make sure that the drill bit is taken out of the chuck immediately after use. So many have been broken over the years when this has not been done and a little carelessness can result in the drill being dropped and the bit snapped in two. Bitter experience shows the even the larger ones can still be broken.

## Checking the Characteristic Impedance of Coaxial Cable

If you have an odd length of coaxial cable lying around, with no markings to indicate its characteristic impedance, it's easy enough to check it. Terminate one end with a 50Ω resistor (a standard 47Ω one will be near enough, or a 50Ω dummy load), then apply power to the other end from a transceiver, at very low power. An SWR of about 1.1 should be obtained. If the cable is 75Ω, about 1.7 will be indicated. Changing the terminating resistor to 68 or 82Ω will give a reading close to unity, proving that the cable is indeed 75Ω.

## Free Software

Electronics Assistant is a Windows program that performs electronics-related calculations. It includes a resistor colour code calculator, resistance, capacitance and power calculations and more. Details of calculations can be saved or printed:
https://tinyurl.com/pwcalculator

Stopwatch, from the same website, is based on public-domain code by **Keith Vertanen**. In basic mode when first opened it counts in the format H:MM:SS:MS; the start, stop and reset buttons being self-explanatory. Double-clicking the display expands the window. While the stopwatch is running click split/lap to add the current time to the list. Subsequent clicks will add further times to the list, and the time between this and the previous entry in the list will be calculated (shown after the delta symbol). Delete last and clear list remove the last entry or all entries from the list respectively. Double-click the display again to hide the split/lap function. Stopwatch always appears on top of other windows.

FidoCadJ is a multiplatform vector drawing program with a complete library of electronic symbols. Schematics and drawings are stored in a very compact text format. There is no netlist concept behind the drawings (so no simulation, and this is a choice) but this allows a great graphical flexibility and ease of use, making FidoCadJ the perfect tool for exchange sketches in forum and newsgroup discussions with a few clicks. Drawings can be exported in several graphic formats, such as PDF.
https://tinyurl.com/pwsymbols

## Trouble Shooting Your Radio

That first radio for the newly licensed has got to work otherwise they may leave the hobby. This also applies to SWLs, albeit receivers are generally less complex. Sometimes we just need to sit back and consider our options. Most amateur radio equipment is reliable and gives good service for many years so an apparent fault may only need a simple adjustment of the controls. That's where the free online PDF *Trouble Shooting Your Radio Equipment* (below) comes in. Read it through and maybe it will help you avoid some unconscious panic bias errors of judgment.
https://tinyurl.com/pwmaintenance

## Mapping Our QSOs

We all like to view where our radio contacts come from but a map that is cluttered with too much information is about as much use as a chocolate teapot. Fear not because **Tim Makins EI8IC** has come to our rescue with his GOM – Global Overlay Mapping. The description says, *"GOM is an important new tool for all aspects of amateur radio throughout the world. More than just a static map, GOM combines the 12 different overlays with an easy-to-use navigation system that can select and load a map from a single click. In addition, every map has Real-Time Mouse Tracking, that displays continuous Positional and Grid-Locator information on the Status Bar, plus instant Beam Headings and Distance Display, customised to your Home location. Also, every IOTA entity is mapped and searchable. It's the only Ham Radio Mapper to do so! Shareware for $15."* Not only that but his website features more free maps. Well worth a visit at:
www.mapability.com/ei8ic

## Sunspot Cycle and Propagation

The link below connects to the Solar Cycle 25 forecast update. But there's more, much more. Scroll down the page to a phenomenal amount of information of interest to amateur radio enthusiasts, such as satellite communications:
https://tinyurl.com/va6bwbh

## Handy Software

Possibly the most comprehensive collection of hobby radio software on the internet can be found via link below. You may find a few broken links but the free/shareware content is overwhelming and also it links to yet more pages of content that in turn link to even more... Some people may already be aware of it but I thought it worth a mention. Source: **Norman G8ATO** of Verulam ARC.
http://ac6v.com/software.htm

## Crimped Connectors

A lot has been said in *PW* about soldering. However, crimped connections, done correctly, can be superior to soldered connections. The link below explains why in detail and with pictures. A basic £5 (not coax or Power Pole) red, blue, yellow spade, ring, fork, terminal crimp tool from eBay is cheaper than a soldering iron and avoids annealed solder connections where the wire becomes hard and fractures with movement and/or vibration.
https://tinyurl.com/rucrimp

## Data Modes

6dB Better than CW? Now that we are presently experiencing HF communication doldrums, data modes may seem appealing. **Andy Talbot G4JNT** kindly offers his free PDF on the subject via link below. A thorough explanation of the virtues of CW versus data modes. Well worth a look if you have just a small space for antennas.
www.g4jnt.com/6dB_Better.pdf

# WSJT-X Update

**Mike Richards G4WNC**
practicalwireless@warnersgroup.co.uk

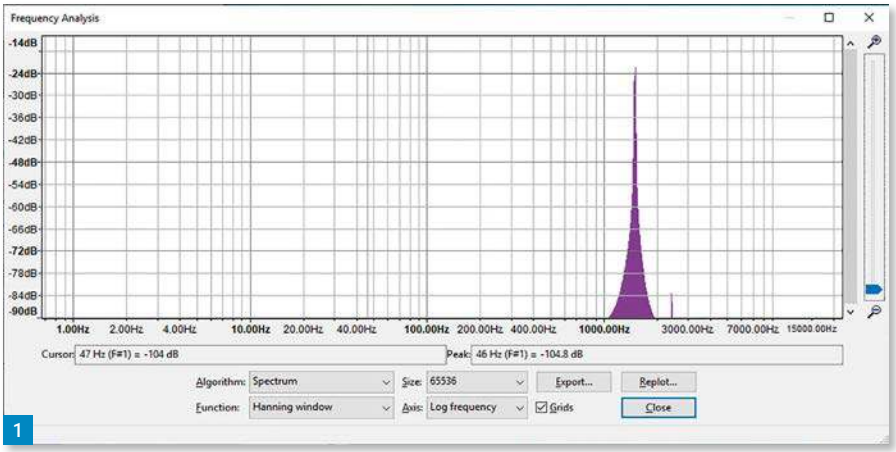
**Mike Richards G4WNC** is looking at an important signal quality improvement for FT8 & FT4, along with ideas for monitoring signal quality.

You may well have noticed that WSJT-X was recently updated to version 2.1.2 but one of the updates that slipped through in the earlier 2.0.1 release was an important change in the generation of FT8 and FT4 modulation tones. In the earlier versions of WSJT-X, modulation tone generation was not strictly phase continuous. As a result, there were abrupt changes in frequency/phase between elements and these generated spikes very similar to key clicks.

To illustrate the problem, I used the open source Audacity software to record and analyse the audio tones produced by WSJT-X 2.0.0 and the latest WSJT-X 2.1.2. The audio was fed to Audacity directly from WSJT-X via a Virtual Audio Cable (VAC). This kept the entire audio chain in the digital domain to avoid distortions from the analogue-to-digital conversion process. I've shown this basic spectrum analysis in **Figs. 1** and **2**. Fig.1 shows the audio spectrum from WSJT-X 2.0.0 whereas Fig. 2 shows the same transmission but using the latest WSJT-X 2.1.2. As you can see, there is a significant difference in the skirt bandwidth and the new WSJT-X 2.1.2 produces a much tighter overall spectrum. For a second test, I connected my station as normal with a VAC to transfer the audio to and from WSJT-X, SDR-Console and my Hermes Lite 2 transceiver. The RF output of the Hermes Lite 2 was sent to a Bird dummy load via a 40dB RF tap. The output from the RF tap was then connected to the input of my Airspy HF+ Discovery via an additional 20dB attenuator. The additional attenuation was to help avoid spurious results due to receiver overload. I disabled the Discovery's AGC and added more internal attenuation, again to tame the signal. You can see a block diagram of the test setup in **Fig. 3**.

With the connections complete, I started a second instance of SDR-Console to monitor the transmit signal quality with the Discovery. For this test, the waterfall display best illustrates the difference between the two WSJT-X versions. You can see the results in **Figs. 4** and **5**. The discontinuities can be seen in the spectrum spikes at the beginning and end of each element in Fig. 4, whereas Fig. 5 is very much cleaner with smaller spikes.

For FT8's original purpose, as an occasionally used data mode for use with weak signals, the small spikes were not a significant problem. However, we've



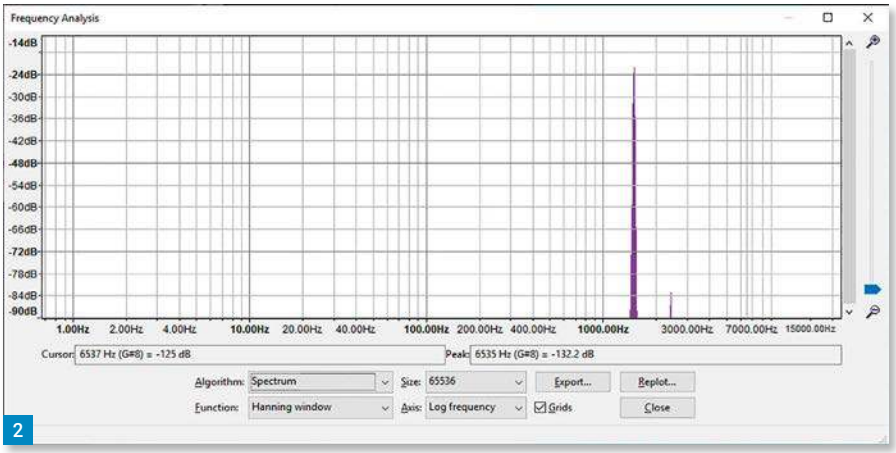




**Fig. 1: Audacity spectrum plot of FT8 using WSJT-X 2.0.0. Fig. 2: Audacity spectrum plot of FT8 using WSJT-X 2.1.1. Fig. 3: FT8 RF signal monitoring with Airspy HF+ Discovery. Fig. 4: RF Waterfall analysis of FT8 using WSJT-X 2.0.0. Fig. 5: RF Waterfall analysis of FT8 using WSJT-X 2.1.1.**

seen FT8 dominate the HF bands and quickly become the most popular data mode. This results in very congested band segments, especially at weekends and during contests. Given the close spacing of signals, keeping the transmissions as clean as possible has become more important, hence the change to GMSK modulation.

## Inside GMFSK

The secret to FT8 and FT4 spectrum improvements has been the use of GMFSK (Gaussian Minimum Frequency Shift Keying). In simple FSK (Frequency Shift Keying) the digital 0s and 1s are represented by two different but closely spaced RF frequencies. A good example of simple FSK is a RTTY signal where the two frequencies are 170Hz apart. Switching between the two frequencies is determined by the data signal so it becomes highly likely that the switch will take place when the audio waveform is non-zero. This sudden change of frequency causes a step in the waveform and it's the abrupt change that gives rise to key clicks. A similar effect occurred with the earlier FT8 and FT4 modulation. Although FT8 uses 8-tones, switching between tones was not phase continuous, hence the keying clicks.

The use of GMSK in the new WSJT-X version introduces two important changes

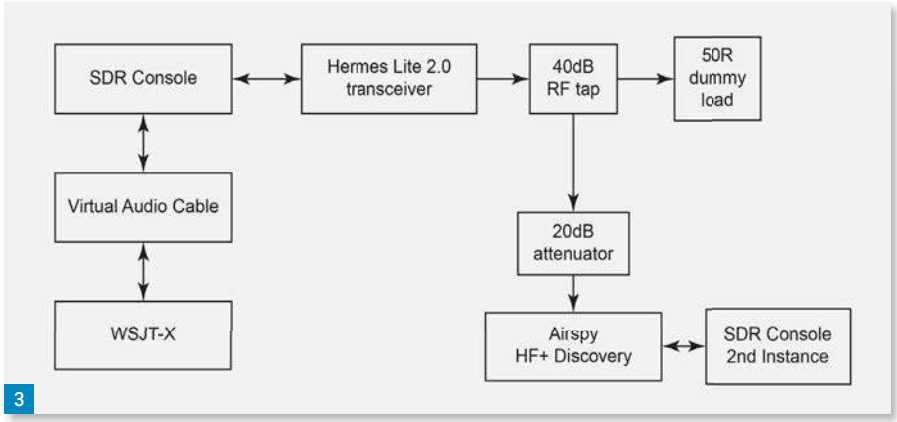
to the waveform generation. The first is that the change between tones occurs at the zero-crossing point of the waveform. That eliminates any phase discontinuities, a major cause of key clicks. Secondly, the frequency shift between tones is always half the data rate, which minimises the frequency change between elements, thus further reducing the bandwidth. To minimise the bandwidth even more, gaussian filtering is applied to the data prior to being applied to the modulator. The net benefit of the changes can be clearly seen in Fig. 5.

## Signal Monitoring

We all have an obligation to ensure our transmitted signals are of acceptable quality and free of artefacts that could cause interference to other users and services. While in the days when I started, this was often a challenging requirement, signal monitoring has become very much easier thanks to the introduction of cheap SDR receivers and PC-based oscilloscopes. I thought it might be useful to run through a few monitoring suggestions. Let's start with the use of a modern digital oscilloscope. We've seen a significant reduction in the price of scopes over the past couple of years and it's now possible to get a good quality two-channel 200MHz digital scope for well under £400!

My primary technique for monitoring my transmissions is to insert an RF tap in the antenna feed and send the tapped signal directly to the oscilloscope. I use a DIY 40dB tap and the design I use is good for up to 50W from LF to 500MHz. I've shown the circuit diagram in **Fig. 6** along with a photo in **Fig. 7**. This design was originally published in the June 2001 edition of *QST* but has been used in several other articles since. The RF tap is straightforward to build and the excellent performance is easily replicated.

I've shown the 'through' response and SWR in **Fig. 8**. Here you can see that the loss (100kHz to 50MHz) is less than 0.2dB and the SWR better than 1.08 throughout the range. The attenuation of the 40dB tap output is also within 0.25dB of 40dB. The short wire adjacent to the first resistor is used to trim the VHF performance. In addition to the tap being a useful monitor take-off point, the accuracy of the tap means that it can also be used to make measurements of the transmit signal. For my station, I leave the 40dB tap permanently connected with the reduced level output routed to my PicoScope 3203 and set for operation as a 50MHz



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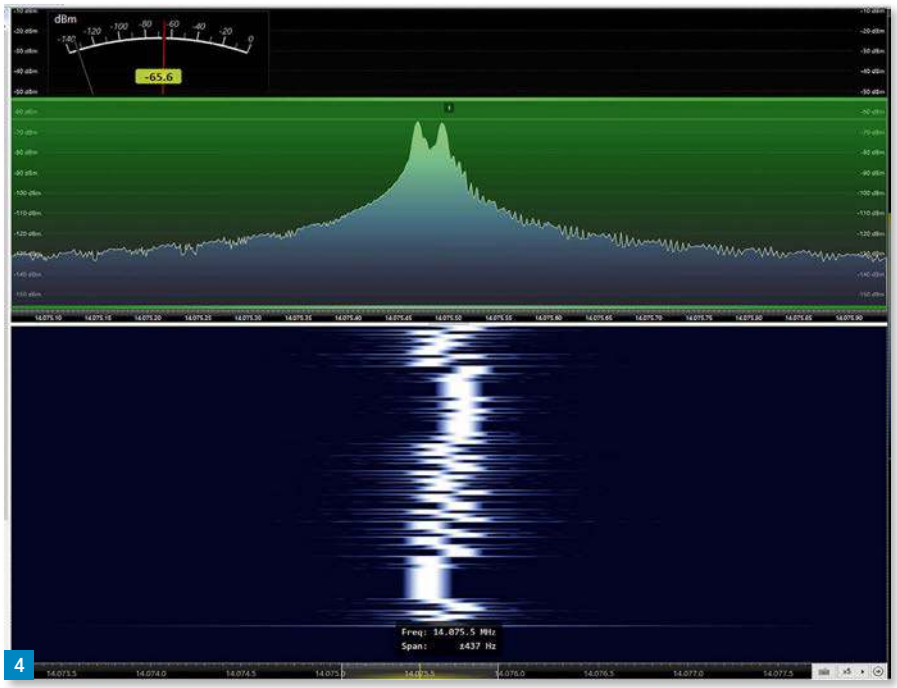

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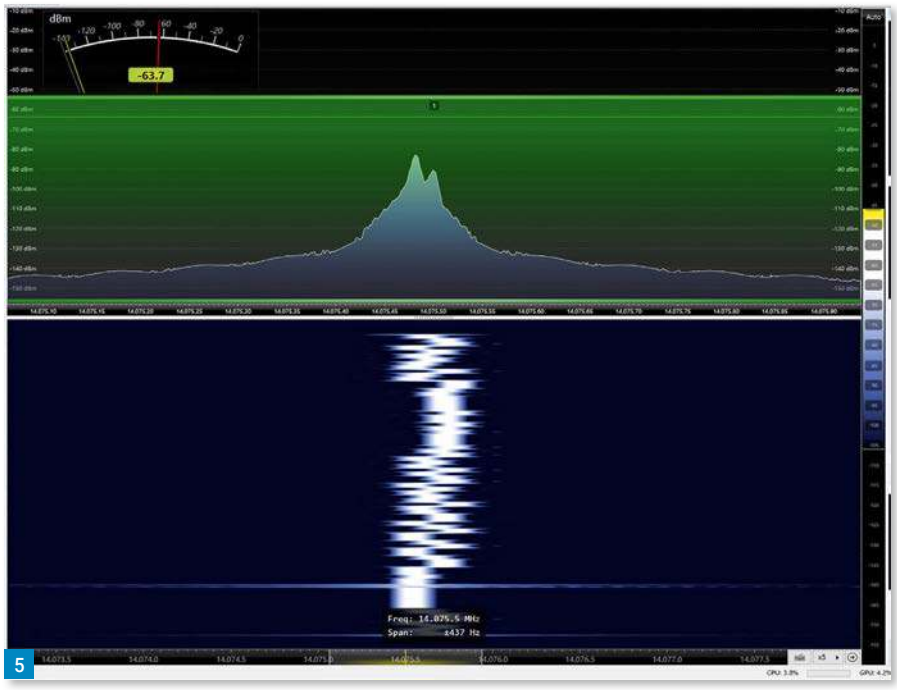

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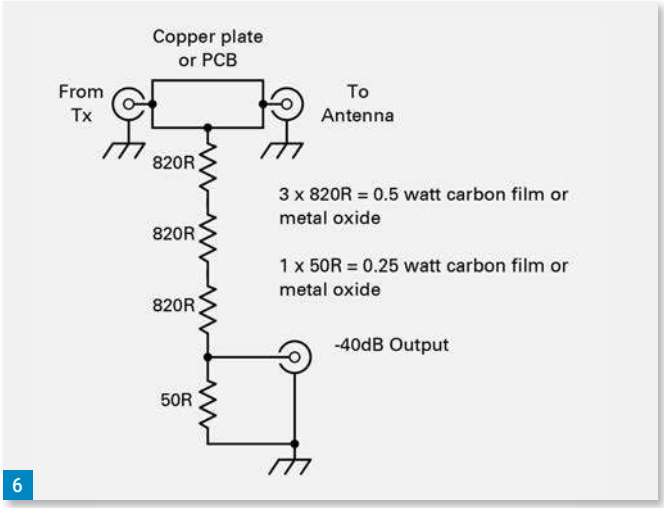
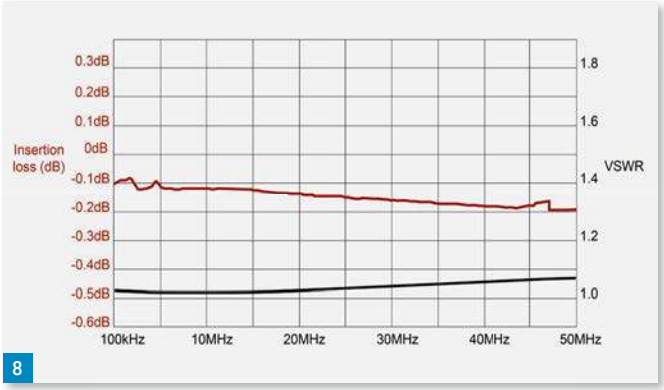




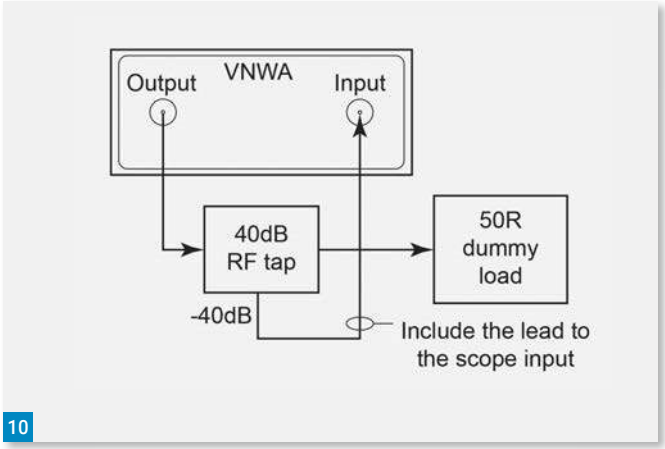




**Fig. 6: 40dB RF tap circuit diagram. Fig. 7: Photo of the inside of the 40dB RF tap. Fig. 8: Forward or through response of the 40dB RF trap (100kHz to 50MHz). Fig. 9: Using a BNC T connector to add a 50Ω termination at the scope input. Fig. 10: Test setup for accurate measurement of the tap loss.**

spectrum analyser. When connecting the tap output to a high impedance device, such as an oscilloscope, it's important to make sure the tap has a 50Ω termination or the readings will be 6dB higher than they should be! The simplest way to provide this termination is to use a BNC T connector as shown in **Fig. 9**.

In addition to providing a visual indication of my transmitted signal and any obvious harmonics, I can add measurements to the spectrum display to show the power at the peak, harmonic distortion and more. As the 40dB probe is a 100x voltage divider you can select a 100x probe in your channel options to get corrected readings. If you don't have the option of selecting a 100x probe, most decent PC-based scopes include the facility to define custom probes so you can add a new 100x probe. By doing this, the scope compensates for the probe loss and directly displays the voltage on the transmit line.

If you want to be super-accurate and have the facilities to measure the loss of your RF tap, you can create a custom probe with the measured voltage ratio of your probe. When measuring the loss of your RF tap, it's important to include the coax connecting your probe to the scope input. An accurate way to measure this is to use a vector network analyser such as the excellent unit by DG8SAQ and sold by SDR-Kits. This is an ideal tool for accurate RF measurements. Before you start you need to do a calibration run to exclude your test leads from the measurement. Once complete, you should connect the RF tap and vector analyser as shown in **Fig. 10**. When you know the precise loss in dB, you can convert that to a voltage ratio using the formula: Vratio = 10×(dB/20)

Alternatively use the online calculator here:

https://tinyurl.com/4em7v2c

As all the PicoScopes use the same software, here's a step by step guide to creating a custom probe:

**1.** From the main screen go to the Tools menu item and select Custom probes.
**2.** Choose the New Probe option to start the wizard.
**3.** Click Next to get to the Probe Output Units panel, click 'Use a standard unit from the list' and select volts.
**4.** Click Next and on the Scaling Method panel change the gradient 'y =' to 100 and make sure the offset is left at 0. Note that I use 100 because that is the input to output voltage ratio of the 40dB tap. You can change this to match the measured ratio for your probe.
**5.** Click Next for the Range Management panel and click the Recommended option.
**6.** Click Next twice to skip over the Filter Method panel.
**7.** In the Custom Probe Identification panel, enter a name for the new probe and a short description.
**8.** Click Finish to complete the process and save the custom probe.

To use the new custom probe, go to the Channel Options drop-down and you will find the new probe in the library. Once selected, all voltage measurements will be automatically corrected thus making the probe transparent.

That's all I have space for this month but next time I'll be taking a close look at the new SDRPlay RSPdx and covering some other signal monitoring techniques.

# A year of QRP

**Joe Chester MW1MWD** reflects on the highs (and lows) of low power operating.

**Joe Chester MW1MWD**
mw1mwd@gmx.com

It's the anniversary of my move into QRP operating. Quite a year, in some respects. Highlights are too many to list, downsides too few to worry about. Looking back, I think there are a few things worth repeating – not literally, but on reflection. High power, or even 100W sounds easier. It would seem to make it easier to clock up QSOs, easier for someone answering your call, or even easier to be heard when answering a call. *"QRP pitches your unwillingness to invest in a proper station, against the ability of the other guy to hear your call"*, said one operator I came across – ouch!

But it does seem like that at first. Then the QSOs start coming in and the logbook continues to fill. You begin to wonder why everyone is not doing this. In two previous pieces (*PW*, December and January) I dealt with the theoretical considerations around QRP, and my first QRP QSOs. In this piece I want to share a few anecdotes about my year with QRP. Starting by asking the question we are all asking – what's the problem with QRP anyway?

The obvious answer to this question is to ask it the other way around – why is there a problem with QRP? Now don't get me wrong; I'm not trying to start a war! But if comparisons are odious, then why do some feel the need? Why do QRPers have to feel defensive? Why the assumption that high power and huge antennas on towers is the way forward? I heard another operator say *"100W in this day and age is just ridiculous"*. Yes, the sunspot cycle is near minimum, and propagation is flakey but RF transmission and reception has been like that since before Marconi, and even for millennia further back than that! Of course, one answer to 'defeat' the poor conditions, or even inefficiencies in antenna design, is to throw more power at it, then sit back and clock up the QSOs at will.

## The Full Answer?

But surely this is not the full answer. Isn't taking a pneumatic drill to cut a small hole in a piece of cardboard just going too far? What happened to the spirit of exploration, of learning, of working the conditions? So that sewing needle will have to work a bit harder to drill that hole but it will get there in the end. *"Life's too short for QRP"*, says the tee-shirt who just wandered by at the rally (Editor please note!). Well yes. However, I must point out that there is a well-known principle involved with amplifiers – it says *"buy an amp if you want to meet an angry neighbour"* (with thanks to **Robert KE2WY** for that one!). I suppose we do build motorways for high speed travel, and cycle paths for those who prefer pedal power. But even this is not either/or, but more horses for courses. So, let's have a look at a couple of horse races! Let's start by talking about DXing and leave contesting until later.

DX hunting arrived with Marconi. You were lucky back then to catch some of the rare and infrequent transmissions from the early pioneers. But we have records from DX chasers even from that era. It's always about going the extra kilometre, right? You've worked all Britain, got DXCC on several modes, then someone says, *"have you worked Bouvet Island?"*, or some other exotic lump of rock. It's so far away that even the kilowatt and 30m high beam guys are going to be challenged. Forget QRP then. Really? *"A QRPer will not break into a DX pile up – you need high power and a Yagi"*, said my friend M one evening. Again, really? I've lost count of the number of 'DX pile-ups' I've cracked. Takes patience, and luck, and timing of the call, but it can be done. Maybe not the Bouvet-like DXpeditions, but there are pile-ups to work every week, even if it's only a weird callsign celebrating some local event a long way away. I didn't work the RAF centenary station GB100RAF on 80m, but I tried!

Or has the meaning of the phrase 'rare DX' been morphed into something more like a playground challenge – 'how far away can you go', or 'how big can you build it', or similar? When I was first licensed, I commuted to work – a two hour drive each way every day. My second- or third-hand FT-290 was connected to a home-made quarter wave on the roof of the car (from a repurposed coat hanger!). I worked several stations regularly every day. Then I'd hear a callsign I'd not heard for a while. *"You're rare DX these days"*, was the frequent reply – yes a few kilometres away!

There are many definitions of DX. In a January 1985 *QST* article, **Doug W1FB** defined DX as *"paths in excess of 1000 miles"* on the HF bands. But, he says, *"DX takes a different meaning for VHF/UHF frequencies, or for microwaves"*. Indeed! And is it not also the case that DX is relative to the receiving station? UK operators don't usually see local stations as DX, but US operators would call us DX! So, the definition of DX becomes more accurately 'distant' from my station. And the definition of 'distant' here is equipment (and frequency) dependent. So, my DX is not your DX! But it is DX, in the sense that it challenges my operating skills with the equipment I have.

## My 2019 Challenge

This year's 'challenge' was to work the US with 10W, which I did in the March ARRL SSB contest. Then there is my first ever SSB contact on 80m with a DIY vertical made out of 300Ω ladder line. I had spent hours working the antenna theory equations, and sending test messages to the RBN, to discover what everyone (including me!) knows. That the losses with a short vertical on the low bands made this almost impossible. But there's the QSO in my log, along with several others that day, including a QSO with an Irish station. Or there is the Russian station on 20m, who gave me an S9+10dB from 4000km away, **Fig. 1**! Not 'rare DX' to everyone, but it was for me!

Since I moved into this bungalow, I've got 60 DXCC entities, with intermittent operating, **Fig. 2**. But I've started counting again since I started QRPing. I don't think I will need a certificate to hang on the wall if I ever get to 100, so I don't collect QSL cards. You're in my log, I know that I've worked you, it's enough (for me anyway!). I sometimes think that things such as the DXCC Honor Roll are carrying things too far. If a new entity turns up, then this is an ATNO (All Time New One) for everyone, and the guys on the Honor Roll all need to work it to keep their place at the table. So, we get enormous pile-ups of big stations blasting away at the DX. And even some dodgy practices, like operating a remote station much closer to the DX and claiming the score! It would take an extraordinary antenna to break into some of these pile-ups with just 10W. But I suppose that the hyper-competitive have to have something

**Fig. 1: 4000km using QRP on 20m**
**Fig. 2: The 20m vertical at the home QTH.**

to do!

And while I'm here – there are not 335 'countries'! Last time I checked in with the UN, there were 193 Member States, and a few official observers, including the Vatican and Palestine – a long way from the number of DXCC entities. So, in effect, DXCC is a game we are playing, inventing more and more inaccessible places in order to raise the maximum 'score' attainable to a higher number. WAC, WAS and WAB, and equivalents elsewhere at least have the benefit of being defined by a recognisable national entity.

The world has changed, and JT/FT/whatever is changing the way people operate in pursuit of DXCC awards. In days past, DXCC was a recognition of an operator's ability to build an effective station and use it to contact amateurs in 100 other countries. It was an achievement because it was difficult, and not just because it could be done. Today, with a white stick tied to a fence, any off-the-shelf transceiver and a computer, DXCC can probably be done with FT8 in a weekend. But what does that actually mean, as an 'achievement'?

## Contesting

Talk of 'achievements' brings me to contesting. Don't get me wrong, I get it – busy lives, few chances to operate, but a day or two a year contesting is enough to satisfy the urge to operate. And there are enough contests out there to satisfy everyone (*PW* October p.56). But my year of QRP dredged up a bit of a problem with contests. Let me go back a bit.

*"QRPers are very frustrating when running"*, said Tom. No, he wasn't in the London Marathon. He's a contest operator. I'm not going to tell you who he is, but you all know him. His comment echoes what I was told by other operators. *"I've heard pile-up operators tell QRP operators to quit doing it and go away. I do the same"*, another guy told me. But don't panic. I think QRPers are just a bit misunderstood.

QRPers have their own contests and, yes, that's fun. And a few QRPers do participate in other contests. Why not? I do it, but mostly for fun, as I'm not a contester. But anyone working a contest station needs to understand the rules. WA7BNM runs a contest calendar website (**contestcalendar.com**), and if you click on a contest it takes you to details of the rules, where you will find the format of the signal report exchange. I worked a few US and Canadian stations in a recent ARRL SSB contest (I mentioned this earlier). One was Tom, who is a really serious contester (he is well known for his contest logging software!). I had also worked him the previous year. He was 59+ with me and clocking up the QSOs at a rate of knots. Family and friends had gathered that day for lunch. But I had put up my DIY vertical the previous day and wanted to see if it was working. The gang stood in the doorway clutching beers, and muttering *"what's he doing?", "is he talking to someone?", "sounds like gibberish to me"*, cue laughter! I received a 59 CT report from Tom and gave him 59 10 – the correct contest response, as I was using 10W. Everyone heard him say *"wow"* before moving on. (Note – you would have enjoyed the banter at the table that day, as I tried to explain what I was doing but that's another story!)

I looked up Tom's e-mail address on QRZ.COM and e-mailed him the following day, not for a QSL card but to ask him what he was using. He was running 1500W through a SteppIR beam on a 30m tower, **Fig. 3**. This, of course, explains how he was 59+ with me, and was able to pull my QRP signal out of the air. But he asked me to say a few things about QRPers in major contests – so here goes. This is all extracted verbatim from his nice (!) e-mails.

Contesters are trying to get the QSO rate as high as they can. There is no time for a chat, or anything other than the minimum

**Fig. 3: SteppIR antenna on a tower, like Tom was using.**

exchange possible. Someone saying, for example, *"callsign callsign you are five and seven with me, my name is joe, juliet oscar echo, and I'm running five hundred milliwatts"* is using up time that could be used to log more contacts. *"The ARRL doesn't care what you tell us, just so you tell all the stations the same thing. Trying to pull out '500 milliwatts' when we are not expecting it is maddening when we realize what you are saying"*, Tom wrote. So, if you're going to contact contest stations, check what the required exchange is – signal report and power, or signal report and CQ zone number or just 59 and a random number, whatever. If you get a response, then a quick 59 10 or whatever is all that's needed. And if the contest station asks for a confirmation of something you said then a quick roger roger roger is all that's needed. End of message!

But is it? I can't disagree with what Tom is saying – contesting is an art form and has its own rationale for how it works. *"Extra stuff just confuses us"*, he said. *"Every station in a contest gets a 59 report"*. Which is fine, I suppose, as it means they don't have to watch the signal strength meter, which speeds up the QSO rate a bit. But really? So, in effect, the report of my signal, if it's less or more than 59, is incorrect? And the contester doesn't care what his signal report actually is? Just report 59, some random number, and move on? Well it's contesting, and contesters are expecting to hear some quite specific very brief response. They really don't care what you are using – they just want the minimum needed for a valid QSO – callsign, a 59, and a letter or number.

I suppose, what Tom is really saying is that poor operating technique in a contest makes life difficult. So, it's not just QRPers then, because I've heard some really crazy QSOs during contests – we all have! An example? Yes, the guy who gives a signal report to a caller and then says QRZ. Again and again, and again with no callsign?

And maybe QRPers need to stop feeling so challenged by the QRO guys. You've proved QRP works, be happy about it! There is no need to feel in some way 'inferior', and there is no need to hammer it home in every QSO. Get on with it and enjoy your success.

Enough, then. Sorry Tom, it's a two-way street (or QSO, if you like). Yeah you want to win, and I want to give you a point. You're frustrated if your hourly QSO rate falls by a fraction because some guy responds differently than you expect, even if his reply is in accordance with the rules. That's life, not QRP! And don't start me on 'contesters pushing ordinary stations off the bands'. OK, Tom, I've done my best to restate what you said, as you asked. I hope you're happy with this, and that this doesn't mean I'm off your QSO list in next year's contest!

Am I saying that contesters would prefer if QRP operators stayed away from contests? I think that's too harsh. But if you are going to join in, then understand what you are doing. And keep it brief, and relevant, in the context of the contest.

In the end, this is all just a bit of fun. Really! Yes, there are serious aspects, such as EMERCOMMS (emergency communications), as practised probably more in the US than elsewhere. And there are really expensive challenges – such as Moonbounce for instance. Every station is different. Every operator is doing something different. We're all playing with RF communications, in an era when the rest of the world is focused on the internet as a communications medium (even if lots of that is via 3/4/5G radio towers). If we define the 'rules' so strictly that we exclude huge numbers of operators, either due to a perceived 'lack' of equipment or skills, then we impoverish our own hobby.

## Final Thoughts

I'm having fun with HF QRP, both at home and out portable. You're having fun building that high-powered amplifier. You're off on an exotic radio expedition, I'm going to the local beach. Your tower is bigger than mine but so what? I get a huge kick out of working someone in another part of the world, however briefly. You just want a point towards your contest score. I should also mention the campaign to protect the assigned QRP frequencies, and even the True Blue Club – all doing their bit to encourage low power operation.

Do whatever you want and what you enjoy. I didn't fully understand QRP until recently. Now it just makes sense. I'll never own a beam on a tower or build a transceiver. Like my CW, my soldering skills are rubbish. But don't tell me it isn't fun to park in a quiet spot upcountry somewhere, set up an antenna in five minutes, work a few stations, and have a nice lunch. Or that you're not amused when I answer your 1500W Yagi-beamed call with my 10W from a piece of wet string. 73, good DX, and good luck in the contest!

**Harry Leeming G3LLL**
harryg3lll@gmail.com

# A Most useful Piece of Test Equipment

**Harry Leeming G3LLL** describes the uses of a dip meter, still a handy tool to have around the shack.

One item of test equipment that never seems to get mentioned much these days is the Grid Dip Meter.

The original instruments contained a valve as the active component, hence the name (transistor versions – no grid – are generally described simply as a Dip Meter). **Fig. 1** shows the circuit of the Heathkit instrument I used in the 1960s. It was aimed at the amateur radio operator, came with a set of plug-in coils, and was an oscillator covering 1.8 to 230MHz. The Grid Dip Meter (or Grid Dip Oscillator, GDO) is tuned by setting the dial and plugging in the correct range coil. As the valve oscillates it passes grid current via R3, and this is registered on the 500µA meter.

The sensitivity of the meter is then set by VR1, to give a reading of around half to three quarters scale. If a coil and a capacitor forming a tuned circuit are then placed near to the plug-in coil, this will draw power from the dip oscillator when it is tuned to the same frequency. The meter reading of the dip meter will then 'dip', indicating the frequency that the adjacent tuned circuit is resonant at. A big advantage of the dip meter is that it can check tuned circuits that have no power on them.

Imagine that you are having problems trying to get a valve PA stage to tune up on the 80m band. Unless you are very brave or plain stupid, every time you want to make any tests around the PA coil, you would have to disconnect the rig from the mains and discharge the high voltage line. With a dip meter, however, the rig you are working on doesn't need to be powered up at all.

To test the PA tuned circuit make sure the rig is disconnected from the mains and discharge the HT line. Set the rig's range switch and the PA tuning to the frequency you wish check, say 3.6MHz, and fit the correct range coil in the dip meter. Note the reading on the front panel meter of the dip meter, bring its coil to about an inch from the PA coil with the two coils in parallel with each other, and tune the dip meter through the 80m band. (The dials on dip meters are often only accurate to around ±5%, but you can always confirm the exact frequency by monitoring on a receiver.) As you get to around 3.6MHz the meter reading should show a sharp dip. If it doesn't, try disconnecting the PA choke because if this has shorted turns on it, it could be the cause of the trouble, or check that there isn't a blob of solder on the PA coil. If this does not help, check the range switch and wiring and any other components in the PA tuned circuit until it will resonate.

## Other Uses

A dip meter can be used to check any item that has an electronic resonance such as a length of feeder. Lengths of feeder that are an exact electrical length have some very useful properties. One that has a length an exact electrical quarter of a wavelength, or an odd number of quarter wavelengths, has the property that the impedance at one end is the opposite to that at the other (open circuit at one end, for example, reflects as a short-circuit at the other). If for instance you want to reject a strong out-of-band signal that is overloading your receiver, or is breaking through on the IF frequency of older equipment, a length of feeder that is an exact quarter wavelength long at this frequency and is open at one end will short-circuit the unwanted station if it is wired in parallel with the antenna lead. But exactly how long should the 'quarter-wave stub' be? If you buy a new length of feeder no doubt the supplier will be able to advise you of the velocity factor. A length of feeder that uses any kind of insulation is always electrically longer that its physical length. RG213 for instance has a velocity factor of around 66%. This means that if it has a physical length 0.66m, it is electrically 1m in length. Widely spaced open wire twin feeder can have a velocity factor of around 98%, hence its physical length is almost the same as its electrical length.

If you have a length of feeder of unknown type and you want to check it, this is quite simple using a dip meter. Take say a 2.5m length as this will be a quarter of a wavelength long physically at 30MHz (10m). Add a very small one-turn loop at one end, leaving it open circuit at the other. Next place the loop near to the 30MHz range coil on a dip meter and tune this until you get a dip (at, say, 24MHz). You will then know by how much your coax is electrically longer than its physical length.

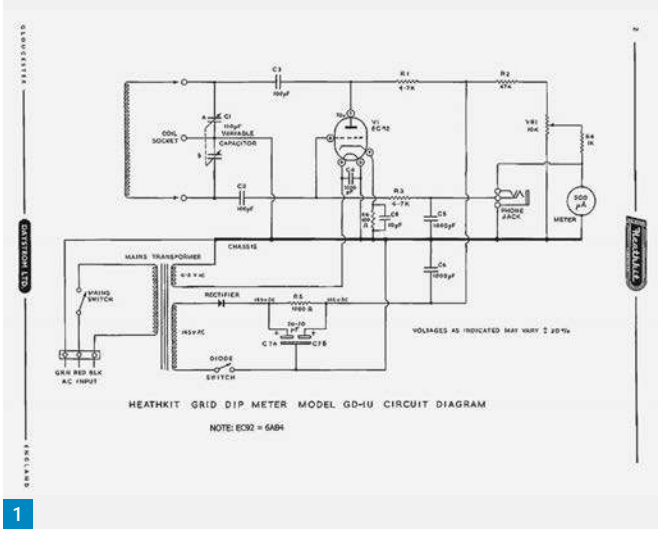
**A dip meter can be used to check any item that has an electronic resonance such as a length of feeder**

Dip meters are very useful, when checking the resonant frequency of antennas, but the valve versions had the disadvantage that they were not very portable. I did operate one on a roof with a long extension lead when I was a lot younger but was very glad later to obtain the TE-15 transistorised version. The circuit of this is shown in **Fig. 2** and it is basically a very simple device.

TR1 forms a wide range RF oscillator in conjunction with the range coil, which is plugged into the socket (a selection of coils is supplied with the meter), and the variable capacitor VC. The output level of the oscillator is controlled by the 10kΩ potentiometer, which is ganged to the on/off switch. The diode rectifies the output, and this is registered on the front panel meter and 'dips' when the resonant frequency coincides with that of a nearby tuned circuit.

## Checking HF Antennas

When I was running the shop I was quite happy to part customers from their money in exchange for a three-element HF beam, but I preferred to get excellent results without parting with loads of cash myself, and found the TE-15 invaluable when constructing fixed wire HF beams. You can, of course, try to make a beam by carefully measuring lengths of wire for the driven element and the reflector, but these are likely to be thrown off tune by the presence of nearby objects. The beauty of a dip meter is that providing that you don't mind

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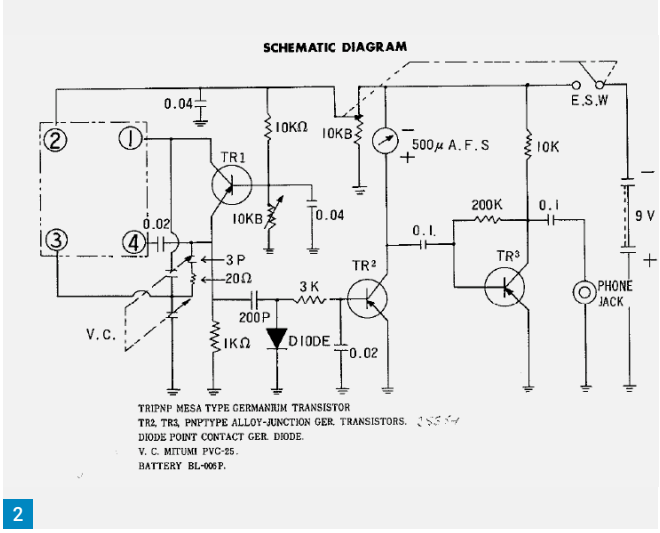


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scrambling around the roof, you can check the resonant frequency of elements after you have installed them. By far my most successful HF antenna I had at a previous QTH was a two-element 20m delta loop, which I eventually expanded into a 20/15m reversible beam and which I wrote up for several UK and USA magazines, including *PW*.

In its original simple form it consisted of two loops as per **Fig. 3**, which were strung from my VHF FM antenna and tuned up by my TE-15 dip meter, the driven element to the centre of the band, and the reflector to about 13.8MHz. I first calibrated the dip meter against a receiver and used single-turn loops at the end of the elements to couple to them when adjusting their length.

When I disconnected the loop from the driven element and connected the feeder, I realised that I had 'hit the jackpot' because my station was performing fabulously, and it seemed about equivalent to a typical three-element trapped beam. Listening on the air you may get the impression that all US stations use high power and vast antennas but using my new antenna I soon found that I was being called by low powered stations using dipoles. A beam helps just as much on reception as it does on transmit.

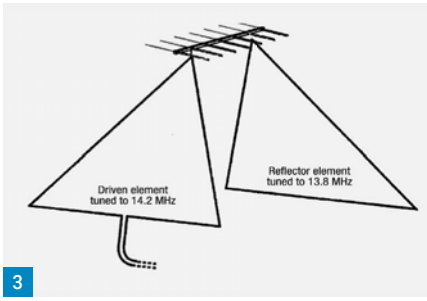
I had it aimed the beam at North America but realised then that I could easily reverse the direction. A property of a length of feeder that is an even number of half wavelengths long, is that the impedance of the load at one end reflects exactly the same impedance to the other. Therefore, if you connect a resistor at one end, the other end will present the same load. Likewise, if you connect a capacitor or an inductance at one end, the far end will likewise present a capacitive or an inductive reactance.

**Fig. 1: Circuit of Heathkit GD-1U GDO. Fig. 2: Circuit of TE-15 transistorised dip meter. Fig. 3: The author's two-element delta loop antenna. Fig. 4: The MFJ=201 dip meter as sold by W&S and others.**

I reasoned that if I made the parasitic element the same length as the driven element and connected a one-and-a-half electrical wavelength of low loss 300Ω 'window' ribbon to it, this would just reach my operating position. I could then connect a small coil to it and resonate the parasitic element just below the 20m band with my dip meter to form a reflector, or wire in a variable capacitor and tune it HF of the band to act as a director. This worked a treat but I then realised that if I made the feeder a few inches longer, there would be no need for the coil. I then wired a 500pF variable capacitor across the end of the feeder, and found that with the capacitor at maximum I was beaming towards North America, whereas at near minimum the parasitic element resonated just HF of the band, acted as a director, and I put a good signal into Europe.

The antenna system did result in rather a lot of wires on the skyline and I got a letter from my local town planning department, saying the I needed to apply for planning permission for my 'CB Aerial'. I wrote back pointing out that I did not have CB antenna, and that the only fixed antennas I had were for FM broadcast and TV, which were no different to my neighbours. The wire antennas, I pointed out, were for my amateur radio equipment, were not a permanent construction, and complied with the relevant guidelines in my licence. I heard no more!

If you want more details, you will find them among the articles on the *PW In the Shop* DVD.

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If you want to try a dip meter yourself, I have noted that used TE-15 units sometimes appears for £30- £50 on eBay and Google, or try your local radio club. Waters and Stanton stock the MFJ 201 version, which appears to be similar, and at the time of writing was £195 – see their website.

# Your Letters

Send your letters to: Practical Wireless Letters, Warners Group Publications plc West Street, Bourne, Lincs PE10 9PH
E-mail: practicalwireless@warnersgroup.co.uk

## A Titanic Story

**Dear Joe,**

Thanks for the Marconi story in *PW*. There was a program on TV about the loss of the Titanic that I half watched, until the story about the radio operator who carried on sending until the last moment. It reminded me of a story in the local newspaper about a Wireless Listener in West Bromwich, Staffordshire, who picked up the distress signal from the *Titanic* or other stations (I'm not sure). The Wireless Listener's name was **Howard Littley** (callsign 2NV, then G2NV). Howard heard on his receiver about the sinking, reported the distress signal and the loss of the *Titanic* to the Police and was then arrested (for spreading alarm/rumours) and put in the cells.until the following day.

I don't know any more about the story but the transmitter on the *Titanic* would have been a spark transmitter. The frequency could that have been 500kHz? Would Howard have access to a Valve Magnifier in 1912? Or would it have been a crystal set and headphones? Would the aerial length that Howard used to receive the signal be the length of his back garden? So, a very short aerial for the frequency in use? I believe the story to be true. In the 1965 *Call Book* there is a G2NV Howard Littley listed on the Isle of Wight.

It makes me think that the noise floor in those days must have been low, low down.

**John Ashmore**

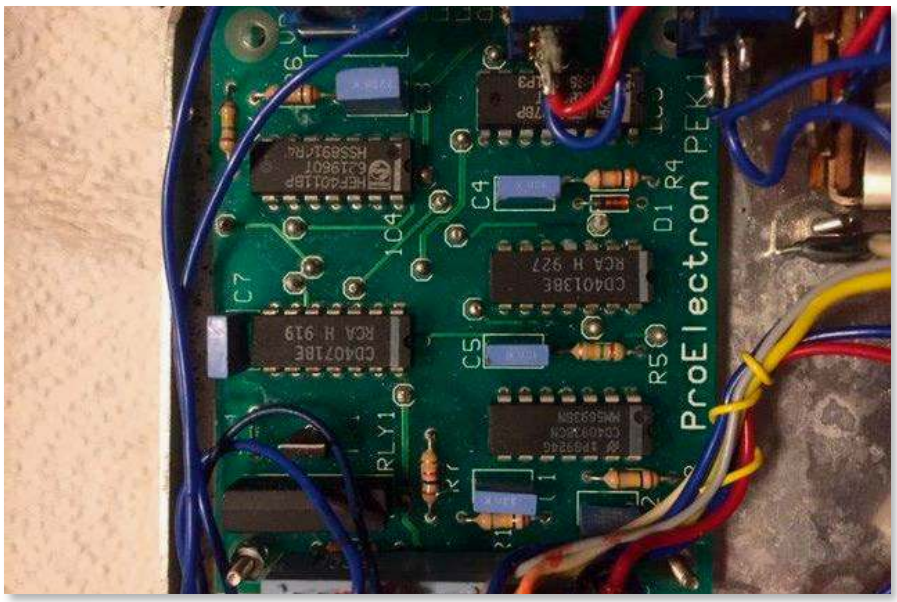
*(**Editor's comment**: The letter above was sent to our columnist **Joe Chester MW1MWD** but Joe and I thought it fascinating and worth reproducing here. I wonder whether any other readers have come across this story?)*

## Suggestions Please!

**Dear Don,**

I have been a reader of *PW* for many years and still enjoy reading the magazine even though I miss the simple constructions written by the late **Rev. George Dobbs G3RJV**.

Many years ago I bought from an advertiser in the magazine a ready-built electronic keyer named Pro Electron PEK 1 (see photo). I don't remember if the keyer was reviewed in the magazine. I built it into a homebrew enclosure and was very satisfied with the result.




**Norleif's Pro Electron PEK1 keyer.**

Some few days ago I installed a new battery. Unfortunately, I must have made a mistake since the keyer doesn't work anymore. The clock generator works, but not the output. I don't believe there was schematic with the keyer, only details of how to connect power and paddle and the output to the transceiver. I am sorry that I cannot find this information back in my technical archive. I have also tried to look for information on internet but without success.

I ask you for helping hands before I leave the keyer into the junkbox. Perhaps there are *PW* readers that can help with information about wiring the keyer and maybe also the schematic.

**Norleif Bjorneseth LA9FG**
**Norway**

*(**Editor's comment**: If any reader can help Norleif, drop me a line and I will forward it to him.)*

## Fantastic Support

**Dear Don,**

I would like to make you aware of the fantastic support given to me by **Martin Waller G0PJO** during my construction of his D70Box project featured in the October 2019 issue of *PW*.

Martin always replied to my e-mails very quickly. Not only was he able to offer a PCB, he even took it upon himself to 'bulk buy' from Europe the special enclosure enabling fellow constructors to save the high carriage cost.

I have read *PW* since the late 1960s, often building projects from the 'Take 20' series (no more than 20 components and costing no more than 20 shillings). The D70Box Morse Tutor certainly has fewer than 20 components but even though it cost more than 20 shillings (£1) to make, it is an excellent reworking of a classic amateur radio product. Thank you, Martin.

**David Mappin G4EDR**
**Filey, North Yorkshire**

## Beginner's Licence

**Dear Don & Tim,**

I've just read **Tim Kirby's** article in the January 2019 issue of *PW* that supports a Beginners licence.

I've recently become interested in amateur radio having acquired some of my father's radio receivers and I now want to progress by getting an amateur radio licence. I started looking around over a year ago for a local

club that can offer training for the Foundation and Intermediate licence. I'm now getting frustrated due to fewer and fewer clubs offering training and exams. I'm starting to question whether the hassle is worth it. I can see the logic in having clubs run the training and exam. Both the beginner to the hobby and the club benefit but this only works if there are sufficient clubs spread out across the country to run the training. When the number of clubs decreases, the reliance on clubs becomes a barrier to individuals taking up the hobby. I personally would be interested in a Beginner's licence if the exam could be done online or by filling out a paper form. I could then gain some experience before deciding if it's worth the time and effort travelling to a not-so-local club to gain further qualifications.

The exam for a Beginner's licence could be a much-simplified version of the current Foundation exam. Let's face it, the majority of the population are walking around with a transceiver in their pocket – it's called a mobile phone. There's no requirement to pass an exam to use a mobile phone so why are newcomers to the hobby required to know Ohm's Law, working at heights, working with power tools and battery technology? If the beginner is limited to approved equipment, limited power and restricted to the 2m and 70cm bands, then there is no need for most of the Foundation exam.

**Peter Holliday**
**Tring, Hertfordshire**

*(**Editor's comment**: Thanks Peter. When I took my Radio Amateur's Exam in the 60s, it was run by City & Guilds. You could be self-taught or attend a local course – in my case I signed up for RAE evening classes at my local, Northampton, technical college. In a way, it's now much easier but, as you say, only if you have a local club that runs the training. I would have thought that was the case in your neck of the woods but apparently not.)*

**Dear Don,**
I read your editorial and **Tim Kirby's** comments on **John Regnault G4SWX's** proposal for a Beginner's licence. I can understand the notion behind this but don't think introducing a fourth Licence class is the answer.

I am also one of those who took the old City and Guilds RAE plus 12WPM CW but do not believe amateur radio should stand still. I belong to two clubs here in Devon and have seen the great success of the current system with many taking up the hobby and progressing. I also see a fair few who do not progress beyond Foundation because they only want to use VHF/UHF/HF QRP, or Intermediate because 50W isn't that much weaker than 100W in most situations and there's a lack of real incentive to proceed.

I believe that there is a generational change becoming very evident. Young people are not necessarily drawn to amateur radio because there are fewer careers in Radio/Electronics but more in Digital technology and media. Also, today's kids have a number of means of communicating that we didn't and even those who get interested in radio can buy licence-free 440MHz transceivers and natter away with no callsigns, exams or protocol. A further point is that even youth organisations are struggling to attract new members as are many other clubs, societies and activities.

As a result, just lowering the bar and focusing on the younger generation may well fail to produce results. What I would suggest is changing to a two-tier system where the entry level can be something like John's proposal but with a period of continued study towards the next step, which will be the current Full (Advanced) licence. The initial licence could be granted for a period of two years during which time the Full licence exam would have to be taken, or the licence would lapse and the callsign reissued. This, in my opinion, would attract and keep those of all ages and backgrounds who developed an interest in radio technology while providing a clear and relatively fast route to a Full licence.

I hope this provides some food for thought.

**Lawrence Stringer G4GZG**
**Torquay**

**Dear Don,**
Regarding the proposal that another level of licence is introduced to attract youngsters into the hobby. Really? Yet another level. Why bother with any exam? If all the RSGB wants is more members then it's simple. Join the RSGB, pay your subs and get a licence thrown in, just like the good old days of BRS numbers.

Are youngsters the way to go? Surely attracting middle-aged, the family left home, spare room, spare money, enough to buy the entry-level of Japanese rig are the sort needed. Giving them a free licence would make more sense. They could then get their grandkids interested when they are looking after them in the holidays.

**Bernard Nock G4BXD**
**Kidderminster**

**Dear Don,**
Yes, it's an excellent idea. I say this not just because we need more members in the hobby but there have been significant equipment developments since I took the RAE and Morse test. A 5W, commercial build, battery powered HT for 2m and 70cm of today is relatively safe for everyone concerned compared to an ancient 100W HF KW2000, Yaesu FT-101ZD or homebrew TV valves rig, which in the wrong hands could not only cause RFI and burns but also kill you if you opened it up for inspection. Three cheers to **John G4SWX**. He may have just saved our hobby.

**Bob Houlston G4PVB**
**St Albans**

## Experimenting

**Dear Don,**
I'm both a licensed radio amateur (as is my father, two other brothers, and a sister-in-law) and avid SDR and listener, and I have a suggestion about experimenting as radio amateurs:

As many people will know, one part of amateur radio is experimentation. They will also know that stations are disappearing from shortwave frequencies, or moving from AM to FM, or FM to DAB/DAB+/DTV and satellite radio. It occurs to me that it would be of great benefit to both amateur radio and broadcast radio if radio amateurs could obtain permission from Ofcom to use an unused frequency to transmit experimental transmissions to test the new modes such as Digital Radio Mondiale and any other means of transmitting stereo on bands not used for it before, in a small bandwidth, and to test ways of transmitting to a very small geographic footprint, using low power and more directional antennas. Obviously, the music used could be the free-for-non-commercial-use Creative Commons. There are a number of websites dedicated to music that can be used without payment, legally, for non-commercial purposes. Ofcom would assume the same controls over speech content as for amateur radio – so no rude words! – and operation of the station.

If low power and/or directional transmission is used successfully, it would allow Ofcom to then grant licences for the promised small-scale radio stations and local stations to broadcasters, whether amateur or 'commercial' and would feed back data on propagation and sound quality that would benefit commercial radio and especially if the increase in DRM stations encourages more manufacturers and broadcasters in that mode. It would benefit DAB/DAB+ stations and would-be stations, and would allow more 'specialist' and 'genre' stations – not just community radio, but short-term pop-up stations – to transmit, for example, church services or school concerts and the like.

By allowing radio amateurs to run small-scale stations like this, it would also publicise amateur radio, and encourage new people to take up the hobby, and even allow academic courses to be transmitted to interested people, much like the Open University did with radio and TV when it first started. That would also benefit the academic bodies because they could publicise courses, supplement learning for struggling students, and even extend and expand on course content. Given that radio amateurs would be easily able to build or modify equipment for the frequencies offered, Ofcom would have a ready source of a mass of technical data, and 'normal' broadcasters would have a ready supply of potential operators for small-scale, local, and non-commercial stations, which could allow the creation of a professional qualification in radio engineering building on the RAE and what is taught in schools.

If supervised operation was allowed, as it has been for Jamboree of The Air, and as it was for G6 licensees wanting to learn HF before taking Morse (as it was when I started, although Morse is no longer a requirement), then it would encourage youth groups of all kinds (and probably many pirate stations would qualify and become legal and responsible), and get people who think *"I'm not technically minded"* into the hobby, and possibly employment in all areas of radio – technicians, engineers, broadcasters, DJs and so on."

So, there you have it – a way to get more and better radio stations, and remove pirates by teaching them to be good operators, rather than nuisances by ignorance or transmitting on frequencies that are allocated. A wonderful way for Ofcom to find better ways of allocating licences and ensuring operation is according to restrictions and permissions. I wonder what the RSGB, Ofcom, radio amateurs, listeners and the public think of the idea?

David Gordon G6ENT (son of G3XOI, brother of G6ENS and G6ENU, and brother-in-law to M6ENU)
**Brighton**

*(**Editor's comment**: Thanks for your e-mail David, some interesting suggestions. That said, I'm not sure such experimentation need be restricted to existing radio amateurs, much as I would love to see more publicity for our hobby. I believe a similar facility has been available for many years on an experimental basis, not necessarily to existing radio amateurs but to bona fide experimenters. The G9 callsign series was used for the purpose. Maybe* PW *readers will have thoughts of their own).*

## Speakers for Clubs

**Dear Don,**
When I look through the Club Events Calendar in the RSGB's *RadCom* each month, it is obvious by the number of Club Nights and Natter Nights that it is difficult to find speakers. I have suggested to the RSGB on several occasions that they or your good selves publish a list of speakers who are willing to speak at club meetings. I am happy to travel to other clubs in the Midlands (or my beloved Cornwall!) for the cost of the mileage.

My subjects are all historical:
•The Long Silence Falls – the first 100 years of maritime telecomms
•The Victorian 'Internet' – the first 50 years of submarine cable telegraphy
•Looking for a Needle in a Haystack – Locating and repairing breaks in Victorian submarine telegraph cables
•Aspects of Telecommunications during the Great War – Submarine Telegraph cables, DF & the Fullerphone
•Secret Listeners – The Y and RSS on both sides during WW2.
•Before Valves – amazing 'electrical' technology before thermionics.
•Cornwall's Communication's Heritage – Fire Beacons to Satellites & Fibre-optics

How about others showing their colours? The RSGB don't seem interested in my suggestion!
**John Moyle G1AWJ**
**Shipston-on-Stour**

*(**Editor' comment**: Thanks John. I seem to recall suggesting something similar in my* Keylines *a while back, with no response, but let's see if this generates anything. I am more than happy to list potential speakers. I have a suspicion that your own offer will be taken up by a number of clubs because, as you say, it is often difficult to find high quality speakers.)*

## Band Use

**Dear Don,**
My letter published in the December *PW* did not obtain the response I expected. Maybe I should have waited until April 1st. To enlighten readers. I have been an operator in Radio Communications for various organisations since 1962 so I am well aware of the sunspot cycle. But amateur radio has several disadvantages in this day and age:

1) The internet has decimated the amateur radio world. Why take exams and buy all that expensive gear just to get RST 73 and so on? Even for SWLs there are so few English stations to listen to.

2) It is easier to use chat rooms and the like on the internet than train for a licence. There used to be one exam that you took rather than the three today. (Excluding the now no longer required Morse test)

3) We mainly get radio activity on weekends, which is when there is a contest on, hardly any during the week

4) and the main problem is apathy. No one can be bothered to use radio. They just use smartphones or the internet.

So what we should do, and no one caught on to it? As broadcast stations leave the airwaves, the question might be *"why has no one thought about those unused frequencies?"* We could ask for the 17m band to be 18.000 to 18.500kHz and the 12m band to be 24.500 to 25.000MHz – our rigs can generally handle that.

I had hoped someone somewhere would have come up with the suggestion that rather than lose frequencies, now is a good time to get some more. After all, my FT-101ZD Mk3 covers all those WARC bands and any increased coverage of the 12 and 17m bands is already there.
**Ross Bradshaw G4DTD**
**Cornwall**

*(**Editor's comment**: Surely you answered this last time Ross – if the bands are already so little used, why extend them? I doubt we can have it both ways! As for why people might use amateur radio rather than the internet, somehow we need to get that message across – isn't it similar to why people enjoy fishing, rather than go to the local supermarket?)*

## Jodrell Bank

**Dear Don,**
I was interested to read about Jodrell Bank (December and January issues) but one bit was not mentioned. When the 4m band was first released to UK amateurs there was a restriction placed in the licence, that stated that it must not be used near to Jodrell Bank. I seem to remember that it was within 50 miles, but not sure. It is fortunate that we had a friend in a high place, because **Sir Bernard** arranged for tests to be made, and this was eventually scrubbed.

It is interesting to note that Sir Bernard was once not in electronics professionally. I can't help wondering if history would have been very different if it had not been for his interest in amateur radio?
**Harry Leeming G3LLL**
**Heysham, Lancs.**

*(**Editor's comment**: Your letter reminds me, Harry, that when I lived to the west*

*of Cambridge and wanted to put up an HF antenna, I was told that the planning application would also have to be run past the Cambridge University (Mullard) Radio Astronomy team. Fortunately, my interest was in HF operation but they were worried that some local amateur would start using the microwave bands and overload their receivers!)*

## Prehistoric Semiconductors

**Dear Don,**

The use of prehistoric semiconductors such as the 723 and 3055 in *PW* projects nicely highlights the non-critical nature of the device specifications but may confuse younger readers who will probably have trouble sourcing them, and/or get charged a premium for scarce device types.

These days I generally design such projects around MOSFETs, which have all but pushed BJTs (bipolar junction transistors) into obscurity. Component sourcing is easier, cheap(er) and maybe even free. UPS (uninterruptable power supplies) mains backup boxes are often easy to get because the SLA (sealed lead acid) batteries tend to dry out and sulphate long before anything else has the chance to fail. They usually contain two main heatsinks with neat rows of ready-mounted power semiconductors, which may not be insulated! Bipolar devices were common but are being overtaken by MOSFETS. Bipolar types were frequently high-gain Darlington type, so you'd be able to control much more current without upgrading the DB139 driver transistor.

MOSFETs, of course, have downsides, such as VGSthr being much bigger than Vbe on a BJT. You may have to use a bootstrap boost rail for the gate drive circuit unless you can afford to lose about 8V of the available voltage headroom. Although some state-of-the-art logic level devices have VGSthr not much more than a Darlington.

The P-channel MOSFET gives you the option of an LDO (low dropout) structure regulator but P-channel are more expensive, less capable and harder to come by.

The other option is an N-channel regulator in a floating ground configuration.

Gate capacitance is pretty much irrelevant in a DC system so you need barely any current at all to drive the gates. The BD139 driver is to boost the series pass transistor in the 723 and you don't need either of them. You can pinch what you need from the 723 internal schematic, which isn't all that much more than an op amp and a reference voltage generator.

There are online blogs on this topic but some can be a little misleading. Some are touted as 'high efficiency'. Some bloggers have assumed an association between MOSFETs and high efficiency switching regulators but this is still a linear regulator dissipating whatever energy that doesn't end up in the load. The driver circuit is more efficient because MOSFETs are voltage controlled instead of current controlled. What you need to accomplish may dictate a slightly more complex driver circuit but MOSFETs are much easier to get hold of, and the net increase in component count will probably end up being small.

On the audio for multiple receivers article (November), bass and treble controls are mentioned in the article and in my experience of shortwave listening they're well worth having, but not nearly enough.

Commercial equalisers with six to eight sliders are much better. Most use gyrator circuits to invert the main characteristic of a capacitor and make it look like an inductor. A row of LM324 op amp ICs seems to be the favourite but various manufacturers make various inventory choices.

It's a lot of wiring up or strip board cutting, especially if you want one for each channel. Apparently, it's possible to make each filter with a single transistor and a scattering of passives. The schematic of that circuit block eludes me at the moment, but it turns up in various guitar pedals on the Schematics Heaven website.

**Ian Field**
**Letchworth**

## Hamfest Write-Up

**Dear Don & Joe,**

Thank you for bringing the 2019 Hamfest into my living room (December *PW*). I have been able to go to the autumn Hamfest most years, starting years ago in London, then Leicester, Donington and Newark. Unfortunately, my wife and I were unable to go in 2019 even though we had booked the Travel Inn for the Thursday night and bought the tickets for the Friday. Thank you again for bringing it to life on the pages of your magazine.

**George Grimshaw G3TQX**
**Bury St Edmunds**

## FT-818 Review

**Dear Don,**

Firstly, many congratulations for the new format seen for the first time in the December issue. It's a big improvement and brings the publication right up-to-date.

I think however, that **Daimon Tilley's** review of the FT-818 radio paints a rather negative view of the set, which is not borne out by the overall market reception on a worldwide basis. Yes, of course, there are some items that could be improved, but I believe we should not forget that the FT-818 (like the former FT-817) is intended to be a broad spectrum set aimed at the lower-end price market attractive to new licensees who wish to experience HF in all its modes before committing to more expensive equipment in the future.

Daimon is undoubtedly very experienced, particularly in CW and in modes not initially of great interest to the beginner. It might be of interest to test the set in the hands of a 'Newbie' and get their impression and experiences in review.

**Jeremy Tarrant M0HWP**
**Trowbridge**

## Christmas Quiz

**Dear Don,**

I enjoyed the December *PW*, but I have a couple of notes on your answers to the Quiz.

Referring to question 16, I have always found the writings of **George Brown** interesting, in particular his autobiography which I summarised in an article to the Crawley radio club some years ago. Firstly, George ran out of wire at 113 radials but 120 was a more convenient whole number and got adopted as part of an FCC specification. No broadcaster was prepared to risk their licence by exceeding the permitted ERP and presumably no contractor wanted to be faulted for the installation of the ground system so 120 became the de facto standard.

However, look at Fig. 30 of Brown's classic paper (see link below):
https://tinyurl.com/smqbz58

In this paper he measures the intensity of the signal with two radials and 113 radials. With 113 radials the field strength was 195mV/m and with just two radials it was 125mv/m. Using 20 log10(v1/V2) that yields a power ratio of 3.8dB, which suggests that two radials might not be as bad as most people fear. This was real measurement. A lot of people try to simulate this but as I understand it a lot of the simulators that are available to amateurs are unable to correctly simulate grounded radials.

There is also an interesting note at the end of Fig. 29, which suggests that with small numbers of radials, shortening them to one third of the standard length does not make much difference. This is followed up by the measurements in Fig. 35 of the paper.

**Stewart Bryant G3YSX**
**Redhill**

# Rallies & Events

Plan your visits with our list of forthcoming events. Warners (Practical Wireless & RadioUser) will be attending events marked with an asterisk (*). Club secretaries/ event organisers: Please send full and accurate details of your events, affiliations and clubs as early as possible if you would like to be mentioned here: **wiessala@hotmail.com**

**February 1st (Saturday)**
**BARRY ARS TABLETOP RALLY:** The rally is at the Wilton Lounge, Sully Sports & Leisure Club, South Road, Sully CF64 5SP. Doors will be open from 10 am to 2 pm. Free entry, single pitch £10, traders £25 (tables included). There will be second-hand radios, computers and electronics, and there is a close unloading point for traders. Catering and a bar will be available.
**Nigel, GW1CUQ**
**gw1cuq@gmail.com**

**February 2nd (Sunday)**
**SOUTH ESSEX ARS CANVEY RADIO & ELECTRONICS RALLY:** The 36th Canvey Radio Rally takes place at the Cornelius Vermuyden School, Dinant Avenue, Canvey Island, Essex SS8 9QS. Talk-in is on 145.550MHz. Free car parking, and easy ground floor access to two large halls. Doors are open at 10 am, disabled visitors can come in from 9.45 am. Admission cost is £3, children under 10 go free. Tea, coffee and soft drinks will be available, as well as bacon butties. There will be radio, computing and electronics traders.
**Tony, G0JYI**
**tony@tonystreet.net**
**Terry Howchen**
**07986 070 040**
**thowchen@hotmail.com**
**www.southessex-ars.co.uk**

**February 7th to 9th (Friday to Sunday)**
**ORLANDO HAMCATION :** The Orlando Amateur Radio Club is hosting the 74th Annual Orlando HamCation at the Central Florida Fairgrounds and Expo Park. HamCation is the second-largest ham radio convention in the United States, with the inaugural event dating back to 1946. The 2019 convention saw 23,700 attendees, a record number for the event. With almost 90 vendors being hosted this year, there will be something for everyone, no matter the level of interest or involvement. Attendees wanting to further their ham radio skills can also test for their license, on 'technician', 'general' and 'amateur-extra' levels. The HamCation website has undergone several updates for this year.
**www.hamcation.com**

**February 9th (Sunday)**
**HARWELL RADIO AND ELECTRONICS RALLY:** The rally is at the Didcot Leisure Centre, Mereland Road, Didcot, Oxon, OX11 8AY (3 miles from Milton Interchange on the A34). Doors are open 10 am to 3 pm – admittance £3.00 (under 12s free). Free car parking. Disabled parking and facilities. Talk-in is on 145.550MHz, using the callsign G3PIA. Local and national traders, special-interest groups, and an RSGB bookstall. Homemade refreshments will be available all day.
**01235 816 379**
**rally@g3pia.net**

**February 16th (Sunday)**
**LOMOND RADIO CLUB BRING-AND-BUY EVENT:** At the John Connolly Centre, Main Street, Renton G82 4LY. Doors open at 10 am. There will be a bring-and-buy and traders; refreshments will be available.
**mm0elf@blueyonder.co.uk**

**February 16th (Sunday)**
**RADIOACTIVE RALLY:** The 2019 RadioActive Rally will take place at Nantwich Civic Hall, Cheshire, CW5 5DG. Free car parking; doors are open at 10:30 am. There will be a bring-and-buy, as well as traders, and an RSGB bookstall. A single raffle ticket is included with the entrance programme; additional tickets are available, and catering is provided on-site.
**Stuart Jackson**
**07880 732 534**

**February 23rd (Sunday)**
**BREDHURST RECEIVING AND TRANSMITTING SOCIETY (BRATS) RADIO RALLY 2020 (RAINHAM RALLY):** The BRATS Rainham Radio Rally 2020 is at the Victory Academy, Magpie Hall Road, Chatham, Kent ME4 5JB (Main Hall). There will be well-known traders, a talk-in station on 145.550MHz (Callsign GB4RRR), an interactive zone for kids, a BRATS kitchen, and much more. Open 10 am to 3 pm. Adults £3, children free.
**07825 838 877**
**Rally-coordinator@brats-qth.org**
**www.brats-qth.org**

**February 23rd (Sunday)**
**RED ROSE WINTER RALLY:** The rally is at St. Joseph's Hall, Chapel Street, Leigh WN7 2PQ. Doors open at 11 am. Trade, individual and Club stands, as well as a bring-and-buy.
**www.wmrc.co.uk**

**March 1st (Sunday)**
**EXETER RADIO & ELECTRONICS RALLY:** The rally will take place in the America Hall, De la Rue Way, Pinhoe, Exeter EX4 8PW. Doors open at 10.30 am (10.15 am for disabled visitors). Admission £2 (under 16s free). There will be trade stands, a bring-and-buy (book-in from 10.15 am), and catering will be available.
**Pete, G3ZVI**
**07714 198 374**
**g3zvi@yahoo.co.uk**

**March 8th (Sunday)**
**PENCOED ARC TABLE TOP SALE:** The event will take place at the Pencoed Rugby Club, The Verlands, Felindre Road, Pencoed CF35 5PB. Doors open 9.30 am, stallholders have admittance from 8 am. Entry £2. Refreshments are available on-site, including hot food.
**Madeline Roberts**
**0773 837 5775.**

**March 15th (Sunday)**
**WYTHALL RADIO CLUB HAMFEST:** The 35th Wythall Radio Club Hamfest will take place at the Club HQ, Wythall House, Silver Street, Wythall B47 6LZ. Doors open at 9.45 am (9.30 am for disabled visitors). Free on-site parking. Admission £4. Four halls of traders, including a bring-and-buy and a club stand. A selection of refreshments will be available all day.
**Ian Reeve, M0IDR**
**01386 839 655**
**wrc4hallsradio@outlook.com**
**www.wythallradioclub.co.uk**

**March 29th (Sunday)**
**CALLINGTON ARS RADIO RALLY:** This year's Callington Rally is at Callington Town Hall, Callington, Cornwall PL17 7BD. Doors will be open from 10 am to 1 pm; admittance is £2. There will be a bring-and-buy (10% commission) and trade stands. Catering is available on site. Ample free parking can be found in the adjacent carpark. The rally is organised jointly by the Devon & Cornwall Repeater Group and the Callington Amateur Radio Society (CARS). More information and bookings:
**Steve, G7HEP**
**Roger, 2E0RPH (Rally Enquiries)**
**07854 088 882**
**2e0rph@gmail.com**

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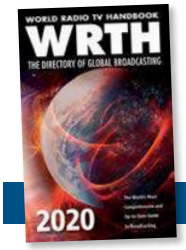


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ON SALE AT OUR BOOK STORE ON PAGE 15

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# The Case for QRO (High Power)

## Some thoughts from the editor **Don Field G3XTT**

**Don Field G3XTT**
practicalwireless@warnersgroup.co.uk

In his *Notes from a Small Station* **Joe Chester MW1MWD** makes the case for QRP operation. I know that this appeals to many *PW* readers and certainly wouldn't knock it. Effective QRP operation makes demands on the operator and the station – feeder losses, antenna inefficiencies and so on become more important when you cannot compensate by increasing transmitter power.

But let me at least make the case for running the power levels that our licence allows (which, incidentally, are certainly not 'high' – high power is what the broadcasters deem necessary to beam their signals around the world, typically tens of kilowatts and large curtain arrays to achieve maximum effective radiated power). Those with a Full licence have earned the right to run 400W so why not take advantage? (It is still, incidentally, significantly lower than the 1500W typically allowed in many other countries) I know that the subject can bring out strong emotions but I'll try to be objective!

At the bottom of the sunspot cycle, as now, QRP will simply not do the job, not even on the principal bands, never mind the 'edge' bands such as 160 and 10m. It's not a case of competing with louder stations, but with propagation. The FT modes (FT8, FT4, etc) have helped to bridge the gap but probably by no more than, say, 10dB.

One of Joe's arguments is that anyone using a linear amplifier is going to end up with neighbour problems. I've certainly had such challenges to overcome in years past, though less so in recent years with widespread cable and satellite TV reception. But surely even that is part of our 'self-training' and is what sets us apart from, say, CB operators who are restricted to type-approved equipment and low power precisely because they are not equipped to deal with such problems when the arise.

It comes down to what your particular interests are and what you want to achieve in the hobby. It's certainly not necessary to run high power all the time. I don't. But there are times when it helps enormously, for example when chasing a rare one on the low bands or when participating in one of the major contests (in smaller contests, there is usually room for everyone to find a clear(ish) spot). And when trying to make true weak-signal contacts on the VHF and UHF bands via troposcatter, moonbounce and the like, high power is not just a luxury, it's essential.

I have friends who have achieved high DX totals with QRO and have found great satisfaction in starting again with QRP late in their amateur radio careers. Conversely, I know of others who have started with low power, found it frustrating and have invested in a linear amplifier. In my case, buying my first amplifier (a second-hand Yaesu FL-2000) made little impact on my high band results (there were sunspots back then!) but transformed my DXing on the 80m band, finally allowing me to achieve DXCC (100 countries worked) on that band from my small suburban garden. What made more difference back then, on the 10m band, was my very first HF gain antenna, a two-element quad I built with garden canes for the princely sum of about £2.50 but that's another story!

# Next month

## in the UK's best & only independent amateur radio magazine...


**MODELLING THE EFHW:** Ian Dilworth G3WRT models the End Fed Half-Wave antenna in a typical suburban environment.

**VALVE & VINTAGE:** Bernard Nock G4BXD has another update on developments at the Military Wireless Museum.

**WHAT NEXT:** Colin Redwood G6MXL completes his mini-series on antenna supports.

**DOING IT BY DESIGN:** Eric Edwards GW8LJJ has a direct conversion receiver for the 40m band.

**THE WILD CAT ANTENNA:** Tom Morgan ZS1AFS describes how he designed an antenna for a rather unusual challenge!

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# Happy New (Products) Year

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A powerful, high performance digital spectrum analyser covering the 1GHz frequency range starting at 50KHz.
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The original DX Commander classic telescopic pole.
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Multipurpose RF instrument integrating a Network Analyser, spectrum analyser, field strength meter and a signal generator.
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High quality RF interface module allowing the Icom IC-7300 to have a pure RF signal output for connection to an external SDR receiver.
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Customisable SDR Multifunction wheel that can be configured for use with various SDR programs.
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Quality linear amplifier with 5" high resolution colour display
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**Anytone D878UV Plus**
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**RigExpert Stick 230**
100Khz-230Mhz Analyser.
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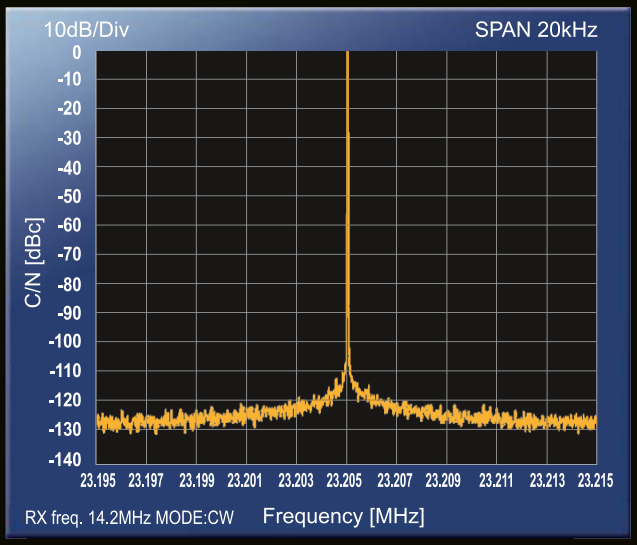
The radio... YAESU

# FTDX101 TECHNICAL HIGHLIGHT - #3

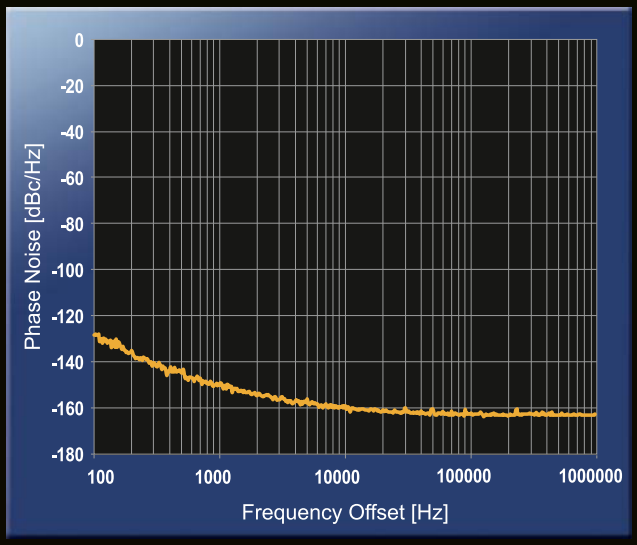
## The 400 MHz HRDDS (High Resolution Direct Digital Synthesizer) Ultra Low-Noise Local Oscillator System

***Provides an outstanding Low-noise, High quality Local oscillator signal that greatly contributes to the excellent multi-signal and the close signal proximity characteristics of the receiver***

### 1st Local OSC Carrier to Noise Ratio (14.2 MHz / Mode CW)




### 1st Local OSC Phase Noise: -150dBc/Hz (14.2 MHz / 2 kHz separation)




±0.1ppm High Precision TCXO

400 MHz HRDDS Unit

**HF/50MHz TRANSCEIVER**
**FTDX101MP** 200W

**HF/50MHz TRANSCEIVER**
**FTDX101D** 100W

* Microphone M-1: Optional

YAESU The radio


**YAESU UK Ltd**
Unit 12 Sun Valley Business Park, Winnall Close
Winchester, Hampshire SO23 0LB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