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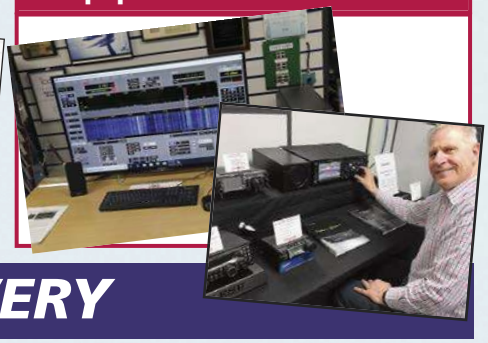

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Keylines

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I've been out and about a bit this month, giving presentations at the Taunton and Weston super Mare clubs. Plenty of *PW* readers at both, I'm pleased to say, with lots of memories of our project blueprints and other aspects of the magazine. I was well looked after at both clubs – my host at Taunton was none other than **Daimon Tilley G4USI**, who has contributed several articles to *PW* in recent years although it was the first time we had actually met.

I have yet to turn to the VHF or UHF bands from my Somerset location but have been back on the HF bands in a reasonably active way since the turn of the year. What I've noticed is that band conditions can be extremely good at times on the lower bands and this was made clear, for example, over the weekend of the ARRL International DX CW Contest. One up-and-coming UK operator, **Jamie M0SDV**, guest-operated at one of the larger UK contest stations and made over 3,000 North American QSOs in the weekend. However, there were none on the 10m band and fewer than 200 on the 15m band. 20 and 40m, though, were buzzing. So why do the bands sound so quiet when there is no contest on? Undoubtedly a big part of the explanation is that nowadays, much of the activity outside contests is focused on FT8 and FT 4 – the band segments dedicated to those modes are often alive with signals strong enough to be workable on other modes. It's reassuring, though, that 40 and 80m in particular continue to be well used during daytime in particular with a variety of nets for groups such as WAB, VMARS and others. Long may it continue.

Recent Gales and Antennas

One aspect of the past month that will have impacted many readers is the strong gales that have passed through. Many had their activities curtailed by having to wind down or dismantle antennas until the weather fronts passed. Others certainly suffered damage. Such weather is a reminder that we need to ensure the mechanical integrity of our antennas. It can be embarrassing, or worse, if they end up crashing through a neighbour's greenhouse, for example (yes, I have heard such stories over the years). My personal recollection is being woken by my wife in the early hours of an October night in 1987 (yes, the hurricane that **Michael Fish** said was impossible) and going out in my dressing gown in driving rain and a howling gale to wind down my mast – a 56ft Hilomast with TH5 Yagi. Not a process I ever wanted to repeat so I have always been particularly careful since.

Bruneval

My son recently passed on to me a book that he had enjoyed, entitled *SAS Shadow Raiders* by **Damien Lewis** (published just last year). It describes an early (1941) special forces raid to capture a German radar set operating from Bruneval on the French coast, covering a strategic stretch of the English Channel. I must admit to not being familiar with the story. Probably like many Brits, I was under the impression that **Robert Watson-Watt** (labelled the 'Father of British Radar') had been one of the main innovators of radar and, indeed, the British top brass of 1941 took some persuading that the Germans were actually ahead in radar development, but this proved to be the case and the raid turned out to be quite a turning point, leading to the use of chaff to 'blind' German radar and to other developments. It's fascinating that stories such as this are still emerging all these years later.

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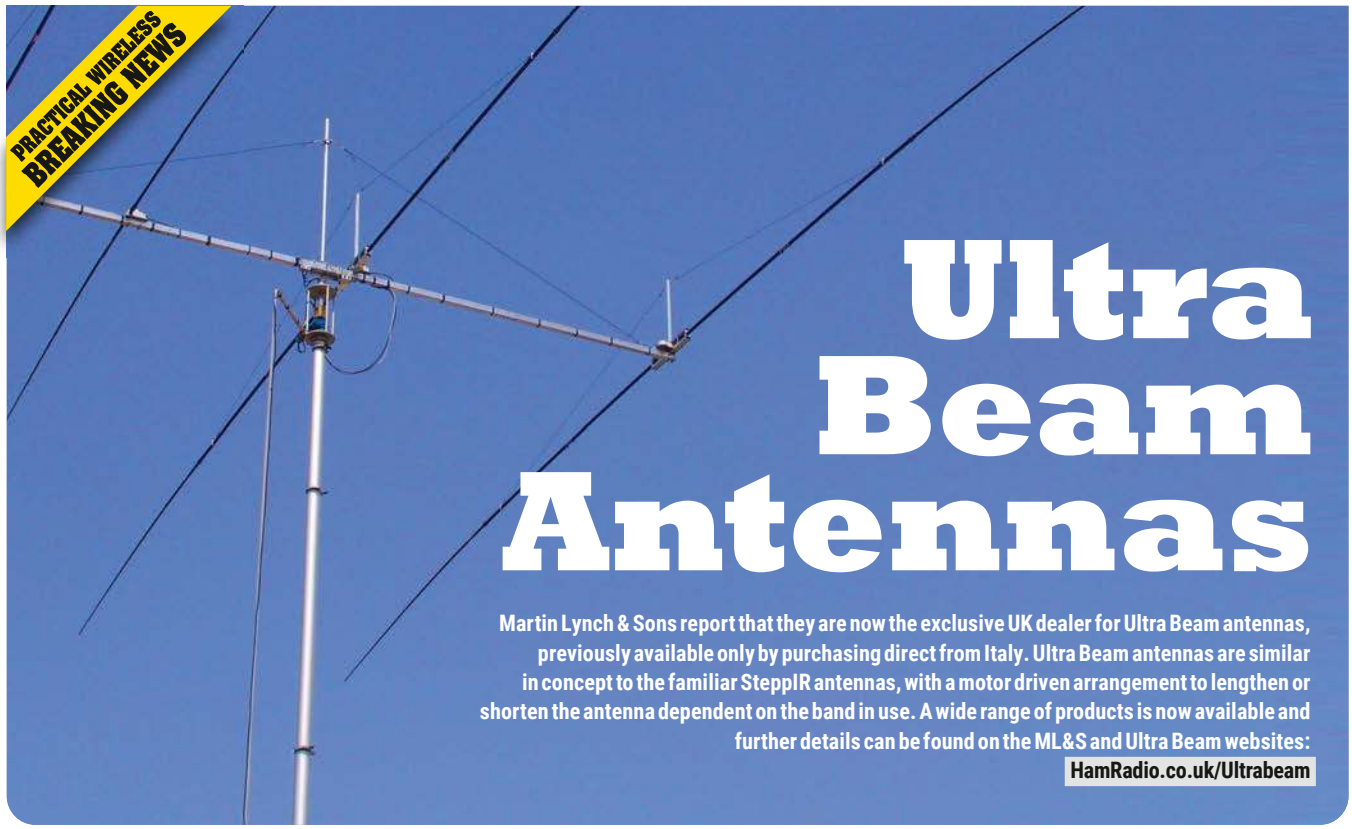
Newsdesk

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



Ultra Beam Antennas

Martin Lynch & Sons report that they are now the exclusive UK dealer for Ultra Beam antennas, previously available only by purchasing direct from Italy. Ultra Beam antennas are similar in concept to the familiar SteppIR antennas, with a motor driven arrangement to lengthen or shorten the antenna dependent on the band in use. A wide range of products is now available and further details can be found on the ML&S and Ultra Beam websites: HamRadio.co.uk/Ultrabeam

Radio News

NEW IARU WEBSITES: "For some time, all parts of IARU have been working to bring together the very different website styles of the three regions and the global site into one single global identity and brand for all four sites. At the same time, new material has been added to broaden appeal of the sites", Don Beattie G3BJ (President, IARU Region 1) reported on January 30th. The new websites are now up and running and all can be accessed direct from the IARU Global home-page:
https://iaru.org

7X7X DXPEDITION SHOWCASES COOPERATION AND YOUTH: (via ARRL News) A cooperative agreement the Algerian and Tunisian IARU member-societies signed in 2014 to reinforce relations through joint activities bore fruit with the 7X7X DXpedition to Algeria late last year. Preparations began in late October 2019, with the goal of activating Algeria on the low bands to benefit from the slump in the solar cycle.
7X2TT kicked off the operation through the Es'hail satellite, demonstrating for the benefit of the younger operators how amateur radio satellites work. The rest of the team built a nearly 40ft tall inverted-L for the 160m band, a full quarter-wave vertical for 80m, a two-element Fritzel Yagi for the high bands; a seven-element Yagi for VHF, a K9AY receiving loop, and a ground plane for 30m, which operated on 40m as well with the addition of a loading coil.
"We did our best to operate two stations at a time," reported team leader Ashraf Chaabane 3V8SF/KF5EYY. "We had quite few technical issues, but we overcame them." 7X7X ended up logging 5,800 contacts in four days.

BITTERN DX GROUP: The Bittern DX Group reports that it has a new meeting place, the Spread Eagle in Erpingham NR11 7QA.
The Club was formed in 2004 and is based in North Norfolk. The Club's aim is to put the emphasis on operation, demonstration and bringing the hobby of amateur radio to the public. But they are also keen contesters on VHF, UHF and HF.
However, their priorities are to get out in the field, to get on the air and to spread the word about amateur radio without the restraints of lectures and evening meetings, especially as there are a number of very good clubs in Norfolk offering that kind of club environment and the Bittern members work with them wherever possible.
The club meets on the last Thursday of each month and there is a regular 2m net. More information at:
www.bittern-dxers.org.uk

FROM MOONRAKER: With internet being a vital part of our hobby internet on the go is a useful commodity. Moonraker have introduced the Maxview Roam, a powerful mobile Wi-Fi solution designed to provide uncompromised internet connectivity, even in remote and rural locations. The powerful roof mount antenna has been designed to maximise 3G/4G signal.
www.moonraker.eu

Radio News

CORONA VIRUS IMPACTS: The Swains Island DXpedition, callsign W8S, scheduled for March, has been postponed because of quarantine restrictions relating to the Corona Virus outbreak (affecting travel within the Pacific area). The team quickly scheduled new dates for the DXpedition of September 23rd to October 6th. The same for the proposed T30ET DXpedition to Kiribati (see HF Highlights), which will now take place in October.

Another effect of the virus on our hobby has been its impact on exports from China. One PW advertiser reports hat there have been significant delays in the shipping of equipment to the UK, especially radios and accessories manufactured in Wuhan Province. Packages are held in warehouses in 'quarantine' before shipping, with no direct contact between the manufacturer's staff and that of the shipping agencies and airlines.

SPECIAL PREFIXES: Chasing special event prefixes seems to be all the rage nowadays and doesn't necessarily require the best HF propagation because many are active from Europe. Here are some forthcoming ones to look out for.

Grupo DXXE of Mexico is celebrating its 15th Anniversary this year with several special callsigns from different countries where there are DXXE members.

4A1DXXE, the flagship call, will be active on all bands, all modes, including satellite and EME, through 2020 mostly during contest and special dates. Several XE operators will make this possible. QSL via LoTW only.

|AO15DXXE will be active from Spain from April 1st to 15th. Operator Salva EA5BB.|AO15DXXE/8 from Canary Islands will be on the air also on April 1st to 15th. Operator Juan EA8RM.

TM15DXXE also active from April 1st to 15th in France by Thierry F4GVO. He will be active on SSB, FT4, FT8, from 6 to 80m.

Expect a few more DXXE Anniversary special callsigns.

R207RRC, by the Russian Robinson club, will activate Kosa Dvukh Pilotov Island (new IOTA AS-207) from April 3rd to 10th.

ARI (Italian national radio society) Fidenza planned to use a series of special callsigns throughout the year to commemorate 12 major events and achievements in the life of Guglielmo Marconi's. Here are the remaining ones.

MARCH: II4MCY, Foundation of the first Marconi Company (1897).

APRIL: II4FTX, First transatlantic radio signals transmission (1901).

MAY: II4TEA, First radio message between the United States and the United Kingdom (1903).

JUNE: II4REP, Rescue of the ocean liner Republic (1909).

JULY: II4NBL, Marconi is awarded the Nobel Prize in Physics (1909).

AUGUST: II4CLT, Inauguration of the radio station at Coltano (1911).

SEPTEMBER: II4PTN, Marconi applies for his first patent (1896).

OCTOBER: II4LGH, Marconi switches on the lights at Sydney Town Hall from Genoa via wireless transmission (1930).

NOVEMBER: II4RVT, Inauguration of Vatican Radio (1931).

DECEMBER: II4MDY, Marconi Day at Chicago World's Fair (1933).

QSLs via IQ4FE, bureau or direct. See website below for details of the Marconi: Genius and Brainwave award.

http://arifidenza.hamlogs.net

NEW IARU REGION 1 134GHZ RECORD: Michael Kuhne DB6NT and Roland Becker DK4RC have achieved a new distance record of 65km on 134GHz. On December 29th, they exchanged reports on both CW and SSB in this cutting-edge amateur radio band. The challenge at these frequencies is the absorption of signals as they pass through the atmosphere. The Kuhne name will be well-known to many readers as manufacturer of leading-edge gear for the VHF, UHF and microwave amateur radio bands. For further details of the record-breaking QSOs, see: www.ok2kkw.com/next/122g/db6nt_134g_65km.htm

IOTA ANNUAL LISTINGS: The IOTA Programme 2020 Honour Roll and Annual Listings are now on the IOTA website (below). There is a total of 1,647 entries, a slight increase from the previous year, with early 2020 submissions indicating a further increase. 253 participants now have scores of over 1,000 or more IOTA groups. 590 have at least 750, which is the Plaque of Excellence level. 63 now are above the 1,100 level. 9A2AA has the most, a total of 1,129 out of a possible 1,133 that have been active. I2YDX and I1JQJ are close behind.

www.iota-world.org

QARMAN AND PHOENIX CUBESATS DEPLOYED FROM ISS: (from AMSAT website) The von Karman Institute in Belgium (VKI) reported the successful deployment of the QARMAN satellite from the International Space Station on February 19th. QARMAN is one of several CubeSats that were scheduled for deployment that week. Also, Arizona State University reports that its Phoenix CubeSat was successfully deployed from the ISS as scheduled. Roughly 30 minutes after deployment, its beacon was heard for the first time at an amateur radio ground station located in Indonesia.

VKI also reports successful reception and decoding of telemetry from QARMAN. It is important to note that both of these satellites are using the same frequency, 437.35MHz, for telemetry transmissions, and that they are in very similar orbits. Both satellites also follow the AX.25 protocol at 9600 baud, with GMSK modulation. It will take some trial and error before each spacecraft's TLEs can be confirmed.

Noting the prevalence of CubeSats built and launched by universities and other organisations, AMSAT has adopted a goal of 'amateur radio in every CubeSat.'

Operating on Oscar 100

Bernard Nock, G4BXD
military1944@aol.com

Readers will know from our VHF column that **Bernard Nock G4BXD** has been having plenty of success operating through Oscar 100. Here he describes his setup.

When I first heard about this geostationary satellite carrying amateur radio I was very excited. Then I realised I had to operate on the 2.4 and 10.4GHz bands. Having never operated above 70cm I was somewhat filled with dread.

However, after a bit of research on the web I came to the conclusion that it might be within my abilities. The equipment was available so the race was on. First a quick bit of background.

It seems the Saudis were putting up a TV satellite and under the cover of darkness the German Amateur Radio Society managed to bungee a little amateur radio transverter to the side of the satellite before it went off for launch.

No, not really. Qatar-OSCAR 100 is the first geostationary amateur radio transponder, a joint project between the Qatar Satellite Company (Es'hailSat), the Qatar Amateur Radio Society (QARS) and AMSAT Deutschland (AMSAT-DL), which provided the technical lead. OSCAR-100 is hosted on Es'hail-2, a Broadcast Transponder Satellite owned by the Es'hailSat Qatar Satellite Company. The satellite is now in geostationary orbit at 25.9°E.

What's Needed

So, the basics are, you need to transmit on the 2.4GHz band, between 2.400050GHz and 2.400300GHz, a 250kHz wide slot, and receive between 10.489550 to 10.489800GHz. The satellite's transverter, or transponder, is a linear type – the low end input comes out at the low end output, while the high end input comes out at the high end output.

It turns out that the receiving side of things is quite easy. Firstly, there is a WebSDR, hosted at Goonhilly Earth Station in Cornwall, enabling you to listen to the Qatar-OSCAR 100 Narrowband transponder onboard the Es'hail-2 satellite (see link below). It's a good idea to look at this website first to get a better idea of the frequencies involved and the suggested bandplan for using the transponder.
https://eshail.batc.org.uk/nb

Secondly and luckily, the frequencies involved in reception are within those we normally use for satellite TV reception. So, you take a standard Low Noise Block (LNB) converter, used all over the country, and the satellite dish associated with it, point the dish in the right direction and, using either a cheap SDR Dongle or an expensive SDR receiver, receive the satellite on your PC or laptop with software freely available.

1

Unfortunately, not all aspects are easy. Standard LNBs are fine for satellite TV but their oscillators are not the most stable around. The oscillator can shift tens of kilohertz during the day as the LNB cools or warms up. One of the best software programs around, SDRConsole by **Simon Brown**, has the facility to lock the received signal to a beacon the satellite transmits, which has the effect of locking the received signals and making reception of SSB and CW possible.

If you want to receive the satellite on your amateur radio setup, then you need to modify the LNB's oscillator. The usual method is to feed in an external reference oscillator signal. LNBs with twin outputs are ideal. One is used as an output while the other is used to feed in to the LNB a stable reference oscillator signal. You then need to convert the output of the LNB, around 739MHz, down to your radio's band, typically 2m or 70cm.

To aid the reception of the satellite's transponder it transmits two beacons, which also serve as band edge markers. On 10.489550GHz is a CW beacon and at 10.489800 is a 400Bit/s BPSK transmission. On an SDR screen these two beacons are easily seen and useful for setting up your system.

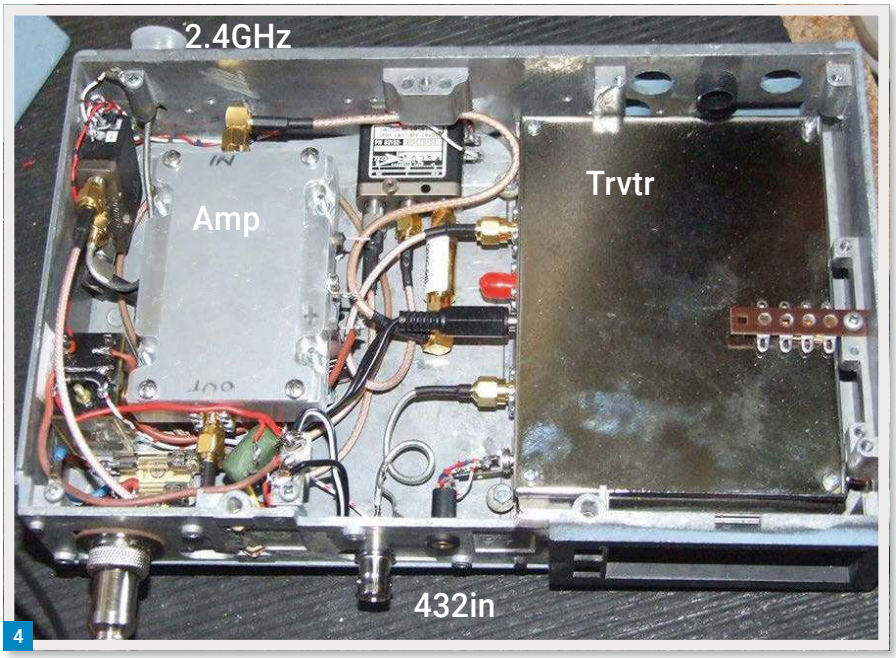
Transmit Side

Transmit-wise you simply need to generate your SSB or CW at 2.4Ghz. This could be by using an HF rig. I use my FT-817, which is a popular driver, and either a 13cm transverter or dedicated up-converter. The usual driving frequency is 2m or 70cm so any multimode (but note though that FM is not allowed through the satellite) whose RF output can be reduced low enough to act as a driver can be used. You could even use a 28MHz to 70cm transverter then transvert up to 2.4GHz.

Antenna

Once you have some RF at 2.4GHz you need an antenna to launch it towards the satellite. You can use a standard Yagi antenna. The preferred uplink signal is Right Hand Circular Polarised (RHCP), which will give the best results so a Helix beam can be used but a linear mode beam with vertical or horizontal polarisation will work, albeit with a slight loss of about 3dB.

The normal method is to use a dish. Again, the standard TV satellite dish is ideal. While a 60cm diameter dish will work,



an 80cm dish or even 1m is far better and with its extra gain means you don't need so much RF power. The feed for the dish can be a Helix or Patch feed system to give you the circular polarisation. If you're using a dish, then the helix or patch needs to be Left Hand polarisation because it will be reversed by the action of the dish reflector.

As to the power needed, I use my FT-817 turned down to about 150mW, which feeds a DXPatrol up-converter with a small Wi-Fi amplifier after generating 2.3W at 2.4GHz. This I feed to an LHCP patch feed on a 1.1m offset dish and receive excellent reports with ease.

Other Options

The super little 13cm transverter made by SG Labs is also usable. It can be switched internally to cover not only the 2320MHz band but also the 2400MHz band enabling it to be used on the satellite for transmit at least. Another supplier is Kuhne of Germany, who make some very nice looking equipment but their prices are a bit higher.

You can also use SDR devices such as the Lime and Lime Mini and the HackRF SDR. The Adalm-Pluto SDR is a popular device with many users on the satellite already. These devices can be used to receive and transmit using various software packages but usually require quite a bit of additional hardware to get them fully functioning. Pluto users often replace the onboard oscillator to improve stability but this requires soldering surface mount devices and the like.

In Use

Using the satellite is just like operating on, say, the 20m band. You can tune around and listen to QSOs. You can wait for someone to call CQ or you can find a clear frequency and net your transmitter to it. There is the slightly odd effect of delay though. With the satellite sitting at 36,000km up, and its being able to see 40% of the earth's surface, the signal time there and back plus a bit of processing time in the transponder means there is something like half a second or more between transmitting and receiving your own signal back.

Fig. 1: The web-based screen. Fig. 2: My two dishes used on QO-100. Fig. 3: The DXPatrol up-converter and amplifier. Fig. 4: The SG Labs transverter and amplifier.

This is not much of a problem on SSB but on CW it can be hard for the brain to process the two sounds, your sidetone and the returned carrier. You can, of course, lower the audio on the receiver while transmitting but it's very helpful to hear yourself, and see your signal if using SDR and screen to ensure you're using the transponder correctly.

If you are using a separate receiver or SDR and transmitter, you will need to make a note of the frequencies of your sets. If you are lucky, there is a correlation between the up and down frequencies. On my system if I am

Fig. 5: The Lime and Lime Mini SDR units.
Fig. 6: The HackRF and Pluto SDR units.

receiving on 10.489750GHz, for example, my 70cm frequency for the uplink will be 432.275Mhz, the last two digits being in sync with the down link. .725 down is .225 up. A good idea is to draw out on graph paper the relationship between the up and down frequencies in your setup so as to make netting quicker. It's bad manners to simply transmit and swish your carrier about until you reach the frequency required.

If you use a down converter to get the received signals on 2m, say, and use 70cm as the driver for the up-link, you may be able to use a dual-band set such as the FT-845, FT-736R or IC-9700, which allows duplex working and you can lock the two together so that the one band tracks the other.

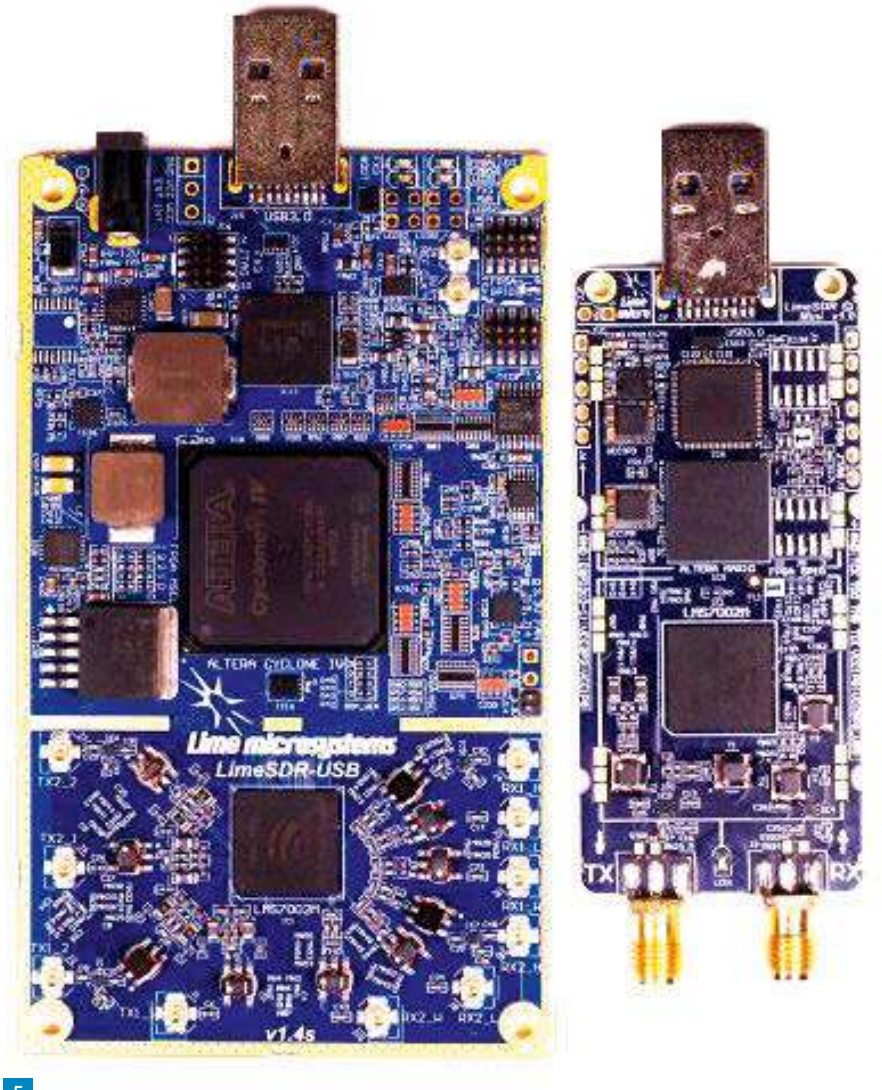
Many operators use a GPS-locked receiver to provide a 10MHz or similar reference signal, which can be used to lock up the LNB, down converter, up-converter or transverter and driving rig to ensure maximum stability. The thought that some operators with new £2k or so transceivers have to stick a 10MHz signal in the back to make it stable is somewhat worrying to me but that's another topic.

DigitalTV

In addition to what's termed the narrow band transponder the satellite can also receive and re-transmit amateur digital television signals.

QO-100 is the first amateur radio satellite with a wideband (WB) transponder for DATV operation. The DATV beacon is currently sending an endless loop to provide users with help with receiving and optimising the receiving system. The video beacon has the following parameters: 10492.50MHz DVB-S2 2 MSym/sec QPSK FEC 2/3 Rolloff 0.2 WebSDR with spectrum display and chat A real-time spectrum display. I'm assuming if you're already into digital TV, this all means something to you.

All in all Oscar 100 is a wonderful piece of technology and while at first seems daunting to operate through it, this can be achieved in a short time span after acquiring a few bits of relatively cheap hardware. The recent arrival on the satellite of a fixed station in the Antarctic shows just what can be worked via this new facility. Its footprint covers the whole of Africa, Asia, India, Europe and as far east as Thailand and west as far as Brazil. Have fun.



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100 Years of the UK Long-Range Maritime Radio Service

Larry Bennett G4HLN
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Larry Bennett G4HLN looks back on 100 years of the UK Maritime Radio Service and, in particular, the history of Portishead Radio.

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2020 marks 100 years since the Post Office inaugurated the UK's first long-range maritime radio service. Utilising former army huts located on Morgan's Hill just outside Devizes, the station (operated by the Post Office) provided long-wave radiotelegraphy communications to and from suitably equipped vessels. The station formally opened in August 1920 with a service operating on a wavelength of 2,100m with a transmitter power of 6kW. Two tubular steel masts of the Marconi pattern were used, with a height of 300ft and spaced 600ft apart. A double cage dipole of length 250ft was erected, each cage consisting of three wires spaced equally around a hoop of 3ft diameter. By 1922, annual traffic figures of over 150,000 contacts and over 3 million words were handled. The photo, **Fig. 1**, shows the station in 1925.

By necessity a second transmitter was installed in 1924 operating on 2,400m and a new receiving station at Highbridge (just outside Burnham-on-Sea) in Somerset was opened on February 2nd 1925. The transmitters were remotely controlled from the Highbridge site by landline.

As traffic levels increased, it became clear that the Devizes transmitters were not performing adequately, and a new transmitter site at Portishead, near Bristol, was constructed. This opened in 1928 and continued to expand as the service developed.

A higher-power transmitter at Rugby was also used to broadcast messages to ships, although this station did not have receiving facilities, which continued to operate from Highbridge.

The Portishead transmitting site, **Fig. 2**, commenced in earnest in December 1927 on 119kHz on high power and on 143/149kHz with six low power transmitters. The transmitting aerials were supported on four 300ft lattice steel masts of 8ft square cross-section, and were carefully designed to minimise interaction at such close frequencies. These proved to be extremely successful and as a result the Devizes site closed in 1929.

The same year, the Highbridge receiving station maintained a watch on short wave for a few hours a day with a single receiver and a borrowed transmitter. Maritime use of the short-wave wireless telegraphy service continued to grow, and technical facilities at Highbridge and Portishead were improved.

The original short-wave transmitter, operating on 18/36m (GKT/GKC) was supplemented by four 20kW transmitters of Post Office design in 1936. In addition, primarily for the cruise liner *Queen Mary*, a rotating beam antenna was constructed; four medium sized telegraph poles mounted on a lattice platform supported the antenna, driven around by a sprocket and chain mechanism. The next photo, **Fig. 3**, shows the operating room in 1938.

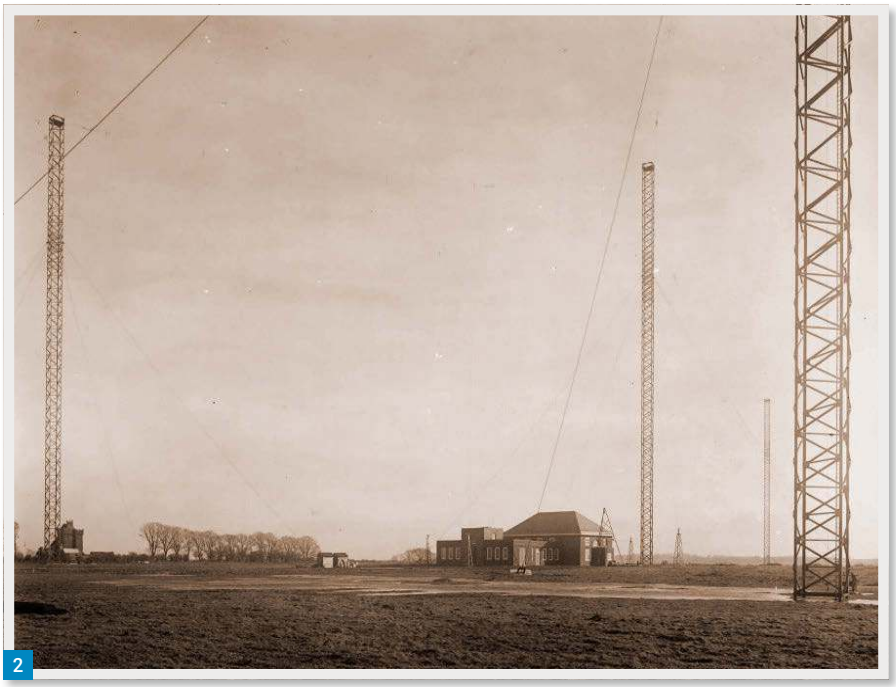
Communication with flying boats (which carried suitable equipment and a radio operator) over the Atlantic Ocean and the Mediterranean also took place on a regular basis, which became the precursor to the aeronautical radio service that developed shortly before the Second World War.

Wartime and the 1950s

The station became a vital tool during the conflict, although the operating methods changed dramatically. Vessels would maintain radio silence unless in distress, so all to-ship traffic was broadcast twice, and no acknowledgement of receipt would be given. In order to provide a 24-hour listening watch, all merchant vessels employed at least three radio officers, each on an 8-hour shift. The station was instrumental in training radio officers prior to their deployment on allied vessels, and also provided an aeronautical service handling traffic from Atlantic patrol aircraft. The rotating aerials, originally designed for the transatlantic cruise liners, were utilised for this service.

Communication with SoE (Special Operations Executive) agents and liaison with the Government Wireless Stations also took place, and a new method of communicating with ships was established. The world was divided into specified 'Areas' and Admiralty radio stations in each area were linked. This

Fig. 1: Devizes radio station c. 1925 (William Welch collection). Fig. 2. Portishead transmitter site 1928 (BT Archives). Fig. 3. Highbridge receiving station c. 1938 (BT Archives). Fig. 4. W/T operating wing 1951 (BT Archives).



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meant that vessels outside the normal coverage area could contact their local station and have their messages relayed back to the UK over Admiralty circuits. This scheme was further developed at the end of the war and became the much-loved 'Long-range Area Scheme', which continued until the early 1970s.

A Royal Navy presence was established at the station, and this continued until the early 1970s. Such staff also assisted with communication with merchant ships, although their primary purpose was to maintain regular contact with RN vessels.

At the end of the war, traffic levels increased drastically, meaning that the station desperately needed to expand. A station expansion was planned, with a new 'Control Room' being built, which contained large steel wall maps and a Ships Bureau position, which held details of all known vessels, their callsigns and last known position. These would be plotted on the maps together with details of which 'Area Station' the vessel would be monitoring. Three new operating wings were built, two of which contained 16 W/T operating positions, **Fig. 4**, and the other a landline and broadcast area.

This station was opened in 1948 and soon became the most highly-advanced maritime radio station in the world, with high-quality receiving aerials of rhombic design spaced every 15° and modern Marconi CR150 and CR100 receivers. Marconi PS213A keys were installed on each console, although these were modified by Post Office engineers in 1950.

The station was still exclusively radiotelegraphy. The radio telephone service was handled by transmitters at Rugby and receiving terminals at Baldock, Brent and Bearley, all linked to the international telephone exchange in London.

Many high-traffic shipping companies decided to install private wire telex links directly to Portishead Radio, ensuring that their traffic would be delivered directly rather than via the telegraph network. In addition, the Meteorological Office, the Admiralty and Lloyds of London also set up direct links to the station.

The Suez crisis in 1956 brought even more traffic to the station, with vessels needing to undertake longer voyages due to the closure of the Suez Canal. This, of course, resulted in further recruitment to cater for these high traffic levels.

The 1960s saw the introduction of the Telex Over Radio (TOR) system, which enabled ships and shipping companies to send messages more efficiently and cheaply. Calls were charged by the minute rather than per word, and many ships became so equipped during the decade.

That same year, the station became involved in the now legendary *Sunday Times* Round-the-world 'Golden Globe' yacht race. Many famous yachtsmen took part, including **Chay Blyth** and **Robin Knox-Johnston**, but the race became renowned for the involvement of **Donald Crowhurst** and his yacht *Teignmouth Electron*. The story of the race is well-known and well-documented, although suffice it to say that the position reports given by the vessel placing him off the coast of South Africa and the Indian Ocean were all received on an aerial at Burnham-on-Sea pointing southwest. This alerted the staff at the station that things were not as they seemed. In reality, Crowhurst was circling around in the South Atlantic giving false positions.

There have been numerous TV documentaries about the above events, and two feature films, *Deep Water* (which is factually based) and *The Mercy* (which is a dramatisation of events), have been released.

The 1970s

The 1970s may be remembered for the numerous changes that took place at the station. In the first couple of years the aforementioned 'Area Scheme' was closed, the Naval presence at the station ended, and in 1970 the Radiotelephone service was moved from Baldock to Burnham-on-Sea, although still utilising the transmitters at Rugby.

The R/T service was housed in a small area at the end of 'C' wing, **Fig. 5**, but only three consoles were available. In order to provide enough facilities, existing terminals at Somerton (a former point-to-point station) were used, staff being

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transported there daily from Burnham-on-Sea by minibus.

The cessation of the 'Area Scheme' in 1972 was probably the most controversial, although it was actually out of the station's control. Many of the participating area stations were located in newly-independent countries who no longer required Admiralty involvement. Although these stations continued to operate, they no longer provided a free relay of traffic back to the UK. This meant that vessels requiring to send messages back to the UK had to communicate directly with Portishead or pay the expensive landline charges of the nearest coast radio station. The station tried to assist vessels in such 'hard to reach' areas by introducing a 'Pacific Watch' and 'Sector Watch' where the station would listen for ships in the Pacific and South-East Asian areas at set times and on specific frequencies. Obviously, this relied on good radio propagation and the skill of the shipboard radio officer to select the optimum frequency and time to communicate with the station.

The Naval presence ended in 1972, the RN having established their own communications network. However, the station continued to handle personal radiotelephone calls from RN vessels on a regular basis until closure.

Traffic levels continued to rise. Figures from 1974 indicated that over 20 million words were handled by a staff of 154 radio officers. A new operating wing was built in 1971 called 'D' Wing, with 12 new W/T consoles, **Fig. 6**. These new consoles were of a totally different design, and although using the new Racal RA1217 receiver (which replaced the ageing CR100s), new Morse keys had to be ordered. No modified Marconi PS213A keys were available for the new wing, so new 'Elektrisk Bureau' (EB) keys were purchased. 'D' Wing also handled the 'Trawler Watch', which maintained contact with the deep-sea trawler *Miranda/GULL* to exchange weather messages and trawler reports from the North Atlantic.

It became clear that the existing station would not be able to handle such an increase in traffic, so in 1976 plans were drawn up to construct a new operations building on land adjacent to the existing station. This would incorporate a new computer-based message handling and delivery system, automatic radiotelex and new communication receivers.

The Portishead transmitter site closed in 1978, and the aerials subsequently removed. Transmitters at Rugby, Leafield and Ongar were modified to cover the maritime service, and transmitters at Dorchester were also utilised for a short time. However, the station continued to be

Fig. 5. Highbridge R/T section c. 1978 (Author's collection). Fig. 6. W/T operating consoles in 'D' WING c.1982 (Author's collection). Fig. 7. W/T section, Highbridge c. 1983 (BT Archives). Fig. 8. Portishead Radio Aeronautical Console (BT Archives). Fig. 9. The last hours of the station entrance building 2007 (Author's collection).

known as Portishead Radio.

The first new building at the Burnham-on-Sea site opened in 1979. This was the staff restaurant and welfare block, which also had a lounge area and bar – much to the delight of the staff on the evening shift. The restaurant was very well used and numerous social functions took place over the following 20 years or so.

The 1980s

The advent of satellite communications was becoming a real concern, although there was little initial impact. Experiments in transmitting and receiving messages to and from ships using basic satellite links had taken place in the early 1970s in association with the vessel *Atlantic Causeway*. However, terrestrial radio traffic figures still continued to rise, and recruitment of staff continued unabated. Newly-qualified radio officers without sea experience were employed, although a six-month training course and a one-year probationary period were required to bring them up to the high standard required.

The new operations building was opened in 1982, with the R/T service becoming the first section to successfully move across. Staff were trained in the new procedures required for W/T traffic handling in the old building before it too was moved across in stages – 22MHz firstly, followed by the remaining sections. The W/T consoles, **Fig. 7**, were equipped with Racal MA1075 receiver front panels, the actual receivers and aerials being located at Somerton with a microwave link providing the control lines. Katsumi EK-150 electronic keys were provided at each point, together with hand-made Morse keys based on the Marconi PS213A model. These were made by the BT Engineering Workshops at Rugby and only 80 were ever made. Of course, staff could use their own keys if required, and provision was made on each console for this.

Radiotelegrams were handled using the new message handling system, which was controlled by a large Honeywell 606 processor, housed in its own temperature-controlled room. This system did away totally with the landline room, messages from ships being delivered directly from the W/T console, and to-ship messages being formatted by staff before being held in the processor for delivery by Morse code when the desired ship next called. An interesting combination of new and old technology.


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The radiotelex system was the last to move across and was virtually automatic. Ships could enter the telex number of the desired destination without the need for operator involvement, and also receive any to-ship messages on request. There would, of course, be a degree of editing involved, but if shipping companies followed the formatting rules, then no operator involvement was required.

Apart from ships, other services such as relief agencies, charities and industries located in countries when no landlines existed used the radio telex service. This was known as the 'Gateway' service, and was extensively used by Oxfam, the Red Cross, and Médecins Sans Frontières (MSF), for example.

The aeronautical radio service was re-established following trials with Dan-Air and other companies. Staff were tasked with investigating the feasibility of such a service, and it became clear that a market did exist within the UK. Two European stations (Stockholm and Bern) already provided such a service, although their call rates back to the UK were expensive. Therefore R/T consoles were modified to work on aeronautical simplex frequencies, **Fig. 8**, and many UK-based airlines used the service for a number of years. Selcall units were installed allowing the station to alert aircraft that a call from their Operations office was required, and quick-tune transmitters and rotating log periodic aerials were installed at Rugby. In fact, Eastern Airlines of the USA used the station as their European base station, and

the station won an international award for the 'fastest-growing aeronautical radio station in the world'. Users of the 'Gateway' service also used the aeronautical frequencies, which made the consoles extremely busy at times.

The remainder of the decade saw the closure of the transmitter sites at Leafield and Ongar, leaving Rugby as the only transmitter site used for the maritime service.

The 1990s

Sadly, the 1990s were to be the last decade of the service. Satellite communication had become firmly established, and the introduction of GMDSS (Global Maritime and Safety System), which would become mandatory for all vessels over 300 GT in 1999 forced vessels to install Inmarsat equipment.

Traffic levels fell considerably and the number of operating consoles was reduced accordingly. Staff who left or retired were not replaced, and other BT groups moved into the building as the radio station contracted. The staff restaurant and welfare block closed and it was clear that the writing was very much on the wall.

However, in 1995, the station celebrated 75 years of the service with various events designed to keep the station in the public eye, with TV reports, national press articles and the first of many staff reunions. Only 100 ships a day were being worked on W/T, and the total establishment of staff was reduced to fewer than 50. Some staff were moved to other departments within BT, and in 1998 moves were made to finally close the service.

On Sunday April 30th 2000, at 1200 GMT, the last broadcast from the station took place, witnessed by a crowd of over 200 ex-staff and media reporters. Within minutes of the closure, engineers commenced work on dismantling the consoles. A sad day in many respects, and in many ways the end of an era.

The text of the last broadcast is reproduced below:

CQ CQ CQ DE GKB2/4/5/6 =
THIS IS THE LAST BROADCAST FROM PORTISHEAD RADIO. FOR 81 YEARS WE HAVE SERVED THE MARITIME COMMUNITY. WE SAY THANK YOU TO ALL THOSE WHO HAVE SUPPORTED AND USED OUR STATION. WE PAY TRIBUTE TO MARCONI WHO MADE IT ALL POSSIBLE. HIS FIRST TRANSMISSIONS ACROSS WATER WERE MADE FROM NEARBY HERE AND SO STARTED THE RADIO ERA. WE ARE PROUD TO HAVE BEEN PART OF THAT ERA. AS THIS HISTORIC TIME IN THE COMMERCIAL MESSAGING WORLD COMES TO A CLOSE THE MANAGER AND RADIO OFFICERS WISH YOU FAREWELL FROM PORTISHEAD RADIO/GKB + VA

The buildings continued to be used by other BT departments but the site was sold to housing developers in 2004. The station was demolished in 2007, **Fig. 9**, to make way for the 'Mulholland Park' development, named after the former station manager **Don Mulholland** and his father **Robert**, who also worked at the station.

Sadly, there is currently no indication that the famous station ever existed on the site. However, efforts are in hand to try to erect some sort of memorial and plaque to record the history of the station, and this anniversary year will be an opportune time to get this arranged.

It was a wonderful place to work, full of local characters and friendships that continue to this day. Staff reunions and meals take place on a regular basis, and the radio station website (below) ensures that the name will never be forgotten.

www.portisheadradio.co.uk

Portishead Radio – we salute you.

Soldering Coax Connectors (Part I)

Tom Morgan ZS1AFS advocates the Bill Orr Method for making the right connections.

Tom Morgan ZS1AFS
zt1tzs1afs@gmail.com

When I first came into amateur radio in the early 1980s I had no internet (if it existed). My station, on the top of Dollis Hill, London NW2, was a donated Hammarlund 180 receiver and a Minimitter (one knob tuning!), on loan from the patent holder **David G2DOJ**, now a Silent Key.

My information came from books. Remember those? One of my first books was *Simple Low Cost Wire Antennas* by **William I Orr W6SAI** & **Stuart D Cowan W2LX**. My copy fell apart through constant use. Fortunately, my daughter found me a new one for my library, **Fig. 1**.

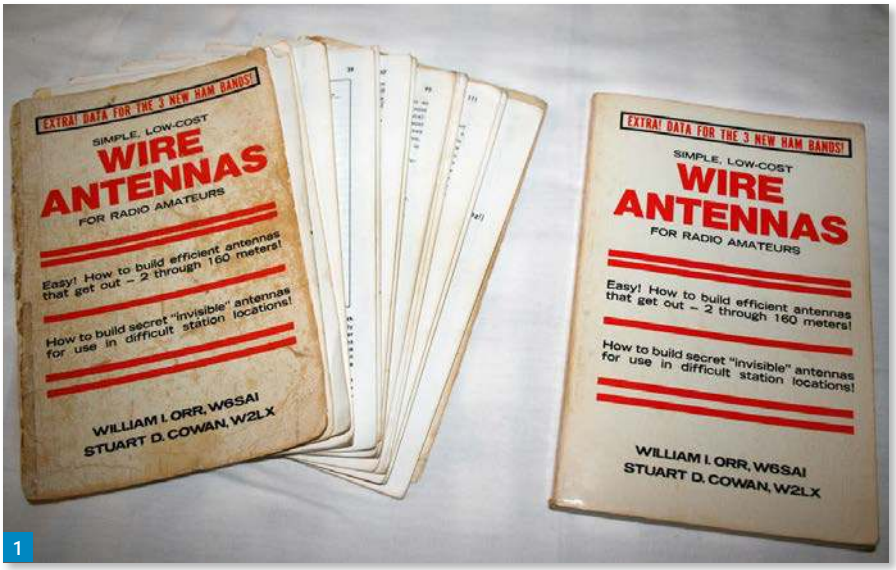
I built my first antenna using Orr's Universal HF Antenna as a guide. It was supported by a neighbour's tree. The dimensions were a lot smaller than those in the book but it worked! One of my earliest contacts was with Brunei on 20m.

Since then, equipment has changed dramatically but some aspects remain the same. Putting plugs on the end of coaxial feeders still has to be done. Some time ago *QST* magazine had discussions on this topic. One well-known DXer advocated soldering of the outer braid to the top of the collar of the body of the plug and then heat shrinking the assembly [1]! I followed Bill Orr's advice, and **Susan ZS1AFR** does the soldering. This is the advice is for RG-8 (RG-213) and a further piece relating to RG-58.

Fitting a PL-259 Plug

(See the photo, **Fig. 2**, while following these steps).

1. Make sure the outer ring of your PL-259 is put on the cable the correct way around. Do this first, I know what happens if you don't.
2. Take your RG-213 and remove 1.5in (4cm is OK) of the black outer cover using a craft knife taking care not to nick the braid.
3. Quickly tin this braid smooth. (You don't have to go all the way to the end. See 4 below). Take care not to overheat the cable. This avoids melting the insulation.
4. Cut the braid so that 7/16in (1.2cm) is left on the cable end. Mark a line at this distance from the outer cover. Then, set the wheel of a small, or 'midget', plumber's pipe cutter over the line/mark. Tighten with each turn until the braid is sliced through. Be careful not to cut through the insulation.
5. Snip off the braid with a pair of wire cutters or scissors.
6. Trim the insulation to leave a collar 1/16in (1.5mm) wide beyond the soldered braid. Do not nick or bend the centre conductor. Once free, the slug of insulation can be slid off following the twist of the wires.
7. Tin the exposed centre conductor.
8. Push the prepared cable into the plug body. Ensure the inner conductor lines up with the centre pin before pushing. Gently turn until the inner tinned braid is completely visible through the holes.
9. Trim the centre conductor and solder to the plug tip. Ensure that the pin is flush with the end of the tip.
10. Solder the braid through the holes quickly, to ensure the insulation does not melt.
11. When the plug cools down, screw the outer ring into position,
12. Connect to equipment socket and have fun.



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The RG-58 Bill Orr Method

(See the photo, **Fig. 3** when working through this one)

1. Place the outer screw ring over the cable, open side facing the cable end.
2. Place the adapter (if needed), narrow end towards cable end.
3. Cut 3/4in (20mm) of outer plastic from the cable. Be careful not to nick the braid.
4. Fan the braid and fold it back on the adapter, trimming to about 3/8in (9mm).
5. Remove 5/8in (1.6cm) of inner insulator without nicking the central connector. This leaves a small insulation gap between the braid and inner connector.
6. Tin the central conductor before insertion into the centre pin of the plug.
7. Gently screw the plug body onto the adapter without moving the cable.
8. Solder the braid through the holes of the plug using a small soldering iron.
9. Finally, solder the centre conductor to the central pin.
10. Slide the coupling ring over the plug and screw into position.

For those using PL-259 plugs only for RG-58 (without an adapter), tinning the outer before insertion is necessary. I replaced all of my cables with RG-213 when the power allowed in ZS was increased to 1kW. The photo, **Fig. 4**, shows manual antenna switching between either of the operating positions at ZT1T. Filters on both transceivers allow simultaneous operations. Labels are essential and are planned for when the WARC band antenna is reinstalled and erected on the side-mount I'm making, but that's another story....

PLEASE NOTE: The author has found, with the newer plugs originating in China, the length of the plug body may vary. Moving

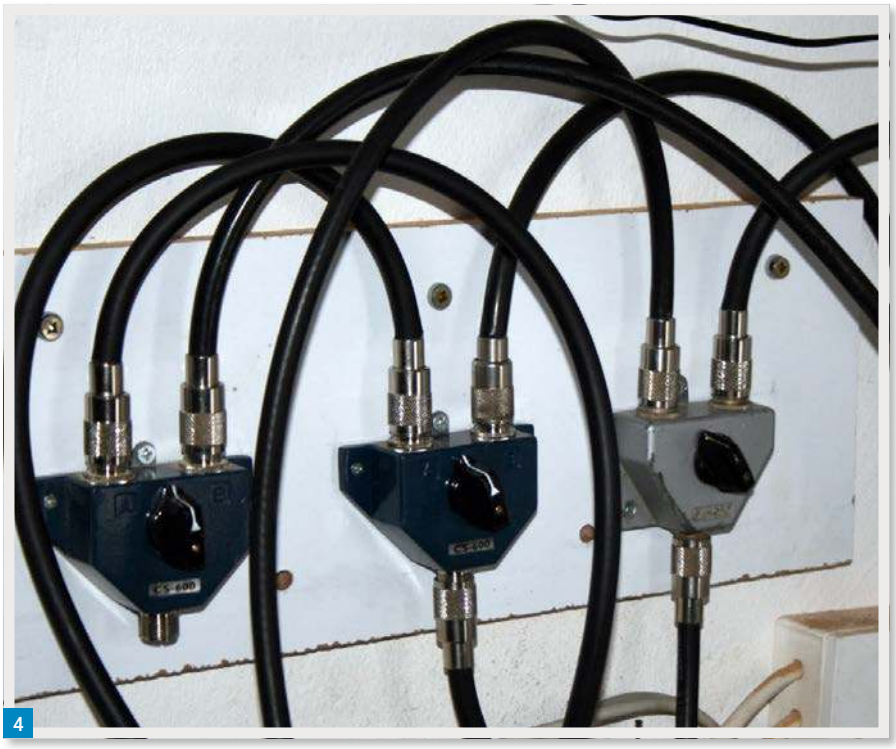

Fig. 1: The Old & The New. Copies of a Bill Orr classic. Fig. 2: Stages from left to right are self-explanatory. Please note the braid exposed on the second from the left is too short. You can always expose more than is needed. Fig. 3: Stages are self-explanatory. The author has no PL-259 plugs solely for RG-58. Fig. 4: Even with multiple outlet ATUs, manual switching is needed when there are two operating positions. There are a lot of plugs in this picture.

back the outer core edge and the insulation collar, if needed, can fulfil most adjustments. It's best to check by fitting the plug before tinning the centre conductor. Cutting the inner conductor is best after tinning, and before final installation.

Next time, I'll cover putting connectors on 7mm cable, which post-dated Bill Orr.

References

[1] *QST* November 2012. *A different Way to Assemble PL-259 plugs, WC3O* (Subtitle: This is the way **Tim Duffy K3LR** puts together coax plugs for his mega contest station).

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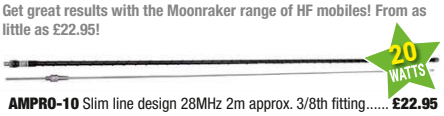

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Marconi Challenger: End of an Era

Michael Jones GW7BBY
michael@internalfire.org

Michael Jones GW7BBY tells the tale of a somewhat rare marine transmitter at the Internal Fire Museum.

I'd like to introduce readers to Internal Fire – Museum of Power's Marconi Challenger: a marine 1.5kW SSB/CW/MCW transmitter covering marine frequencies from 500kHz to 22MHz and intended for use as a main transmitter on board ship, **Fig. 1**. This was Marconi's last traditional ship's transmitter. It is technically magnificent, well-engineered, easy to use and with a good reputation for reliability. Unfortunately, it was a marketing disaster!

Writing on the Wall

At the time of the Challenger's development and subsequent launch in 1982, the Conqueror Transmitter, **Fig. 2**, was less than ten years old and met the same specification as the Challenger. Like the Challenger, the Conqueror was a fully synthesised design. The design philosophy and even much of the circuit details are very similar, a topic I shall return to later. In the early 1980s the writing was already on the wall for the 'traditional' ship's radio room and its banks of equipment. INMARSAT (International Marine Satellite) had already commenced operations; DSC (Digital Selective Calling) was gaining favour and the satellite based GMDSS (Global Marine Distress and Safety System) was at the planning stage and due to be phased in between 1990 and 1999.

As far as I can ascertain there were, predictably, differing camps within the Marconi organisation when the conqueror replacement was being considered. The Technical Department favoured a self-tuning 400W transceiver with remote ATU that could be used by unskilled operators. However, the sales department insisted that customers still demanded separate I.5kW transmitters and communication receivers. On top of this Marconi had been involved in the technology and operation of GMDSS from its inception so should have foreseen developments. While Marconi deliberated, markets changed. The 'auto-tuning transceiver' and the magic words 'solid-state' became the must-have features. GMDSS was already being finalised and it was clear to the technical department that the 1500W manually-tuned transmitter and separate receiver would not be required in future. Notwithstanding this, a conservative management resistant to change decreed that the Challenger go ahead and the 400W transceiver be abandoned.

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The Rivals

Before the first Challenger came off the production line in 1982, the Swedish PTT introduced their Maritex automatic telex service, then Skanti produced a 150W remote-controlled solid-state transceiver, followed soon after by a 400W version. With the Thrane & Thrane telex terminal they could offer a station that met all regulations yet could be used by anyone capable of typing. The INMARSAT system too was gaining momentum.

In the event, from a production run of 25 Challengers, only 11 or 12 were actually installed. We believe five went to Australian Bulk Carriers (one of these transmitters is now privately owned in Australia), two or three went to the Southern Shipping Company of India in 1985, one was installed on the *Pride of Calais* (now at the museum) and one was installed on her sister ship: the *Pride of Dover*. We also understand that there is a working unit on the Russian Research ship *Akademik (Shokalskiy)*. So, we can account for 11 of the Challengers sold. If anyone can fill in the gaps or correct any of the foregoing, especially the *Pride of Dover*, please let me know.

Pride of Calais Radio Room

The museum's 1980s Marconi Radio Room, **Fig. 3**, including the Challenger, came from the cross-channel ferry *Pride of Calais*. She gave faultless service from 1987 to 2013 when she was scrapped in Turkey. This Radio Room probably represents the pinnacle of the traditional ship's radio room with separate transmitters and communications receivers together with a skilled operator to use and maintain the equipment. Although *Pride of Calais* was scrapped in 2013, it is likely that the radio room was removed at some point between 1990 and 1999 when INMARSAT, DSC and GMDSS were being phased in.

As the pictures show, the Challenger is a magnificent beast. The hardware consists, from bottom to top, of the following:

1. Three-Phase Power Supply: Transformers, 2.2kV HT, 400V Screen, Bias and Heater supplies. This drawer also contains the Send/Receive and Keying Relays.
2. Synthesiser Drawer, **Fig. 4**: This contains a number of circuits: Frequency Generator, Band Oscillator, 2 - 3MHz PLL, SSB Filter, Keying and frequency dividers, Output amplifier, Display and Mode selection
3. RF Unit, **Figs. 5** & **6**: Solid-State driver, Valve final stage with four 4CX350s, **Figs. 7** & **8**, output matching sections, metering circuit and antenna switch.

As so few Challengers entered service, there is virtually no documentation to be found. We have obtained a copy of the *Ship's Operating Manual* from **Neil Wilson** of The Radio Museum, Watchett. This includes a brief technical description and most circuit diagrams. Tantalisingly, the most useful pages containing the RF circuits, pages 25 to 29 are missing!

Restoration: The Challenge!

Work started in Spring 2018. On powering it up two issues were apparent, there was no HT and the RF drive was tripping out.

The unit has three protection circuits:

1. To protect personnel there are gate switches on each of the drawers. If they are not overridden HT will be removed if a draw is opened.


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Fig. 1: Challenger transmitter.
Fig. 2: Conqueror transmitter.
Fig. 3: Pride of Calais Radio Room.

2. HT supply is delayed at switch on for 30 seconds to allow the valves to warm up prior to HT being applied. HT is also inhibited if the bias supply fails or the airflow through the valve box fails.
3. The drive protection circuit (the one giving me problems), inhibits RF drive to the final stage if either bandswitch is moved or both RF unit and synthesiser bandswitches are not synchronised; anode tune or antenna Load switch is moved; Clear, Recall, 500 or 2182kHz key is pressed or keypad data is incomplete; the 2 to 3 MHz Phase-locked VCO goes out of lock; Valve box air temperature is >125ºC or, finally, if excessive current is drawn the main breaker will trip.

HT Issues

I decided to tackle the HT issue first. I

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checked all the fuses, including a big very special looking fuse for the 2.2kV HT. Some of the front panel fuses were missing or blown. I replaced these and was then able to check the screen (400V) and bias (–27V) voltages and found them a little bit out. I was easily able to adjust them to the correct values, but still no HT. Each of the drawers has a 'Gate' switch – effectively a microswitch activated by a spring-loaded plunger. The microswitches are all connected in series so that if any drawer is opened the HT is disconnected. All very Health and Safety, except that upon testing the switches, they were found to be very intermittent (this turned out to be a recurring theme!). In the end I defeated this part of the circuit and thus restored the HT. I do have some new microswitches to restore the safety circuit during the winter shut-down.

Why was Drive from the Synthesiser Tripping?

Now I had HT but was still left with the RF drive to the final stage tripped out. This took a while to track down. I could force the correct output from the synthesiser by taking the output from the trip circuit low, so I knew quite early on that fundamentally all the circuits were working and the correct 6V pk-pk RF could be sent to the driver section. The bias was fine but faulty feedback from the RF unit was possible. The PLL claimed to be locked. The tripping occurred from cold so overheating was unlikely to be the cause. However, the thermal switch is a normally-open bimetallic strip located in the exhaust airflow from one of the 4CX350 chimneys. Visually it appeared to be fine and a hot soldering iron caused the switch to operate correctly. A continuity check showed that the switch contacts were working correctly.

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I was left with one or other of the switches in the RF unit being faulty. There it was: each control, Anode tune, Antenna Load and Bandswitch has a microswitch, operated by an indented wheel on the switch shaft. Two of the microswitches were intermittent: they would close correctly once but randomly fail to close or open. Access to the switches is difficult so for the moment I bypassed this part of the circuit and thus solved the 'RF tripping' issue.

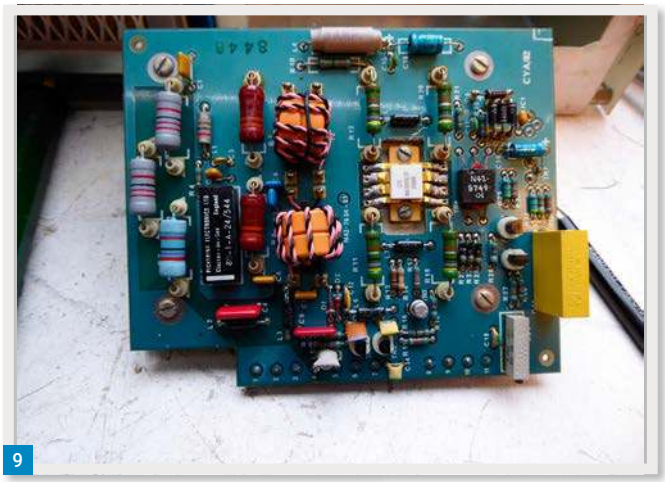
I was now able to select the tune position and get the correct output from the Synthesised Drive, but no drive appearing on the Drive meter, no anode current drawn despite HT, screen and bias voltages being correct. The output from the synthesised drive goes to a solid-state driver section, which is inside the valve box. After checking the coax from the drive to the valve box, it was time to haul the RF unit out, not difficult, but a two-man job made awkward by the restricted space in the *Pride of Calais* bay.

The Send/Receive and Keying Challenge!

A parallel issue now that the Synthesiser drawer was working correctly was understanding the Send/Receive (S/R) and Keying circuits and interfacing the transmitter with the main console. The absence of full documentation made an understanding of the S/R and Keying circuits in particular, more difficult.

There is a terminal strip at the front of the power supply that carries all the connections to interface the transmitter with the console, key and handset. For instance, there are three key inputs all marked 0V, a key input marked 'Key' and a '24V key in' connection – what is this? I understand 'key' can refer to the Morse Key or to 'keying' the transmitter to put it into transmit, but where is this 24V supposed to come from? The technical description in the manual that we have only devotes two small paragraphs, a dozen lines, to these two circuits and the circuit diagram was not very helpful. I had a reasonable idea what to do, but was uncertain and unwilling to risk a transmitter that I did not own.

If readers recall **Tony Nailer G4CFY's** articles in *PW*, they will know that when Tony hit a brick wall he would take the dog for a walk and by the time he came home he would have come up with a solution. I have a similar strategy. I take a shower. While I luxuriate in the steaming water my mind seems to relax and solutions present themselves. I had



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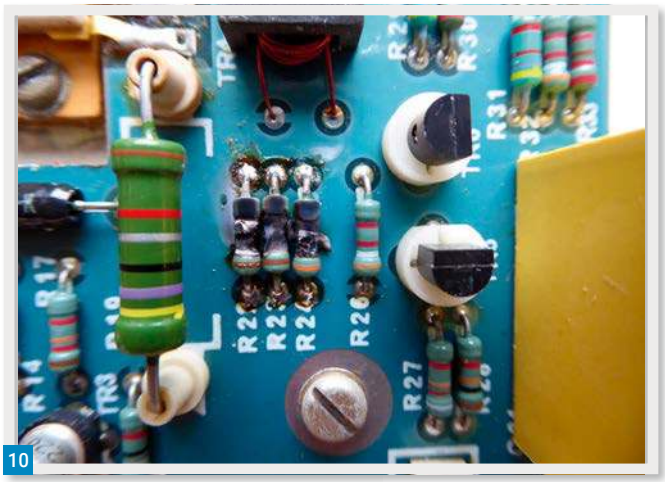

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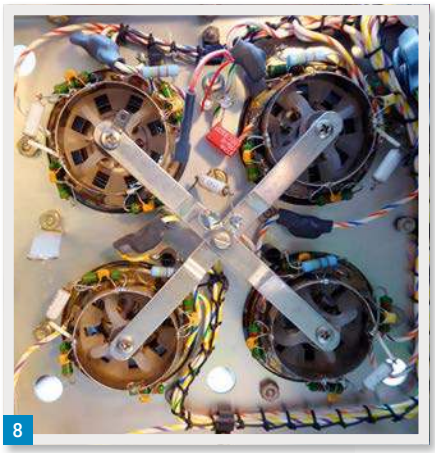

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Fig. 4: Synthesiser drawer. Fig. 5: RF Unit, Left side showing valve box and variometers. Fig. 6: RF Unit: Top View. Lower right: LF Variometer, Upper Right: 1 of 2 Loading coils, Upper Left: MF Variometer Fig. 7: Valve box. Fig. 8: Underside of valve bases, 'X' is the Control Grid feed. Fig. 9: Driver Board. Fig. 10: Burnt out resistors, in Pi Section.

realised that my problem was really one of understanding Marconi's design philosophy, the terminology and methods used. Now, we have a complete set of manuals for the Challenger's predecessor, the Conqueror. The Conqueror has virtually the same specification as the Challenger, including being fully synthesised. Even if some parts are different, just like Ford, Marconi would not re-invent the wheel every time they produced a new design. I got out the Conqueror manuals and found the functional diagram very nearly the same as the Challenger's. Some circuits were identical, others very similar after allowing for advances in technology. Crucially the S/R and Keying circuits followed the same principles and the Conqueror manual devoted a whole chapter to these circuits and supplied the necessary clues.

The S/R circuit is powered up at switch-on and is controlled by the mode switch. To put the transmitter into standby ready for CW keying or PTT a 24V supply is required to the keying circuit. This is the '24V Key in'. This can come from an external source such as the console or from the transmitter PSU. I took the supply from the PSU via a standby switch on the console. The CW key connections also became clear. For CW the Morse key directly controls the Keying circuit allowing full break-in keying. For SSB the PTT (or pressel) is fed via the mode switch and S/R circuit, which then controls the Keying circuit. There are other modes such as Telex, 2182kHz distress call and autokey that would also be controlled via the mode switch, but do not concern us for amateur operation. At this stage a short wire antenna clipped onto the output from the synthesiser drawer enabled me to hear a clear USB or CW test transmission in one of the nearby receivers.

Final Drive Issues

Returning now to the valve box, inside it was immediately obvious that three resistors were burnt out. They form a Pi section attenuator/matching circuit, **Figs. 9** & **10**. After replacing these I tested the driver section on the bench. Feeding it with 6V pk-pk from a signal generator produced about 25V pk-pk output. Since this was more than I was putting in, I reasonably concluded, erroneously, that the driver section was working.

After re-assembling, I still could not set up the correct initial conditions: 100mA Ia with Vg1 between −27 and −20 V DC bias. Reducing the drive beyond −20V allowed some anode current to flow. It would then load up and a miniscule amount of drive was shown on the drive meter and some antenna current was shown. As a rough estimate maybe 200W but obviously not right.

Time to check the four 4CX350 valves more closely. One had blueing on the cooling fins indicating serious overheating, a second valve showed some sign of overheating while the other two seemed fine, but in view of the condition of the first two valves, remained suspect. We don't have a valve tester capable of testing these valves but a basic check with a meter showed all the filaments to be functional with no obvious internal shorts. These valves are very reliable and give long service life. On the other hand the control grids are very fragile and should not be allowed to go positive, otherwise excessive grid current will be drawn. If greater than 2mA, damage can result. The other common failure mode occurs if operated without HT, then the screen will act as primary anode and draw excessive electrons from the cathode resulting in heating and deformation of the screen. Given the HT failure, this may have happened. The final thought is low emissivity owing to old age. If the valves were reasonable, I would have expected substantially more output given 24V pk-pk on the control grids. As all other operating conditions were correct, I then concluded that all four 4CX350s should be replaced at an estimated cost in the region of £1000.00, a considerable sum to a small museum such as ours. One option was to buy used but tested good 4CX350s from eBay. Still not cheap and not a comfortable route to take. Our curator, **Paul**, contacted Eimac directly and they generously agreed to supply a full set of four valves at no charge but they would take two months to manufacture and ship.

I'll continue the saga next month but just to mention that by the time this article is published the museum will be closed for the winter and will re-open with a Crank-Up weekend at Easter 2020. Check either of the websites below for further details:

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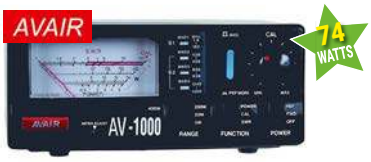

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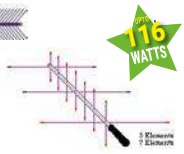

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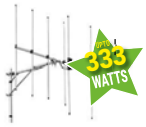

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Tim Kirby
longworthtim@gmail.com

Getting more out of your Digital Hotspot

Tim Kirby GW4VXE starts his column with an explanation of how to make the most from your digital hotspot.

I wonder how many of you bought one of the digital hotspot devices, perhaps one of the MMDVM devices we've reviewed here in *PW*, initially found it interesting and then have not done much with it? I've certainly had phases like that. However, in recent months, I've spent a little more time setting mine up and getting more out of it for everyday type QSOs, which has been very rewarding.

The key is finding a talkgroup/room/reflector (imagine all these terms as synonyms for a conference call or 'net') where you feel at home and can enjoy some chats that are meaningful. Perhaps more meaningful than people keying up, doing radio checks and then vanishing, or worse still, somewhere where the QSO police hound you off for having a conversation longer than a minute or two (when the reflector had been silent for the previous hour!). I've been lucky enough to find a few of these places over time, mostly on DMR (Brandmeister) and Fusion as it happens, but that's no reflection on D-STAR where there are also interesting contacts to be made.

Static Talkgroups

What I've done, on DMR in particular is to set up some static talkgroups on my hotspot, which are always there whenever I connect to the Brandmeister network. They've tended to be ones with a local (geographic) focus, such as the Salop Cluster, Wales Chat or the Southern Ireland Repeater Network. The last two are local to me and the first often carries activity from friends in an area where I used to live. There's not that much traffic on any of them, such that when there is, QSOs tend to be a bit more than cursory and can be quite interesting.

What's a static talkgroup? It's a talkgroup that is always available on your hotspot, as opposed to a dynamic talkgroup, which you can set up by issuing a command from your handheld (or the admin console of your hotspot). You'd probably use a dynamic talkgroup style connection for a talkgroup that you only use occasionally and don't want to have running all the time on your hotspot (for example, the worldwide talkgroups are great for testing, but a bit distracting to be listening to all the time). There's a little feature of the Brandmeister network such that if you connect up a dynamic talkgroup and don't disconnect it before you switch off your hotspot, it'll be there next time you switch your hotspot on. That's caught me out a few times!

So, how do you set up a static talkgroup? These instructions are for the Brandmeister network. You will first need to set up a 'Self Care' account on the Brandmeister network website:

http://brandmeister.network

Follow the 'Register' link in the red menu bar at the top of the page. You'll need to enter details such as your callsign, your e-mail address, choose a password and enter your DMR ID as well as answering an 'anti-spam' question. The type of account that you want to choose for a hotspot is 'Personal User Account' rather than 'Repeater Account'. Answer all the questions and press submit. You'll then need to wait until one of the Brandmeister admin team validate your account. When I did it the process took a few days. Be patient. As with many things in amateur radio, these processes are carried out by volunteers who have differing calls on their time!

Once you have been set up with an account you can log in to the self-care website with your callsign and the password that you chose. You'll then be presented with the User Dashboard screen, which you can explore if you wish.

You need to set up the static talkgroups in the 'My Hotspots' section. You should see a hotspot with your DMR ID in that list (it shows up in red if the hotspot is offline and green if it is online). If it doesn't appear there, try switching on your hotspot, connected to the Brandmeister network and after a few moments, refresh your screen and hopefully you'll now see it in the list.

Now, click on the hotspot in the left hand, black menu bar and you should see a screen that displays the parameters for your hotspot. Most of these can be left alone but the section you need is towards the bottom of the screen – 'Static Talkgroups'. All you need to do, to make a talkgroup static, is to enter the number in the left-hand box, click the right-hand facing arrow and you're done. There's also the ability just below to have scheduled static talkgroups, which means that you can take them on or off line depending on the time of the day.

If you don't know the talkgroup's number, then you can see a list of Brandmeister talkgroups at the link below although curiously not all talkgroups are shown but it's a good start:

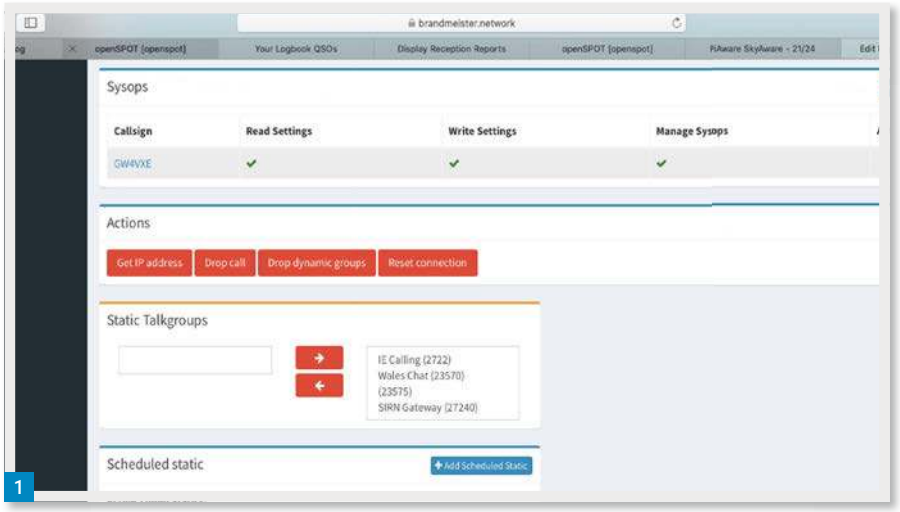
www.pistar.uk/dmr_bm_talkgroups.php

In Use

That's all you need to do as far as setting up the hotspot is concerned. On the DMR radio that you use to 'talk' to the hotspot, you'll need to make sure that you are suitably set up. Depending on the DMR radio you have, you can set it up differently. You'll need, at least, to be able to listen to the hotspot – having the correct frequency, time slot and color code selected – but in a way that allows you to hear all the talkgroups that the hotspot transmits. Depending on the radio you have, this may be known by different terms. The Anytone radios call it 'Digital Monitor' whereas other radios call it 'promiscuous mode'. With that correctly configured, you will be able to hear the hotspot transmitting all the static and any dynamic talkgroups that you have set up.

In order to be able to transmit, you can do one of two things. If your radio allows you to set a talkgroup 'on the fly', then you don't need to do anything else. When a transmission comes up you simply note which of the talkgroups it was on, select that same talkgroup on your radio, quickly key up to connect and you can then reply on the correct talkgroup. If your radio doesn't allow you to change the talkgroup 'on the fly', then you'll need to do a little work in your codeplug, setting up a channel for each of the static talkgroups you have set up. The frequency, time slot and color code will be the same for each; only the

Photo 1: Setting up static talkgroups on the Brandmeister self-care website.



talkgroup will differ. Then when a call comes through that you want to answer, you note which talkgroup it was on and quickly change to the appropriate channel setting on your radio.

Perhaps one talkgroup on the Brandmeister network you might like to try is 27240, which is connected to the Southern Ireland Repeater Network. Several repeaters are networked together. Although the network is quiet at times, there are often some interesting contacts to be made around Ireland, Wales and southwestern England. In better conditions, perhaps with the sea path to the south, you may even hear French and Spanish stations coming into the 2m repeaters on the southern coast of Ireland. You could try 'UK talkgroup' 2350 perhaps. If you do that, you might also set up the UK Chat talkgroups 2351, 2352 and 2353 so that you can QSY away from the main talkgroup for a longer conversation.

Also, ask around and see whether there are any talkgroups that are used locally to you and which act as a meeting place. You can then set those up.

If you've a hotspot and digital radio that are perhaps languishing a little, I hope you'll give this a go. It's quite fun to set up and you will be rewarded with some interesting conversations I'm sure.

The 6m Band

It was interesting to see some DX Cluster spots for a 6m (50MHz) Es opening in early February. From the UK, the band was open into Spain and Portugal. Someone asked whether it was the first Es opening of the season. I remember a similar opening happened two or three years ago and **Lyn G8JLY** (then GW8JLY) suggested that it was actually more likely to be the last of the Winter Es season rather than the first of the new season, which I think is a possibility. Normally (but remember that this is propagation, so there's no exactitude involved) 50MHz goes fairly quiet until mid to late April, other than meteor scatter propagation, which is available to a greater or lesser extent throughout the year. I'm particularly looking forward to the transatlantic Es season this year, now being blessed with a very low horizon in that direction. It will be interesting to see what is possible. The first antenna to try will probably be my first 50MHz beam from 1985 or thereabouts, a five-element Tonna, which many people used in those days.

Jef Van Raepenbusch ON8NT (Aalter) managed to catch some contacts toward the beginning of January on FT8: LZ2CM (KN13), G3YDY (JO01), LZ2HM (KN12), F1EBN (JN18), G0MBL (JO01), F1SZP (JN08) and OH8WD (KP23). Jef runs 10W from an IC-7300 to a V-2000 triband vertical.

The 4m Band

Colin Fawcett G8YIG (Stalybridge) writes to say that he is active on the 4m (70MHz) band using a rotary dipole and an Icom IC-7300. Colin's QTH is 500ft above sea level and he is getting good results. Please keep in touch, Colin, I don't get too much 70MHz news outside of the Sporadic E season. That goes for anyone else active on the band too, please.

The 2m Band

Mike Webb GD6ICR just missed the last deadline but had an interesting report from the late December 2m (144MHz) tropo. Mike writes, "*Here on the Isle of Man, quite a few people managed to work D41CV on FT8. On December 28th I managed to work EA8TJ and D41CV on FT8 and then asked him to go to 144.330MHz on SSB and got reports both ways. I was really happy about that! I worked six EAs on the 29th and numerous other countries on FT8 and FSK441 (for meteor scatter), including OE, UT, I, F, SM and DL. My most fruitful month on 2m in many year*". Following the high winds in January, Mike says he turned his antenna and it snapped in two as a U-bolt failed. I hope a simple repair is possible, Mike!

Keith Watkins G8IXN (Redruth) noticed the Isle of Man repeater GB3GD coming through during a very north-south tropo opening across the sea on January 20th.

Jef ON8NT had a good month considering the conditions and only listed the contacts greater than 400km: G8JLY (IO82), EA2XR (IN83), EA1MX (IN73), F6CIS (IN94), F1GTU (JN05), F1NZC (JN15), DK1FG (JN59), F0GIW (IN96), F6DZR (JN96), G1BHM (IO70), GW3TKH (IO81), GW4SHF (IO82), M0SAS (IO82), G4RRA (IO80) and G7RAU (IN79)

Simon Evans G6AHX (Twyning) took part in the UK Activity contest on February 4th, using 10W into his 8-element ZL special. Best DX was F1BHL/P (IN99).

Peter Taylor G8BCG (Liskeard) managed to find a sufficient gap in the gales to raise his 2m EME array on February 6th to work C21MB from Nauru. Peter says there was barely a trace on his horizontal array of four Yagis, but it was easy on the vertical array with only two Yagis. It just shows the importance of the correct polarisation.

Here at **GW4VXE** (Goodwick) I've been avoiding the storms, but I did put up a small 10-element Yagi on a short pole lashed to a gate post to see what could be worked on FT8, particularly in the more challenging directions such as the east and south-east, which are through various mountain ranges. During the tropo on January 19/20th the highlights were GM3SEK (IO74) and G4VCJ (IO94). Other distant contacts were GI6ATZ (IO74), M0WGF (JO01), F6DBI (IN88), 2E0TXI (JO00) and G1SBN (IO93). I was pleased to copy CU3EQ (HM68) on FT8 on January 20th during some tropo to the southwest, but sadly I was not in the shack at the time!

The 70cm Band

Keith G8IXN noticed the Isle of Man repeater GB3IM on the 70cm (432MHz) band coming through around S1 at 1400 on January 20th.

Jef ON8NT runs 25W from an IC-9700 to a 5-element LPDA. On FT8 during the

Photo 2: G3VKV's new dual-band feed for his QO-100 satellite station. Photo 3: G8BCG's QSO with Nauru on 2m EME.

month he worked EA2XR (IN83), F6HMO (JN18) and F6KBF (JN18).

ARISS

Jef ON8NT monitored an ARISS contact on January 22nd with **Luca Parmitano KF5KPD** operating. The participants on the ground were located at the Ontario Science Centre in Toronto. On January 28th, Jef noted another ARISS contact, this time to a school in Serbia. Finally, on January 30th and 31st, Jef received and decoded several SSTV images sent by the Russian cosmonauts as part of the MAI-75 experiment.

David Ryan M0GIW was monitoring 145.800MHz on February 1st when Luca Parmitano was operating as IR0ISS from the International Space Station and made some random QSOs with amateurs. Dave made a recording of the pass, which you can hear at:

https://tinyurl.com/uv9vpd3

Kevin Hewitt ZB2GI lists the following contacts through AO-91: EA5GX (IM99), EA8DDS/P (IL27), G0IIQ (IO93), G4GVB (JO02), IK8YSS (JN70) and 9A2EY (JN85). Through AO-92 Kev worked HB9OAB (JN96) and IK8YSS (JN70). Kev monitored ARISS schools contacts on January 27th and 28th and SSTV from the ISS on January 30th/31st.

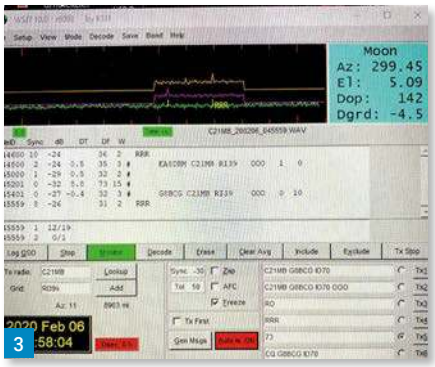
Kev also writes, "*HuskySat-1 was deployed from the ISS on January 31st and began telemetry transmissions on 435.800MHz. The 3U Cube Satellite was developed at the University of Washington. The satellite has a 145 to 435MHz linear transponder for amateur radio communication and a 1k2 BPSK telemetry beacon. I used a Yaesu FT-817 connected via a data interface to a Win7 Notebook PC running FoxTelem and a manually-tracked 2m/70cm Log Periodic to decode the telemetry beacon.*'

Satellites

Peter G8BCG says he's been working a steady progression of new DXCC entities via QO-100, with the latest being DP0GVN from Antarctica and 9V1HY from Singapore. To his astonishment, his dish did not move off-track during Storm Ciara.

Here at GW4VXE, most of the activity has been on the AO-91 and AO-92 satellites, using a Kenwood TH-D72E handheld and an Elk 144/432MHz log periodic. Highlights have been VE1VOX (FN85), N5LEX (FN11), VO2AC (GO11), EA8ASW (IL18), EA8DEC (IL18), EA8BGO (IL28) and OH5LK (KP30). It's true to say that I have been a 'fair weather' operator and not ventured out when there has been rain and gales, which seems to have been most of the time.


2



3

Patrick Stoddard WD9EWK (Phoenix) reports plenty of news of activity and plans for the future. Patrick says, "*Even though we are in the middle of wintertime, we are still seeing satellite operators going out to different places and putting rare grids on the air.* ***Clayton W5PFG,*** *the new AMSAT president, has done this around the Orlando Hamcation in early February. In addition to attending that convention, Clayton operated from locations throughout the state of Florida.* ***Ron AD0DX*** *went from his home in Colorado to operate from rarely-heard locations in Washington state (grids CN78 and CN98) along the USA/Canada border. And I have done my part to put different locations on the air here in Arizona.*

"Before the Yuma (Arizona) Hamfest in mid-February, I made another trip to the rare grid DM31 in southern Arizona, along the USA/Mexico border. Most of grid DM31 is in Mexico, except for the north-eastern corner, which extends across the international border. I drove to the Organ Pipe Cactus National Monument in that area and spent a day (February 13th) working satellites in FM, SSB, and the ISS packet digipeater. I worked 16 passes through the day, logging 73 contacts before finishing my drive to the Yuma Hamfest for the weekend.

"With great sunny weather, the Yuma Hamfest draws visitors from throughout the USA, as well as from Canada and nearby Mexico. AMSAT has been at this event since 2009, and part of the AMSAT presence involves demonstrations using different satellites. This year was no exception.

"AMSAT, and satellite operators worldwide, have been waiting for the launch of the last Fox-1 satellite, Fox-1E. Also, a new Kenwood TM-D710GA and power supply should be going up to the ISS, which could open up more options for satellite operators: a better packet/APRS digipeater operating at 10W, and a cross-band voice repeater that has been designed to operate at 5W. The lower power level should keep this mode from overheating the radio, yet we should be able to hear it with ease. All of these functions have been put into the Kenwood radio's firmware, so it can't be accidentally wiped out".

Graham Jones G3VKV (Cheltenham) passes on the good news that the available bandwidth on the QO-100 narrowband transponder has been doubled to 500kHz. There are now three beacons: lower, middle and upper. Graham also says, "*I'm building a second smaller TX/RX for QO100 using an Adalm Pluto plus 5W amplifier and poty dual-band feed with a modified Octagon LNB giving 1250MHz IF (external Leo Bodnar oscillator). It's all working as separate units but just needs final assembly to a 1.2m prime focus dish".*

That's it for this month. Many thanks to everyone who's sent news or information – please keep your reports coming, they're much appreciated.

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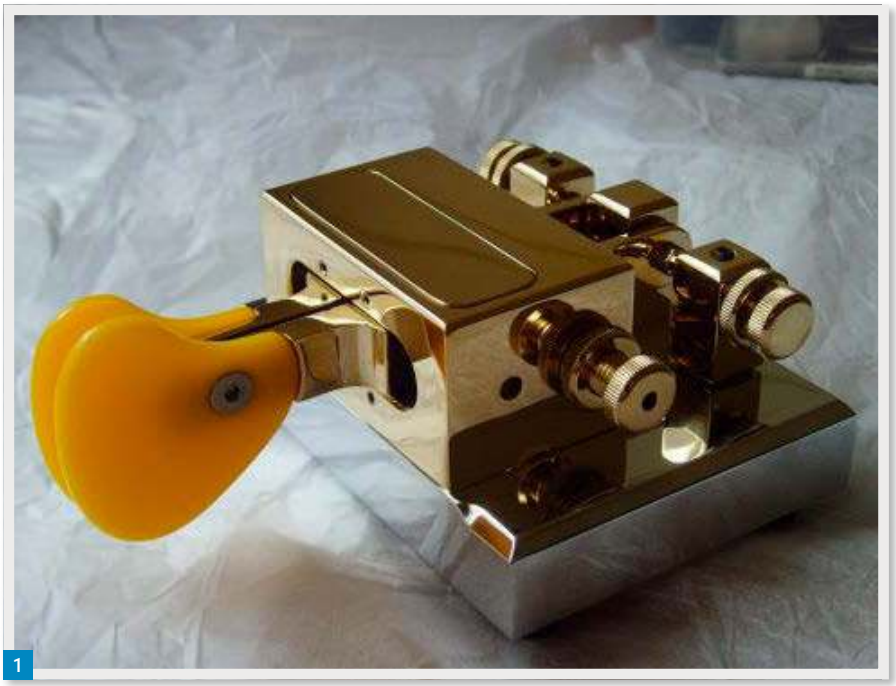


1

We have all come across people who are old car renovators and collectors. They are very fastidious about their cars. They won't take them out in the rain, won't let anybody touch them (it leaves marks on the unblemished paintwork!) and treat them like works of art!

You find much the same with Morse operators. They treat their keys in much the same way. They must be dust free, polished weekly, covered when not in use, and fed with a diet of TLC when caressing the paddle itself. It must have the correct feel, be extremely well engineered, retain adjustments over a long period, and look good on the desk!

I recently came across **Valery Pavlov RA1AOM**, from St. Petersburg. Val is a Morse operator, a skilled engineer and someone who has an appreciation of the Morse Key as a work of art, as well as a tool with which to send Morse. Val was a professional operator in the Soviet army, so he does appreciate a well-made key himself.

There are others who make superb keys along similar lines, such as **Kevin Gunstone M0AGA** with his Chevron paddle **Fig. 1.** I hope to be featuring the Chevron in a future column.

However, Val has taken this to another level and produced not only superb keys, but they take on the look of a work of art.

Val has been designing keys for more than 30 years and has had a lot of experience in the Morse business. He is a professional ship radio operator and has trained about 400 people.

He mainly makes electronic key paddles with one and two levers, but also sometimes makes vertical keys and semi-automatic ones. The main difference between his products and others is that almost all parts are made of stainless steel and highly polished.

For the bases Val uses mineral stones, such as Jasper, serpentinite, obsidian, granite and others. Making keys is his hobby, and Val works as a mechanical engineer for the assembly of mass analysers. The production of keys of this nature requires a lot of time. On average, the production of one product takes about 40 hours or even more. Therefore, customers have to wait a few months.

Manufacturing methods have changed a lot over the years, and most manufacturers have stopped using springs. Val is no different. He uses neodymium magnets for his designs. He has now developed a new design of a key with magnets working in repulsion.

A Selection of RA1AOM Keys

Here are a few pictures of some of his keys, which, as you can see, do look very attractive.

The photo, **Fig. 2**, shows his single lever paddle, obviously the one I would go for. I cannot use a dual-lever one after 65 years glued to a single lever paddle!

The mechanism body is made of stainless steel, the lever is made of titanium, it is secured in the central position by way of two neodymium magnets, one of which is fixed to the back of the lever and the second is supplied on the adjusting screw providing tension adjustment. Contact screws with fine thread pitch provide more precise adjustment while contact pads are made of spring bronze to provide a comfortable tactile sensation during manipulation. The mechanism is mounted on a base of Jasper or other mineral stone. The lower substrate is also made of stainless steel. All parts are hand-polished. The design is very well established among fans of high-speed telegraphy.

Fig. 1: The beautiful Chevron paddle, made by Kevin M0AGA. Fig. 2: The RA1AOM single-lever paddle. Fig. 3: Single-lever paddle as Fig. 3 but with alternative base. Fig. 4: Val's dual-lever paddle design (as used at OH73ELK). Fig. 5: The traditional straight key.

In the entire area of the lower substrate a pad of corrugated rubber is glued to ensure the stability of the manipulator during operation. The weight of the product is approximately 1.8kg. The shape and material of the paddle may be different as **Fig. 3** illustrates.

The mechanism is made of stainless steel; the lever has a T-shape centring magnet, located at the end of the titanium rod. The second magnet is fed on a screw that is located in the centre of the disc, fixed on studs in the back of the bearing block. The contact plates are slightly spring-loaded; the mechanism can be installed on a stand of any shape. Val says, *"Usually I use Ural Jasper, Serpentinite, Obsidian, Indian Granite 'Star Galaxy' and*

2

3

stainless steel (as on my QSL)".

The lower substrate is made of stainless steel. The weight is about 2kg, which provides a stable location on the table. All parts are hand-polished.

Dual lever paddles

Val's dual-lever paddle, **Fig. 4**, differs from many designs in that all adjustments (the force of pressing the lever and adjusting the gap between the contacts) are carried out using adjusting screws on the back bar, which is attached to the bearing block. The contact block is located between the levers. The pads are made of spring bronze. The levers are made of duralumin. All other parts are made of hand-polished stainless steel. Various mineral stones are used as the base – Ural Jasper, serpentinite, obsidian, some varieties of granite.

The paddle in Fig. 5 actually belongs to OH73ELK. It can be found in the holiday home in a beautiful location. Take a look at: **www.oh73elk.net**

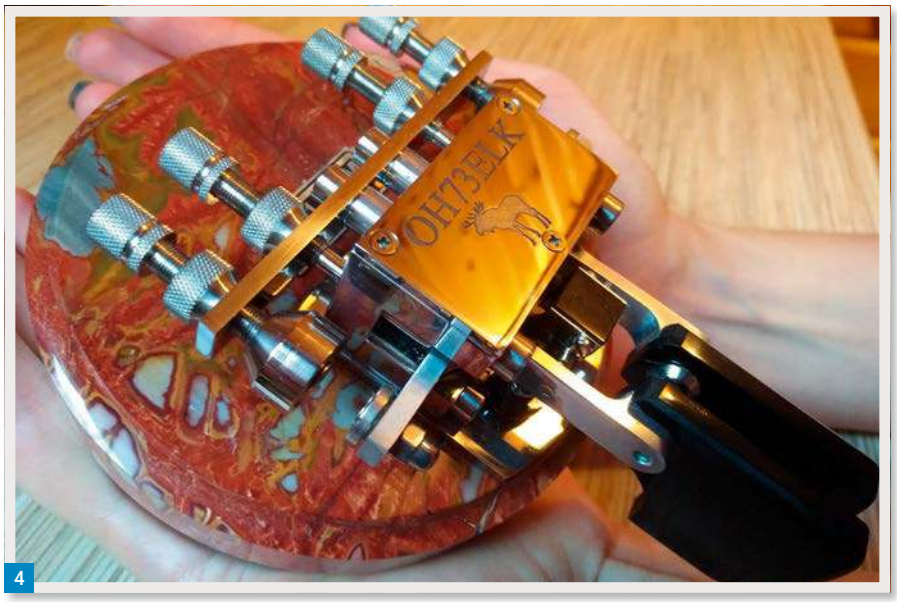
Finally, if you want a gorgeous looking straight key, then have a look at this, **Fig. 5**. Nothing more to say really. It's called The Green Pump. Val obviously keeps himself very busy in his workshop!

Lots more can be seen on Val's QRZ.com page and W7BC QRZ.com page. You should play this YouTube too: **https://tinyurl.com/upksjc8**

and this one: **https://youtu.be/G_Iq3z_5KB4**

By the way you might find Val operating on board ship. He sometimes works with the icebreaker *Museum Krassin* signing R1LK.

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



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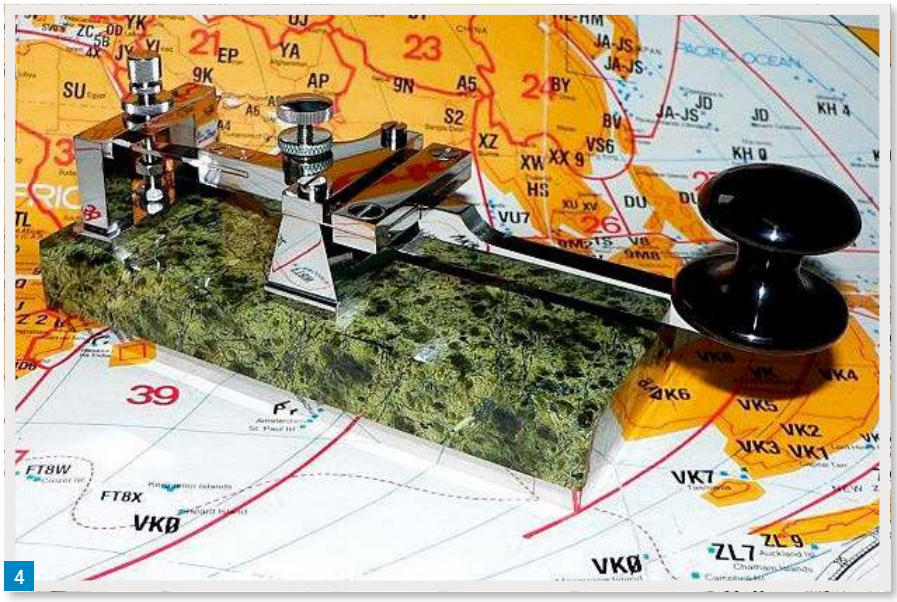


4

Seaside Operation

John Rowlands MW1CFN makes the case for operating close to the sea but also takes care to warn of the potential hazards.

John Rowlands MW1CFN
practicalwireless@warnersgroup.co.uk

The UK is, as we are apt to remind ourselves these days, an island nation. Surrounded by seawater, we are never more than about 60 miles from the coast. For amateur radio, this offers exciting possibilities to those willing to pack radio gear into the car or rucksack, **Fig. 1**.

But why would you bother going to the effort, when you can operate in warm comfort from home?

Well, although we have proven ourselves through passing a radio exam or two, that doesn't provide immunity from the ever-increasing domestic sources of interference, nor from planning consent headaches. And home rarely offers the best physical and electrical environment for radio.

Luckily, radio doesn't have to be confined to the home. We can divert our energy into seeking an answer to the question: where else can we operate from, and maybe get a breath of fresh air into the bargain? The answer, simply, is the seaside!

Horizontal or Vertical?

Now, if you pick up a radio book, it will probably tell you to use a vertical antenna and locate it as close as possible – not more than quarter-wave away – to the water's edge.

Because seawater is electrically conductive, radio waves in the immediate vicinity of your antenna are not absorbed anywhere near as much as even the best ground found inland. In fact, at HF frequencies, seawater is nearly a perfect reflector. This goes a very long way to reducing losses. A simple way to think of it is the sea forming an extremely good groundplane – much better than the few radials we normally depend upon.

As **Fig. 2** shows, a vertical antenna (dotted line) produces strong signals at very low angles near seawater. A horizontal dipole located inland would have to be installed unfeasibly high to achieve the same effect.

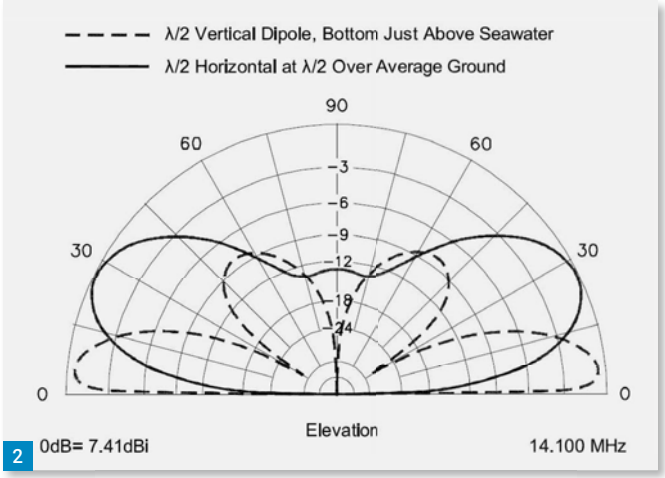
In addition, vertically polarised radio waves take both a very low angle path parallel to the water, and also a path that, at some distance from the antenna, leads to a shallow reflection off the surface of the water. Seen from a very distant vantage point (such as our sought-after DX stations), these two paths are essentially the same, and do not lead to any appreciable change in phase. As a result, the two waves tend to add up, yielding a strong, peak signal at very low angles, often at 1° or less above the horizon. The same happens on receive for incoming waves from a distant station. It's for these reasons that you'll find most DXpeditions located near the sea choose single and multiple-element vertical antennas.

1

Get Your Feet Wet?

It's often repeated in radio texts that you must be within a quarter-wavelength of the water to get the benefits of operating at the coast. Certainly, if the weather's fine, the wind low, and the beach not too shallow, operating at, or even in the water can bring the maximum benefit to your operating.

But, in the UK at least, the tidal range can be high, and the weather often poor. At shallow beaches, especially, the tide leads to water moving very quickly, sometimes in unpredictable ways. At best, moving your antenna every ten minutes, maybe in poor light as well, is highly inconvenient.



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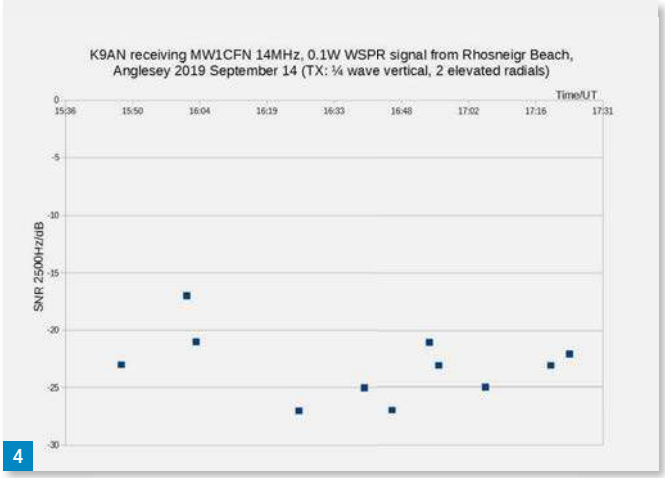

4


3

Safety at the Seaside

Working at the coast always carries considerable risk. Please take time to understand your chosen operating location. Tidal predictions are just that: they are not precise statements of what the tide will do and are often rendered inaccurate by weather. Make sure that the flooding tide won't suddenly come in behind you, as it often does on shallow beaches and flats. Ask fishermen you come across for advice. They are usually very knowledgeable.

Always carry a mobile phone with plenty of charge, and call 999, asking for the Coastguard, as soon as you think you might be in danger. Don't leave it until your feet are already under water! You may even wish to carry a Personal Locator Beacon (PLB) at large sand/mud flats. Look out for 'sinking sand' and know what to do if you are caught out by it. If you are setting up an antenna on a busy beach, make sure people won't walk into radials and coax, or trip over them. Adequate public liability insurance, to cover you in the event of injury to passers-by is highly advisable.

Fig. 1: A seaside location has much to offer! Fig. 2: Elevation plot of vertical dipole by the sea compared with a horizontal dipole a half-wavelength above average ground. Fig. 3: Working the Far East on 17m from Anglesey's coast. The tide has taken the sea over 1km away but notice how the flats remain saturated with seawater. Fig. 4: Going against received wisdom, no increasing trend is seen in signal strength as the sea moves from beyond three quarters of a wavelength (left) to washing the base of the antenna.

At worst, such conditions can be very dangerous.

So, can you get most of the benefits of the sea from further than a quarter-wavelength back from the water's edge, even in a car parked up on a tarmac sea front? You certainly can!

One reason working further up the shore works almost or equally well is that, even when the tide is out, a shallow beach or mudflat will tend to remain saturated with seawater all the way to the surface, **Fig. 3**. As a consequence, the distinction between what is electrically 'land' and what is 'seawater' is very much more subtle than most texts, almost always based on computer models that can't accommodate such fine detail, assume.

That this is so is easily tested with WSPR, by plotting the signal strength – in this case, **Fig. 4**, of my 0.1W WSPR

Fig. 5: Raspberry Pi setup for the car. Good local knowledge is needed for operating this close to the waves! It's much safer – and often just as effective - to park on a seafront somewhere.

signal to top-performing US station, K9AN, against time as the tide comes in. As you can see, the signal from the seaside doesn't obviously increase as the water gets closer to the antenna (by the end of the run, the water was lapping at the antenna base).

If you only wish to send WSPR from the beach, then the situation is really easy. You just take a WSPRlite or similar micro-transmitter, a USB battery pack, and a mobile phone or radio-controlled clock for setting the transmissions going at the correct time. Hook it all up to a simple mobile whip on the car, or quarter-wave vertical antenna on the beach. Two radials are perfectly adequate in the latter case.

If you also want to receive WSPR, or look for 'real' QSOs with digital modes such as FT8, then you will need a computer of some sort. For this, the easiest answer is probably the Raspberry Pi, model 3B+ or later. The Pi is now a very capable palm-top computer that I find, for WSJT-X software, performs better than a Windows laptop. Very conveniently, a Pi operates on 5V DC, rather than the 19V DC typical for laptops. Just plug the Pi into a 2.1A USB DC outlet found in most modern cars, and you're up and running, **Fig. 5**. I can even operate my Pi and its 7in LED screen for several hours from a 20Ah Li-ion battery pack.

One thing you will have to watch out for with the Raspberry Pi is RFI from the various cables connected to it. Without corrective measures, the RFI can be quite strong. It's best to wrap every cable several times around a large, split TDK ZCAT 3035-1330 (13mm inner diameter) ferrite.

And the benefit of all this? My mobile whip on the car parked at the coast will typically yield a 4 to 17dB enhancement over a quarter-wave vertical only a couple of kilometres inland. A full quarter-wave vertical at the beach will produce about 6-19dB enhancement, with exceptional examples found up to 27dB stronger.

Of course, some weak stations that would not be heard at all inland are brought comfortably within workable strength at the coast, **Table 1**. Your outgoing signal is also 'boosted' by a similar amount. Another big advantage of coastal working is that, because signals are arriving from very low angles, you will typically find stations to work 60-90 minutes earlier than you can from inland sites.

Say "Hello"!

A fantastic element of working at the coast is that, inevitably, people will come up to you and ask what's going on. This is a great opportunity to tell people about amateur radio, which they won't know much about. I've found just about everybody is blown away when they are told a signal carrying less energy than that used by a tiny LED has just been received in San Francisco. You can even prove it by showing them the WSPRnet map on a mobile device!

Station Heard	Distance km	Delta Loop Median SNR	Mobile Whip Median SNR	Whip cf Delta
K6MCS	8159	-23.5	-14	9.5
AA7FV	8185	-21	-14	7
K5XL	7328	-21	-17	4
KC1CXD	4882	-22	-20	2
W8DOL	5606	-21	-18	3
JA5NVN	9501	NOT HEARD	-24	
KK1D	5104	-5	-5	0
ES2ADF	1812	NOT HEARD	-18	
VE3LJT	5449	NOT HEARD	-25	
AE7YQ	8234	NOT HEARD	-23	
KSOFT/10	6236	NOT HEARD	-24	
RZ3TJ	3026	-16	-16	0
AD0MO	6435	-28	-22	6
N8DMT	6027	NOT HEARD	-25	
VA3UAL	5406	NOT HEARD	-27	
OZ7IT	1075	-6	2	8
W3EEE	6574	-19	-15	4
ALDLZ	4730	-26	-22	4
AA1HF	4882	-29	-22.5	6.5
			Median Diff	4

Table 1: Despite being the simplest of antennas, the mobile whip produces a median enhancement of 4dB, and a peak enhancement nearly 10dB at the beach over a delta loop only a couple of km inland. Notice how several stations heard comfortably at the beach are missed altogether by the inland antenna. Enhancements seen on any given outing will vary with location and path.

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An old favourite of George's... The Sudden Receiver

Lee Aldridge G4EJB
leeG4EJB@outlook.com

Lee Aldridge G4EJB revisits another old favourite from the stable of the late Rev George Dobbs G3RJV.

In the last couple of years, I have built a few direct conversion (DC) receivers and some of them have been based on **George Dobbs G3RJV's** famous *Sudden* receiver, primarily in my 30 and 40m QRP transmitters/receivers. I believe George first presented the *Sudden* receiver in *PW* back in March 1991. I thought a variation of this little receiver might be of interest, particularly to those of you who don't like soldering very much and for one, my eyesight isn't what it used to be either.

First of all, let's hear from G3RJV about the *Sudden* DC receiver in his *Carrying on the Practical Way* article, *PW* April 2009: *"The Sudden is a direct conversion (DC) receiver. Most (*remember this is 2009 – **ed**.*) receivers are of the superheterodyne (superhet) design in which the received signal is converted to an intermediate frequency (IF) for amplifying and filtering, and then converted into the audio frequencies that we can hear. The DC receiver, as the name implies, directly converts the radio frequency (RF) signal to the audio frequency (AF) we listen to. The signals from the antenna are fed via input tuned circuits to a mixer; sometimes called a product detector. Here the radio signals are converted into audio signals, by mixing them with a local oscillator. If the frequency difference between the radio signal and the local oscillator is within the audio frequency range, an audio signal will appear at the output of the mixer where both signals are present. This audio signal can then be amplified to provide a comfortable listening level".*

The circuit diagram, **Fig. 1**, is that of the *Sudden* as it appeared in *PW* November 2009.

Last Year's Project

Last year I decided to build a 7MHz CW transmitter and receiver on breadboard to see if I could make it work. You see, I still fondly remember the fun I had as a kid with my Philips Electronics set and found building on breadboard rekindled that sense of accomplishment. (After all, that electronics set did lead me into amateur radio and many years working in telecommunications).

But rather than just show off that little gem, based on George's utility transmitter (yes, another *PW* article) and the *Sudden* receiver, at this point I thought I'd put together a *Sudden* receiver on breadboard. Circuit-wise, it is similar to the one George describes in his Nov. '09 article and I've built it in a couple of stages to show some simple steps and alignment.

I decided to use new components for this little project. Where do I get the key components to build the receiver? Well, membership of the G-QRP club gives me, among many other things, access to the excellent Club Sales run by **Graham G3MFJ**. Please note component sales are for members only. The components can, of course, be sourced from other suppliers in the UK, including the 400-point breadboard. The general parts like capacitors and resistors, I have collected over the last couple of years from various suppliers and rallies.

The breadboard method of construction just requires components to have sufficient lead length to hold securely in the tracks. By getting the parts together before I start building, it gives me a chance to gauge the required area of board for each stage.

The Build

I built the LM386 audio amplifier stage first. This was actually my second attempt at placing the components on the board because I hadn't left enough room for the next stage of construction (some plan!). I then added a 9V regulator so that I could use any of my 12V DC supplies. The photo, **Fig. 2**, shows the result of my efforts.

After completing the amplifier and checking the wiring, I thought what's the best way of testing it? Well first of all, I connected my recently built AF function generator and variable voltage supply (see *Warts and All Revisited – PW* Feb 2020), set to 12V. I immediately discovered the generator output overloaded the audio amplifier, even when turned to minimum. So, a quick test is, with the 12V supply connected, place a finger on the input capacitor's wire leads – if there's buzz on the speaker, there's a good chance it's working.

Next, I put the NE602 mixer/oscillator IC in place and started to add the associated components. To quote George about the front-end: *"The single tuned circuit input filter in the original receiver is a rather lightweight solution to combating broadcast station breakthrough on or near the 7MHz band. Although the input attenuator helps, a bandpass filter would be better. There are many available circuits".*

For this project, I stuck with the single tuned circuit, using a toroid core for the coil because it fitted the board without soldering being required. Unfortunately, I had to use a lighter gauge of wire than I wanted to and it meant the ends of the windings sprang closer together than I would have liked. In my version of the *Sudden*, I used a 7.37MHz ceramic resonator in the oscillator part of the circuit to provide 40m coverage. The ceramic resonator has an inductor and an old variable capacitor in series connected to 0V to pull the receiver frequency down to 7.1 to 7.2MHz or thereabouts. George discusses other options in his articles.

Again, I checked my wiring before re-connecting 12V. Now time to use my HF signal source (see *An HF Signal Source using Negative Electrical Resistance – PW* March 2020) to get the receiver oscillator within the 40m band. To achieve this, I had to play around with the inductor and capacitor values in series with the ceramic resonator.

I then connected my 40m inverted-V antenna and peaked the input tuned circuit trimmer for loudest signal. The stability of this basic receiver was more than respectable enough to listen to SSB transmissions. Not bad for a few components on a bit of breadboard, **Fig. 3**.

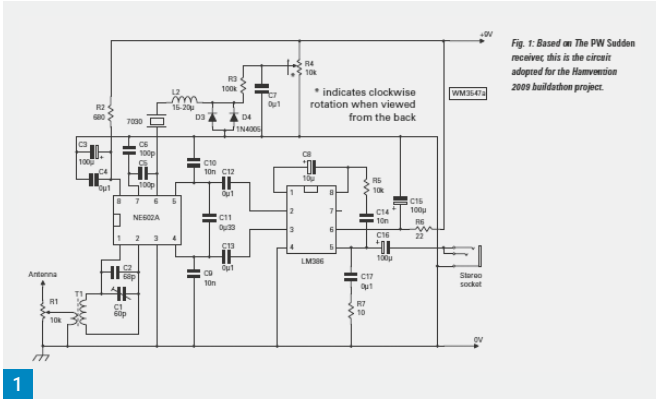
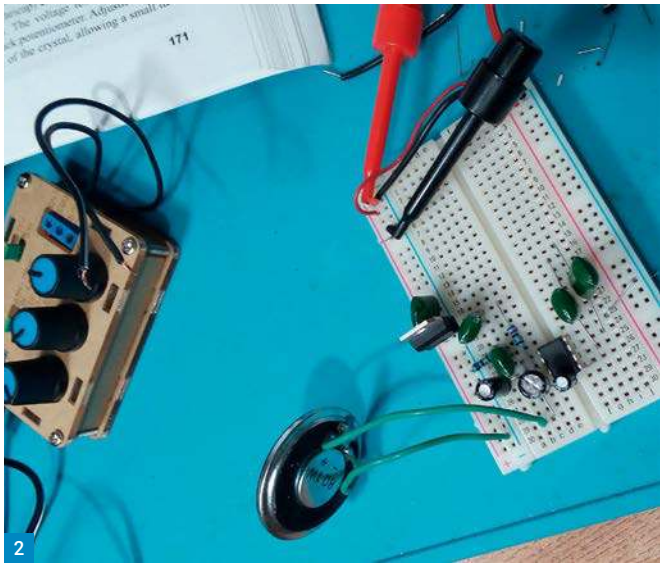
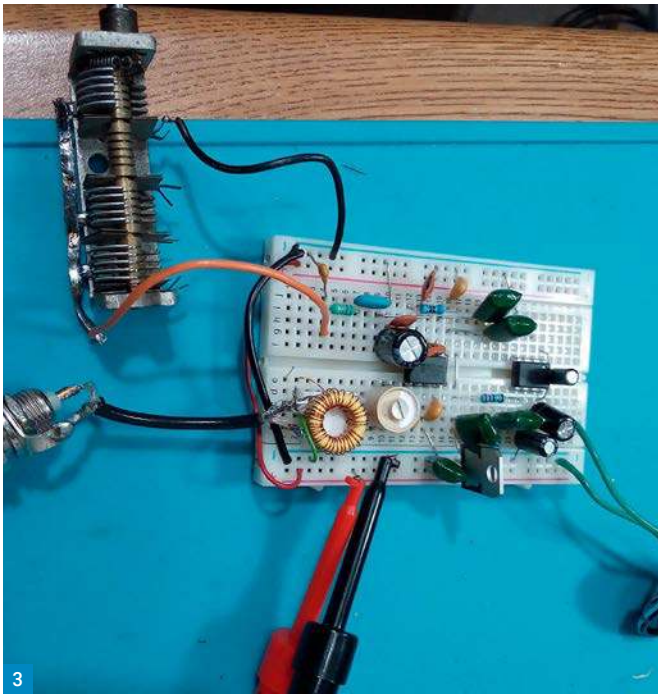
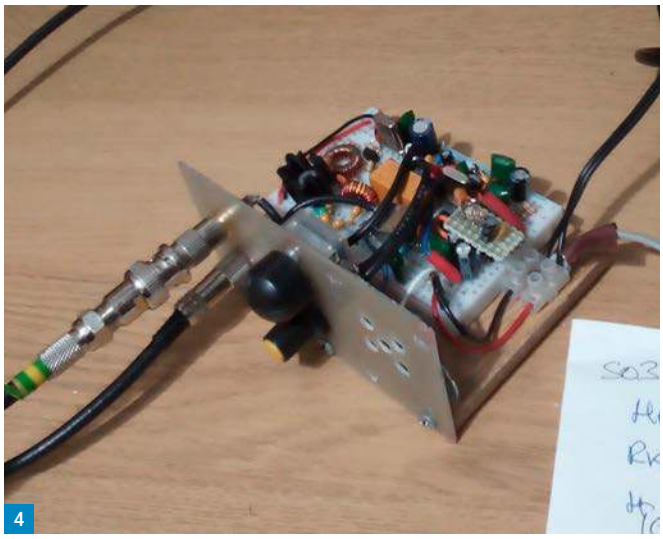


Fig. 1: Based on The PW Sudden receiver, this is the circuit adopted for the Hamvention 2009 buildathon project.







The Results

Please don't expect cutting edge performance from this little receiver but my other *Sudden*-based receivers have already performed well in numerous QSOs on 40m and 30m. My favourite, though, is the breadboard 40m transmitter/receiver, **Fig. 4**, because it just makes me smile every time I actually make a contact with it.

The transmitter and receiver have nearly 8kHz of tracked tuning using two separate variable crystal-controlled oscillators (that took a little time to get right), there's semi-break-in keying, audio boost circuitry and a speaker.

A couple of words of caution about breadboard. First, the actual construction with metal strips means there is some noticeable capacitance between tracks. I measured the capacitance as 6pF between two adjacent tracks using my cheap component tester. This does affect the oscillator frequency when using series capacitance and inductance. Secondly, don't force heavy gauge wire or components with heavy gauge wire-ends into the board. It can damage the board and possibly make for poor connections within the same track. But I'm still amazed how well this method works on the lower HF frequencies.

George's articles provide all types of insights that are well worth a read. There are *Sudden*-related articles in Nov '09, May '10 and Dec '10 in particular detailing Spectrum coils used as replacements to the old Toko coils. There are also further articles detailing the NE602/LM386 combination in receivers on the *Carrying on the Practical Way* CD.

Fig. 1: Circuit of Sudden receiver.
Fig. 2: LM386 audio amplifier on breadboard.
Fig. 3: Completed Sudden receiver on breadboard.
Fig. 4: Breadboard 40m transmitter/receiver.

Having made this simple receiver work, something else made me smile – I should have finished reading George's April '09 article to the end. The last words from George: *"I breadboarded a receiver using the VXO technique and the circuitry described this month and it made a very useful receiver for the 7MHz band. So, try it and have fun!"*

The *Carrying on the Practical Way* CD is available from the Radio Enthusiast website at:
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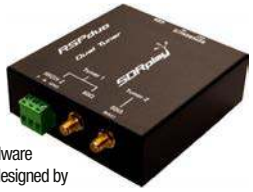
ERW7 USB computer interface cable for DX-R8E..... **£39.95**

SDRplay



The people behind SDRplay are a small group of engineers based in the UK with strong connections to the UK Wireless Chip Industry. They have both software and hardware expertise and the RSP was designed by them here in the UK.

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Raspberry Pi Explained For Radio Amateurs

Don Field G3XTT
practicalwireless@warnersgroup.co.uk

Don G3XTT couldn't resist a look at a new book from PW columnist Mike Richards G4WNC.

Mike Richards G4WNC is well-known to *PW* readers. He took over the RTTY column from **Ron Ham** around 25 years ago and has stayed with us, following developments in amateur radio data communications, as well as being an occasional reviewer, especially of SDR and other leading-edge gear.

Mike's enthusiasm for the Raspberry Pi is also well-known, both from his columns in this magazine and the Pi workshops he has run at the RSGB Convention.

This book, then, is a natural end-product of his years of playing with the Raspberry Pi in an amateur radio context, as a cost-effective platform for data modes and much else. However, there is obviously an existing wide literature about the Pi as well as lots of resources on the internet. So, is there a role for this new RSGB publication?

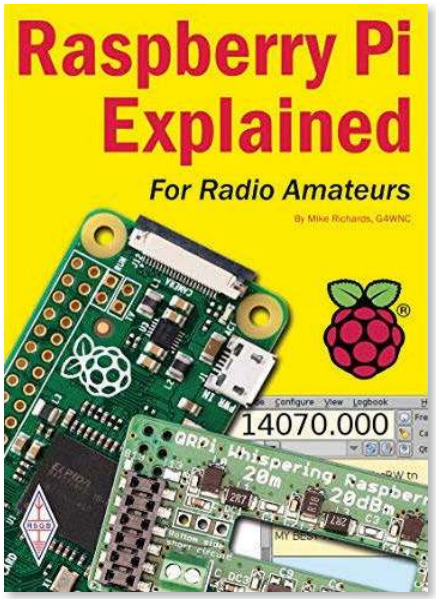
Where this Book Fits In

To begin to answer that, I can do no better than quote from Mike's own introduction to the book. *"There are already plenty of Raspberry Pi books that cover the Pi from many angles, and I have bought many of them myself. However, I've yet to find one that feels like that vital reference you grab when you start a project. If you're anything like me, you are probably thinking 'what can I get the Pi to do right now'! So, I have started with a series of projects so that you can quickly make your Pi do something useful. This is followed by how to install popular radio applications and using the Pi for Software Defined Radio (SDR). After a while you'll want to create your own projects and this is where the other chapters will help you".*

As Mike says, the documentation that comes with the Pi is about how to get it up and running but that still leaves the question for we radio amateurs as to what use it can be in the shack. In my case, I log, run data modes, interface to my rigs and so on using a traditional PC. I have quite a selection of PCs of various generations, each replacing an earlier one. I'm working right now on the most up to date because editing *PW* is my most demanding application but my shack PC, which cost me a little over £100, is more than adequate for the radio applications I run.

Why do I need a Pi?

So, why a Pi? To an extent the answer is



the same as why build your own radio gear. Many of us came into the hobby because we enjoy tinkering with things technical (sorry, 'self-training' to invoke that well-used phrase!). And whereas few of us will program for the PC, which requires a lot of basic understanding of the Windows operating system, it's actually not too challenging to learn basic Pi programming, knock up some simple projects and, in the process, to learn and to enjoy. And where the Pi really scores is in applications such as WSPR, APRS and the like, where you might want to leave an application running 24/7 without tying up your shack PC.

Contents

Mike's book starts with describing the various members of the Raspberry Pi family and how to install the operating system of your choice. The next chapter takes the reader through some simple, starter projects that could be handy around the shack. Mike then moves on to installing the popular radio applications such as FLDIGI and WSJT-X. This is followed by a look at using the Pi with SDR transceivers such as the ANAN that run software from the HPSDR project.

There's a chapter on Pi Linux, particularly Raspbian, the Linux distribution developed especially for the Pi. This leads, after a chapter on hardware quirks (design compromises that keep the cost of the Pi nice and low), to doing your own programming, although this is certainly not something that all readers of the book will want to do. However, why not? This is where the real learning comes in. The author admits that he's not a trained programmer. Rather, he is self-taught but, as *PW* readers know, that hasn't stopped Mike from getting a lot out of the Pi over many years.

The later chapters focus on interfacing the Pi to the outside word, using its GPIO (General Purpose Input Output) connector, options for powering the Pi and connecting to various display types. There's also a chapter on keeping time, important for applications where clock accuracy is crucial.

Interestingly, before concluding with a chapter on alternative single-board computers and some troubleshooting tips, Mike includes a chapter on Voice Control and Artificial Intelligence (AI). This threw me because I rather think of voice recognition and AI as requiring massive amounts of computing power. What I hadn't been aware of is that Google have partnered with the Raspberry Pi development team to make their AI platform available on the Pi. The idea, of course, is to make the Pi even easier to use, by enabling a level of voice control.

Worth Buying?

All in all, this looks like being a handy book and I will certainly be revisiting my Raspberry Pi with a view to using it in the shack rather than simply 'playing' with its basic functions. In terms of coverage, the content strikes me as pretty comprehensive. From a personal point of view I would like to have seen something on Morse code (a Pi could surely be a great electronic memory Morse key, with a suitable paddle interface). However, I Googled that and there are indeed many Pi-based Morse code trainers and key designs available online. That brings me to a second point, which is that I would have liked Mike to recommend his favourite (most useful) online sites and forums dedicated to the Pi because, frankly, the choice is pretty overwhelming. However, these are minor quibbles with what is likely to be a really handy resource for anyone with a Pi in the shack or thinking about trying one out.

Raspberry Pi Explained, For Radio Amateurs runs to 202 pages and is available from the RSGB for £15.99 (non-members): https://tinyurl.com/uy6vd4p

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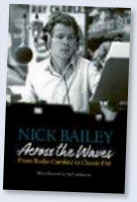

This autobiography gives a an count of Nick Bailey's life with Radio Caroline, other radio stations and finally with Classic FM. Reviewed in September's RadioUser, this is "an extremely entertaining and very readable book..."

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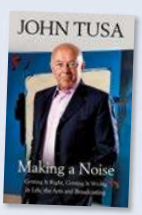

John Tusa looks back over a long and varied career in radio, television and the arts. In this autobiography, Etched with candour, this is an entertaining memoir of Tusa's life.

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

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Submarine Radio

Philip Rush
practicalwireless@warnersgroup.co.uk

Philip Rush tells the tale of his dad's exploits as a submarine wireless operator.

1

I grew up with amateur radio. The smell of solder, the colour coding of resistors, a whole vocabulary of coils, two-metre antennae, mobile stations and QSL cards.

My Dad was G3HBZ. He talked to people round the world and told them what the weather was like and how clearly he could hear their voices. He was unfazed that a man in Afghanistan should speak perfect English with such crystal-clear diction, unfazed that a man on the north coast of Australia had a story about his daughter having to be rushed to hospital. He spoke to a man in Prague as the Russians invaded in 1968. I never heard a woman's voice.

We lived in Middlesex and our house was one of those chalet houses where the roof ran very low and the upstairs bedrooms were really in the attic, with dormer windows poking through. There was no loft to speak of, as a result, but there were cupboards in the eaves, one for each bedroom. These were useful as built-in wardrobes or places to hide toys when it was time to tidy up.

A Radio Base

Dad converted his to a radio base. He fitted partitions across from front to back and set his equipment on to the battens. By crouching as he went through the door he could squeeze into a small chair and look at the dials and so forth, which were all part of the fun. His equipment was finished in a businesslike pale grey, which had something of the bird's egg about it, and was labelled carefully, at first with pieces of printed laminate, the letters etched in and coloured white, and later with Dymo tape, which was his pride and joy. The lexical field of amateur radio was captured on plastic tape with a distinctive smell and fixed to the metal boxes. The space was about four feet deep and five feet high. There was room for a small desk and a chair, but once you were in, you couldn't shut the door.

I have looked through some of the photographs that have survived from these years and there are none of all this. No pictures of radio cupboards. We must have considered it normal and in those days, the sixties and early seventies, you took photographs of special occasions and not of normal routines. It's a pity there are no photographs because I am having to rely on my memory, which will I am sure have been altered and faded by time.

My Dad used a Morse key with a huge amount of skill. He used his left hand. He knew the alphabet, of course, but also a plethora of little catches and tricks, which helped him to send words more quickly than we could speak. Text messages today use similar dodges to contract words and save time.

He received QSL cards in the post. They were gorgeous things, often with wonderful stamps, and deserved a museum of their own. I don't know what became of them. When Dad died in 2016, I looked high and low for them but they had gone. I can't really imagine his having thrown them away. I found one of his, and the green colour of the callsign lettering brought back a host of memories.

Mobile Rallies

We went to mobile rallies. The boot of our Morris Traveller was filled with equipment, a whip antenna was fixed to a bracket by the rear bumper and we set off west. Longleat was a big destination, and once we went to a USAF airbase in Oxfordshire and drove along a runway. On the way, Dad kept up a conversation with the mobile rally people telling them where he was, what the weather was like and how clearly he could hear them, which, considering everything, was very clearly indeed. The Morris Traveller was not a fast car and I always thought Dad drove safely, but these days he would have been pulled over and

Photo 1: Dad at a radio. Photo 2: The gear in the back of the Morris Traveller. Photo 3: Radio gear in the submarine museum.

fined. This was by no means a hands-free operation.

At the rally, Dad would tour the stands, meet old friends, and spend a few pence on components and oddments. He showed them to us as a schoolboy might show his mum what he'd swapped a tin soldier for.

Sometimes, we didn't go to the rally itself but would set up our own alternative base on the Wessex downs. Once or twice Dad used a kite to carry an antenna into the sky and it would be our job to keep the kite flying. The kite had his callsign on (of course) and was a natty blue and white that mum had sewn for him, and which made it look like some sort of Royal Navy signal flag.

Navy Days

Dad served in the Navy towards the end of the WWII. He was a wireless telegraphist on a submarine. He never spoke about his experiences. We found some of his things when he died. He appears to have travelled on *HMS Porpoise* to western Australia – this would have been in 1944 – where he was taken off the ship and sent to Colombo to join a 'listening station' at a naval base named after a golf club. *Porpoise* went on to lay mines around the west coast of Burma, to combat the Japanese fleet. In January 1945, *HMS Porpoise* was sunk by a Japanese aircraft and lost with all hands. All the men who had travelled with Dad on a submarine to Australia were dead. We think now that this was why he never spoke of those days.

Portsmouth

Recently, my brother and I visited the submarine museum in Portsmouth. If you have been, you will remember it well. If you have not been, the first thing to know is that although there is a kind of waiting room, and a garden of remembrance with all the names of those lost from ships such as *Porpoise*., the museum is basically a submarine, *HMS Alliance*, which has had two doors cut into the hull and which has been tidied up as a museum and as a memorial.

I expected it to be cramped and I expected it to be cylindrical. But I did not expect it to be this cramped and I did not expect it to be so nakedly cylindrical. We stood in the forward torpedo section, the business end, and a retired submariner told us about life on a submarine. They have a language all their own, submariners. Towards the end of this introductory talk he told us that we'd now walk past the ward-room, the galley (where a 'chef' cooked 180 meals a day), the navigation room and the wireless telegraphy room. My brother and I wormed our way to the back of our group, which was dominated by a dozen

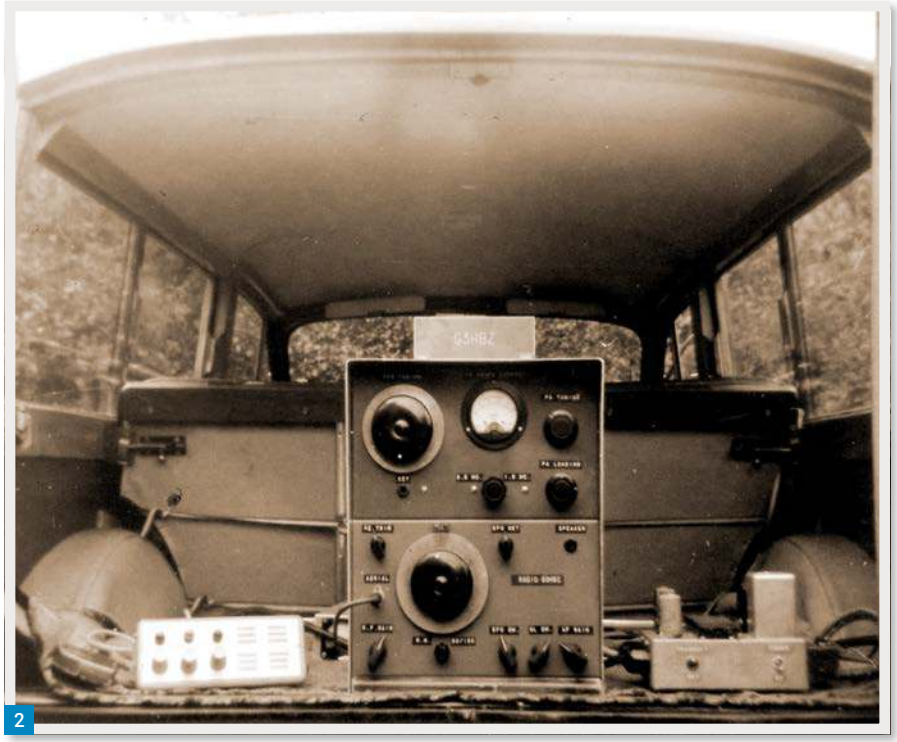
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Photo 4: Memorial plaque at Portsmouth.

young men who were training to serve on the Navy's new generation of submarines, so we could pay attention to the wireless room and take some pictures.

We got to the wireless room as the rest of them got to the important bit of the submarine, the one you see in the films, with the periscope and **John Gregson**. We couldn't believe our eyes. Here was a beautiful reconstruction of Dad's eaves cupboard: the partitions, the desk, the not-enough-room-to-swing-a-cat and the grey-fronted, carefully labelled equipment. As we took a couple of photos in the bad light, we laughed with tears in our eyes. We had never realised that Dad had built a submarine in the eaves of our suburban home.

But here it was. And there was the Morse key, bolted down on the bench, to the operator's left-hand side. When Dad began in the Navy, on shore training, he instinctively moved the key across to his right-hand and the notepad to his left. *"What do you think you're doing?"* the man barked. My Dad explained he was left-handed. *"Not any more you're not!"* Dad learned to write again with a beautiful flair, but always ate with the fork in his right hand and bowled with the ball in his left.

We ended in the engine room. Huge diesel engines with everything naked. The pistons were there right in front of you like some sort of demonstration of internal combustion. Despite the passing of time the smell of diesel lingered. To one side stood a lathe and we were told that this was the most important part of the submarine. (My brother and I nodded, even though we both knew the radio was clearly the most important part.) The boat had no room for spare parts. To be fair it had no room for sailors either, who couldn't sit down except if they were on duty where a chair was required, and there were fewer than 40 bunks for a complement of over 60. Anyway, if something broke, you had to make a replacement. There seemed to be no end of baked-bean tins available as raw material. As long as it wasn't too urgent, and you could make a replacement out of the broken bit or with a baked bin can, the lathe would do the trick.

The Penny Drops

At this point, and only 70 years after the event, the penny dropped, and we understood why Dad had been so valuable to the Navy – he could fix a radio on a submarine. There would have been a couple of clearly labelled boxes containing resistors, valves, capacitors and so on. And I am certain of this, because in our eaves cupboards there were old OXO tins, big ones, which shops used to hold dozens of the little vacuum-packed stock cubes, each with one end painted matt black and on the black in beautiful, right-handed, lettering, 'Resistors', 'Capacitors', or 'Valves (transmitter)'. And Dad would have replaced a valve, or fidgeted with a circuit, or re-soldered connections and blown the new joint the way a sheriff in a Western blows the barrel-end of his revolver. I saw it all a thousand times.

The smell of solder, the smell of diesel, the smell of 60 sailors who hadn't washed for a month, the deafening roar of the engines, the constant risk of drowning. And out there, a thousand aeroplanes that would do their best to kill you.

MP3 Player

Geoff Theasby G8BMI offers another handy project – an MP3 player for minimal cost and maximum fun!

Geoff Theasby G8BMI
geofftheasby@gmail.com

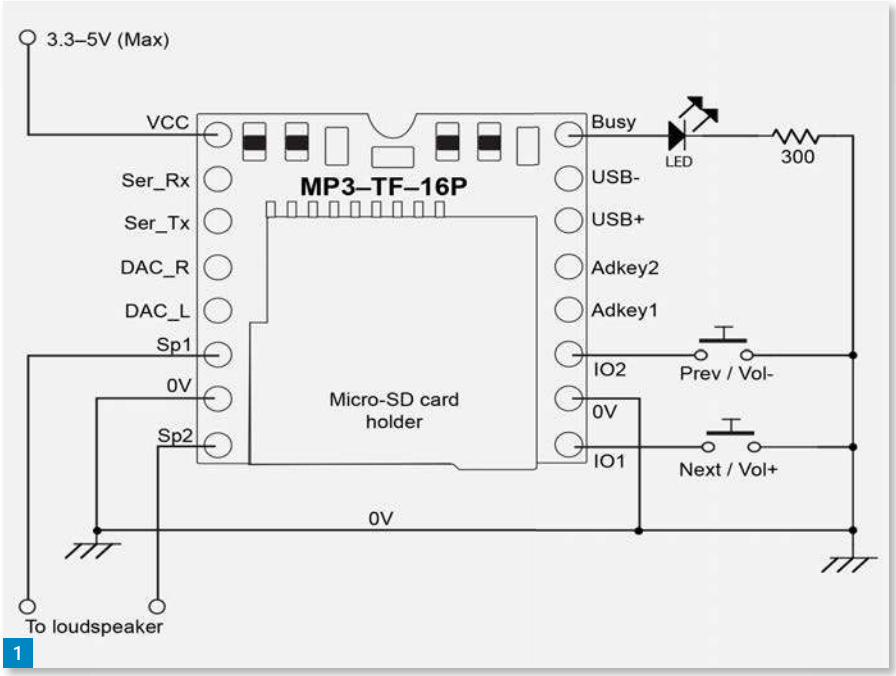
I present here one of the most absorbing, fun and instructive projects, on a square inch basis, I have tried of late. On a PCB the size of a large postage stamp, there is an mp3 music player capable of holding perhaps 3000 tracks. All that is required is this module, memory card, a loudspeaker, some push buttons and a handful of resistors.

In constructing my various audio projects, filters and so on, I needed a source of recorded sound that was familiar. Some readers may like background music in the shack when not 'on the air'. Using the station receiver does not offer long term consistency, and test oscillators become tedious after a few minutes. I dug out an old cassette tape player and found a tape, although I no longer used them in the hi-fi. As the current trend is for music streaming online, I decided an mp3 player would suit. Now, such music players are available for about £15 upwards but anyone can buy one in a shop. As an electronics enthusiast I wanted to make one. These modules are ubiquitous, costing only £1 upwards, and I found this one, which is simple but is capable of being more complex if required. Unlike many such electronic modules, it does not require an Arduino to make it work, or any form of programming, but can operate as a stand-alone unit. Search for 'MP3 module' on eBay, for example, and you will find this and similar products, all for well under a fiver.

Description

The basic circuit is shown in **Fig. 1** and is about as simple as can be. Such simplicity hides a complete intolerance of the slightest wiring error. After building a couple in an evening, I spent most of the next day getting them going. I released the 'magic smoke' on one, but a second survived my abuse. Using two buttons, the module will start, stop, play the previous track or the next, and vary the volume. Further complexity can be incorporated, with 20 buttons to access its full memory, or it can be connected to an Arduino or similar, allowing programming from the desktop computer using its USB connection.

The IC at its heart uses a novel design that offers various facilities, selectable by choosing different resistors, but using the same pin on the module. If you build it on Veroboard using switches in echelon as in the photo, **Fig. 2**, and double, nay, triple-check orientation before switching on, all will be well. The final PCB measures 90 by 30mm.



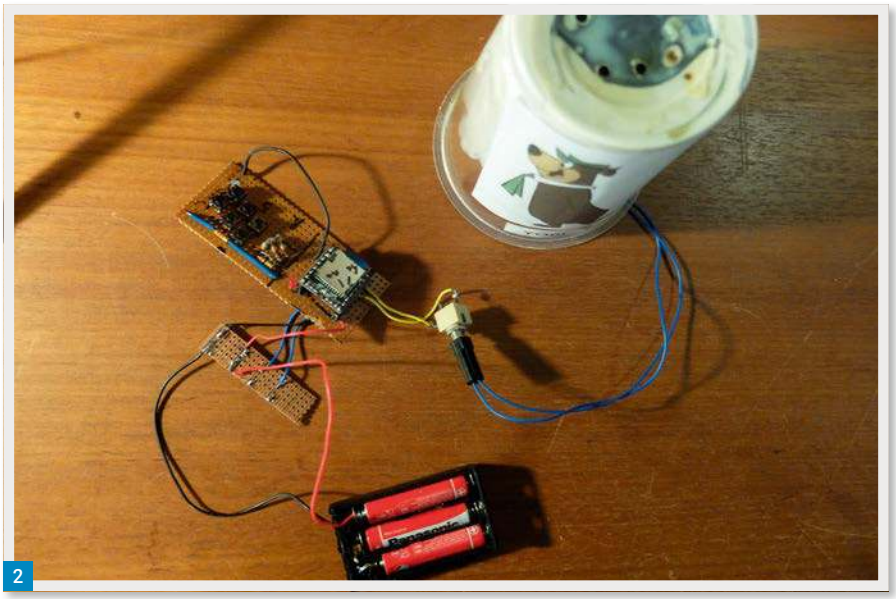


Fig. 1: Circuit diagram. Fig. 2: The author's realisation of the circuit on Veroboard with Yogi, the speaker!

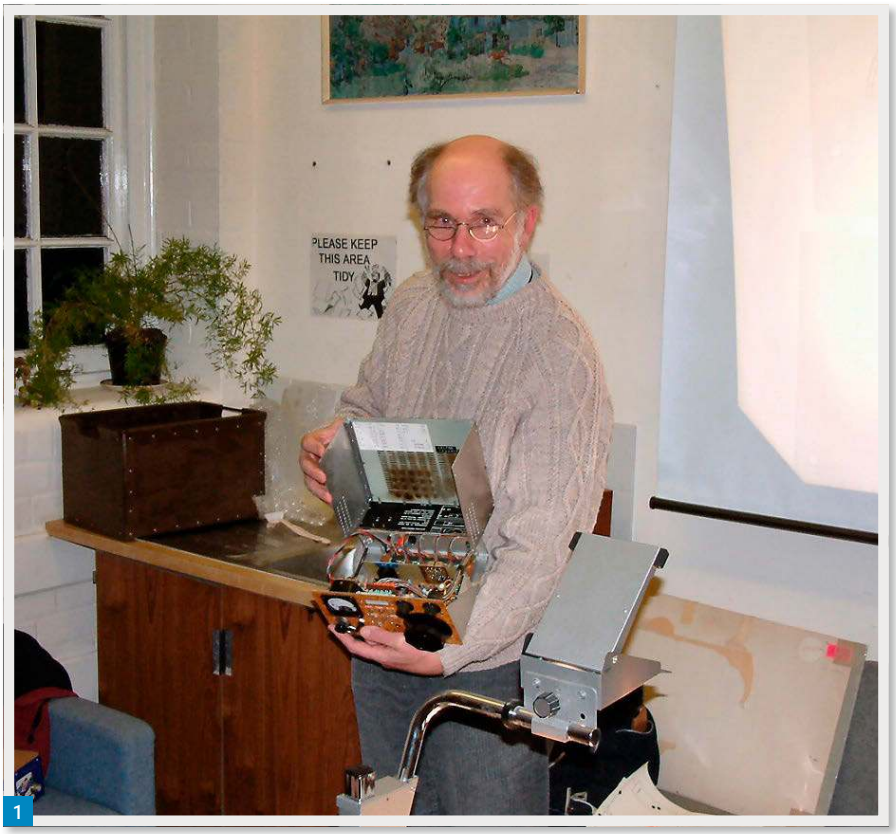
The infinite baffle speaker is made from yoghurt pot with a 2in loudspeaker glued in. I call it Yogi. The wide base is stable although the weight is high up. Lined with foam/wadding, it provides free sound improvement.

Quick dodge: instead of trying to solder wires together in mid-air, use this simple Veroboard interface. It works beautifully, avoiding the risk of short circuits in testing: https://tinyurl.com/yxhrf8rb

Colin Redwood G6MXL
practicalwireless@warnersgroup.co.uk

Radio Clubs

Colin Redwood G6MXL looks a radio clubs and societies, focussing on their role in the hobby.



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While it is possible to enjoy our hobby without being a member of local amateur radio club or society, I think that by doing so, amateurs risk missing out on some useful self-development that local clubs offer.

Talks

Many local radio clubs will see a programme of talks as one of their main activities. Some clubs limit these talks to pure amateur radio topics, others go beyond to cover other technical subjects that are likely to be of interest to members. From time to time, some clubs hold evenings of short 10-minute talks or similar. These short duration talks are a great way to pass on some hints and tips, or even just get the message over that the speaker is starting to explore a particular aspect of the hobby and would welcome an exchange of hints and tips with other members. Some clubs try to organise a talk every week, others less frequently. I'm sure I'm not alone in finding a well-publicised programme of regular talks a major attraction for me to attend my local club. Make sure that your own club makes a particular point of welcoming visitors and external speakers.

Many speakers these days will want access to a projector and screen so that they can connect to their laptop computer to project their PowerPoint material or demonstrate some of the numerous aspects of the hobby that involve using a computer. Internet access is becoming an increasingly important prerequisite for some talks. Some speakers will bring along equipment to demonstrate during their talk, **Fig. 1.**

Skype

Some clubs use Skype to enable them to arrange talks by speakers who live well away from the club, even in other countries. This can work well. If you are asked to give a talk over Skype for the first time, I'd suggest having a practice run in advance to make sure that all the technology works. If you are using diagrams, pictures, videos or PowerPoint, I'd also suggest checking them all out in advance, to make sure they are all visible at the other end. If your club is considering using Skype for the first time, I'd suggest trying it out with a local member so that you can iron out any technical issues before inviting a long-distance speaker.

Skype may also be a useful tool to help members who are unable to get to the club to participate in meetings.

Training

For some clubs, training for the three licence exams (Foundation, Intermediate and Full) forms a very significant part of their activities, **Fig. 2**. Some clubs have been less active in their training activities in the last six months or so while they update their training materials for the new syllabus that came into effect in September 2019.

Mentoring

Besides training for the three licence exams, many clubs provide all manner of formal and informal help to their members. This can include getting advice and opinions for other members, help in setting up equipment, erecting antennas or providing a local signal to try out some home-built equipment. Much of this informal help might be considered mentoring.

I've sometimes read of newcomers complaining that club members won't provide the help they desire. In one instance the person was expecting a very significant commitment of time to repair a transceiver, yet the amateur in question had not even joined the club. Not every club will have members with the equipment, knowledge and skills to repair transceivers. Even if they could, many amateurs won't feel comfortable repairing another amateur's equipment. These sorts of activities tend to work best when help is reciprocated in some way.

Construction

Many clubs have some sort of constructional activities either regularly or from time to time. There is no doubt that having others around to mentor those new to construction can be very helpful, especially if you need help diagnosing a fault or need to use some specialist test equipment. Even the most experienced

Fig. 1: A talk at a local club.
Fig. 2: Providing training for amateur radio licence exams is an important part of the programme for many clubs.
Fig. 3: Operating from a club meeting.

constructor can sometimes benefit for talking through a fault with someone who may look at it from a completely difference perspective.

On-Air

Many clubs try to have some on-air activity from their meeting place, **Fig. 3**. For some, this might be in the form of using equipment brought along by members. Other clubs may have antenna farms ranging from simple wire antennas up to multi-element beams for a number of bands with a range of transceivers and linear amplifiers capable of using them. This can be an excellent opportunity for members to experience bands or modes that they don't usually operate. I know of one club that is equipped to give members the opportunity to make EME contacts on 10GHz – something that only a very small minority of amateurs have ever tried.

This aspect of club activities should not be under-estimated. It may provide the only way for members who cannot set up a station at home to get on the air. On air operation including club nets can also provide publicity for the club, giving the club 'street cred' among local amateurs.

Contest Groups

The extent that clubs get involved in contesting varies. Some exist solely to participate in contests, while others may never participate in contests. I suspect that most clubs fall in between these two extremes.

Repeater and Beacon Groups

Some clubs build and run local repeaters or beacons. Some of these repeater and beacon groups are independent of local radio clubs, others are a subsidiary of a local radio club.

Natter

Without doubt, many radio amateurs attending amateur radio clubs like to have a chat with fellow amateurs on just about any subject you imagine. While amateur radio topics are popular, other topics are also covered in their chats. Some clubs specifically schedule informal 'natter nites'.

Promotional Activities

There is no doubt that the future of amateur radio benefits from some promotion. There's no single way that guarantees success. Some clubs are very active in what I would call taking amateur radio to the public, **Fig. 4**. Others prefer to attract potential recruits to their meetings. Probably a combination of the two is optimal. Attending local rallies as a club is good way to promote your club. If there are no rallies within, say, a 50-mile radius, then it might be worth organising one – but be prepared for a lot of work!

Remember also that the club website (hopefully all clubs have one nowadays) is up to date and welcoming in its appearance and content. The website is, for many, their first encounter with the club and is the club's public face to the wider population.


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Socialising

In addition to their amateur radio activities, many clubs run social events from time to time. For some this may be limited to an annual barbeque or dinner. Others organise quizzes or may have a regular meet-up for breakfast.

Finding Your Local Club

There are several ways of finding your local clubs. Firstly, you can have a look in the RSGB's *Year Book,* **Fig. 5**. Secondly, you can have a look at the RSGB website (URL below). Thirdly have a chat with local amateurs you talk to on the air. Finally, you can search with your favourite search engine using terms such as amateur radio and the name of your local town.

https://rsgb.org/main/clubs/club-finder

No Club

If you can't find a suitable club in your locality, then you could look to starting a new club. While this may seem a bit daunting, it is a relatively easy thing to do. You'll need to do some research. You'll need to find a way of contacting prospective members. The RSGB's Year Book has a list of amateurs in postcode sequence. You could use this as a prompt for knocking on doors or sending letters. In addition, sending letters to the Editors of Practical Wireless, RadioUser and RadCom can also be an effective way of publicising an embryo club. QRZ.COM is a source of e-mail addresses, although I suspect many may be out-of-date.


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Finding Premises

Finding premises for a club to meet can be quite a challenge. Almost certainly you'll need to pay to hire a hall for a few hours a week. There are a number of organisations that can be approached, all of whom may be pleased to welcome additional income. I'd suggest approaching local schools and colleges and local youth organisations such as the Scouts and Guides. Many religious groups have halls that they let, but be aware there may be limitations on

when you can meet such as no meeting on their religious festivals and similar. Some clubs meet in local pubs who may welcome the extra business that club members can bring. In each of these cases, it is worth checking the likely reaction to erecting antennas on a permanent basis before committing to a long-term hiring agreement.

Insurance

Insurance should be a consideration for all radio clubs. The two main areas that need consideration are public liability and equipment. Public liability needs to be considered so that the club is covered in the event that it is sued as a result of accidents to members, the public or the premises as a result of club activities. As a club starts to acquire equipment it needs to find some secure storage for it. It makes sense to insure the equipment against theft and accidental damage. In all cases, I would recommend checking that the insurance (including that which comes with the RSGB Club membership) properly meets the needs of the club. Don't just assume. Consider what would happen if the club's transceiver was stolen from the unattended storage location.

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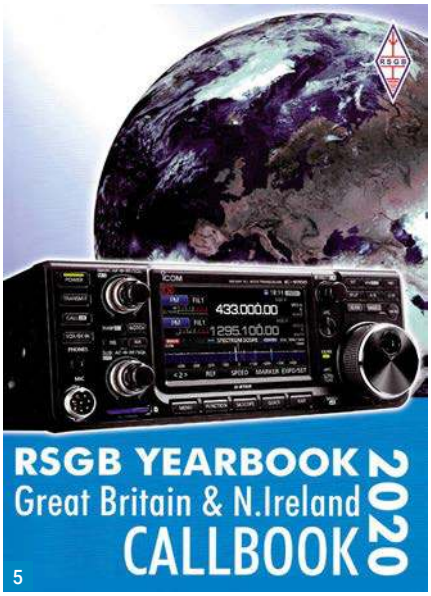

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Fig. 4: Taking amateur radio to the public.
Fig. 5: The RSGB Year Book is available from the PW Bookshop.

RSGB Affiliation

Most local clubs are affiliated to the RSGB. There are numerous benefits that include being able to enter RSGB contests, use the RSGB QSL Card bureau, having access to EMC help and planning help. For a club an important benefit is the public liability insurance that comes as part of the club affiliation. The RSGB also has available a suitable pro forma club constitution, which can be tailored to your particular circumstances.

Virtual Clubs

What on earth is a virtual club I hear you say? I'll take Essex Ham as an example. In addition to the various 'regular' local amateur radio societies in Essex, there is a separate 'virtual' organisation called 'Essex Ham'. Essex Ham is open for all amateurs to join for free. While its membership comes mainly from amateurs in Essex, some also come from neighbouring counties and even further afield, with many joining Essex Ham in addition to their local society. Essex Ham does not have formal meetings, but instead organises various activities across the county to promote amateur radio and to support newcomers to the hobby. They also run a popular online Foundation course, which has recently been updated to cover the new 2019 exam syllabus. Many amateurs are using Essex Ham to help them in preparing for their practical assessments and exams.

Other examples of virtual clubs include Cambridge-based Camb-Hams (see link below).
www.camb-hams.com

PW Archive Discs

I recently checked out the latest *PW* archive disc, which covers the whole of 2019. As usual it reminded me of the wide range of topics that *PW* covers in a year.

One point to note with these archive discs is that to get the full benefit of all the links, you'll need to install the relevant version of Adobe Acrobat Reader for your computer. Some other pdf readers may not follow the links.

These archive discs are a great way of reducing the space taken up by the hard-copy versions of *Practical Wireless* magazines. It's much easier to find a particular magazine. No need to rummage through a shelf of misfiled magazines only to discover that you have left the particular issue in another room! An additional bonus is that once you have finished with a particular article, you just need to close the file on your computer – no need to remember to put the hard copy back in the correct place on your shelf.

I've also found that loading the archive discs onto my laptop is a really useful way to carry numerous back issues of *PW* with me when travelling.

Dates for Your Diary

Every year there are a number of events that take place that are designed to help promote amateur radio to the wider public. I covered these in some detail in early 2017. It seems like a good idea to remind readers of the dates for 2020 and I have set them out in **Table 1**.

- **MARCONI DAY**
  25th April 2020
  Organised by Cornish Amateur Radio Club
  http://gx4crc.com
- **MILLS ON THE AIR**
  9th/10th May 2020
  Organised by Denby Dale Amateur Radio Society
  www.mills-on-the-air.net
- **MUSEUMS ON THE AIR**
  20th & 21st + 27th & 28th June 2020
  Organised by Radio Amateur Events
  www.radio-amateur-events.org/IMW/index.htm
- **LIGHTHOUSES ON THE AIR**
  22nd & 23rd August 2020
  Organised by K&P Mulcahy VK2CE
  www.illw.net
- **CHURCHES & CHAPELS ON THE AIR (CHOTA)**
  12th September 2020
  World Assoc. of Christian Radio Amateurs & Listeners
  www.wacral.org/chota-2020
- **RAILWAYS ON THE AIR (ROTA)**
  26th & 27th September 2020
  Organised by Bishop Auckland Radio Amateur Club
  http://rota.barac.org.uk
- **INTERNATIONAL AIR AMBULANCE WEEK**
  5th to 13th September 2020
  Organised by Radio Amateur Events
  www.radio-amateur-events.org/IAW/index.htm
- **JABOREE ON THE AIR (JOTA)**
  16th to 18th October 2020
  Organised by The Scouts
  http://scouts.org.uk + http://jotajoti.info

Table 1: Operating Events for 2020

Steve Telenius-Lowe PJ4DX
teleniuslowe@gmail.com

The Bands Pick Up

Steve Telenius-Lowe PJ4DX reports that the HF bands have been looking a bit more lively since the start of the year and there are some interesting DXpeditions still to come.

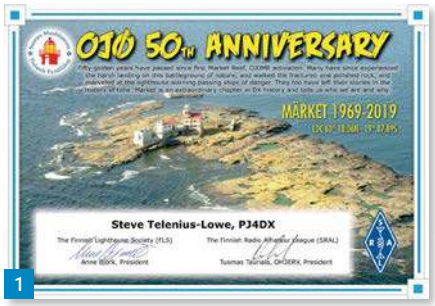
In the September 2019 column I reported on the 50th anniversary of Market Reef (OJ0) becoming a DXCC entity. Then, a couple of weeks ago, I was surprised to receive an e-mail from **Martti OH2BH**, one of the operators on the first DXpedition from that entity in 1969, who attached the certificate shown in **Fig. 1**. I had not applied for it, so I am not sure whether I received the certificate because I was one of the many amateurs who have operated from the island over the past half-century, or if it was because I had worked the appropriate number of OJ0 stations during the 50th anniversary year. Whichever, it was a pleasant surprise!

We often have amateur radio visitors to Bonaire and when we do the resident amateurs here usually get together with them for a dinner. Unusually, though, in January no fewer than three separate groups of amateur visitors were on the island at the same time: **Sylvain VE2LH** and his wife **Josée VE2JU**, **Scott W4PA** and his wife **Maria**, and **Klaas PA1KE.** The photo in **Fig. 2** was taken by Josée who is unfortunately therefore not in the picture.

The Bands Liven Up

I can't have been the only operator who thought that there had been little of DX interest on the bands since early November of last year. A combination of flat HF conditions and a lack of DXpeditions made the bands seem very lacklustre. Those 'winter doldrums' well and truly came to an end on January 31st, though, with the appearance of HU1DL, a German operation from the Pacific coast of El Salvador, followed a couple of days later by TI9A from Cocos Island in the Pacific. Both those stations were easy to work from here, at least on the bands from 21MHz and down, and I worked HU1DL on no fewer than 13 band-mode slots, including 160m SSB and 60m CW, during their first four days of activity.

Both operations were a lot more difficult to work from the UK, though on the other hand the French F6KOP group's operation from Bethlehem in Palestine as E44CC would have been a lot easier to work from the UK than it was from here! Then add to the mix two simultaneous IOTA operations from Tanzanian islands, 5H4WZ (Pemba Island, AF-063) and 5I5TT/5I5ZZ (Zanzibar, IOTA AF-032) and there was certainly a lot to chase during the first half of February.



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Look Out For. . .

Four Belgian operators, including **Ief ON6KX** and **Roger ON7TQ** (**Fig. 3**) plus SWL Kevin, who will be active as TU2R from Côte d'Ivoire (the Ivory Coast) between March 23rd and April 3rd, including an entry in the CQ WPX SSB contest. Outside the contest they will operate CW, SSB, RTTY and FT8 on 160m to 10m. Further details at:
tu2r.wordpress.com

Alex 5B4ALX will be active as T30ET from Tarawa (IOTA OC-017), West Kiribati, from March 18th to April 6th on 160m to 6m. Alex will use SSB, CW, RTTY, FT4 and FT8. See Alex's website for information on his use of FT8 and how to work T30ET on that mode:
https://tinyurl.com/qooqksq

Brian Price GW4DVB will be on his annual holiday DXpedition to Palm Island (IOTA NA-025) in St Vincent and the Grenadines and active as **J88PI**. Look for him between April 6th and 14th on 40, 20, 17, 15 and 10m SSB, SSTV and FT8. Brian writes *"Palm Island Resort is one of the southernmost islands in the Grenadines, about a mile from Union Island; it has five magical beaches with bright white sand merging into vibrant turquoise seas. To get to Palm Island you fly to Barbados, take a 55-minute flight to Union Island, then a 10-minute motorboat to reach this private 135-acre hideaway... With coral reefs on three sides, crystal clear waters and five stunning beaches. Palm Island is small enough to walk around, yet large enough to find a deserted cove to hang up an antenna, relax and work the world."* Brian will be using 100W from a Yaesu FT-991A to a 10m-long vertical, **Fig. 4**, and a fan dipole. He asks for QSLs to be sent direct only to PO Box 20:20, Llanharan, Pontyclun, Wales CF72 9ZA.
www.g4dvb.co.uk

Readers' News

Owen Williams G0PHY (Biggleswade, Bedfordshire) wrote, *"Looking back on my log, things may be improving with a few more DX contacts and more time spent listening for DXpeditions. Contacts were made with C5FUD in the Gambia and RA9WU in Asiatic Russia, E44CC the French DXpedition to Palestine and KP4/AA7CH on NA-249, a new IOTA for me. I've spent time listening for VK9NK on Norfolk Island but have not heard him yet. I've also heard the Italians on Zanzibar* [5I5TT – **Ed**] *but have not worked them yet, but there is still a week to go so they may find a way into the G0PHY logbook. There is also 5H4WZ on Pemba Island to listen for; that would be another new IOTA for me. Storm Ciara broke one of the support ropes for one of the dipole ends but it's easily repairable."* Owen received the Antarctica award, **Fig. 5**, from the Russian Arktika club, which commemorated the Russian claim of the discovery of Antarctica 200 years ago. *"I managed to get enough points from working their special event station R200ANT and submitting copies of the 11 QSLs collected from 2001 to 2017,"* he said. The discovery of Antarctica is a fascinating story but the Russian claim is disputed because **Lazarev** and **Bellingshausen** only sighted an ice shelf, whereas Royal Navy Captain **Edward Bransfield** became the first to confirm the existence of land on January 30th 1820.
wikipedia.org/wiki/Antarctica

Tony Usher G4HZW (Mobberley, Cheshire) was another who mentioned storm Ciara. He wrote while 70mph gales from the storm were lashing his antennas. *"I'm glad to report that the 28MHz 4-element Sirio has stood up to the conditions well. For the price (still only about £120) it's excellent value. The other*

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antennas – 7MHz vertical, Moonraker VHF collinear and the Wellbrook loop – have also survived, as has the Tennamast standing, as it does, in 2.3 tons of concrete! 28MHz continues to be very poor – just 23 contacts, 22 EUs and 1 PY. 7MHz, 155 contacts in 43 DXCC entities. The band is open 24/7; I'm finding FT4 is more productive than FT8 on 7MHz."

Tom Morgan ZS1AFS (Robertston, near Cape Town) used his special ZT1T callsign once again over the Christmas/New Year period and worked 68 countries, mostly on 7 and 14MHz, but with some on 18MHz and a few on 21MHz.

Opening his New Year's Day log with 40m QRP, **Victor Brand G3JNB** (Shefford, Bedfordshire) worked LZ1EV in Bulgaria on a delightfully clear band. From New Jersey, NY2P was CQing on an equally tranquil 17m and worked first call. *"At 2230 on the 4th, **Oliver V44KAO** St Kitts, was calling on 40m amidst heavy QRN. An HB9 and I vied for his attention but he came back to me and my 50W to the fishing rod vertical. Days later on 80m, clear copy again as I screwed my new WOLFWAVE audio processor down to 120Hz and plucked both C31CT Andorra and W4A North Carolina from some dreadful noise. A pile-up raged on 20m above **T6AA** Kabul, so I slipped down to call him barely 'up one' to give me a 'DX Hat Trick' with **Robert** logged on 20, 30 and 40m. At dusk on the 17th, **Douglas VA5DX**, the only signal on 30m, heard me at 539. Nature smiled at last on the 22nd and an extraordinary 'lift' had 40/30/20m wide open. Starved of DX, powerful EUs piled in and it was hopeless until, on 40m, I slipped past the simplex roar around **Vlad VK3/***

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***UA4WHX** in Australia by calling him 500Hz up! Then on 80m, to my utter astonishment, at 2250UTC I did the same with JT5DX Mongolia with a wide split. By mid-afternoon on the 24th, Vlad was back and logged on 30m. On the 25th, propagation faltered but at noon I did work 9J2BO CQing from Lusaka on an otherwise silent 15m. For the closing days of January, the halcyon conditions were no more, leaving me to work only 'local' DX such as S01WS on 17m. And, finally, 'Hope springs eternal' as I await confirmation of my reply to a very, very weak late night CQ. I received the 'G3' but lost the rest to QRN. Who? JT5DX! Where? On TOPBAND!"*

Etienne Vrebos OS8D (Brussels) has made some equipment changes recently. A while ago his Icom IC-7851 failed and is now back in Japan for repair. He replaced it with an Icom IC-7610 but later decided he preferred his old Yaesu FTdx5000, so Etienne sold the Icom. Meanwhile, his Acom 1500 amplifier also failed, so for this month he has been using the FTdx5000 'barefoot'. He says he made around 225 QSOs all over the world using the Yaesu. *"It means my activities on HF were OK with only 200W. I didn't miss anything that important, and most QSOs with the US and Siberia (Far East) were very easy with 200W,"* he reports. Finally, he took delivery

Fig. 1: Market Reef 50th anniversary certificate. Fig. 2: Left to right: Sylvain VE2LH, Steve PJ4DX, Klaas PA1KE, Bert PJ4KY, Peter PJ4NX, Scott W4PA, Maria (Scott's wife). (Photo: Josée VE2JU) Fig. 3: Ief ON6KX (left) and Roger ON7TQ who will be operating as TU2R from Côte d'Ivoire in March 23rd and early April.

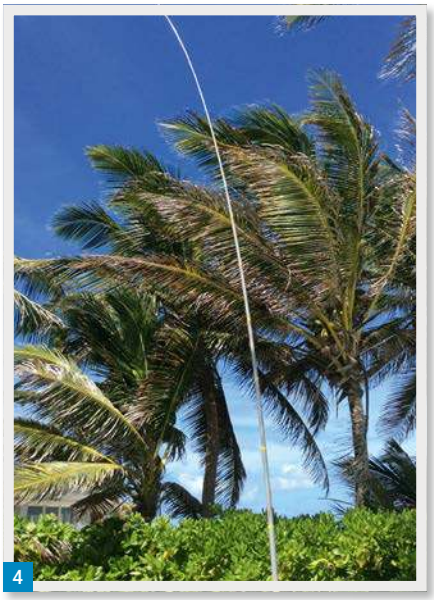
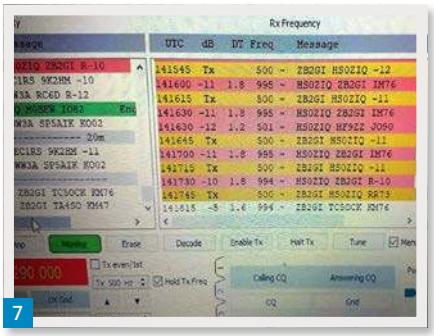


Fig. 4: The 10m-long vertical antenna used by Brian J88PI on Palm Island.
Fig. 5: Russian Antarctica-200 certificate awarded to Owen G0PHY. Fig. 6: Ken G4VZV operating 'beach portable' from EA5.
Fig. 7: Screen shot taken by HS0ZIQ in Thailand, showing his QSO with ZB2GI using FT8.

of a new Acom 1500 linear on February 7th. I use the same amplifier and (touch wood) have not had a single problem with it in nearly six years of almost daily use. I see that the Acom 1500 has had a cosmetic facelift since I bought mine, though I understand the circuit is the same as that in my older version, which was reviewed in *PW*, June 2017.

Ian Abel G3ZHI (Maltby, Yorkshire) sent in the photo, **Fig. 6**, of **Ken EA5/G4VZV** operating 'beach portable' in Spain. Ian wrote, *"He has been doing very well working DX from south-eastern Spain using his trolley setup. His equipment is Yaesu FT-857D, linear RM-405V, ATU MFJ-934B; Ken uses a vertical wire a quarter-wave long clipped to a telescopic DX Commander antenna pole."* More photos and further information are at:
qrz.com/db/g4vzv

Kevin Hewitt ZB2GI (Gibraltar) wrote *"**John King ZB2JK** operated as HS0ZIQ from Phuket Island (IOTA AS-053) during Christmas and the New Year. I managed to work him on 20m SSB and FT8 operating from the GARS club station. The path between us was only open for about 30 minutes a day."* The FT8 screen shot in **Fig. 7** was taken by John in Thailand. Kevin added that GARS runs a *WSPR* transmitter using the club callsign, ZB2GU, from the top of the Rock. Running just 100mW on 30m to a 10m-long wire, ZL2BCI reported receiving the transmitter multiple times at a distance of around 19,600km.



Around the Bands

Owen G0PHY: 14MHz SSB: C5FUD, E44CC, RA9WU. **18MHz SSB:** KP4/AA7CH (Vieques Island, IOTA NA-249).

Tony G4HZW: 7MHz FT4/FT8: 5B60ALX, 6Y5HN, 9K2HQ, CX9AU, EA8JK, HI8S, K1HTV, K4KCL, K5YG, KB8BIP, KC9WBL, KP4COD, NX3T, P4/S50N, RA0QK/8, TO7D (Guadeloupe), VP5D, W0ALA, WA6YOU, XP3A (Greenland), YV4ABR. **28MHz FT8:** PY2DMZ (+ 22 EUs).

Etienne OS8D reported **7MHz SSB:** UP0L. **14MHz SSB:** 3V8CB, 5I5TT, 5Z4/G3AB, EX8VM, FM8QR, HS0ZEX, PZ5RA, VK3XXY, VK9NK, ZD7FT, ZL2SDX, ZS1OPB. **18MHz SSB:** PY5QW, V51WH. **21MHz SSB:** ZS1OPB. **28MHz SSB:** VO1FOG.

Kevin ZB2GI operated as ZB2GI and ZB2GI/P to work: **5MHz FT8:** CU2DX, EA8ZT, KD5M, OX3HI, VE2BJG, W1NG. **10MHz FT8:** AC4VM, HI8CJ, K1ZN, KO2OK, KU4SD, N2CAR, PY7PX. **14MHz SSB:** AB4SF, AK1N, HS0ZIQ, K5XS, K9EYG, N8KIM, PT7ZT, VE3VEE, VE7BYI, VE9RPF, VO1GRC, W0BR, W2KV, W3FOX. **14MHz FT8:** 9K2OD, 9Z4Y, AB1HL, CE3JBD, HK3PJ, HS0ZIQ, K4KZY, N2BJ, N6AR, P49X, PY1IC. **18MHz FT8:** EA8OM, HI3Y, K4ZO, K7BV, K0DEQ, KD9TZ, LU6ETB, PY5EG, VE2HJ, W1OP, W9ILY.

Signing Off

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

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Modelling the EFHW

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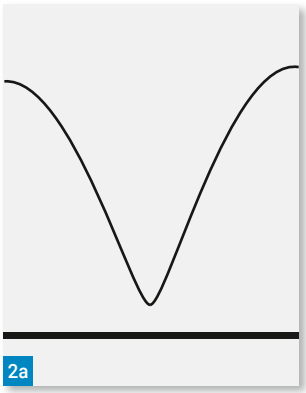
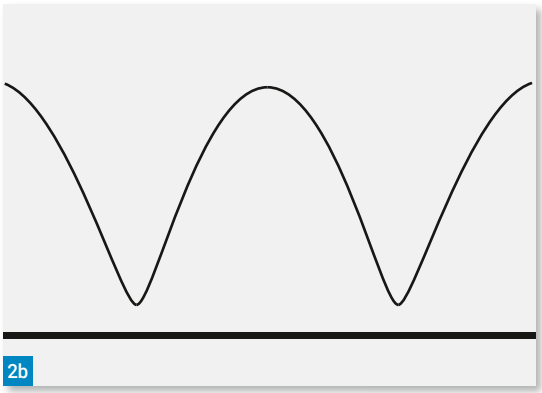
As promised in his article last month, **Ian Dilworth G3WRT** models an EFHW antenna in a suburban environment

In order to examine what to expect from a new antenna I decided to electromagnetically model it using a commercially available method of moments code [1 & 2]. The results are presented in this article. Although these results are specific to my location and wire antenna support heights, I think they represent and are applicable to a typical average amateur location. For example, the maximum height of my antenna supports are a tree pulley at 15m and a house at 11m. The results are applicable to 80-10m and 40-10m end-fed half wave (EFHW) antennas operated in similar arrangements.

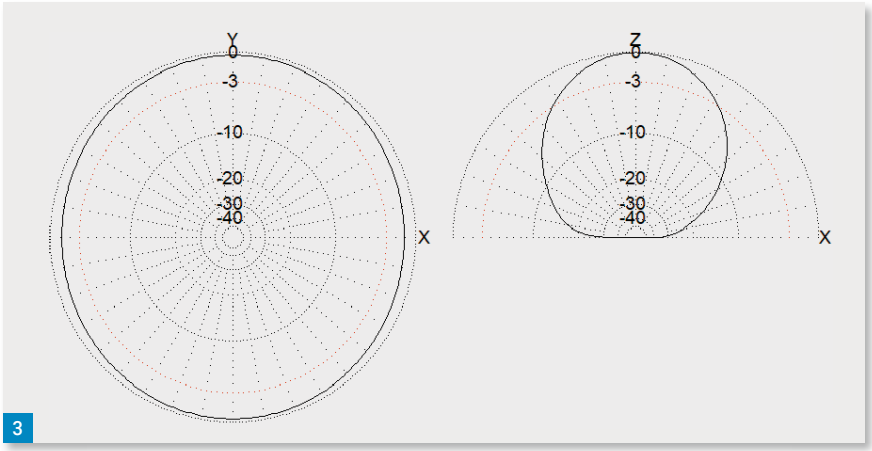
The basics of an EFHW are that it is a half wavelength long at the lowest operating frequency at which it presents a very high impedance at an end-fed feedpoint. Multiple half waves of the wire also present a high impedance at harmonics of the fundamental. Thus, the antenna can be operated on harmonically-related amateur bands provided the high impedance feed is broadband matched to a transceiver. Universally we use 50Ω feeds and the half-wave antenna typically presents up to 5kΩ impedances. This implies a 100:1 broadband transformer. We can readily create a broadband transformer producing half of that ratio, in fact 49:1. Employing such a ratio has the effect of dampening the antenna somewhat because it is mismatched to some extent. However, this has the advantage of broadening the resonance and making the operational bandwidth practically useful. This was illustrated in last month's article (See Table 2 from that article). For the following results for the EFHW 80 -10m antenna used [3] it is useful to consider the voltage and current waveforms on the wire versus frequency. Two example voltage waveforms are shown in **Figs. 2a** and **2b**.

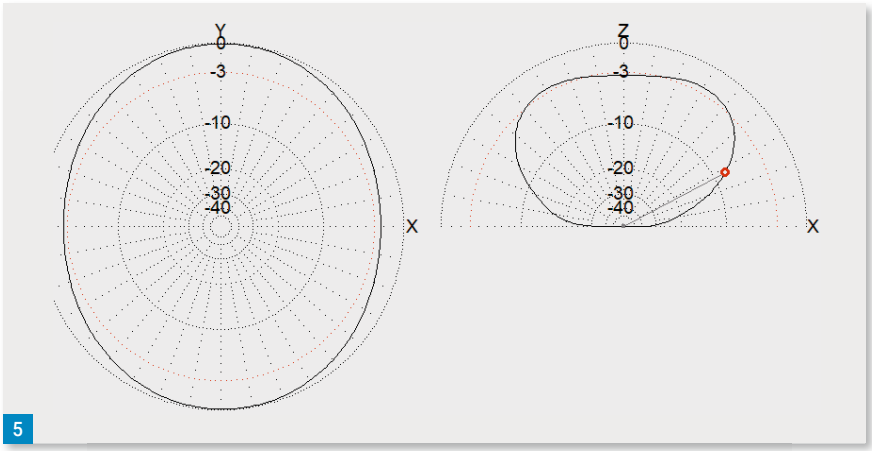

2a

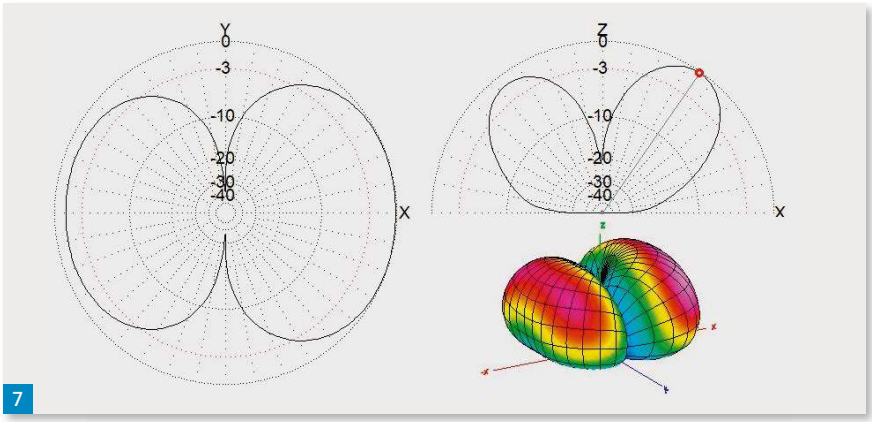

2b

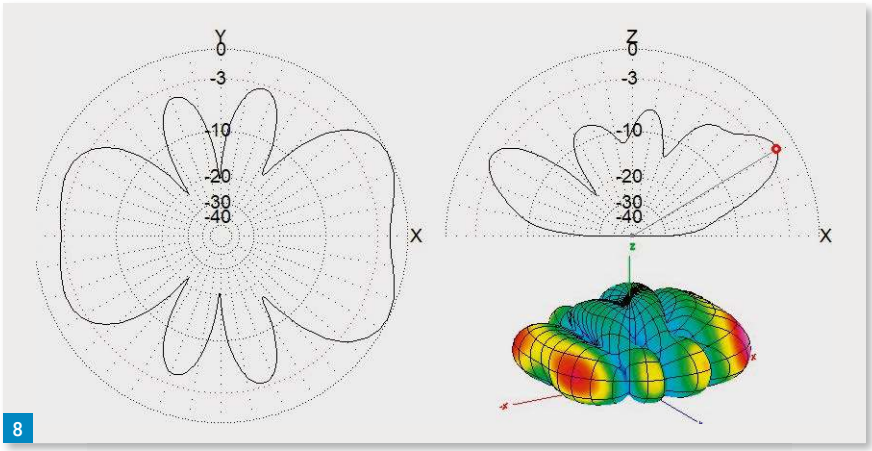
Note that for clarity we only illustrate the half-wave standing voltage quasi sinusoids. The corresponding current distributions are 90°-shifted along the wire (that is to say, a minimum voltage corresponds to a current maximum so, for example, that's in the middle of the 80m half-wave). These are standing waves on the antenna and can be sensed along the wires by a suitable probe when transmitting a carrier.

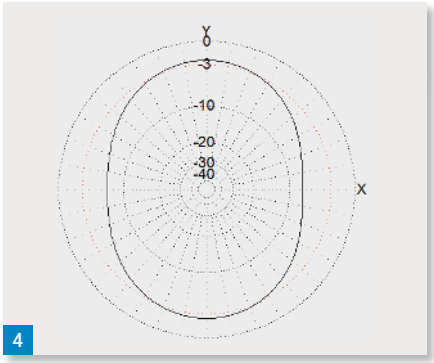
The antenna modelling uses a XYZ coordinate system and the wire antenna is a straight wire in the 'X' plane starting at











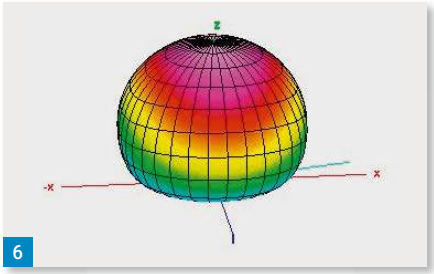
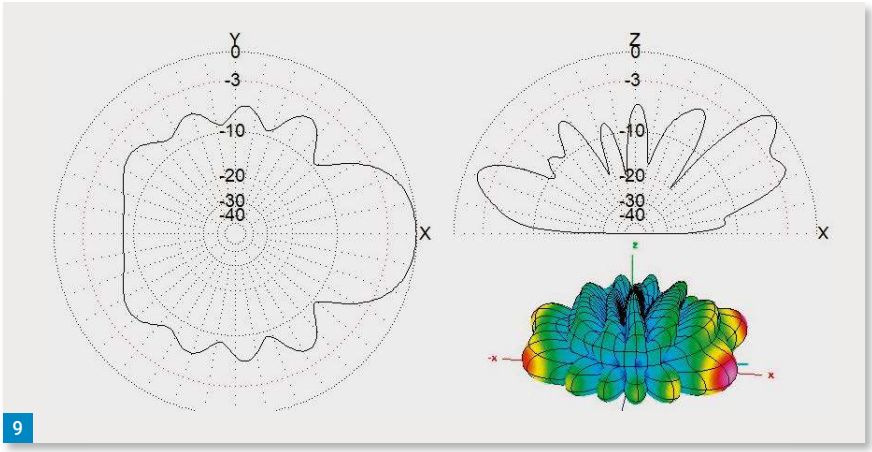


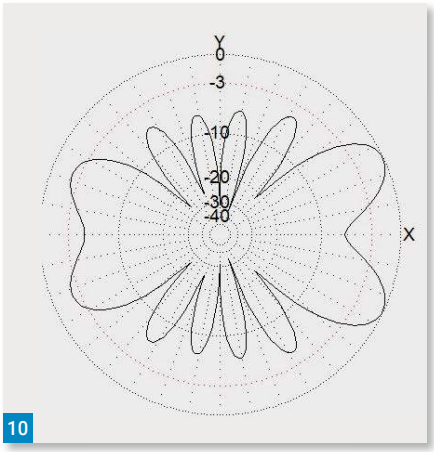
Fig. 1: The actual antenna, showing the coordinate system used for modelling. Fig. 2a: For a half-wave wire on 80m, the voltage distribution along the wire as would be indicated by a voltage detector probe – high voltage at the ends, low voltage at the centre. Fig. 2b: Voltage distribution on the same wire as Fig. 1a but for a 40m signal, where the wire accommodates two half waves. Fig. 3: Azimuth and elevation plots of the antenna on 80m, the elevation plot being for 70°. Fig. 4: The azimuthal plot for an elevation angle of 45°. The radiation is well down (see text). Fig. 5: The antenna modelled as if at 30m above ground – the main lobe is now around 50° to 60° but not many users would be able to get it this high. Fig. 6: 3D plot of the 80m radiation pattern at the author's QTH. Fig. 7: Set of plots for the author's antenna for the 40m band. Fig, 8: The plots for 20m – the pattern is starting to become much more complex, with multiple lobes.

a height of 11m in the 'Z' plane and ending near a tree at 15m also in Z plane as shown in the photo, **Fig. 1**.

The Antenna on 80m

At 70° elevation angle the azimuth radiation, seen in **Fig. 3**, is nearly circular with about 1dB less radiation in the X plane or the direction of the antenna wire. In my case it is almost exactly East – West. The feedpoint at 11m height on a house eave is at the East and the other end of the antenna is at 15m using a tree support. Because of the low height of the antenna wire (0.15 wavelengths at 80m) nearly all the radiation is directly upward so the majority of it will reflect off the ionosphere directly above the antenna. This is why such antennas are known as 'cloud





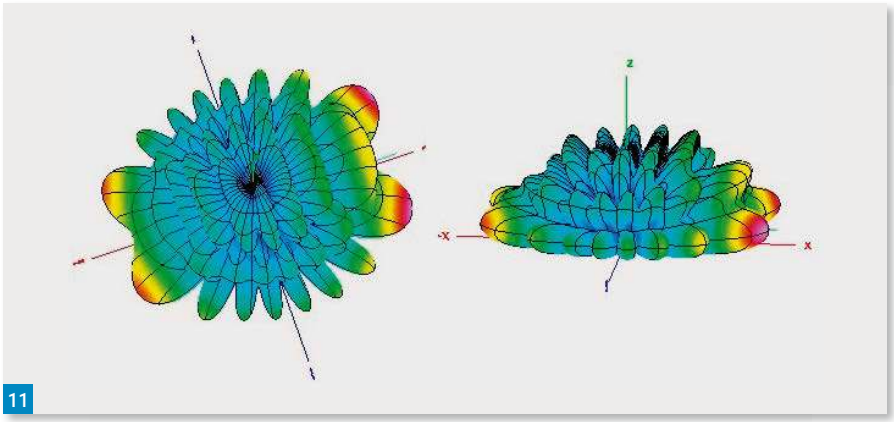


Fig. 9: The 15m pattern with the azimuthal pattern shown for 90°. Fig. 10: The azimuthal pattern for 15m (as Fig. 9) but this time for a 20° angle of elevation. Fig. 11: The 10m radiation pattern – now very complex and probably even more so in practice, given surrounding objects, etc.

warmers' or near vertical incidence sky wave (NVIS) and cannot be expected to produce DX working.

Considering the radiation at an elevation angle of 45°, the left-hand X –Y plot, **Fig. 4**, illustrates that is −3dB with respect to the maximum in the Y plane and −8dB in the X plane. So, the antenna becomes not only less potent than the vertically incident radiation, it also becomes directional to some extent.

If this 80m half wave antenna is elevated to 30m, a height of 0.375 wavelengths, which is probably unrealistic for the vast majority, the resultant response to be expected is shown in **Fig. 5**. Now the peak response is at an elevation angle of about 50-60°. A possibility of DX operation with only 3dB less vertical radiation. As illustrated, the radiation at an elevation angle of 30° is about −8dB.

To understand the total radiation pattern very many 2D plots are required at many elevation angles. A 3D plot is far more helpful in this respect. The plot in **Fig. 6** illustrates the 80m response of the antenna at G3WRT's QTH with the antenna at an average of 12m height. Red/purple represents the maximum and green/blue about −10/30dB. The black at the top is an artefact of the grid lines.

40m Radiation Pattern

As the effective electrical length of the EFHW becomes significantly longer with respect to the fundamental wavelength (80m half wave) we might expect constructive and destructive interference effects from the standing waves. At 40m the antenna becomes two half wavelengths long. It is still rather low to the ground (0.3 wavelengths) and the ground's influence results in the peak radiation at about 55° elevation angle. It also bifurcates into two lobes as illustrated, **Fig. 7**.

20m Radiation Pattern.

At 20m the antenna is four half wavelengths long and 0.6 wavelengths high. The radiation pattern becomes much more complex. There are now some useful low elevation angle lobes, **Fig. 8**, helpful for DX chasing.

15m Radiation Pattern

At 15m we have an even more complicated pattern. Looking at the azimuthal pattern (X-Y) shown in the left-hand plot of **Fig. 9**, it appears not to match that shown on the right pattern. That is because the left-hand plot only represents radiation at a 40° elevation angle. The power of the 3D plot now becomes evident because it contains so much more information.

15m Pattern at 20° Elevation Angle

The same antenna pattern at 20° elevation angle, **Fig. 10**, illustrates the limitation of 2D representations.

10m Radiation Pattern

The radiation pattern at 10m, **Fig. 11**, represents the interference and superposition of eight half wavelength antennas. Not surprisingly it is relatively complex. Also, now because it is at a height of 1.2 wavelengths, it also produces very low angle radiation lobes together with many more minor lobes at various elevation and azimuthal angles. It would be unlucky if a wanted station fell in the direction of one of the, admittedly many, nulls.

Conclusions

I have shown that using a readily available method of moments design tool it is possible to model a typical and modest practical antenna for HF. I have used it for the parametric design of several antennas. I know from experience that this modelling does work in practice and I really do have confidence that it represents reality. In a future article I intend to simultaneously compare it with another antenna at this location in order to gain further insights into the accuracy of modelled antennas and experience on the bands.

References

[1] MMANA GAL PRO. See web for details.
[2] **www.nap.edu/read/5019/chapter/13**
[3] 'myantenna 80 – 10 EFHW'. See web.
[4] *The sloping wire loop – a DX antenna for 18-70MHz, Practical Wireless*, March 2015.

On Top of the World

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Maurice Webb GW0UGQ describes how he dealt with getting on the air from a tower block.

Like many others, I gave up amateur radio about 15 years ago, initially for personal reasons and later due to health issues, which meant moving QTH to my present location (see QRZ.com).

It was while at my new QTH that I decided to attempt to return to the hobby. However, this time, only in a small way.

My new QTH is in one of those large multi-storey tower blocks in our town centre. I started with 2m and 70cm using a small collinear antenna mounted in what used to be the old balcony area, which was how the buildings were originally built in the late 1960s. What a time that was – the 'Flower Power era'!

These days, the balconies are now totally enclosed with windows, so with the help of a cheap camera tripod stand (bought off eBay), that was how part of my return into radio started, **Fig. 1**. (Note: the tower block is being modernised at time of writing).

My radio at that time was the black sheep of Yaesu's 'shack in a box' range, the FT-100. I have, though, done most of the modifications needed to make it a respectable performer, (see **K0LEE.com**). Many thanks to **Paul G7RXY** for the many hours of prolonged and exhausting VHF/UHF tests, to obtain the best overall antenna position.

The Challenge of HF

Being really an HF person, I was now faced with major problems. Like many people in my situation, the local county council, for obvious reasons, will not allow the use of some conventional standard antenna systems such as a long end-fed wire or similar from the balcony window. I therefore had to think what could be done cost effectively, to enable an attempt at HF operation. My thanks, therefore, to a great friend of mine over many years, **Andy G3PKW**, who suggested trying a magnetic loop. I had been more accustomed to vertical antennas at my previous QTH, where I used an MFJ-1792 for 40m and 80m. I have never tried a magnetic loop, so this was going to be a new and steep learning curve.

I first started experimenting with the small 'Whizz Loop', **Fig. 2**, from Moonraker (reviewed in November 2019 *PW* – **ed**.). I chose this type because it was reasonably priced, while also small enough to try and play around with in my apartment. It is designed for use with QRP rigs such as the Yaesu FT-817. So, it fits the bill for me because I only wanted to run low power, having regard for my present living area. It has a moulded PL259 adapter that screws into the rear of various rigs. However, not so with the FT-100, which uses a small fly cable to an SO239 socket. I combated this slight problem by using a small desk-type mount. That was a conventional cup or mug wooden stand, used in most kitchens.

I just used simple cable ties to hold it in place, which allowed it to be rotated for better reception. I found I could get a good SWR on all the bands that it is designed for, except 50MHz, where the SWR was quite high. But I was really playing with the

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Fig. 1: The indoor collinear antenna.
Fig. 2: The Moonraker Whizz loop.

14MHz band. Please note that the 'Whizz Loop' is for 10W maximum power.

Please also bear in mind that the building I live in, as I said, was originally constructed in the late 1960s. Therefore, the method of construction was, and probably still is, to have steel rods within the concrete walls for added strength (reinforced concrete). So that may and probably can cause problems, which I and others must also take into account.

Initial Experiences

After weeks and weeks of testing the antenna, using the above idea, and using different positions within my apartment lounge, it was proven that I had further problems with internally generated noise within the building. Also, as pointed out to me by another local amateur, some of these high-rise tower blocks also get some revenue from various companies for installation of their masts on the roof space. This was another issue I had not taken into account. As you can see, I had a lot of issues working against me but I still hoped for some success. I seem to recall a quote along the lines of *"with my project and experiment I can achieve great things"*.

During the test period signals were being received, and reasonably strong, but most were competing with my newly discovered internal noise. It was about a week later, while I was checking the various blogs on the internet with regard to loops, that I read and learned about a particular antenna. It was then I thought, *"Hey, I can adopt my Whizz loop, to do that!"* The idea was novel, and I hadn't really thought about that. So, I set to work, as said, adopting my loop antenna, to the same idea.

The basic principle of this re-modelling of my loop, is to be able to mount or place it outside an apartment window. The distance from the outer building is adjusted by moving a small bamboo cane in or out, as appropriate.

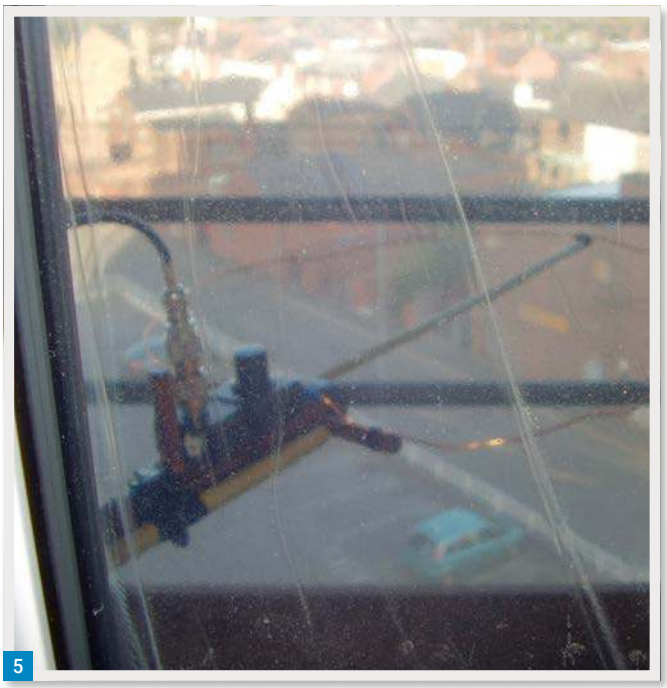
The whole assembly mounts onto a small 'Z' type bracket arrangement, which then can be clamped to the windowsill. Please note that although very convenient to adopt this novel idea, it must and should not be used in adverse weather, including rain, because the Whizz loop is not primarily designed for that type of application, or operation.

My construction, albeit, very crude and of a 'Heath Robinson' nature, did the job for my experiment. Admittedly, you can and will perfect the idea to your own needs. It should be noted, I also use this idea when I go along portable, on the banks of the River Dee, which is on my doorstep. For that I adapted a four-wheel small shopping trolley with a small tube, to house the antenna, and a 12V 7Ah battery goes inside the trolley. So, it's quite fun, and simple to use on nice sunny days.

My Configuration

The photos, **Figs. 3** and **4**, show the loop mounted with a suitable length of thin bamboo cane. The bamboo cane is placed through the two cable ties on the 'Z' bracket, as can be seen. These are then tightened to give rigidity to the assembly, and rotation of the bamboo can place the loop level, in a horizontal plane (omni-directional). It is also quite easy to reach the tuning control to peak signals and to dip for minimum SWR. It is best to peak for band noise on your chosen frequency of operation, then dip for lowest SWR. Also note that any variation from that frequency will alter the tuning of the loop by some degree.

The next photo, **Fig. 5**, shows the 'Whizz Loop' mounted outside my apartment window. I am sorry about the poor picture,



which is dark. This is due to a protective plastic covering on the windows, due to the current refurbishment programme. You can see all the scaffolding in the way of the loop, so it's really getting a thorough test! The other small cane keeps the loop rigid and almost circular, and horizontal when mounted, outside the window.

As can be seen in Fig. 5, my apartment is relatively high above ground. I am located on the 7th floor, approximately 90ft AGL. At present I can only play with the antenna when the workmen are not here. The results I have obtained have been very rewarding. Most signals are between S3 and S7, with some over S9. I did, however, suffer with QSB, but in saying that, the bands currently have not been in great condition, due to where we are in the sunspot cycle. Also, I have all the scaffolding to contend with. I expect that this little Whizz loop will really perform once all the modifications have been done and the scaffolding has been taken down.

As said, I am very pleased with my results obtained, and there will be a lot of other people similarly placed so maybe this will give food for thought. It's great to hear the various stations and once again be part of the wonderful hobby of amateur radio. I know with modern communication techniques and the internet it can all be done from your laptop computer. But is that really amateur radio? For me, the answer is *"no"*.

Any comments and feedback are welcome. My e-mail address is at the head of the article.

Fig. 3: The loop mounted on bamboo cane.
Fig. 4: The supporting bracket.
Fig. 5: The loop outside the apartment window.

Low-Level Test Signals

Mike Richards G4WNC explains how to make low-level RF measurements with a high degree of accuracy.

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practicalwireless@warnersgroup.co.uk

Following on from last month's look at the signal analysis tools in SDR Sharp, I promised to let you know how to create low-level test signals for receiver measurement.

Generating Low-level Signals

Most modern receivers have sensitivities of better than 1µV. Generating accurate signals at such a low level can be a challenge. The standard method is to use a decent signal generator, but these certainly aren't cheap and most old HP, Marconi and Rohde & Schwartz signal generators sell at a premium. In addition to not knowing the calibration state of an older signal generator, they are usually very large and heavy.

One alternative worth consideration is a modern function generator or Arbitrary Waveform Generator (AWG). The AWGs are so named because, in addition to standard sine and square waveforms, you can specify custom waveforms. For receiver testing, we don't need the AWG element, just the sinewave output. The AWG uses SDR techniques to create the output signal digitally. An FPGA (Field Programmable Gate Array) does the processing to create the digital waveform, which is then converted to the desired analogue output using an ADC (Analogue to Digital Converter). Amateur radio SDR transmitters use the same technique. The purity of the AWG is defined by the accuracy of the digital signal and the bit depth of the ADCs. Most decent AWGs use either a 14-bit or 16-bit ADC. Although not as clean as a top RF signal generator, a good AWG will have harmonics of typically -50dBc or better and these generators usually feature low phase noise. I recently had a chance to review the Siglent SDG1062X, **Fig. 1**, and was so impressed that I bought it (from **labtronix.co.uk**)!

One of the features that attracted me to the Siglent was its excellent output level control. The output impedance can be set to 50Ω and the output level specified in dBm. Most AWGs only specify the output in peak voltage, which is not helpful for our purposes. A look at the SDG1062X specification shows that the output accuracy is within 1% and the flatness throughout its 0 to 60MHz frequency range is within ±0.3dB, which is excellent for radio work. The frequency accuracy is also very good and specified to be within 25ppm over the temperature range 0-40°C. At room temperature, the control is very much tighter. For precise frequency setting, the SDG1062X supports an external 10MHz clock, such as the popular Leo Bodenar GPS clock unit. The SDG1062X also features two completely independent output channels, so you get two signal generators for the price of one!

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If you want a slightly cheaper option, with the same features, the SDG1032X is worth considering. Of course, there has to be a downside, and that's the high-level output. Most AWG/function generators feature an output of up to 20V pk-pk. The SDG1062X is no exception and can supply 20V pk-pk into a high impedance load and 5V pk-pk (+21dBm) into 50Ω. However, the lowest level setting of the internal attenuator is −53dBm. That's way too high for receiver testing, so an external attenuator is an essential addition.

RF Attenuators

Attenuators may seem easy to build, but not when you want to achieve 100dB of

Fig. 1: Siglent SDG1062X AWG.
Fig. 2: HP/Agilent 8495G high-quality attenuator.
Fig. 3: Trilithic rotary attenuators.
Fig. 4: Trilithic switch contacts.

attenuation with an accuracy of 0.5dB or better over a 30MHz or greater frequency range! The simplest answer is to use a good quality commercial attenuator. My suggestion is to turn to eBay where you will find plenty of quality attenuators that have been recovered from redundant test equipment. The manufacturers to look out for are HP/Agilent, Trilithic and Rohde & Schwartz, all of whom produce top quality attenuators.

The most common standalone attenuators on the second-hand market, are the HP/Agilent 8494/5/6 series, **Fig. 2**. Of these, the model 8496 is the most versatile because it features 110dB of attenuation in 10dB steps. The attenuators are available in several versions with an assortment of attenuations. I've shown the model numbering system in **Tables 1** and **2**. As you can see, the A and B suffix are the manually switched versions with a rotary control. These high-quality attenuators tend to be quite expensive at around the £100 mark on eBay but you see the occasional cheaper offering. I managed to get an 8495G (70dB, DC-4GHz) for £40 by making an offer towards the end of the sale period. One extra point to watch, with the programmable versions, is the programming cable. If it doesn't come with the cable, you'll either need to direct wire a connection or purchase a second-hand cable (Approx. £40).

An excellent alternative to the HP attenuators is the Trilithic range of rotary attenuators. Beautifully made and manually switched, these attenuators come with a marked knob and can be used without any further work, **Fig. 3**. I have a few of these in the shack because they are so useful. The models currently available are: 0 to 100dB in 10dB steps, 0-70dB in 10dB steps and 0-10dB in 1dB steps. There are also some dual-rotary versions available that feature 30dB, 50dB and 70dB attenuation, adjustable in 1dB increments. While they are rated for operation to 2GHz, below 500MHz the insertion loss is better than 0.1dB and the accuracy is better than 0.5dB for the 10dB steps and 0.2dB for the 1dB steps. I've run several tests on these attenuators using my DG8SAQ VNWA and the measured performance is well within the specification. There is always an element of risk with surplus equipment on eBay but these units are so well made

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that the risk is minimal. The most common problem is dirty contacts and a soft detent. Cleaning the contacts is an easy task because the gold-plated contacts are fixed to the input/output connectors, **Fig. 4**. Just remove the connectors and you can clean the contacts with cleaning buds and an alcohol-based cleaner. Make sure you replace the connectors in their original position. The soft detent is not so easy to fix because it's a sealed unit, so you need to take a bit more care when setting the attenuation.

4

Programming HP 8494/5/6 Attenuators

These compact and accurate attenuators use sets of three or four attenuator sections and relay switching to select the required attenuation. Each section uses a thin film attenuator card with a loss-less thru-line and switched slab-line. These slab-lines are solenoid switched between the zero loss thru-line and the attenuator card and retained in place by magnets. Once the solenoid has switched, it automatically disconnects the power. The result is a latched switch that only requires a short pulse (20ms) at 24V to switch states. Each solenoid has two control lines, one to activate its section and the other to deactivate it. To control each attenuator section, we need a single-pole changeover switch. We can easily generate the 24V supply from a 5V USB connection using one of the popular XL6009E boost modules that you'll find on Amazon and other popular component suppliers. I've shown the schematic for a three-section attenuator in **Fig. 5**. Because these attenuators have a magnetic latch you can disconnect the programmer once you've set the desired attenuation.

Accurate Signal Level

If you don't have a signal source with an accurate output level, there are some other techniques you can employ to ensure you have an accurate start point. I suggest you concentrate on achieving an accurate 0dBm output, as this is far easier to measure accurately than very low-level signals. Given that we universally employ 50Ω as the standard impedance for RF work, 0dBm in 50Ω is 223.6mV RMS.

The first measurement technique is to use your oscilloscope. Modern digital scopes are capable of surprisingly accurate measurements. I use a PicoScope 3203D and I've found the best way to set a precise signal level is to use the reference cursors to mark the positive and negative peaks of the required level, **Fig. 6**. For example, 0dBm in 50Ω is 223.6mV RMS and that translates to 316.2mV peak. To set this on a scope,

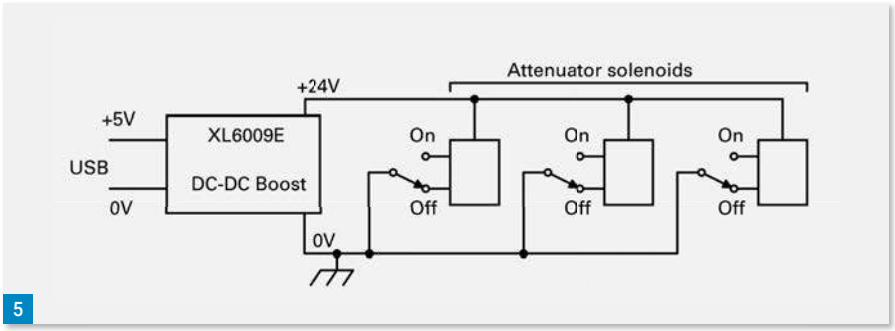
Fig. 5: Circuit of a simple Agilent 8494/5/6 programmer. Fig. 6: Using an oscilloscope to set the generator to 0dBm. Fig. 7: BNC T connector used to terminate the scope connection.

Model No	Attenuation/Steps
8494	0-11dB/1dB
8495	0-70dB/10dB
8496	0-110dB/10dB

Table 1: HP/Agilent Attenuator Model Index

Suffix Letter	Parameter
A	Manual rotary control, DC to 4GHz
B	Manual rotary control, DC to 18GHz
G	Programmable control, DC to 4GHz
H	Programmable control, DC to 18GHz

Table 2: HP/Agilent 8494/5/6 Suffix Table



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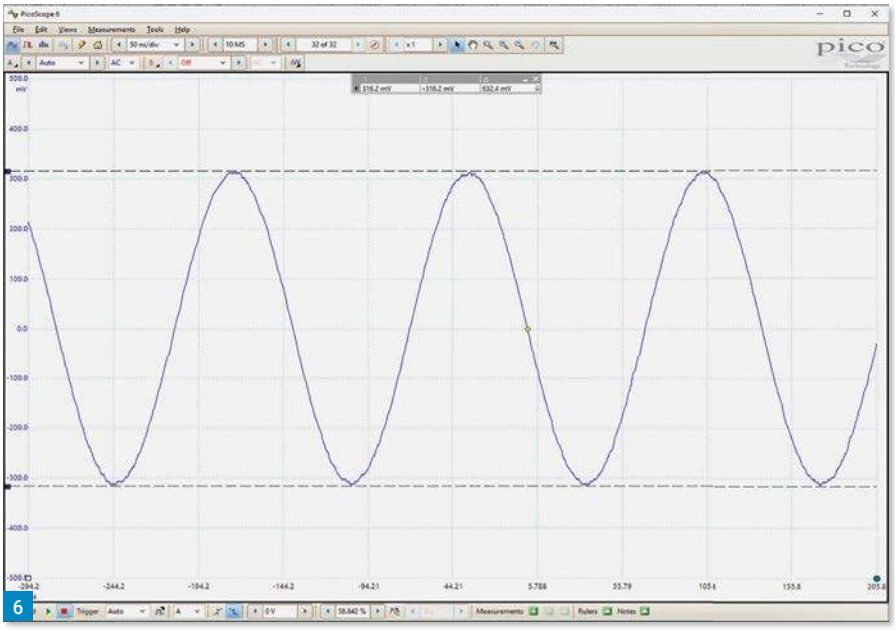

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place cursors at +316.2mV and −316.2mV. Now you can apply the signal and adjust the level of your signal generator so that the peaks of the sinewave fit in between the two cursors. When making this adjustment, it's important to terminate the scope input with 50Ω. I use a BNC 'T' connector with a BNC 50Ω load connected to the spare port, **Fig. 7**. If you have a modern scope, I recommend keeping it in calibration. The Picoscope team offer a full calibration service for £74 and that includes a full test report showing the readings provided by the scope vs. the measurement standard. This information allows you to use an offset to improve the accuracy of the readings.

An alternative measurement option is to use an SDR Play RSP as a signal level meter. Providing you're running a recent version of the free SDRuno software, the signal levels are shown in dBm and are normally good to within a dB or so of the true reading. For best results set the receiver software to CW mode and centre the signal. The only problem with this solution is the variable input impedance of the RSP antenna socket. The simple solution is to connect an attenuator between the signal generator and the RSP to mask the SDR Play impedance variations. I recommend using 40dB or more. In addition to masking the impedance changes, the attenuator reduces the 0dBm signal sufficiently to avoid overloading the RSP.

Once you've attained an accurate 0dBm signal from your generator, you can use the attenuators I suggested earlier to deliver accurate low-level test signals. However, there are a few points you need to consider when making your measurements:

• Power-up your test equipment and the device under test and let them warm-up before starting any measurements.

• Your measurements must be repeatable. If you get different results each time, something is wrong, so you need to investigate.


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• Ensure your test connections are terminated in 50Ω. An unterminated connection will give a +6dB error.

• If the results seem unusually good or bad, you're probably doing something wrong.

• Be suspicious.

Rallies & Events

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

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

March 22nd (Sunday)
CW BOOT CAMP: Stirling and District ARS, Unit 68, Bandeath Industrial Estate, Throsk FK7 7NP. GMDX. in conjunction with Stirling & District ARS are running a CW Boot Camp in Stirling. Great opportunity to improve your CW skills, registration open to all. Further information:
https://www.gmdx.org.uk/cwbootcamp

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

March 29th (Sunday)
DOVER ARC HAMZILLA RADIO FEST AND ELECTRONICS FAIR: The Dover Amateur Radio Club (CARC) Rally will be taking place, once again, at last year's wonderful venue of Discovery Park, Sandwich Kent CT13 9FF. There will be offers, talks and demonstrations. Admission, (Early Bird 9:30 am) is £5; general & disabled (10:00 am) is £3; under 16s and carers for disabled visitors go for free. Hot and cold drinks and food will be on sale. Lots of big-name traders already booked. RSGB-licenced exam venue, exams are available on the day.
https://www.hamzilla.uk
https://darc.online

April 4th (Saturday)
23RD ANNUAL GMDX CONVENTION: The Convention of Scotland's DX Association will take place at the King Robert Hotel, Whins of Milton, Stirling FK7 0LJ. GMDX AGM, lectures and card checking.
www.gmdx.org.uk

April 5th (Sunday)
HACK GREEN BUNKER RALLY: The rally takes place at the Hack Green Secret Nuclear Bunker, Nantwich, Cheshire CW5 8AL. Sale of electronic equipment, amateur gear, components, military radio items and vehicle spares. Doors open 10 am.
01270 623 353
coldwar@hackgreen.co.uk
www.hackgreen.co.uk

April 5th (Sunday)
YEOVIL ARC QRP CONVENTION: The Digby Hall, Sherborne, Dorset DT9 3AA. Doors open 9.30 am to 2 pm, admission is £3 (regrettably no dogs please, except guide dogs). The event is supported by the RSGB, RAFARS and BYLARA. There will be club stands as well as new and 2nd hand stalls. Two talks are scheduled during the day; Getting Aerials to Radiate Well, by Rob, G3MYM (10.30 am), and The Hentenna by Dave, G3ZXX (12.00 noon). Refreshments will be available.
wjh069@gmail.com
secretary@yeovil-arc.com
http:// Yeovil-arc.com

April 11th (Saturday)
MFARS SURPLUS SALE & RADIO MEET: The event is at Linkwood View, 3 Thornhill Drive, New Elgin, IV30 6GQ. Doors open 10 am; sale from 12 noon. Refreshments available, and there will be a large meeting-up area. Free car parking. Tables £10.
mfars.secretary@gmail.com
www.mfars.club

April 19th (Sunday)
WEST LONDON RADIO & ELECTRONICS SHOW (KEMPTON RALLY): The West London Radio and Electronics Show will take place at Kempton Park Racecourse, Staines Road East, Sunbury on Thames, TW16 5AQ. A talk-in station will be on air. Car parking is free, and doors open at 10 am, with disabled visitors gaining access 10 minutes earlier. There will be trade stands and a bring-and-buy, as well as special-interest groups and lectures. Catering available.
08451 650 351
info@radiofairs.co.uk
www.radiofairs.co.uk

April 26th (Sunday)
ANDOVER RADIO CLUB RADIO & COMPUTER BOOT SALE: Sellers 9 am - Buyers 10 am. Organised by The Andover Radio Amateur Club. Tables in the hall £10. £8 per Boot & £2 Buyers. Postcode for your Satnav: SP11 ØJE.
arac@arac.org.uk
www.arac.org.uk

April 26th (Sunday)
CAMBRIDGE REPEATER GROUP RALLY: The event takes place at Foxton Village Hall, Hardman Road, Foxton, Cambridge CB22 6RN. Car parking is free. Doors open 9.30 am for public entry and 7.30 am for traders. Entry is £3. There will be a talk-in station. You will see traders a Bring-and-Buy and an RSGB bookstall. There will be a car boot sale area. Catering is available on site.
07941 972 724
rally2019@cambridgerepeaters.net
www.cambridgerepeaters.net

April 26th (Sunday)
NARSA – NORTHERN AMATEUR RADIO SOCIETIES ASSOCIATION EXHIBITION (BLACKPOOL RALLY): The NARSA (Blackpool) Rally will take place at its usual venue, The Norbreck Castle Exhibition Centre, Queens Promenade, Blackpool FY2 9AA. Doors open 10:30 am (10:15 for disabled visitors). Free on-site parking. Admission £5 (under 14's free). Food and beverages available all day. Usual traders, club- and special-interest groups, and an RSGB book stand. There is also a construction-competition and a club stand competition.
01270 761 608
dwilson@btinternet.com
www.narsa.org.uk

May 2nd (Saturday)
CDXC CONVENTION, AGM & DINNER: This UK DX Foundation event is at the Link Hotel, Loughborough. Non-members are welcome, and there will be a partners' programme. Four DX & technical talks. Costs vary. Full details in January's CDXC Digest.
Chris@G3SVL.com
Website: www.cdxc.org.uk

May 3rd (Sunday)
THORPE CAMP HAMFEST: The Hamfest is at the Thorpe Camp Visitor Centre, Tattershall Thorpe, LN4 4PL. Open for traders from 6.30 am and to the public from 9 am. Entry is £4, with children under 12 going free. Hot and cold refreshments are available on site. Car parking is available within the grounds.
0795 665 4481

May 8th (Friday)
DARTMOOR RADIO CLUB RALLY : This event is at The Butchers Hall, Pannier Market, Tavistock PL19 0AL. Doors open at 10 am. Admission is £2.50. There will be traders and a bring-and-buy. Refreshments will be available.
07854 088 882
2e0rph@gmail.com

May 15th to 17th (Friday to Sunday)
DAYTON HAMVENTION 2020: Greene County Fairgrounds and Expo Center, Dayton, Ohio, USA.
https://hamvention.org

May 16th (Saturday)
READING DX MEETING: The Reading International Radio Group meets from 2.30 to 5 pm in Room 3 at Reading International Solidarity Centre (RISC), 35-39 London Street, Reading RG1 4PS. Meetings are an opportunity to get together for anyone interested in listening to broadcast stations from around the world on the short wave, medium wave and FM bands. All meetings include a well-researched talk and tea break.
barraclough.mike@gmail.com
www.bdxc.org.uk/diary.html

May 31st (Sunday)
DURHAM DISTRICT ARS RADIO RALLY: Bowburn Community Association, Durham Road, Bowburn, Co. Durham DH6 5AT Doors open 10.10 am to 2.30 am with disabled visitors gaining access at 10 am. Admittance is £2. There will be traders, a Bring-and-Buy, as well as an RSGB bookstall and Special Interest Groups. Catering and a licensed bar.
07826 924 1192
dadars@gmx.com

Joe Chester MW1MWD
mw1mwd@gmx.com

The Magic of a Piece of Wire (Part I)

Joe Chester MW1MWD has been playing with end-fed wire antennas and finding that they do the trick on several fronts.

Now that the Sun has fallen into a deep, dream-free sleep, the thoughts of amateurs worldwide turn to the problem of making QSOs in the poor propagation conditions we are currently experiencing. Some have already gone to the Dark Side (!) of automatic computer-generated contacts with FT8 and its variations. Others dream of towers and monoband Yagis. A lucky few have been able to achieve the latter, by going to remote working. But this type of thing is all too difficult for an old ragchew merchant!

But one of the things I'm sure many of us are doing now is wondering about a better antenna to catch the fading rays. A magic antenna, with no need to dig up the garden to plant a field of radials, or erect tall scaffolding poles buried in cubic metre blocks of concrete. Something light, easy, neighbour friendly, and maybe a bit portable for the Summer picnic under the glare of that spotless Sun. Well Joe's Notes is here to help. So, let me introduce you to – this length of wire! Any length, really, but the longer the better (up to a point). Whatever you can droop over a tree, or hang off a fishing pole, or even just throw up on the roof of a shed or caravan.

Done to Death?

Surely not? The end fed antenna (EFA)? Random length wire? Done to death. Tried that 30 years ago – dismal failure. Bought that donut shaped lump of ferrite, and wrapped wire around it. There was a bang when I keyed up, and the fuse in the rig blew! OK. But let's do a little more research. Antenna theory has moved on dramatically since we all started learning the dits and dahs. And I'll do most of the analysis for you. At the bottom of this piece is a list of the antenna specialists I have consulted about this. I will now summarise what they had to say, and at the end I will tell you about a piece of wire and a box that I used to work into both the Ukraine and North America. Magic? No, just successful application of the theory.

In practice, the EFA is a whole family of antennas, from the so called random length of wire (it ceases to be random when you cut it!), to the end-fed half-wave (EFHW), the base-fed sloper, the Vee and inverted-Vee, or maybe the inverted-L. The names may be different, and mostly reflect how it is mounted, but the operational theory is the same. The doyen of antenna theory and practice **L B Cebik W4NRL** [1] says that these are all just variants of a 'base-fed sloping wire' or an EFA, if you like. He says that in general these antennas *"will never be the strongest signal in the band. However, they will in all of their simplicity put a usable signal in more places on more bands than almost any other contender, both in the field and in the typical small modern backyard"*. That wire can be straight or bent, and it will still work well.

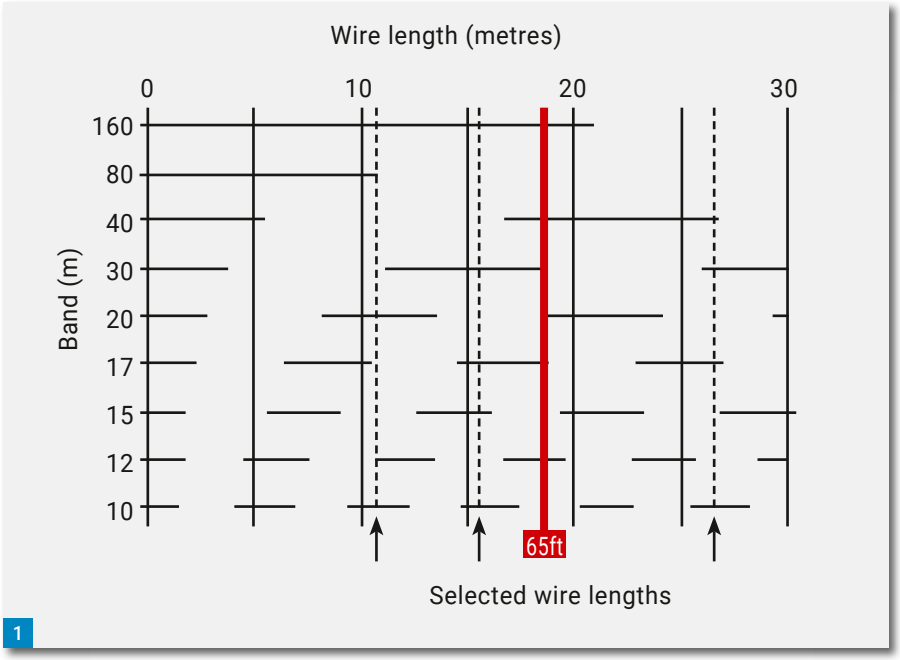


Fig. 1: Graphic showing 'practical' lengths for end-fed antennas. (courtesy RSGB).
Fig. 2: CocoaNEC results at 3.7MHz for a 19.8m sloper, and the same length as an inverted-L.

If you have only one high point, then you have an EFA, or EFHW, or a base-fed sloper, or a Vee; two mounting points and it's an L. All share the same RF characteristics and deliver more or less the same performance. Uniquely, the inverted-L puts out RF power both horizontally and vertically polarised, the exact ratio depending on the frequency and the length of the horizontal versus the vertical parts of the antenna. Since all these configurations are operationally similar, then a slightly better understanding of the theoretical aspects will not be just rewarding for its own sake but can lead to significant improvements in antenna performance in practical situations. This means, at your QTH!

A Poor Reputation?

The reputation of the EFA has nothing to do with its being just a wire. The EFA, or any of its variants, works as well as any other radiator of similar length and height. The problems come from how it's fed, which, if done badly, leads to ground currents that bring RF into the shack. So, without an adequate 'ground', the energy that would normally go to a ground rod or a field of radials, ends up on the feedline straight back into the shack. In effect, the feeder becomes a part of the radiator. Of course, these problems are more obvious the more power you throw at it. Which explains why many QRP operators think the EFA is a magic antenna but why it's avoided by the high power guys. The solution is to look at the theory and act accordingly. Your EFA will also need a counterpoise. But let's start at the beginning.

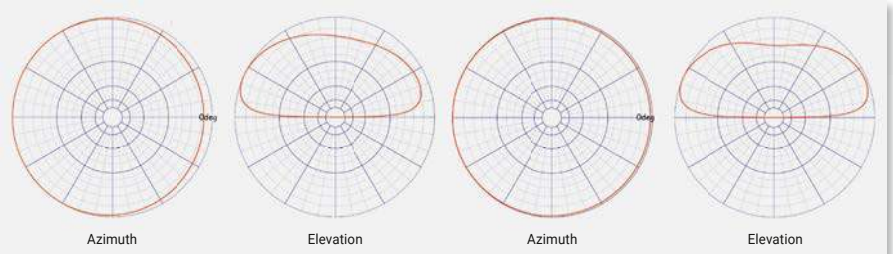
Back to Basics

The first question is *"how long is this piece of wire?"* Let's start in with **Alan G3CCB** [2]. 'Wayward' is his word for the EFA. Any length of wire will have a resonant frequency, at which the centre of the wire will show zero voltage but high current. Conversely, at the ends, the current is zero, and the voltage is high. Ohm's Law (Resistance = Volts/Amps) tells us that the resistance (strictly impedance) at the ends is, therefore, huge – a large number divided by a very, very small one). This is why many of us favour dipoles, because connecting the feeder to the low voltage centre makes it easier to match the impedance. But that doesn't mean that the wire can't be fed at one of its ends, or anywhere along its length really, as in the OCFD (off-centre fed dipole) or Windom. The key is to get the wire up in the air, as high as you can, and then get it as close as you can to resonance (minimum impedance) on the band of interest.

If you are only interested in a single band, then maybe the EFHW is all you need *(but see our recent features about the EFHW – **Ed**.)*. Typical end impedance values can reach 5000Ω or more on the end [3], so you will need some kind of impedance matching unit. And if you want to use high power, then you need to make sure this matchbox is designed properly, which is not that easy. QRP operators have it simpler, and there are lots of couplers available that can do this for low power work. However, we are after something a bit more useful – a multi-band EFA. Let's look at a specific example.

A Practical Example

Peter VK6YSF has modelled EFAs of various lengths [4]. He suggests, through antenna modelling, that a 23m long wire on 80m shows a gain of –7.5dBi, with the best gain along its length. For reference, a half-wave dipole, mounted more than half a wavelength high, would be expected to have a gain of about 2dBi. But this is impractical for most of us (40m of wire antenna mounted up at 40m?). Peter's analysis, however, provides two pieces of better news. One is that the maximum radiation of the EFA is angled at about 30° above the horizon, which is good for DX! *(I can't help coming in again here – the angle of the main lobe will depend on the height above ground in wavelength terms. And 30° certainly won't do the business for truly long-haul DX where arrival angles can be well below 10°. However, that's almost impossible to achieve except on the coast or with a dipole several wavelengths high. So, in support of Joe, 30° or so is a pretty good result while still accommodating those inter-*



2 19.8 long wire erected as a sloper 19.8 wire erected as an inverted L

*UK and European QSOs – **Ed**.)* And, secondly, on other bands, the EFA is a better performer, and on 20m it can be about the same as a dipole. Other wire lengths can also perform the same way. But be careful with the length of the wire you choose. Choose badly, and the end impedance could be hard to match.

The complication comes because you want to use the same wire on more than one band. If the length of wire you choose is a half wavelength on any frequency on which you want to operate, then the end impedance heads in the direction of infinity and is very difficult to match. Much work has been done to try to work out the length of wire which avoids massive end impedances on various bands. Alan has a nice graphic, **Fig. 1**, which allows you to pick a length and see on which bands it will or won't. If your wire length misses any of Alan's solid horizontal lines, the end impedance will be reasonable. On Alan's diagram three lengths are marked with a dotted vertical line, all of which should work well on several bands. These lengths are 10.5, 15.5, and 26.5m. Another version of this is Peter's scatter graph in Ref. 2. If you work with one of these lengths, or one with similar characteristics, then you avoid the really difficult impedance matching problems.

I should say something about the shape of the wire – or rather, whether it needs to be straight or can be bent. I said earlier, and Cebik confirms this, that all wires are operationally the same, from the RF perspective. But there are some differences in performance. Have a look at **Fig. 2**. This compares a 19.8m long straight wire, with one bent at an angle of 90° (the classic inverted L shape). Cebik says that *"the sloping wire is similar in performance to the corresponding inverted-L"*. There are differences, but they are subtle. You do need to understand these subtleties to get the best out of these radiators. The most obvious thing to notice is that these are in effect omnidirectional radiators, but with a slightly better performance at an azimuth of 180°, in effect, back in the direction of the feedpoint. So, it's important to set it up with this in mind to get the best out of it. The second thing to note is that the elevation angle of maximum radiation is about the same for both radiators: 23° for the straight wire and 26° for the bent one.

But look more closely at the radiation patterns. Note that the sloper is a slightly poorer performer than the inverted-L. The calculated figures are 1.47dBi and 1.56dBi respectively. You can see this on both the azimuth and elevation diagrams. I have run these calculations for various other shapes, including running the wire up to a tree, and then bending it out in the horizontal plane. The radiation pattern gets messy, but with essentially the same results. The diagrams in Fig. 2 were done for 3.7MHz but the results are the same for other bands. Cebik sums it up nicely: *"All the values from 40m to 10m are lower for the straight wire than the L values by a noticeable amount". "Noticeable",* he says, but, as my calculations show, this is hardly half an S-point! There you are then – bend your length of wire any way you like, and it will still work.

And what about radials – yes there is a theoretical difference between, say, 64 half-wave radial wires buried a foot in the ground and a single ground stake. I prefer a single counterpoise wire, about a metre off the ground, running along my wooden fence, the length of which I can vary to achieve the lowest SWR possible on the band on which I am operating. But the differences are not enormous, probably about another 2dB, if I'm reading Cebik's work correctly. Altogether these inefficiencies add up to about one S point.

I'll continue these thoughts next month.

References

[1] L. B. Cebik, W4RNL, *Straightening out the Inverted L*, available at: **https://tinyurl.com/wm8688q**
[2] *Taming the End Fed Aerial* by Alan Chester G3CCB, in *HF Antennas for Everyone* by Giles Read G1MFG, RSGB Publications, available from the PW Bookshop.
[3] Steve Yates AA5TB, *The End Fed Half Wave Antenna* available at: **www.aa5tb.com/efha.html**
[4] Peter Miles VK6YSF, available at: **www.vk6ysf.com/longwire_antenna.html**

Fuses Again

Harry Leeming G3LLL
harryg3lll@gmail.com

Harry Leeming G3LLL has another round-up of handy tips, particularly for dealing with older equipment.

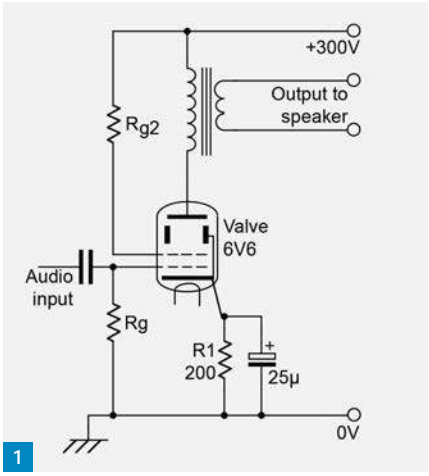
A few months ago I mentioned the desirability of checking that the correct fuse was fitted to your equipment because having the wrong fuse fitted can be very expensive. (No, no, no, fitting a 5A fuse, or a slow-blow one, in place of a 3A quick-blow type just will not do.)

A common cause of blown fuses in solid-state, as well as in valve equipment, is short-circuited silicon rectifiers in the PSU.

I once had a customer in the shop with a PSU I had sold some years previously, complaining loudly about the quality of the mains transformer because his had just burnt out. I looked at the state of the unit, the underside of which was visibly burnt, and told him that it would cost more than it was worth to repair and that it would be cheaper to buy a new 13.5V PSU. This resulted in more complaints of rubbish and robbery but I then looked at the 'fuse' and when I pointed out that it was shorted out with metal foil, he went quiet. If the correct fuse had been fitted, I could have replaced the short-circuited power supply rectifiers for a modest service charge and all would have been well, but it cost him a lot of cash for a new PSU. I was not over sympathetic! Why not put down your *PW* for a few minutes, and check that all your equipment is fitted with the correct fuse?

Valves are Different to Transistors

With an NPN transistor a positive voltage has to be applied to the base before it will pass any current, but with a valve a negative bias has to be applied to the control grid, to limit the current and to 'bias' it onto the linear part of its characteristic. The standard way of applying this bias is to fit a 'cathode bias' resistor as per **Fig. 1**. If due to the characteristics of the valve for instance, 10V bias is required to set the current to, say, 50mA for linear 'Class A' operation, this can be set by choosing the correct value of R1. As current is drawn through the valve a voltage is developed across R1. Its value according to Mr Ohm should be R=E/I = 10/0.05 = 200Ω. The value is not critical, hence the nearest preferred values of 180 or 220Ω would normally be used. The big advantage with cathode bias is that the stage is automatically protected against being over-run. If, for instance, a valve gets rather too hot, its current would normally increase, but with cathode bias this will cause an increase of voltage across the bias resistor, which will increase the negative bias and hence limit the increase.



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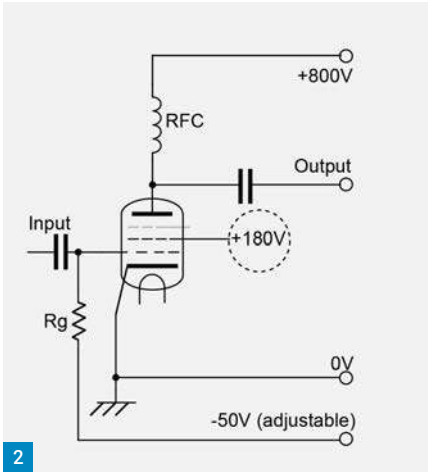

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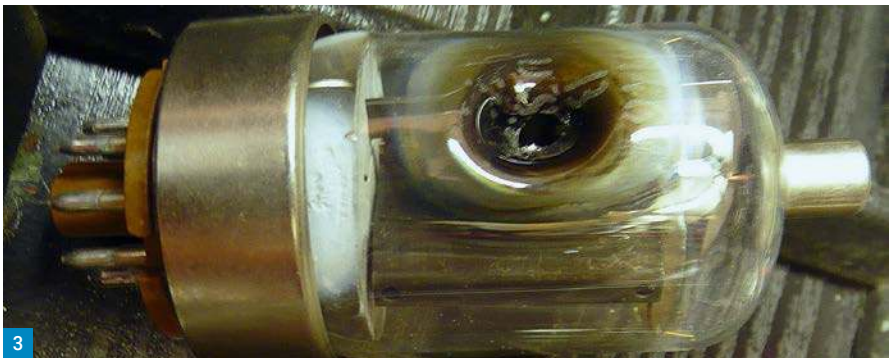

3

Class A however is rather an inefficient way of running devices. The audio amplifier output stage shown in Fig. 1, for instance, would consume about 15W of power (50mA at 300V) but deliver a maximum of around 5-6W to the speaker. Worse still, it would still consume the full 15W, even when there was no signal passing through it. This might not matter too much with stages running low power but trying to handle a few hundred watts of audio or RF with class A amplification would consume rather a lot off electricity, need forced cooling, and be the equivalent of continually running a fan heater.

Because of this, many high-power audio and RF amplifiers operate in class B (or class A/B, a kind of halfway house). In the most efficient form of class B, the amplifier valves are biased so as to be passing only a small current and hence consume little power, until a signal arrives. The catch with this mode of operation is that it requires fixed bias, as per **Fig. 2**, instead of cathode bias. With a fixed negative bias applied to the grids there is no protection against overheating, 'thermal run away', so if the valves do start to get excessively hot, this causes an increase of current, which increases the heat, which increases the current more. This should eventually blow a fuse provided the correct type and value of fuse is fitted (sorry to rub it in!), otherwise it can result in a burnt-out mains transformer and melted PA valves.

With any valve rig the first lines of defence against thermal runaway in the PA stage are to see that the cooling fan is running freely, the ventilation holes are not clogged with dust, and that the rig is mounted on a hard surface so that it can freely draw in cool air.

Most HF rigs with valve PAs are fitted with a 3-way switch marked ALC, PO, and I/C. 'I/C' should be your default position. When operating, always leave the switch set to this so that you can monitor the current in the PA

Fig. 1: Fitting a cathode bias resistor. Fig. 2: Fixed bias arrangement. Fig. 3: Melted 6146. Fig. 4: Adding some cathode bias to the PA in an FT-102. Fig. 5: Extract from FT-101 circuit diagram, showing the antenna lamp fuse (upper right).

valves. Somewhere in your rig there will be a preset control, and this should be adjusted so as to set the PA resting current at the required value as per your manual. Once you have done this, keep your eye on the PA current during 'overs' and if it starts to creep up, go back to receive before disaster strikes.

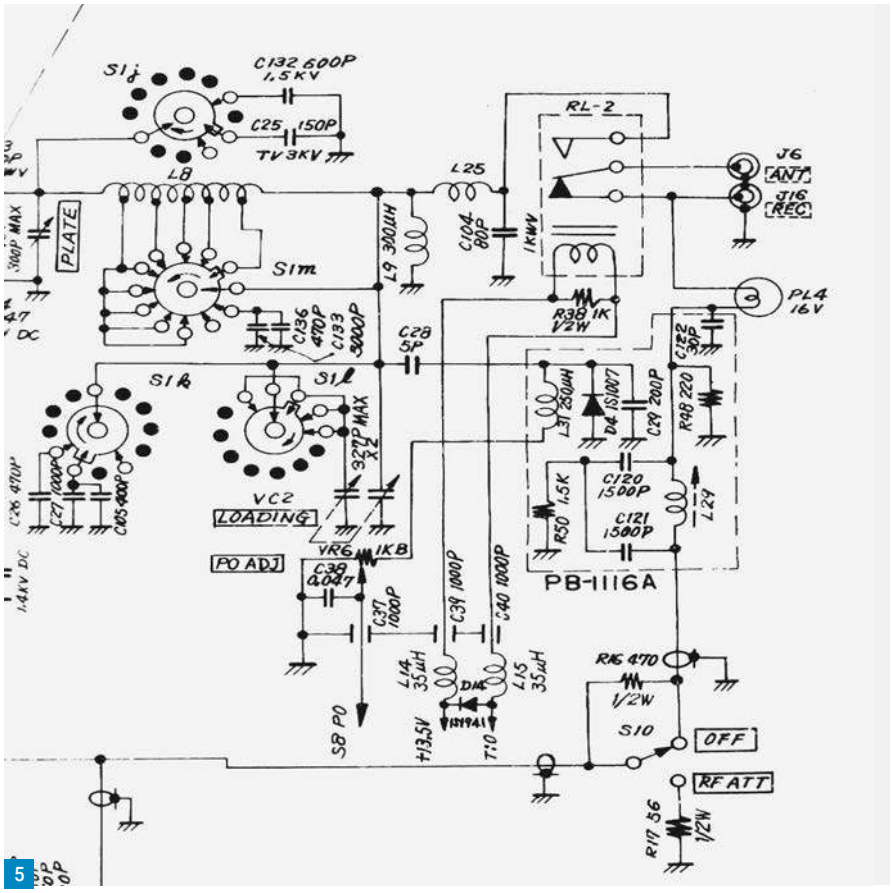
Good quality PA valves are now quite difficult to get hold of (sorry, don't ask me, I am long since retired) and it would appear that some of those available are more susceptible to thermal runaway than those fitted in the equipment originally. One rig that seems to suffer from this problem is the Yaesu FT-102, which uses three 6146B valves in the PA stage. Perhaps these are a little close to each other, as I did have a few of these rigs in with the PA valves in rather a sorry state as per the photo, **Fig. 3**. Some users have got over the problem by fitting more powerful, hence rather noisy fans, but I preferred to add a little cathode bias by cutting a connection at 'X' as per **Fig. 5** resulting in class A/B operation. The 68Ω 5W resistor reduces the output power output from around 150W to about 70W, but many users were happy to lose half an 'S' point for increased reliability, and protection against thermal run away.

My Rig Is Very Deaf but the 'S' Meter still reads S9

Tom was tuning through the 10m band, not expecting to hear much when he came across a tremendous signal. It was from George who was coming down the A6. They got chatting and this resulted in George being invited in for a cup of tea, and an hour-long chat.

Tom did not use his equipment again for a couple of days, when he found to his horror that while the calibrator signal still registered S9, his rig had become extremely insensitive. The receiver sounded lively, but only the very strongest signals could be heard, and they were down in the noise.

He was puzzled so that evening he went on the local 2m net to see if anyone had any suggestions. When a newcomer Peter suggested that the trouble was caused by a blown fuse, everyone thought at first that he was trying to be funny. Eventually Peter was able to explain that many HF rigs are fitted with a 'lamp fuse' and that this is intended to protect the receiver against being damaged by excessive levels of RF, such as can occur



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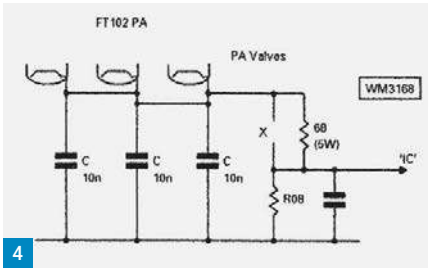
if a mobile station parks right under you antenna, or if you get your leads crossed and transmit from one rig into another (and yes, I did accidently once do this with a rig in the workshop).

The location of this lamp fuse is not made very clear in the manuals, and often needs to be traced from the circuit diagram. That for the FT-101, PL4, is shown in **Fig. 4**. On some of the older rigs Yaesu used a tubular 'clip-in' 100mA pilot lamp, mounted on the PA compartment to act as a fuse, whereas on later solid-state rigs they tend to hide it as a solder-in low current lamp on a circuit board. I could never remember where the things were and had to trace them out afresh whenever I got a rig in with a faulty one. Still, from a repair point of view in the shop, they were a 'nice little earner'.

Setting S Meters and Checking Sensitivity

When I equipped my service department for carrying out radio and hi-fi repairs in the 1960s, I purchased a normal standard radio and TV workshop signal generator. This was perfectly fine until I started handling amateur radio equipment. Frequency accuracy was not a problem because I could check this on a counter, but signal levels were, because with the output attenuator set for minimum



4

output, any sensitive shortwave transceiver would still indicate S9+.

Professional grade HF signal generators were somewhat out of my price range, so when I spotted a rather old but clean looking Marconi generator, 'In Working Order', for £25 on a Bring and Buy stall, I couldn't open my wallet fast enough.

It was excellent and looked rather good. I placed it so that customers could see it, and got many comments on the line of *"How can we carry out our own repairs when you need such expensive test equipment"*. I didn't enlighten them!

It seemed just what I wanted because the output when fed directly into a sensitive receiver could be turned down until the signal all but disappeared, but how accurate was the output meter and attenuator, and how could I check it? I'll let you into this secret next time.

Your Letters

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

Anderson Powerpole Connectors

Dear Don,

Further your *PW* article on Powerpole connectors in the November 2019 issue, here is a summary of a recent correspondence between myself and **Ian White GM3SEK** on the subject of Powerpole connectors and, in particular, the problems associated with cheap Chinese imports. Ian points out that there is a good 'Right vs Wrong' guide on the ARRL website (URL below) and suggests that the two most important diagrams are at the bottom of page 2 and the top of page 3 – the tolerances are very, very tight.
https://tinyurl.com/y5spp7bc

Ian uses an ordinary hex crimping tool rather than the very expensive US import. One of the available sizes gives a reasonably firm grip on 20A red/black cable but he then follows up with solder.

The fake ones come from eBay and carry an 'A' in a circle on the crimp part (see photo) whereas the genuine ones do not. In terms of construction, the Chinese ones are made of 0.5mm metal whereas the genuine parts are 0.6mm.

The inferior Chinese connectors result in a 'limp' feel when mating whereas the correct ones result in a more resounding, firm mate with a more solid lock. There is also very slight difference in the casings with the Chinese ones being slightly lighter red and a slightly bigger square indentation in the moulding.

Bob Parkes G3REP
Steyning, Sussex

Cheap copy and the real thing.

Current Prefix Confusion

Dear Don,

Whether or not you agree with the current three-tier licence system, few will argue that Ofcom's decision to issue Foundation licensees with callsigns in the M series is confusing. I'm sure that many will have heard overseas stations completely unaware that the poor standard of operation from some M stations that they are complaining about on HF are in fact Foundation stations, clearly without the experience that is to be gained by going through the three stages of their licence training process. These stations are often using far in excess of their 10W limit, simply because they can, and some have no intention of continuing further because there is no incentive for them to do so.

A number of years ago, UK mobile phone numbers had all sorts of dialling codes, which also caused confusion. In their wisdom Ofcom chose to sort the matter out by re-allocating mobile phones with the 07 code. A similar re-shuffle could be done to resolve our radio callsign dilemma.

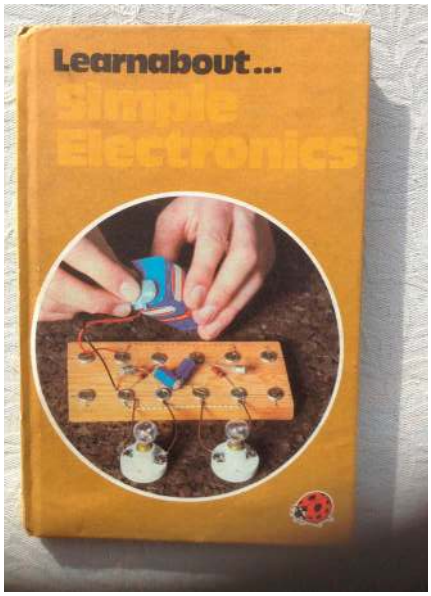
As the UK is fortunate to have three prefixes, why not use one for each of the three license classes: G = Full, M = Intermediate, 2 = Foundation.

This would be fairly easy to achieve because in most cases the call suffixes would remain the same. Ignoring the regional identifiers for simplicity, the following scheme would cause the least amount of inconvenience:

- M0 & M1 become G2 & G9
- M3 becomes 2E3
- M5 becomes G5
- M6 becomes 2E6
- M7 becomes 2E7
- 2E0 becomes M8
- 2E1 becomes M9

Stu Hammond G4KUR
Meriden, Warwickshire

*(**Editor's comment**: An interesting suggestion Stu although I think the chicken has already well and truly escaped the roost. Indeed, it seems that pretty much anything goes nowadays, with new licensees showing up with two-letter suffixes, for which I gather they have paid a one-off fee of £20? Any reader comments?)*



Classic Ladybird book.

Children's Electrical Book

Dear Don,

My grandson is now nine years old, the age that I was when I was away at school and into crystal sets wired to my bed springs. The set I made was built into a tobacco tin and gave me great company during my years away from home. On returning home *Practical Wireless* was my magazine of choice.

I have now worked through electrical circuits with my children, as in the Ladybird book, see photo, but am at a loss when looking for a more up-to-date book or series of books for my grandson.

Can you recommend a get-you-started book on modern electrical circuits that might capture the imagination of a modern youngster? We have worked through very simple lighting circuits and Morse code.

Having had so much pleasure from electrical gadgets when very young it seems a pity not to be able to work with my grandson on something more captivating than a crystal set!

Barrie Eggleton

*(**Editor's comment**: Sadly Barrie, I can't think of anything although it would be handy for sitting down with my own nine-year-old*

granddaughter. Any reader suggestions would be very welcome! The book in the photo is, unless I am very much mistaken, the one authored by the late ***George Dobbs G3RJV****)*

Good Service

Dear Don,
May I make a statement via the good offices of your magazines *Practical Wireless* and *RadioUser*, both of which I subscribe to.

Just recently I purchased an item from Nevada in Portsmouth. I realised I had made an error, which, if unrectified, would have cost a considerable amount of money. As soon as I realised what I had done, I telephoned Nevada and spoke with two members of staff, **Paul Saunders** and, a little later, **Glyn Dodwell**.

Having explained what I had done and assured them it was my error, I was told to return the goods and they would sort out the matter, which they duly did. I can honestly say that never have I received such superb service. There was nothing they would not do to prevent me from worrying about the botch I had made.

Thank you, Nevada, for all your help and the kindness shown me by two amateurs who know how to look after other amateurs. Great staff, great service.

Rich Brand G0SJR
Eaton Bray, Bedfordshire

Extra Heatsinking for FT-817

Dear Don,
I believe in good heatsinking of transistors to keep them as cool as possible to prevent them overheating.

I've had my FT-817ND a little over two years now and sometimes made fairly long FM transmissions when the heatsink gets quite hot. I decided extra heatsinking would be a good idea but how to do it?

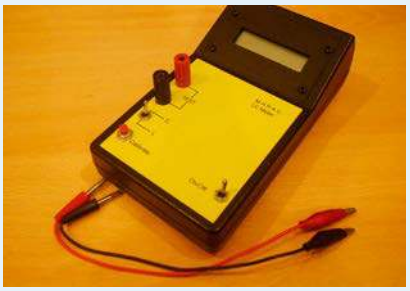
This is what I came up with, involving no modification to the rig. A piece of aluminium bar was cut to length as seen in the photo. The holes were already drilled so I enlarged the second one from the left to fit over the ground lug and chamfered the hole with a drill so it fits nicely over the flared base of the lug. The aluminium was filed at an angle indicated by the green marker pen to clear the letters GND because they are raised up and so it sits well on the existing heatsink. All burrs are removed.

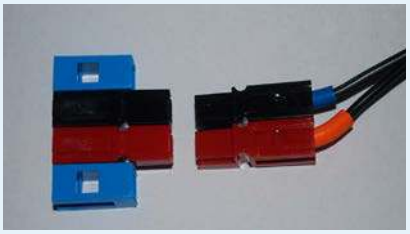
The second photo shows the additional heatsink in position, fixed by the existing ground lug screw plus a larger washer.

★Star Letter

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

Front Panels, Powerpole Connectors





Dear Don,
Reading through the February *PW* article *Making Professional Front Panel Artwork* I had one of those 'Been There' moments in the paragraph about laminating the artwork prior to fixing. Laminating any artwork with a thermal process will often introduce bubbles, quite often due to humidity. It was because of bubbling in the laminating process that I looked at other methods of making front panel artwork that was easy to produce and durable. The answer came from the 'day job'.

The attached pictures were achieved with a CAD program. I have tried various software for drawing such as Paint, Corel Draw and the like but despite working to a grid the results were not as good as using the CAD program. There are plenty of free CAD programs available that will give very good results for making panel decals. The LC meter decal was printed out full size on an Avery address label using a laser printer, with an overlay of WH Smith book laminating film for protection. The front panel for the dual-band transverter was again done with CAD but printed on plain paper using a large format printer (left over from the old day job – now used for radio panels and printing family trees). As this was done on plain paper it was fixed with 3M photo mount adhesive and again overlaid with the book laminating film for protection. I have since found a source of adhesive paper suitable for use with the large format printer but not yet had chance to try it out.

On the subject of Powerpole connectors, these have certainly become a popular connector in amateur radio circles. Having worked with connectors from various manufacturers professionally for nearly 30 years, the Powerpole does have a weak spot in that there is no insulation support on the terminal, which can lead to failure if the connector is subject to repeated mechanical forces (such as for Field Day operations). The solution I use is a short piece of either Neoprene binding sleeve or heatshrink over the crimp and the incoming wire.

As with any crimped connection it is important that sufficient pressure is applied to the crimp to achieve a secure, low loss connection. While the £5-special crimping tools will create a crimped joint, the success is all down to wrist pressure. To achieve a reliable crimp the ratchet type crimping tool is to be preferred, admittedly more expensive but much more repeatable results.

Powerpole connectors can be easily fixed through a panel with the blue half blocks, as in the photo, using a 16 x 8 mm hole with 2x 3mm holes at 24mm centres equally spaced along the long axis of the hole.

David Hobro G4IDF
Worcester

I smeared heatsink compound on the aluminium before fitting it, for good heat transference.

After a four-minute FM transmission it was pretty warm, proving heat was conducting into it. It provides a larger area in addition to the original heatsink for the heat to dissipate into. Imagine the heat building up inside the FT-817. If a heatsink with fins is available, it would be better at dissipating heat into the air but the protective carrying case would prevent air flow.

Talking of cases, have you thought about making your own? I obtained a few pieces of leather, cut them to shape, sewed them together and put Velcro down one side and also on the protective flap. I have a couple of hole punches which were my dad's.

Well that's my first attempt at sewing something other than just patching things. I think it turned out quite well – see photo. Perhaps I'll also punch some holes around the heatsink area to help with cooling, maybe cut a slot for the new heatsink.

Bill Kitchen G4GHB
Ashton-under-Lyne

Roger Bip

Dear Don,

This morning in a local net it was a discussion about the 'Roger-bip' at the end of the over. It was a little group in favour but the majority were against of it. The main question is whether this repetitive and annoying sound is according to our communication laws.

I saw in an old magazine the advertisement of a microphone that included this bip, fortunately not now. Probably it is permitted in CB, but what about in our amateur radio world?

Jorge Dorvier EA4EO
Madrid, Spain

*(**Editor's comment**: I don't see any regulatory reason why not, Jorge. And it can be useful in weak signal work on VHF/UHF to know that the other party has passed the transmission across. But what do readers think?)*

Antenna Supports

Dear Don,

I have just read **Colin Redwood's** article on antenna supports with interest. It's an excellent 'practical' article. At the end it lists potential suppliers of bits and pieces. One that was missing from the list and that I have found very useful is CPC Ltd (website below). They do a huge range of electronics, antenna fittings (masts, brackets, clamps, etc) and tools at good prices and offer free deliveries on web orders over £8. Payment by card and no account required.

www.cpc.farnell.com

I suspect many people think they are 'trade only' but in fact they are happy to deal directly with the public.

I enjoy reading *Practical Wireless*; keep up the good work!

Chris Jordan G0NGN
Craven Arms, Shropshire

Darwinian CW Contest?

Dear Don,

I dabbled in the recent CW contest (CQWW 160 CW at the end of January) but more interestingly was what I observed on the spectrum scope of my IC-7300. In this 160m snapshot (see photo) it typically shows the strongest stations at the bottom end of the band and the occasional strong, outlier, up the other end, presumably on a different strategy. Nevertheless, there is a definite graduation and diminution in strength as you go up the band. This also applied, in my observation, to the speed of the Morse and hence contacts and CQ calls. Those near 1810kHz were definitely faster in WPM than those higher in frequency. It strikes me this is a Darwinian process in action. It will be interesting to see if, as I suspect, those near the low end, will be the highest scorers? As a definite <20WPM man I felt rather out of it all. But I am somewhat rusty on the key.

Ian Dilworth G3WRT
Ipswich

*(**Editor's comment**: Thanks Ian, an interesting observation. Do remember, of course, that the power limit for most EU countries is lower above 1850kHz so that may be part of the explanation. The serious (and hence faster?) competitors hang out where they can run higher power. But it will be interesting to see.)*

Hints and Tips

Dear Don,

I like the *Hints & Tips* section (which last appeared in February) and hope that it will become a regular feature. However, I have some concerns over finding the impedance of coax.

• Many SWR meters need at least 20W to give a reliable reading. This means that you must use a dummy load or resistor of adequate rating and also take care not to exceed the mismatch rating of your rig.

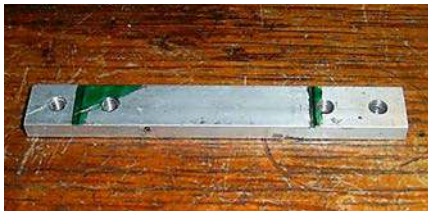
• A 50Ω dummy load connected to the SWR through 'n' electrical half waves of coax of any impedance will give a unity SWR. It is best to use an odd number of quarter wavelengths.

• If you don't get unity SWR, then it is not 50Ω and this may be all that you need to know.

• If you use a quarter wavelength and get an SWR of about 2:1, then it is 75Ω coax.

• Another good way is to measure the voltage at two points about one quarter of a wavelength apart. If they are the same it is 50Ω.

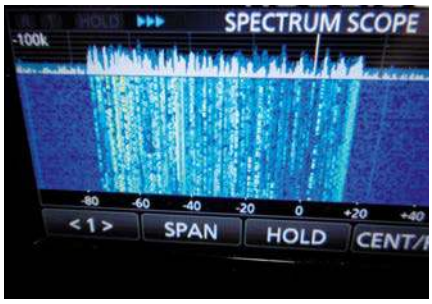
Gerald Stancey G3MCK
Oakham



The aluminium bar.

The additional heatsink in position.

The homebrew leather carrying case.



160m spectrum during the CQ 160 CW Contest.

(***Editor's comment***: *Thanks Gerald. Several readers have asked for the* Hints & Tips *column to appear more often. I am more than happy to do so but obviously I need input. This is not necessarily about high-tech but about useful ideas in and around the shack to make life easier. Send them to me at the editorial e-mail address and I will run a compilation from time to time.)*

Portishead Radio

Dear Don,
Seeing the piece in *Keylines* on Portishead Radio (where I took my Morse test), I thought you might be interested in the enclosed pictures. I assume the building on the site was part of the station. I have some information in an old DIY book from the 1920s on the station.
Chris Cleverly G4LGF

(***Editor's, comment***: *Chris sent some photos of decaying buildings and a large chain anchored to the ground (part of the guy system?). There's more this month – see* ***Larry Bennett's*** *feature – but the Highbridge site, at least, is now a housing estate! It's a shame we are losing these excellent radio sites – I recently saw that a special event station in Australia will be allowed to hook into a disused broadcast array. That should ensure some big signals!)*

Reader Biographies

Dear Don,
I notice that the *Letters* section of the November. issue is taken up by Mini-Autobiographies of a couple of readers. I am interested in and write about Social Histories or Personal Stories behind the subject being recorded. The stories of people's beginnings, or life in amateur radio, are often encouraging to those just entering the hobby and can point the way to their radio ambitions. Occasional short features from readers could be entertaining and even have a funny aspect, waiting to be told.
Geoff Voller G3JUL
Ashford, Surrey

(***Editor's comment***: *Good to hear from you Geoff. Older readers will recall that before his retirement, Geoff was the only 'professional' radio amateur in the country, manning the demonstration station at the Science Museum. And, yes, I too have always found amateur radio personal histories of interest.* Short Wave Magazine *used to feature* The Other Man's Station *but nowadays very few radio amateurs are happy to share their stories. However, it would be good to hear a few, especially those who, for example, used amateur radio to stay in touch with home when working abroad and before the days of WhatsApp and the like! Back in 2005 the RSGB published* Who's Who in Amateur Radio, *in which Geoff and your editor both feature, but the details were no more than would typically be found nowadays on the* ***qrz.com*** *website)*

Licence Classes

Dear Don,
In my day when I took the RAE there was one licence. If you wanted to use HF then you took a Morse test at 12WPM. The Morse test has been dropped so we could still have only one licence that is multi-choice, unlike the half hour questions that I had to answer.

However, today we have three licences taking the place of one. Why not combine all three licences into one and add a few more questions on the paper as well? Why do we need three? One would do.

Anyone contemplating coming into the hobby is going to be put off having to take three licences but would be more attracted to just a single licence.
Ross Bradshaw G4DTD
Roche, Cornwall

(***Editor's comment***: *Thanks Ross, though personally I don't agree – not everyone will be sufficiently interested in the hobby to make the 'giant leap' in one go. I happen to think your final assertion is quite incorrect although no doubt there are readers who would agree with you.)*

J Birkett

Dear Don,
Reading the delightful article on **John Birkett** in the March edition, about 30 years ago, I remember receiving a phone call from a restoration group in the USA, seeking my help in order to advertise over here for a T1154/R1155 set that they needed to complete their latest project.

You can imagine the reaction when I told them that our ham radio retailer J. Birkett of Lincoln had them on display in his shop window and simply gave them John's phone number. Indeed, looking at your photograph, it appears that they are still in stock!
Victor Brand G3JNB
Bedfordshire

A G4PVB Cornucopia

Dear Don,
It is often remarked by engineers that when we, the UK, adopted decimal in the '70s it made it more difficult for us to export to America and easier for Japan to export to us. Doh! Several decades later, despite the previous efforts of the Metrication Board, we may still find it necessary to convert units. But help is at hand from the Digi-Key link below. Oodles of free online conversions and calculators:
tinyurl.com/v8yutbw

On a related subject, I was in despair when the control knob of my American radio came loose seemingly requiring an American Fine Allen key to secure. But the bridge saddles adjustment Allen key for my American guitar came to the rescue. By the way, I put a few dabs of white Tippex on my black Allen keys to aid visibility to find if dropped.
www.guitarmania.co.uk

Search for 'allen key tele' to find quantity 2 for £3.99 plus £1.00 postage. Alternatively, you can buy a genuine USA Fender Telecaster for a mere £1,200 and get a free Allen key but check with the XYL station manager first!

I used to use silicone sealant nonchalant-

ly to secure loose items in my projects until I read by **Barry G3YEU**: *"Beware of sealants that exude a vinegar smell when curing, as the acetic acid will eat away almost any metal in time."* So, I Googled for more information and, yes, it is well documented that in some circumstances silicone sealant may damage electrical metal connections. Quote from link below: "*If you are involved in applications where the corrosiveness of an acetoxy cure silicone would damage your products – a good example is anything to do with electronics – then you should specify a neutral cure, alkoxy RTV silicone sealant.*"

tinyurl.com/sealantmetal

In August 2019, the Essex Ham team helped BBC World Service presenter **Gareth Mitchell** to get his first amateur radio licence. In this interview with Gareth, he explains the process of studying for the exam online, taking the practicals, and sitting an online exam:

tinyurl.com/yx3mxboh

Subsequent to letter of **Ron Taylor G4GXO** Grid Dip Meters, *PW* March 2020, I scoured the internet to find popular models. Seemingly the Kenwood/Trio DM-81/DM-801 at typically £100 second-hand looks to be a bargain. But you don't have to buy one to benefit from the knowledge of owning one. PA0FRI has uploaded the manual of the DM-81. You can easily read all the specifications and valuable uses just as Ron described:

tinyurl.com/gdmdm-81

There is also information on other Grid Dip Meters (albeit in Dutch) along with good resolution pictures at the following:

tinyurl.com/sga3tss

Click on the Union Jack flag on the site for an English translation.

Operating a 100W K3 or similar without an inline fuse is like using an electric mower in the rain because you have an RCD installed. Optimism is not a strategy. Yes, your power supply may have overcurrent crowbar protection and the radio may have a fuse on the back panel but you're overlooking the damage that 13.8V at 20A more can do to your connecting and surrounding cables, including the possible fire hazard.

I like to install my fuses as close as I can to the power source with one each for the positive and negative. The most obvious choice for me was automotive blade fuses. They come in two sizes, mini, standard & maxi, are relatively cheap as are the inline fuse holders.

The 12 Volt Planet search box via link below will possibly answer all your questions on this subject. Their Blade Fuse Extraction Tool is only 54p.

www.12voltplanet.co.uk

Here's a free website that makes you smack your forehead and exclaim "Why didn't I think of that?" With just a few mouse clicks you can ascertain the coordinates of any place on the world or, conversely, enter known coordinates to display that location:

getlatlong.net

Finally, if you want an in depth clearly spoken 'conversation' with a well-informed amateur radio enthusiast who transmits but also owns his own microphone manufacturing company then it can only be Dr Bob Heil K9EID. The action starts at 1:55:

tinyurl.com/bobheilk9eid

Bob Houlston
St Albans

*(**Editor's comment:** Thanks Bob for sharing with readers some of the handy resources and suggestions you've come across. I know you've sent others too and I'll get round to including most of them eventually!)*

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The Internet and Amateur Radio

I was reflecting recently on how the internet has impacted amateur radio, as indeed in most other aspects of life. It's taken a while but it's the arrival of broadband that has had the biggest effect. Back in the late 1980s the AK1A Cluster software arrived on the scene, designed originally for club members to share real-time updates (a WhatsApp of its day!). But DXers and contesters saw the benefits for alerting each other to interesting stations on the bands. Very soon, there was a demand to link individual nodes so that the DX alerts could be shared more widely. This was done mainly on a 70cm and 23cm backbone. Now we link internationally via the internet.

On a quite different front, the RSGB's *DX News Sheet* and similar bulletins elsewhere died a death when it became possible to distribute such news via e-mail and avoid the delays and cost associated with using the postal service.

No one nowadays (that I know of) would question the use of the internet for such applications. We also use it to source technical and other information, to communicate with friends and fellow club members via reflectors, Facebook, Twitter and the like.

Where debate remains heated is where our radios connect to the internet. Just as the use of repeaters was resisted by some when they first appeared, so the internet is seen as some kind of global repeater and not even relying on the amateur wavebands.

Personally, though, I think the biggest challenge the internet presents to our hobby nowadays is not the interconnection for DMR and similar, or its use for remote operation of our stations, but the way it takes day to day ragchewing from the bands so that they only seem to come to life when there is a contest or DXpedition. Not that we can put the genie back in the bottle! Thankfully, as I mention in the *Letters* pages, some regular on air nets continue.

As always, your thoughts are welcome.

This Month

It's another packed issue this month, despite a lack of product reviews (just a timing issue – we will have several over the next few months). With summer coming, for example, our thoughts turn to antennas and we feature two more on end-fed wires. I'm also pleased to be featuring an article by **Bernard Nock G4BXD** about operating Oscar 100. Bernard is best-known to *PW* readers for his *Valve & Vintage* features and his Military Wireless Museum but, in the best traditions of the hobby, he's also embracing the new.

I'm equally pleased that **Larry Bennett G4HLN**, who I mentioned in last month's *Keylines*, has written an article about the history of the UK's maritime radio service. Many of the operators trained at Highbridge and elsewhere spent time at sea before settling down to shore-based life working at one of the coastal stations. They were all highly competent Morse operators and many hold amateur radio licences and keep up their Morse skills on our bands now that the Maritime Service no longer needs them. Lots of us will recall sharing the 160m band with stations like Niton Radio, Humber Radio and others and being careful to avoid causing them interference. Indeed, we would never have believed how things would change, with every country now having access to the band (back then it was just a handful) and, in the last weekend of February during the CQWW 160 Phone Contest, SSB signals right across the band for 48 hours, with leading European entrants making more than 1,000 contacts in 50+ countries and multiple US and Canadian states and provinces.

Don Field
Editor, *Practical Wireless* Magazine

Next Month

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

THE SENHAIX 8800 REVIEWED: Tim Kirby G4VXE reviews this dual-band handheld, novel in that it is programmable from an Android phone or tablet.
INNOVANTENNAS XR-6 MkII: Steve Ireland VK6VZ/G3ZZD reviews a 20m through 6m Yagi antenna but also includes advice on putting together an HF Yagi from a kit of parts.
PROSIGNS AND ABBREVIATIONS: Tony Smith G4FAI takes a look at the origins of prosigns and abbreviations used in amateur radio telegraphy.
SIMPLE VERTICAL ANTENNAS: Don G3XTT shows how to create an effective 'antenna farm' with wire antennas and fibreglass poles.
REMOTE OPERATION OF DIGITAL MODES: Daimon Tilley G4USI explains how to operate the digital modes while away from your shack.

There are all your other regular columns too, including Carrying on the G3RJV Way, HF Highlights, Doing it by Design, World of VHF, Notes from a Small Station, Making Waves, What Next and Data Modes. And there will be the second parts of Tom Morgan ZS1AFS's feature on soldering coax connectors and Michael Jones GW7BBY's restoration of the

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