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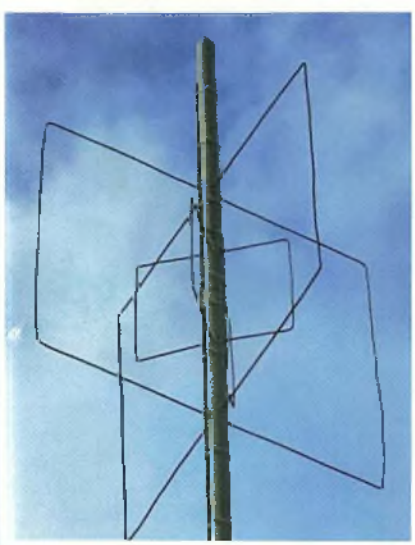

Homebrew Satellite Antenna
A useful weekend project

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Peter Waters G3OJV

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Peter Waters G3OJV, operates the first FT-DX101 to come into the UK.

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IC-V80E	2m Handy	£129.95
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Metered Dummy load that has a range up to 60Mz. Ideal for HF stations. Fitted by-pass switch.

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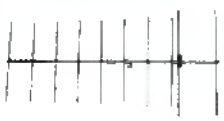

A-502HBR....6m 2 El. Phased 6.3dBi 400W.....£89.95
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Height is 6.52m. £209.95

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The ever popular 5-band model that covers 80m to 10m. This is a great backyard antenna that can be ground mounted.
The height is 7.64m
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6BTV
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1kW End Fed Design

MyAntenna USA

No ATU Needed
EFHW-4010 66ft
40-20-15-10m
EFHW-8010 132ft
80-40-30-20-17
15-12-10m

Peter Waters G3OJV says, this has to be the perfect wire antenna solution for many. End fed makes installation easy. No ATU is a big plus. I use one myself and it beats the pants of the old G5RV.

MyAntenna EFHW-4010 .....£149.95
MyAntenna EFHW-8010 .....£159.95

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Strong, fibre glass telescopic masts for wire antennas and verticals. A dream answer for back garden or portable.

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22-HD ....22m long •2/0m collapsed
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26-HD ....26m long • 2.0m collapsed
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Diamond CX-310A .....3 Way PL £88.95
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Watson CX-SW2N .....2 Way N.....£41.94
Watson CX-SW2PL .....2 Way PL £34.95
Watson CX-SW3N .....3 Way N.....£59.95
Watson CX-SW3PL .....3 Way PL £54.95
Watson CX-SW4N .....4 Way N.....£79.95
Watson CX-SW4PL .....4 Way PL £69.95

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RCS-4LX.....4 Way with static protect..£216.95
RCS-4X.....4 Way standard.....£179.95
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RCS-10L.....8 Way standard.....£229.95
RCS-8VX.....5 Way standard VHF.....£183.95
RCS-8VNX...5 Way standard VHF N.....£193.95
RCS-12X.....8 Way auto band sensor....£334.95
RCS-12LX...As above + static protect..£377.95

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Contents

Practical Wireless April 2019 • Volume 95 • Number 4 • Issue 1343

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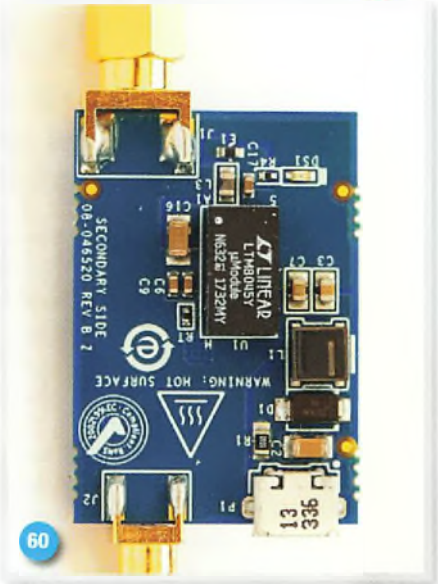


WARNERS GROUP PUBLICATIONS PLC

Cornish Radio Amateur Club Exam Passes

The Cornish Radio Amateur Club reports 11 successful Foundation licence passes on February 3rd. They are particularly proud that 10-year-old Anne Marie was one of the successful candidates. She can be seen in the photo wearing a hat standing on the stage above the other ten new licence holders and to the far left in the photo holding the banner is one of the trainers, **Rick G4PGD**.

Moonraker acquires Sharman MultiCOM

Moonraker has acquired the Sharman brand, website, goodwill and stock. Sharman's, which has traded since 1971, was one of the first companies selling CB radios and accessories in the UK. Since its inception it has evolved and now distributes a full and complete range of two-way radio products and accessories to the hobby and professional markets.

Justin Godefroy of Moonraker, which is already established as one of the largest retailers and wholesalers of radio communication products in the UK and Europe, commented: *"Sharman's is a great business with some superb products and we are looking forward to continuing the Sharman MultiCOM brand and product range. Together, the Moonraker and Sharman brands now deliver one of the largest ranges of hobby radio communication equipment in the market.*

"We intend to maintain the ethos of both companies of delivering competitive pricing, quality 'in stock' products and excellent customer service from a fun and friendly team".

Mull in May

Members of Tynemouth Amateur Radio Club, GONWM, are travelling to Mull from May 17th to 24th where they will be operating using the callsign GSONWM.

Subject to conditions the group will be operating up to four stations across the HF bands on SSB, CW, RTTY and FT8 (Fox/Hound mode) and they hope to have a go at VHF/UHF Satellite operation.

QSL is via **m0urx.com**. GSONWM can be followed on Facebook, Twitter, Instagram and the club website: http://tynemouthradioclub.com

Peterborough Club News

2019 started with a Natter Night and a discussion about what 'radio goodies' Santa had given members. Alan GBXLH, club secretary, brought along his Christmas present to himself, a four-band HF loop manufactured by 2E0ERO in Northampton. The bands covered by the magnetic loop are40/30/20/17m and it is approximately 60cm in diameter. Alan bought the loop, new, on eBay for £175.

Most of the components were manufactured by Adrian 2E0ERO using 3D laser printing for spacers and mounts and a CNC milling machine for the tuning capacitor, assembly being a family affair. The loop is designed for QRP use only and is not suitable for wet weather operation. See the pictures on Adrian's qrz.com page.

Alan Demonstrated the performance of the loop with it fed from his Elecraft KX3. The loop's motorised tuning capacitor worked well and the internal ATU on the KX3 tuned it to perfection. On a test a few days before the meeting, at a friend's QTH, the loop mounted near the ground compared well on receive with a 40m wire antenna. Receive signals were only 1 to 2 S points down with much less noise on the signal.

The second meeting saw another presentation by Alan about a new piece of kit purchased by the club, the Metronova 180 VNA analyser. He explained that this is Bluetooth-enabled and measures SWR, R, Z, X and L plus forward and transmission loss and much more. The touch-screen also allows for multiple band viewing when cutting and setting up antennas. The versatile analyser measures anything that the antenna builder needs plus more. It can be plugged into a computer and accepts firmware upgrades. At a cost of £259 from most dealers, the club believes it's good value for money.

Gavin GM0GAV has let us know that the GMDX Group are running a CW Boot Camp on Sunday March 10th. The venue is Stirling and District Amateur Radio Society, Unit 68, Bandeath Industrial Estate, Throsk FK7 7NP

The meetings begin at 09:30 (local) so please be sure to arrive in plenty of time. The day finishes at approximately 16:30.

Your main decision is to decide which group you want to work with: under 12WPM, up to 20WPM, and 20WPM up. Within each group, the aim is to develop your practical CW skills. Note that at times all groups are combined for talks and group CW activities.

You can participate and drop out as you wish, meeting others with a common interests and different levels of proficiency. There will be an opportunity to listen or to operate the well-equipped GM6NX station on CW under supervision. Perhaps you will make your first CW QSO?

GMDX hope to offer an opportunity to take the RSGB Morse test, if there is sufficient interest. Please indicate if you wish to do this when you e-mail your interest in attending.

Finally, what to bring? All of the following:

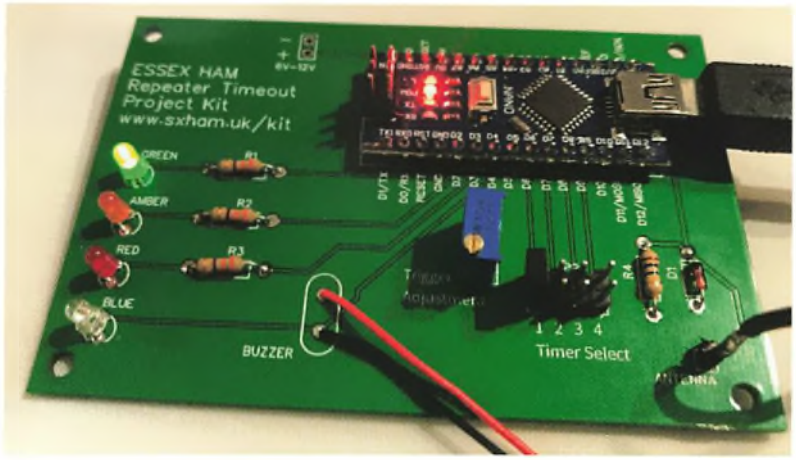
- Morse key with 3.5mm jack and 3.5/6.0mm adaptor.
- High impedance headphones, same jack requirements.
- Writing pad and pencil/pen.
- Name badge with callsign.
- Registration Fee £10.00; please bring correct amount (cash only).
- Mug and your lunch.

GMDX will provide drinks and biscuits but please bring your own lunch. Bear in mind that there will be just a 30-minute lunch break.

You will be able to put faces to names and callsigns and meet new fellow-enthusiasts. Get advice on how to develop your CW skills. Find new ways to learn and get you past your blocks. Try different keys. Find yourself a CW mentor.

This event is open to all but places are limited, so it is important that you pre-register your interest in attending to **gmdxgroup@gmail.com**

www.gmdx.org.uk



Repeater Timeout Detector

A brand-new project kit has been released by HAMtronics in the UK – a repeater timeout detector.

The kit makes use of an Arduino Nano board and some basic components to detect local RF when you start transmitting. It provides a visual and audible warning when the timeout is approaching and when it has been exceeded. The kit can be set to timeout intervals between one and four minutes.

The kit is easy to construct and supplied with full instructions. It makes for an ideal beginner's project and is handy for repeater users. The kit can also be used as a low-price club construction project or at a buildathon.

Two versions are available, one of which is a Special Edition version branded with the name 'Essex Ham' because the idea stemmed from the group's weekly Monday Night Net, where overs are limited to two minutes.

For Essex Ham's video review, go to the Essex Ham website (below) or to the HAMtronics site to purchase a kit. Current UK price is £10 plus P&P.

www.essexham.co.uk/kits
www.hamtronics.uk

Isle of Wight Awards

The Isle of Wight Radio Society is celebrating its 50th Anniversary with an awards scheme in which all amateurs and SWLs can take part. Certificates will be awarded for working IWRS members, the society's callsign G3SKY and any special event stations during the anniversary year. This will include working IWRS members through the Isle of Wight Repeater GB3IW. The type of certificate awarded, Gold, Silver or Bronze, will depend on the number of IWRS stations worked. The scheme will run from April 1st 2019 to March 30th 2020. Full details of the rules, etc, can be found on the Society's Facebook page:

www.facebook.com/groups/IOWRS

The point of contact for this awards scheme is **Paul G0GMY**, e-mail:

paul.g0gmy@gmail.com

Android Peanut

Ian G3ZHI advises that peanut is an android VoIP (Voice over Internet) application that allows radio amateurs to talk on analogue and over-the-air gateways to D-STAR, DMR, Fusion, Wires-X and so on using a cellphone or other android device.

When using it in analogue, peanut-to-peanut the audio quality is excellent so it is ideal for older amateurs who are having trouble with hearing loss.

You can also run it on a windows PC using an android emulator. See here for the minimum requirements:

https://tinyurl.com/y2fx2x2c

Ian says peanut is busy with amateur radio chats and is ideal for amateurs who like to have a long conversation and not ten-second QSOs. Its use is limited to radio amateurs and you need to get a code from PA7LIM to participate:

www.pa7lim.nl/peanut

Maritime Radio Day

Regular correspondent **Ross G4DTD** draws readers' attention to this year's Maritime Radio Day, which will be held from April 14th (1200UTC) to 15th (2200UTC). It is primarily aimed at what Ross describes as 'all those ex-seagoing types and those who worked in Coast Stations'. Details can be found on:

http://www.trafficlist.net/mrd

ICQ Podcast

The February 17th episode features the latest worldwide amateur radio news while **Colin M6BOY** rounds up the news in brief and the main feature is 50 years of Worked All Britain.

www.icqpodcast.com

ANZAC Day

Peter Wolfenden VK3RV, WIA (Wireless Institute of Australia) Historian, has kindly provided the following: ANZAC Day, named after the Australian and New Zealand Army Corps, was established initially as a consequence of WWI and in particular the Gallipoli Campaign, which saw so many young men from that part of the world sacrificed or badly maimed. Now Australia's and New Zealand's foremost Day of Remembrance, it is a day entirely dedicated to those who fell, suffered or served in all wars and conflicts, including peace-keeping operations.

ANZAC Day ceremonies are held on April 25th each year, a public holiday, and are multi-faceted, usually commencing with a Dawn Service, an ANZAC Day Breakfast (also referred to by some as the Gun-fire Breakfast), followed by Parades, Wreath Laying, a Period of Silence and the Sounding of The Last Post. April 25th was the day on which, in 1915, Australian and New Zealand soldiers, as part of an Allied expedition, landed on the Gallipoli Peninsula in an attempt to open the way to the Black Sea for the Allied navies.

The Commonwealth of Australia was formed in 1901 from the six former British colonies that made up the land mass of Australia, and it is generally accepted that the Gallipoli battle in 1915 enduringly defined Australia as a nation. Both Australia and New Zealand entered WWI when on August 4th 1914, the mother country declared war on Imperial Germany and Austro-Hungary. That costly fight, resulting in some 11,430 deaths of Australian and NZ soldiers, and defeat, is now part of Australia's and New Zealand's psyche and heritage.

Australia was quick to react to the declaration of war. Less than four hours after its proclamation in London, a German cargo ship, the *SS Pfalz*, was stopped from escaping Australian waters by a shot fired across her bow, at the Port Phillip Bay Heads (Victoria) This action has been described as the 'first shot fired in anger in WWI'.

So, it is quite appropriate that *PW* has chosen April to publish **John Sones'** article about the WIA's *Wireless Men and Women at War* anthology. The book contains many stories about amateur radio operators – ordinary, but simultaneously, unusual people, who in difficult situations served us all well during those times of conflict.

Australia's regulating authority, the ACMA, automatically allows all Australian radio amateurs to substitute their normal callsign prefix VK with the prefix AX on ANZAC Day as an amateur radio salute to the servicemen and women who served.

Please note: The use of the AX callsign prefix for the 24-hour period on Anzac Day April 25th, is based on local time in each State, not UTC time.

Choke Cookbook

Jim K9YC has published *A New Choke Cookbook for the 160-10m Bands* on his website. Jim concentrates on two sizes of type-31 Fair-rite magnetic cores, covering theory and practice for controlling RF current on the outside of transmitter feedlines:

http://k9yc.com/2018Cookbook.pdf

• E-mail: tim@g4vxe.com • Twitter: g4vxe

MMDVM Nano hotspot for DMR, D-STAR, C4FM, NXDN and P25

Tim Kirby G4VXE looks at another useful and cost-effective digital voice hotspot.

When Moonraker were looking to stock a Multimode Digital Voice Modem (MMDVM) hotspot, there are so many to choose from that Chris Taylor G0WTZ decided to ask a real expert in the subject, Jonathan Naylor G4KLX for his recommendation. Jonathan recommended that Chris take a look at the BI7JTA models and this is what they have done.

Here at *PW*, we have already reviewed a very similar MMDVM device in the shape of the Zumspot-RPi. The MMDVM Nano should have the same capabilities as the Zumspot but we wanted to see how, if at all, the performance differed. If you would like a detailed description of what an MMDVM device can do, please refer to the Zumspot review (*PW* December 2018).

However, as a reminder the MMDVM devices are digital radio hotspots, with a transmitter power of around 10mW. They act as personal repeaters, so that you can connect to a variety of digital radio networks (D-STAR, DMR, C4FM, P25, NXDN) using a digital handheld. Excitingly, some cross-mode capabilities exist, from DMR to C4FM and NXDN, for example, and from C4FM to DMR, P25 and NXDN. Please note that the MMDVM doesn't allow cross-mode contacts to and from D-STAR, although there are some reflectors that do allow this functionality. The Nano has the MMDVM board attached to a NanoPi single-board computer, which has WiFi built in. This means that you can power the hotspot from a USB port or power supply and pick internet connectivity from your home WiFi, or perhaps from your mobile phone acting as a Personal Hotspot.

The Nano is small enough to use in a car – supplied from USB power and tethered to your mobile phone for an internet connection.

First Impressions

The Nano is surprisingly small! It's presented in a 3D printed case that has a slightly rough look to it but is robust and well-fitting. There's a small window in the case for an OLED display as well as an RJ-45 network port, micro-USB connector for power, a port where the WiFi adapter is connected and an aperture for the micro-SD card containing the file system for the NanoPi computer.

Thinking that the Nano would be like the Zumspot, I powered up the device on USB and hopefully scanned the WiFi for a 'Pi-Star-Setup' WiFi network to appear. It didn't and no new WiFi networks appeared. I have subsequently discovered that there were some bugs in the versions of Pi-Star that were current at the time, which may have prevented this happening.

Later, I discovered in the instructions (URL below) that if I had created a WiFi network on my phone called 888888-2G with a password of 0123456789, the hotspot would have connected to it! https://tinyurl.com/y7z25al2

What I decided to do, however, was to connect the Nano into my router, using a networking cable and the RJ-45 connector on the Nano. I was then able to use Fing, a network scanner running on my smartphone, to find the IP address of the Nano. Then I was able to start to configure it from a web browser, using the IP address I had just discovered. In fact, the first thing I did was to edit the WiFi parameters so that it could connect to the house WiFi rather than being hardwired from the router.

It was at this stage that I discovered that the WiFi capabilities of the unit were not as I had expected. If I moved the Nano out of the room where the WiFi router is situated, the connection dropped. I asked Chris Taylor to check another unit to see whether this was standard across other models. He said no and that he had successfully connected to a WiFi router around 30m away. However, if you want to use a Nano somewhere that you feel the WiFi signal is weak, it may be worth you checking that you can return the unit if it doesn't work as planned.

Once I'd worked through the networking setup wrinkles, Pi-Star setup itself was very easy, although I found the BI7JTA instructions rather less clear than the general Pi-Star setup instructions at the link below, which I would probably recommend as an alternative. By the way, Chris G0WTZ recommends the Nano.MMDVM support group on Facebook.
https://tinyurl.com/yyhuxnga

Something I did notice was that the NanoPi board was faster to restart than the Pi Zero W that I use with my Zumspot. This will be because it is a slightly faster processor.

Getting on the Air

With the hotspot configured with its frequency, I was able to try it on the air and quickly put it into DMR mode, connected to the Worldwide Brandmeister reflector 4639 and listened on the appropriate frequency with a DMR radio (I used an Anytone AT-868 for testing). Sure enough, I was able to make some test contacts. D-STAR was the same and I was able to connect the Nano hotspot to the worldwide reflector REF001C and connect using my Icom IC-E92 handheld. (Note that you must put your rig in repeater mode on D-STAR, albeit with a repeater shift of 0kHz, otherwise it will not work). Finally, I put the Nano into YSF (Yaesu System Fusion or C4FM) mode and connected the hotspot to the America Link 'room' or reflector, which worked well.

The nice thing about MMDVM-type hotspots is that you can be connected to, say, D-STAR, DMR and YSF networks all at the same time and the hotspot will change into the appropriate mode automatically as traffic comes up on the different networks. If you start listening to a D-STAR contact, say, you can 'anchor' it to the D-STAR system by waiting for a quick break in transmissions and transmitting a D-STAR signal with your handheld so that the MMDVM will not move over to, for example, Fusion in the middle of an interesting D-STAR QSO!

The Nano has low enough power consumption that you can use a USB power bank to provide its power. I found this was more than adequate for several hours use.

I was also pleased to find that I could use the cross-mode capabilities of the hotspot to go from YSF to DMR, NXDN and P25 systems as well as from DMR to YSF and NXDN systems.

One of the nice things about the OLED display on the Nano is that it shows you which mode is active and if there is a station transmitting, what their callsign is. You can also see the IP address of the hotspot, which can be useful at times.

Out and About

One of the very adaptable things about the MMDVM-type hotspots is that you can take them out and about with you, perhaps in the car (or even in a rucksack if you are walking), so that you can tether the WiFi to your mobile phone's hotspot and listen to whatever digital network you wish. I used the WiFi configuration to add in the SSID and password for my iPhone's hotspot, so that if I wanted to use the Nano in the car, I could. Sure enough, that worked fine and I enjoyed using the Nano when I was parked up at a local hilltop, being able to make contacts into the USA using the Fusion systems.

Updates of Pi-Star software are possible through the configuration dashboard menus and I successfully upgraded to the latest version of Pi-Star on the Nano.

Conclusion

The MMDVM Nano worked well as a hotspot and did everything I asked of it. The setup was a little more quirky than other MMDVM models I have used but once done, it worked fine. It may be that those problems were more a product of the Pi-Star software than the Nano itself. The WiFi performance was notably less than I would have expected but that was hopefully just the WiFi adapter on the review model. Apart from those reservations, I was happy with the performance of the Nano. If you are a digital radio enthusiast, you will almost certainly want to own an MMDVM-type hotspot because they provide a very flexible approach to digital radio, especially with the possibility of cross-mode connections.

Many thanks to Chris Taylor of Moonraker for the kind loan of the hotspot and for answering all my questions. The MMDVM Nano is available from Moonraker Ltd and costs £134.99.

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Build Your Own satellite Antenna

John Hemming GOUYT describes an experimental satellite antenna for 2m/70cm.

Last summer I was recovering from surgery on the brevis tendon in my ankle so I was housebound for around eight weeks. As luck would have it the World Cup was on so I was enjoying my recovery with a beer in hand, football and the wonderful weather.

But of course, as a radio amateur, I wanted to operate outside in the sun. Being unable to travel I decided to work the FM satellites with my dual-band handhelds. Positioning myself in the centre of the garden I was able to hear a few passes of AO-91/2 from my garden chair while my leg was in plaster. I managed, by swinging around my handheld, to make a couple of contacts via AO-91 so the bug had bitten and plans were formed to construct a better antenna.

Time for Research

I researched some designs and decided on a dual-band Yagi using five elements on 70cm coupled with a Moxon two-element for 2m. Of course, this antenna was very good and I was able to make contacts by tracking the satellites across the sky at different elevations. I was able to work through all of the popular FM satellites, including AO-85, AO-91, AO-92 and SO-50. It was a struggle being in a plaster cast and often I would wait for the XYL to return from work and she would hold the antenna under my instructions as to where to point it. This was not ideal so I started working on plans for an omnidirectional antenna to work the birds (satellites) from the comfort of my garden chair while resting my leg!

I had time to research many satellite omnidirectional antennas. These included the 'Eggbeater' versions 1 and 2, Lindenblad dipole array, different vertical antennas, phased crossed dipoles, lazy-H, AWX, cloverleaf and double quads.

I managed to make a number of these antennas and some were better than others while attached to a vertical support on a tripod in the garden.

Although I was able to make some contacts with these antennas, I was still not happy because there was lots of fading and loss of signal if the satellite had a high elevation angle. I was sure I could improve on them or design my own antenna.

The design brief I set myself was:

- A single feed dual-band antenna for 2m and 70cm

A view of the basic assembly with no housing.

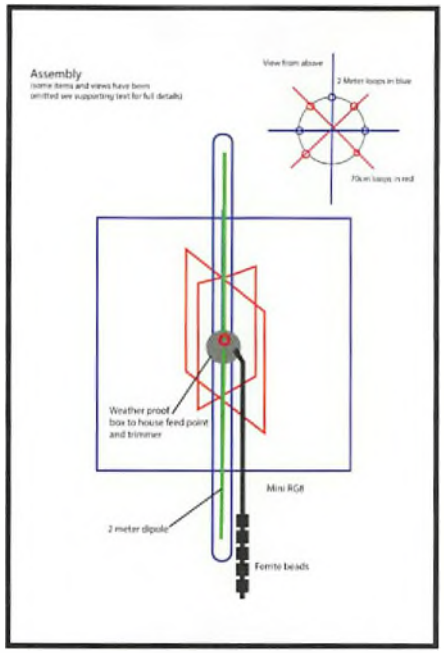
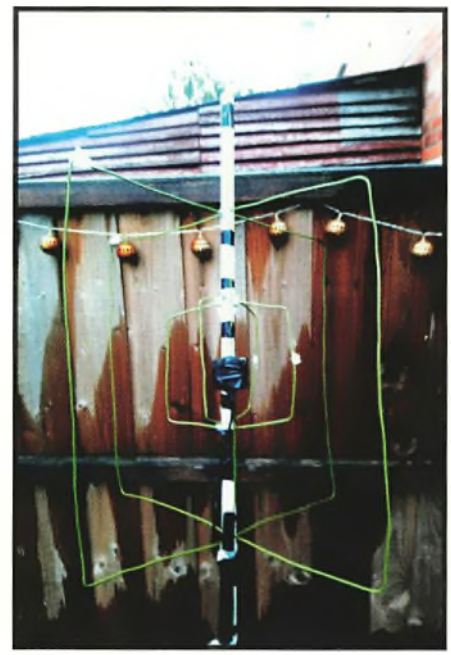


Fig. 1: Plan view and side elevation of the antenna.



The prototype mounted outdoors.

The author's wife lending a hand!

- No need to use a diplexer
- Gain over a dipole
- Mixed polarisation
- Omnidirectional

The antennas that most impressed me in my research were the Eggbeater and a version of the Lindenblad parasitic antenna for 70cm. I therefore looked more closely at how they worked and tried to incorporate their success into my design.

Because I had previously made a dual-band single-feed Yagi using the open-sleeve method of energising a 70cm radiator from the 2m feed, I decided this would be the heart of my design. I also took note from the parasitic Lindenblad, which uses a single vertical dipole with a number of horizontal dipoles at different angles to achieve close to circular polarisation.

I wondered whether, if I combined some of these techniques but swapped parasitic dipoles with crossed quads similar to the Eggbeater (doing this for both bands but on a single support), would this possibly work? I set about designing and thinking about how I could mount a centre-fed open-sleeve dipole for 2m/70cm with parasitic crossed quads for extra gain and multi-polarisation radiation.

I mention multi-polarisation – both vertical and horizontal radiation because the signal from the satellite changes as it crosses the sky. Fading is often caused by the satellite changing its polarisation along with the addition of multipath distortion where the received signal is bouncing off other objects such as rooftops, trees and the ground. These multipath effects mean that signals reach your antenna at different times, leading to multiple out-of-phase signals rather than one clean signal.

Many successful satellite antennas use circular polarisation but it doesn't guarantee a perfect fade-free pass and usually has some loss of signal when compared to an antenna with the correct polarisation (bear in mind that as the signal polarisation changes, it will have both horizontal and vertical components so to get the best results, it's necessary to be able to copy both simultaneously).

Design and Construction

Let me, then, explain the design and construction. The basic configuration is shown in **Fig. 1** – a vertical dipole, with crossed full-wave loops for both 2m and 70cm. The various photos should also give an idea of how it is put together. My shopping list for this antenna comprised:

- 22mm PVC pipe (white) cut approx. 1m long
- Reel of PVC coated steel garden wire or hard drawn copper
- Mini RG8
- Trimmer 5-50pF (see what you have in your scrap box)
- 6 ferrite beads
- Electrical tape
- Tie wraps
- Plastic mounting pole

I used 22mm white plastic/PVC tubing found at most DIY stores for the main support of every element. (Black tubing has a higher carbon content and could affect the antenna.)

I used PVC-covered steel garden wire approximately 3mm in diameter but any hard-drawn steel or copper wire could be used.

The first job was to mount a 2m dipole on one of the sides, fixed in place with electrical tape and tie wraps. The next stage was to mount the 70cm radiator at 180° to the 2m dipole so on the opposite side of the tubing.

Measurements

I used the formula 143/frequency to give me the length of a half wave and simply divided this by two for each leg of the 2m dipole. Thus 143/145 = 92.8cm, divide by 2 = 46.4cm for each leg. However, I would advise starting slightly longer (such as 49.6cm for each leg) and then trimming for best match/SWR once the 70cm radiator is fixed in place. The calculated length of the 70cm radiator is 143/435 = 32.8cm so either cut at 33cm or 32cm – it will make little difference.

The centre feedpoint I originally made from electrical choc-bloc connectors but then used a plastic dipole centre piece to make this weatherproof and to house a trimmer. I found I needed the trimmer to tune out any reactance once everything was assembled (more on this later).

I then used the same formula to measure the quad loop lengths, which is 143/Frequency x 2 (for a full wavelength loop), giving the length of wire I needed to trim. I actually rounded this up to make life easier because these measurements were not that critical and I wanted to use the an-

tenna wideband from 144 to146MHz and 432 to 436MHz. I rounded up the figures from the same formulas as above, to give me a quad loop length for the 70cm band of 66cm and for the 2m band a length of 196cm.

You will need to cut two lengths of wire for each band because you will be making crossed loops. Once cut, I simply divided by four for each side of the quad and bent into a square shape with roughly equal sides.

Assembling the Loops

The difficult bit is assembling the loops onto the PVC tubing. Use the centre of the dipole as a reference/datum point. First measure for the holes where the 70cm loops will fit. (I used the tip of my soldering iron to make the holes but you can use a drill if needed.) So, for example, 8.25cm above and below this point but 90° from the dipole elements. The second loop needs to be crossed so turn the tubing 90° and make the second set of holes for the second loop. You will need to make these holes just above the measurement of the first loop by about 5cm or less.

I pushed the partially-formed loop through the wire, turning the tube until it was fitted. I used a small choc-bloc connector to complete the loop. You can, of course, use different methods to complete the loop such as soldering or crimping.

Then it's the turn of the 2m loops, again using the centre of the dipole for a reference point and making holes above and below this point to insert the loops but, importantly, these loops will be turned 45° degrees from the 70cm loops, as can be seen in the plan view in Fig. 1.

Hopefully now you have completed the dipole centre and fixed the loops in place. To feed the antenna you will need to use a small fly lead (3m) of high-quality coaxial cable. I recommend Mini RG8. I do advise using the best quality and lowest loss coax as possible both for the fly lead and for the feeder to the shack because with satellite work it can be the difference in making a contact or not even hearing them due to the weak signals and feeder losses. The fly-lead is taken to the feedpoint of the 2m dipole.

Trimming

I mentioned earlier that I used a small trimmer to tune out reactance because I found that, once assembled, I had introduced some reactance. I tuned the trimmer for the best match. Others who have built the antenna didn't need to and just trimmed the dipole lengths towards the end of the build instead. As long as you have a good match of 70cm and 2m, you should be in business whatever your method.

After trimming, I managed to achieve a 1:1 match on 70 cm and 1.2 on 2m, both of which are perfectly acceptable.

You will also need to use around five or six ferrite beads to slip over the coax feed and fix them in place just below the point where the lower 2m dipole element ends. This is to stop your coax fly-lead becoming part of the antenna and radiating.

Finally, fix the antenna to a suitable plastic mounting pole before using any steel or aluminium mast. The antenna is now complete.

Testing

I checked out the antenna with it mounted around 7ft above ground. The ultimate test for me would be to see if I could hear SO-50 on a high elevation pass without moving the antenna or aiming it at the satellite. I mention SO-50 because this satellite has a 70cm downlink and is quite difficult to hear without a beam.

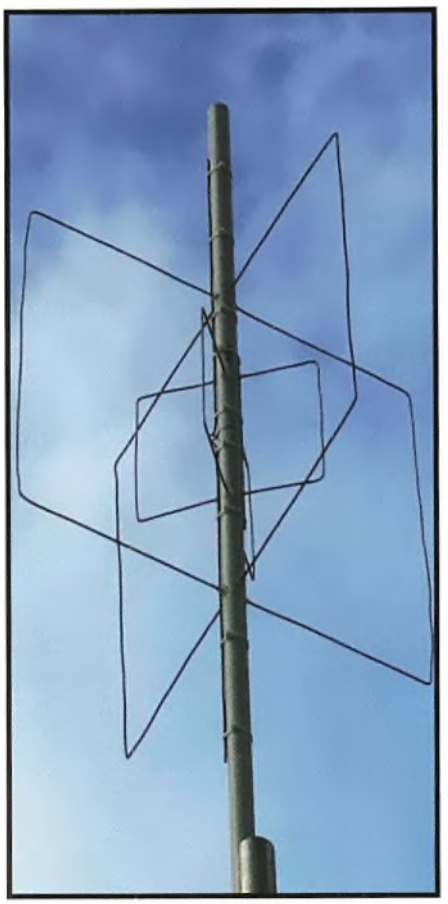
So, at 75° I waited for the bird to come over. Fully quieting signals from the satellite were heard! Compared to a single vertical dipole it certainly showed huge promise. (A vertical dipole has a doughnut-shaped radiation pattern and although good on lower elevation passes fails miserably with a high elevation pass because of the 'hole' in the doughnut.)

Next was to test the antenna on transmit. I managed to work through a number of satellites with the antenna still just 7ft from the ground, with good signals across Europe. I'm guessing that the ground acted as a reflector or a large dish to help with the signals.

I then wanted to test the antenna higher up above my roofline, so I could try to work some linear satellites such as AO-73 and FO-29. My son helped with the installation and the experimental antenna was fixed in place just above the guttering on an 8ft mast.

I used around 15m of RG213 to connect to the fly-lead and fed back into my shack – as I said earlier, good quality low-loss feeder is essential.

To my surprise I tuned around and the antenna also worked quite well across the SSB and FM sections of the bands. Compared with my collinear, this antenna certainly sounded different and pulled in



A version built by Craig N8PWM.

stations both horizontally and vertically polarised.

The next test was to try to work FO-29 semi duplex from my Yaesu FT-100D. Using around 20W I managed to work YO5TP, HA6NM, F4DXV, PE1NIL, EA2AZW, UX0FF, OH5LK, UT9NA and R7MU. I also used the antenna with the FM satellites with similar results.

In conclusion, I feel that this antenna, although not perfect and having room for development and tweaks, has a great place in my antenna systems. I am now developing Stage 2 with an added ground-plane system, loops 90° out phase from each other and more parasitic elements.

Although the design may seem a little unorthodox and breaks some rules of antenna building, it was a fun solution that happened to work compared with other simple satellite antennas.

Since building the antenna I was requested to submit my papers to the American AMSAT organisation and was bowled over that it was included in talks at the Space Symposium and has been built by some of our American cousins with good results.

Why not have a go? It's an afternoon's work. I'm sure you will be impressed.

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The New Advanced Licence

Tony Jones G7ETW completes his overview of the new examinations by covering the revised Advanced syllabus.

This is my third article about the new amateur radio examinations and before I get started on the detail of the new Advanced syllabus, I need to say something. These updates have been a controversial subject and some people are very critical of the syllabus changes. Their main reasons seem to be:

- A more difficult Foundation syllabus is a barrier to getting people into the hobby.
- A more difficult Intermediate syllabus discourages Foundation licensees from progressing.
- Everything was fine as it was.
- There is a lot of work to do in migrating to the new syllabi.
- The new syllabus elements, primarily Digital Signals, are not necessary.

Well, there is some truth in some of that. But anyone would think, reading this, that an Intermediate licence was the pinnacle of being a radio amateur. It isn't, and the licence names make my point for me. 'Foundation' is the beginning and 'Intermediate' is a waypoint on the journey to a 'Full' licence, awarded for 'Advanced' knowledge.

The driver for change was that too few amateurs currently progress to Full. See **Fig. 1**, for which I thank **Steve Thomas M1ACB**, RSGB General Manager. This shows that only about 300 new licences are issued annually but in 2017 1500 Full licensees died. Extrapolate this over not very long and a picture emerges in which Full licensees are rare, Intermediates are uncommon and Foundation licences make up the great majority of UK radio amateurs.

I mean no disrespect to Foundation and Intermediate licensees, let me make that clear. The bands, the clubs and the hobby need you. But amateurs stopping before Full has become a problem. If Full licensees continue to decline in number, who will hold club, special event and repeater calls? Who will sign off practical sheets for courses? Who – to be blunt – will have the necessarily deeper knowledge required to deliver the courses? And if those things don't alarm you, consider this: how long can we expect HM Government to leave us alone with all those priceless chunks of spectrum and all our other privileges if fewer and fewer amateurs are licensed to use them?

This is where the new Advanced syllabus comes in – Intermediate licensees will find it easier to progress. Not because the standard has dropped (or risen), please note – it hasn't – but because the new syllabus structure will produce students who are better prepared for the final jump.

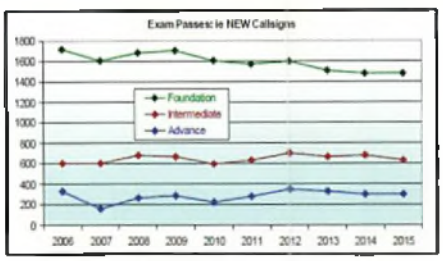


Fig. 1: Exam pass statistics.

In what follows I've used 'Foundation', 'Intermediate', 'Advanced' and 'Full' as shorthand to mean both licence and syllabus levels. By 'lower' levels I mean Foundation and Intermediate.

Hurdle number 1: All that Electronics

One of the reasons many Intermediate amateurs have been put off from taking their Full is the large amount of electronics in the syllabus. Nowadays, with fewer amateurs doing significant construction, having to know about electronics to component level is (for some) controversial but I return to my basic argument: this is an Advanced qualification, which distances us from mere users or consumers of technology.

Table 1 details the electronics content referenced to the old syllabus and shows where it is now. As you can see, much of the electronics learning has migrated downwards. In taking their Foundation and Intermediate, amateurs get progressively exposed to many of what were considered Advanced technical topics. Advanced requires understanding of these points, for sure, but I don't think students will find this the mountain to be climbed that it once was.

Hurdle number 2: Digital Signals

Digital signals are, I suspect, more of an issue for teachers than students. We all have our favourite activities in the hobby, and if something 'new' falls outside that, it is human nature to ignore it.

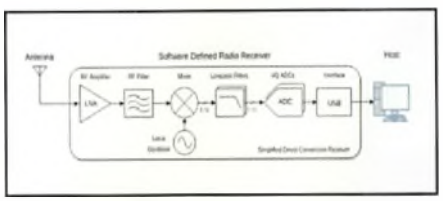
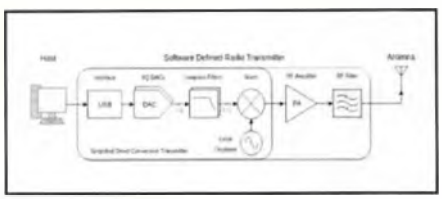


Fig. 2: Block diagrams of 2(s) SDR receiver and



2(b) SDR transmitter.

Digital Signals is important though. This fusion of radio and IT technology is everywhere and it's worth remembering that radio amateurs have had a lot to do with it. In these days of internet-connected everything, Joe Average sees us as dinosaurs because we do not use what he would even regard as Technology. SDR is, in this context, 'sexy' (not a word I ever expected to type for *PW*. 'Cute' was the closest I got before) and it will enthuse and motivate new dare-I say-it younger amateurs.

At Foundation, students learn the absolute basics, as recall points:

- Analogue to Digital converters (ADCs).
- Digital to Analogue converters (DACs).
- Special software that does all the modulating and demodulating using maths.

At Intermediate we get a little nearer to how things work. Students learn about:

- Sampling rates and Nyquist's Law.
- Look-up table to generate sinewave
- Fourier Transform analysis (name of, as a recall point).

Only at Advanced do we get to the engineering realities of digital signal processing:

- I and Q components.
- Image frequencies and filters.

• Undersampling.
• Fourier Transform analysis – what it does (but still a recall point).
• Distortion caused by sampling above Nyquist rate.

See **Figs. 2a** and **2b** for SDR block diagrams. These are the same ones I used for the Intermediate article – I have not seen any of the 'official' ones yet.

I will be writing a from-first-principles article on this but looking at these teaching points, all I see is some new names and related facts for students to remember, and some simple maths. There is bound to be someone in your club for whom this is their bread and butter so why not bring them into the teaching team just for these items?

Hurdle 3: The Maths

A lot of people find any maths difficult, never mind technical maths using scientific notation. On Foundation courses I have met people unsure of the meaning of multiplication and division, which makes teaching the Ohm's Law and Power triangles difficult! Understanding units, for example that 1mA is one thousandth of an Amp, also written as 0.001A, is a lot to handle for some students.

It's the same at Intermediate but fortunately there was (and still is) no extra maths to speak of. Being 'hopeless at maths' has never been a barrier to the lower levels, because the radio fundamentals such as frequency and wavelength, and resonant frequency and capacitance and inductance, are taught graphically.

At Full, some mathematical skill is essential and nothing can be or has been done about that. It's Advanced radio, as I said, and students cannot guess the answers to those questions and safely pass. I think we should ask students what their highest qualification in maths is, looking for GCSE Grade C or above as an absolute minimum. If necessary, we can put on remedial sessions. And if club teachers don't have good enough maths (to teach Full) – well it's never too late to learn!

Computer maths is no help by the way. In IT we have giga-things (and micro-processors) but we never process numbers in units of less than one. That's Binary for you.

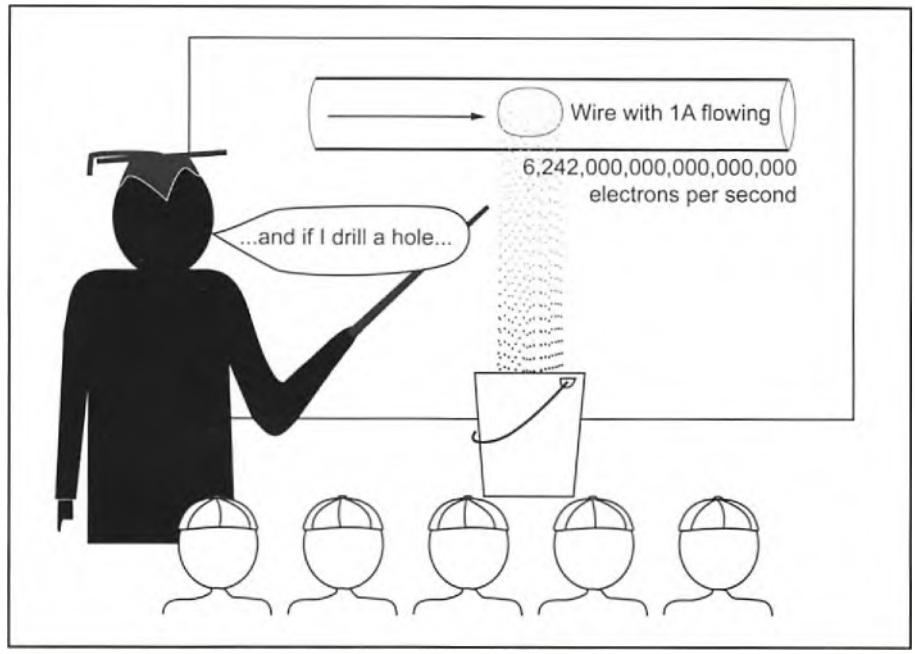


Fig. 3: A Coulomb is a measure of electrical charge (quantity).

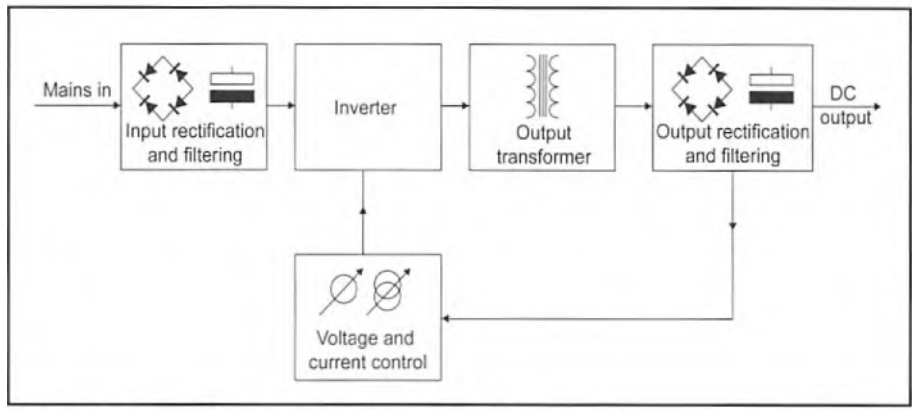


Fig. 4: Block diagram of typical switch-mode power supply.

Selected New Syllabus Points to Note

Section 1: Licensing Conditions

The old syllabus says (Section 1a) 'Licence clause numbers below are for ease of reference and do not necessarily indicate that the clauses not quoted are outside the scope of the syllabus'. Decoding this triple negative, the whole licence (supplied in the exam) was examinable. This is still true – any question could have its root anywhere in the licence, not just in Section 1.

1A5 – Circumstances under which an amateur must transmit a callsign on air. (Same as Foundation).

1C1 – Rules regarding encrypted transmissions (not allowed at lower levels).

1D4 – This contains a need to have equipment for 'the reception of messages on all frequencies and modes in use for transmissions.' I think this must mean our transmissions – i.e. we must be able to receive messages akin to those we transmit.

Section 2: Technical Aspects

2A1 – Effect of component tolerances (Tolerances feature at the lower levels).

2D1 – Introduction of the Coulomb. The Coulomb is the scientific unit of electrical charge. Students need to know that a current of 1A in a circuit means that 1 Coulomb of electrical charge (symbol Q, unit C) is flowing per second everywhere. I remember a physics teacher illustrating this by drawing a wire and a bucket, **Fig. 3**. I never forgot it (evidently!).

Students meet the Ampere early in their Foundation, as a fundamental 'thing'. Adding the Coulomb allows current and capacitance to be seen as to do with electrical charge quantifiably. The Volt could have been further defined as well, as the Joule per Coulomb, but this was not done. This is a pity – it would have allowed Potential Difference to be properly explained in terms of energy and work.

2H2 – Crystals. Crystals, called 'mechanical resonators' at Intermediate but introduced at Foundation, are manufactured for series or parallel use, and the stability of their applications – chiefly oscillators and filters – will suffer if they are not used as intended.

2H6 – Understand feedback in an oscil-

lator. This is a recall point at Intermediate.

2J4 – Switch-Mode Power Supply functions. Students are required to understand the basic workings of a switch-mode power supply and to know the elements of a block diagram, **Fig. 4**. With so many switch-mode power supplies in use nowadays, this is a very useful inclusion.

Section 3: Transmitters and Receivers

3A2 – Modulation Index. This was introduced, but not by name, back at Foundation. At Full, students must understand how this affects sidebands.

3G1 – Students must understand that overdriving an RF PA leads to excessive bandwidth. This is first encountered at Foundation.

3H3 – Intermodulation distortion. Intermodulation distortion is introduced. Overdriving a receiver leads to this undesirable effect and reduces the ability to isolate weak signals, students learn. Dynamic range is also defined, measured in decibels (dB).

Section 4: Feeders and Antennas

There was no change in this section other than being renumbered.

Section 5: Propagation

5B2 – Critical frequency. At Intermediate we had MUF and LUF, but Full students must recall the 'critical' frequency and its effects.

5B3 – NVIS propagation. Near-Vertical Incident Skywave is a method of HF communication used by the military (and RAYNET). Unlike DX, for which we want a very low angle of take-off, NVIS uses a very high one with a frequency below the LUF – usually 5MHz or lower. Think of an umbrella above with RF going up and being reflected almost back on itself. This gives reliable communication over a few hundred square miles with the terrain having little effect. The transmitting antenna needs to be horizontally polarised (i.e. transmitting upwards – think of a dipole) and very close to the ground, **Fig. 5**.

5C3 – Earth-Moon-Earth Propagation, otherwise called Moonbounce. This relies on using the Moon as a reflector for VHF. Because the path loss is very high, and the Moon is not a good reflector of RF, a high-power VHF transmitter (ask students why it can't be HF), a high gain antenna, and a low noise receiver are required. This is likely to be one of those 'what of the following is not required' questions, **Fig. 6**.

5D1 – Galactic noise. I do not remember this from 1989! This is extra-terrestrial QRN.

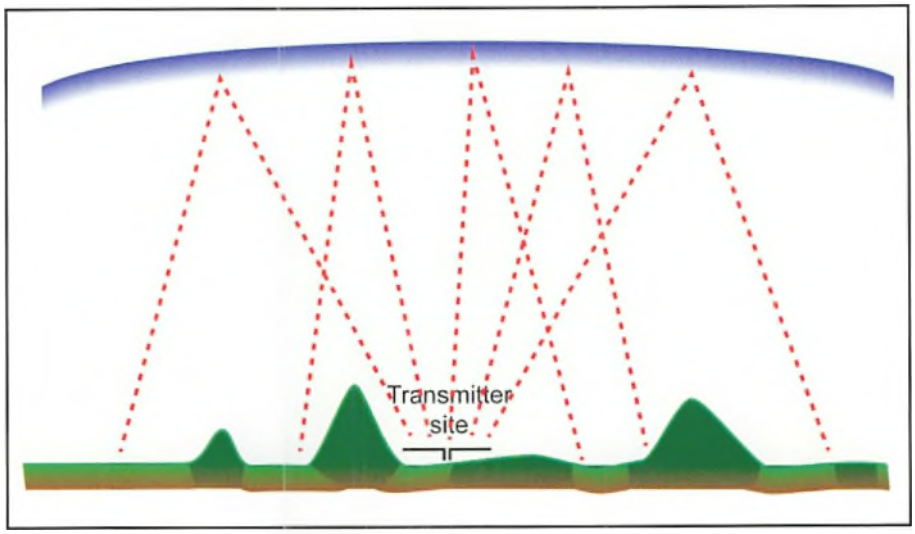


Fig. 5: NVIS (Near Vertical Incidence Skywave) propagation.

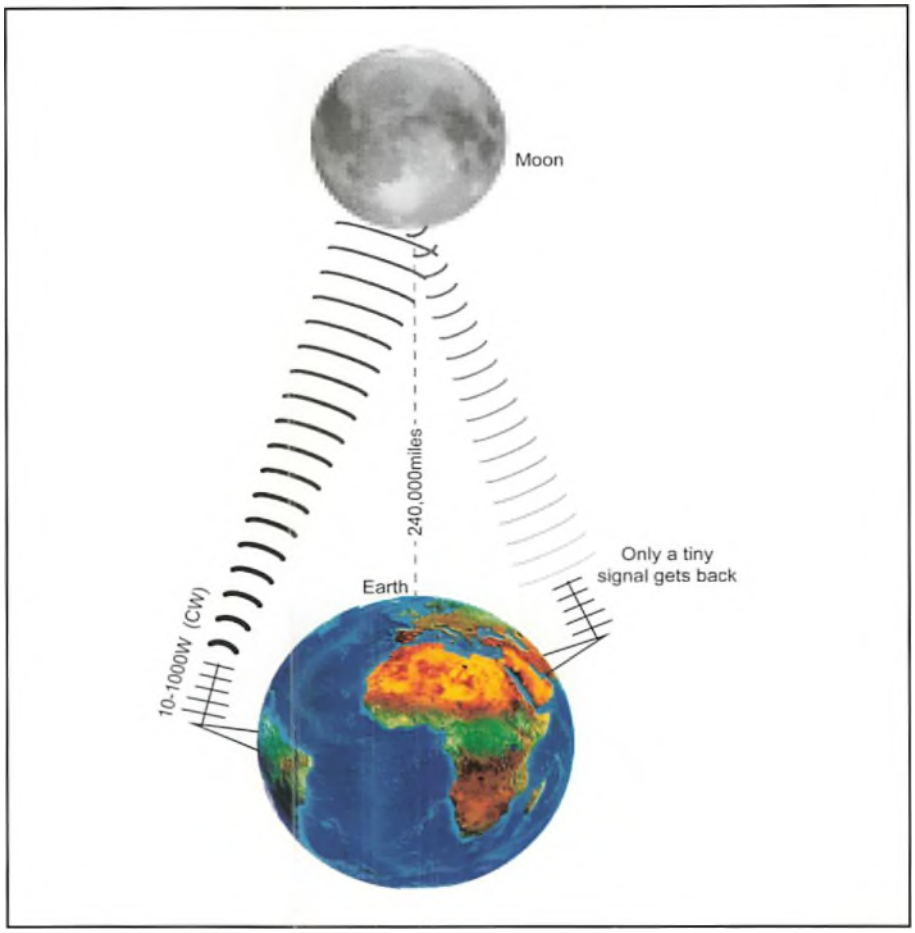


Fig. 6: Moonbounce propagation.

5D2 – Link Budget factors. Link Budget factors are transmitter power, feeder loss, antenna gain and path loss (which incorporates spreader and obstruction loss). What this has to do with amateur radio beats me.

Section 6: EMC

6A2 – Immunity at Full has a factor besides the RF and the equipment itself. Students learn that installing a piece of equipment badly can reduce immunity.

6A4 – Imported or home-brewed equipment may not pass relevant EMC standards but radio amateurs' homebrew kit is not required to. Provided we adhere to our licence, we are acting lawfully. This is important to know if a 'situation' should arise with a disgruntled neighbour!

6B1 carries on from 6A4. Cordless

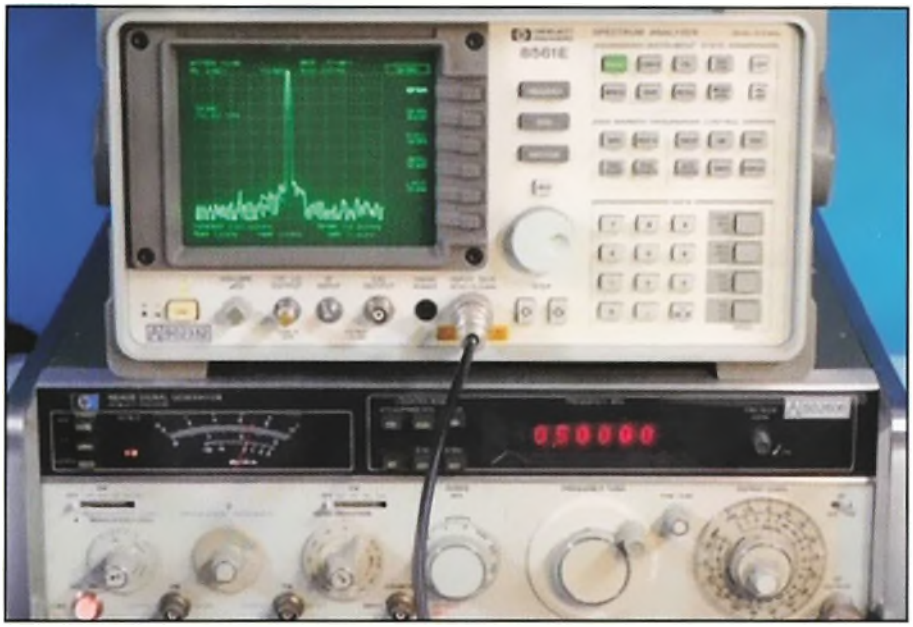


Fig. 7: Output of a signal generator being displayed on an oscilloscope.

phones and some IT products, confusingly, may generate some interference but this is 'satisfactory', the syllabus says! And imported toys may not be compliant with relevant regulations. I have no idea what this means in practice.

6F1 – Mobile Installations. The '*Federation of Commercial Services UK Code of Practice for use of radio and other ancillary equipment*' – who could forget that? – is named as the standard for installing radio equipment in motor vehicles. This phrase is one to simply recognise as the correct answer in EMC questions.

Section 7: Operating Procedures

7B1 – Use of bandplans. Students must identify various items on the supplied bandplans, which are on 50MHz and 472kHz (not the same bands as the schedule questions). These may not be the real bandplans but few students are likely to have experience on LF so there should be no confusion there!

7B2 – Students need to recall that foreign bandplans can be different to ours – for example, the US 40m band goes to 7.3MHz. This is actually quite serious, since operating using the wrong mode but in (UK) band is inconsiderate, and to be avoided, but operating (any mode) out of band is an offence, and any Full licensee should certainly know better.

7H1 – Special Event Calls. Students should know the process for applying for a Special Event call. At the lower levels this is not permitted so this is a likely topic for questions.

3a Potential Difference and EMF	Intermediate
3b Resistance (series and parallel)	Foundation and Intermediate
3c Power in DC circuits	Foundation, Intermediate and Advanced (section 2B)
3d Potential Dividers	Intermediate
3e Capacitance	Foundation, Intermediate and Advanced (section 2D)
3f Inductance	Intermediate and Advanced (section 2D)
3g AC circuits	Foundation, Intermediate and Advanced (section 2E)
3h	Didn't exist
3i Tuned Circuits	Advanced (section 2H). Q introduced at Intermediate
3j Transformers	Foundation, Intermediate and Advanced (section 2G)
3k Filters	Intermediate
3l Screening	Intermediate
3mTemperature effects	Intermediate (including practical exercise)
3n Semiconductor	Foundation, Intermediate and Advanced
Depletion layer ('holes and electrons')	NOW REMOVED
Thermionic Valves	NOW REMOVED
3o Decibels	Foundation, Intermediate and Advanced
3p Mains Power supplies	Intermediate (but Switch Mode PSUs added)

Table 1: Summary of changes between Licence levels.

Section 8: Safety

8F4 – This teaches that mains electricity in other countries may be of different voltages and frequencies. Wikipedia lists no countries with mains voltages greater than ours (well, a few still have 240V) or frequencies greater than 60Hz, so it is hard to imagine, as the syllabus says, that connecting UK appliances abroad could be 'hazardous'. But it is possible, I suppose.

8F6 – Risk Assessments, first met at Foundation, are revisited. Students must understand how to identify hazards but only to recall the nature and severity of harm they may hold. Given the litigious nature of modern life, and that this is Advanced, I would have expected the whole thing to be an 'understand' requirement.

8F7 – Mains Generator safety. Having once had to prevent a teenage boy refuelling a petrol generator (and spilling some!) while it was running, I was pleased to see this covered.

Section 9: Measurements and Construction

9A4 – Signal Generator basics. This section concerns the use of signal generators. Students learn, for example, that not all systems have 50Ω impedance, and this could make a big difference when connecting kit up or making measurements.

9A9 – Spectrum Analysers. There is an Intermediate practical that requires students to recognise a signal's fundamental and harmonics using a receiver or a Spectrum Analyser. At Full, students must be able to 'identify' these things, presumably from a Spectrum Analyser image. These tie in very well. See **Fig. 7** for an example of a signal generator feeding a spectrum analyser. This shows a 500kHz signal.

Conclusion

When the new syllabi are operational, clubs will – I hope and believe – be turning out greater numbers of more knowledgeable radio amateurs. By the time students get to Intermediate they will be closer to Full than before and more of them will see this and want to progress.

Please, take a new look at the Advanced syllabus. Don't be put off by it! Can you find a way, either by formal teaching or tutorial sessions, or by doing something online, or by acting as mentors, to support Intermediates in that final step?

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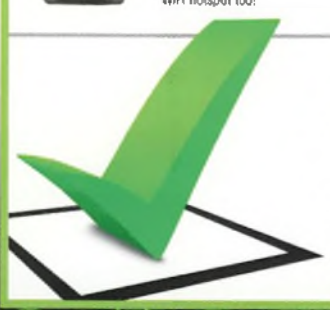

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3D Printing for Amateur Radio

Daimon Tilley G4USI introduces 3D printing, a handy way of fabricating boxes, knobs, insulators and much else.

Radio amateurs are often people who like to tinker. Whether that is messing around with antennas, building rigs and equipment, or just exploring some of the maze of menus on modern rigs, the tinkering spirit is often present.

One of the recent avenues of my own tinkering is 3D printing and in this article I intend to explain what 3D printing is, outline the equipment needed and costs, describe the basic process and consider how you might use 3D printing in pursuit of amateur radio.

My own journey in 3D printing started at about the same time as my return to amateur radio after a 30 year or more absence, in Spring 2018. I wanted something stimulating to help occupy my time as well as encouraging my young children in the art of tinkering.

What is 3D Printing?

In 3D printing, the printer is a device that is computer controlled and can move in all three axes, side to side, backwards and forwards and up and down. Typically, there is a base plate that takes care of the backwards and forwards movement while the printer head moves up and down and from side to side. A series of stepper motors and belts control these movements to a high degree of precision – fractions of a millimetre. Similar construction is used in technology such as CNC routers, milling machines and laser cutters.

Printing takes place by the interpretation of a digital design file from Computer Aided Design (CAD) software and then by heating and extruding a thin filament, similar to plastic strimming line, onto the baseplate in the desired shape and size. These filaments are available in a number of materials, including PLA (bio-degradable), ABS, PET and other materials.

What can you Print?

You can print pretty much anything that you have the design file for! The main limitation is size (each printer has a maximum size it can print) but if you break a design down into multiple pieces, you can join them together later. Other considerations include the strength and design of the object and the material you are printing with. For example, I currently use a type of plastic called PLA for my printing. However, if I was printing something that would be permanently outside, or in a hot environment, like a car in summer, I would choose a different material because PLA degrades under long-term exposure to ultraviolet light and has a lower melting point than ABS, for example. It's a question of design, experimentation and thinking about the end use. A great place to take a look at what is possible is this website:

www.thingiverse.com

Many people design and post 3D designs there, although beware, some people post designs that are not feasible to print! Mostly, though, what you see is printable. A look at the comments and a little experience will soon help you determine this. In the website you can search on a term and see what comes back – 'amateur radio', for example. It is perfectly possible to download files from Thingiverse and then print them yourself. Alternatively, you might want to get creative and design your own projects. Again, there are many different pieces of CAD software available and a good number are free. I personally use the free online CAD tool at:

www.tinkercad.com

This CAD software also allows you to design circuit diagrams!

How Much Does it Cost?

In terms of financial outlay, 3D printing is pretty much like amateur radio – it can be done very simply and cheaply, you can build your own device or buy low-end equipment for around £100, or you can spend many thousands of pounds on professional quality equipment. I spent many hours researching this and came to the conclusion that if you buy cheap, you buy twice. So, I opted for a mid-range printer, which I brought in kit form. This had the advantage of reducing the overall price by over £100 and allowing me to learn about its construction while building it (I told you it was good tinkering!).

A callsign coaster.

Microphone.

I bought my printer from Prusa Printers (website below), a Czech company that has a fantastic reputation and following. The design is open-source and you will find many cheap copies online but, of course, cheaper price often means cheaper components. You pay your money and you take your chances.

www.prusaprinters.org

There are also some ongoing costs. As well as your electricity supply, you will need filament and this varies in price. However, I am getting good reliable results with filament on 1kg spools for £15, enough for many projects. Each filament

comes in a single colour and it's possible to print in more than one colour by changing filament during printing. Alternatively, some of the latest models now hold two or three different colours at once and will automate this colour change for you.

The Printing Process

Actually, carrying out the printing process is not difficult but can be a little daunting the first time. Basically, you need to design or download the CAD file for your object in a specific format. Often this is a .stl file. This file is then uploaded into a piece of software called a Slicer. The slicing software does what it says on the tin – it 'slices' the model into layers and allows you to amend things like print quality, speed, the density of the object, colour changes and so on.

The slicing software I use came free with the printer and the files from this are then output in a .gcode format that the printer can understand. On my printer, I then upload the .gcode file onto an SD card, which I insert into the printer, and press 'print'.

It really is quite simple to download and print an existing design. It's just a matter of moving files around on your machine between software and the SD card. My printer came with excellent build and first-use instructions and there are many high-quality tutorial videos on the internet.

Depending on the complexity and size of the print, printing can take anything from a few minutes to many hours. My longest single print so far were the parts of a case for a homebrew transceiver at 14 hours for a single part. It probably took 24 hours of total printing to finish the project.

Printing for Amateur Radio

The sky really is the limit where amateur radio is concerned or, rather, your imagination. If you have taken a look at **thingiverse.com** you will get a bit of an idea of what is possible but here I will just give you a flavour of what I have printed for radio, although I am often printing other things too, for the kitchen or children, for example.

I have printed a callsign plaque for my shack, a handheld microphone, a paddle type CW keyer, a case with cooling fan for my Raspberry Pi, a callsign coaster, guying and antenna supports for portable vertical antennas, and my largest project to date, a case for my home-brew uBitx QRP transceiver. Some of these are the design of others that I have simply downloaded and printed, some I have designed myself, and in some cases I have downloaded someone else's design and then heavily modified it for my own needs. Anything is possible, particularly as your experience grows.

There are both advantages and disadvantages to the 3D printing process. Advantages include the ability to design products yourself or use other people's designs, designs that might not exist for sale, to learn a new skill and have fun, and to enhance your radio hobby through bespoke gear to support your operating.

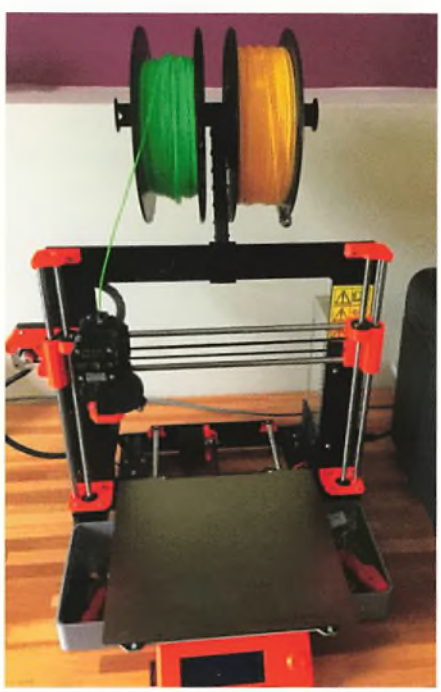
Disadvantages might include the initial outlay, the time it consumes designing and printing and the fact that it can be addictive! You need to be aware that sometimes it might just be simpler and easier to buy what you need, if it exists, than to print it, but the satisfaction of doing it yourself is not to be underestimated.

A selection of my printing for radio is shown in the accompanying photographs and I hope you will be inspired to consider 3D printing for yourself. Perhaps, instead of researching and ordering that new dipole centre and insulators you need, you might print it instead.

Guying and antenna supports for use with a fishing pole portable antenna.

Raspberry Pi case.

A homebrew transceiver 'go-box' case.



The author's Prusa i3 Mk3 printer.

Feature by Paul Morrison GOVHT

E-mail: paulmorrison.home@gmail.com

QRP Travel & Operating in Australia

Paul Morrison GOVHT describes his QRP efforts from Australia and manages a fascinating interview with QRP specialist VK3YE.

I had been planning a trip to Singapore, Australia and New Zealand for some time. This four-week extended holiday was timed to coincide with my wife's 50th birthday and to celebrate our recent our 25th wedding anniversary. Of course, as well as my XYL, I had also arranged to take my amateur radio equipment along – after all, we've 'been together' longer than my wife and I!

Equipment Selection

Before leaving the UK, the first priority was (naturally) deciding what equipment would accompany me. While this trip was first and foremost a holiday, I still wanted to operate from portable locations whenever possible. Given that we are somewhere around the bottom of the current solar cycle, my first thoughts turned to my 100W Yaesu FT-891 mobile transceiver. However, this would necessitate transporting my usual 22Ah lithium battery on the aircraft, which, it transpired, was quite out of the question. The reason was very simple – most carriers restrict batteries to carry-on hand luggage and typically they must be less than 100Watt-hour (expressed as 'Wh') to comply with airline regulations. Individual carriers may permit up to 160Wh but you must have formal permission before boarding. A quick calculation helped me determine what battery I could legitimately take with me: (Wh) = Volts (V) x Amp hour (Ah), so clearly my 12V, 22Ah battery would have been well over the acceptable limit at 264Wh. A QRP radio would, however, happily operate from a much smaller capacity 8A, 12V battery (do the calculation). Therefore, this is the battery I ended up taking. I did learn later that passengers are able to take up to two separate batteries of up to 100Wh each if appropriately packaged but I felt the extra bulk and weight wasn't necessary for my own purposes.

Where possible I tend to use resonant wire antennas for portable work because of their simplicity and overall efficiency. On this trip, in addition to my normal home-made linked dipole for 20 and 40m, I also took a new G-Whip 421 end-fed antenna covering the 40/20 and 10m bands, which was less than 12m in length overall. With the basics decided upon, I packed my trusty old FT-817, 7m telescopic travel mast and a few useful accessories for the very long flight. Although it was never formally requested, I also took a printed copy of my licence, just in case.

Fig. 1: Apartment location on the Gold Coast.

Licensing

There were no automatic or reciprocal type licensing arrangements in our first stay-over location, Singapore, albeit it was entirely possible to apply in advance for a temporary licence. I was far too busy with work commitments prior to my trip to sort this out and, besides, the inevitable jet lag meant I really wasn't feeling up to operating even if I had a licence in place. So, I waited until we travelled on to Australia three days later before unpacking the FT-817. Usefully, Australia welcomes licence holders from the UK (and many other parts of the world). Under its 'Class licence' scheme, a UK amateur is authorised to use the same bands and conditions as back home (excluding 60m) for up to 90 days. No licence fees are payable and no application need be made. You simply insert the respective regional (state) locator in front of your own callsign followed by a 'stroke' and away you go! One of the many benefits of a Commonwealth state.

I used the downtime in Sydney (our first port of call) to familiarise myself with the regional locators and a wealth of other information found on the Wireless Institute of Australia (WIA) website. This is the national radio society equivalent to our own RSGB representing radio amateurs in Australia, with its origins dating back to 1910. According to various reports, there are around 14,500 Australian amateur radio licences in existence. Interestingly, here in the UK we have around 74,000 licences in circulation – a significant difference given the disparate geography of our respective countries.

Getting Set Up

After a brief three-day city break in Sydney (and having made the schoolboy error of getting rather sunburned on Bondi beach),

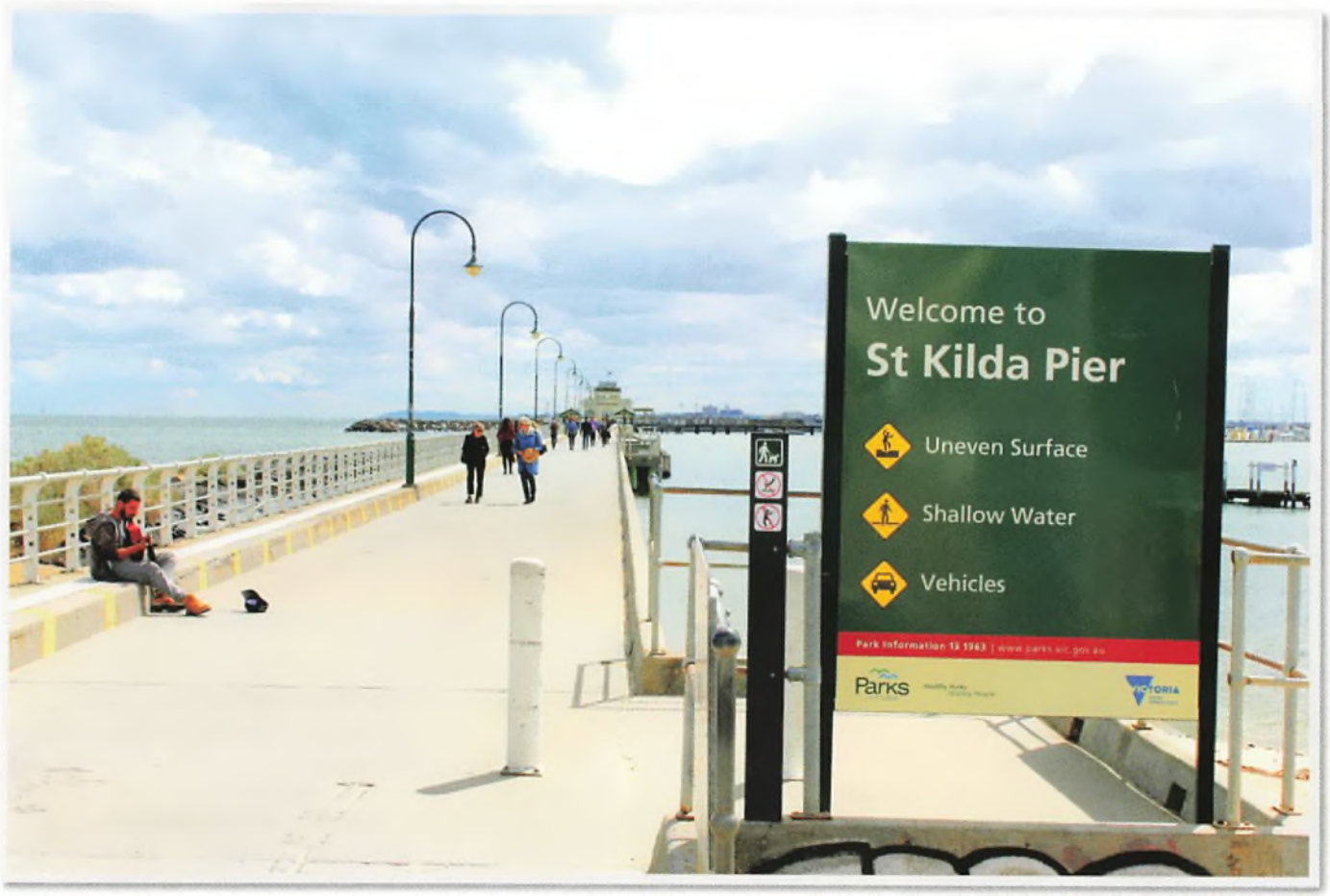


Fig. 2: St Kilda Pier.

we took a short internal flight up to the Gold Coast. Our accommodation was a modern high-rise apartment, 17 floors up directly overlooking white, sandy beaches and the beautiful Coral Sea. After unpacking, and appreciating my new surroundings, I quickly worked out how best to erect my end-fed antenna, making use of our elevated 'wrap around' balcony, **Fig. 1**. The antenna was erected in a makeshift inverted-V arrangement improvising a heightened centre section with a broom, a short length of dowel from a nearby hardware store and some duct tape securing everything to the balcony. I had hoped the significant height and relative closeness to the sea would transform my 5W QRP station into a DX pile-up busting station. However, this proved to be a pipedream. Bearing in mind we were on the very edge of the east coast, it appears the building effectively screened my antenna, cocooning it from the rest of Australia, meaning that VK4/G0VHT/P didn't make any contacts despite plenty of efforts! To make matters worse, my sunburn frustratingly prevented me from any kind of beach operating, so I resigned myself to monitoring the bands using my elevated 'listening post'. It was still fascinating to hear several loud Japanese and New Zealand stations ragchewing on 20m. Interestingly, outside of contests, I noted very few 'rubber stamp' type QSOs. Everyone seemed to hold 'proper' conversations rather than rushed contacts – now that was refreshing!

Notwithstanding the above, over the next week or so I was struck by the relatively low level of activity on both the 40 and 20m bands. I can't comment on the other bands due to my antenna limitations. I did have to check my radio's RF gain setting and antenna connections on more than one occasion because I thought there must have been a problem at my end. It wasn't until a loud station would 'boom through' out of the quietness that I realised it wasn't my radio or a lack of propagation. Quite a contrast compared to the many European stations I'm used to hearing on the same bands day and night back in the UK!

Getting Acquainted

I was interested to find out more about amateur radio in 'Oz' so after a period of enforced SWLing on the Gold Coast and with the next leg of our journey scheduled for Melbourne, I contacted **Peter Parker VK3YE** (well-known QRP enthusiast, home brewer, YouTuber and author of several QRP/antenna-related books) to see whether he wanted to meet up so I could get his take on the Australian amateur radio scene. Peter was very gracious and responded positively to my suggestion. After establishing which part of Melbourne we were staying in, he recommended meeting on St Kilda pier late afternoon because 40m usually opened up around that time.

When the agreed day and time arrived, I left my XYL behind shopping in the quaint nearby holiday town of Kilda. That gave me around two hours free time – I'm 51 years of age but still find the need to seek XYL permission to disappear and 'play radios'! It's worth pointing out that at the time this article was written (early November) Melbourne was much colder than I expected. Although just a couple of hours flying time south of our previous location, 14°C and heavy rain felt decidedly chilly compared to the beautiful sunshine and 30°C we experienced on the Gold Coast. Ah well, at least I didn't have to worry about sunburn here! Despite this, I still optimistically underdressed for the portable operating period

from St Kilda pier. My jeans and polo shirt proved altogether inadequate for the chilly sea breeze and darkening storm clouds!

St Kilda pier, **Fig. 2**, extends out into the sea some 450m before shifting parallel to the beach, creating a pretty man-made harbour for small boats and yachts. The location itself was not too busy in terms of passers-by and there was plenty of space to set up my antenna. There was also a very convenient café nearby and I chose this for our Q&A session but first it was time make some contacts!

Peter, **Fig. 3**, was an excellent host. Friendly, down to earth and clearly an experienced QRP operator. Once my mast was securely fixed to the pier railings and the end-fed antenna erected in an inverted-V configuration, **Fig. 4**, we were scanning the 40m band. After making some brief CQ calls using the VK3 regional prefix, Peter explained that my transmissions needed to be longer in duration to increase my chances of being heard – not just because of the low output power but also to take into account the generally lower levels of activity in Australia. Over the next few hours we made a number of interesting QSOs, **Fig. 5**, mostly with special event stations commemorating 100 years since Armistice day. Band conditions were, however, marginal and the going proved tough a lot of the time. Without a doubt, 'tailgating' proved to be most effective means of making contacts. Peter used this 'pouncing' technique at the end of QSOs to good effect. Midway through the proceedings, we changed to 20m and Peter used an App on his phone to send WSPR audio tones by placing his mobile handset next to my microphone. This was all new to me and it was fascinating to see how many stations rapidly picked up our beacon in just a couple of minutes using this impressive mode.

The next hour flew by and while I was thoroughly enjoying the operating session, the wind chill and setting sun signalled it was time to pack up and head over to the café. With coffee and cake gratefully consumed in a much warmer setting, Peter and I discussed broader amateur radio issues and some of the various related challenges we both have in our respective countries. What follows is a brief summary of our conversation in a simple Q&A format:

Paul: Peter, thanks for taking time out to meet with me. How is amateur radio regarded in Australia, is it a popular pas-

Fig. 3: Peter VK3YE with the author.

time or as just another geeky, fringe type hobby?

Peter: *I think it's pretty much regarded as an obscure, fringe type activity. I suppose people's lives are moving further away from the type of radios we still play around with. In the past, non-hams tuned into far off AM radio stations to learn what is going on in the world but with the advent of local FM radio, the proliferation of the internet and everyday digital services, ham radio is definitely considered a fringe hobby in Australia.*

Paul: Is emergency communications and its connection with amateur radio a strong focus here in Australia?

Peter: *Not as much nowadays as it used to be. In Australia we have an organisation called the Wireless Institute Civil Emergency Network who provide assistance in bushfires and other regional emergencies. However, generally speaking our emergency authorities are quite well organised and it's much easier for the official services to manage with their own radio equipment without having to rely so much on amateur radio support.*

Paul: I've observed lots of whip antennas on 4x4 type vehicles here in Australia, more so than in the UK. Are these CB antennas?

Peter: *Yes they are. One thing we have in Australia that is different to other countries is in addition to AM and SSB CB on 27MHz, we have also got UHF CB. This allows 5W RF output and you can use gain antennas such as beams and the like without any restrictions. We have hundreds of UHF CB repeaters, particularly in our countryside areas. UHF CB is used a lot by 4x4 drivers, farmers and truck drivers, less so in the cities.*

Paul: Do you think the relatively large numbers of CB users offers a natural way for progression into ham radio?

Peter: *It did a lot in the 70s and 80s but these days CB is not seen as a hobby, it's more of a 'tool' so very few now want or need to progress into amateur radio.*

Paul: How would you describe the diversity of amateur radio in Australia? Are there many female operators and does the hobby attract sufficient numbers of younger people?

Peter: *I think probably like the UK, the demographic of amateur radio operators is skewed towards older men typically although I'm not aware of any recent surveys or publications to confirm this. That said, there was a bit of an influx with our Foundation licence, which we brought in more than 10 years ago. Some of these were younger operators and moved on to their Advanced ticket but there is definitely an attrition rate among Foundation licence holders. The more mainstream amateur population have not been great at encouraging Foundation holders to progress. So, for example, the amateur radio press can only publish what is submitted to them and that normally reflects Full licence holders.*

Paul: We are here now on a public pier near central Melbourne. How do you describe amateur radio to passers-by who stop ask what you're doing?

Peter: *Some people think you are track-*

Fig. 4: Antenna setup at St Kilda Pier.

ing birds, prospecting for gold or talking to a spaceman (which we can do, of course). To be honest, a lot probably depends on the antennas you are using at the time. In my case I sometimes carry contraptions such as one-metre diameter loops or a five-metre pole, which I carry on my backpack pedestrian mobile style and these obviously attract a lot more questions from the public. I get the same level of queries when tracking fast-moving satellites. Some people have relatives who once were hams or they might know someone and some may have some familiarity with it. Sometimes the questions you get off the air are much more interesting than those on air. I often carry a little business card, which directs them to my YouTube channel and website so they can find further information.

Paul: What got you interested in amateur radio in the first place?

Peter: *I suppose it was fiddling about with electronic junk when I was seven or eight years old that got me interested in electronics and radio later. It was during a time people were always throwing out old radios or TV's. This was typically first-generation transistor radios and valved equipment. Living in a small town about 300km from the nearest electronic shops such as Tandy Electronics, meant scavenging in open-pit rubbish dumps to find the parts I needed. You might have to step over dead sheep but I always found what I was looking for!*

Paul: Are you a member of the WIA and if so, why?

Peter: *Yes, I am a member and have been for most of my time as a licensed amateur. I have written various articles for them. They now produce the only magazine for amateur radio in Australia. There used to be a commercial publication, which has an interesting history but the bottom line is it's no longer published. Until recently the WIA magazine was circulated monthly but now it's a bi-monthly publication. WIA does run weekly news broadcasts, looks after the examination systems and represents us internationally and nationally. There was some past controversy over the WIA in relation to corporate governance, resourcing, conflicts of interests etc. Several Directors resigned a number of years ago. One of those ex-directors set up a rival organisation but it doesn't have the same foothold as the WIA. I believe the WIA has around 4,000 members but it used to have over half the licensed amateurs. That said, I reckon only 50% of those were active at that time which skews the figures.*

Paul: Why do you focus on QRP? What is the main attraction for you?

Peter: *Most of my life I have built equipment. My first rig was a valved, home-brewed, crystal-controlled CW QRP station for 80m. I did try using transistors in the early days but my projects didn't work! I suppose QRP gives you immense satisfaction making contacts with small amounts of power, especially small lightweight portable gear. I have lived by the beach for the last ten years so low power operation from there is particularly attractive. Your beaches in the UK look very different, don't they? Rocky and stony – then you look at your weather and you wonder if operating from the beach there is quite so appealing!*

Paul: I see from your YouTube videos that you make use of CW and SSB. Which mode do you prefer using most and why?

Peter: *I used to exclusively use CW because it's much easier to build a CW rig but while I can still read Morse in my head at a reasonable speed I've maybe lost patience with it now. It's not a huge interest for me anymore and I probably only use it about 10% of my operating time.*

Paul: Have you tried FT8? Is it as popular here in Australia as it is in the UK and the rest of the world? Same question for network radios – have these taken off in Australia?

Peter: *I think FT8 is equally popular over here, I've downloaded the software but I think there's a new version that allows you to add more data to your contacts, to personalise your QSOs – I haven't gone*

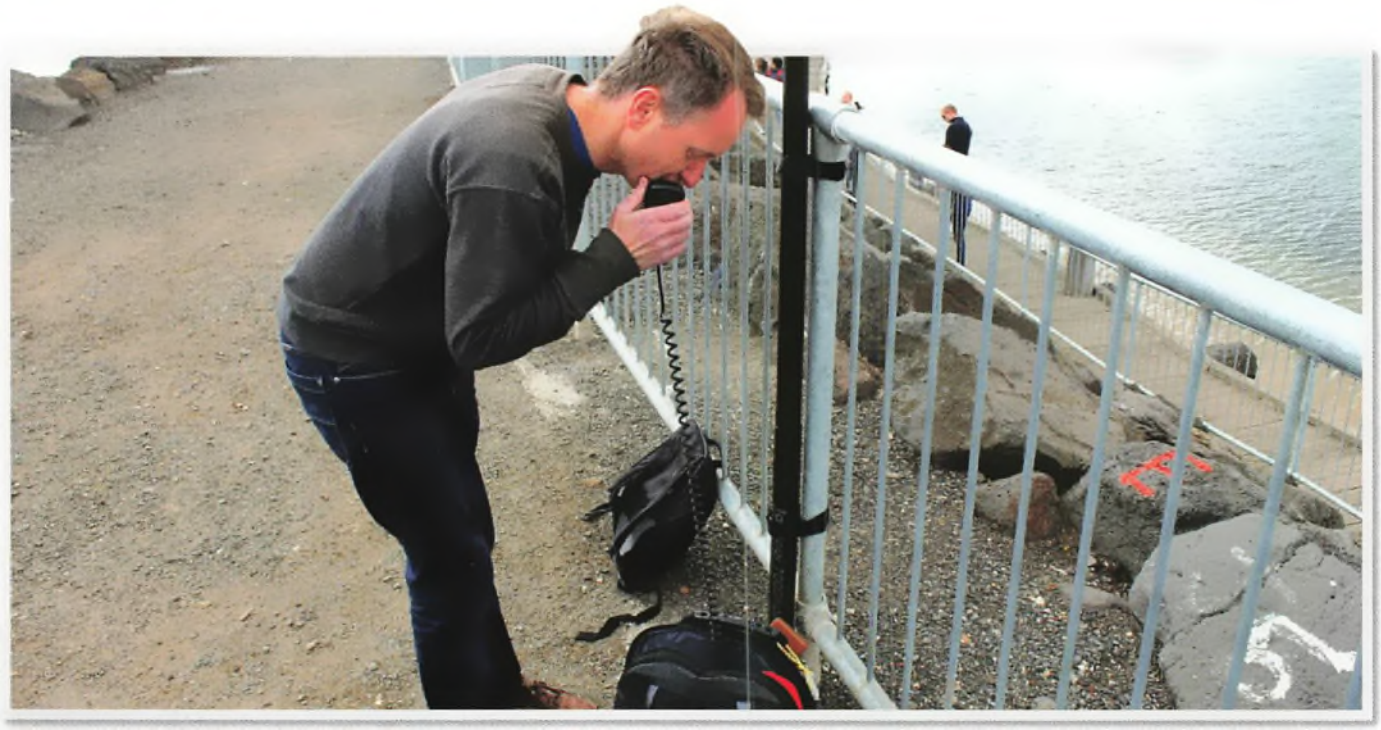


Fig. 5: Peter takes over the microphone to show how it's done!

into any of that just yet. I quite enjoy using 'Whisper' (WSPR) when the bands are quiet or you don't feel like talking. It's not direct communications as such but you can see how far you're getting out and the benefits of being able to do that with very small amounts of power. I built my own WSPR transmitter with just a few milliwatts into a balanced mixer. It worked really well. I've never heard of Network Radios. Is it like a more sophisticated form of CB? I've heard about smartphones being used with a software PTT button. I assume it's similar to that but no, it's not really something I'm aware of that's being made use of here in Australia.

Paul: What is the most satisfying aspect of amateur radio for you personally and why?

Peter: *I like the fact you can try out lots of different facets of the hobby. You can go into antennas, then drift away, come back and try 160m AM for a while, have a go at contests, both HF and VHF. You think of other hobbies such as horse riding, you've always got to feed and look after your horse whereas with our hobby you can be more sporadic and come back to things when you want. I like the flexibility amateur radio offers.*

Paul: How did your YouTube channel start out, what was the main driver for you to start it?

Peter: *Well, it was a logical extension to my website. I've been writing magazine articles since the 1980s and made use of the web in 1997 when I built my VK3YE.com site. It wasn't the first ham radio website but I did start this fairly early on. There are somethings probably better demonstrated and shown visually through video media and that's when YouTube became useful for me.*

Paul: How do you decide on YouTube content given QRP is a relatively 'niche' market? Do you feel under pressure to keep uploading content?

Peter: *No, I don't feel any pressure. I may go a month or so between videos. I've learned there are certain topics or key words that really get people excited. You know I looked at my channel and compared that with the number of subscribers of the former Prime Minster and I had more! Niche websites and YouTube channels can get large numbers of views. If you want guaranteed large views, make a video about magnetic loops! There seems to be an insatiable appetite for people to watch these. Maybe it's selling the dream of this tiny miracle antenna – even though its performance is not that great, it will radiate a signal.*

I do try to be a little bit different with my channel. There are other types of YouTube programmes (some in the USA go for several hours) but personally I find these rather boring. It's better to have lots of topics and spread them out over a number of short videos. I know I should do better with my audio, microphones and video effects but I think it's the subject matter content that people really want to see.

Paul: In the UK we produce something called TX Factor, have you seen this?

Peter: *Ah yes, now I have watched that and it's very professionally done, probably the best of the amateur radio shows out there in my opinion. It's also watchable for a non-amateur whereas many others are not. It's really good.*

Paul: I see you have authored a number of books related to the subject of low power operating. Any future publications planned?

Peter: *I have published four books to date and there will be more. I won't say what they are just yet but I'm working on ideas right now. I have one book 99% completed and I do work on it most days. Then I realise it's still 99% completed but it will be a good one when eventually finished and of general interest to amateur radio. I am tempted to write another antenna book too.*

Time literally whizzed by on St Kilda pier and soon it was almost dark – time to finish the interview and head back to the XYL. Peter joined us for dinner and was very entertaining. He was also interested to learn more about UK amateur radio and British politics in particular!

I was glad to have spent the evening with Peter. He provided a fascinating insight into the world of amateur radio and QRP operating and freely gave up his time to meet a visiting 'pommy'. The following day, we were back on a plane, this time flying to New Zealand where I really wanted to make up for some lost operating time but that is a tale for another time!

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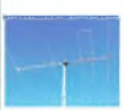

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Landline Telegraphy

Roger Cooke G3LDI looks at American (and Japanese!) Morse before turning to other CW-related topics.

Morse code has not always been the code that radio amateurs learn and use today. American Morse Code (also known as Railroad Morse) is the latter-day name for the original version of the Morse Code developed in the mid-1840s by **Samuel Morse** and **Alfred Vail** for their electric telegraph. The 'American' qualifier was added because, after most of the rest of the world adopted International Morse Code, the companies that continued to use the original Morse Code were mainly located in the United States.

American Morse Code was first used on the Baltimore-Washington telegraph line between Baltimore, Maryland, and the old Supreme Court chamber in the Capitol building in Washington, D.C. The first public message *"What hath God wrought"* was sent on May 24th 1844, by Morse in Washington to Alfred Vail at the Baltimore and Ohio Railroad (B&O) 'outer depot' (now the B&O Railroad Museum) in Baltimore.

American Morse is now nearly extinct. It is most frequently seen in American railroad museums and American Civil War re-enactments. Morse Code today virtually always means the International Morse, which supplanted American Morse.

The railroad operators were extremely skilled at reading Railroad or American Morse, using a sounder. Each relay station had these installed and the click-clack noise from the sounder was the only sound the operator had to decode messages. This may sound easy but only when you actually try it, and try to copy a whole message, is the difficulty realised. Slow speeds are not too bad but anything over about 15WPM and it takes consummate skill to decode.

Sounders are still around. Indeed, there will be an evening at the Norfolk ARC in July when we shall be showing and operating the sounders, courtesy of **Roy G3ZIG** who has a few in his collection. It will be fun to see who can actually use them to decode a message. **Fig. 1**.

Needless to say, we will not be using American Morse, only the International variety. Those railroad operators who had a problem copying the distinct clickety-clack of the sounder used to place a tobacco-tin lid on the top of the sounder to make it easier to copy. They were referred to as LIDS, a term which has become synonymous with poor operators on the air today.

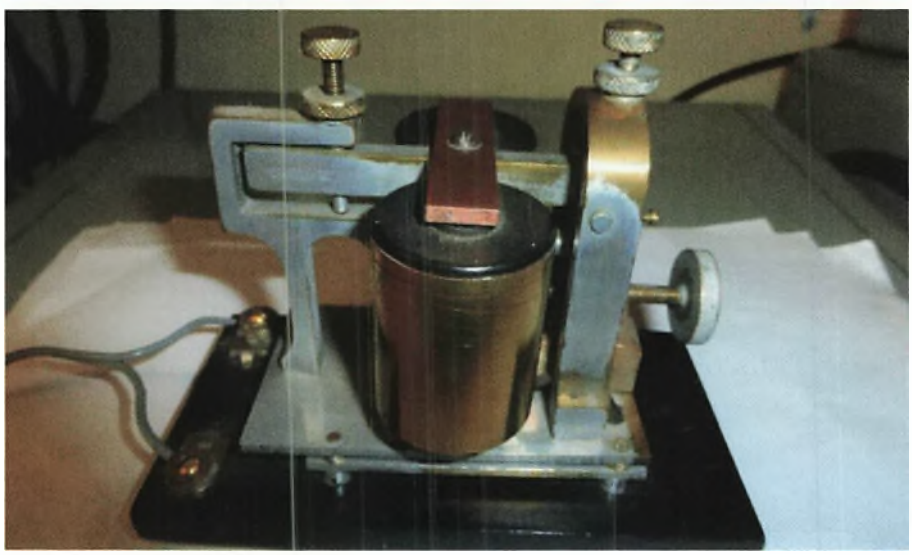

Fig. 1: Bunnell American Morse sounder.

American Morse differed from the more modern International Code in its construction. In its original implementation, the Morse Code specification included the following:

- short mark or dot (•)
- longer mark or dash (–)
- intra-character gap (standard gap between the dots and dashes in a character)
- short gap (between letters)
- medium gap (between words)
- long gap (between sentences)
- long intra-character gap (longer internal gap used in C, O, R, Y, Z and &)
- 'long dash' (—, the letter L)
- even longer dash (——, the numeral 0)

American Morse code is shown in **Fig. 2**. I had a lifelong friend in Seattle, **Dick Bendicksen N7ZL**. He was originally licensed as W7LPM and was a real expert in code. He operated in WW2 in the Philippines and was fluent in both American and International Morse Code. He is a Silent Key now, unfortunately, passing away some years ago, at the age of 87. We had regular skeds almost every day for years and visited with each other several times too.

To see how difficult it is to copy from a sounder, take a look at this YouTube video: **www.youtube.com/watch?v=lD6r4-2_0bc**

Japanese Morse

Working Japanese stations is fine when using International Morse Code but if you speak Japanese and wish to converse using Japanese Morse, then you will have some more learning and more practice to do! Their code is shown in **Fig. 3**.

Bootcamps – again!

There are now three Bootcamps scheduled for the remainder of this year as below. Norfolk ARC will be adding another in the autumn, but no date has been set as yet.

- Sunday, April 28th, Norwich ARC, G3LDI.
- Saturday, May 4th, Hereford area, G4FAD.
- Saturday, October 19th, Essex CW ARC, G0IBN.

If your club is starting a Bootcamp, please let me know and I will add it to the list. I don't think you will regret running one at your club; it really is both beneficial and a lot of fun.

The Essex Club was fortunate to receive sponsorship from FOC in order to run their Bootcamp at a local village hall. They used the money to acquire some training equipment and are happy to offer it for loan to

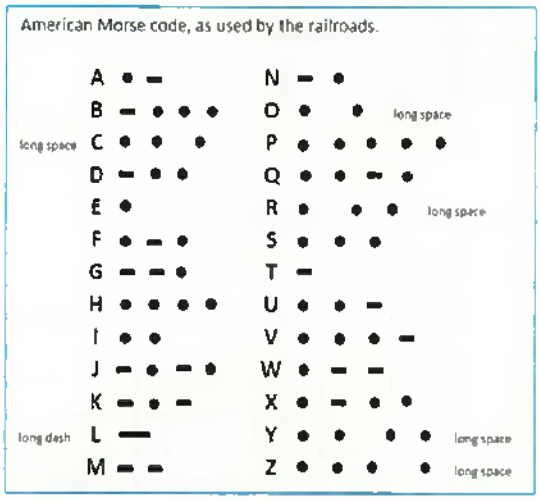

Fig. 2: American Morse code.

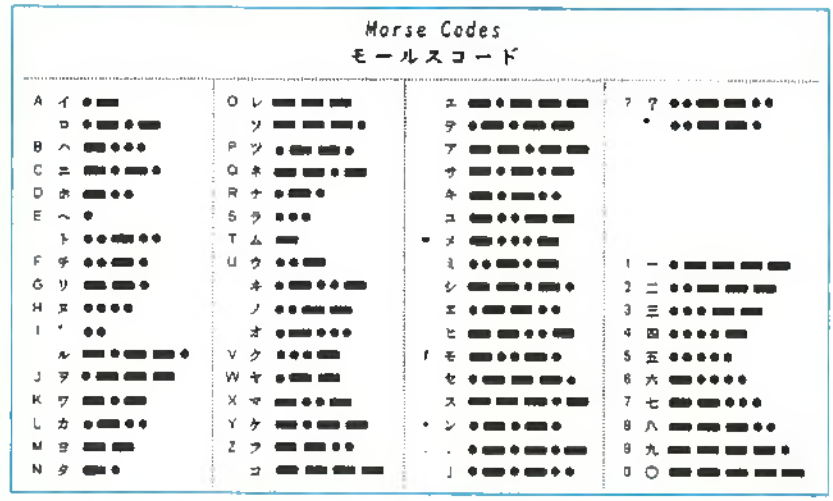

Fig. 3: Japanese Morse code.

other clubs running a Bootcamp. If you would like to borrow it, please contact **Andy G0IBN** at: **g0ibn1@yahoo.com**

M0AGA Chevron Paddle

If any of you are lucky enough to own a Rolls Royce paddle, the Chevron, made by **Kevin Gunstone M0AGA**, you might be interested in protecting it with a dust cover. There are two people that I know of who make these. One is **Tom Kelly AB6Z** (website below), who now has the dimensions for making a dust cover for Kevin's Chevron paddle. He can add your callsign (and FOC emblem where applicable) if you like.
gifts4hams.com

The other, in the UK but who sells worldwide, is **Pete Sobye G0PNM**, who also has the dimensions for Kevin's key.
www.g0pnm.uk

Pete featured on the last episode of TX Factor when he was the winner of the prize draw. He also makes other shack accessories, so it's worth taking a look at his range of products. When I am lucky enough to own a Chevron, I shall be in touch Pete!

Morse Practice Oscillator

The following was sent to me by regular *PW* reader and correspondent **Bob Houlston G4PVB**: KMK (Kent Morse Keys) offer a ready-built Morse practice oscillator but for just a fraction of the price you can build it if you supply the case. So, for use in my GB2CW broadcasts I did. The instructions were clear and well presented. It worked first time. The pitch (quite pleasant) and volume are variable. Silicone sealant (wear eye protection in use) secures most loose things. I fitted 3.5mm and 6.35mm jack sockets. Total cost, including the supplied kit, about £30, though this will vary according to what you have to hand. Apart from waiting for the silicone sealant to dry, it took about two hours to build so could be a useful club night project, **Fig. 4**. Source:
www.kent-engineers.com

Adjusting Paddles

I recently took my Begali HST apart, disassembled the contacts and so on and gave it a thoroughly good clean. I was surprised at just how much dust and accumulated fluff there was. I suppose I should have a dust cover to protect it, like those with the Chevron probably have! After reassembly I spent 20 minutes setting it up and adjusting the contacts. Again, surprisingly, it did make a difference to my keying accuracy. I thought my age was causing some mis-keys and mistakes but I definitely noticed an improvement. It obviously pays to take a regular look at our paddles.

If you have an MFJ-564B twin lever paddle, there is a YouTube video regarding maintenance that's worth a look:
https://youtu.be/ulXz-AZdDPM

Rag Chewing

There are so many 5nn73 QSOs now, that some people have resorted to forcing the other station to actually say something in the way of conversation. This was the theme of Ray G4FON's talk at the RSGB Convention this year.

Stew GW0ETF/GW4J had this to say about it: *"I find contesting immense fun but it doesn't do much for my conversational skills. So, I do try to CQ outside of contests when I can to try to rebalance things. At the moment I try to spend some time around dusk here on 20m and regularly have some nice QSOs with West Coast/Rockies area but conditions usually keep them fairly short plus sometimes if I'm lucky, there will be others waiting. Often when there's Europe propagation, say, on 40m, I get called by stations only after my GW prefix, which means lots of 599/73 type contacts but that can be fun too.*

Fig. 4: Kent Morse practice oscillator.

"I don't know if you use a panadapter but if you do, take a look on 20m a few minutes before 1300UTC on a Wednesday [the CWops CW Test events, as Roger has mentioned previously, run over three operating periods each Wednesday, the first being 1300 to 1400UTC – **ed.**]. *Barring DXpeditions, the middle part of the CW section has lately been flat as a snooker table. Then as the seconds approach 1300 and beyond, a forest of mid-height signals springs up and lasts until 1400UTC when the forest becomes a desert again. Post-CWT there is clearly propagation – it's just that nobody is on. Most CWTers, including me, want (or need) to upload their scores and get away but maybe I'll try hanging on with a few CQs with my official CWops call (G(W)2CWO) in case there may be some lingerers happy to chew some rag. And there's always 40m and 80m for us locals (80 is usually a graveyard in the day). If this becomes a regular thing, we could think about advertising it as a time for potential new members to look for those conversational QSOs".*

Please keep the input coming. 73 and May the Morse be with you. Roger G3LDI.

• E-mail: teleniuslowe@gmail.com

DXpeditions and Visitors

Steve Telenius-Lowe PJ4DX reports on some recent DXpeditions, one of which brought some welcome visitors to his Caribbean island.

It's well known that we're now at the bottom of the solar cycle and waiting for some sunspots to return to enliven HF propagation. It's therefore not surprising that conditions during the period under review (second half of January and first half of February) were less than stellar. But, while poor conditions on 15, 12 and 10m are to be expected at the bottom of a solar cycle, at least in November and December they were balanced by good – and occasionally spectacular – propagation on 40, 80 and 160m. Unfortunately, by the second half of January those days seemed to be behind us, as propagation on the low bands returned to normal and the higher bands seemed to deteriorate further.

Nevertheless, there was at least one highlight worth reporting. The Radio Club de Provins (F6KOP) team travelled to Banana Island (AF-037) off the coast of Sierra Leone and operated as 9LY1JM, **Fig. 1**, from January 9th to 21st. With a group of ten experienced operators and an ocean-front location, 9LY1JM put out excellent signals and made over 50,000 QSOs. I worked them on all bands from 12m to 160m and on both CW and SSB for a total of 13 band-mode slots. The group was also active on FT8, RTTY and PSK and the majority of this month's contributors to the column made at least one contact with them.

It was impressive to see that the 9LY1JM log was uploaded to Logbook of the World (LoTW) very soon after the end of the expedition too.

Bonaire Visitors

In January we had the pleasure of welcoming three well-known DXpeditioners to Bonaire: **Heye DJ9RR**, **Norbert DJ7JC** and **Emil DL8JJ**, **Fig. 2**. They operated for eight days as PJ4P using CW, SSB and FT8, and made an entry in the CQ 160m CW contest. All three operators have taken part in numerous DXpeditions, many of which I'm sure *HF Highlights* readers will have worked. Take a look at their impressive CVs on the PJ4P QRZ.com page:
www.qrz.com/db/pj4p

Look Out for...

In last month's column I suggested looking out for TT8RR and TT8XX from Chad in March but added that I hoped *"this group has more luck than **Kenneth LA7GIA**, who... was closed down by the security police after only one day"* when he operated as TT8KO last October. It seems the Italian DX Team also faced such difficulties because *"The IDT DXpedition to Chad, initially planned for March 2019, has been put on hold for security reasons. As a consequence, the activity from Uganda, originally planned for September – October this year, has been rescheduled from 13 to 25 March 2019."* So, look out instead for 5X3C on SSB, CW and RTTY, and 5X3E on FT8.
www.i2ysb.com/idt

Readers' News

Reg Williams G0OOF wrote that *"For me it has not been too exciting on SSB during January so I decided to take the plunge and give WSJT-X v2 a go using FT8 mode. I purchased a suitable USB CAT control and audio interface with leads suitable to use with a second radio, a Kenwood TS-870. It took some time to get the configuration correct. Internet was useful to sort the problem out. Pleased to say all is working well with the software and radio. The radio is set up for approximately 40W maximum with no ALC. I have concentrated mainly working on 17m with some excursions to 20m and 40m. 17m has provided a good number of USA stations, which I am pleased about because I am collecting states and counties on that band. These can be worked generally in the early afternoon to evening time. My best contact so far is RI1ANL, which was worked on 20m recently in the evening."* Reg also uses JTALERT-X and GridTracker and commented that GT is an interesting program but really needs a second screen on which to show it. He concludes by saying *"When conditions improve, I will be returning to SSB. In the meantime, FT8 is nicely filling the gap."*

Fig. 1: The 9LY1JM DXpedition logo.

Fig. 2: The PJ4P operators, l to r Heye DJ9RR, Norbert DJ7JC and Emil DL8JJ.

The 2019 log of **Victor Brand G3JNB** was opened by 9G2HO, the Ho City University Technical Club's station in Ghana, on 17m followed by RT9X on 20m. Conditions were *"infinitely variable on HF, from zilch to good copy"* until the 11th when the effects of a CME hit Earth. *"The HF bands were so quiet until I noticed a faint signal that slipped in and out of audibility and eventually copied a weak CQ on 17m from 9LY1JM... which at that moment seemed to be the only show in town for the 'Deserving'. I spent ages trying up and down the apparent split and, eventually, got through after they kindly persevered with my callsign... On 40m **Richard 9M2MRS**, **Fig. 3**, located over 6,500 miles away in West Malaysia, was spotted on the Cluster calling CQ and was just audible here late afternoon on the 14th. With my*

Fig. 3: Richard 9M2MRS (PA0RRS) in his shack in West Malaysia.

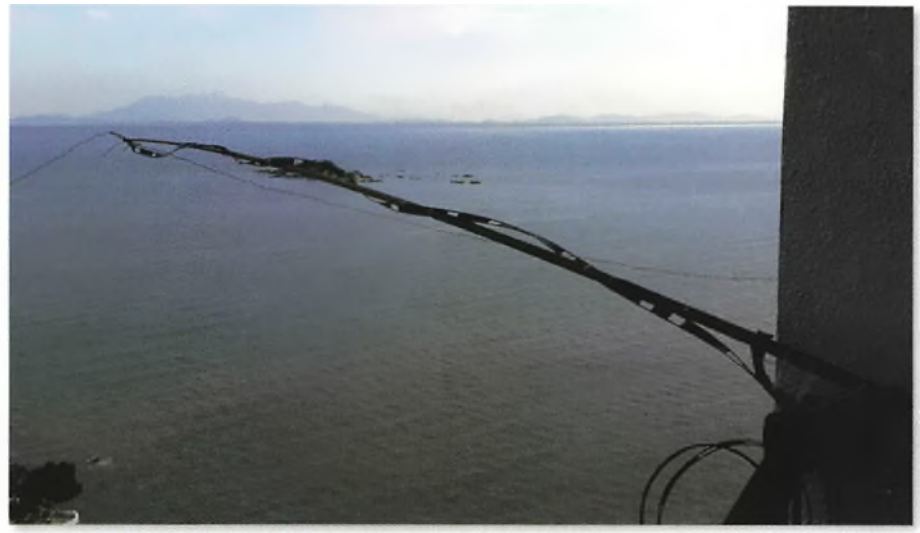

Fig. 4: The 9M2MRS antenna overlooking the sea from Penang, Malaysia.

50W to my half-sloper/doublet, I called and called for 50 minutes and could faintly hear Richard's occasional reply despite fast and deep QSB but it was not until dusk approached that we actually worked on a short peak, followed by a delightful comparing of notes over Cluster's personal messaging link. He was running an FT-450D with 100W to a G5RV propped up on his balcony. **Fig. 4**. *The magic of ham radio!"* Back on 20m, HH2AA, the Haiti Radio Club, was running a pile-up from Port-au-Prince and, despite a wide split, replied to Victor's first call, as did 9M2YDX and then PJ4P on Bonaire. Finally, P4/DL4MM on Aruba eventually obliged on 40m, Victor reports.

Martin Evans GW4TPG reckoned it was *a "bit of a mixed bag this time around, due mainly to other duties keeping me out of the shack and away from the good stuff, giving me limited DX chasing time. Still I managed to achieve 101 worked on 80m to complete 5BDXCC worked plus DXCC on 12, 17 and 30m as well. I just need another 19 to confirm on 80m to get the full award. Santa brought me a couple of good books,* The RSGB Amateur Radio Operating Manual *and* DXing On the Edge: The Thrill of 160 Meters [by **Jeff Briggs K1ZM** – PJ4DX]. *The* Operating Manual *is always a good book to keep in the shack as it's packed to the rafters with good information, edited by a certain PJ4DX I think* [Thanks for the 'flowers' Martin, but I can't take all the credit: it was a joint effort with **Mike G3XDV** – PJ4DX]. *It's interesting to compare the latest edition with the first one I bought way back in 1983 and see just how much the hobby has changed. For example, the older edition has a way of cutting noise from a Creed Teleprinter by placing it on a paving slab (!), the new edition in contrast not surprisingly has no mention of a teleprinter whatsoever. Next month I should have some news reports on 160m because I am in the process of putting up a tree-mounted inverted-L. The Battle Creek Special is working so well on 40m and 80m I want to try to leave it alone if possible and have a totally separate topband antenna."*

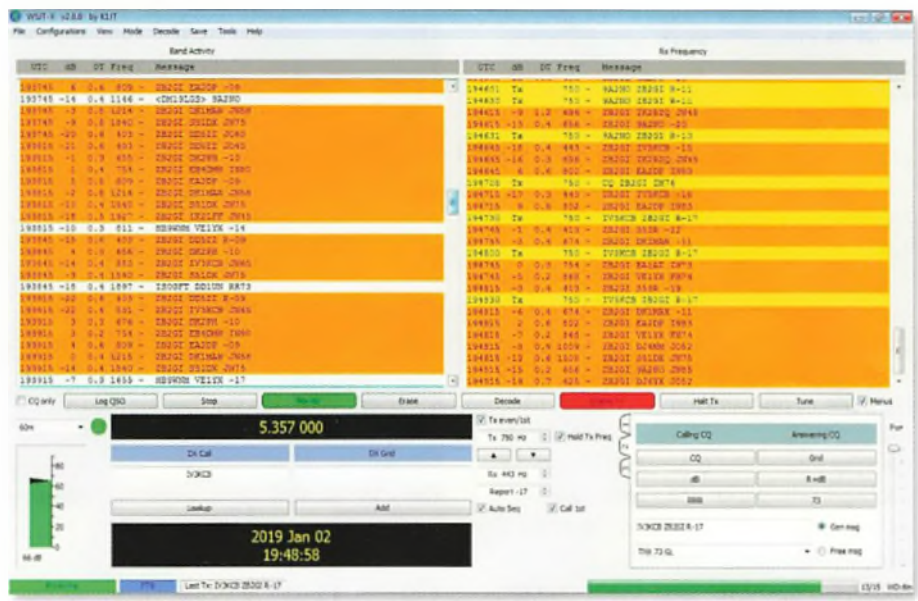

Fig. 5: Screenshot of 60m FT8 operation by Kevin ZB2GI.

Owen Williams G0PHY said there was *"not much activity this month with more time spent listening than making contacts... The month got off to a slow start; the first contact being on the 15th with the French team in Sierra Leone, 9LY1JM, on 14MHz. Next was the German team on Bonaire, PJ4P, again on 14MHz. The only other station of any note worked on 14MHz was 7X2VFK from, according to their QRZ.com page, the Sahara Desert. There were, however, quite a few stations to chase on 14MHz. On most days there were some east coast USA stations audible and I heard one station just west of Chicago giving his local temperature as –29 centigrade! RD0B/P on Dickson Island was a strong signal one morning with evidence of polar flutter on his audio. ET3AA was heard two afternoons running at the end of the month. I spent a few afternoons trying to work RI1ANM at the Vostok base in Antarctica. I heard him calling CQ but his signal was just above the noise and suffering from QSB. So, there's definitely DX about. On 7MHz the best DX was UA6BQU near the Sea of Azov. Stations in Kuwait and Indonesia were heard but not worked."*

Etienne Vrebos ON8DN/OS8D said he had *"Some activity this month of January but disappointed by the poor activity in general and really poor propagation."* He used an Icom IC-7851 and Acom 1500 amplifier with 1000W output to a Hexbeam 8m above ground and a Butternut HF2V at ground level with 40 radials for 40m and 80m. On 80m he worked *"mostly Europeans"* but managed a QSO with yours truly PJ4DX on 20m SSB and on 17m Etienne worked an ATNO (All Time New One) in the form of

5X2B (Uganda). Despite his complaint of really poor propagation, Etienne's 20m log in particular would be the envy of many HF operators (see band reports).

Despite being at the bottom of the solar cycle, **Tony Usher G4HZW** says he hasn't given up on 10m. He *"called CQ most days (FT8, Yaesu FT-450, 50W, 4-element Sirio CB antenna) but conditions have been dire even on FT8... More on offer on 40m (FT8, Yaesu FT-450, 50W, quarter-wave vertical with 16 radials): east coast Ws, loads of EUs and a couple of JAs. I did listen on 20m using the FT-450 plus my Wellbrook loop and saw plenty of DX there with west coast Ws, JA, VK and ZL. I have an appropriate fibreglass pole and I'll perhaps give 20m a go some time, although by then it'll be the Sporadic E season and I'll be thinking 10m is not a bad band after all!"*

Terry Martin M0CLH again offers *"a smallish log as painting and decorating takes over from actual building work! Also, more experiments with WSPRlite – it's amazing how far 20mW signals go (at least on the lower bands). Good to catch a VK on 40m and fill a slot with the slightly unusual call-sign of 9LY1JM."*

When **Kevin Hewitt ZB2GI** was operating portable from the top of the Rock of Gibraltar in January, *"the rock apes pulled the 10m wire off the balun. After reconnecting the wire with **John King ZB2JK**, 20m was open across the pond into the US and Canada with S9 reports in both directions."* Kevin added that on 60m FT8, **Fig. 5**, he worked into Brazil, Italy, Sweden and Turkey: *"all countries awarded full-time 60m allocations at the end of 2018."*

Carl Gorse 2E0HPI/P says that he had a sore throat for a few weeks so had not done much radio but, *"feeling much better this morning, I took the Elecraft KX2 and MFJ-1979 vertical to the beach at Crimdon, **Fig. 6**. Only using the internal battery pack, I set the power to 2W. I did quite well* [see band reports]. *It just shows what can be achieved under the current conditions and the recent solar storm using the North Sea and low power. Next month I am planning on more activity – just hoping the snow does not return any time soon!"*

Fig. 6: The 2E0HPI/P set-up on the North Sea coast.

Band Reports

Reg G0OOF used FT8 exclusively to work, on 40m: EA9ABC, TF5B, WW1WW. 20m: A45XR, LU5DT, PY2BL, RI1ANL, TF8V, VE3ODR. 17m: 7Z1IS, A45XR, CO8LY, CU2AP, FG8OJ, KW4SP, PY1SX, SV9BMG, ZS6HON.

Martin GW4TPG worked the following: 80m CW: 7X4AN. 80m FT8: GD3YUM (Martin's 100th DXCC on 80m), K0TT, PJ4P, S01WS, YV5JLO. 40m CW: TZ4AM. 30m CW: 9LY1JM, J68GD. 30m FT8: A41ZZ, A92GE, C5YK, CU2AP, FG/F6ITD, HS0ZGV, J73HGL, JR1LJZ, XP3A (Greenland), YE1AR. 20m CW: 9LY1JM. 20m RTTY: 9LY1JM. 20m FT8: 7X3WPL, 9G2HO, A41ZZ, HH2AA, TR8CA.

Owen G0PHY used SSB only to work, on 40m: OL120AB, UA6BQU. 20m: 7X2VFK, 9LY1JM, PJ4P.

Etienne ON8DN / OS8D also used SSB only to work, on 40m: HI1LT, OY1OF, T77LA. 20m: 3B9VB, 9LY1JM, 9X9PJ, CX1AV, ET3AA, EY7AD, FG4NN, FM8QR, HS0ZNR, JI1ICF, JY5MM, PJ2DD, PJ4P, RI1ANM (Antarctica), ST2ND, TO7D (Guadeloupe), UK8FAI, UN0LM, VK4SX, VU2VID, YF9CDL, ZD7FT, ZL2BAQ, ZS1AFS. 17m: 5X2B, 6Y6Y, 9LY1JM, TI8II.

Tony G4HZW used FT8 only: 40m: JF2XGF, JR1XGF. 10m: PU1JSV, PY2CP, PY5KD, ZP4KD.

Terry M0CLH offers these: 40m CW: DL70AFUG, PJ4P. 40m FT8: LZ1354PM, VK3OD. 30m FT8: 4Z5AV, EA9CD, K1GUY, OD5ZZ, TF2MSN, Z68M. 20m SSB: KA2HTV. 20m CW: 9LY1JM, LZ1354PM, PJ4P. 20m RTTY: P4/S50N. 20m FT8: 3B9FR, 9G5ZS, FG8OJ, PY2VA, RV9DC. 17m CW: EA9/DL2JRM. 17m FT8: N5WA, VE1JBC.

Kevin ZB2GI, operating both from home and /P from the Top of the Rock, reports: 60m FT8: 5B4ALX, EA8OM, HB0WR, K1CF, K2JL, K4CIA, N6AR, N9US, PY7DJ, TA4RC, VE1YX, ZP4KFX, W3WTE. 20m SSB: DQ1200ASP (1200yrs city of Asperg), GD1JNB, K1BZ, K4WMS, K0TRL, KB2DMD, KE5EE, N2BJ, N8ZDE, R900BL, VE1BEJ, VE2N, VE3ZZ, W3FOX, W4UW, WA6AEE. 15m FT8: EW7A.

Carl 2E0HPI/P used 20m SSB: 4Z4DX, EB7HQE, LY3A, OG5T, RA1QGN, SP8GEW, SY2BEW, YU7SMA.

Signing Off

Thanks to all contributors. Please send all input for this column to **teleniuslowe@gmail.com** by the 11th of each month. For the June issue the deadline is April 11th. 73, Steve PJ4DX.

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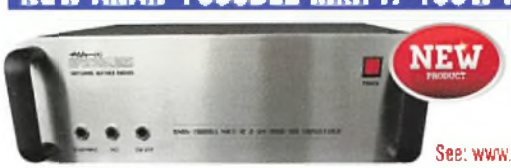

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Noise Generator & Component Identifier

Geoff Theasby G8BMI has two more low-price projects for the shack.

Designed by K7QO and bought from QRP Guys in the USA for £14, this noise generator is very simple but useful, nevertheless. I built it in an hour and it worked first time. It is quite straightforward, an avalanche or Zener diode followed by three stages of amplification. It contains its own on-board battery so it will be of use 'in the field'. It generates 40dB of noise at 7MHz, 30dB at 14MHz and 1dB at 28MHz. Use it with an ATU to tune for lowest SWR by adjusting for minimum noise. I find that the peaks on my ATU are much sharper and more pronounced than when tuning an antenna by ear on the receiver. Also, receiver filters can be checked using a software spectrum analyser 'app' on a smartphone or PC. (Such as 'Frequensee' for Android smartphones, or DL4YHF's audio analyser on the PC) No electrical connection to the smartphone is required. Using my Icom R-70 receiver tuned to 7MHz, I can see the shape of its filters, SSB to 3kHz, CW 500Hz and RTTY 200Hz. The photos, **Figs. 1** and **2**, show the CW and RTTY filter characteristics. https://qrpguys.com/k7qo-noise-bridge

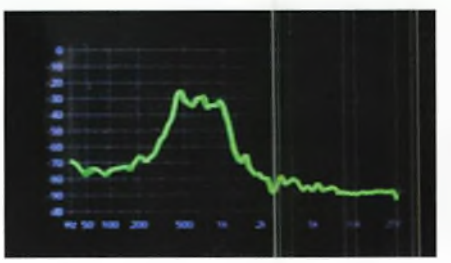

Fig. 1: CW filter shape, using the noise generator and smartphone App.

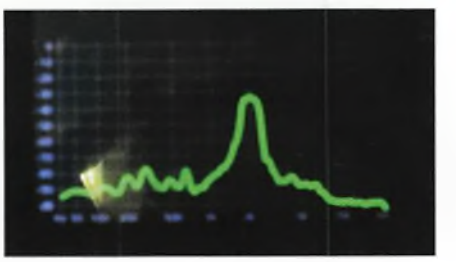

Fig. 2: As Fig. 1 but for the RTTY filtering.

Component Identifier

Known as M328 Mr4, this module, **Fig. 3**, available on eBay, will test and measure semiconductors, resistors, capacitors, inductors and so on. Using a 'zero insertion force' IC socket for items under test, it is not so sophisticated as those from Peak Electronics, for example, but it only costs £5! Readout is on a monochrome LCD display, 55 x 30mm. The unboxed PCB had a tendency to rock in use on the bench, so I fitted self-adhesive rubber feet, after which it was happy. In practical tests, a toroid wound for a QRP ATU was measured as 0.3Ω and 0.02mH; a transmitting choke was 9.8Ω and 94mH; a 2N3702 as a PNP transistor, hFE 82 (Specification is 60-300); a 10kΩ resistor as 10.09kΩ; a 33pF capacitor as 32pF and an LED as Vfwd 1.82. Semiconductor leads are also identified. This device does not like voltage regulators, power transistors, power MOSFETs or power Darlingtons.

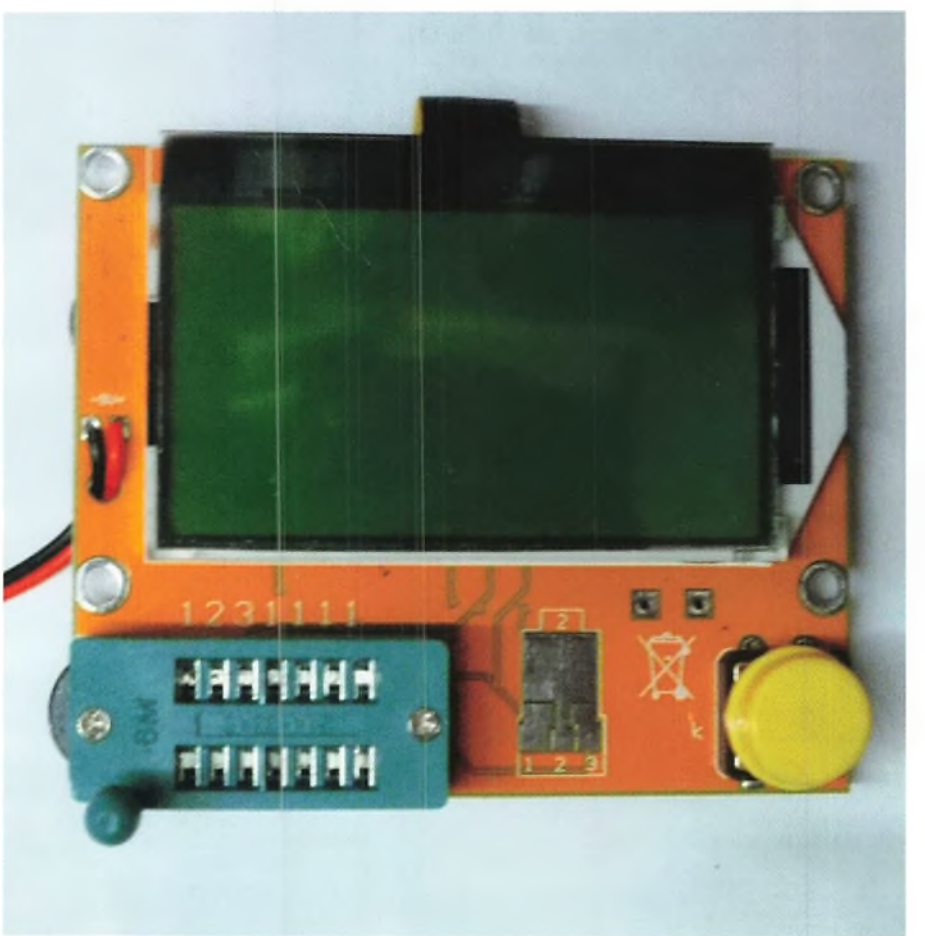

Fig. 3: The component identifier.

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Time to try FT8 on 70cm?

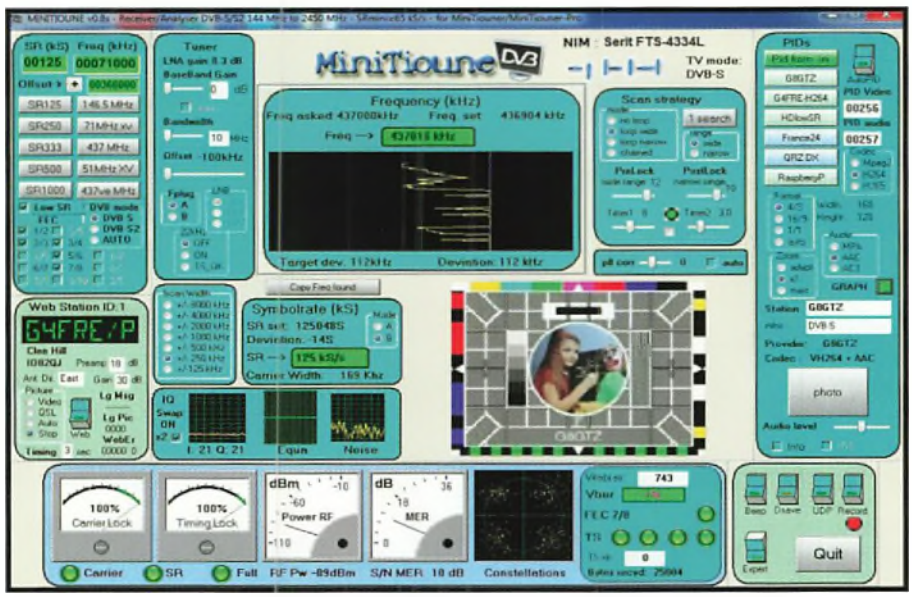
Tim Kirby G4VXE has his usual selection of news on the VHF bands and above but starts with a spotlight on 70cm FT8.

It's around a year ago that I read a tweet from Jason G4KVT about FT8 on 2m and decided to give it a go, just using the antenna I had up, a V2000 vertical. Twelve months later there are a lot of contacts in the log and I have been amazed how well a simple vertical has performed. I am, admittedly, in a great location. I have been intrigued, though, that using vertical polarisation doesn't seem to have been the barrier that I expected. Although a goodly number of the stations I work regularly use verticals, I also work plenty of people using horizontal polarisation. I have wondered whether because there's a fair amount of scatter involved, such that polarisation is potentially mixed, that having a vertically polarised antenna is less of a barrier.

Over the last month or two, I've had a lot more people asking me about trying FT8 on 70cm and to date, I haven't had a huge amount of success. I know that dispersion and other effects potentially make FT8 less successful on 70cm than 2m. I reasoned that I should still see some signals and that aircraft scatter ought to be successful. It may very well be but perhaps we have to use data modes such as the wider JT4 to cope with the scattering and dispersion effects.

All of which is leading into saying that this is a really interesting area for us to try. If you are one of those who have been trying 2m FT8 using a vertical, why not try some 70cm paths? If there is someone that you work easily on 2m FT8, then why not try on 70cm and see what happens? It will be interesting to explore. I was delighted, on February 10th, to make my first contact on 70cm FT8 with **Malcolm G3ZNU**, over a distance of around 50km. Vertical to vertical it worked fine. We had previously tried cross-polarised, which saw some signals but less effective than I would have expected, compared with what happens on 2m. This may be because beamwidths tend to be narrower on 70cm, with longer Yagis generally being the order of the day.

And, of course, if you have a beam up for 70cm, then it should be possible to make some very interesting contacts. I was excited, for example, to learn that **Captain Yuri UT1FG/MM** was operating on both 2m and 70cm FT8 during his recent passage through the North Sea, English Channel and into the Atlantic on the way to Brazil. That gives the opportunity for some very useful 'wet squares' on both 2m and 70cm. See how your tests compare to 2m and please let me know what you find out. Most people seem to be using 432.174MHz for FT8 now, so that's probably a good place to keep an eye on. It would be great to see the level of 70cm FT8 activity increase to the point where random contacts (as opposed to skeds) are an everyday occurrence.



A screenshot from the record-breaking 71MHz DATV contact between G4FRE/P and GBGKZ/P

Amateur Radio Satellite Meets Art

Richard Brooks GW1JFV recently visited the Tate Modern Art Gallery in London and was intrigued to find an exhibit called 'Ten Minute Transmission' by **Jennifer Allora** and **Guillermo Calzadilla**, as part of the 'Media Networks' collection, which is part of the permanent collection.

The description of the exhibit reads, *'This work was inspired by artist **Alexander Calder's** suspended sculptures, or mobiles. Another influence was Russian artist and architect **Vladimir Tatlin's** unrealised design, Monument to the Third International 1919, a tower with a rotating radio station at the top.*

The title of this work, Ten Minute Transmission, refers to the period of time when the International Space Station (ISS) can be contacted via radio as it flies past. The ISS orbits the Earth once every 90 minutes but passes close enough to the antenna just twice a day. Usually the radio only picks up sounds of encrypted data packets sent back to Earth from the station. Two-way voice communication with the astronauts is now rare and needs to be requested in advance.'

The exhibit itself consists of a sculpture representing the International Space Station (ISS), which acts as the 'antenna', and a Kenwood TS-2000, which is powered up, albeit tuned to 148.495MHz. I did wonder whether we should contact the curator of the exhibition and suggest that the rig should be re-tuned to 145.825MHz, where, if the antenna is any good (I don't think it is resonant on 2m), may cause data signals to be received!

Is this the first time, I wonder, that an amateur radio transceiver has been part of an art installation? Very many thanks to Richard for bringing this to my attention. If this intrigues you, why not pay a visit?

The 6m Band

John Wood G3YQC (Hereford) is the only correspondent to mention the 6m (50MHz) band this month. On January 24th, John worked EI7BMB. He's seen the odd signal from Spain, which seems to happen mostly in the afternoons, perhaps just popping up for a single period.

The 4m Band

Dave Robinson G4FRE reports a 71MHz digital TV contact from Clee Hill (IO82QJ) with G8GTZ/P at Win Green (IO80WX) for a new UK distance record of 160km. Dave writes, *"I am using the Minitoune receiver that only goes down to 145MHz so I have to use an external transverter to receive 4m. I use the same process for 6m DATV. I modified a G4DDK Nacton 70/28MHz transverter for 437/71MHz and another one for 437/50MHz. On transmit, I use the BATC Portsdown transmitter at 437MHz into the same transverter to an amplifier. The antenna on 4m is a PowAbeam 5-element".*

The 2m Band

Jef Van Raepenbusch ON8NT had a couple of equipment problems during the month. First of all, he had to take his FT-736R in for repair, having had some reports of distorted modulation on SSB as well as some interference on receive, which proved to be self-generated within the receiver. However, Jef was determined to remain active and decided to try a Yaesu FT-290 MkII on the 2m (144MHz) band. The transceiver drifts but Jef says that FT8 is still decoding and wonders whether anyone has tried FT8 through amateur satellites. I suspect that the drift as a result of Doppler shift would be rather more substantial, unless automatically controlled, than the software could cope with.

Additionally, Jef had some problems with his Linux desktop PC, which was nearly ten years old. However, after a clean-up of dust, some more memory and an upgrade of the operating system to Linuxmint 19.01 Tessa, everything is now running again although some fine tuning and reinstallations have been required for some of the radio software that Jef uses.

Jef's log listing only contacts over 500km, using the FT-290 Mk II and a 20W amplifier, has some nice entries: F0GOW (IN96), GM0EWX (IO67), GI6ATZ (IO74), GW6TEO (IO71), F6DBI (IN88), EI3KD (IO51), EI19RE (IO51), F1NZC (JN15), G4RRA (IO80) and DL3TW (JO44). The GM0EWX contact at 948km is a particularly satisfying one.

In addition, Jef heard, but did not work, EA5DF (IM99) at a distance of around 1300km. The signals were very strong but only for a short time. This must almost certainly have been meteor scatter.

Malcolm Appleby G3ZNU (Great Missenden) also mentions a meteor burst and that he was reported by R1AO (KP40) on February 2nd, while Malcolm was trying to work G0NNF in IO92. Malcolm is running 50W to a 5-element Yagi.

Derek Brown G8ECI (Louth) says that he has worked the odd DX station on FT8 and that, because he tends to leave his system running 24/7, people see that from the PSK Reporter website that he is receiving them and try a call just in case he's in the shack. It's always worth a try! As Derek says, most of the time, he doesn't see the call until a few hours later.

Pete Walker G4RRM (Crewe) says not a lot to report this month, although he has made two new first time contacts on 2m FT8 with G0NNF (IO92) and M1AEC (IO82).

John G3YQC says that he has seen a fair amount of activity, mostly from G stations with a few near continental stations also being worked.

Dave Thorpe G4FKI (Ampthill) says that he hears CW signals on 144.050MHz most days and wonders whether this is the same around the rest of the UK?

WD9EWK demonstrating portable satellite operation from an Arizona hamfest – note the winter weather!

Here at **G4VXE** there have been plenty of enjoyable regular contacts around the UK and near continent. It was also good to work UT1FG/MM (in JO11 and JO00 squares).

The 70cm Band

John G3YQC says that he has often been trying 432.174MHz but has yet to make a contact on FT8 and suspects he may need to get a beam. However, John's e-mail prompted us to try the band and we were able to work over a distance of around 100km, vertical to vertical.

At G4VXE, as I said earlier, I was delighted to make my first FT8 contact on the band, with G3ZNU (IO91) and then shortly after, with G3YQC (IO82).

The 23cm Band

Derek G8ECI writes, *"I have been monitoring the GB3NGI beacon [on 1296.905MHz] and I can pretty much guarantee some aircraft reflections on an hourly basis. This is because the flight path bisects the direct path from JO03 to IO65 and I copy a lot of trails on the waterfall display and also a few decodes on JT4G, so even with my preamp in the shack I am quite pleased with the results care of various large jets flying up over Cumbria and near regions. I did purchase a 25W PA/Preamp from SG-Labs in Bulgaria and am making plans to put that on the pole just under the Wimo Yagi. It has a preamp built in so will enhance the receive side as well. I just need some decent weather to do it all!"*

Satellites

Jef ON8NT received some SSTV pictures from the ISS on January 30th/31st and

February 1st. Jef also mentions that the D-STAR ONE satellite was successfully launched and seems to be active from time to time. For more information, see: www.d-star.one

Kevin Hewitt ZB2GI (Gibraltar) sent an interesting log. Through AO-91, Kevin worked: EA4GPZ (IN80), SV3DVO (KM59), F4DXV (JN04), EA4GQS (IN80), IU1LBM (JN61), OE6MDF (JN77), G3PGA (IN70), EA5WA (IM99), DC3ZB (JO40), EA5DF (IM99), DJ5MN (JN58), DK5MV (JO40), EA1NF (IN80), G0IIQ (IO93), G7SVF (IO92), 9H1TT (JM75), IW3HRT (JN61), IZ5ILX (JN54), EB5YF (IM98) and DJ8MS (JO54). Malta and Greece were two new satellite countries in the log. In addition, during a 64° westerly pass, Kevin heard VO2AAA calling but was unable to complete a QSO. Via AO-92, Kevin worked 7X3WPL (JM13), EA1SS (IN70), DJ5MN (JN58) and DK5MV (JO40). Kevin says that he tried three SO-50 passes but found no activity.

Kevin also writes, *"Moscow Aviation Institute hosted the Inter MAI 75 SSTV event on January 30th to February 1st. The 1300-1900 UTC activation periods coincided with orbits that overflew Moscow. ARISS transmitted the PD120 images on 145.800MHz FM. I received six full images with no duplicates during three passes varying from 32° to 62°. My setup comprised a Yaesu FT-817 connected via a data interface to a Win7 Notebook PC running MMSSTV and a manually tracked 2m/70cm log periodic.*

"I also monitored the ARISS contact with the Colégio Campo de Flores, Almada in Portugal on February 2nd. ARISS used OR4ISS and the Colégio Campo de Flores used CS5SS with the contact conducted in English. I heard the stations make first contact and astronaut ***David St-Jacques KG5FYI*** *reply to 15 questions during a 25° westerly pass over the Rock".*

Peter Atkins G4DOL (Dorset) reports a nice contact through AO-7 in Mode B with **Alexandre PT2AP** who was on holiday in the north west region of Brazil in HI22 square. Alexandre was using a home-made handheld antenna and a TS-2000. At 1628 on January 28th Peter and Alexandre completed a contact. They had a mutual footprint for 90 seconds at around 2° of elevation. F4DXV and F0DIH were also able to complete contacts with PT2AP. Peter also reports working AB1OC (FN42), AA8CH (EN62) and WB8RJY (EN72) all via AO-7 in Mode B.

Patrick Stoddard WD9EWK (Phoenix) writes, *"Seeing the ISS digipeater on the air again last Saturday (February 2nd) was a good thing. As others have reported since then, the system appears to be hard of hearing. Passes where I would normally be able to see the ISS retransmit my packets are now difficult to impossible for me to work. Even from a location that had no noise or interference, I could only get a message through on one high ISS pass.*

"With the start of 2019, I attended a hamfest and hosted an AMSAT booth on January 12th. A nice morning here in the Phoenix area, the hamfest was like many I attend – starts early, ends around midday, with demonstrations on satellite passes throughout the morning. The demonstrations had nice crowds, especially the AO-91 and AO-92 passes that can easily be heard on HTs with standard duckie antennas. More Hamfests are coming up, over the next few months, before the hot summertime arrives here.

"On February 2nd I made a day-trip out to the rare grid DM31 in southern Arizona, near the USA/Mexico border. I had not been to DM31 in almost a year and I don't think anyone else had put DM31 on the satellites in that time. Operators who had started working satellites in the past year were hoping to work DM31 and I looked forward to a day of radio time from the Organ Pipe Cactus National Monument.

"After leaving home early that morning, it was a two and a half hour drive to reach DM31. I arrived a few minutes before an SO-50 pass that covered most of the continental USA, and made a few QSOs to start the day. The AO-91 and AO-92 passes were the busiest, logging 10 to 12 QSOs on each pass. It was nice to hear stations in Central America on those passes and to get DM31 into their logs. I worked more than FM from DM31. There were many passes on SSB satellites, along with packet from FalconSat-3 and the newly-reactivated ISS digipeater. Being in a national monument, I had a few visits by park rangers – initially checking to see if I was OK, then some questions about my radio equipment, and later just for a chat. These park rangers are essentially the police officers for the national monument, an area covering over 500 square miles next to the USA/Mexico border.

"At sunset, I packed up for the drive home. I had worked 27 passes from DM31, logging at least one QSO on 23 of those passes. I logged a total of 103 QSOs with stations across the continental USA, Canada, Mexico, Costa Rica, El Salvador and Panama and through each of the four FM satellites (AO-85, AO-91, AO-92, SO-50), 11 passes on five different SSB satellites (AO-7, CAS-4A, CAS-4B, FO-29, XW-2A), and four passes through the orbiting digipeaters on FalconSat-3 and the ISS. This was, by far, the busiest I have been from DM31, over many trips going back to my first DM31 road trip in 2009. With good mid-winter weather in the Arizona desert, it was a great way to spend a Saturday".

Operating from the desert is something we don't do a lot of in the UK, here's WD9EWK operating from the Organ Pipe Cactus National Monument in Arizona.

At G4VXE it was good to work G7HCE (IO80) using the ISS digipeater. As Patrick WD9EWK mentioned, the digipeater is much harder to get into than before. Hopefully the problem can be found and corrected but in the meantime, it's good to hear the digipeater beaconing again.

That's it for this month. Thanks for all your news. And if you have been thinking of getting in touch, please do! See you next month.

E-mail: HARRYG3LLL@gmail.com

Hints & Hazards

Harry Leeming G3LLL is back with his usual diet of sage advice and intriguing anecdotes.

"While you are up there, perhaps you could stop playing with your aerial for a few minutes and check that the gutters are clear"; sound familiar?

A few years ago I had the ladders up to adjust my antenna system, when I noticed that the trough was half-full of debris and bird droppings so I grabbed a trowel, dug out the mess and thought no more of it, until a finger started to swell and was turning red. I went to see my doctor, who put me on a course of antibiotics and advised me if this did not do the trick, to go promptly to A&E. Fortunately it did.

I happened to mention this to a builder, who seemed to be going to a lot of trouble cleaning everything with bleach. After doing some work for me, he told me that I had been very lucky. Apparently, bird droppings, particularly those from pigeons, carry some nasty bugs and he had a friend who ended up seriously ill in hospital after coming into contact with them. I took this as a warning and now always were rubber gloves if I handle an antenna or anything else that birds may have contaminated.

Protect Your Signal Generator.

Last time I mentioned that it is possible to get hold of some old but very useful signal generators at rallies. One thing I forgot to mention, however, is how easily these can be damaged when testing transceivers. We all get distracted and in a moment of carelessness, can accidently key a microphone or flick the wrong switch, transmit with the generator connected, and burn the attenuator out. To protect myself from this, I made an in-line fuse unit, which I had permanently in circuit.

I constructed this from a scrap CB SWR meter similar to that shown in **Fig. 1** and modified it by cutting a small gap in the PCB strip that ran between the input and output PL259 sockets. I then bridged the gap with a low voltage, low current lamp and connected this permanently to the signal generator. The loss was about 4dB and I allowed for this when making measurements.

Soldering Sensitive Parts

When building our G3LLL RF clippers and FM units for the early FT-101s in the 1970s, a few were found to be faulty when tested due to the failure of the dual-gate FET. The cost of replacements was very low because I was buying these devices by the hundred, but it was annoying and time consuming replacing them.

There has always been great emphasis on the risk of damaging new transistors and FETs with static but I learned that this was not the only danger, and over the years found that there are other ways of doing damage. As a result, I now recommend, and try to follow, these rules:

1. Make sure that the equipment you are working on, and any test equipment you have attached to it, is not plugged into the mains. Even when equipment is switched off, there can be enough leakage by the internal capacity of a mains transformer, or via mains suppressor capacitors, to wreck delicate devices.

2. Be sure that your soldering iron is at the same potential as the equipment you are working on by either earthing them both or linking them together.

3. Disconnect any antennas.

4. Avoid Nylon carpets or if you can't avoid them, get a scent spray filled with water and slightly dampen the area around where you stand.

5.Grip the leads with long-nose pliers to act as a heat sink when soldering. This is more easily done if you wrap a rubber band around the handles of the pliers. (Note also that a pair of pliers plus a rubber band makes a very useful 'third hand' when struggling to hold something.)

Finally, if you have to fit a small expensive FET that is difficult to obtain, or for some reason you cannot comply with the above, play it safe. Take a small piece of cotton wool, soak it in water and jamb it between the device's leads before attempting to solder it in place. This will short out any stray voltages and also act as a heatsink. Be sure to remove the cotton wool and dry the area around the device with a hair dryer before switching on the equipment after repair!

And Talking about Hair Dryers

Hair dryers can be a most useful tool in a workshop. Apart from using them to remove moisture, they are invaluable when you need to warm up, or cool down equipment quickly to try to chase elusive temperature sensitive intermittent faults

TVs, Hi-Fi and Street Lights

A few months ago I was commenting on how the AC/DC TVs were rather dicey from a safety point of view. They created other problems too.

In the 1960s I was running the hi-fi department of the family business and had quite a few complaints that some hi-fi equipment had mains transformers that emitted a mechanical hum. They were perfectly fine when we tried them in the shop. It only later came to light that the hum occurred in the evenings and got worse if there was a popular programme on the TV. Many of our customers lived in terraced houses and it was common for a whole row to be connected to the same phase of the mains.

With half-wave rectification and correctly wired AC/DC TVs, this ensured that they were all taking a 'gulp' of current on the same half of the mains cycle. This resulted in the positive half of the cycle becoming slightly less than the negative one. Presumably this distortion of the mains supply produced many harmonics of 50Hz and it was these that the mains transformers objected to.

The 'work around' was to mount the mains transformers on rubber grommets, and to advise the customers not to mount their equipment on anything that could act as a sounding board.

Another problem caused by TVs was that in some areas the streetlights would mysteriously be switched on or off at odd times. Eventually someone twigged that this tended to occur either at the beginning or the end of a popular TV programme and put two and two together. In these areas the street lights were controlled by sending DC pulses along the mains supply, and somehow switching on or off of hundreds of TVs at the same time duplicated the pulses. The control system had to be redesigned and made 'TVI proof'.

Modern Electronic Devices

Are you ever embarrassed to find that your grandchildren know more about the latest electronic devices than you do? There is nothing new about that and a customer, a retired police officer, told me about his embarrassing moment.

He was a young trainee constable in the 1960s and because he always had plenty to say, he was told to read up on personal and home security and visit a local school in a rough area, where he had been 'volunteered' to give the kids a lecture. Soon he found himself stood in front of a class of young lads and had just made the point that even a dummy alarm box was quite a good deterrent, when Jimmy, a 13-year old, stuck his hand up. *"They're no use"*, he said, *"Anyone can tell that there is no bell in the box"*. When asked how, he volunteered, *"you just fire a catapult at them, and if it doesn't 'ding', it's a dummy"*.

My customer said that he was left wondering whether it was Jimmy who should have been invited to give a lecture on security, to the local police.

Another Odd Customer

As you might expect, over the years I had quite a collection of oddball customers in the shop, some of them not very bright. If you wanted to find out how to stop youngsters letting off fireworks, would you expect a warm welcome in a shop that made their living by selling them? No?

A rather rough looking guy called in and demanded to know, *"How can I get a radio ham closed down; he is interfering with my TV?"* I explained the position with regard to the Amateur Radio Licence, and Ofcom, and suggested that co-operation with the amateur, and trying out of various filters, was the best course.

He certainly had no intention of wasting his money on ferrite rings or filters. He wanted to take more aggressive action, call in Ofcom and simply have the radio amateur closed down, but then he had second thoughts. As he was leaving the shop he volunteered, *"Actually I haven't got a TV licence, will that make any difference?"* No prizes for answers to that one – I doubt if the editor would dare print them!

Come to think of it; surely if I assist someone to obtain good TV reception knowing, or having good reason to believe that they have not got a TV licence, then possibly I have committed an offence? If you have problems and are willing to show someone your transmitting licence, surely you can expect them show you their TV licence?

Fig. 1: A CB SWR meter similar to that used by Harry to construct an in-line fuse unit.

Shocks from Amateur Radio Equipment

Several customers came to me complaining that when they held the rig with one hand and plugged the PL259 plug feeding an earthed antenna system with the other, they got quite a shock. Now holding two separate conductors tightly at the same time is not a particularly clever idea because if something really is live, you are all set up to get a very nasty shock across your chest and heart (or even be condemned as beyond local repair and returned to your maker). Remember the golden rule when dealing with mains operated equipment: Never tightly grip two exposed conducting objects that have the slightest chance of being earthed or live, at the same time.

Actually, in those cases where equipment was brought to me for testing, I never found an actual fault, only that sometimes the equipment in question did not comply with current UK safety regulations. If equipment doesn't have the double insulation symbol on it, when used in the UK, it should be fitted with a three-core mains lead and be earthed at the mains plug.

There is also a UK requirement that any filter capacitors connected between the mains and chassis should not be larger than 0.005µF and should be of a super safe type intended for use in such a position.

I'm not sure when the regulations were instituted but in the 1960s and 70s a lot of non-compliant equipment was around. Many amateur radio transmitters and receivers had normal type 0.01µF mains filter capacitors from the mains to chassis, had only single insulation, and were fitted with a two-core mains lead. If the chassis was not earthed, and filter capacitors were fitted as per **Fig. 2**, then the chassis was held at half the mains potential, 120V, above ground, hence the shock. When I became aware of the situation, to cover myself against being sued for selling dangerous equipment, I started fitting three-core mains leads to any such equipment that I sold.

So, what is happening when someone says, *"But my rig (or hi-fi equipment) is properly earthed and I still get a shock when I plug the antenna in"*. In these circumstances check if there is an AC voltage on your antenna. Do this by connecting one lead of a test meter to earth and the other to the antenna lead. This fault is not as common now but I had this complaint from my hi-fi customers quite a number of times in the 1970s and it usually arose because of faulty TV sets.

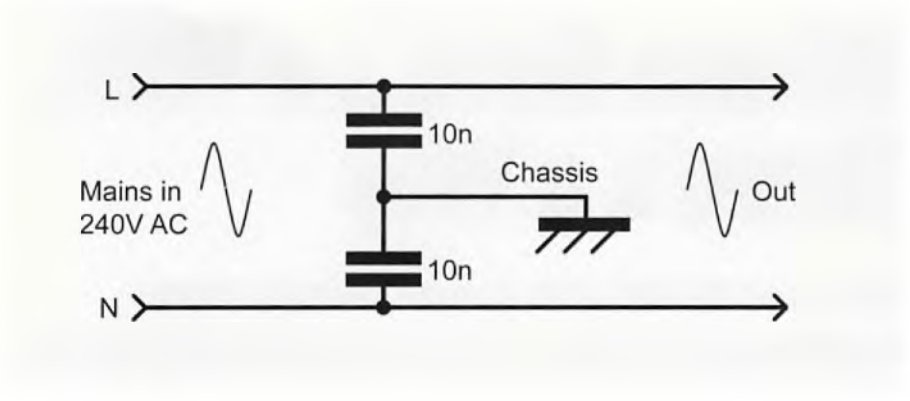


Fig. 2: A potentially hazardous mains circuit (see text).

If your antenna is on the same chimney stack as your neighbour's TV, the lashing wires can touch and then if their TV, or any other equipment they are using, becomes live, so will your antenna lead.

You Can Have Too Many Earths

If to comply with safety regulations your rig is fitted with a three-pin mains plug, and you have an antenna system that is well earthed, you could run into trouble.

Quite a lot of house wiring is earthed via the incoming cable from the electricity substation, which might be some distance away. If you have made a valiant attempt to connect a really good buried earth to your antenna, the resistance to earth via your house wiring and your buried earth could be less than that via the substation. In this case a serious short to earth in a nearby house, or on the utility company's cable, could send a large current to ground via your house wiring. Less serious is the fact that by having two earth paths you have formed an earth loop, which as any hi-fi enthusiast will tell you, can be the cause of various kinds of mysterious hum or feedback.

You could, of course, get over these difficulties by removing your rig's earth connection from the third pin of the plug but this then would mean that you were not complying with wiring regulations, and other safety problems raise their head too.

The simplest solution is to leave the equipment earthed to the mains by the three-pin plug but wire a 0.01µF disc ceramic capacitor in series with the lead from your ATU or your rig to your buried earth rod system, and then fit a couple of ferrite rings on the mains lead of your rig. This will ensure that your equipment is earthed from a safety point of view to the mains, yet radio-wise it is isolated from the mains earth and gets its ground via your antenna's earthing system. *"Better to be safe than sorry"*.

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Where there's a Ham, There's a Way

John Sones M0AAO looks at some examples of how Australian radio amateurs served their country during WW1, WW2 and in peacetime.

I grew up with Jennifer who later emigrated to Australia, obtaining the callsigns VK5ANW and VK3WQ and becoming a historian for the Australian Ladies Amateur Radio Association (ALARA). Her partner **Peter VK3RV** is also a historian for the Wireless Institute of Australia (WIA). We have kept in touch over the years and recently they sent me the book *Wireless – Men and Women at War*, **Fig. 1**, size A4 with180 pages, published in 2017 by the WIA. Peter played a large part in putting the book together and has also written some of the articles.

It contains a series of 42 pieces by 19 authors, including Jennifer, about Australian radio amateurs who played a part in various wars, in particular WW1 and WW2, by using their special skills in such a way as to make a difference. Wartime radio was often driven by the circumstances that service personnel found themselves in, which I am sure will interest those who are involved with vintage equipment. In this article I can only touch briefly on the detail in the book and hope that by giving a few examples of the equipment used, mentioning some of the ground-breaking achievements by Australian amateurs over the years along with examples of what their service personnel went through, I can give *PW* readers a feel of what the book is about.

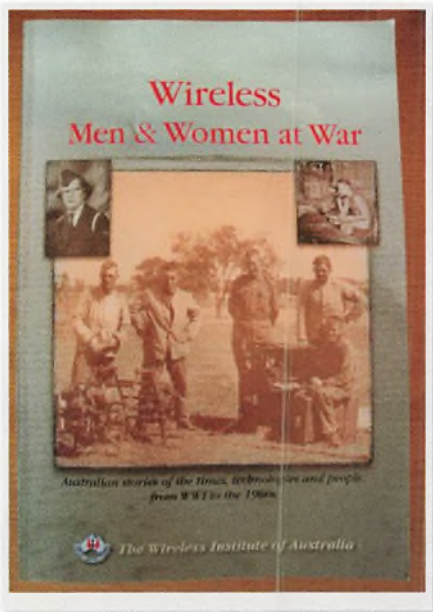

Fig. 1: Front cover of book showing the Marconi Pack set in the field (cover photo copyright WIA).

First World War

During WW1, Royal Australian Navy (RAN) ships were equipped with Marconi equipment that would have been receivable over considerable distances, which made them more vulnerable to being found by the enemy. **Walter King Witt** , callsign XKW, had enlisted in the RAN and was a CTW Operator. On January 15th 1915 his service record shows *'Naval Board expresses appreciation for services rendered in connection with 1st Australian convoy'*. He had used his *'little Ford spark coil'* to transmit between the leading and last ships, a distance of about ten miles, *'in preference to the more powerful spark provided by the Marconi Company, which had a note something like a boy with a stick on a picket fence.'*

When you see what the modern army uses today, it's hard to imagine radio equipment that might require several horses to transport it and still had to be assembled by several men in eight minutes! These were 500W so-called 'Pack Sets', **Fig. 2**. The rotary spark transmitters had a range of 35 miles in daylight and the receivers used a battery-biased carborundum crystal detector, all operating on a wavelength of about 700m. There was also a 1.5kW 'Wagon Set', which usually operated as a base station and used two limbered horse-drawn wagons to move around. Each type came with fuel supplies, earth mats and collapsible masts, 30ft for the 'Pack Set' and 70ft for the 'Wagon Set'.

This type of equipment saw service in 1916 with the squadron of the Australian Imperial Force (AIF) who became known as the 'The Anzac Wireless' in the harsh conditions of Mesopotamia.

Wireless in the air was also in its infancy and Morse code was essential for communication by pilots. In particular they were taught how to report the fall of shot from the artillery and the location of suitable targets. Communication by radio was one way, **Fig. 3**, from the pilot to the station on the ground. Ground to air was by ground strips of white sheet, lamp signals or Poppet Panels – a canvas shutter arrangement that showed either black or white patches to the pilot. **Bert Billings**, callsign XJP, is possibly the first and last ANZAC (Australian and New Zealand Army Corp) Wireless Operator having served in many places in both World Wars. Having been interested in experimental wireless telegraphy from 1912, he was the first operator to communicate from the Gallipoli Peninsular with British warships, went on to transfer to the Australian Flying Corps servicing the earliest aircraft transmitters and with other instructors devised a special pilot training course whereby the pilot had to feed out the antenna, plug in the 6V transmitter and commence sending via a half-inch spark and tuning coils precisely in that order because otherwise they believed that there was a risk of setting the aircraft on fire!

Between the Wars

Between the two World Wars, the Royal Australian Air Force (RAAF) was experimenting with shortwave transmissions. In 1924, **Gilbert Thomas Miles**, then 3II and later VK2KI, while serving in the RAAF worked on a transmitter which was to be the first in the service. Using a Marconi 'football' type valve as a keyed 100W input oscillator with 1200V on the anode, two edge-wound helix coils screwed to the wall and coupled to a vertical copper tube antenna, they made contact with the Royal Air Force in England on 32m using the callsign V1S (Victoria One Squadron). He went on to be involved in a series of survey and army co-operation flights from Point Cook in the mid-1920s. One such flight involved a quenched spark-gap transmitter on 1500m and a receiver with three valves powered by a wind driven generator mounted on the outside of the fuselage.

The RAAF went on to recognise the importance of wireless communications, establishing a 'Wireless Reserve' in 1929 initiated by **Flight Lieutenant H K Love A3BM/VK3KU**. This was restructured in 1933 in part organised by **Bob Cunningham VK3ML** and **Vaughan Marshall VK3UK**. There was a later reorganisation into districts and sections, many of which were headed by radio amateurs. Interestingly, the RAF didn't start a similar reserve until 1936. By 1939 there were 155 amateur members of the Australian reserve who were all called up for WW2.

The Australian Army were also seeking to improve their radio communications and their first shortwave station was built by servicemen, including radio amateurs. In 1930, a small group met at the 3rd Divisional Signals in Melbourne to design a shortwave wireless set, **Fig. 4**. The design was sent for official approval, which after modification was given the go-ahead providing it was mobile and as far as possible constructed using army apparatus. It was built by a group of army personnel, including **Lieutenant Stewart Embling VK3DC**. Full technical details are in the book.

A need had been identified to link the various states of the Commonwealth (of Australia) and the extraordinary developments that there had been in shortwave wireless communication were seen to offer a possible solution.

The way that women were treated with regard to war service was very different in Australia to the UK. Despite the formation of the Australian Women's Service Corps during WW1, the only roles that they were allowed to carry out were those of Army Nursing or Wardsmaids. At the start of WW2 things were not much better with the question of admitting women to the Services still being ignored until October 1941. One of the lady amateurs who made a difference was **Florence Violet McKenzie OBE A2GA/VK2FV/VK2GA**. Having realised that war was imminent, she set up a free Morse code training school for her pupils who were mainly women and the school became known as the Women's Emergency Signalling Corps. The WRANS (Women's Royal Australian Naval Service) started with 14 of her trainees at the Harman Wireless Station. This grew to a wartime peak of 105 officers and 2,518 ratings. Florence trained the trainers. Over the years, personally and via her lady trainers, she was attributed as teaching some 12,000 servicemen Morse code.

Fig. 2: Marconi Pack set (copyright Jim Gordon VK3ZKK), Australian Army Signals Museum Macleod, Victoria.

Second World War

During WW2 there were examples of how 'cobbled together' radios made a huge difference and, in some cases, saved lives. **'Snow' Campbell VK3MR** was a Prisoner of War (PoW) in Italy and describes the harsh conditions that they lived in with shaved hair and only shorts being the general state of dress. He was later moved to Germany where they managed to find odd radio bits and to construct a receiver from various materials, for example making the condenser from aluminium plates from their food dishes using nail files and scissors and the insulators from toothbrush handles, all of course being done secretly. This enabled them to hear the London and European stations. The antenna was the hardest thing to hide and they sometimes laid false trails for their German guards, much to the latter's annoyance.

'Winnie the war winner', **Fig. 5**, is one of the important iconic items from Australia's involvement in WW2. This relates to a 'lost' group of Australian commandos on the island of Timor in 1942 in an area controlled by the Japanese. On April 19th, the message *"Force intact. Still fighting. Badly need boots, money, quinine (for malaria), tommy-gun ammunition"* was sent by the crazy contraption built after three attempts from salvaged parts with inadequate tools by a group led by **Signaller Max Loveless VK7ML**. After a verification procedure because it was believed that all their force had surrendered, RAAF bombers dropped supplies and this was followed by supplies from the RAN, enabling them to continue their guerrilla action.

Contact with the outside world was also important to PoWs. **Bill Moore VK2HZ** was detained in the PoW camp at Batavia. He had made a receiver from 'salvaged' parts and being the camp's optician, was allowed certain tools, which made construction easier. His first receiver had a radio frequency amplifier, a detector and an audio amplifier, all operating from torch batteries. During the day everything was hidden but came out at night to monitor 49m for news broadcasts from the Australian Broadcasting Commission and the BBC, which gave those interned hope. He had at least one close shave, however, having to bow to the Japanese Camp Commandant with a set under his arm!

Fig. 3: Aircraft Spark Gap transmitter (copyright as Fig. 2).

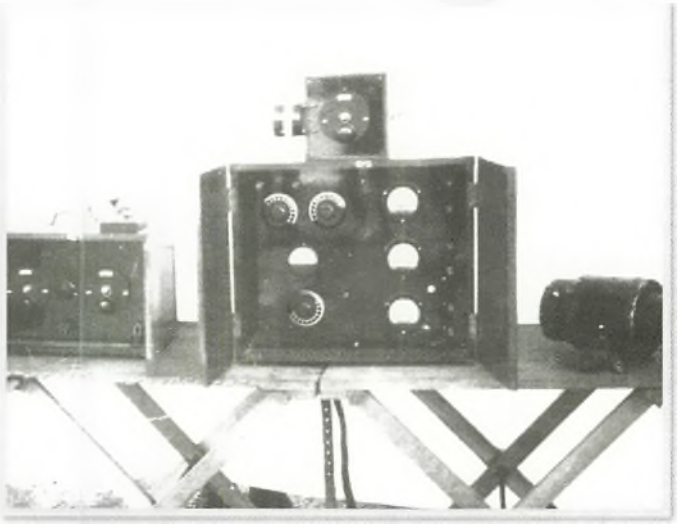

Fig. 4: First Army shortwave transceiver (copyright as Fig. 2).

George Basil Lance VK3DS recalls Air Warning and Coast Watching in New Guinea. Equipment and buildings were subject to very adverse conditions with the control room, which was a native hut, having a life expectancy of six weeks before the white ants caused too much damage and it had to be burned to the ground and a new one built. Tropic proofing was by using sealed power transformers and burning two 100W light globes inside the transmitters to keep them constantly warm and dry. The biggest blowouts were caused by large praying mantis insects crawling on the caps of the 866 rectifiers.

Radio systems were also being developed to help protect essential services. **John Bulling VK5KX** was an electrical engineer with the Adelaide Electric Supply Company (AESC) before being called up and was tasked to develop two-way communications to AESC mobile vehicles because there was a concern that the power distribution system might get attacked. The base station transmitter on 31.1MHz used a pair of 805 valves for the RF power amplifier and a second pair for modulators with an output of 200W fed to a dipole on the roof of a building. The mobile transmitter had a three-stage unit with a crystal oscillator, multiplier and an 807 final amplifier. The receivers were super-regenerative, giving a typical background hiss, but worked well.

Phil Williams VK5NN was also an AESC employee, later joining the RAAF to work on developing a radar screen around Australia and New Guinea. This included a transportable Light Weight Air Warning Radar system, later supplied to the RAAF, the British in Burma and the Americans in the Pacific where it gave consistent and reliable warning ranges of 80 to 100 miles (and more). To make it easy to deploy, the equipment and operator were housed in a tent, using a rotating platform turned by hand.

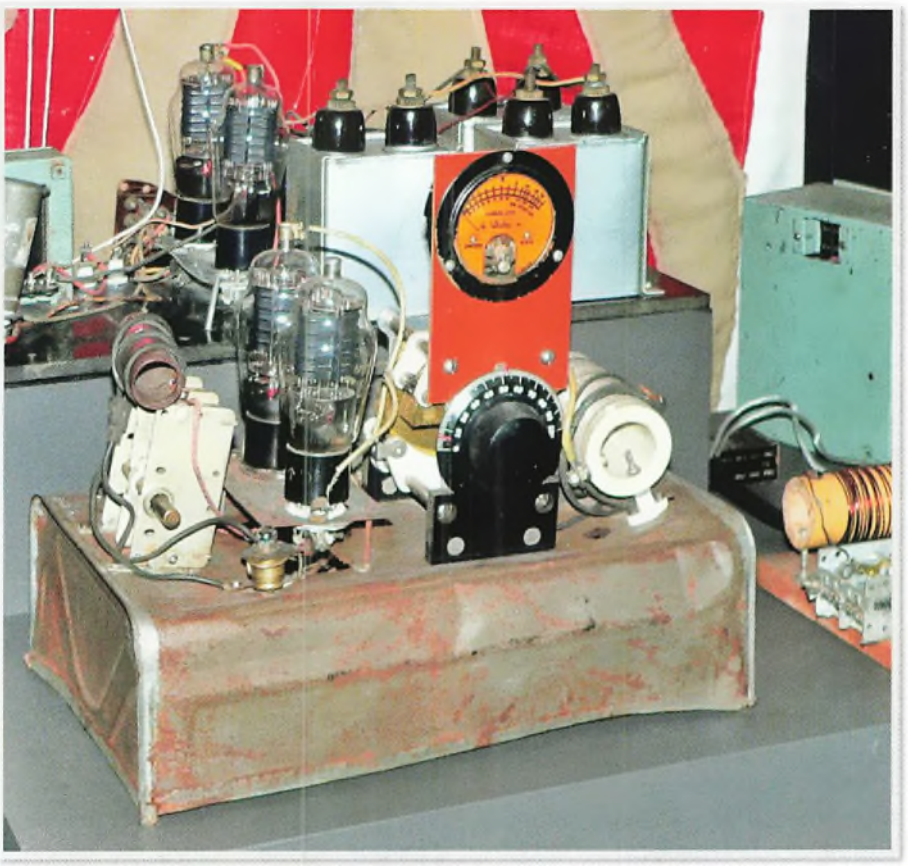

Fig. 5: Winnie the War Winner (copyright Bill Roper VK3BR).

The last section of the book is about the ANZACs and the special amateur radio remembrance in 2015 of their fated Gallipoli landings 100 years previously.

While I have given examples of the some of the technical descriptions in the book, it also includes a lot of detail about the personal lives of those featured. It gives a feel from an Australian perspective for what many endured to keep us free so has a very important historical aspect as well and will, I am sure, also interest readers outside Australia.

(All photos in this article are taken from the Wireless Institute of Australia publication *Wireless Men and Women at War*, who retain copyright as shown but have kindly given permission for the photos to be reproduced here.)

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Digital Voice Technologies

Don G3XTT guides readers through the alphabet soup that is the current state of digital voice on the VHF/UHF bands.

Elsewhere in this issue you'll find Tim Kirby G4VXE's review of another digital voice hotspot. He refers to DMR, D-STAR, C4FM, NXDN and P25 as modes that it will handle. But have you ever stopped to wonder what the differences are between the various digital voice modes, why they don't intercommunicate, and what, if any, the advantages are of one versus another?

Why Digital?

Perhaps one of the first questions to address is why we want to send voice digitally at all. After all, AM, SSB and FM seem to have worked pretty well for most of the history of amateur radio. They can be generated relatively easily and be received on most radios, while on VHF and UHF (and even on the 10m HF band) we have a well-established network of FM repeaters.

We are also probably well aware that the broadcast world are having trouble persuading us that digital is the way to go for radio (although digital TV is now well established). It's partly because a number of 'standards' are competing (DAB is primarily a UK-led standard, while Radio Mondiale, used on HF, has its limitations). And a digital receiver is an extra expense if you already have a house full of transistor radios from years gone by (and ditto in your car), while for fixed use you probably just want to plug into the internet.

For radio amateurs, the main attraction of digital, so far as I can see, is that it allows straightforward networking, enabling calls to be set up across the globe, using the existing internet as the backbone. The necessary routing information can be embedded into the digital bitstream alongside voice and there is scope for coding and carrying other sorts of traffic too, such as APRS, images or other types of data. Another attraction might be that, using hotspot technology, a station can be established anywhere you have an internet connection, ideal if your location is one where it is impossible or challenging to erect HF or VHF antennas.

Fig. 1: The Kenwood TH-74E, one of the first non-Icom radios to include D-STAR capability.

How is it Done?

Most of you will realise, particularly if you are regular readers of this magazine, that the underlying principles of digital transmission of voice are easy to understand. The analogue voice waveform is sampled in an analogue-to-digital converter (ADC) and the digital bitstream can then be modulated onto an RF carrier. But there's the rub. There are many ways in which the sampling can be done and there are a number of ways that the data can then be applied to the carrier. Which means that there are potentially hundreds, if not thousands, of combinations that could be used to make it happen. The choice depends on many factors such as the quality of voice transmission required, the type of propagation that is likely to be encountered during the radio part of the connection and so on. It also matters whether the system is only intended to carry speech or whether data transmission is also a requirement. Speech can afford transmission errors and still be perfectly readable whereas data transmission must be more robust because while the human ear can cope with occasional transmission errors, computers tend to be less sympathetic!

Communications theory tells us that an audio waveform has to be sampled at, as a minimum, twice the highest frequency likely to be encountered. If we want to send speech of up to 3kHz, say, then we need to sample at 6,000 samples/second or better. The samples will then have to be encoded and the number of bits we use to encode each one will depend on how accurately we want to reproduce the speech at the other end. All this means that transmitting high-fidelity classical music, for example, will require a very high bit rate. Fortunately, communication quality speech is much less demanding. What's more, there is quite a lot of 'redundancy' in speech so a number of methods have been developed to make the whole process more efficient.

Genesis of Systems

It's important to be aware that some of the systems being used in the amateur radio world had their origins in the commercial world while some were developed specifically for the amateur market. Why does this matter? D-STAR is essentially an Icom initiative although the standard is open to others to use (as Kenwood have done in, for example, the TH-D74 handheld, **Fig. 1**). Yaesu have chosen to go their own way

with System Fusion, which Tim G4VXE has been covering in recent months. What both have in common is that the radios manufactured for these systems generally offer FM capability too and, indeed, the System Fusion repeaters are also capable of FM as well as Fusion operation. These two systems have also been developed with amateur radio callsigns and requirements (such as APRS) in mind.

In contrast, P25 (an older technology used by Motorola and other commercial manufacturers, **Fig. 2**), NXDN (another commercial system, albeit in limited use in the amateur radio world, **Fig. 3**) and DMR (increasingly used in amateur radio) were all developed for commercial use and transceivers employing them reflected this. For example, there would normally be no straightforward way for the user to change frequency (unless required for day to day use). A group of radios would normally be programmed to a specific channel (or channels) for company use and the last thing the company wants is for employees to start changing the programming! Similarly, the radios were purely DMR and even this comes in more than one guise, not so much in the actual encoding of the speech but in the way they network. Motorola's name for DMR is MOTOTRBO while, for example, Hytera refers to it as Hytera DMA. Each company has its own take on the implementation of the 'standard'. The following link gives more information, including an explanation of Tier 1, Tier 2 (as used in the amateur radio world) and Tier 3 DMR architectures. https://tinyurl.com/yxzpqv6n

Fig. 2: An Icom P25 commercial set.

Consequences

The consequence is that DMR radios that come to the amateur market second-hand from the commercial world, while usually competitively priced, are likely to require specialist programming tools and lack the flexibility of transceivers made specially for the amateur radio market. Thus, for example, it might make sense for a club with the necessary expertise to bulk buy ex-commercial DMR sets and program for the local DMR repeater for members' use. But those sets won't help a member who travels the country and wants to use it elsewhere. The good news, though, is that some amateur radio manufacturers are now offering DMR sets at attractive prices – we have reviewed some of them here in *PW* – and those are generally more geared to amateur radio requirements. So it's not clear cut – we are starting to see some DMR transceivers that can be programmed from the keypad without needing a computer and many include FM capability too (The Anytone AT-D868UV, **Fig. 4**, reviewed in last October's issue, is a good example of both aspects).

What it all means is that your choice of which option to take, should you decide that digital voice is for you, will depend on several factors. An obvious consideration is which system is in use in your locality, particularly if you belong to a club that has made a choice and/or if there is a digital repeater accessible close by. Another factor is whether you want to be able to travel with your digital radio and easily reprogram it for the repeater(s) you run across along the way. A third might be the specific use(s) that you want to put the radio to, such as APRS beaconing. A fourth will be your wishes for international networking.

Having said all that, and having explained that the various encoding methods are mutually incompatible, if you read *PW* regularly you will have come across reviews of hotspots. As I said right at the start, we review one in this very issue. Most of these will accept any of the digital standards and allow you to connect to the relevant global network, so that, for example, you can use your DMR or D-STAR handheld to chat with a DMR or D-STAR user in the USA or Australia. I gather from one of the leading UK vendors that there is quite a community of 'hotspotters' nowadays, including Foundation licensees, who simply use their amateur radio licence as a way of linking across the living room to a hotspot but enjoying global communication, nevertheless. Personally, while I understand the fun of this, I'd love to see those folk move on to other aspects of the hobby – hopefully many do so in the fullness of time. But there's no denying the magic, even in this day and age, of enjoying global communication with fellow enthusiasts in a simple and, effectively, cost-free way.

Technologies

Anyway, given that I am running this article under the *Technical for the Terrified* banner, let's end with a few of the technical bits. Traditional amplitude modulation is based, as you will all know, on varying the amplitude of an RF carrier in time with the audio (voice) signal. This process results in (and the maths shows this too) a carrier and two sidebands, both carrying identical information. For example, a 1kHz tone applied to a 1MHz carrier will result in carrier plus two new signals, one 1kHz above the carrier in frequency and one that is 1kHz below. SSB, then, is simply this but with the carrier and one of those sidebands removed, given that the carrier bears no information content and both sidebands have identical information. In contrast, FM involves changing not the amplitude but the frequency of the RF carrier in synch with the modulating audio. This offers a number of advantages over AM or SSB, particularly for high quality broadcasting, because the carrier can be allowed to swing a long way either side of its nominal frequency, allowing more accurate reproduction of, say, music with its large dynamic range and covering several octaves. In amateur radio practice, FM channel spacing started at 25kHz (as used back then in the commercial world) and

Fig. 3: A Kenwood ad for NXDN transceivers.

has now settled on 12.5kHz, given better and more stable equipment.

A third method is phase modulation, where neither the amplitude nor the frequency is shifted in synch with the modulation, but rather the phase of the carrier. This is not used for voice transmission but you will often find it as the modulation method of choice for data transmissions – QPSK (Quadrature Phase Shift Keying) and PSK (as in, say, PSK31 and PSK63) being terms that you will have seen, even if you haven't operated those modes.

Table 1 summarises the key aspects of the various systems I have discussed. I have taken it from an article in the April 2015 issue of *QST*. While digital voice has moved on in some ways since then, the underlying technologies of each system are the same. The codec (Coder/Decoder) is the method for turning the digital stream from the ADC into the particular coding system in use (and doing the opposite for received data). I won't go into detail here but AMBE stands for Advanced Multiband Excitation while IMBE is Improved Multiband Excitation. You can find out more from Wikipedia and other sources where you will learn, for example, that AMBE was developed for use by the Inmarsat (maritime satellite) and Iridium commercial satellite systems. Its use requires a licence from Digital Voice Systems Inc, so there has been criticism in some amateur radio circles that D-STAR isn't actually as 'open' as the manufacturers would like us to believe.

The data stream from the Codec then needs to be applied to the RF carrier. 4-FSK means, as you might guess, that the method employed is 4-tone frequency-shift keying, while 2-GMSK is a two-tone Gaussian minimum shift keying, a variation that is claimed to occupy less bandwidth.

The Sharing column refers to the way in which the common bandwidth is shared. FDMA (Frequency Division Multiple Access) indicates that different transmitters operate on different frequencies (yes, a fancy name for what happens on most of our bands!) while TDMA (Time Division Multiple Access) has different transmitters sharing a carrier frequency but interleaving their transmissions which, as you'll understand, requires accurate timing but does, for example, allow DMR repeaters to carry two voice channels on the same frequency (you'll hear this referred to as Timeslot 1 and Timeslot 2).

The last column, headed Access, is the digital voice equivalent of CTCSS or DCS tones that you'll be familiar with in the analogue world of FM repeaters. As I explained earlier, D-STAR and Fusion use amateur radio callsigns as the basis, for obvious reasons, but the other systems, having originated outside the world of amateur radio, use a variety of other identification and routing protocols.

Type	Codec	Modulation	Sharing	Access
D-STAR	AMBE	2-GMSK	FDMA	Callsigns
DMR	AMBE+2	4-FSK	TDMA	Colour codes
System Fusion	AMBE+2	4-FSK	FDMA	Callsigns
NXDN	AMBE+2	4-FSK	FDMA	6-bit RAN
P25 Phase 1	IMBE	4-FSK	FDMA	12-bit NAC
P25 Phase 2	AMBE+2	4-FSK	TDMA	12-bit NAC

Table 1: Digital Voice Systems Compared

Fig. 4: The Anytone AT-D-868UV has both DMR and FM capability.

The Bottom Line

I hopethis overview helps you to understand the key differences between the various digital voice systems. Each system, as you'll have seen, has its pros and cons so you have some thinking to do before taking the plunge. Unfortunately, the sheer variety of systems has also diluted VHF/UHF activity in that, while there may still be as many amateurs using VHF and UHF repeaters and simplex as before, they can't now all intercommunicate. In fairness, other factors are at play too, such as the large-scale migration to FT8 operation at VHF. How it will all pan out remains to be seen. Will one system come to predominate (as VHS did over Betamax for those of you old enough to remember) or will they simply continue to coexist on our bands? This latter may well be the case because we are starting to see the emergence of multi-protocol reflectors, enabling someone with, say, a D-STAR radio to connect and speak to someone using a Fusion radio connected to the same reflector. In other words, although the protocols are different, the huge processing power of modern PCs means that protocol conversion can be cost-effective and may serve to bring those disparate groups together after all. Watch this space!

• E-mail: practicalwireless@warnersgroup.co.uk

HEMA

Colin Redwood G6MXL looks at a relatively new award scheme covering hilltops that don't quite qualify as summits for Summits on the Air. He concludes with a request to readers who use Facebook.

There's no doubt that amateur radio can be a pretty sedentary hobby, although it doesn't have to be. This month I am introducing readers to a relatively new award scheme for operating from hilltops. As you will discover, the HEMA scheme is an alternative to Summits on the Air (SOTA) for some hilltops that don't quite qualify for SOTA, which I last discussed in the August 2015 *What Next* column. With the weather hopefully improving over the next few months, I want to encourage readers out of their cosy shacks and to get on the air from hilltops.

Jargon

You could be forgiven for thinking that the jargon and terminology associated with the operation and technology of amateur radio is more than enough for a lifetime. HEMA stands for HuMPs Excluding Marilyns Award. *"What is a HuMP and what is a Marilyn?"* I hear you ask.

SOTA in the UK confines its attention to summits that are at least 150m above the surrounding land (termed a 150m prominence). Such summits are called Marilyns, **Fig. 1**, Hill A. **HuMP**s **E**xcluding **M**arilyns **A**ward (HEMA) concerns itself with the summits that are at least 100m above surrounding land (**Hu**ndred **M**eter **P**rominence) but less than 150m above surrounding land required for SOTA, see **Fig. 1**, Hill B.

If I use a football analogy, summits that are 150m above the surrounding land might be considered the Premier league and are covered by the SOTA programme. Summits between 100m and 150m above surrounding land (prominence) might be considered in the Championship league and are covered by HEMA.

Why HEMA Is Needed

Having covered the essential difference between SOTA and HEMA, I think the next question that needs an answer is, *"Do we really need a second hilltop award scheme"?* A lot will depend on where you are located geographically. In parts of the country where there are no or very few Marilyns, then hills that fall into the HEMA category may be all that are available. If for example, you live on Jersey or Guernsey – neither of which have any Marilyns – then the fact that there are summits that meet HEMA criteria will no doubt be very welcome.

Locally to me, one of my favourite hilltops, Swyre Head in Dorset, was relegated a few years ago from SOTA when recent re-surveying revealed that it didn't, in fact, quite have the 150m prominence required to be a Marilyn. Fortunately for me, Swyre Head is well within the 100m to 150m prominence required for HEMA so I can continue to operate and claim contacts from it towards HEMA instead of SOTA.

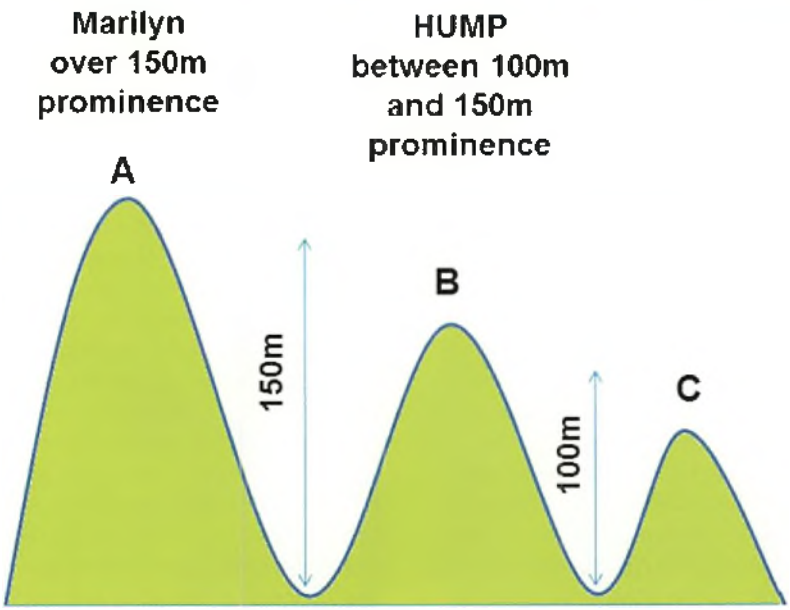


Fig. 1: The difference between a Marilyn (Hill A) that qualifies for SOTA and a HuMP (Hill B) that qualifies for HEMA.

Operating from Hilltops

If you've operated from a popular hilltop, you'll know how crowded some Marilyn summits can get, **Fig. 2**. Many HuMPs are less popular with visitors, enabling operating at, or close to, the summit with reasonable ease and without being disturbed by other visitors.

I'll come to the awards themselves shortly but I think the approach you take to operating from a hilltop will be broadly the same regardless of its prominence. You'll certainly be able to use all the same equipment and techniques to get to both categories of summits. Likewise, amateur radio equipment and operating techniques will be broadly identical.

As with SOTA, the challenges involved in getting to the activation zone of a HuMP vary from a gentle stroll from a nearby car park to a significant climb needing suitable equipment. If you are new to SOTA or HEMA, then I would suggest tackling a summit that is easily accessible. That way you'll get a feel of the radio side of activating a hilltop. As your enthusiasm grows, then you might feel more confident to tackle a more challenging summit. There's no reason why HEMA activations cannot be combined with Worked All Britain activities!

HEMA Rules

The rules for operations that count towards HEMA are very straightforward. You don't have to operate from the actual top of the hill. As long as you are no lower than 25m vertically from the summit, that's

fine. This area is known as the Activation Zone (AZ) in the rules.

You are expected to operate using portable power (such as batteries or solar panels) and arrive in the activation zone by walking or cycling. Operation must not use any form of repeater, satellite, internet link or similar.

Chasers and Activators

An activator is someone making contacts from a HEMA activation zone. A chaser is anyone who makes contacts with an activator (unless, of course, they are also operating from an HEMA activation zone at the time of the contact).

There are awards available to both activators and chasers. The full rules can be found at:
www.hema.org.uk/rulesWebsite.jsp

Book

In 2017, the RSGB published a useful book entitled *SOTA explained* written by **Jamie Davies MM0JMI, Fig. 3**. While the book's focus is on SOTA, almost all the content will be relevant to anyone who enjoys operating in the countryside and hilltops in particular. The book includes chapters on amateur radio for hill-walkers and hill-walking for radio amateurs. It is full of practical hints and tips that I am sure readers intending to operate from hilltops will find invaluable.

Clothing

While some HuMPs may be a little less exposed than Marilyns, you'll still need to think about suitable clothing to take. Even in good weather, you'll find that it is generally cooler on the top of hills. You'll be burning plenty of calories on the way up, which help to keep you warm. Once you are sat down for an hour or two on a cold and draughty summit, a warm body will quickly cool. Clothing with plenty of pockets can help with carrying some smaller items such as a microphone, leads, connectors and adaptors, batteries, Morse keys and other pocket-sized items.

Fig. 2: The author operating from the crowded summit of Snowdon (SOTA) in North Wales.

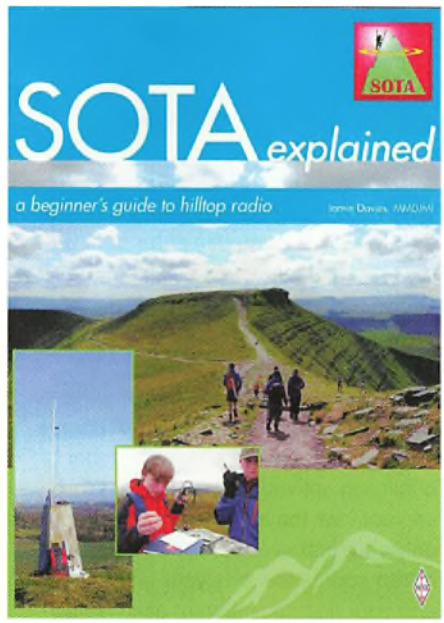


Fig. 3: The SOTA explained book, published by the RSGB.

All activity in the HEMA scheme is undertaken entirely at the activator's or chaser's own risk. You are also responsible for ensuring that you have the necessary permission to visit relevant hilltops. Note that land-access laws and regulations vary between different parts of the British Isles and are no doubt different in other DXCC entities beyond the British Isles. Yes, like SOTA, the HEMA scheme is slowly extending to other parts of the world – currently Eire, parts of mainland Spain, parts of northern France, the Netherlands and parts of Australia.

Radio Equipment

Because you'll be carrying a complete station to the activation zone near, or at, the summit, you'll need to consider its weight. To start with, a lightweight VHF/UHF handheld can be a good choice. However, these days, so few people listen on the FM calling frequencies that you might be disappointed. The award rules are clear that contacts via any form of relay are not permitted, as I mentioned earlier. However, there's no reason why you couldn't call through a local repeater and then move to a simplex channel to make a valid contact.

For the HF bands, a lightweight battery-powered transceiver such as Yaesu's FT-817, Elecraft's KX3 or a home-built QRP transceiver would all be suitable. You'll need a suitable power source to allow operation for an hour or two. For an antenna, there are plenty of choices, including various designs and supports from SOTABEAMS. I'd suggest the 40m, 30m and 20m bands would be a good choice during the sunspot minimum.

	Hilltops	Unactivated
England	269	18
Wales	208	24
Scotland	943	894
IOM	6	1
N. Ireland	49	40
Jersey	1	1
Guernsey	2	2
Rep. of Ireland	330	329

The number of HuMPs in each of the DXCC in the British Isles.

Logbook

You'll need to keep a log of your contacts. For activators, a small paper notebook is likely to be the lightest option. There is a range of 'rite in the rain' notebooks, which are ideal for use in inclement weather. Alternatively, an 'App' on a mobile phone could be used. Be careful to write down callsigns clearly because when you return home you'll need to transcribe your log to the HEMA online database.

Registering

Before you can register your activations, you'll need to register on the HEMA website. This just requires your callsign, name and e-mail address, **Fig. 4**.

Notifying Activations

Once you have activated a HEMA hilltop, you can enter details of your contacts on the HEMA database by selecting the New Activation option and the relevant DXCC, HEMA Regions and Summit. You'll

be asked for some information regarding your activation, including the date and the callsign you used, **Fig. 5**. You can then go ahead and enter the QSO details.

Notifying Chasing Contacts

When you make contacts with a station on a HEMA hilltop, you can enter details on the HEMA database by selecting the New Chase tab.

The Awards

The awards for activators in the scheme are based around the number of unique HEMAs you activate and the number of qualifying activations you make. While you can activate the same hilltop many times, only your first ever activation of each hilltop counts towards your unique total, and your first activation of each hilltop per year counts towards your qualifying activations.

For activators, there is a starter award for the first ten unique activations you make. Thereafter, there are awards for 25 unique activations, 50 unique activations and so on. For chasers, there are the equivalent awards for contacts with stations activating a hilltop, where you can claim a point per different summit per day.

In addition to the 'Unique Summit' award, there are also the 'Qualifying Points' awards available for qualifying contacts. These are for contacts made from a hilltop that you have previously operated from (so not unique). The starter Qualifying points awards can be obtained for 25 points, and then in multiples of 100 points from 100 upwards.

There is no fee for any of the awards, which are sent by e-mail so that you can print them at home. The HEMA awards manager must be able to verify that claimed contacts took place.

Conclusions

I hope I have shown that there is indeed a place for a second award scheme for hilltop operations alongside the more established SOTA scheme.

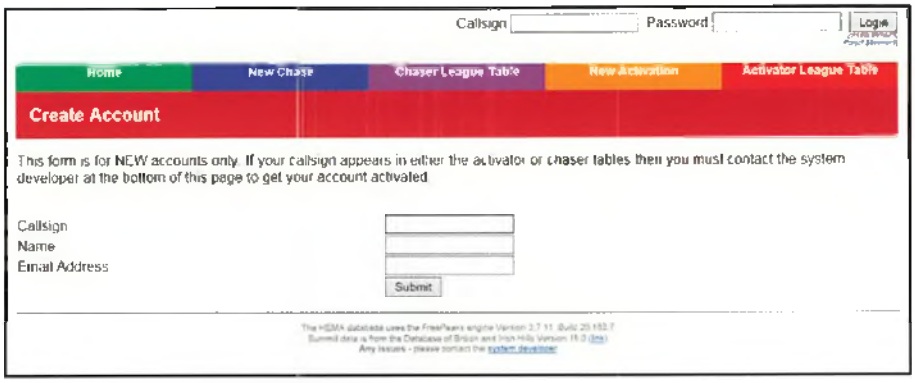


Fig. 4: Registering for HEMA is straightforward.

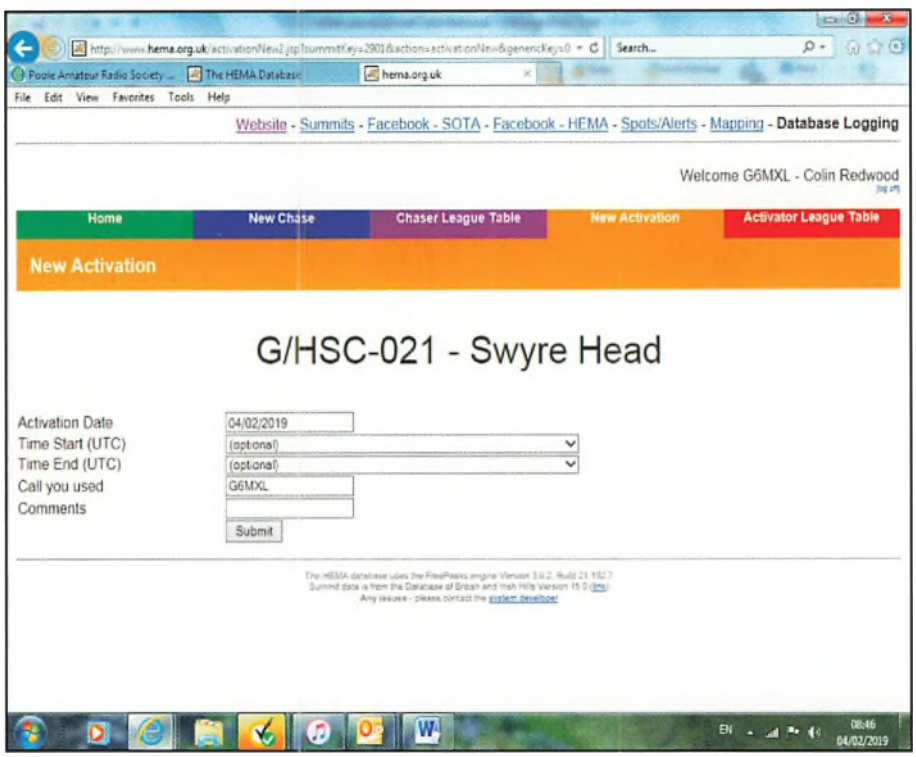


Fig. 5: Entering details of contacts made during an activation.

Facebook

Those readers who use Facebook will probably have come across various amateur radio groups. In a future *What Next* column, I am planning to look at a number of the groups. If readers have favourite amateur radio Facebook groups they would like to recommend to others, I would be pleased to receive details so that I can include a good range of them. Incidentally, HEMA has a useful Facebook group, called 'HEMA or HuMPS Amateur Radio'.

E-Mail: practicalwireless@warnersgroup.co.uk

Data Modes with Es'Hail-2

Es'Hail-2 marks a whole new opportunity for amateur radio. Mike Richards G4WNC offers advice on how to take advantage.

By the time you read this, the Es'Hail-2 geostationary amateur satellite will be fully active and in service. This is a great opportunity to experiment with something new. I've shown a summary of the Es'Hail-2 transponders in **Table 1**. The narrow band transponder is the simplest to use and employs a 2.4GHz uplink and a 10GHz downlink. To achieve a geostationary orbit, the satellite is located at 22° longitude and 22,000 miles above the equator. While its geostationary orbit means we can use fixed antennas, the signal levels will much weaker than with closer (low earth orbit) orbiting satellites. This is a good case for utilising **Joe Taylor K1JT's** weak signals modes!

Receive Antenna

Let's start by looking at the equipment required to receive the downlink. This uses the 10GHz (3cm) band and the standard receive technique is to use an LNB (Low Noise Block) located at the feedpoint of a dish antenna. Remarkably similar to satellite TV! In fact, it is so similar we can make use of readily available satellite TV kit for the first part of the receive chain. For the UK's latitude, we probably need a 0.65m or larger dish so I would go for the largest you can tolerate. There are lots of TV dish suppliers out there and you may even have a suitable old dish hanging around! For my setup, I've ordered an 80cm unit from SystemSat for £34 with free carriage.

LNB

In addition to the dish, you will need a suitable LNB. This choice requires some care because the LNB is a critical performance element. In addition to a low-noise front-end, we need a unit that has the frequency stability to support narrow-band modes. Most standard TV LNBs are only used for wideband TV reception so frequency stability is not a major concern. However, once you get to narrow-band data modes, where a 3kHz wide channel can contain all the traffic, the stability becomes critical. Fortunately for us, **Andy Talbot G4JNT** has done some excellent investigative work that he has generously published: www.g4jnt.com/pll_lnb_tests.pdf

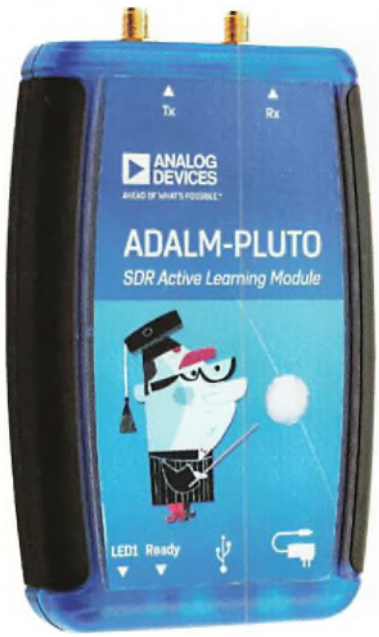


Fig. 1: ADALAM Pluto SDR.

Andy's work shows that the Octagon Optima Twin is a strong contender and is often available for under £20. An important feature of the Octagon unit is its use of PLL (Phase Locked Loop) techniques for the local oscillator chain. Even with the standard 27MHz crystal, it provides a stability and phase noise performance that may well be adequate for narrow-band data modes operation. For improved stability, the crystal can be replaced with a feed from an external, GPS disciplined oscillator. If using this latter technique, you could also change the reference frequency to 27.515076MHz, thus moving the LNB IF output conveniently into the 432MHz amateur band, instead of 618MHz.

The LNB has plenty of gain, so you will also need an attenuator at the shack end of the feed to prevent receiver overload. The LNB is powered over the coax feed using a standard bias-tee arrangement and requires 12V and about 125mA. These TV LNB's also include antenna polarity switching as well as a choice of two local oscillator frequencies. Antenna polarity is controlled by the supply voltage, with 12-14V used for vertical polarity and 18V to switch to horizontal. Local oscillator switching is done by injecting a 22kHz audio tone of about 0.5V pk-pk into the coax feed. However, for Es'Hail-2 operation, we don't need to worry about switching because the settings we require can be met with a simple 12V DC bias-tee. The easiest way to receive the 618MHz IF signal is with one of the popular, USB connected, SDR receivers such as the Airspy, SDR-play RSPs, ADALM-Pluto or Lime SDR while even a simple RTL-SDR Dongle will do the job. As is always the case at very high frequencies, the very first RF Stage (the LNB) has the greatest impact on the overall performance.

Uplink

For the 2.4GHz Es'Hail-2 uplink, the recommendation is for 10W into a 75cm dish. This may initially be a problem for many but there are a couple of easy solutions available. **Simon Brown G4ELI** has been doing some great work to add full transceive facilities to his SDR Console software. The latest public release, 3.0.5 includes full transceive for the Analog Devices ADALAM-Pluto SDR transceiver, **Fig. 1**. With the aid of a simple firmware hack, this has continuous transceive coverage from 70MHz to 6GHz so is ideal for 2.4GHz. Simon is currently finalising full transceive for the Lime SDR boards and this should be incorporated into the 3.0.6 release that will probably be available by the time you read this. Just to make life even more interesting Analog Devices have released a small 2.4GHz, filtered PA for the Pluto to boost its output to 1W. Part number is EVAL-CN0417-EBZ, **Fig. 2**. While Analog Devices evaluation boards are often very expensive, the Pluto 1W PA costs just £28.54 plus VAT and carriage from DigiKey. If you buy two or more, you get free express shipping from the US so

Fig. 2: Analog Devices 1 watt, 2.4GHz PA.

Fig. 3: Hakko style replacement elements/bits.

it would be worth partnering with a fellow amateur. The Pluto PA operates from a 5V USB supply and provides 20dB gain so could also be used with the Lime SDRs. However, the Pluto SDR has an added attraction because it's possible to run it via an Ethernet link by adding a simple USB-to-Ethernet converter. This connectivity is not yet supported in SDR-Console but is likely to be added soon. By using an Ethernet link for the Pluto, it could be located close to the antenna feed thus minimising the transmit feeder loss. Given that we'll be using efficient data modes for the contacts, 1W should be enough. I'll have more on this next month but in the meantime, you can start by listening to the satellite's narrow-band traffic at: https://eshail.batc.org.uk/nb

RadioBerry Update

My RadioBerry DDS transceiver is now complete and working well. There were quite a few challenges in the construction, with 0603 size components, a 144-pin FPGA and a tiny 6-pad TCXO all to hand solder. Before I started, I found a few old PCBs with similar size (0603) components and chips and started removing and re-soldering until a I found a technique that worked for me. The essential tools turned out to be:

- A set of tweezers (angled and straight) – cheap ones are fine.
- Good quality fine-point temperature-controlled soldering iron and bits.
- A syringe of 'no-clean' solder flux.
- Isopropyl alcohol wipes.
- Small hot-air gun.
- Small clamp or vice to hold the PCB steady.
- Fine-gauge solder, 0.6mm.
- Solder wick braid 2.5mm.
- Magnifying desk lamp.

I started by using my old Weller temperature-controlled iron but was having problems getting enough heat to the board when using a very fine tip. Following a few web searches and YouTube videos, I noticed that a lot of people use the Hakko range of irons. Rather than use a replaceable tip, these irons have a combined tip and heater assembly that's replaceable, **Fig. 3**. This seems to give better heat transfer when using very small bits. Being a bit mean, I went for one of the Hakko clones on eBay and bought a 75W FX-951 for just under £50 from a UK supplier, **Fig. 4**. I also bought a pack of ten assorted bits from another eBay supplier for £20. This proved to be a much more effective combination for SMD (surface-mount) work. As you might expect, it's important to keep the PCB clean and I used the Isopropyl wipes for that job.

Because the large ICs were the hardest to fit I, that's where I started. The 144-pin FPGA was the trickiest because I had to be very careful not to bend any of the pins. To help with this, I bought an Aoyue 932 vacuum pick-up unit from **PCB.soldering.co.uk** (about £30). This was not essential but I found it very useful for picking and placing large chips. You could achieve a similar effect using a cocktail stick and Blu Tack. Getting the 144, 0.5mm spaced pins accurately aligned was quite tricky but I got there in the end and soldered a single pin on each side to hold it in place. I then applied flux to all the pins and soldered each pin with a very fine bit using a wiping action where I dragged the iron along the pin and away from chip. I created a few solder bridges, but these were easily removed with the solder wick.

Fig. 4: Hakko clone soldering station.

Most of the resistors and capacitors were 0603 devices and I soldered these by first applying flux to both pads and then adding some extra solder to one of the pads. The component was then held in position with tweezers while I heated the joint to complete the attachment at one end. I then moved on to solder the other end of the component. I inserted all the components in place using this technique but the end-result looked a bit untidy. The joints were electrically fine but not neatly

Narrowband Linear Transponder	
2400.050 to 2400.300MHz	Uplink
10,489.550 to 10,489.800MHz	Downlink
Wideband Digital Transponder	
2401.500 to 2409.500MHz	Uplink
10,491.000 to 10,499.000MHz	Downlink

Table 1: Es'Hail transponders.

aligned with the pads. The solution was to run over the board with the hot-air gun set to a moderate air-flow and a temperature of around 300°C. As the board and components heated-up, the solder melted and the surface tension of the solder caused the components to float to their correct orientation, like magic! The final task was to clear any surplus flux residue using a flux cleaner. As you can see from my photo of the completed RadioBerry, **Fig. 5**, it worked quite well.

I was pleased to find that the RadioBerry sprang into to life first time but my initial euphoria evaporated when I realised it was completely deaf! After some investigation, I tracked it down to a capacitor across the differential input to the transceiver chip. This should have been 8.2pF but Digi-Key had accidentally supplied 10µF capacitors in the pack marked as 8.2p! Moral of the story, check all component values before installing.

Pi Power

My final item for this month concerns powering the Raspberry Pi. Once I began experimenting with the RadioBerry and associated software, I started to get low voltage warnings from the Pi. That's signalled by a lightning bolt appearing in the top right-hand corner of the display. When I measured the 5V line on the Pi GPIO pins, it was reading 4.8V, which is too low for reliable operation. The 5V supply appeared to be fine so the problem was soon narrowed-down to the voltage-drop in the USB cable. I was aware of this as a potential problem but it was the combined power draw of the Pi and RadioBerry that brought it to light. If you're a regular Pi user, you may have noticed that most Pi power supplies are now sold with a 5.2V output voltage to help negate the problem. I also set about finding a decent USB cable. From my tests so far, the Anker PowerLine USB cables seem to be a very good choice because they use 21AWG for the positive 5V feed and a 20AWG wire plus a conductive sheathing for the return. I'm planning to do some tests on several cables so will report back here later.

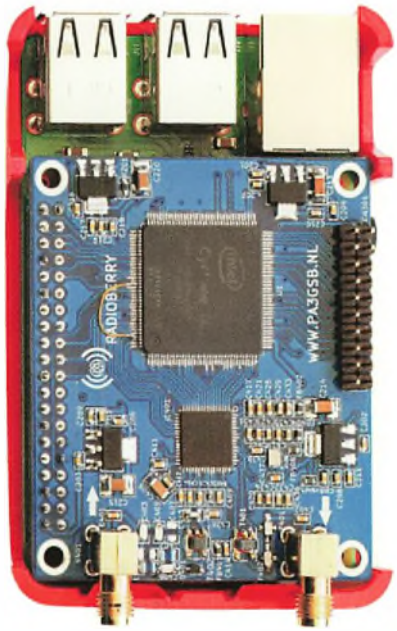


Fig. 5: Completed RadioBerry DDS transceiver mounted on a Raspberry Pi.

Rallies

Send all your rally info to Georg Wiessala at: wiessala@hotmail.com

Plan your rally visits with our comprehensive list of forthcoming events. RadioUser will be attending events marked with an asterisk* – come along to our stand for great deals on subscriptions to *Practical Wireless* and *RadioUser*. Club Secretaries and Event Organisers: please send us details of your events if you would like them to be mentioned here.

March 16th (Saturday)
LAUGHARNE RALLY
The Laugharne Rally of the UK Microwave Group will take place, from 10 am to 1 pm, at Laugharne Millennium Memorial Hall, Clifton Street, Laugharne, Wales SA33 4QG.
Matthew
https://tinyurl.com/y9jwxgz3

March 16th (Saturday)
MICROWAVE ROUNDTABLE
The Cardiff University ARS will be hosting a meeting of the UK Microwave Group at its campus in Cardiff. This one-day event is a mix of talks, measurements, and socializing about activities in the GHz frequencies.
https://tinyurl.com/yysbclwo
http://www.sbarc.co.uk
http://twitter.com/G4WAW
https://tinyurl.com/y6ap5w4f

March 17th (Sunday)
WHYTHALL RADIO CLUB HAMFEST
The 34th Wythall Radio Club Hamfest will be held at The Club HQ, Wythall House, Silver Street, Wythall B47 6LZ. Doors will open at 9.45am, with access for disabled visitors from approximately 9.30am. Free on-site parking will be available. Admission costs £4. There will be four halls of traders, including a bring-and-buy, and the club stand. A selection of refreshments will be available all day, and bar facilities are open within Wythall House from noon onwards.
Ian Reeve M0IDR
Tel: 01386 839 655
www.wythallradioclub.co.uk

March 24th (Sunday)
CALLINGTON RADIO RALLY
The Callington Radio Rally is organised jointly by the Devon and Cornwall Repeater Group and the Callington ARS. It will be held at Callington Town Hall, New Road, Callington, Cornwall PL17 7BD. The doors will open at 10am, and admission is £2; those under 14 years of age are going free. There is ample free car parking adjacent to the venue, trade stands, amateur radio sellers, a bring-and-buy, and on-site catering.
Roger, 2E0RPH
2e0rph@gmail.com

March 24th (Sunday)
CAUSEWAY COAST GLENS ARC RADIO RALLY
The rally takes place at the Bushmills Community Centre, 14 Dunluce Road, Bushmills, Co. Antrim BT57 8QG. Doors are open from 11am. Admittance is £3.
stephen769@talktalk.net

March 24th (Sunday)
HAMZILLA RADIO FEST AND ELECTRONICS FAIR
The Hamzilla Radio Fest and Electronics Fair, hosted by the Dover ARC, will take place at the Discovery Science Park, Gateway House, Ramsgate Road, Sandwich, Kent, CT13 9FF. Open 10am to 4pm. Online ticket entrance £3; Limited early bird tickets £5. Tables cost £10. Online purchase/ bookings are now available; bring-and-buy sale, catering, lectures/ seminars, RSGB bookstall, special interest groups, trade stands, guest speakers, digital village, demos. Icom, SDRPlay and many more exhibitors. Disabled facilities. Plenty of free parking. RSGB examinations will be held.
Aaron Coote M0IER
club@darc.online
M0IERDX@gmail.com

March 31st (Sunday)
BATC REGIONAL CONVENTION
The British Amateur Television Club (BATC, see *RadioUser*, March 2019) will hold a number of "mini-conventions" in various regions of the country during 2019. The Club is pleased to announce the first of these in Bristol on 31st March 2019. The event will take place from 10 am to 4 pm at the premises of the North Bristol ARC, SHE7 building, Braemar Crescent, Filton, Bristol BS7 0TD. These are not regular rallies involving traders but technical meetings for ATV enthusiasts, and for those thinking of making a start in this aspect of the hobby. There will be a full day of talks and demonstrations, and the opportunity to meet some of the most active ATV enthusiasts. There will also be test equipment on hand to test and align visitors' projects. Full details are on the BATC Forum before the event.
Shaun O'Sullivan, G8VPG
Tel: 01225 873 098,
g8vpg@aol.com

March 31st (Sunday)
PENCOED RADIO CLUB TABLE TOP SALE
Doors are open 9.30am, and stall holders have admittance from 8am. Refreshments are available on site.
Madeline Roberts
Tel: 0773 837 5775

April 6th (Saturday)
GMDX Convention
The GMDX Convention 2019 – Scotland's only annual DX Convention – will take place at the King Robert Hotel in Stirling. Booking/ payment details and information about the conference programme and the DX Dinner can be found on the website. Don Field, editor of *Practical Wireless*, will be one of the guest speakers.
www.gmdx.org.uk

April 7th (Sunday)
CAMBRIDGESHIRE REPEATER GROUP RALLY
The CRG Rally is taking place at the Foxton Village Hall, Hardman Road, Foxton, Cambridge CB22 6RN. Car parking is free. Doors open 9.30am for public entry and 7.30am for traders. Entry is £2. There will also be a talk-in station, traders, a bring-and-buy table, and an RSGB bookstall. Catering is available on site – the burger van has been booked.
Lawrence, M0LCM
www.cambridgerepeaters.net

April 7th (Sunday)
YEOVIL ARC 35TH QRP CONVENTION
The 35th Yeovil ARC QRP Convention will take place at Digby Hall, Sherborne, Dorset DT9 3AA. Doors are open 9.30am to 3.30pm. Admission is £3. The venue is wheelchair-friendly.
The rally is supported by RSGB RAFARS and BYLARA. There will be refreshments and parking, club stands, and new and second-hand stalls. The talks on the day will be about (1) *A Remarkable Very Young Lady Radio Amateur*, and (2) *An introduction to MAP Loops*. Regrettably only guide dogs can be admitted.
Bob Harris, G8UED
wjh069@gmail.com

April 12th to 14th (Friday to Sunday)
INTERNATIONAL DX CONVENTION (IDXC)
The 70th International DX Convention, sponsored by the Northern California DX Club, will be held at the Visalia Conference Center in downtown Visalia, California, USA.
If you are a DXer, or interested in any aspect of amateur radio, then IDXC is the place to be.
Top DX operators and contesters from around the world will be there. You'll match those familiar callsigns with new faces and shake hands with the person you have had a sched with for the past 10 years, but whom you have never met.
https://tinyurl.com/ybudjrbz

April 14th (Sunday)
HACK GREEN BUNKER RALLY
The Hack Green Bunker Rally will take place at the Hack Green Nuclear Bunker, French Lane, Hack Green, Nr Nantwich, Baddington, Cheshire CW5 8AL. There will be sales of electronic equipment, amateur gear, components, military radio items and vehicle spares. Doors are open from 10 am, and refreshments are available on site.
Contact 01270 623 353
coldwar@hackgreen.co.uk

April 14th (Sunday)
RIPON RADIO RALLY
The rally takes place at Hugh Ripley Hall, Ripon, HG4 2PT. Doors are open at 10am. Refreshments will be available on site. Information and table booking form on the website.
www.ripon.org.uk

April 14th (Sunday)
WEST LONDON RADIO & ELECTRONICS SHOW (Kempton Rally)
The Kempton Rally will take place at the Kempton Park Racecourse, Staines Road East, Sunbury on Thames, TW16 5AQ. A talk-in station will be on the air.
Car parking is free, and the doors open at 10 am; disabled visitors will gain access 10 minutes earlier. There will be trade stands and a bring-and-buy, as well as special interest groups and lectures. Catering is available on site.
Paul, M0CJX
info@radiofairs.co.uk
www.radiofairs.co.uk

April 28th (Sunday)
NARSA – NORTHERN AMATEUR RADIO SOCIETIES ASSOCIATION EXHIBITION (Blackpool Rally)
The 2019 Northern Amateur Radio Society Association's Blackpool Rally will take place at the Norbreck Castle Exhibition Centre, Blackpool FY2 9AA. There will be a talk-in station, plenty of car parking, trade stands, a bring-and-buy stall, special interest groups, and an RSGB bookstall. Doors open at 10.30am (10.15am for disabled visitors). Catering is available on site.
Dave, M0OBW
www.narsa.org.uk

May 5th
THORPE CAMP HAMFEST
The Thorpe Camp Hamfest is open for traders who camp over to set up from 29th April. For more information:
Sylvia or Ant
Tel: 0795 665 4481

• E-mail: leeg4ejb@outlook.com

Advantages to Building rather than Buying

Lee Aldridge G4EJB continues his self-learning while dealing with antenna matching issues.

As you may have noticed, I have kept costs to a minimum in returning to this hobby, one reason being to show it's still possible. Wrestling with the basics this time around has taught me far more than I knew previously. I think 40 years or so ago it was a case of finding how to make things work and then operate. This time I appreciate the subtlety of how things work, when they work!

For example, the high VSWR reading from my 20m antenna was not as originally suspected the water damaged coax but the addition of an extension coax cable. When I built my SWR bridge, I did so with 50Ω impedance in mind. I mentioned ages back that the old coax was 75Ω but had shown a VSWR of 1.3:1 so I hadn't really appreciated how lucky I was to have used a piece of coax of the 'right length' to get up and working. There's more. To save money on RF connectors, I have been using F-type coaxial connectors and adaptors with QRP (I thought they might be fine with low power HF).

Knowing RF connectors will introduce some losses and there could be SWR issues with adaptors, it even brought back memories of an informative club talk given by **Dave Yates G3PGQ** in the seventies (1970s, that is), which included an insight into adaptors and SWR issues. (I will always be indebted to Dave for his help and advice in my early years in the hobby.) So, prior to dismantling the coax off my 20m antenna, I connected my portable 20m transmitter/receiver directly to the original piece of coax to check the VSWR. As expected, it still showed 1.3:1. I then measured my extension coax cable into a 50Ω load and, sure enough, this was giving something around 2.5:1. Slightly puzzled, I made a longer lead with similar results. At that point the shed was locked up and I went for a sulk.

Solving the Puzzle

The upshot was, I decided to build a simple antenna matching unit so the radio and 20m CWAZ LP filter would see something like a 1:1 match. It started out as an L match but because I had two identical old variable capacitors, it became a Pi matching unit along the lines of **Tony Haas G4LDY's** design in the G-QRP Club *Antenna Handbook*, see **Fig. 1**.

Instead of a tapped coil and associated switch, I wrapped a piece of paper over an old ferrite rod, put some fabric tape around the paper and wound on 11 turns of 18SWG enamelled copper wire. Why the heavy gauge wire with QRP? It stays in place around the former and the ferrite rod can be moved as required. Rather than fit any terminations, I opted for coaxial tails. Does it work? Yes, very reasonably, but it will only be used with low power.

This spurred me on to modify my 50Ω load to incorporate an RMS-reading RF probe to the same design (courtesy of **Adam Farson VA7OJ/AB4OJ**), **Fig. 2**, as my existing RF probe.

This meant I could measure losses in the antenna system without having to perch my existing probe on the RF output contact on my dummy load. I hoped the screening would aid consistent readings and further limit radiation. I could then work out the RF power using V^2/R with a calcula-

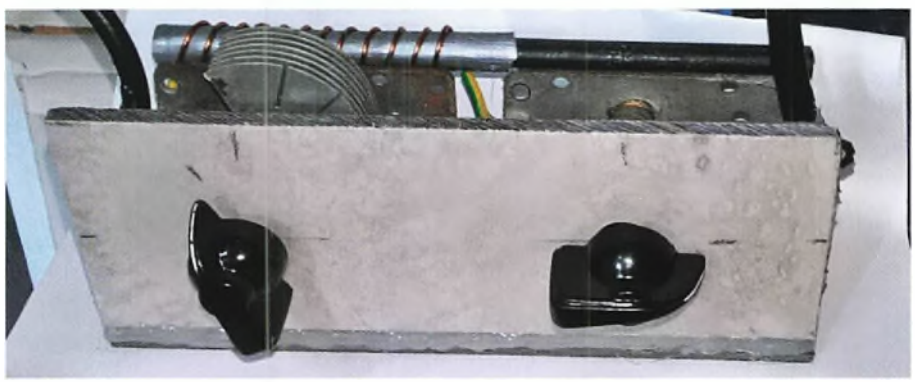


Fig. 1: Antenna Matching Unit.

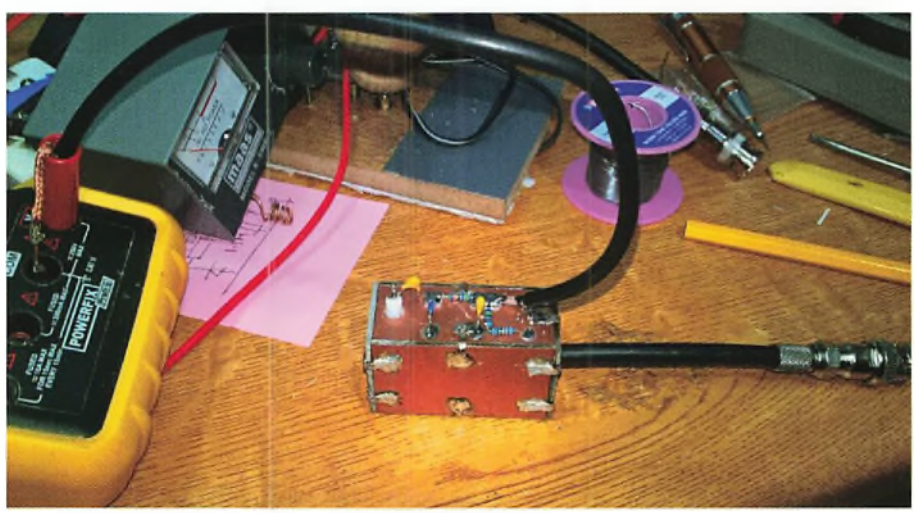


Fig. 2: 50Ω load with built-on RF probe prior to being encased.

tor and hopefully have more meaningful measurements. A Post-it was even put on the cupboard door showing power and voltages ranging from 500mW to 1W – that's getting serious.

Using my portable 20m transmitter/receiver with a flat battery, I took measurements at the transmitter output, the 20m CWAZ lowpass filter output and the antenna matching unit with the dummy load/RF probe. Then I used an online dB calculator to work out losses: https://tinyurl.com/yddbsp25

For example, with 0.405W at the filter output and 0.375W at the matching unit antenna connector, the calculator showed a loss of 0.33dB. Now I don't expect my homemade probe and £8 DVM are that accurate but I'm happy enough to see a relative low loss across my matching unit. So, the old coax has a reprieve – for now!

The 20m dipole is still configured as a CFR dipole but the RF choke has been moved to a calculated 0.275 wavelength from the dipole feedpoint, as I'm using an untuned choke. Does it improve anything? I'd like to say 'yes' but based on reception alone (operating time has been at a minimum), it's very easy to let over-optimism get the better of you with the variance of 20m band conditions. I shall be experimenting further with the antenna and coax shortly. Meantime the soldering iron has been put to further use.

Dip Oscillator

Remember me saying I must build a FET Dip Oscillator? Well, I finally built the FET Dip Oscillator described in **Peter Dobbs G3LDO's** book *Building Successful HF Antennas*, because it looked really useful for antennas. (Really, I just wanted to see what happened with a large coil wound around a piece of laminated floor panel.)

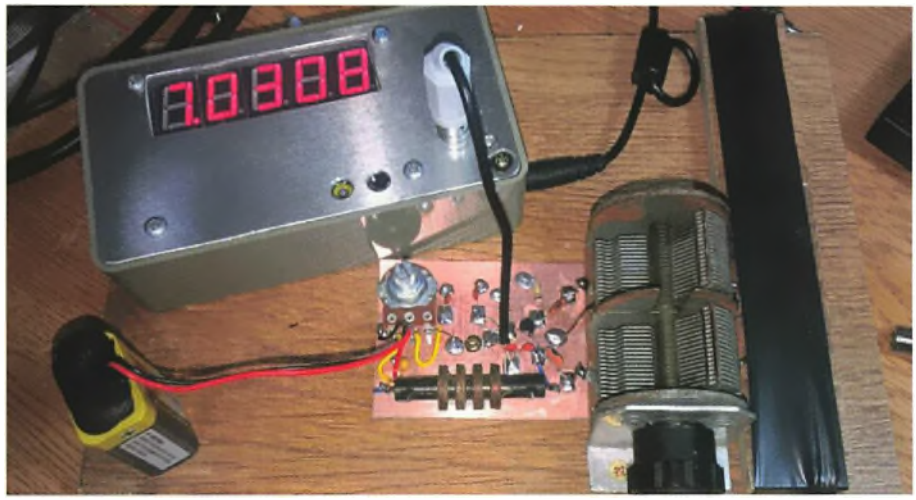


Fig. 3: FET Dip Oscillator.

The rest of the oscillator was built Manhattan style then tested before being encased with some pieces of PCB, **Fig. 3**.

It didn't function at first. I checked DC voltages with my DVM – all was well – then used the DVM on continuity to check from the 100pF coupling capacitors through the fixed vanes of the variable to the coil. I'd failed to solder one end of the coil to the variable capacitor so got that sorted. With the larger than specified variable capacitor, I took one turn off the coil. Coverage is from about 5MHz to 21MHz – very useful. The oscillator is far more stable than I expected and I've used it with my frequency counter to roughly calibrate a couple of my simple receivers (I call these 'Rubidium Pencil Marks' because pencil marks rarely move). Even my 40m Pixie has frequencies marked on it.

I had planned to sort the 30/40m inverted-V dipole but the weather went against me. Instead, as a pragmatic solution to further antenna development, I followed **George Dobbs G3RJV's** advice in his book *QRP Basics* about the W3EDP antenna. My thinking was I could use it on any band with a basic matching unit and the correct counterpoise. It would give me experience with a long-wire antenna that would then be pressed into portable operation in a few weeks. What really amused me was, I was returning to where I had started just over a year ago – a long-wire antenna – but this time with an antenna that has stood the test of time, since 1936 to be precise. And it wasn't steel wire. I had bought 100m of lightweight PVC-covered tinned copper wire for antenna, radial and counterpoise work.

The W3EDP wire antenna isn't very high, even though I had inched my way up one of my wooden antenna masts to get a little more height. Just don't ask how but it's good that I learned some ladder skills with trees. Anyway, having survived that and the freezing temperatures (there was ice on the guy ropes), I set about building something similar to the simple matching unit that George had included in his book. I can't wait to see how this works and I will make a few contacts with it, ready for The Peaks!

• E-mail: mwimwd@gmx.com

Retrying some of Marconi's early Radio Experiments

Having wrestled with portable operating, Joe Chester MW1MWD sets out to to retrace the footsteps of Marconi.

Over several years, from the late 1890s onwards, Signore G G Marconi reported the results of experiments with what were then called Hertzian waves, after the great German physicist Heinrich Hertz who discovered them. One of the things he reported was that he succeeded in sending a Morse code signal by radio across the Atlantic. They gave him a Nobel Prize for this. Of course, he knew almost nothing about radio theory, propagation or antennas. He was a businessman, interested in the commercial possibilities of wireless transmission, and in this endeavour he succeeded.

Marconi built all the equipment he used. Apart from the odd input from some more scientifically learned friends, it was a case of trial and error, of get some wire in the air, attach a spark gap to it, and listen to see whether anything could be heard some distance away. He started at distances of a metre or less, and quickly moved on to hundreds of metres, and eventually a few thousand kilometres across the Atlantic. Or so he claimed.

But did He?

The problem is that he almost certainly didn't achieve all that he claimed he had. As a businessman, he needed results to get the investment he needed. It is well known today (see URL below) that the transatlantic transmissions he said he heard were probably just atmospheric noise. Transatlantic radio transmissions, on the LF frequencies he used, are, even with today's advanced equipment, very difficult, requiring careful design of appropriate antennas. He knew nothing of this, and his equipment was rudimentary. https://tinyurl.com/6w6qz5t

So, if his transatlantic results are today seen as somewhat doubtful, what of his other experiments? Did he actually succeed in sending LF signals across to France reliably when he said he did? And ship-to-shore from out in the Atlantic? Or were the results he announced a bit fortuitous, perhaps somewhat exaggerated, and the result of faulty experimental design – his listeners knew exactly when to listen and at what times, even exactly what was being sent.

Because 2019 is the 120th anniversary of some of these experiments, I'm going to try to replicate what he did, from the same locations. I'll be using modern equipment but sticking as closely as I can to his experimental designs.

The first step is to sort out an antenna. Marconi used very low frequencies, so I've decided to operate on 80m – I'll say why I picked this later. He used verticals and sometimes long wires suspended from kites. We're a small team, just two of us. So, setting up a transmitter and flying a kite at the same time is probably asking too much of the rest of the team!

I rang my friend M for guidance. Now understand, he's a QRO (high power) and full-sized antenna type of guy. *"Short verticals on the low bands are notoriously inefficient, difficult to tune, and noisy"*, he volunteered. *"You'll also need a big amplifier but the Isle of Wight is nice"*, he said. Talk about stating the obvious! Asking around on the web generated a few interesting responses. **Bruce W2SE** suggested I try horizontal polarisation, like an NVIS antenna, and **Ken K5DNL** suggested trying a T. But Marconi used verticals. So, a vertical it has to be.

A Short Vertical for 80m

I started working on the antenna on fine days during the Winter. M dropped by occasionally, to gawk at my efforts. My first attempt was to follow the recommendations in **Scott Andersen's** Buddipole cookbook. This has a radiator of just 1.77m, very short for 80m use. The

The author's version of a Marconi vertical – a SOTABEAMS 7m pole, with 300Ω ladder line, shorted at the top, as radiator, and a matching coil (the blue box) a metre off the ground.

feedpoint is 3m off the ground, and I use a 20m counterpoise, stretched along the wooden garden fence, and at no point closer than 2m to the ground. Scott says this antenna has a gain of -3.82dBi so it's putting out less than half the power of an isotropic radiator. A longer radiator increases gain slightly but this is still a poor antenna. However, it worked, and one Sunday morning, I made a few contacts. Nevertheless, I suspected that a light bulb might work just as well!

Frank N4SPP has also done some work on this type of antenna (link below). He made several versions, with various homemade coils. He got good results with a 5.5m radiator on a 6m fibreglass pole, a homemade coil, and a 7m counterpoise. Clearly, the longer the radiator the better the performance, and ultimately a well-grounded quarter-wave at 20m would be ideal.

https://tinyurl.com/yc2dcxqx

Obvious, says M, and of course he's right, as usual. *"I told you to get as much wire as you can up as high as possible"*, he said. Yes, indeed, but I live in a bungalow, with a postage-stamp back garden, in a quiet neighbourhood. Taking on the planning issues involved in a 20m mast was not going to happen. And such a monster would not be very portable either.

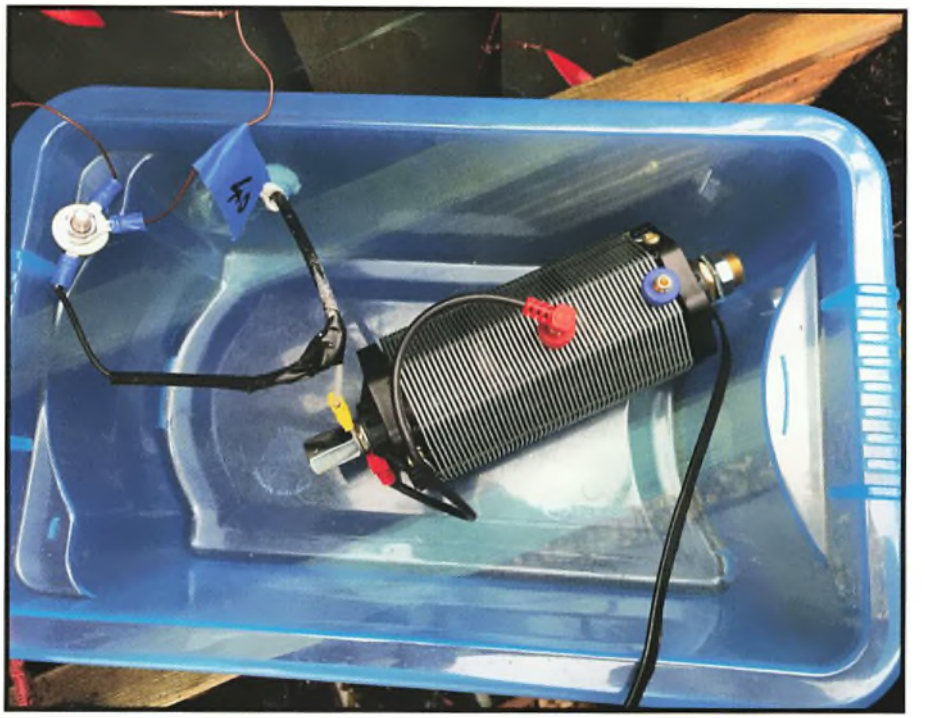
A Better Solution

For my second attempt, I attached a 6m length of wire to a SOTABEAMS 7m portable pole. This radiator is three times the length of the previous one with the same feedpoint and counterpoise. My antenna analyser was used to get the best position for the tap on the coil. I got a match at 3.710MHz, and a 140kHz bandwidth with an SWR under 2:1. Moving the tap up the coil, away from the feedpoint, raised the resonant frequency, and vice versa. I added length to the counterpoise, by unwinding more wire from its spool, and, although it did move the resonant frequency (longer lowers it), it worked fine at its original length. This is beginning to feel a bit Marconi-like, but even this failed to impress M!

I calculated the efficiency of this system, using **Phil AD5X's** equations (URL below), at about 25%, very much better than the previous attempt. Over the week or so that followed, I used my IC-7300, at 100W, with this antenna. I got mostly 59 reports, and a 57 from **John** in Clacton. So, it's getting better. One of the nice things about this antenna is that it can be put up and taken down in less than a minute. Which also means less chance of curious neighbours complaining. And it's portable!

ad5x.com/presentations.htm

While I was writing this piece, the postman arrived to deliver February's *PW*. And what do I find on page 24? Only our esteemed Editor tackling the same issue – the efficiency of vertical antennas. His radiator is 5.5m, mounted just over



The BP Low Band coil attached to one side of a ladder line radiator – the two taps are the resonant points for 80m and 40m; there are two brown counterpoise wires, one for each band.

head height. His VSWR and impedance numbers for the low end of 80m underline the difficulties of low band verticals. But I have an advantage over the antenna he was testing – the BP coil at the feedpoint, and the 'tunable' counterpoise. This allows me to find the resonant frequency of the vertical element and drop the SWR right down to a usable level.

A Final Tweak

There are several other things I can do to improve efficiency. Obviously, a longer radiator would help. But getting beyond the 7m fibreglass pole starts creating mounting difficulties. An inverted-L would possibly be even better at the QTH, but that's not what this series is about. I also found designs for longer radiators wrapped carefully in a spiral around very expensive poles. A final tweak came from **Brian G0IER**. He tried using ladder-line, shorted at the top to, in effect, double the length of the radiating element. I tried this too and got a 56-57 from **Geoff GM0OFQ** one lunchtime. Significantly, this was on the KX3, using only 10W (Geoff was also using a KX3 but with an amplifier).

The real problem here is the grounding. In the days of AM shortwave commercial transmitters, groundplanes consisted of miles of wire radials, and even acres of buried steel mesh. The ground losses with short verticals overpower the limited radiation resistance of the short radiator (Phil AD5X again). The long counterpoise I'm using out portable will go some way to reducing ground losses. At the QTH, I'm looking at trying a folded counterpoise FCP (URL below) to reduce ground losses. But the Footsteps project is about portable work. My modified BP, with the SOTABEAMS pole, is the best I can do, and it will have to serve.

k2av.com

One of the nice features of the solution I've settled on is that it's a good match to what Marconi used in Poole 120 years ago. The coil is the key. I've even found the coil he used. It's in the Museum of the History of Science in Oxford. You can see an image of it online:

https://tinyurl.com/ycsqcyyh

Summary

Marconi used very inefficient equipment and trial and error way back then. I'm not really, therefore, chasing down 'the' most efficient and effective equipment solution. My modified Buddipole will do the antenna job, matching that of Marconi's efforts, and my KX3 is a good match for his transmitter (I'll discuss why next month). I've got an NoV from Ofcom for this work – GB9GGM – and set up a web page on QRZ.com under that callsign. Please check there regularly for operating times and frequencies. Let's know what you hear, if anything! I will, of course, report back my results (if any!) via *PW*.

E-mail: jewell@btinternet.com

23cm, The Next Band Up? (Part 1)

Sam Jewell G4DDK makes a welcome return to PW, explaining how to get started on the 23cm band, the 'Next Band Up'.

Although most radio amateurs will be aware of the amateur radio spectrum allocations between 137kHz and 440MHz, it is likely that many will not have ventured any higher. Why is that? One reason is that there are relatively few commercial transceivers that include any of these bands and those that do tend to be expensive compared to equipment for the lower bands. In many cases coverage of 'the next band up' is often as an optional add-on. With few exceptions, the only higher band offered is 1240 to 1300MHz (the 23cm band). In the UK we are fortunate to have the wider band covering 1240 to 1325MHz but the vast majority of amateur 23cm allocations in other countries stop at 1300MHz so that has become the normal limit for any commercial amateur transceiver offering.

In this short introduction, including a second part next month, I hope to encourage you to explore the interesting characteristics of '23cm, the next band up'.

What's There?

A UK bandplan for 23cm has been produced by the RSGB and can be viewed online at:
https://tinyurl.com/ycntdkkc

Since the bandplan may be subject to change from time to time, it has not been reproduced in this article.

What is immediately obvious is that the bandplan supports a great many communications modes, including amateur TV (ATV, both FM and digital), voice simplex and voice repeater, digital voice (DV), digital data (DD), satellite uplinks, traditional CW and SSB and digital modes (MGM).

It would be unreasonable, for most of us, to try to remember the whole bandplan. Possibly remembering that most narrowband DX operation takes place in the sub-band between 1296.000MHz and 1296.200MHz and the satellite uplinks are in the sub-band between 1260 and 1270MHz is enough.

The introduction of more direct, simplex, DV in the future seems possible with the introduction of the new Icom IC-9700, although this is D-STAR only. To date, there seems to be little interest in DMR and Fusion digital simplex in this band. Other DV modes may also appear, in due course. The IARU Region 1 recommended DV simplex calling frequency is 1297.725MHz. This will be one to watch in the future.

Reference to the RSGB web page is the best way to ensure that you do not operate where it might not be appreciated by current users.

It should be noted that adherence to the bandplan is not mandatory but doing so will likely result in the greatest number of successful radio contacts. For those who prefer to experiment, it may be preferable to move to some of the lesser-used parts of the band. This is entirely acceptable if it doesn't cause interference to the primary band users or intentional interference to other amateur band users. There are some geographical limitations on operation, imposed by Ofcom.

Mostly minor changes to the recommended bandplan may be needed, in the future, as some primary user services expand and make it more difficult to operate in all the present allocations.

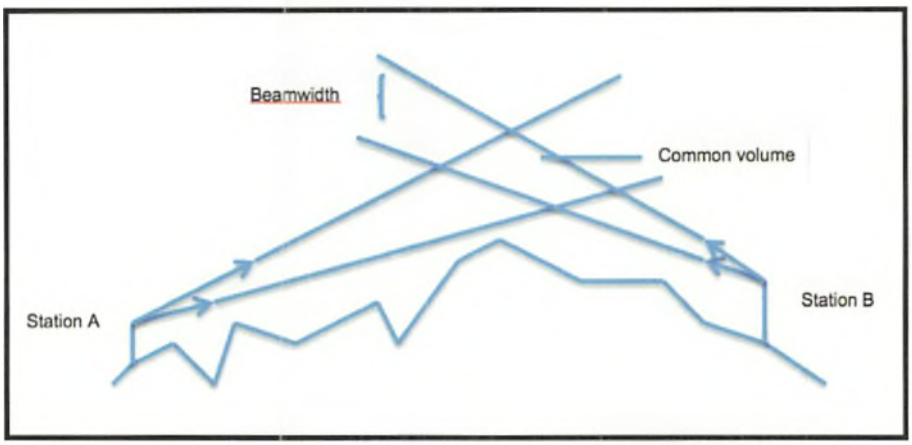


Fig. 1: Tropo scattering (TrS) from common-volume troposphere dust particles, cloud droplets and irregularities in the refractive index, causing VHF/UHF radio signals to bend round the Earth's curvature.

Why Higher?

While the HF bands offer the opportunity to work stations across the globe, to the average radio amateur the VHF and above bands seem to be limited to working just a few and maybe little further than a few tens of kilometres. However, as I'll discuss, other propagation mechanisms exist while EME (Earth Moon Earth, also known as moonbounce or moon reflection) can give global coverage and amateur radio satellites can allow transatlantic coverage.

Increasing levels of man-made noise (QRM), due to the proliferation of electronic devices now in common use, may cover up many weak and sought-after HF stations, making it harder for the average HF amateur to work those stations with the usual 100W and a length of wire. Add to this poor HF propagation at this part of the solar cycle and HF can become a frustrating experience.

The noise problem is now beginning to affect the VHF and lower UHF bands too. Above about 500MHz much of this QRM noise disappears and above about 1GHz the natural noise (QRN) drops to very low levels. Up to around 20GHz QRN remains low giving rise to this part of the radio spectrum being known as the 'low noise window'. What happens above about 20GHz is a little more complicated and beyond the scope of this article.

The low noise window is favoured by radio astronomers and for space communications. It offers an opportunity to see what lies beyond the noise 'smog' that can cover up signals at lower frequencies. Amateur microwave enthusiasts use and enjoy our allocations in the low noise window because it opens opportunities to receive weak signals that would otherwise be masked by QRM and QRN. We can receive low level signals from satellites and extremely weak signals from other radio amateurs reflected off the surface of the moon. Long distance terrestrial contacts are possible using a variety of scatter and reflection propagation modes.

A whole new area of technology is opened in the form of low noise receivers and low noise antennas. It is possible to 'hear' the presence of natural moon noise, even with small antennas, on the 2.3, 3.4, 5.7 and 10GHz amateur bands

What about the 23cm Band?

VHF radio amateurs will be familiar with the need for antennas with gain. This is important as the frequency of operation increases. A single- or dual-band vertical antenna is often used at 144MHz and 432MHz but tends to limit the distance over which the DX can be worked unless there is 'a bit of a lift on'. The ability to point a high-gain antenna at the station you want to work increases signal level at the other station's receiver and makes distant contacts more likely. It's possible to work stations on the 23cm band using just a vertical antenna but unless that lift in conditions is present or the antenna is sited on a mountain, range will be severely limited. The following section describes some of the propagation modes that enable long distances to be covered on 'the next band up'.

Propagation at 23cm

Most contacts on 23cm, under about 30 to 50km, are made by a combination of reflection from buildings and other large, solid objects and by diffraction over and around buildings and trees. Because these propagation-enhancing objects are not usually moving, the signal level between two stations is often quite stable. Signal strength can be anything from very strong to quite weak.

Most terrestrial contacts on the 23cm band, beyond this distance, are accomplished mainly by tropospheric scatter (troposcatter) propagation.

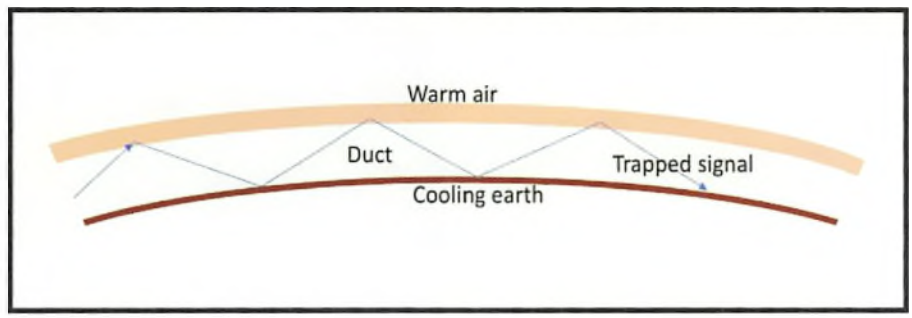


Fig. 2: Surface ducting.

Troposcatter is a weak signal mode. Don't expect strong signals in this propagation mode. Weak signals work best with narrow band modes such as CW, SSB or (increasingly) digital modulation. Because signals are generally weak, higher gain antennas, such as long Yagis, are a good idea. Higher power is also very desirable. 10W RF output transceivers are soon found to be very range limited on troposcatter, covering perhaps 100km, unless supplemented by high gain antennas systems. Another characteristic of troposcatter is scintillation and this may make weak SSB signals difficult to understand. CW usually works, however.

With troposcatter, the two partner stations beam at a common volume of the troposphere where small changes in the refractive index of the troposphere cause the radio wave to be refracted back towards the earth and the partner station. These changes in refractive index are caused by turbulence in the upper air, temperature changes and water vapour content. Side scatter can also occur but usually leads to much weaker signals. The effect is shown in **Fig. 1**, a diagram that first appeared in the July 2014 issue of *PW* where the author, the late **Colin Bayliss G3WKZ**, discussed troposcatter in more detail.

At certain times of the year strong signals can propagate over the surface of large areas of water, such as sea or large lakes. This is called an evaporation duct and it can be an interesting and often a long-distance propagation mode. Evaporation ducting can also extend over low-lying land areas.

With an evaporation duct warm air is advected from over land to lay over (usually) colder water. The change in temperature and humidity of the air above the cold-water surface may then lead to signals being refracted or reflected within the duct formed between the water and the overlaying warm and humid air. Such evaporation ducts form readily across the North Sea and probably the Irish Sea in early spring, leading to strong signals between near coastal locations, maybe reaching as much as 30km inland, on opposite sides of the area of water. It may also allow strong signals to propagate along the length of the sea or lake coast. Ducting of this type is common from around mid-April until late summer in the northern hemisphere.

A second form of surface ducting is due to thermal inversion and occurs when the ground cools rapidly after a warm day. A duct may form between the cool air immediately above the ground and warm air above, as illustrated in **Fig. 2**. (Tropospheric propagation was also covered in the November 2018 instalment of *Making Waves* – **ed.**) Signals are trapped by refraction within the duct that is formed. Often the duct is quite thin and will therefore only support frequencies above 1GHz, such as within our 23cm band.

Even longer paths may appear due to elevated ducts that form when, for example, high pressure systems persist for a period of time, when the air within the high pressure system descends in the central area. As it descends it becomes warmer and may form a layer over the much colder air beneath, forming an inversion duct, but unlike surface ducts it appears at many hundreds to several thousands of metres. The thickness of the duct layer determines what range of wavelength of signal will propagate. Elevated ducting may extend for thousands of kilometres, leading to very long-distance propagation. This type of propagation is often referred to as a 'large area of interference' in TV weather forecasts.

In recent years another propagation mode has become very popular. Aircraft flying at heights of a few thousand metres to about 10km (39,000 feet) have a long horizon range of up to about 400km, to

sea level. Conversely, a station at sea level can 'see' an aircraft at that height. If two suitably equipped 23cm stations beam their antennas towards the same aircraft, it is possible to reflect signals off the aircraft. These signals reflect in all directions, including forward, so a station 400km beyond the aircraft can be worked, for a total range up to about 800km. In some circumstances the range can be as much as 1000km but this is generally when a second propagation mode is also present to extend the reflection range at one end of the contact. This mode of propagation is known as Aircraft Reflection (AR) or sometimes as Aircraft Scatter (AS).

AR has been known and used by radio amateurs for many years and is like en-route air traffic control radar. Indeed, radio amateurs share the same band as these long-distance radars. Thankfully, we don't cause the radars any problem and they only occasionally cause us any interference.

We need to know two things to use AR effectively. One is that there is a suitably placed aircraft for a path to work and second that there is someone to work at the end of the path. Mainly due to the appearance of several computer programs that make it easy to see where aircraft are in real time, AR has become a very practical way to make long distance contacts around Europe. These programs take available flight information and overlay the position of aircraft onto a map of the region, such as northwest Europe. They also add other useful information such as type (size) of the aircraft, headings, and height. To work a known station you enter their locator, such as IO84XX, and because you have already entered your location into the program, it will draw a circle around the actual path mid-point where a reflection is most likely.

This works well and because larger aircraft can give useable reflections for over a minute, but more often less, there is time to make a CW or fast mode digital QSO before the signal again fades away. SSB can be used but is much less common. Aircraft reflection, using an application such as Airscout by DL2ALF (URL below) can be very reliable and is used a lot in contests. However, in most cases it presupposes that you know the location of the other station and that they are willing to make a QSO with you. Chat facilities such as ON4KST chat (second URL below) is usually used for this purpose and the use of chat to exchange proposals (sked) is allowed in many contests.

www.airscout.eu
www.on4kst.com/chat

Fig. 3: The moon can be used as a passive reflector of signals (photo by G3ZVW).

For very long distances you need to use EME, **Fig. 3** (see also last month's *Making Waves*). Here signals are reflected off the surface of the moon and back to the earth. If the moon is simultaneously visible at any two points on the earth's surface, these points can be in radio contact by EME. Because the moon is simultaneously visible at any two points on the earth's surface during the lunar month (28 days), worldwide communications are possible. Obviously, at the most distant points, this will not be every day, but for example, the UK to the USA is possible every single day and for many hours at a time.

After 2m, 23cm is possibly the most popular EME band. It offers the possibility of small 'backyard' antenna systems that are acceptable to both neighbours and partner. These antennas may be a dish reflector and feed arrangement or a single or multiple Yagi antennas. CW is popular but probably eclipsed by the number of digital signals now being seen and decoded. JT65C is the preferred mode on 23cm and with 100W at the antenna and a small dish or single long Yagi, hundreds of stations around the world can be worked. EME is probably the ultimate weak signal mode, that is until we have radio amateurs on Mars or beyond!

Propagation modes such as meteor scatter, Ionoscatter, aurora scatter and rain scatter are rare at 23cm, so are not mentioned further in this short article. Transequatorial propagation (TEP) is not possible. Space objects such as the ISS and some larger satellites can provide useful long-distance contacts by acting as passive reflectors but do require EME-capable stations at either end of the path.

Finally, several amateur satellites carry transponders with a 23cm (L band) receiver and downlinks on another band. Currently only AO-92 has an active 23cm uplink and then it is only switched on at weekends. ESEO also carries a 23cm uplink receiver, but it is currently not active. My thanks to **Pete 2M0SQL** for his update on these satellites.

Next month I'll talk about equipment and antennas for the band, including a discussion of the use of SDR technologies.

The 1240MHz to 1300MHz band primary users are Radiolocation, Radionavigation, Radionavigation – satellite, Earth Exploration – satellite and Space Research. Amateur and Amateur – satellite are secondary users. Between 1300 and 1325MHz there is no space related allocation; primary or amateur. It should be clear that we are very much dependent on the primary users for access to the band and should never cause them any deliberate interference.

• E-mail: zt1tzs1afs@gmail.com

The Curse of Bouvet Island

Tom Morgan ZS1AFS reflects on recent attempts to activate remote Bouvet Island and wonders whether the Curse of Bouvet is at work!

Most people have never heard of Bouvet Island. It's a little speck in the South Atlantic Ocean about 3km x 5km that has little significance except for Norwegian naturalists, scientists and amateur radio operators. It's the second most sought after place to contact after North Korea. No one lives there and the last radio expedition (DXpedition) was by the astronaut, the late **Dr Chuck Brady N4BQW** from December 16th 2000 to March 5th 2001.

He was the medic for a Norwegian-led five-person scientific expedition. So, the said government covered all of the logistics and planning – and costs! Before leaving Cape Town, Brady visited **Dennis ZS1AU**, made sked arrangements and told him to keep quiet until 3Y0C was established. Judging by the size of the group of Cape Town amateurs assembled who heard THREE-YANKEE-ZERO-CHARLIE calling at 0700UTC on December 16th 2000, it was an open secret.

According to ZS1AU the generator was running out of oil so fast it would be finished before the pick up. 3Y0C went off the air but with only a few battery hours to go the problem was fixed and shortly afterwards the amateur radio world started the Nth pileup. But problems continued when the amplifier failed to function well – and it remained so. The weather attacked the antennas. The 160m dipole had 25 joints, with the Hexbeam needing to be patched up. Chuck was determined to beat the conditions and worked many LF contacts when not repairing antennas.

Bad Luck Strikes Again

When it came to leave, the bogey struck again. They were due to depart on March 2nd but the weather worsened. The relief ship *The Lance* encountered high seas and her late arrival was a relief. Although the camp had packed up, Chuck continued limited battery operation until the morning of March 5th 2001. The ship pulled away the next day. Chuck and the team defeated all that was thrown at them. Later attempts did not fair so well.

3Y0Z

So, what's the Curse? Several groups have considered the ultimate DXpedition. But rather than test Bouvet, they had logistic and financial reasons not to go. Finally, in 2018 a group of Americans raised millions of dollars to charter a ship to take them to the island, hang about while they set up their radio station and talked to the world, and then take them home again.

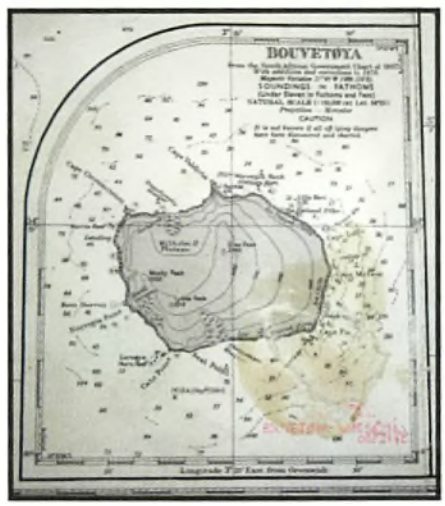


Chart of Bouvet from the author's collection.

In 2018 the 3Y0Z DXpedition, led by **Ralph K0IR**, was a very well-planned effort. When Bouvet Island hove into view at 0600GMT on January 31st 2018 the team were delighted. The ship *Betanzos* anchored to the east of the island in 25m of water. When they arrived at Bouvet the weather should have been at its most benign.

Unfortunately, high winds, low cloud and very rough seas had plagued them for a large part of the voyage from Punta Del Este. The cloud ceiling at 500ft and visibility of one mile meant the helicopters could not take off, also because of the 10m swell. And then the ship developed an engine problem that could not be repaired! The vessel has two engines for double redundancy. But if the remaining one developed a fault that could not be fixed, it would be fatal. The vessel had to return to a port. Cape Town was the nearest that had repair facilities. On February 5th 2018, with long-backward glances, they bore away. Was this the Curse of Bouvet?

The voyage to Cape Town was slow and the DXpeditioners had plenty of time to reflect – on what could have been. It was a very sad end to such a promising efficiently organised DXpedition. Almost as an echo, January 2019 saw notices on the amateur radio websites that donations were being returned to those who had contributed to what some say was the most expensive amateur radio operation, ever.

Rebel Group

At that time, another DXpedition group, the Rebel Group, 3Y0I was in Cape Town. The group that was to embark for Bouvet Island received a blow without getting in sight of the island. They'd been waiting for weeks for the vessel to leave. However, *Atlantic Tuna*, chartered by this European group, was restricted to port for non-payment just a few days before it was due to sail! There was a mad dash to remove items belonging to the DXpedition before the ship could be formally 'arrested'. Much of this was cloaked in a veil of silence and inquiries went unanswered.

Before that unfortunate event there were several blogs, including photographs on the internet of the Bouvet Island DXpeditioners enjoying the delights of the Royal Cape Yacht Club. But time was ticking away. After well over a month waiting, the dozen or so members of the team learned that the ship was restricted to port.

How long this will take to sort out is anyone's guess. If a ship is impounded it is a maritime matter and is heard in the High Court. So, this dispute could rule out any trip soon. The Curse of Bouvet had struck again. No wonder the Rebel Group called Bouvet *"The Everest of amateur radio"*, or is it just cursed?

Letters

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£20 STAR LETTER

Dear Don,
I am just picking up on your request for suggestions of Museums where interesting radio equipment can, in this case, not only be seen but be seen working. I have an extensive collection of vintage gear, work on board HMS Belfast and have visited many museums with radio equipment. I'm not easily impressed but my absolute favourite radio museum is the RAF Signals Museum at RAF Henlow run by **Alf** and team: http://tinyurl.com/nbkgmse

So why is it so special? Simply, the kit works. The staff really know their stuff and there's a wonderfully relaxed atmosphere where visitors can ask as many questions as they like and get them answered by guys who know the equipment intimately and then operate the equipment (once the chaps are happy you know what you're doing!). If you want to sit down in a recreation of a Y station and have a listen on an AR88, an HRO or S27, you can do so for as long as you like. Or perhaps tune up a T1154/R1155 combination taken from an Air Sea Rescue Launch (the launch is at the Hendon Museum) into a dummy load and bang out some CW. You could gaze in wonder at the operating 1950s radar terminals using electromechanical devices and software to depict radar returns from an attack by Russian Bear bombers off the east coast being taken out by F4 Phantoms. The azimuth and elevation consoles are authentically linked for a very real Cold War radar operator's experience. Gripping stuff I can tell you. And should there be maintenance required during your visit, you can even help out. On my last visit I was fault-finding on one of azimuth radar consoles with one of the team. Makes a change from a 19 set.

I could mention the array of teleprinter equipment – all working, of course, and regularly used to produce material for the film industry. I took a 7B along on one visit for Alf to fix. To test it we printed off the message written by Alf for the Netflix production of *The Queen* announcing the start of the Korean War. Just brilliant.

Saving the best until last, my absolute favourite bit of kit is the fully operational T1509 transmitter complete with the operator's table. 300W of CW and 250W of AM put my KW Vanguard somewhat in the shade. If you ask nicely, you can have a go sending CW… to the dummy load or over the air if licensed. Seriously impressive bit of kit and astonishing that they were given to cadet units with the lethal (in the wrong hands) PA anodes readily accessible to fiddling fingers in the open drawers. Modern day H&S inspectors would have a fit! I loved it.

I'd better mention the comprehensive range of airborne radio kit, the working gee set, the fully functioning diversity sets and so on and so forth. I've taken fellow club members up there perhaps a little puzzled by my enthusiasm for the place. They've all returned for a repeat visit because there's so much to see for the vintage radio enthusiast. Their tip is don't expect to just pop in for a couple of hours, It's not long enough. Give yourself time to ask questions and play with the kit. I'd reckon on four hours for a comfortable visit. It'll fly by, if you can pardon the pun.

I hasten to add I've no connection to the place … other than a profound spiritual need to return at least twice a year to get my fix of that T1509.

On a serious note, RAF Henlow's future is uncertain, meaning the Museum may also be at risk. See it while you can. The more visitors they have the greater the chance of preserving this very unique establishment.

David Coles M0IDF
Loughton

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

Museums

Dear Don,
You asked in *Keylines* (PW March) for ideas for recommendations for radio museums where radio equipment of old can been seen. I suggest The RAF Signals Museum, Henlow, where not only such gear can be viewed, but there is a working amateur radio station. I have been on several occasions where we were made most welcome. It is necessary to book because the museum is 'inside the wire' but details are on the website below.
http://tinyurl.com/nbkgmse

Readers might also be interested in the Pathfinder Museum located at RAF Wyton near Huntingdon, Cambs. As well as some interesting displays about the Pathfinders, there are some radio related exhibits – when I went, they had a console from a Nimrod AEW. Again, booking required.
http://tinyurl.com/yxcsnorf

Finally, the Military Intelligence Museum is also worthy of a visit. This museum displays the activities of the SOE and has some interesting spy sets on display. Also booking required.
http://tinyurl.com/y27n8q6p
David J Howlett M0VTG
Peterborough

Dear Don,
Being an avid reader of *PW* I see that you are asking if anywhere has the old valve sets.

The Wings Museum is a WWII memorial museum that displays not only recovered wreckage but also the poignant information about the crews who were flying at the time. Re,ains of aircraft and other artefacts, parts of which have been restored by volunteers, really show the result of war and serve as a reminder of the sugffering that the participants went through.

In 2010 the museum moved to its present location, about six miles south of Gatwick, and a couple of us who are volunteers started to restore some old WWII radios. Since then more have been donated and as part of the museum, we have a 'radio shack' in which we display up to 20 receivers/transmitters, about ten of which are now working. One corner hass the story of the Voluntary Interceptors plus two of the radios used, although initially Vis did use their own receivers.

Guests, including school and Scout/Beavers, etc can learn a little about the old valve sets with all their strange iciosyncrasies. There are also two Morse keys on which, if they send their name, they are given a certificate.

We do have an amateur radio station with HF, 2, 4 and 70cm,

which we also demonstrate, along with information on how to become involved in amareyr radio and the RSGB, with a list of local clubs.

The Museum, which is manned by volunteers, is open every Saturday and Sunday from the beginning of March until Remembrance Sunday in November and arrangement can also be made to open at other times for groups. The radio shack is manned on Saturdays and other times when the museum is open, by arrangements.

There are two of us who operate there on a regular basis. Myself and **Bernie G0DDE**. We use a club call MX0WGS when operating at the museum.

The sets that we have are donated and have usually been sitting in a loft, garage etc and sometimes the relations that donate them have no idea what they are. We make them safe with new wiring, capacitors and the like, rather than a full restoration, get them working so people can hear what they sounded like.

One young lad asked me if it was the "old BBC" that he could hear! I had to think about that.

For more information, please look at:

wingsmuseum.co.uk

Barrie Bloomfield G4OKB
Lindfield, W Sussex

*(**Editor's comment:** My thanks for all the suggestions. It's good to know that some much of our radio heritage is being preserved. I just noticed, too, that **Peter Waters** (of Waters & Stanton) has posted on Facebook regarding his visit to the Orkney Wireless Museum – a bit off the beaten track but clearly worth a visit if you're in the area. And we haven't even mentioned our own **Bernard Nock G4BXD's** Military Wireless Museum. All good stuff.)*

Multimeters again

Dear Don,

In his letter which appeared in the February issue of *PW* about the article that I wrote about selecting a multimeter, **Bill Tracey GM4UBJ** makes some very valid points about test leads, some of which were covered in my article and others which weren't.

As Bill says, it is advisable where possible to use probes with finger guards to help prevent fingers slipping down the probes and making contact with the circuit under test. This, along with the need to use good quality, well insulated leads that are free from damage, was mentioned in the original text and its importance cannot be over emphasised.

When making measurements that involve high voltages and/or currents it is advisable to try to connect the test leads by means of crocodile clips or similar before power is applied to the circuit under test. Inserting a multimeter set to measure current into a circuit that draws several amps by merely touching the probes across two points is likely to results in sparking – especially if a good contact isn't made. Far better to have the meter as part of the circuit before power is applied.

Bill advises the use of fused test leads and these are indeed a good idea. However, a word of warning might not go amiss inasmuch that if fused test leads are used, it's a good idea to get into the habit of checking the leads for continuity before and after carrying out the test. A meter reading of zero volts

Letters

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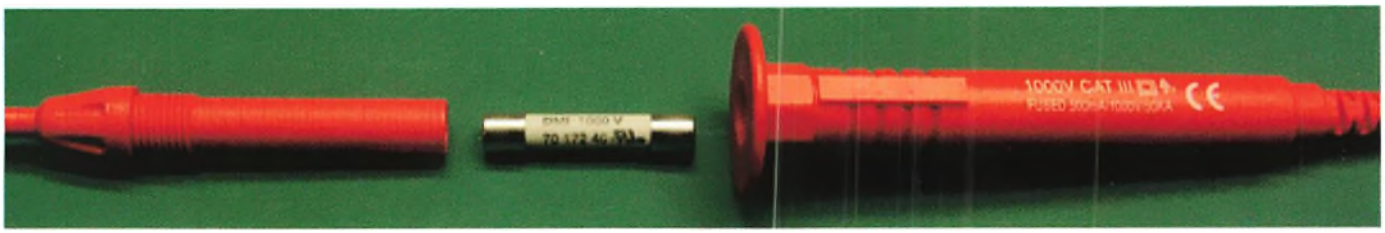


or amps may mean that there is no voltage or current present but it could also mean that the test lead fuse has blown or that the test leads or even the meter itself is faulty. In fact, checking the continuity of the leads is good practice whether or not fused leads are used.

If it is anticipated that measuring mains current will be a regular occurrence, it's worth building a simple test rig with a mains lead and socket with terminals that the meter can be connected to.

Chris Murphy M0HLS
Derby

Dear Don,

That fused test leads are required for connecting multimeters to the mains is a timely warning by **Bill GM4UBJ** (*Letters*, February). It is little appreciated just how much energy can be dissipated if a meter fails while directly on the mains (not through a BS1362 plug fuse). Short-term energy is proportional to current-squared multiplied by the time for which it flows ('I-squared-t' law). The time for a fuse to break might be a fraction of a second, but while this is happening the prospective short-circuit current is very large and, squared, that figure is enormous. Multiply the short time by the huge I-squared to get an almost pyrotechnic release of energy that gives rise to reports of meters exploding into fireballs.

Illustrated (see photo) is the fused test lead that I keep specially for such measurements. It is Cat III rated at 1000V and the high rupture current fuse can handle up to 50, 000A while breaking. Yes, read that figure again, it is not exaggerated. A cartridge fuse blows faster than a miniature circuit breaker can trip (old-fashioned open fuse wire is slower still). As the internal wire melts/explodes, the resulting vapour can maintain the conduction path unless quenched. That's why these fuses are expensive – but worth it. The illustrated example is of 1.25in format.

You have been warned!

Godfrey Manning G4GLM
Edgware

PW Metal Box

Dear Don,

I have purchased on eBay a metal box on the front of which is pressed the words Practical Wireless (see photo). The box is approximately 6 x 4 x half an inch. The seller thought it came free in *PW* in the 1950s.

I have taken *PW* since the early 1960s and have a number of copies of PW up to that date but cannot remember it being contained in the pages?

Can any readers shed light on its provenance?

Andrew Humphriss 2E0NDZ
Stratford upon Avon

RAE vs. Multiple Choice

Dear Don,

I've just spotted that in the February *Letters* pages Ray Howes G4OWY asks if I was taking the mickey and

questions my recollections of the simplicity of the RAE 50 years ago. No, I was not taking the mickey and I have no need to 'recollect' anything because I have my original City & Guilds December 1968 RAE paper in front of me as I write. It's A5 size and there are ten questions. The first two, covering Licensing Conditions and Interference Reduction, are compulsory. Out of the remaining eight, only six have to be answered. As an example, Q3 asks the difference between a permanent magnet and an electromagnet and asks, with the aid of a diagram, for an explanation of the working of either an electromagnetic relay or a moving coil loudspeaker. The other seven being in a similar vein, a time of three hours being allowed to complete the paper, and that was it. I would be quite happy to forward a copy to Ray if he wishes. (A copy of it was recently added to the RSGB Heritage pages).

If that isn't simple compared to today's Foundation, Intermediate and Full Licences, with syllabuses contained in multi-page A4 booklets (the 1969 syllabus was contained on two A5 sides), then I don't know what is.

David Hall G8CLI
Warwick

CW Elitist Snobbery?

Dear Don,

I think it's time to defend CWops and the FOC from all the negative comments in recent *Letters* pages. As a charter member of CWops I would like to point out that they have taught over 2,000 students Morse code, most of whom knew nothing of the code before joining the CW Academy. The Academy is run on a voluntary basis and takes students from all over the world at speeds from 8 to 25WPM and above and is free to anybody who wants to learn Morse code. They also run a contest each Wednesday in three one-hour periods and have special slow sessions in order to encourage new entrants. They present a prestigious award each year to recognise people who have given freely to help

Please note: The opinions expressed in any letter published in PW are those of the named correspondent whose letter has been published and they don't necessarily reflect the opinions of the editorial staff or Warners Group. Editor

with Morse Code and our own **Roger G3LDI** won it last year!

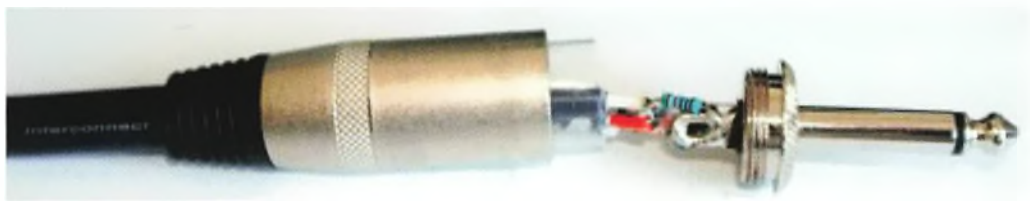
In the FOC handbook it states the following: Rule 4.A. *"FOC operators should send at a speed that is considerate of the other station's ability"*. Rule 5.B. *"FOC members should give encouragement to newcomers"*. These rules are not negotiable – it is the FOC code of Conduct. It may interest readers to know that the FOC has just donated £1000 to buy equipment for the Morse Code Bootcamps that are taking place around the country. So hardly elitist if we do all we can to encourage newcomers to take up Morse code.

I was interested in the comments regarding Morse speeds. *"At sea we would copy at 18-20WPM"*. This is because the operators were writing or typing out the copy. When amateur operators are running at 25WPM and above we are not copying it down, just reading it in our heads. If you had a telephone or SSB contact do you write it all down? No of course not so why do it for CW conversation?

I hate to tell you all but there are many clubs who have higher than 25WPM to join, for example. the excellent German High Speed Club which starts at 25WPM and goes up to the EHSC (European High Speed CW Club) who need 60WPM to join. The legendary Chicken Fat Operators club at 45WPM, all on a keyboard by the way. Fast Operators Club (FOG) 60WPM and, finally, Speed Operators Club (SOB) at a mere 80WPM. They all are on the bands at those sort of speeds and nobody died, they just do it for fun.

Surely as Morse operators we should be working together and making sure that we operate to the best of our ability and help each other. I look forward to meeting fellow Morse enthusiasts at our local Hereford Bootcamp on May 4th. It is going to be good fun...the first of many I hope.

Rich Langford G4FAD
Hereford

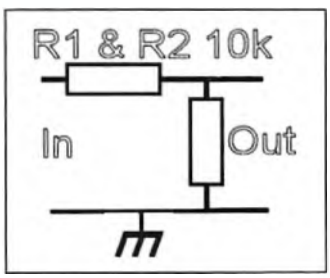


Passive Preamp

Dear Don,

Wherever your journey in radio takes you, the time will likely come when you want to match a high output line audio to high sensitivity input. In my case it was the 2V output of a CD player to the 250mV input of a guitar amplifier for my teenage student. I use an L pad attenuator to balance things out and minimise overload distortion. It also seemingly improves the timbre. Two 10kΩ resistors, one in series the other parallel, see graphic. I install the pad in the shell of a wide body jack plug (to accommodate the thick CD phono leads, see photo) where the two channels are joined for mono. Thank you to **Norman G8ATO** of Verulam ARC for introducing me to L pads. By the way, radio enthusiasts have always been the friend of electric guitarists, for example the legendary (Leo) 'Fender Radio Service': tinyurl.com/leoradio

Bob Houlston G4PVB
St Albans



Igranic Coils and More

Dear Don,

With regard to the Igranic coils marked **"What are the wild waves saying"** (G4GLM, March *Letters*), in 1947 I bought one of the radio sets in a junk shop in Tunbridge Wells for about 5 shillings (25p). What did I do with it? Stripped it down for parts!

It would be interesting to see a photo of the inside of **Godfrey's** set because the wiring was laid out very neatly, all with right-angle bends.

About the same time, I acquired one of the spy receivers MCR1, which I think finally gave up working, so I threw it away. I have regretted what I did with both those units.

With respect to **Andy Cox M0HLT's** mention of wire antennas, *"As much wire up as you can"*, it is probably good to add *"As high as possible"*. The mention of commercial antennas brought to mind that the only one I ever used (second-hand, of course) was in the 1960s, an 8-over-8 skeleton slot for 2m, which I rotated using a cowl-gill motor and gearbox originally used on a WW2 Wellington bomber. It was an excellent antenna but one day a very pleasant elderly neighbour accosted me and said she could hear me when I transmitted. This baffled me until I found out it was only when she was wearing her hearing aid! We did a few tests, and the signal was only breaking through when the antenna was pointing directly towards her detached house. Marking a red sector on the direction indicator where the antenna pointed to her house solved the problem, and we continued to be good friends.

Robert Dancy G3JRD

Classified Adverts

DISCLAIMER Some of the products offered for sale in advertisements in this magazine may have been obtained from abroad or from unauthorised sources. Practical Wireless advises readers contemplating mail order to enquire whether the products are suitable for use in the UK and have full after-sales back-up available. The publishers of Practical Wireless wish to point out that it is the responsibility of readers to ascertain the legality or otherwise of items offered for sale by advertisers in this magazine.

Antennas

G4TPH MAGLOOPS Remote tune and manual tune models. 40m through 10m, 100 Watts, SSB. See PW review on website. Details at www.g4tph.com

Repairs

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

For Sale

MICROPHONES & ACCESSORIES. Replacement microphones for a wide range of transceivers. Cables for Heil and studio microphones, headsets and mixers. PC headset adapters, PTT switches, replacement curly cords and microphone extension cables. DTMF microphones for echolink. For these and more great items go to **www.technofix.co.uk** or **technofix.uk**

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

Wanted

VINTAGE FIREWORK COLLECTOR – do not light the blue touch paper and burn British Heritage, private collector will pay cash and collect from anywhere, licensed explosive storage. Call Tony on 07956 506300

While prices of goods shown in advertisements are correct at the time of going to press, readers are advised to check both prices and availability of goods with the advertiser before ordering from non-current issues of the magazine

Valves

VALVES AND ALLIED COMPONENTS IN STOCK Ring for free list. Valves/ books/ magazines wanted. Geoff Davies (Radio). Tel: 01788 574774.

Order form for Classified Adverts

PLEASE WRITE IN BLOCK CAPITALS

The prepaid rate for classified advertisements is 42 pence per word (minimum 12 words), box number 70p extra. Semi-display setting £13.90 per single column centimetre (minimum 3cm). Please add 20% VAT to the total. All cheques, postal orders, etc., to be made payable to Warners Group Publications. Advertisements, together with remittance, should be sent to the **Practical Wireless Classified Adverts, Warners Group Publications, West Street, Bourne, Lincs PE10 9PH.**

Please insert this advertisement in the ..... issue of Practical Wireless (if you do not specify an issue we will insert it in the next available issue of PW) for ..... insertion/s. I enclose Cheque/P.O. for £ .....(42p per word, 12 minimum, please add 20% VAT to total).

Category heading: .....

Name: .....

Address: .....

.....

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Telephone number:

.....

Please photocopy this form or write on a separate sheet if you prefer

Bargain Basement

Bargain Basement adverts now cost £5 per advert (subscribers still free) and will also be published in *RadioUser*, our sister magazine, unless requested otherwise.

WANTED

LOWE PR150 preselector wanted.
Tel: Stephen on 01582 503806 Luton

OLD HALF INCH FERRITE RODS. Must be half inch 12.7mm in diameter and be six inches long or more. Will pay good money for the rods.
Tel: Peter Tankard on 0114 2316321 between 9AM and 9PM Monday to Saturday

TECSUN S2000 or Grundig version, in good condition.
Tel: John 01933 674056 (Northants)

TRANSISTOR T 165/6, Possibly by RCA. Even better if working.
Godfrey G4GLM. (020) 8958 5113. cgmm2@btinternet.com

FOR SALE

ZLP ELECTRONICS DIGIMASTER PRO3, top of the range digital interface. Complete with interface cables for Kenwood TS-2000. Other interface cable sets are available for most popular transceivers. £80 inc p&p, buyer collect or meet halfway. **Tel: Tim, G7JYQ. 020 8241 9396 g7jyq-tim@blueyonder.co.uk (Kingston-upon-Thames)**

ICOM 718 HF TRANSCEIVER with hand mic, full working condition, with manual. Clean, no marks or scratches. Selling due to upgrade £350 including p&p. **Tel: Gordon 01724 734742 (M0GIQ)**

80M MINI DIPOLE comprising of two Ampro Mobiles and Dipole Centre 4m length 250w. Has only been used indoors. Prefer buyer collects or arranges collection. £30. **Email only: Patrick-carpenter@hotmail.co.uk**

Bargain Basement adverts cost £5.00 per advert

(SUBSCRIBERS STILL FREE) and will also be published in Radio User unless requested otherwise.

BY EMAIL
Firstly email your advert's wording to
kristina.green@warnersgroup.co.uk
and then call **01778 392096** to make your payment.

BY POST
Send your advert to:
Bargain Basement, Practical Wireless,
Warners Group Publications plc,
West Street, Bourne, Lincs. PE10 9PH

Please write your advert clearly in BLOCK CAPITALS up to a maximum of 30 words, plus 12 words for your contact details on the form provided and send it together with your payment of £5 (subscribers can place their advert free of charge as long as they provide their subs number or mailing label). Cheques should be made payable to **Warners Group Publications plc**, credit card payments also accepted.

Please help us to help you by preparing your advert carefully. Any advert which contains ?? marks indicates that the advertising dept. could not read/interpret the wording. Advertisements from traders or for equipment that it is illegal to possess, use or which cannot be licensed in the UK, will not be accepted. No responsibility will be taken for errors and no correspondence will be entered into on any decision taken by the Editor on any of these conditions.

You should state clearly in your advert whether equipment is professionally built, home-brewed or modified. The Publishers of Practical wireless also wish to point out that it is the responsibility of the buyer to ascertain the suitability of goods offered for purchase.

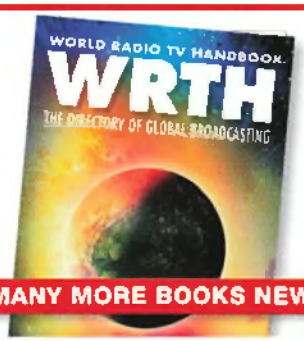
Specialist Dealers

Mid Glamorgan

Scotland

Somerset

Suffolk



MANY MORE BOOKS NEW IN STOCK AT THE PW BOOK STORE ON PAGE 43

Advertisers' Index

Coming next month

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

REVIEW: KENWOOD TS-890 Ron Stone GW3YDX gets his hands on the new flagship HF/6m transceiver from Kenwood. Find out how he rates it.

REVIEW: BAOFENG UV-5RC PLUS Tim Kirby G4VXE looks at the Baofeng UV-5RC Plus, the latest version of the well-known value handheld. At a price of under £30 from a UK retailer, he asks, should everyone have one of these in their shack?

BREXIT AND AMATEUR RADIO Just in case you were wondering ... Steve Telenius-Lowe PJ4DX explains what, if any, impact Brexit will have on operating from Europe.

VALVE & VINTAGE Michael Jones GW7BBY returns with the latest from Internal Fire – Museum of Power. Last summer's season went very well, the new Steam Hall is open and the museum improves day by day.

SECOND-HAND Don G3XTT steps into the second-hand slot to look at the classic FT-1000 series from Yaesu.

There are all your other regular columns too, including *What Next, Morse Mode, HF Highlights, World of VHF, Data Modes, In the Shop, Technical for the Terrified, Starting Over* and *Exploring New Fields*.

The radio... YAESU

The Conclusive Choice

1- Pulling out weak signals during extremely harsh band conditions

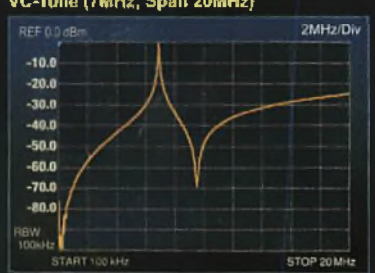
VC-Tune

Unparalleled damping characteristic of –70 dB maximum attenuation

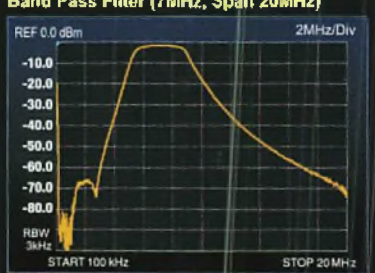
Newly developed VC-Tune RF Preselector with high precision stepping motor drive provides outstanding attenuation characteristics

VC-Tune further improves the high performance RF μ-Tuning system design adopted in FTDX9000, using a remarkable miniaturization design while producing an unparalleled attenuation characteristic of maximum attenuation -70 dB. A high precision stepping motor drives a variable capacitor to continuously cover the band as it follows the movement of the selected frequency by the operator. Fine-tuning for optimum improvement point is also available by MPVD (Multi-Purpose VFO Outer Dial) placed outside the VFO dial.

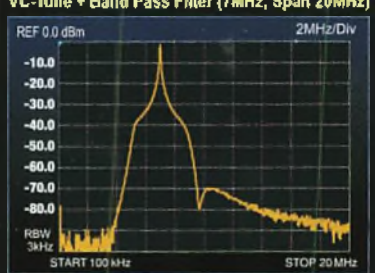
VC-Tune (7MHz, Span 20MHz)



Band Pass Filter (7MHz, Span 20MHz)



VC-Tune + Band Pass Filter (7MHz, Span 20MHz)



Maximum Attenuation: –70dB
–3dB Bandwidth:62kHz

VC-Tune
(Variable Capacitor Unit)

In Homage to the Founder of Yaesu – Sako Hasegawa JA1MP

FTDX101MP 200W

HF/50MHz TRANSCEIVER

The Ultimate

FTDX101D 100W

HF/50MHz TRANSCEIVER

YAESU
The radio

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

For the latest Yaesu News , visit us on the internet at www.yaesu.co.uk