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INCORPORATING RadioUser

MARCH 2026 THE UK'S NUMBER ONE AMATEUR RADIO MAGAZINE

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A COOL KILOWATT

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The new Icom IC-7300

So how does the latest version compare with the original?

The Marconi beam

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Keylines

Sadly, a very limited amount of radio for me this month, something I hope to put right as the year goes on. My main antenna has come loose from the pole as a result of strong winds and as soon as the weather improves (the rain stops!) I need to retighten everything. At the same time, I need to sort my 6m antenna (above the main HF antenna) as the SWR seems to have shot up for no obvious reason. Such is life! But at least I haven't had the problems that some of my friends in Cornwall have had, where the winds early in the New Year were even stronger and antenna damage somewhat worse.

Which aspect of the hobby is yours?

Although amateur radio could be regarded as something of a niche hobby, it nevertheless has many quite separate facets and few of us have the time or inclination to follow more than a handful. Indeed, that's one of the challenges of editing *PW*, to try to cover as many of the bases as possible.

When I started in amateur radio on the late 1960s, most amateurs were either in the hobby for the technical side (self-training in electronics by building and learning) or operating (primarily on HF although the recently introduced Class B VHF-only licence was encouraging both innovation and operating at VHF and UHF frequencies).

Nowadays even HF and VHF operating have splintered, to include, mainly at VHF, digital voice modes, and on all bands a huge increase in the use of digital modes generally.

Home construction is still alive, mainly for QRP (low power) operation. But there is also a very significant interest in legacy equipment, particularly from the days of WW II but also from the halcyon days of commercial valve equipment from the 60s and 70s in particular (KW Days, the FT-101 – see this month's *HF* column, and so on).

And let's not forget Public Service radio. In the UK that is principally centred on RAYNET and the activities of many clubs who support sponsored walks, community events and so on. Public Service is big in the USA where they seem to suffer more natural disasters – the monthly magazine of the ARRL, *QST*, has a monthly column devoted to Public Service radio. And Public Service radio is also of great importance in many developing countries where the national infrastructure is less well developed – in parts of the Caribbean for example, where severe weather is an annual event.

Just going back again, when I was first licensed the Cold War was very much to the fore but amateur radio was alive and thriving behind the Iron Curtain, mostly state supported with the expressed intention of using it to train a cadre of folk in the technical and operating aspects of radio. Not something we have ever had here in the UK, despite radio amateurs doing such a sterling job during WW II.

Traffic handling and phone patch

I wonder how many readers remember the days of Phone Patch. Not something we were permitted here in the UK, with the Post Office maintaining a stranglehold on landline communications, but common in many other countries and especially the USA.

Going back in time, the American Radio Relay League was so-called because in the early days of the last century long-distance phone lines were largely non-existent and radio amateurs offered their services in passing 'traffic' across the country, carrying messages on behalf of third parties, by Morse code at first. It certainly proved to be a great training ground for excellent Morse operation.

Later, though, the idea transformed into allowing those same third parties to use their phones, ring a local amateur, be patched through to an amateur at the other side of the country, and connected onwards to the intended recipient, maybe a friend or relation.

This service by radio amateurs took on a whole new dimension in the years of the Vietnam war, when radio amateurs provided a service to allow families to connect with their loved ones serving in Vietnam. The frequencies used were largely just outside the amateur bands but using amateur equipment and antennas, albeit provided by the military. The MARS (Military Affiliate Amateur Radio Service) still exists although I am unclear as to exactly what role it plays nowadays, given the ubiquity of international communications via mobile phones.

Don Field G3XTT
Editor, *Practical Wireless* Magazine

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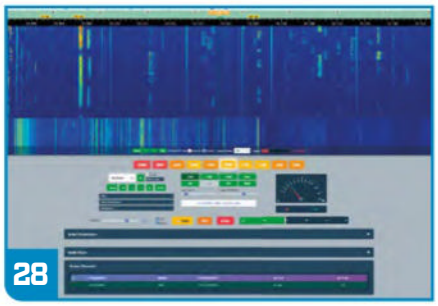
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Newsdesk

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

News from Martin Lynch & Sons

The ACOM 2020S (1) solid-state 1.8–54MHz linear amplifier is a high-power broadband amplifier designed to meet the requirements of demanding HF and 6m operation. Aimed at contest stations, DXers, and well-equipped home stations, the 2020S combines robust output capability with all modern control and protection features.

Capable of delivering up to 1500W PEP or a continuous carrier across its operating range, supporting effective operation on SSB, CW and digital modes.

A colour touchscreen remote control unit provides clear visual feedback and intuitive access to amplifier status, settings, and operational parameters.

Designed to operate with a wide range of transceivers, using either RF sensing or CAT control to follow frequency changes automatically where supported.

With built-in monitoring and protection circuitry guard against excessive drive, high SWR, overheating, and other fault conditions, enhancing long-term reliability.

Network connectivity allows the amplifier to be integrated into remotely operated stations, reflecting the growing interest in off-site and shared amateur radio installations.

The **SenseCAP Solar Node P1-Pro (2)** for Meshtastic empowers you with resilient, secure off-grid communication. This compact, self-contained Low Power Wide Area Network (LoRa) node uses a wireless protocol for long-distance, low-power data transmission, ensuring you can send short text messages and share your position even when internet and mobile networks fail.

Operating as part of a Meshtastic LoRa mesh network, the P1-Pro allows messages to be passed directly between nodes. This does not rely on any central infrastructure. As a result, it is well-suited to local emergency communications, outdoor activities, and situations where conventional services may be disrupted.

The **Heavy Duty Cup Holder Mount** offers a simple and practical non-permanent solution for mounting your FTX-1, Icom IC-705, IC-7100 and similar devices inside your vehicle. Designed to fit securely into most standard cup holders, it provides a stable mounting point without the need for drilling or permanent vehicle modification.

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The **Nissei NS-1245A** is a robust 40A DC switching power supply designed to serve as the dependable heart of an amateur radio shack. Capable of supplying up to 40A at 13.8V DC, the NS-1245A delivers stable, high-current power for transceivers, amplifiers and accessories with efficiency and reliability.

JCASE-XKI4 Waterproof Transceiver Case. Protective cases rarely attract the same attention as radios or antennas, yet for the increasing number of amateurs operating portable, they play a crucial role in safeguarding often expensive equipment. The JCASE-XKI4 is a hard, waterproof transceiver case designed to support several popular compact HF radios, aiming to provide a single, flexible solution for portable operators.

The **TopBytes DXSpotter (3)** introduces a dedicated hardware solution for DX spots: a compact, Wi-Fi-enabled display that brings real-time DX cluster spots into the shack without the need for a computer to be switched on. Its promise is simple: deliver live spot data at a glance with minimal fuss.

For operators who spend significant time chasing DX, contesting or simply enjoying the ebb and flow of band openings, the DXSpotter provides a constant window into global activity with minimal fuss. Handheld transceivers continue to play an important role in amateur radio, providing convenient access to local repeaters, simplex operation and increasingly, digital voice networks. The **AnyTone AT-D890UV** is a feature-rich dual-band handheld that combines traditional FM operation with modern digital capabilities, including DMR, GPS, NXDN and APRS. Aimed at operators seeking versatility beyond a basic handheld, it offers an impressive specification set in a compact package.

https://www.hamradio.co.uk

THE RSGB IS NOW ON INSTAGRAM

The RSGB has launched its official Instagram profile. This addition to the Society's social media presence will help it to connect in a new way and showcase the exciting world of amateur radio and STEM.

Through Instagram, the RSGB aims to:

- Support youth activities and highlight opportunities for young radio enthusiasts
- Engage with like-minded organisations that promote STEM education and innovation
- Inspire the RF engineers of the future by sharing stories, projects and events
- Connect with other groups that enjoy practical activities

Follow the RSGB account on Instagram, like its posts, share them with your friends and join the conversation as the Society builds a new community. Search for 'theRSGB'.

NEW 60M FREQUENCIES IN USA

New 60m frequencies approved by the FCC in December became available to US amateurs as of 13 February 2026, along with new power restrictions on those frequencies. It's a bit confusing, as different rules apply to different segments of the band. The changes result from the FCC's action to approve a worldwide 60m amateur allocation made by the World Radiocommunication Conference in 2015 (WRC-15). For more information, see:

https://tinyurl.com/mt8p8jpa

INDIAN SATELLITE DEMONSTRATION

12,000+ students witnessed real-time satellite communication with the International Space Station. As part of the 'Rastriya Katha Sibir' organised by Shri Vedik Mission Trust, an unprecedented live science and space outreach program was conducted with the active support of AMSAT-INDIA and UPARC (ISRO). The highlight of the event was a live two-way amateur radio satellite communication via the International Space Station (ISS), demonstrated by **Rajesh Vagadia VU2EXP**, Regional Coordinator of AMSAT-INDIA and an experienced amateur satellite operator.

On 30 December 2025, an additional experimental live satellite demonstration was conducted for a smaller group of approximately 120 students. This session was aimed to provide a comparative learning experience using a much smaller satellite. The satellite chosen was HADES-ICM (SO-125), a PocketCube satellite. Students were first briefed on the basics of ham radio and satellite communication. VU2EXP operated using a portable ground station, and after a few calls, a strong downlink signal was received from VU2JEK. A comfortable QSO and report exchange followed. Despite an excellent overhead pass, no additional stations were copied until LOS.

Discontinuation of the IRC

Since its introduction in 1907, the International Reply Coupon (IRC) has been a universal tool for sending international mail, used by people around the globe, including amateur radio operators, to cover the return postage of their coveted QSL cards. However, during the 28th Universal Postal Congress in Dubai (September 2025), member countries of the Universal Postal Union (UPU) voted to discontinue the IRC, effective 31 December 2026. The UPU describes this decision as *"a natural progression within the broader transformation of international postal services, in alignment with the digital practices and modern outlook of their customers"*.

Current IRCs already in circulation bearing the expiry date 31 December 2025 will now be valid for an additional year. It should be noted, however, that many countries have stopped selling or accepting IRCs for several years now.

FM Broadcasting in Norway

Tim GW4VXE, in his VHF column, recently had some information about FM broadcasting and stations in Norway. **Peter LB0K** has kindly provided more background. *"You have correct information about national programme channels on FM, these were required to move to DAB broadcasting some years ago and most of the redundant transmitter gear has been donated to needy broadcasting services in Africa. Some (most) local broadcasting services could ill afford the costs of DAB services and anyway the DAB coverage was unlikely to achieve 100% coverage for some few years, if that. So, these local stations were allowed to continue but under a very strict regime. There is now a growing movement to remove many of these restrictions.*

"I'd like to tell you a little about one of these broadcasting services, so that you can maybe share some of the info with readers.

"Bergen Kringkaster is based on the island of Askøy, which lies just NW of the city of Bergen on the west coast and is operated by the Foreningen Bergen Kringkaster (Bergen Broadcaster Assoc.). This is a group of radio and DX enthusiasts who look after the old LW/MW transmitter site that is now a museum. The Assoc. has a licence to produce and transmit programmes.

"The prime FM transmission is on 93.8MHz from a J-pole antenna at 7m. There are two repeaters in use to extend coverage, the first transmits on 100.3MHz from near the city centre, and the second transmits on 88.6MHz from a hill to the south of the city. This will probably be the easiest one to receive across and down the North Sea. And there are plans to add a third repeater on a very good site in the coming months.

"We also rent out transmission time to other programme providers, mostly religious groups, and some of these can be recognised in their programming as they can remind one of VoA short wave programmes in 'Special English'. These were programmes for non-English speaking listeners enunciated very clearly in a reduced vocabulary version of American-English.

"Another service we operate is a Medium Wave AM transmission on 1314kHz, transmitter power is 500-800W and the antenna is a 15m Comrod ex-maritime vertical. This service is one of the prime reasons for our activities, as it is considered as a part of being a museum, in similar manner to the trams in Crick or the facilities at Amberley. We welcome listener reports to the email address on the website. The museum is open every Sunday between 1100 and 1500, and at other times by appointment. Our web pages can be found at": **www.bergenkringkaster.no**

RSGB EMC COMMITTEE PUBLISHES NEW GUIDE FOR REPORTING HARMFUL INTERFERENCE: The RSGB EMC Committee has recently published a new *Guide for Reporting Harmful Interference to Ofcom*. The leaflet contains some do's and don'ts on the style and content of the report that has to be submitted. It also provides some examples on wording that can be used. This is the 18th leaflet the EMC Committee has released that offers advice on dealing with interference issues. Download them all by going to:
rsgb.org/emc

IMPORTANT CHANGES TO THE RSGB QSL SERVICE: The RSGB is pleased to announce the next stage in developing its QSL Bureau Services following the retirement of RSGB QSL Bureau Manager **Richard Constantine G3UGF**. After a comprehensive review of long-term options, the Society has entered into a formal Contractual Agreement with the German National Radio Society, Deutscher Amateur Radio Club, to process all incoming and outgoing RSGB QSL cards. DARC operates a modern, high-capacity QSL bureau. Its systems already support a number of national societies and offer industrial-scale reliability, digital processing capability and long-term resilience. This partnership will provide a robust and effective QSL bureau service for RSGB members. Volunteers remain central to the RSGB QSL Bureau Service and the RSGB extends its thanks to all sub-managers, whose dedication forms the backbone of the service. The new arrangements are designed to support volunteer involvement, not replace it, and to ensure volunteers have a strong infrastructure behind them. The new service preserves the traditional bureau structure but will offer additional options for RSGB members who send cards. Find out more about these developments on the newly updated QSL Bureau pages on the RSGB website at:
rsgb.org/qsl

USEFUL WEBSITES

A new 'for sale' website for amateur radio gear:
arc.ntwk.co.uk
Bandplan generator:
https://tinyurl.com/3yva46cs

Richard Constantine G3UGF
richard@norcomm.co.uk

A Cool Kilowatt

Richard G3UGF gets his hands on the new PW-2 amplifier from Icom.

It was exactly two months to the day that the courier driver last staggered up my drive with Icom's IC-7760 transceiver. Now he was back again on his own with another box, also marked two-man lift.

This time it was only 23kg and contained the much-awaited IC-PW2, 1 kilowatt solid state linear amplifier. Was it going to live up to the hype and its serious price tag? Only time would tell.

I already knew after 20 minutes of climbing two flights of stairs (resting half way) and depositing the box safely in the shack that coffee would be needed.

Discarding the foreign language manuals and putting the English translation to one side the first of the accessories out of the box was a blank panel, similar to a shallow tray. I had no idea of its use until I found the identically sized digital display unit. The flush fitting blank panel fits to the front of the amplifier. It's both cosmetic, physical and dust protection for the gold contacts normally covered by the control unit, when configured as a stand-alone amplifier.

It was immediately clear that unless you have a very strong or possibly reinforced desk you're unlikely to stack an IC-7760's main transceiver unit and amplifier at around some 50kg total on a suspended veneered chipboard surface – you have been warned.

That said, while this amplifier was designed to complement Icom's range, provision has been made for it to be operated in conjunction with other and probably much lighter radios.

Next came an angled metal desk stand for the digital display controller when used remotely. Ingeniously the display unit has two circular chrome magnets at the rear that snap securely into indents in the non-slip desk stand, no screws no clips required.

When the controller is mounted directly on the amplifier it locates on two lugs on the bottom edge. There's a flush mounted push button on the top of the amplifier that operates two securer/release catches on the rear of the controller. All in all, it's well thought out.

While the amplifier is capable of being used by two separate exciters, the package only includes four interconnecting leads each 3m in length for a single radio. Depending on installation requirements they may be considered a little long as supplied but Icom are trying to cover all bases. Personally, I would duplicate them rather than cut the originals, if needed.

There's a substantial PL259 RF coax lead and a control cable for use with the remote desk top controller in standalone mode. Two of the leads are specifically for use with an Icom radio. A 7-pin DIN type for input and output of signals such as ALC and a CI-V remote control jack lead for using CI-V commands

The instruction manual has very clear connection diagrams for both Icom and other manufacturers' radios. Separate RCA phono sockets are available on the back of the unit to accommodate other makes of radio. When used

Photo 1: Remote controller.

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with other transceivers, the manual states *"When using a non-Icom exciter change the frequency band of the amplifier and switch the antennas before transmitting"*.

The chunky AC power cable is not detachable. Don't be tempted to plug it into a cheap trail socket! It's nice to see rear panel mounted circuit breakers rather than fuse holders

Frontpanel

The layout and operation of the control panel is, like all modern Icoms, somewhat intuitive, and enhanced by the use of illuminated push switches Once powered you select which exciter is to be used. Chose any one of six antenna ports (if you have an acre of land) even when the amplifier is in standby mode. There's an SD card slot to memorise settings and firmware upgrades. The amplifier includes a digital clock. Nice to see that the CR2032 back-up battery clips in rather than the old wired type.

Humorously, the handbook disclaimer says that when changing the battery there should always be two people to carry, lift or turn over the amplifier – now you tell me!

Display

The 4.3in (11cm) viewable colour screen is extremely comprehensive. Apart from the obvious digital representation of analogue meters showing power, current, temperature, voltage, VSWR and ALC, the lower half of the screen gives more information.

Band input 1 to the left and band input 2 to the right. You can see the operating frequency and there's an AUTO icon that shows if the amplifier is being controlled via the CI-V route. Regarding CI-V control the baud rate is adjustable for use with external devices such as a rotator. The amplifier can also be remotely controlled.

The lower centre portion shows the power output figure, current operating temperature and the temperature at which protection kicks in, so that you can keep an eye on it when in heavy use.

Menuscreen

Any Icom user will be familiar with the touch panel icons in the menu screen. The PW-2 has nice little representations of Yagis and dipoles that can be selected and assigned to the 1-6 antenna ports. There's a Keyboard function for naming items and an engineering SET screen

It's worth mentioning here that the comprehensive handbook contains around 14 pages to walk the user through setting up and operating the linear, well worth taking slowly and enjoying the process. There are five pages of easy-to-understand graphic diagrams that show how to set up and link various combinations of Icom and non-Icom equipment.

Protection

Thankfully this amplifier includes some impressive and fast acting protections that monitor errors and load conditions. When activated it beeps. There's a visual 'Protect' warning and the amplifier screen immediately shows Temperature and VSWR. Certain

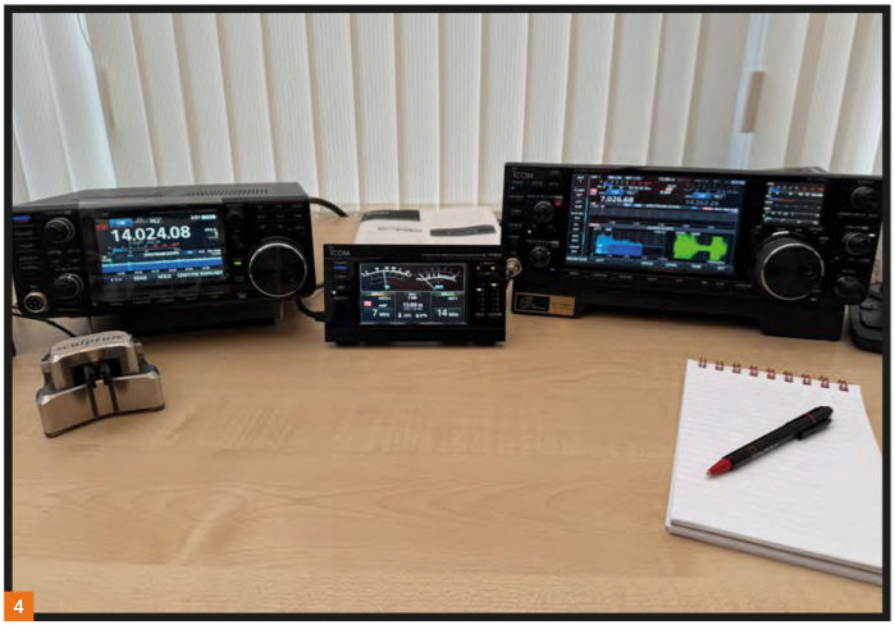

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Photo 2: Rear view of the PW-2.
Photo 3: IC-PW2 local mode alongside the IC-7760.
Photo 4: Two inputs, IC-7760 and IC-7300 Mk 2 (requires leads plus OPC-599 adapter).

functions are locked out to prevent harm and the amplifier can be re-set in receive mode by pressing the Protect button again. The screen also shows messages directing the user to the possible source of the issue.

The PW2 has very quiet automatic variable speed fans. There are two for the 45A switch mode power supply and three for the RF circuitry. Protection includes self-monitoring of the PA temperature, ALC voltage, input RF power, band protection in case they become out of synch and abnormal operation of the AC unit.

Antenna tuner

When the amplifier is bypassed in standby the ATU can still be used. It's a good idea to match the antenna before releasing the beast. It follows the usual impedance range for automatic units of 16.7-150Ω and should complete and memorise its work in around 2-3 seconds, achieving a VSWR match of 1.5:1 or less. It's really best used in conjunction with band resonant antennas that just want to move up or down the band from the natural resonant frequency. Of course, any antenna has to be capable of conservatively handling the 1kW output. Wet string won't do!

Receive-I/O

Increasingly more and more stations are using separate low noise receiving antennas, such as loops etc, especially in high noise urban environments. They can also be extremely useful for contest operation. The use of external bandpass filtering for multi-op stations is also a consideration. The use of a receive antenna is programable and memorised in conjunction with each antenna and displayed on the antenna screen. The touchscreen allows it to be used or disconnected at will.

PA and pre-distortion

I remember the days when transistors were only used for audio and switching You would struggle to find a device to provide 10 watts of RF on 1.8MHz. To now have a single, practical broadband LDMOS device operating well within its safety margin at 1kW of RF up to 60MHz is to me a revelation.

For the 'techies', it's an MRFX1K80RH. Designed by Dutch company NXP, an offshoot of Philips, I read somewhere that it's capable of 1.8kW at 470MHz -impressive. Its main application is for FM and digital transmission, which can present a problem for linear SSB resulting in some distortion. Icom now incorporate DPD, a digital pre-distortion feedback system, in their latest generation of radios. It senses the output and feeds back digital information to lower levels in the signal chain (FPGA) to correct anomalies and ensure linearity. It's in the IC-7760 and the later versions of IC-7610, but not in the latest IC-7300 Mk2.

The first thing that you have to do just once only when setting up the amplifier for the first time is to go through the ALC setting for each band. It's not complicated but the English grammar in the handbook needs to be read carefully.

Remote control

Basic local control of the amplifier is possible using a USB-CI-V cable connected between a PC and the Remote-Auxiliary jack on the rear of the amplifier and following the instructions in the manual. A much better way that replicates the display is to download software for remote control RS-W2 for Microsoft but not Mac (£58.49). It provides full local or remote internet access when using a compatible Icom transceiver. It provides the front panel interface on your PC. It requires the amplifier's firmware to be updated to version 1.30+ and network settings configured for either a static or dynamic IP address if using a network. The manual is available online from ICOM-UK.

Performance

As already stated, the IC-PW2 at 1kW output is operating well within its margin of safety provided the VSWR is around 1.3:1 or less (1.5:1 in the manual). The broadband PA incudes low pass filters and of course the package has its own auto-tuner.

It only requires around 70W of drive for a full 1kW output so there's no stress on the exciter, making whole system work well. TX/RX switching time is fast. Full break-in when using CW is not a problem.

Luxury comes at a price or does it?

If you think about it, add together the cost of say a more conventional quality amplifier with two inputs, an auto tuner with a 1.5kW rating, suitable coaxial switching for up to six antennas with band assignment and visual display plus a separate receive antenna capability, power and supply metering plus a whole host of other features, you begin to see where this device is coming from.

You can dispense with those lossy patch cables and connectors, send half that stuff no longer needed to eBay, trade it in or like me just keep dusting your ever-growing collection.

I've worked with some hot and very high-power amplifiers commercially. As an amateur it's always in my mind that if you blow a valve it's going to be a costly disaster. Understanding that the IC-PW2 is operating at almost half its maximum rating and incorporating so many safety features and visual indicators is most reassuring.

As you would expect it comes into its own when integrated with Icom equipment but other radios appear to interface easily and well.

To me Icom's IC-PW2 is all about having a clearer bench and more operating time. Frankly the system is something of a delight to use when everything is in place.

I really like what the IC-PW2 does and I'm keeping it. Just need to uprate my antennas to cope with it and find more angle iron to support the bench!

IC-PW2 circa £5,095 at time of press. OPC-599 interface lead for IC-7300 £35. My thanks to Icom UK and ML&S. **PW**

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Steve Telenius-Lowe G4JVG
teleniuslowe@gmail.com

The New Icom IC-7300 Mk2

Steve Telenius-Lowe G4JVG asks "How does it compare with the original version?"

The Icom IC-7300 is one of the most popular HF / 6m 100W transceivers ever. It was officially launched in early 2016 and quickly became a best-seller, selling over 100,000 units by 2024. I used one for several years while living in Bonaire, making many tens of thousands of QSOs with it and only sold it, to one of the local amateurs, when I decided to return to England in 2024.

At the JARL Ham Fair in Tokyo last year Icom announced the introduction of a new Mk2 version, claiming *"dramatically enhanced performance, including superior RMDR, lower phase noise and the addition of features such as an HDMI port and a built-in CW decoder"*.

I ordered one and it was delivered to me on 11 December, well in time for Christmas and the day *before* it had been expected to arrive at UK retailers! I was therefore lucky enough to become the proud owner of one of the first IC-7300 Mk2s in the UK.

I described the IC-7300 an *"HF / 6m"* transceiver but the European version, as supplied by UK retailers, does of course also include the 70MHz / 4m band. (The one I owned in Bonaire was the North American version, so having access to the 4m band was in fact new to *me*, though it won't be to most UK users.) I won't describe the operation of this transceiver because the IC-7300 is already well known; instead this article concentrates on the differences between the original IC-7300 and the IC-7300 Mk2. To avoid any confusion I will refer to the original IC-7300 as the Mk1.

First impressions

The transceiver arrived double boxed and comes complete with an HM-219 hand microphone, a DC power cable with built-in EMC filter, several connector plugs, spare fuses and no fewer than five separate printed instruction manuals in English, French, German, Spanish and Italian. The English version runs to 81 A4 pages and is described as the 'basic' manual – the 'advanced' manual can be downloaded as a PDF from Icom's website.

The front panel of the Mk2 (**Fig. 1**) looks almost identical to that of the Mk1; it is the rear panel (**Fig. 2**) that looks rather different.

New connectors

Before we look at the transceiver's electrical performance, here's a rundown of the new features that the Mk2 offers. Many of these are associated with the rear panel of the transceiver, which now looks quite 'busy'.

Two of the new connectors on the rear panel are a pair of 50Ω SMA sockets, labelled RX-ANT IN and RX-ANT OUT, that are between the TX/RX switching circuit and the receiver's RF stage. This facility allows the operator to use a separate receive antenna or to insert an RF filter or preamplifier in the receive chain. T

his is a facility that many Mk1 users would have liked and in fact for a while the American manufacturer INRAD offered a simple modification to allow a receive antenna to be used with the original IC-7300. It is good to see that Icom took notice of operators' requirements and that this is now a standard feature in the Mk2.

Another new connector on the rear panel

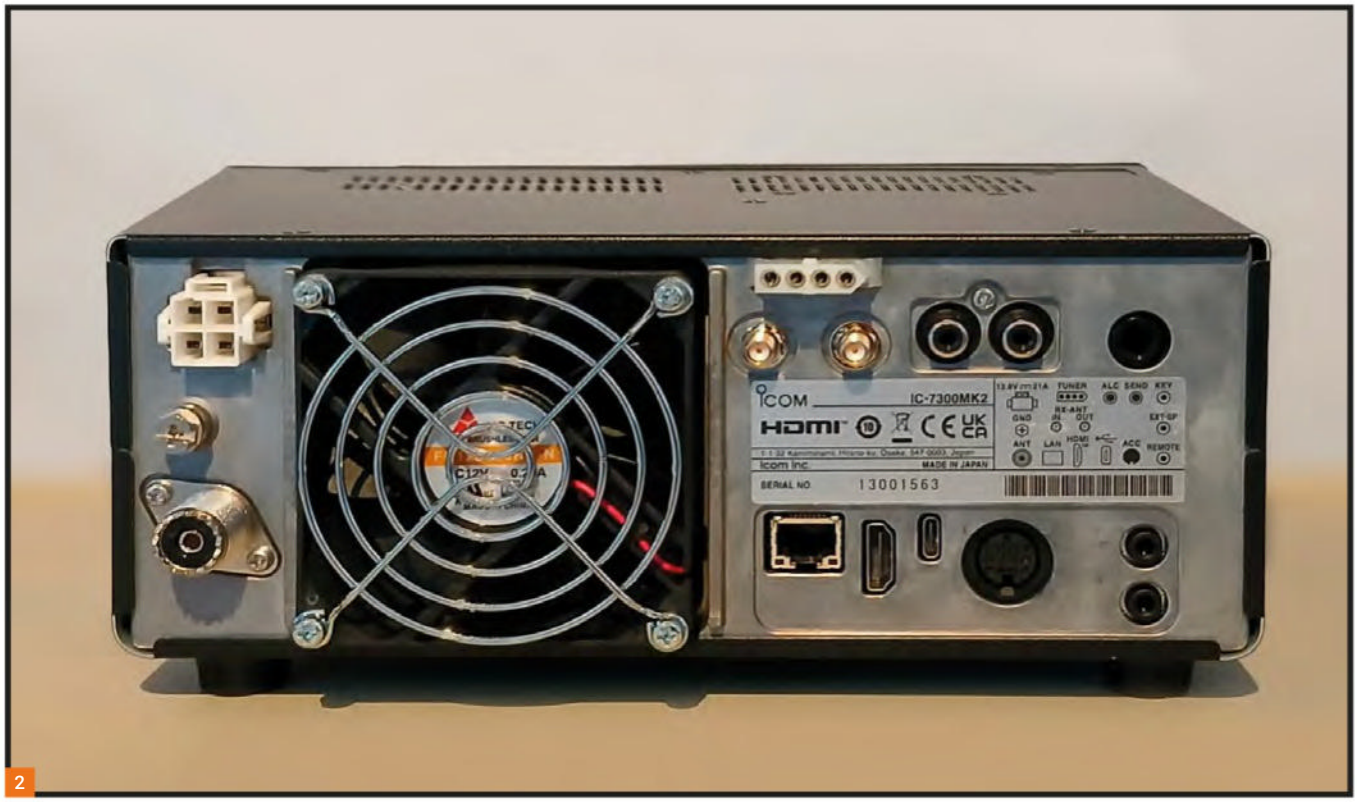

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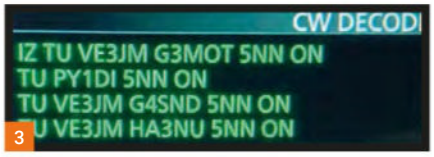
Fig. 1: The IC-7300 Mk2 front panel is almost identical to that of the original version.
Fig. 2: The rear panel is now quite 'busy', with four more connectors than the original IC-7300.
Fig. 3: One of the new features is a CW decoder, which works well.
Fig. 4: The new version of Icom's free RS-BA1 software allows the IC-7300 Mk2 to be operated remotely, without the necessity of a computer at the station end.
Fig. 5: The Mk2's improved RMDR: IC-7300MK2 in red, original IC-7300 in blue (courtesy IC-7300 Mk2 pre-release information sheet).
Fig. 6: The Mk2's improved transmit phase noise (courtesy IC-7300 Mk2 pre-release information sheet).

is an HDMI port to allow the front-panel screen to be viewed on an external monitor. Audio can also be output through the HDMI connection to monitor's speakers.

The final 'new' connector to be found on the rear panel is a Type-C USB port. This is in addition to the USB Type-B ('printer cable') connector that was also provided on the Mk1 version (Icom calls this the Ethernet [LAN] connector). Icom says that the new Type-C USB connector can provide dual virtual COM ports and audio input / output capabilities. Two applications, such as FT8 and logging or contest software, can be used simultaneously with just the one USB cable.

The other connectors on the rear panel are the same as those found on the IC-7300 Mk1.



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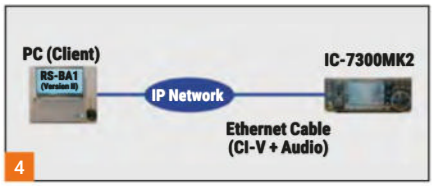

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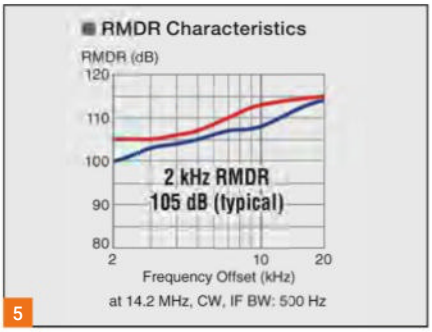
Other new features

One of the new features with the Mk2 is an audio peak filter which is designed to improve the ease of reception of CW signals. It provides up to 6dB emphasis (in 1dB steps) of the CW signal's audio frequency. This was a feature, known as the 'Contour' control, in the Yaesu FT-2000 which I used for several years before I bought the original IC-7300 and, while only an occasional CW operator, I did sometimes find it useful to 'home in' on specific signals. No doubt this new feature will be welcomed by Mk2 users who are keen CW operators.

While the Mk1 could decode standard 45 baud, 170Hz-shift, RTTY signals, it was down to the operator to read CW signals in his or her head. The Mk2 has added a built-in CW decoder for the first time. I looked in vain in the printed manual for how to use this: you do need to download the advanced manual



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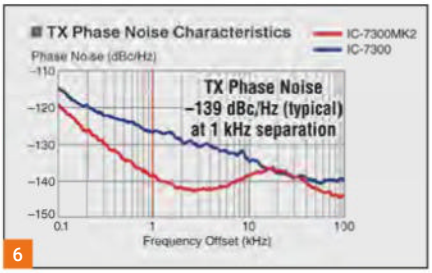

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for instructions on this and several other features. I found the decoder to work well provided the wanted signal did not suffer too much from interfering signals in the passband. See **Fig. 3**: here VE3JM is working G3MOT, PY1DI, G4SND and HA3NU in the ARRL 10m Contest, and sending 5NN ON, i.e. 599 Ontario. As more and more operators who have never needed to learn Morse code take to the bands this will undoubtedly

Continued on Page 15

Filters for Flights

Billy McFarland GM6DX builds a simple but effective coaxial filter.

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One issue that you can face when going on radio trips, especially where flights are involved, is weight limits. Running multiple stations will always require some sort of filtering. Carrying bandpass filters isn't always an option so for our recent trip I opted for some coaxial filters.

These are simple filters that only require:

1 x PL259 plug
1 x Length of 50Ω coax
1 x SO239 T-Piece
1 x two-port cable connector

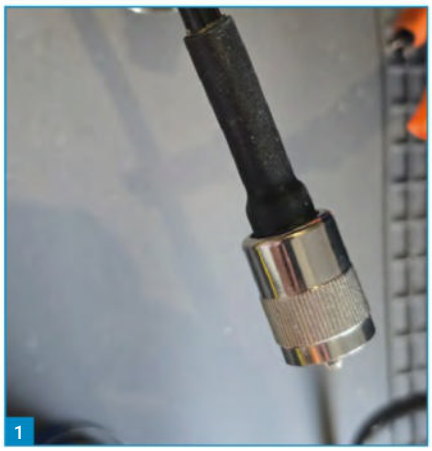
Making these isn't that difficult but will require the use of an antenna analyser. The first step that you need to do is to fit a PL259 plug onto your coax as seen in **Fig. 1**. Now, the coax type that you use will be 50Ω but can vary depending on weight and power limits. For our trip we are using Airborne 5 by Messi & Paoloni so I made the filters from that also. Once we have the plug fitted we need to do a simple calculation, 300 / frequency = wavelength, so 300/18.1MHz = 16.5m. Not finished there, take our wavelength and divide it by 4, gives us 4.1m. Cut the coax to your size, in my case it was 4.1m. Now we could cut the length of coax a bit more accurately by using the velocity factor, but this method keeps the calculation simple. Connect your new length of coax to your analyser and get ready to tune to a quarter wave.

There are a few ways in which you can do this using your analyser. The first method is selecting stub tuner if your analyser has one. Simply trim small pieces of coax (about 1 inch long) at a time, until the frequency of your coax is in the middle of the band that you need. What this looks like on the analyser with this feature is seen in **Fig. 2**.

The next method is selecting the R, X feature. Similar to other methods you trim the coax small pieces off at a time until the R and X value cross each other showing where the resonant frequency is. This method can be seen in **Fig. 3**.

The final way in which you can do this is by showing all the readings of the length of coax. Again, trim small pieces off at a time, but this time you are looking for X reading as close to 0 as possible. This can be seen in **Fig. 4**.

Once we have the filter trimmed to the correct length we need to create an electrical short at the end. This will create a bandpass filter. Strip the ends of the coax as seen in **Fig. 5** and then fit the two ends into the wire connection block as seen in **Fig. 6**. I added some hot glue around the connections to prevent anything from moving during usage etc.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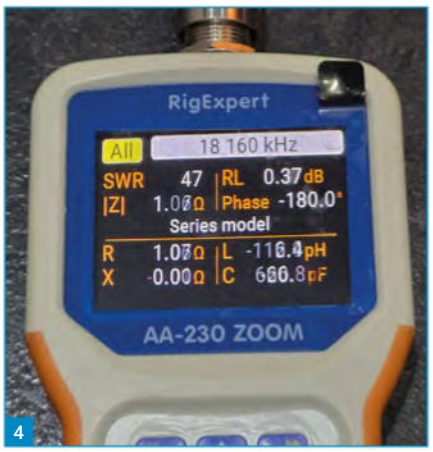

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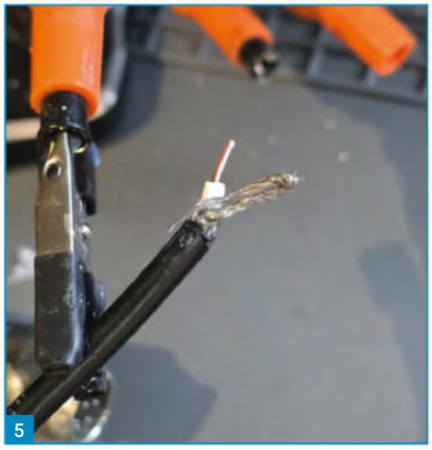
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As these coaxial stubs are shorted, then they work best at rejecting the 4th, 6th, 8th (and so on) harmonics. I made some for all the frequencies in use but the real advantage is for the non-WARC bands, 10/15/20/40/80/160m. If you make one for, say, topband, then it will null out the 80/40/20/15 and 10m bands. If you make one for the 20m band, then it will reject the 10m band. You can see the complete filter in **Fig. 7**.

Now how do we connect this coaxial filter into our antenna system to make use of it? Well, there are a few different methods. If you are using barefoot (no amplifier), then

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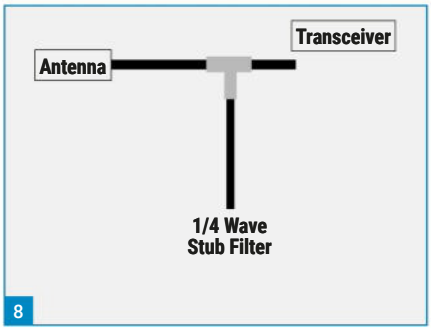

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Fig. 1: Coax plug fitted. Fig. 2: Resonant frequency of untrimmed coax showing on analyser. Fig. 3: Measured using stub tuner setting. Fig. 4: Measured using R, X feature.
Fig. 5: Strip the coax ends. Fig. 6: Fit the ends into a connection block. Fig. 7: The completed filter. Fig. 8: Diagram showing how the filter is connected.

you connect this filter to a T-piece with the transceiver and antenna at either end of the T section.

If you are using an amplifier, then as long as the coax is rated you can connect this after the amplifier in the same manner. If you are using bandpass filters (either, after the transceiver or amplifier), then you can connect it inline after the bandpass filter. To help explain it I have drawn a picture of the setup as seen in **Fig. 8**.

These coaxial filters work very well and are easy to make. Giving anywhere between 30-40 dB attenuation and even up to 60+ dB when multiple stub filters are connected together. Don't forget you can add to the attenuation levels by using different antennas that have different polarisation at each radio station, such as a vertical and a dipole antenna.

If running more than one station is something that you are thinking about, then give this a go.

As always, any questions please email me at **gm6dx@outlook.com**

Continued from Page 13

be a popular feature and, along with the rig's built-in CW memory keyer, may well encourage more operators to give CW operation a go for the first time.

An important new feature for many operators will be the simplified way of controlling the transceiver remotely over the internet, using version 2 of Icom's RS-BA1 software. See **Fig. 4**: a base station computer is no longer required and, importantly, the software allows you to turn the transceiver on and off via the internet.

Although I have not tried it yet, the simplified remote control capability is one of the features that persuaded me to buy the Mk2. The software can be downloaded free of charge from Icom's website and comes as a 26.5MB zipped file.

These days it seems to have been around for ever but, when the IC-7300 was first introduced in 2016, the popular FT8 mode had not yet been invented. After it came along, I made many thousands of FT8 QSOs using my Mk1 transceiver, but the Mk2 has now made it even easier by adding a one-touch FT8 preset that automatically configures all the necessary settings. Pressing 'Normal' from the Preset Menu returns the transceiver to conventional operation. There are also three additional user-programmable presets to allow for future digital modes.

Improved performance

Icom says the main enhanced features of the Mk2 are improved RMDR, improved phase noise, power saving and lower heat generation.

RMDR stands for reciprocal mixing dynamic range and is a measure of how much the receiver's sensitivity is degraded by nearby strong signals, for example how well weak DX signals can be heard in the presence of unwanted nearby transmissions. At 100dB, the IC-7300 Mk1 was already good in this respect but, according to Icom, the Mk2 is about 5dB better at 105dB, a very good figure. See **Fig. 5**.

Icom says that the IC-7300 Mk2's transmit phase noise has been improved by about 12dB compared with the Mk1, **Fig. 6**. This is important if you are operating in a multi-transmitter environment, e.g. a special event station or in a multi-operator contest and it should result in reduced broad-band 'white noise' inter-station interference.

It is arguably of less importance if you are only ever operating your station from home, although Icom also points out that *"the superior phase noise characteristics reduce noise components in both receive and transmit signals"*. Looking at Fig. 6, the greatest improvement in the phase noise is on the lower-frequency bands, though between approx 18 and 32MHz there is little or no difference between the two versions.

Finally, Icom states that the Mk2 has lower power consumption, approximately 0.7A (typical) compared with 0.9A for the Mk1, when in receive standby. There is less heat generated and the fan noise is much less noticeable, they say.

In Bonaire I often operated for long periods in SSB contests as well as using high duty-cycle modes such as FT8 and FT4. The Mk1 did indeed run pretty hot under such circumstances, though to be fair the ambient 'shack' temperature there was often well in excess of 32°C anyway!

Any reduction in the operating temperature is to be welcomed of course, though because I always wear headphones when operating I never used to find the fan noise to be objectionable.

Is it worth it?

The IC-7300 Mk2 costs £1360 from the usual UK retailers. The Mk1 version had been for sale at £1199 and new stock is still available but, with the arrival of the new model, its price has now been reduced to just £975. Is it worth paying £385 more for the Mk2? I think the answer to that will depend on your circumstances. There's no doubt that even the Mk1 is a fine transceiver, and at £975 it's a real bargain, coming in at £274 cheaper than the main opposition (even at its newly-reduced price!). However, bear in mind that the future resale value of the Mk2 will undoubtedly be higher than that of the Mk1.

The Mk1 design is now 10 years old and the improved electrical performance of the Mk2 and its new features are certainly worth having. If you are in the market for a new transceiver, as I was, then the Mk2 is certainly worthy of serious consideration. If you are an existing satisfied user of the Mk1, it might not be worth 'upgrading' to the Mk2 – unless of course you are a contest operator or activator of special event stations who would appreciate the improvement in electrical performance, or if you want to use a separate receive antenna, or if your Morse skills are not quite up either to rag-chewing on the key or reading contest exchanges at 40WPM, or... In fact, there are a number of good reasons why you might well want to upgrade.

I think Icom has yet another winner in the IC-7300 Mk2. **PW**

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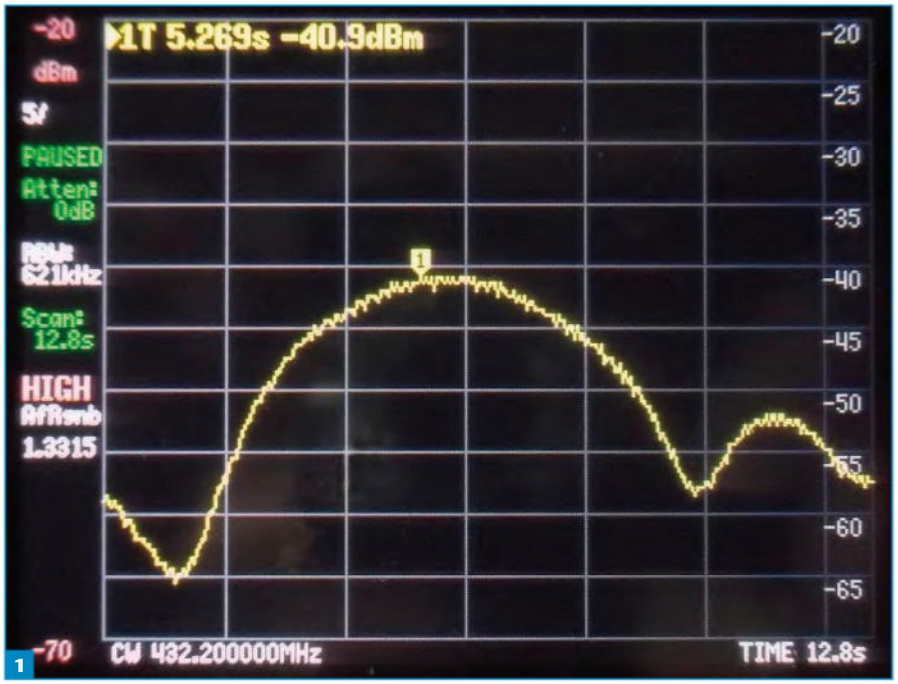


Zero-ing in with a TinySA

Ross Wilkinson G6GVI finds a low-cost way of measuring antenna radiation patterns.

Last year, I wrote a feature for *RadCom* [**1**] about measuring antenna radiation patterns at home, and how these tests can check your antenna's performance, validate improvements or even discover faults. I had built up my own custom system using a telescope mount as a rotator, which I used in my garden and at a meeting of the Bolton Wireless Club to measure a number of 23cm antennas, including G4AQB's 'Plumber's Delight' slot-fed dual Yagi which featured in a recent issue of *Practical Wireless* [**2**].

Since then there have been developments in making this process even easier, now using commonly available equipment. Having read that my system used a log-detector receiver with USB output, **Nick G0HIK** enquired if the popular TinySA handheld spectrum analysers could be used for this purpose. At that time I'd never used one, but soon borrowed a unit for the initial tests and since then I've acquired one of my own.

I found that the TinySA's 'Frequency' menu does include 'Zero Span', which gives a continuous amplitude readout on a single frequency. By default this sweeps in a few milliseconds, but using the 'Display, Sweep Settings, Sweep Time' sub-menu allows this to be set manually. Now if this sweep time is set to be equal to the rotation time, it will display the antenna pattern (in rectangular co-ordinates) across the screen, as illustrated in **Fig. 1**. This sweep has a horizontal resolution of 290 points across the display, which is more than sufficient for this scan of 180° from my little 70cm antenna. However, it needs care to capture the result: touching the screen to start the analyser sweep at the beginning of the antenna's rotation and then hitting 'Pause sweep' after it completes. In that figure, the analyser was set to automatic 'RBW' receiver bandwidth (600kHz), but narrowing this down to 10kHz would improve the signal-to-noise ratio and rejection of interference, resulting in a smoother trace.

Interfacing with the G4HFQ PolarPlot program

This free program [3] generates excellent graphical plots from antenna measurements, made by feeding the output of my SSB receiver into the PC soundcard. However, it also supports a serial (RS232 in those days!) interface for digital watt-meter projects by OZ2CPU and M0DFT, which led me to wondering if this same input could be adapted for the modern TinySA devices. I wrote to Bob G4HFQ, who kindly sent me the details of how his program handles the serial input data.

Meanwhile, exploring the USB serial-port interface to the TinySA, I discovered that sending the 'data 2' command prompts it to output all the point values from its previous sweep as text (in dBm). This is in marked contrast to my own log-detector receiver outputting a stream of 16-bit values encoded in pairs of alternate bytes, which then needs further 'mathematical massage' to get back into recognisable dBm values.

I quickly developed a Python script to read in the data-stream from the TinySA and translate it into the four-digit format originally used by the M0DFT meter. Then, using the com0com utility [**4**] to create a pair of linked 'Virtual COM Ports' on my computer, this output data-stream from my program is fed into PolarPlot's serial input port, as shown in **Fig. 2**. This all worked fine with the analyser I'd borrowed from Steve, so next I sent a compiled version to Nick to try with his TinySA Ultra model. He found a slight difference in behaviour compared with the Basic model I was using, which prompted an update to my algorithm.

When I first contacted Bob, he explained that he'd retired from programming, but I was delighted to hear from him again the following week that this project had re-awakened his interest and he would be firing up his Visual Basic development system once more. He would look into the possibility of updating his program to support the TinySA input directly, without the need for my program and com0com.

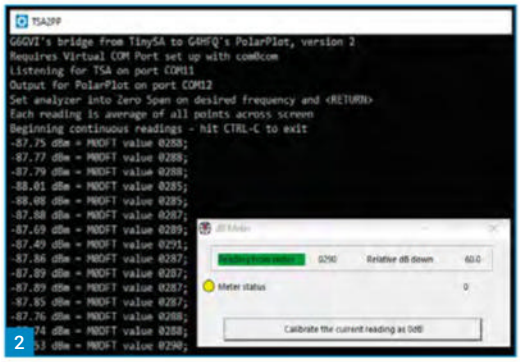
Then a couple of weeks later, I thought of a much more straightforward way of importing the data derived from the TinySA: rather than feeding it into the serial port in real-time, it could be written into a special text-file (.PLP format) for subsequent reading into PolarPlot. I found more details of how to create and format these files in the section 'Creating/editing a .plp file' in the PLPHelp.chm file installed along with the PolarPlot program. Incidentally, this also explains how to import a simple list of values (there must be at least 60 of them) using the program's built-in Editor.

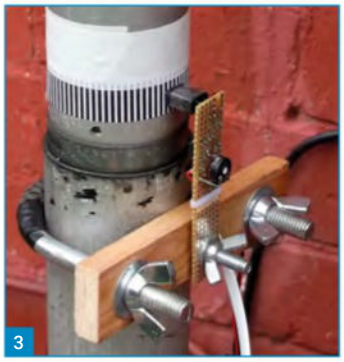
I have now written a new Python program 'TSAtoPolar' to set up the TinySA, then read its sweep data and format it into a .PLP file including all the annotation for reading into PolarPlot directly. A compiled version is posted on my project web-page [**5**].

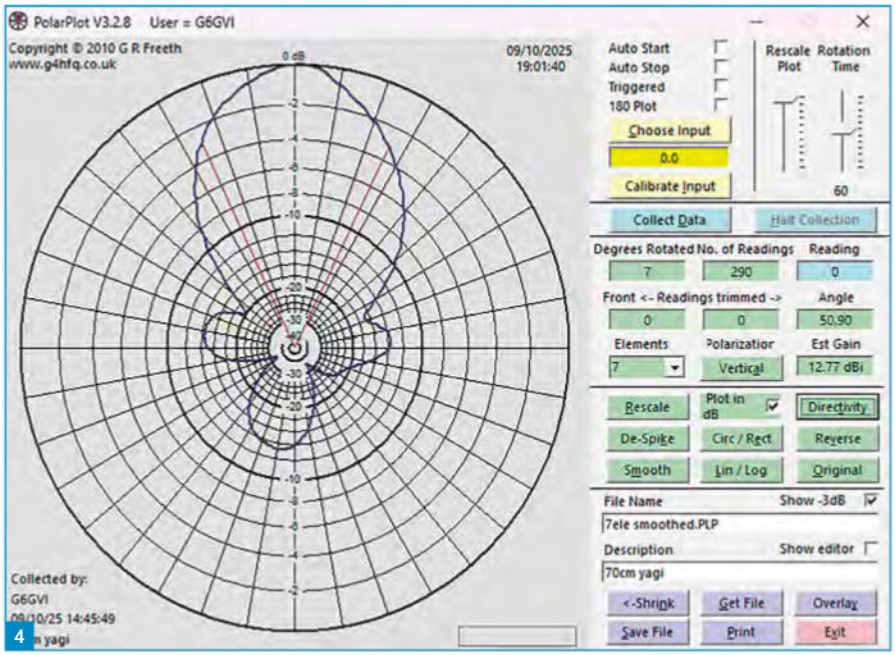
One good turn

Aside from the TinySA and a PC running PolarPlot, another requirement for antenna pattern measurement is some method of turning the Antenna Under Test. In my garden test-range, I've used a geared DC motor which turns through a complete revolution in about 25 seconds. But whatever rotator is used, it must have a consistent rotation time, so that

Fig. 1: Sweep shown on TinySA screen.
Fig. 2: Data fed to PolarPlot's serial input.
Fig. 3: Homebrew shaft encoder.
Fig. 4: The resulting plot of antenna pattern.







the analyser's sweep can be set to capture the whole scan.

Now I've just used manual (two-handed) synchronisation to start up my rotator and trigger the analyser sweep simultaneously, but at Nick's request I'm looking at adding a couple of serial-port commands to start and stop his rotator under control from my program.

In another experiment, I had my 4m Moxon Rectangle antenna on the top of a telescopic mast, to receive a distant beacon. For this, I rigged up a crude shaft-encoder using a reflex Infra-Red sensor and a strip of printed 'zebra stripes', as shown in **Fig. 3**. This provided a series of pulses as I rotated the mast by hand, to operate the PolarPlot program in 'Triggered' mode (although this only works with real-time inputs from the soundcard or a serial power meter).

Sourcing a signal

The final ingredient of the testing range is of course a stable signal source on the desired frequency. For local testing down the garden, my RFExplorer [**6**] with its internal battery is ideal, but other low-cost generators such as the ADF4351 units [**7**] (which can be powered from a USB power-bank) are available. Alternatively, a NanoVNA, in 'CW FREQ' mode, or even a handie transceiver which can be set to milliwatt output power level could be employed. It's best if possible to fit a unidirectional antenna on the source, minimising stray reflections from nearby objects.

For testing a larger antenna *in situ* up on the mast, a more distant source is needed: so find an on-air signal from a local station or beacon (but choose one over a path which isn't subject to short-term propagation variations). Also be sure that the source antenna is using the same polarisation as your Antenna Under Test, otherwise cross-polarisation will produce misleading results, with nulls and side-lobes.

Results and conclusions

As I discovered back in 2014, using a sensitive radio receiver for short-range testing in the garden is challenging: I needed to either use a very weak signal-source (such as the ninth harmonic of a 16MHz oscillator) or a set of attenuators to keep my receiver operating within its linear range and achieve the best dynamic range of measurements. In contrast, the TinySA is a lot easier to set up, as it operates over a much wider signal range than the receiver and soundcard combination.

The first time I tried out my TSAtoPolar program on the garden range, it seemed that my small 70cm beam antenna had a much 'sharper' response than expected, but I soon realised that this was due to a scaling error. The analyser was reporting measured power levels, but PolarPlot expects these as voltages, so I needed to introduce a square root into my code. After that, the plot was exactly as expected: see **Fig. 4**. The asymmetries in this pattern from my vertically-polarised beam are probably due to interactions with its feeder (hanging down behind the Antenna Under Test) and perhaps also to using a simple omni antenna on my signal source, which would 'illuminate' more of the surroundings and provide stray reflections.

We've seen that a fancy anechoic chamber isn't required to do practical antenna measurements: for UHF and above, even a small garden can serve as an 'open field site'. It's not advantageous to use a hilltop location, where the receiver could be exposed to lots of strong interfering signals: a site in a 'quiet' area would be better. So, if you have a TinySA and would like have a go at measuring your own antennas, the program and associated files are available from my web-page [**5**] – happy plotting!

References

1. RadCom, November 2025, pp 64-66
2. Practical Wireless, October 2025, pp 8-9
3. G4HFQ's PolarPlot program: **https://tinyurl.com/mv8raye2**
4. "com0com" Null-modem emulator **https://sourceforge.net/projects/com0com**
5. G6GVI's project webpage: **www.qsl.net/g6gvi/polarplots.html**
6. RF Explorer Signal Generator: **https://tinyurl.com/3umzy8j7**
7. Touch-screen signal generator: **https://tinyurl.com/2bpfbund**

Acknowledgements

My sincere thanks to Bob G4HFQ for searching out the details of his program's serial interface. Thanks also to Nick G0HIK for the original suggestion and beta-testing with his own TinySA Ultra and particularly to **Steve G4AQB** and **Martin M0MJK** for providing the analysers which I used for development and testing. **PW**

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WWA and RIP IRC

Steve G4JVG brings his usual compilation of HF news.

Welcome to the March *HF Highlights*. On 11 December, the ARRL announced that American amateurs are gaining access to the WRC-15 5MHz-band frequencies of 5351.5 – 5366.5kHz with a permitted power of just 9.15W ERP. There are no antenna restrictions but antenna gain must be used to calculate the ERP. The allocation is on a secondary basis and amateurs must avoid interference to non-amateur stations using this spectrum. The maximum permitted bandwidth is 2.8kHz and the new allocation is available to General and higher class licensees.

US amateurs may continue to use their existing channels centred on 5332, 5348, 5373 and 5405kHz, also on a secondary basis but with a permitted power of 100W ERP on these four frequencies.

tinyurl.com/mvk62ey6

QSL from yesteryear

The 'QSL from yesteryear' this month is that of D68C, **Fig. 1**. A quarter of a century ago I was one of the 26 'Five Star DXers Association' (FSDXA) members who put D68C on the air, **Fig. 2**, from the Comoros Islands in the Indian Ocean. The operation took place in February 2001 and we made a total of 168,722 QSOs, which set a new world record for the number of contacts made on a single DXpedition. Some operators were on the island for a full three weeks, although not all of us could take such a long time off work and so spent either the first or the second two weeks as part of the team. I was on the initial two-week shift, which allowed me to work D68C myself after I had returned home and, between 23 and 25 February, I made six QSOs with the station on 28, 24, 21, 14 and 7MHz SSB – as well as on 28MHz FM. I recall that the operator on the 7MHz QSO was none other than *PW's The World of VHF* columnist **Tim**, then **G4VXE**. Other team members included *PW* Editor **Don G3XTT**; the current RSGB President **Bob GU4YOX**; **Mike G3SED**, the now-retired owner of Nevada Radio, and **Mark M0DXR**, chairman of the organising committee of this year's World Radiosport Team Championship.

Early 2001 was at the peak of solar cycle 23 and propagation in general was excellent and on 28MHz in particular it was simply superb. We took advantage of that by operating no fewer than three stations simultaneously on 28MHz, on CW, SSB and FM.

I was one of the founder members of FSDXA which, under the leadership of **Neville G3NUG** (SK), went on to activate 3B9C (Rodrigues Island, 2004), 3B7C (St Brandon, 2007) and T32C (Christmas Island, East Kiribati, 2011) before being wound up shortly after.

RIP IRC

The venerable International Reply Coupon (IRC), **Fig. 3**, is being discontinued. For decades IRCs have been used by radio amateurs and SWLs when applying for a direct (i.e. non-bureau) QSL card to provide the recipient with return postage. Theoretically at least, an IRC can be exchanged at any post office for a stamp of the cost of an airmail letter to another country. In recent years, though, some post offices have refused to accept them, even though they are supposed to be valid in all Universal Postal Union (UPU) member countries.

However, the *425 DX News* bulletin on 20 December reported that, at its congress in Dubai last September, UPU members voted to discontinue the IRC altogether at the end of 2026. Current IRCs with an expiry date of 31 December 2025 will now be valid for an additional year. Here in the UK, Royal Mail stopped *selling* IRCs at the end of 2011, due to the lack of demand.

tinyurl.com/43ppw67y

What to look for in February-March

Look for stations using the special ZL100 prefix to be active until 31 March while celebrating the 100th anniversary of the founding of New Zealand's national amateur radio society, NZART. Members of the society may also use ZM in place of their usual ZL prefix throughout the year.

According to *DX-World*, an international team of 14 operators plan activity from XX9, Macao, between 19 and 31 March.

dx-world.net/xx9-macao

Indonesian operator **Herman YB3GIH** is active as 3X/YB3GIH from Guinea and expects to be in the country until June. He has been active on 14 and 21MHz SSB.

As reported last month, the 3Y0K Bouvet Island DXpedition is scheduled to be active for two to three weeks over the February-March period (exact dates depending on weather conditions etc). 3Y0K plans activity mainly on SSB and CW, with some FT8 and RTTY. See:

https://3y0k.com

The month on the air

...But first, something that *wasn't* on the air. The AU7RS Lakshadweep Islands DXpedition scheduled for 10 to 22 January was postponed at the last minute. A note posted on their website on the 9th states that due to imported antennas being held up in customs the expedition would now take place at a later date.

vu2rs.com/vu7r

DM9EE was operating 'holiday style' as SV5/DM9EE from the island of Rhodes between 27 December and 5 January using CW, SSB and FT8 on all HF bands.

Brian GW4DVB operated FT8 and SSB as V4/G4DVB from the station of **John V47JA** on St Kitts from 29 December until 8 January.

The third World Wide Award, 'WWA 2026' kicked off on 1 January with numerous SES (special event stations) throughout the world, many with the 'WWA' suffix, active for the whole


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Fig. 1: All four sides of the gatefold D68C QSL dating from 2001. Fig. 2: Putting up the Titanex 160m vertical on the beach on the Comoros. Fig. 3: An old-style IRC. All IRCs will cease to be valid after the end of this year. Fig. 4: GB2WWA's QRZ.com page on 11 January. Fig. 5: Tim GW4VXE's FT-277ZD / FT-101ZD which he put on the air for a day in January.

month on all bands and modes. By the deadline date of this column, 11 January, over 100,000 chasers in 242 DXCC entities had collectively made 1.9 *million* QSOs (**Fig. 4**), with more than half of the SES activity period still to run. There can't be many radio amateurs who were active in January who did not make at least one contact with a WWA station!

Readers' news

Tim Kirby GW4VXE operating as **GW4MM** found conditions quite variable. There have been some good days and Tim says it was a real pleasure to work KH7XS in Hawaii on 10m CW around 1700UTC on 1 January. Despite a very strong signal, Tim didn't hear any other signals from the Pacific area. Since the New Year, Tim has been enjoying working the WWA stations for a bit of fun. 8E1A from Indonesia was a nice one around 1500UTC on 9 January. Despite a fairly low 80m dipole (9m at the high point), Tim has been pleased to work **VK6LW** on 80m a couple of times in the last few weeks. It's all down to conditions – *"sometimes **Kev** can hear me, sometimes he can't"*. **Allan VK2GR** has also been heard on 80m but, so far, Tim hasn't managed a QSO. A week or so ago, noting an 'Old School QSO Party' taking place, Tim decided to use his old FT-101ZD (actually a Sommerkamp-badged FT-277ZD, **Fig. 5**) for the day. He says it was great fun – using it with a 1980s vintage AEA Morse Machine. Best DX on 10m was XQ4CW/1 on 100W from the FT-101ZD but lots of stations worked on 80m up to 10m. Tim enjoyed it, but the next day was happy to switch back to the more modern FTdx10!

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Reg Williams G0OOF reckoned *"It has been a good month for working lots of FT8 stations, with some nice DX ones in the mix. This has been mainly due to the awful weather being experienced over the month and mainly staying indoors. 28MHz has been particularly good, being open towards the end of the month, from before sunrise to closing sometime after sunset...*

"I have recently applied for an Antarctic award sponsored by WAP – WADA, Worldwide Antarctic Program and Worked Antarctic Directory Award. The basic award is to work ten different bases belonging to three different nations. Although 'basic' it is still quite a challenge. The best time to work the stations, providing there are radio hams in their communities, is the Antarctic summer. I choose FT8 mode as I have found most Antarctic amateurs use that more than other modes... The next challenge is acquiring the QSL cards to prove the QSO, which can take a long time. Patience pays off though. Luckily cards can be photocopied and sent with the application, or they can be verified by two amateurs: the second option for me.

"On the theme of Antarctica, LZ0A is operating from a Bulgarian Antarctic base on the South Shetland Islands. He is mainly operating FT8 and CW, and mostly FT8 but I have not resolved his signal yet. He seems to spend a lot of his operating time on 14MHz in between his work schedule. Fortunately, he is there for the whole of January so there should be a good chance of working him if propagation favours."

Simon Davis-Crane G7WKX reported on the trip he made with his wife **Nic 2E0NYQ** to the Catalan area of Spain over Christmas and New Year (see *HF Highlights* December 2025). *"Nic and I managed to activate seven SOTAs, 15 POTAs* (**Fig. 6**) *and worked 27 countries during our activations, all using SSB with the Elecraft KX-2 and simple SotaBeams linked dipole. Best DX was ZL1TM, who we managed to contact twice on different days, each time on 20m SSB, using just 8W. We also managed to work the USA. ZL1TM was the first SSB contact I've ever made with New Zealand since being first licensed back in 1996, so that was quite a special contact for us both. Our thanks again to EURAO for helping with the EA3 licence for Nic."*

www.eurao.org

Owen Williams G0PHY said *"My activity this month was during the ARRL 10m DX Contest and the RAC Winter Contest. I had a problem with the feed to my 10m dipole so had to use the 20m dipole for the ARRL contest. Conditions were not as good as last year but I did manage to work some stations on the east coast of the USA. The Canadian contest coincided with the Croatian DX contest so hearing any Canadian*

stations was a bit of a challenge. Otherwise, it's been a bit too cold to go into the shack or play with the Spiderpole."

Etienne Vrebos OS8D (**Fig. 7**) is one of the most active Portable operators anywhere and has been busy activating castles, parks, bunkers and World Wide Flora and Fauna sites in Belgium. He reports: *"I'm really happy and again went for the first place in WCA with 130 castles activated in 2025, which brings my score to about 530 castles in three years – and that's a lot. As if this wasn't enough, I made 50 activations of parks and 50 activations of ONFF, but reached the score of 206 bunkers activated – it seems that's a full time job!"* From home he also worked 4300 parks *"in less than a year, mostly US stations with low power, some even with their rig at 20W. Hunted bunkers: nearly 1000, especially UK ones this year, and hunted WWFF I believe about 2500 in two years... I have to admit it became for me a new lifestyle, a goal, not for being the first one in every department."*

But portable operating is Etienne's forte and he is an evangelist for this, prompting people *"to get outside and have activities in the nature... Activations can be done by foot, by bicycle, motorcycle, car or public transportation... I prove you can do it without heavy equipment... That's my message: let them go outside and enjoy: it's free."*

A new 47-minute long *YouTube* video about Belgian Bunkers on the Air includes content of Etienne's portable operations. It has been made by **Luc ON5SEL** and is mainly in Flemish Dutch although Etienne says an English version will be available shortly. See:

youtube.com/watch?v=LEYP_IrLroY

Carl Gorse M8HPI (**Fig. 8**) worked a new DXCC entity in the shape of TG9AMM in Guatemala on 28MHz SSB. He wrote: *"I also finished the year with the 2000 Parks on the Air Hunter award and over 300 activated parks. Sadly the bands and weather turned for the worse up here* [Hartlepool – ***Ed***] *with ice and snow. On a good note, my partner **Lindsay** has started her Essex Ham course for her Foundation licence and is looking forward to many park activities with me around the UK."* Good luck to Lindsay and we look forward to seeing reports from her in *HF Highlights* too!

28MHz beacons

The 28MHz beacon report for the period 1 – 28 December comes from our regular beaconologist, **Neil Clarke G0CAS**: Once again Sporadic E took place on some days. For example, IZ0EGC 28175 during the morning of the 10th and 11th, and OE3XAC 28188 on the 13th and 19th. In fact, the 19th was by far the best day, with beacons in Scandinavia such as SK7GH 28298 and OZ7IGY 28270 being heard, while in Germany, DB0TEN 28245, DK0TEN 28257, DB0UM 28279 and DB0MFI 28285 were also logged. Numerous Italian beacons were logged plus ZB2TEN 28170, which was also heard on the 24th and 25th. The opening on the 19th could possibly be due to the winter Sporadic E season, which occurs every year around Christmas and New Year. From across the North Atlantic, 4U1UN 28200 was logged on 26 days, W call areas 1 to 5 were heard around 25 days each, and call areas 8, 9, and 0 were heard around 20. No beacons from the W6 or 7 call areas were heard. Back to 28200, where LU4AA and OA4B were logged on eight days each and, still on 28200, VK6RBP was logged on 13 days while ZL6B was heard on just three days.

Fig. 6: EA3/G7WKX and EA3/2E0NYQ operating from a POTA site in Catalonia.
Fig. 7: Etienne OS8D operating portable from the relative warmth of his car on 28 December.
Fig. 8: Carl M8HPI on another portable operation.

Band highlights

Key: Q = <20W, M = 20 – 100W, H = >100W, S = Single-element antenna, B = Beam (see January *HF Highlights* for a more detailed explanation).

Martin VK4CG (MS): 7MHz SSB: EA5JZ, G4BVB, K9RM. **14MHz SSB:** G6MC, GW2HFR, JH1GEX, MI5AFK, VK9DX. **21MHz SSB:** 9M8WWA, G0IDX, LR1WWA, OH7WP. **28MHz SSB:** BY5HB, OH6RM.

Tim GW4MM (HS): 3.5MHz CW: VE3KG, VK6LW. **7MHz CW:** UN7AB, VK5GG. **10MHz CW:** VK2GR, ZL2AGY. **14MHz CW:** 8E1A, BA4TB, PJ4PA. **18MHz CW:** 4V1L, S01WS, BA4TB, TI5/VA3RA, V26K, ZD7BG. **21MHz CW:** 8P5A, V26K, XR1D, ZD7BG. **24MHz CW:** FY5KE, RW0AR, ZD7BG. **28MHz CW:** 8P5A, CX5FK, FY5KE, KH7XS, S01WS, TZ4AM, V26K, XQ4CW/1, ZD7BG.

Reg G0OOF (MS): 7MHz FT8: 9K2WA, TO9W (=FS), YB5WIR, YS1MS, ZF2OO. **10MHz FT8:** CX1RL, HC2GRC, JA5QJD, KP2B, VK2SKI, VP8ON, ZF2OO, ZL4AS. **14MHz FT8:** A92GE, FK8HM, J73ESL, JR2SHA, KP4COD. **18MHz FT8:** FK8HM, J38W, KG6DX (=KH2). **21MHz FT8:** 9Y4DG, CX6TU, HI3T, V26K, VP2MAA. **24MHz FT8:** 3B8HK, FM8BK, FR4OM, HH2AA, JA7KQVI, KP2B. **28MHz FT8:** 7Q6UJ, 9J2FI, 9Y4DG, BD4MHH, C5YK, DU3AW, HI8T, PJ7UK, V31DL, ZS6KBS.

Owen G0PHY (HS): 14MHz SSB: H25A, VE7RAC, VO2RAC. **28MHz SSB:** CN8PA, CQ9A, TA3T, W8ZN, WX3B.

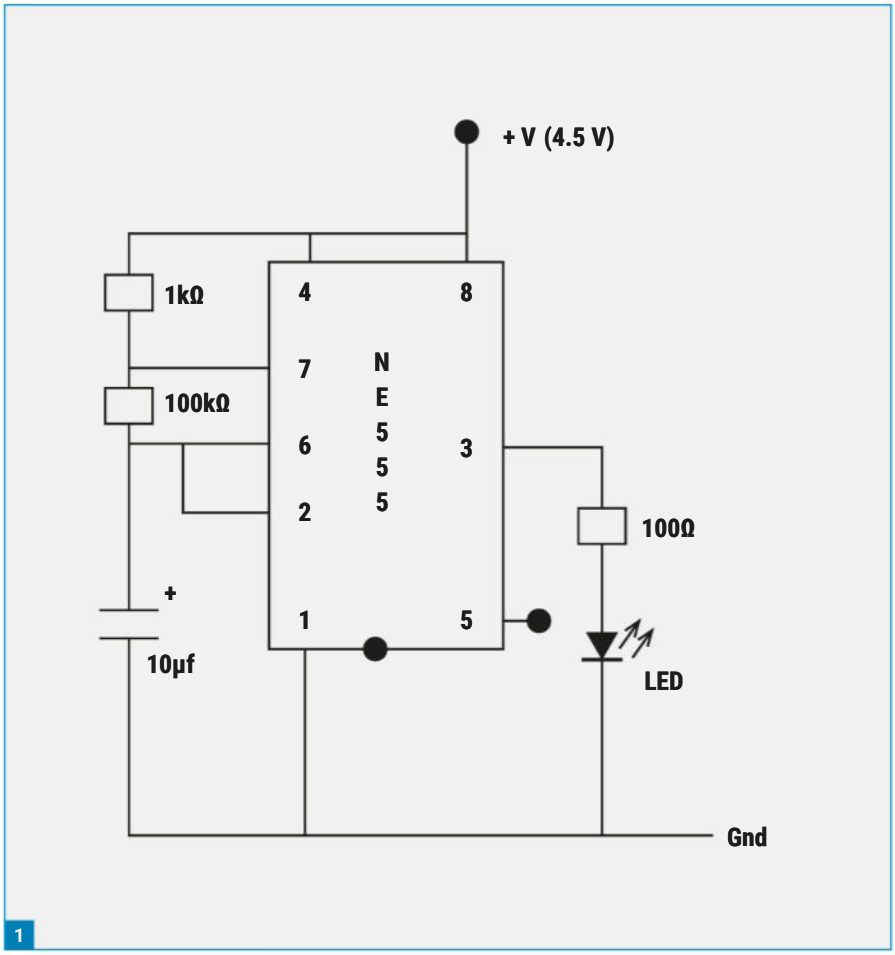
Etienne OS8D (HB): 14MHz SSB: VK9DX. **18MHz SSB:** J6/8P5KH, JP1NYG/1. **21MHz SSB:** KP4YAT, V31HQ, WP3S/DOC. **24MHz SSB:** AT4WWA. **28MHz SSB:** AP2HA, C5WL, CD6LHE, FY4JI, J6/8P5KH, J69Z, LR1WWA, LU3DW, PY2JY, PZ5OZ, TI2CMM, TI8/N7ZG/P, TO2FY (=FY), VP9/MM0EFI, VP9NT.

Carl M8HPI (MS) 28MHz SSB: AD9WM, N5WGA, KE0QEQ, PY4LR, TG9AMM, WP4TRV, YV1GIY, ZS1SMP.

Signing off

Thanks to all contributors. Please send all input for this column to teleniuslowe@gmail.com by the 11th of each month. For the May issue the deadline is 11 March. 73, Steve G4JVG. **PW**

Tony Jones G7ETW
charles.jones125@yahoo.co.uk



1

Circuit Boards

Tony Jones G7ETW reviews various options for home construction.

Fig. 1 shows an NE555 astable (aka, oscillator) circuit which slowly flashes an LED. I've decided to take a simple circuit, implement it in different ways, and see how it comes out. I won't explain the circuit because I did an NE555 article once before. This piece is all about construction style.

This representation of the chip uses four sides, but a real world NE555 is a dual-inline eight-legged device, and practical layouts call for some engineering creativity.

Dead-bug

Those of an artistic disposition, please skip this paragraph. **Fig. 2** shows this circuit at its most basic**.** This was surprisingly enjoyable to do. Unexpectedly, it fired up first time. Even so, I would never make anything I wanted to actually use this way.

Stripboard

Veroboard, to use its brand name, is a British invention, developed by the Vero Company and patented in 1959 for prototyping and small production runs.

Fig. 3 shows the circuit constructed onto a smallish a piece of 0.1 inch board.

Note the vertical tinned-copper wire links – five of them, in a circuit of six components. Two are needed to connect pins 2 and 6. I did not do this badly to make a point; Vero's gridlike nature dictates this kind of thing.

Perhaps that's not entirely fair, for I've employed an orthodoxy of design. 'Above' the chip I have a positive DC rail, and below it there's a corresponding ground. This isn't a law of physics, so I tried another approach, shown in **Fig. 4**. The NE555's leg 1, left of the orientation notch, is ground and leg 8, opposite, is the DC positive connection. This looks neater, but now I need flying leads.

Perfboard

This is a lot newer. It came out of the Maker movement and I first used this to make shields for Arduinos. The top surface, like stripboard, has a matrix of holes on a 0.1 inch spacing. But the underside, is different. Each hole is standalone, surrounded by a tiny copper circle. Compared to Vero, there is much less copper to solder to.

Figs 5 and **6** show my layout. Components are bottom-soldered and lead-outs are used to make the connections. It's horrible, but again I didn't deliberately do a bad job. This is how lots of people do this.

With greater skill, underside 'tracks' can be made by running solder across the holes, and I do have a couple of short runs on this board. But this is not easy. Sometimes the copper circles lift off, making a run impossible without a repair, or the solder refuses to flow.

Double-sided Perfboard

There exists Perfboard with copper on both sides. Confusion abounds over what 'double-sided' means judging by the products I see on Amazon.

For any board-type to be double-sided, the top must surely be insulated from the bottom, making two separate circuits possible. Through-board holes which aren't vias would allow this. But sometimes – and most Amazon listings are far from clear – holes are 'thru-plated', making them vias. That takes this insulation away.

Even on boards with no thru-plating, solder always 'wicks through' when a hole is soldered. This can be seen in my pictures.

'Double-sided' Perfboard, whether the seller correctly understands and describes the thru-plating or not, is more trouble than it's worth I reckon. But I recognise that I'm a Perfboard novice, so perhaps I've got the wrong end of the stick. Please email and set me right if I have.

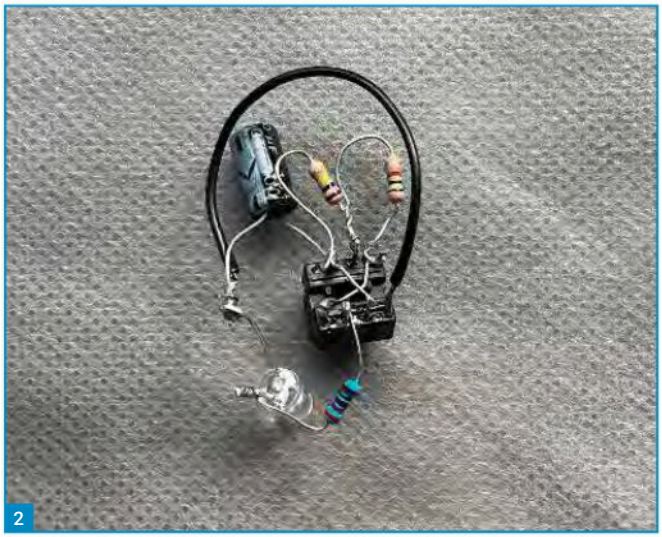
Solderable Breadboard

This was completely new to me. It is a cross between Perfboard, Breadboard and Vero. The underside is like Vero, with rows of connected holes in fives separated by a breadboard-like 'trench'.

These contacts are easier to solder to than both Perfboard (because they are robust) and Vero (because the contact area is smaller, making for tiny, beautiful joints).

The layout, shown in **Figs 7** and **8,** is the smallest I made, but it didn't feel cramped. Use of flying leads saved some space of course.

Fig. 1: Basic OpAmp oscillator circuit.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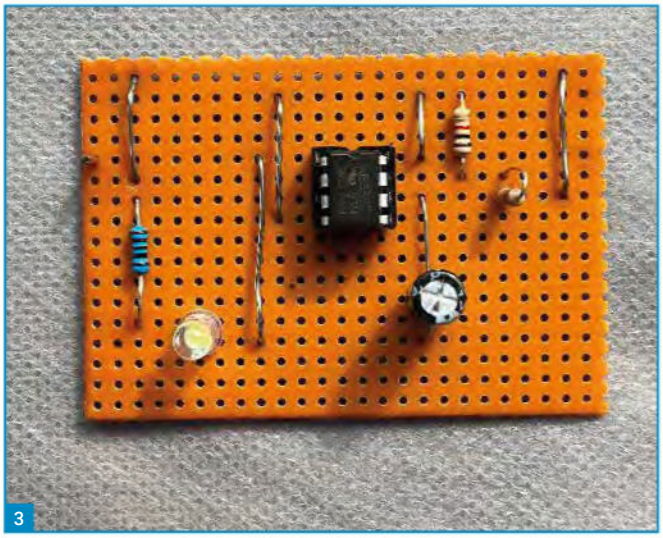
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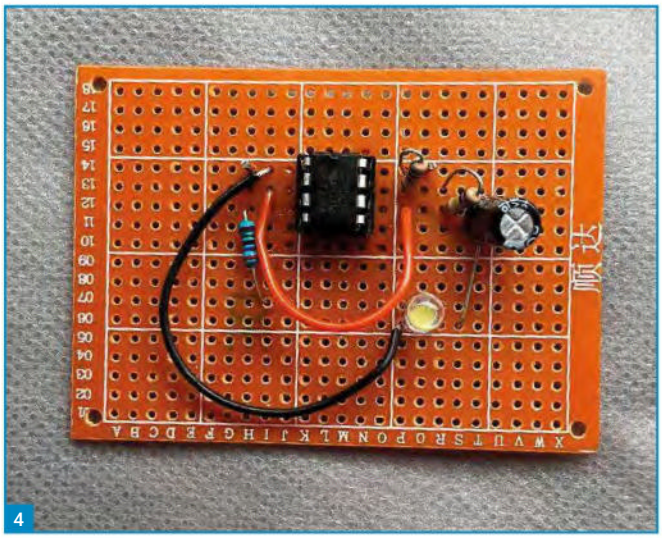
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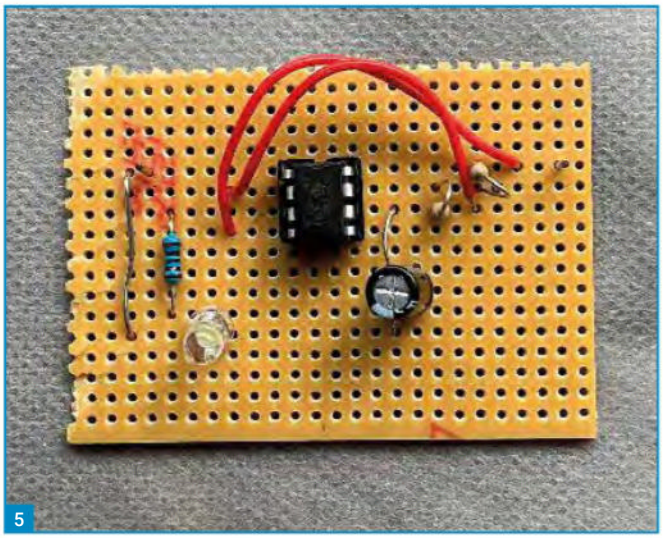
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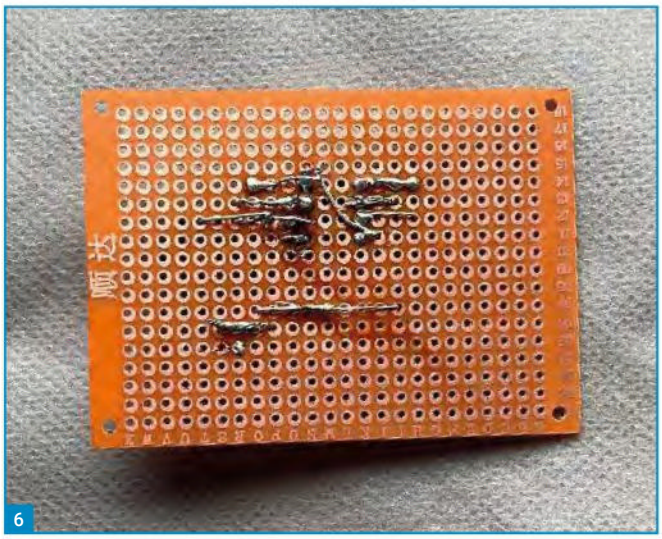
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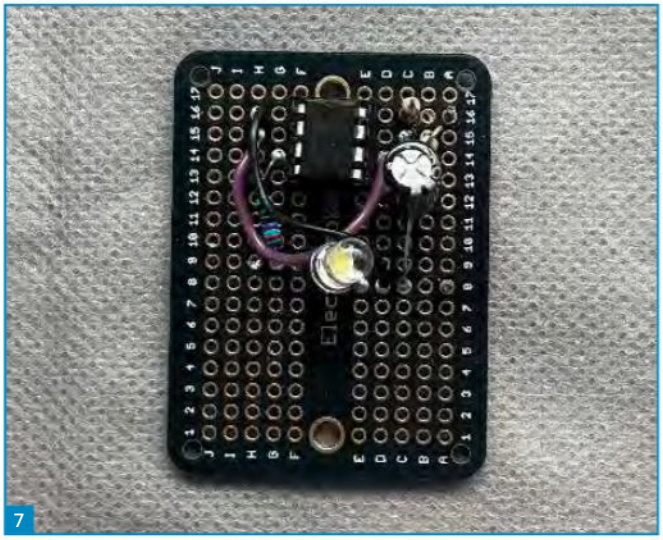
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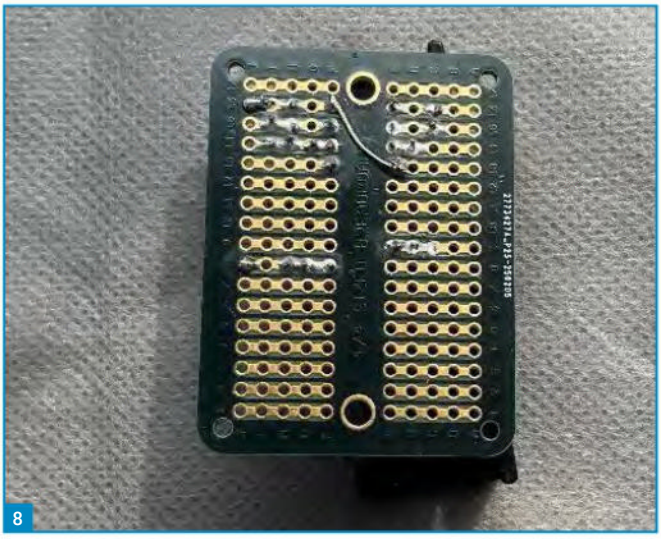
Matrix board

This is just holes, with no copper. My layout is shown in **Figs 9** and **10**. The underside looks a mess for sure. Fitting the IC socket was difficult. Soldering to its connections end-on, as one usually would, is troublesome because there is no board copper from which solder can 'reach out'. Splaying the pins out flat against the board proved to be the answer.

Eccentric use of Vero

All of these layouts suffer from the same weakness, which is the need for cross-IC links. On a double-sided board, this would be child's play.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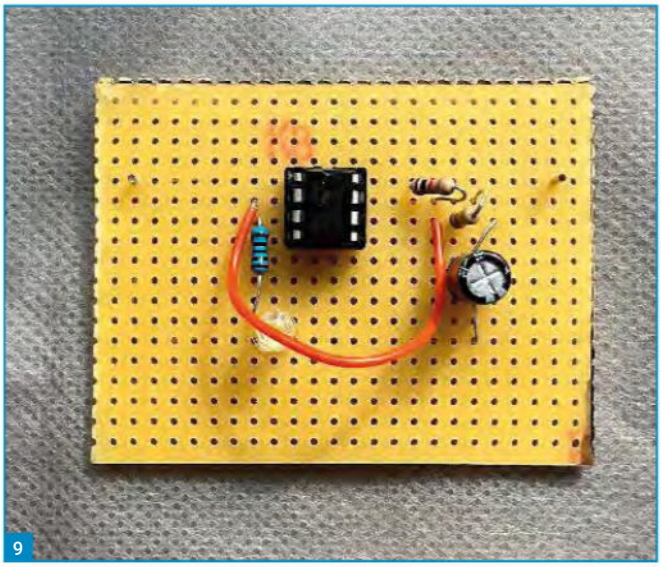
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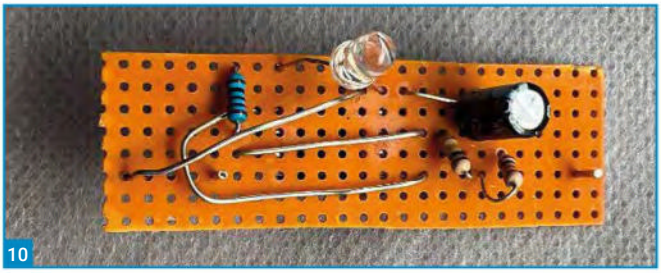
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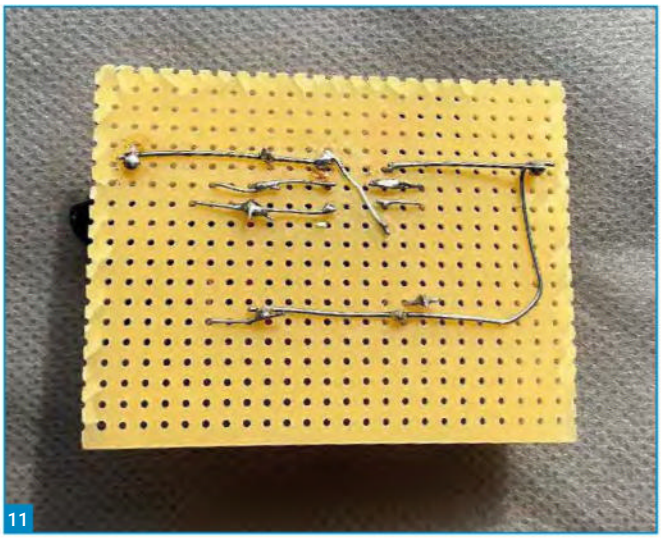
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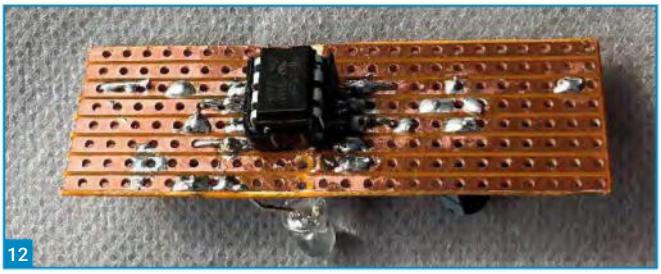
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Fig. 2: Built with dead bug construction. **Fig. 3:** Built on Veroboard.
Fig. 4: An alternative Veroboard approach with flying leads. **Fig. 5:** Perfboard, above.
Fig. 6: Perfboard, below. **Fig. 7:** Solderable breadboard, above. **Fig. 8:** Solderable breadboard, below.
Fig. 9: Matrix board, above. **Fig. 10:** Matrix board, below. **Fig. 11:** Double-sided Vero approach.
Fig. 12: As Fig. 11 but opposite side of board. **Fig. 13:** The TDA7377 – doesn't fit standard 0.1 pin spacing.

Figs 11 and **12** show an attempt at a double-sided Vero layout. The NE555 is soldered on the copper side, leaving the 'top' free for the necessary three links.

I could do a nicer job of this now I've proved the concept, I'm sure, but I can't in all honesty recommend this method. It's harder to understand than any one-sided layout and does not lend itself to being easily secured in a box.

Limitations

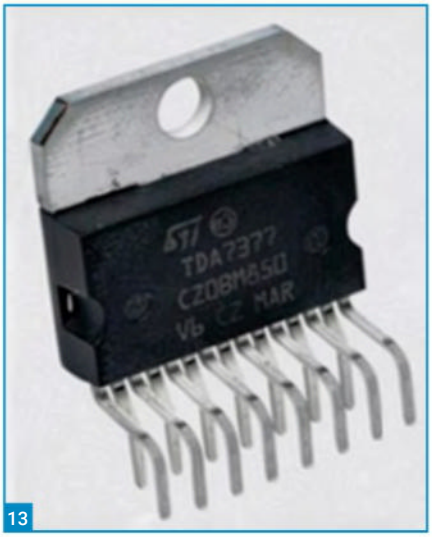
0.1 inch matrix board generally is obviously unsuitable for components that don't match that pitch, e.g. STMicroelectronics's TDA7377, an audio amp I've often used. As **Fig. 13** shows, this has 15 legs split over two rows offset by 0.05 inch.

Vero we all know. We're used to it, but it needs care in use. It's all too easy to mis-locate or omit a track-break. Shorts between tracks are not always easy to see, and for currents more than an amp or two it's not recommended.

Solderable Breadboard really surprised me. I liked it, and I will use it again, but only for small, low component-count circuits. I must say, it does look very smart.

And the winner is...

Much to my surprise, Perfboard, despite my difficulties and reservations. For sheer flexibility, it's unbeatable. I've seen YouTube videos of remarkable Perfboard builds every bit as good as purpose-built PCBs. I just need to use it, to persevere and gain skills with it. Experiment and develop; that's what being a radio amateur is all about. **PW**



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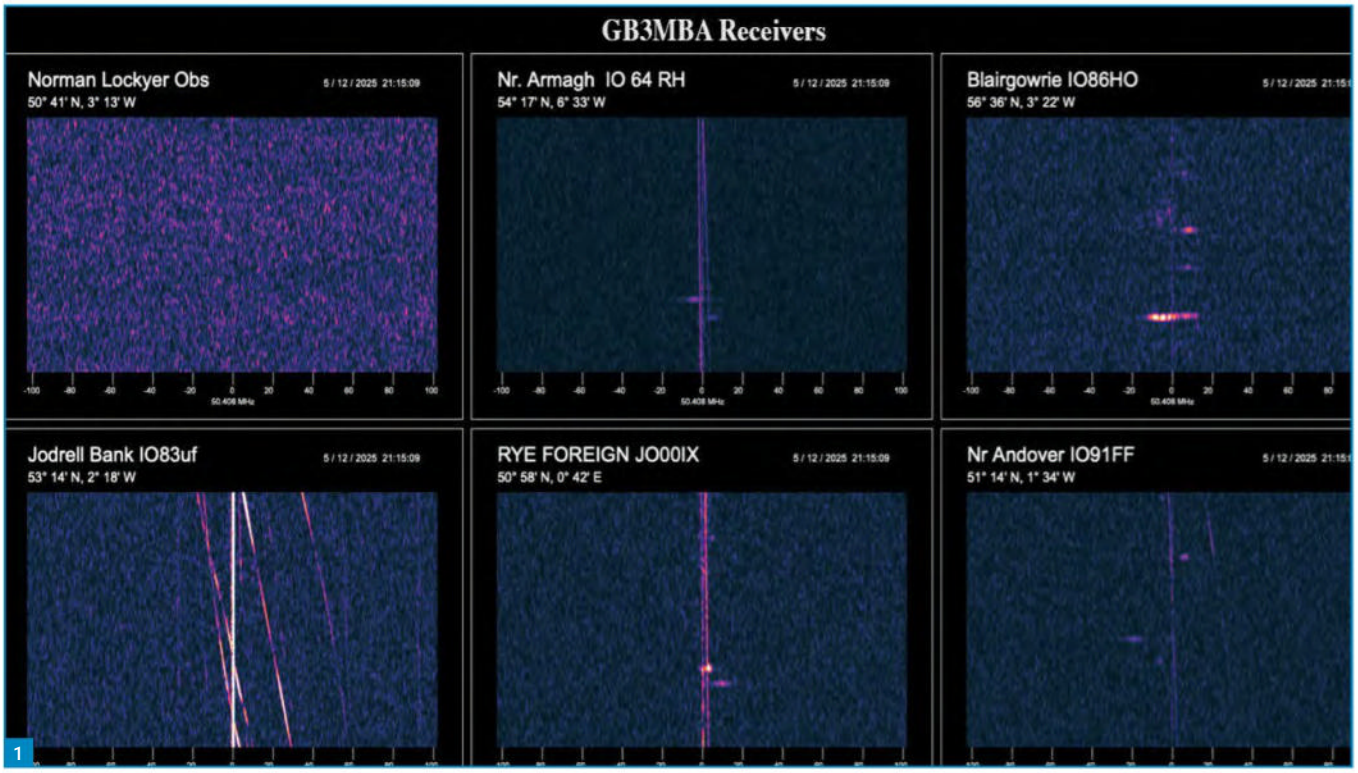

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An introduction to Meteor Scatter

Tim GW4VXE offers an introduction to working stations on VHF via meteor scatter.

Tim Kirby GW4VXE
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The chances are, that if you are interested in VHF propagation, you may well have seen or heard meteor scatter propagation without you knowing it!

If you're an SSB operator, then perhaps during a contest you have been listening and heard a sudden, strong burst of a signal which fades quickly. Or, if you're an FT8 operator, perhaps you've seen a decode at good strength of a station from perhaps 1000 miles away – and generally you'll only see one or maybe if you're lucky, two decodes from the station. That's meteor scatter!

Meteor scatter is an interesting mode of propagation. You can hear it sometimes on the HF bands, particularly 10m. You might be listening to a weak signal, perhaps from another UK station, or a station in continental Europe and you'll suddenly hear them peak up. I once had a 10m meteor scatter contact when operating from VE3EJ's QTH, with K3ZO near Washington. But generally, it's VHF operators that are interested in meteor scatter operation. It affects 50, 70, 144MHz – although meteor scatter contacts have been recorded on 432MHz too, but it takes a lot more patience to succeed on 432MHz.

One of the great things about meteor scatter propagation is that it will work from any location where you can see some sky! Obviously, locations with good take off will work better than those without, but even so, severely compromised locations can work for meteor scatter. When I used to live in Cheltenham, at the foot of the Cotswolds, which is not a great VHF location, I found meteor scatter a useful mode for working to the east.

What is meteor scatter propagation?

Well, it's a form of radio propagation that uses the ionized trails left by tiny meteors (meteoroids) as they enter and burn up in the Earth's upper atmosphere to reflect or scatter radio waves.

This temporary ionization trail acts like a short-lived, high-altitude reflector, enabling communications between two radio stations that would otherwise be out of range of each other.

Millions of tiny meteoroids, often no larger than a grain of sand, enter the atmosphere every day, mostly at altitudes between 80 and 120km (in the E layer of the ionosphere). As a meteoroid burns up, it creates a super-heated column of ionized particles (plasma). This trail is dense enough to reflect radio signals. The ionized trails are very temporary, typically lasting from a few hundredths of a second to a few seconds, though occasionally longer for larger meteors.

Bearing all this in mind, there are a couple of useful points about meteor scatter propagation. The first is that as stated above, the meteoroids enter the atmosphere every day – so at some level, meteor scatter propagation is always available. Sure, it is much better when there's a major meteor shower, such as the Quadrantids or Perseids around, but a reasonably equipped station (say 100W to a Yagi) should be able to make a meteor scatter contact with another similarly equipped station on 50MHz, pretty much any day of the year. On 144MHz too, although perhaps slightly more power would increase the chances of success.

Some times of the day are better than others, morning hours from say 0600 to 0900UTC with a peak around the time of local dawn tend to be best. You can consider the side of the earth where morning is to be like the windscreen

Fig. 1: Reflections received from the GB3MBA meteor beacon.
Fig. 2: A Perseid meteor as seen from above, taken from the International Space Station Courtesy: NASA

on a car. As the earth moves forward, it meets the meteoroids, which burn up causing ionised trails, which you can bounce your signals off. It's a bit like the windscreen of your car, catching all the insects – whereas you see many fewer insects on your side or rear windows. Same principle! As the day goes on, and you're no longer in the 'morning' zone, you'll meet less meteoroids head on and it's less effective for meteor scatter propagation.

That's not to say you shouldn't try meteor scatter contacts outside the morning peak – of course you should! It might just take a bit longer.

Something that I didn't realise until recently is that not all meteor showers are equal. **Dr Bill Ward GM0ICF** opened my eyes to this idea. The meteor showers with the greatest velocity will cause more intense ionisation, which will hopefully translate to louder and longer bursts of signal!

The meteor showers with the greatest velocity are the Leonids (mid-November), Epsilon Geminids (mid-October), Orionids (Late October) and Eta Aquarids (Early May). Historically, radio amateurs considered the Perseids (August), Geminids (December) and Quadrantids (early January) the best showers, but that may not actually be the case, other than the fact that a lot of people tend to know about these showers and come on the air for them. Look out for those lesser known 'fast' showers too.

We'll go onto how you could use meteor scatter yourself to make contacts in a moment. But there's plenty you can do without transmitting! In fact, there's plenty you can do even if you don't have a receiver yourself!

Enter the UK Meteor Radar Project:
https://ukmeteorbeacon.org/Home

There are a couple of presentations from the RSGB Convention that you can look at to give you more information about the project – have a look at this video of a presentation from **Brian Coleman G4NNS** (URL below) to give you some background and describe the project in more detail. But the long and short is that there is a beacon on 50.408MHz located in Nottinghamshire which 'beams' upwards, illuminating a cone of the sky above the UK.
https://tinyurl.com/2z648bzv

I mentioned not needing to have a receiver yourself! Have a look at:
https://ukmeteorbeacon.org/beaconclient

Here you will see data from six receiving stations situated around the UK. Meteor bursts or pings will show up as bright flashes on the screen. The vertical lines you see, especially on the Jodrell Bank receiver, are most likely the tropo signal from the beacon. Slanting lines are most likely reflections from aircraft and the bright flashes are meteor reflections. It's fascinating! Watch at pretty much any time of the day and you should see something going on! The receivers are all time synchronised – so it's interesting to look and see if a particular burst is received at the same time on more than one receiver – or whether it appears on one before another – giving you an idea of the direction that the meteor is travelling. Although out of the scope of this article, it's pretty interesting from an aircraft scatter point of view as well!

Well, having seen this on the web, perhaps you'd like to have a go at receiving these signals yourself. Dead easy! If you have a rig that receives 50MHz, great, or you could use an SDR receiver – even a cheap RTL-SDR dongle. Set the frequency to 50.408MHz. For an aerial, you could make a simple wire dipole for 6m. In fact, you're better off doing that than using a 6m beam, which will have a fairly narrow vertical beamwidth and will only 'see' a small area of sky compared to your dipole. If you need some ideas about how to put together a suitable dipole, once again, the UK Meteor Radar Project website has some ideas:
https://ukmeteorbeacon.org/Observing#2

There are other non-amateur signals that you can receive by meteor scatter – for example, the GRAVES radar in France, on 143.050MHz. That can be received with a simple white stick vertical and an RTL-SDR dongle and will give interesting results.

This is enough to generate plenty of interest and you can waste hours looking at the reflections (and it's fun to listen to them as well!), but perhaps you would like to have a go at making some meteor scatter contacts yourself.

Making two-way meteor scatter contacts

On both 6m and 2m around 100W should give you some good results. What about an aerial? On 6m, you can get some results with a simple dipole but you'll do better with a Yagi. A small 2 or 3 element Yagi would be fine. And on 2m, a short Yagi - say a 5-element will give surprisingly good results over medium distances. If you're wanting to push the boundaries out to around 2000km, then a longer Yagi will give much better results. Actually, in the peak of one of the major showers, on 6m, reflections are so continuous, it sounds like an Es opening – so a simple antenna such as a vertical will work. Don't expect that all the time, though!

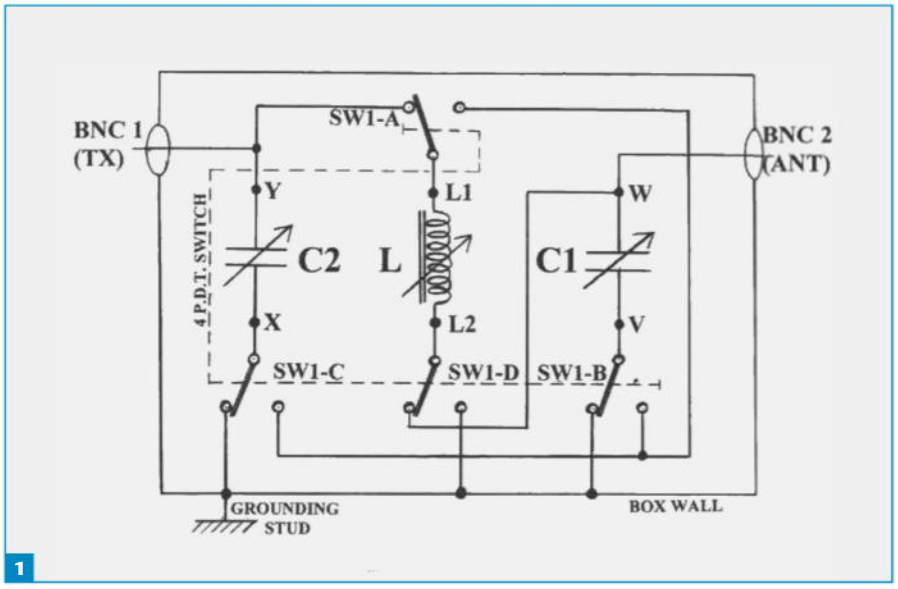
If you have your transceiver connected up to your computer for, say, FT8 operation and you're using WSJT-X, MSHV or JTDX, then you already have the software that you need. Rather than FT8, you'll need to select the MSK144 mode. There are other, older modes used for meteor scatter, such as FSK441, but concentrate on MSK144 as you get started.

Then you'll need to find someone to have a go at working! Outside major showers, a lot of skeds are arranged using the ON4KST VHF chat (URL below) – although in showers, there's plenty of 'random' activity where people call CQ (WSJT-X, MSHV and JTDX are programmed up with the correct frequencies; 50.260 and 144.360MHz).
https://on4kst.info

The basic mode of operation is that each

Continued on Page 27

Ken Ruiz ZB2MD
practicalwireless@warnersgroup.co.uk



1

An easy 4 and 6m ATU

Ken Ruiz ZB2MD describes a low power ATU suitable for tuning a variety of antennas on to the 4 and 6m bands.

I am at the early stages of putting together a /P QRP station. My mind has been occupied with ATUs, and I built a couple to evaluate. One of them was very fiddly to operate and I could foresee some practical shortcomings when not in the comfort of the home shack. This 'failure' was instrumental to the development of the 4 and 6m ATU described here. The configuration is well known.

The abandoned ATU was a two-in-one affair, comprising a single variable coil and two variable capacitors which could be arranged in a T or a Pi configuration on the turn of a 4p2w switch [**1**, **2**]. The single air-spaced coil became a variable inductor by sliding a ferrite rod in and out of its otherwise air core. See **Fig. 1**.

Development of the idea

It occurred to me that although I had come across several HF designs, there was precious little available for the four and six metre bands. It is easier to have custom antennas for these bands compared to the longer frequencies where multibanding is more common, but an antenna prepared at home might not be so well matched when /P in a different environment. Better to have an ATU and not need it, than need it and not have it.

As to my abandoned two-in-one HF ATU project, I thought I would try converting this to a 4 and 6m ATU, and attempt to tune my multiband dipole (4 – 30m) [**3**] with it.

The case was opened, and the ferrite rod was removed altogether leaving an air-spaced coil. With the ATU in T configuration, turns of the coil were removed progressively simply by short-circuiting them using a short length of wire with a crocodile clip at each end.

At each shorter coil setting, attempts were made to tune the relevant antenna configuration (as described in [3]) first on 4m, and then on 6m. Notes were made regarding the most favourable coil length and ease of tuning. The process was repeated with the original HF ATU in Pi configuration.

It was seen that the antenna was more easily tuned when in T configuration than Pi. A match was best achieved on 6m using 8 turns of the coil, and on 4m using 4 turns of the coil.

All the wiring was removed from the original ATU, leaving only the front panel components – both variable capacitors and the switch. A 4p2w switch is an overkill when asked to perform a spst function, but it was already in place and replacing it with a simpler device (needing a smaller diameter mounting hole) would have introduced unnecessary work.

Simple point-to-point wiring completed the circuit as per the diagram in **Fig. 2**. The coil is made from 30A mains wiring stripped of insulation.

As the turns are air-spaced it need not be made of insulated wire. Additionally, securing taps is far easier. I settled on a coil of 15mm internal diameter, 8 turns, and a 3cm length. The smaller the coil, stray inductances become more significant. I would suggest therefore, anyone wishing to duplicate this design would be better off not trying to duplicate this coil exactly, instead making a reasonably approximate copy using several more turns that is thought necessary and then experiment as described to find the optimal number of turns for each band.

The capacitors were purchased from Kanga Products (URL below) and are 2 x 270pF dual-gang, supplied with datasheets. The gangs were paralleled to give approx. 500pF per variable capacitor.

www.kanga-products.co.uk

Fig. 3 shows the ATU constructed on the lid of the admittedly oversized box – but as I said this was already available with all parts bar the coil mounted on it.

The power handling capabilities of these variable capacitors are limited, and typically ATUs built using these components are said to be rated at around 10W. Higher rating can be achieved with physically larger air-spaced capacitors and larger coils using heavier gauge wire.

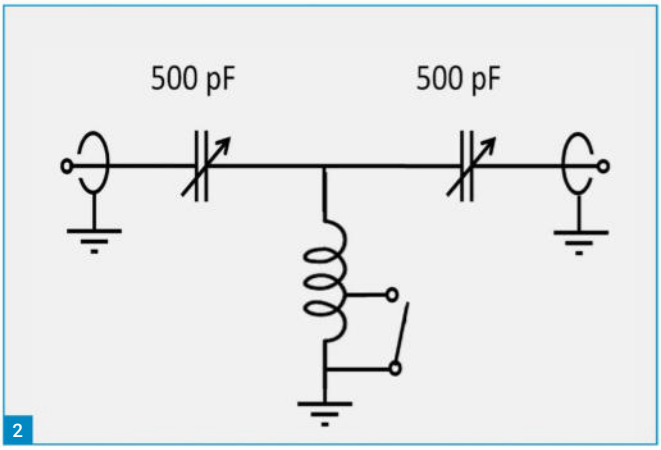
Performance

Naturally, ideas must be tested. Each of the four antennas available at this QTH were tried on 4 and 6m on a mid-band frequency. Each was connected directly to the transmitter (Yaesu FT-710 set at 5W) to record the direct SWR, and then tuned with this ATU with the lowest SWR achieved recorded. Results are available in **Table 1**. Of course, your antennas are probably different from mine and they are most certainly at a different location!

It is not surprising that antennas cut for particular bands were easily tuned on those bands. Tuning offset dipoles for 12 and 17m on 4 and 6m respectively (utilising the third harmonic resonances) was also easy. What was more surprising was, albeit with sharper nulls, was the ability to tune unlikely combinations to a reasonable extent. I trust this might be of use to you.

References

[1] Haas, T., G4LDY. 'No Cost' ATU. *Sprat* No 28, p5.
[2] Earnshaw, J., G4YSS. Pi – T mini HF ATU. *Sprat* No 113, p18 – 20..
[3] Ruiz, K., ZB2MD. Further tweaks to a multiband dipole. *PW* 2024, vol 101 No.9 (September) p56-7. **PW**



Ant	6m direct swr	6m tune	4m direct swr	4m tune
4m 3rd harm offset dipole	>3	1.1	3	1
6m 3rd harm offset dipole	>3	1	1.7	1
4m flowerpot	>3	1.5	2	1
6m flowerpot	1.4	1	3	1.6
40m efhw	>3	2	inf	1.6

Table 1: Tuning results using the 4 and 6m ATU

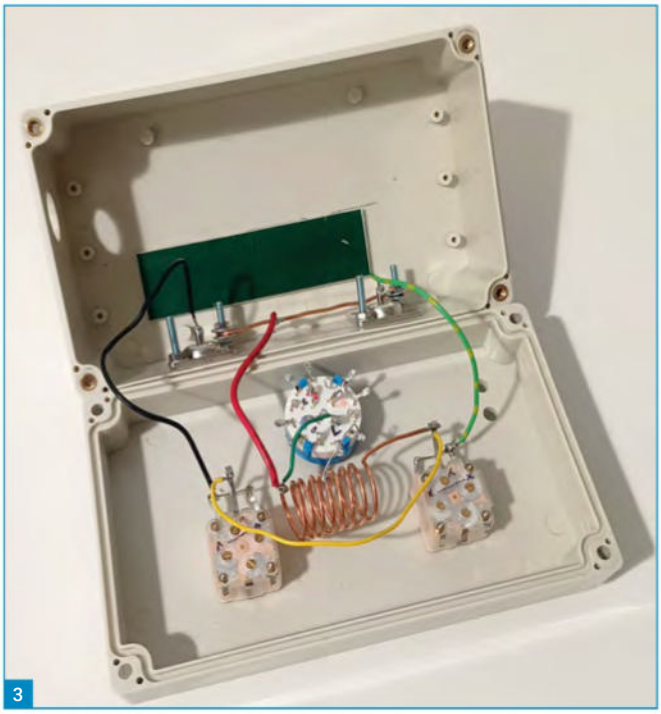


Fig. 1: The two-in-one T and Pi ATU (this circuit diagram taken from Sprat No 113, p18). Fig. 2: 6 and 4m ATU. See text for coil details. Fig. 3: The ATU constructed in the box lid, where there is room for the input and output sockets if desired. Note various unused holes in the case were for the original project.

Shower Name	Major Activity Dates (Approx.)	Peak Date (Approx.)	Comments	Parent Body
Quadrantids	Dec 28 – Jan 12	Jan 3 – 4	Can have high ZHR (120/hr) but the peak is very short (just a few hours).	Asteroid 2003 EH1
Lyrids	Apr 14 – 30	Apr 22 – 23	Medium strength, known for producing occasional bright fireballs.	Comet C/1861 G1 Thatcher
Eta Aquariids	Apr 19 – May 28	May 5 – 6	Known for producing meteors with high velocity and fine trains.	Comet 1P/Halley
Perseids	Jul 17 – Aug 24	Aug 12 – 13	One of the best and most reliable of the year. High rates and often bright, fast meteors.	Comet 109P/Swift-Tuttle
Orionids	Oct 2 – Nov 7	Oct 21 – 22	Fast-moving meteors associated with Comet Halley (the second shower from this comet).	Comet 1P/Halley
Leonids	Nov 6 – 30	Nov 17 – 18	Known for being the fastest meteors (71 km/s), which creates dense ionization trails—excellent for scatter.	Comet 55P/Tempel–Tuttle
Geminids	Dec 4 – 20	Dec 13 – 14	Often the strongest shower of the year (ZHR up to 150/hr). Excellent for radio communication.	Asteroid 3200 Phaethon

Table 1: Main annual meteor showers.

Continued from Page 25

station transmits for a specified period (just like on FT8) and then listens for the next period. On 6m, the default period length is 15 seconds, but check on 2m – the default is usually 30 seconds but some people have been known to use 15 seconds – which obviously confuses things!

The software makes things pretty straightforward. It's handy to have some basic ideas in your mind. For a meteor scatter QSO to be considered complete, both stations should have received both callsigns, a signal report and an acknowledgement that the report has been received. When reflections are poor that can take a while – other times, the QSO can go through really quickly. If I'm trying to work say, CT1HIX – it could go something like this.

I start off transmitting CT1HIX GW4VXE IO71

As soon as I receive a fragment of the callsigns say 'VXE CT1H' I can start sending a report eg CT1HIX GW4VXE +5

Hopefully CT1HIX will, before too long receive what I'm sending and will start to send me a roger report eg GW4VXE CT1HIX R+00

Once I've received BOTH callsigns, my report and the 'R' I can send CT1HIX GW4VXE RR73

Finally, CT1HIX will send back GW4VXE CT1HIX 73

The sequence is just the same as an FT8 QSO, so will be familiar to most people.

If you'd like to see more, I'd recommend an RSGB video of a 2013 presentation made by **Lyn Leach G8JLY**, then GW8JLY, on Meteor Scatter for Beginners:

https://tinyurl.com/mmrdr8dv

In the video Lyn talks about the FSK441 mode, which is still used by some, although more people tend to use MSK144 these days. The principles are the same, even if the software is a little different. Lyn's a real expert on meteor scatter and it's well worth listening to what he has to say.

Major meteor showers of the year

I've listed the main meteor showers of the year in **Table 1.**

Give it a go!

Finally – I hope this article has given you an insight into meteor scatter and how it can be used by radio amateurs. For me, it's an interesting branch of the hobby bringing together two things I'm very fond of; amateur radio and astronomy! But be warned, it can become addictive. **PW**

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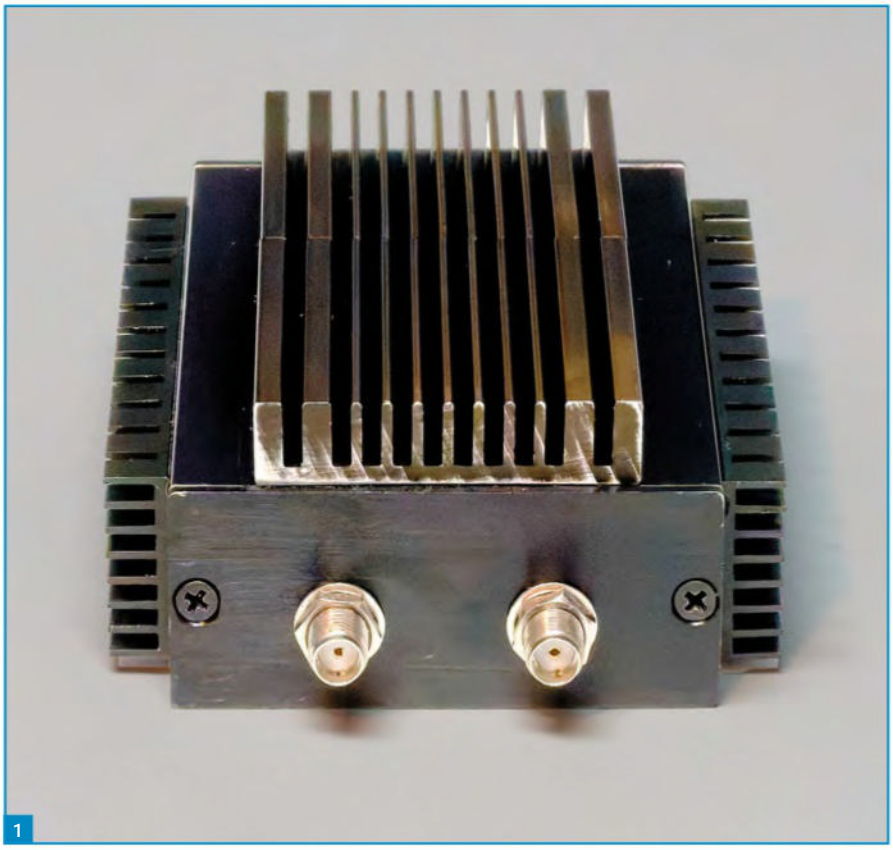

1

UberSDR

Mike G4WNC introduces some exciting new software.

This month I'm focussing on an exciting new open-source SDR system called UberSDR that promises to bring a wide range of advanced features, such as all-band skimming of CW, FT8, FT4 and more.

Introduction to ka9q-radio

Phil Karn KA9Q has been working at the forefront of amateur SDR development for many years, and UberSDR relies on Phil's work to provide the heavy lifting. One of Phil's projects that's not received much attention, at least in this column, is the ka1q-radio SDR system. This is a departure from the conventional amateur radio SDR system, i.e. an ADC and FPGA front-end followed by on-board digital processing and a complex software package that provides the GUI and links everything together. By contrast, the ka1q-radio system is a modular receiver, with separate, self-contained software packages for each function. The principle here is that it's more effective to design software that does one job very well than to attempt to create a large package covering a wide range of functions. Using a modular approach makes the ka9q-radio system extremely versatile, and the code is highly efficient. For example, a Raspberry Pi 4 has enough power to simultaneously demodulate all channels on the VHF/FM band with ka9q-radio.

Arguably, the most crucial component is the radiod module, as it handles the main signal processing and interfaces with the SDR hardware. In the case of UberSDR, it works with the RX888 MkII receiver, **Fig. 1**, running at half the sample rate (64.8Msps). That's a lot of data to handle! Doing the maths shows that 64.8Msps with 16-bit samples results in data arriving at just over 1Gb/s! In addition to handling the data, the software must perform a forward Fast Fourier Transform. Phil uses the MIT FFTW3 package, which is currently the most efficient open-source FFT library. As a result, the ka9q-radio radiod module can easily handle the 64.8Msps of the RX888 MkII.

The secret behind the efficiency of the ka1q-radio is to use a large forward FFT (Fast Fourier Transform) in the radiod module, followed by smaller inverse FFTs to derive narrow spectral slices that produce audio or IQ data for demodulation. The simplest way to visualise this process is to think of a typical spectrum or waterfall display that is common in most SDRs. Each measurement point in the display is called a bin because it collects data within a very narrow frequency band. An inverse FFT combines data from multiple bins and reconstructs the audio or IQ signal. The bandwidth of the resultant signal depends on the number of bins used to source the inverse FFT. I've illustrated this process in **Fig. 2**.

A complication arises because FFTs are iterative. i.e. they take a sample of the incoming signal and iterate over it multiple times to compute the value to store in each bin. This is why spectrum displays appear to stutter when you specify an FFT size that is too large. However, for our SDR receiver, we need a continuous process. The answer is to use the overlap-and-save technique. In this system, each FFT overlaps with the previous one, and the overlap is subsequently discarded, to produce a continuous output. For radiod, the default sample size is 20ms. This is a simplified explanation, but the principle holds.

The behaviour of the ka9q-radio modules is determined by their configuration files, which enable a highly flexible system. Supporting the radiod module are numerous other modules and decoders used to complete the receiver system. Communications between the radio modules employs IP multicast. The main benefit here is that many modules can access and use the same data stream. This lets the system run multiple demodulators or decoders from the same feed, keeping processor load to a minimum. In fact, with a moderately powerful computer, it's possible to receive hundreds of radio channels simultaneously.

The only snag with IP multicast is that many older Wi-Fi systems don't handle the streams correctly and send all multicast packets to every device on the network, regardless of whether they're listening. This can flood the network. There are several ways to avoid this problem. The simplest is to run all the decoders on the computer that's hosting radiod. A second is to use a wired Ethernet network with switches that support IGMP snooping. These switches can intercept multicast packets and forward them only to hosts that are actively listening.

UberSDR

Although ka9q-radio is an excellent, highly versatile SDR system, it is essentially a Linux-based command-line application, which limits its adoption to those comfortable with working with Linux at that level. However, thanks to some generously donated work by **Nathan M9PSY** and the UberSDR development team, we now have an easy-to-use GUI-based application that utilises the ka9q-radio

Fig. 1: RX888 MkII SDR used in UberSDR.
Fig. 2: ka9q-radio - Illustration of FFT based down sampling to create receiver slices.
Fig. 3: UberSDR web interface. Fig. 4: HP ProDesk 600 G3 I used as the server for UberSDR.

modules (**Fig. 3**). The software is fully open source and available now. See their website for details:

https://ubersdr.org

The application itself is still Linux-based, but only to run the server. The team have provided Linux and Windows client applications that you can use to operate the radio. The key to the success and ease of installation of UberSDR is the use of Docker containers. By packaging an application in Docker containers, the core software and all dependencies are bundled and run in an isolated environment. This means the software will run and behave identically on any compatible machine. This completely overcomes the classic compatibility problems often encountered when running conventional software. Docker containers differ from virtual machines because they use the host machine's Linux kernel. This makes the package much smaller, allowing it to start faster and run more efficiently.

Installing UberSDR

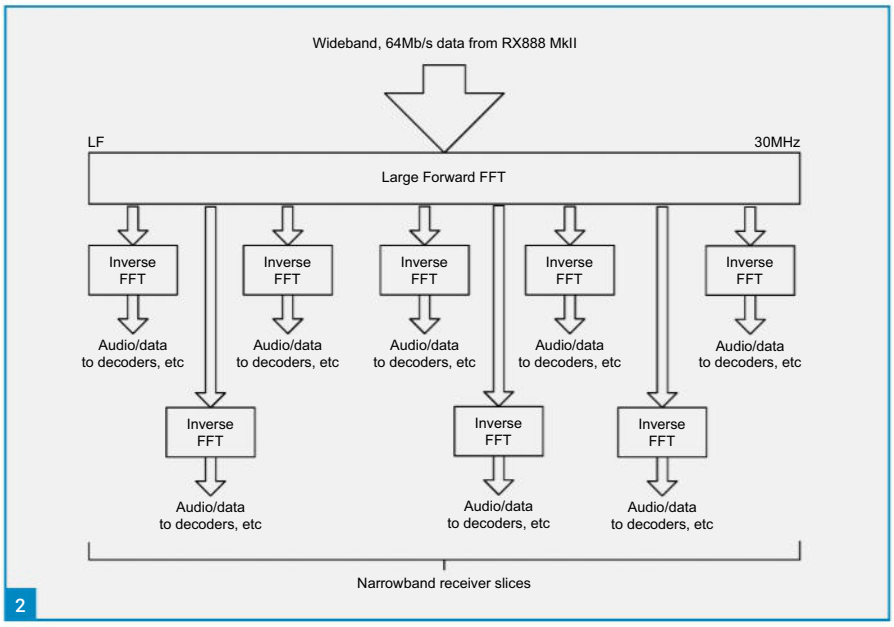
UberSDR runs on a Linux server and works very well on the cheap surplus business PCs that you will find advertised on eBay. You may even have a suitable old PC kicking around the shack. The required processing power depends on how you plan to use UberSDR. If you're using it as a conventional single-channel receiver, you can get away with a low-powered Celeron-based unit. However, if you want to use the skimming facilities, you will need more power. The development team recommends a 6th-generation Intel Core i7 as a suitable medium-power configuration. Your PC must have at least one USB 3.0 port, as this is required to handle the high-speed samples from the RX888 MkII receiver. To test the system, I found an HP ProDesk 600 G3 mini-PC with an i7-6700 processor, **Fig. 4**, that was selling for £110, including postage. This can run UberSDR with multiple online users while decoding and reporting WSPR, FT4 and FT8 signals across all bands from LF to 28MHz!

The installation process is straightforward, and I'll walk you through the steps here.

The first task is to create a bootable USB stick loaded with Ubuntu server that you can use to install the operating system onto your target PC. Begin by downloading the latest Ubuntu server from the web:

https://ubuntu.com/download/server

Next, you need a utility that will transfer the downloaded ISO to a USB stick and make



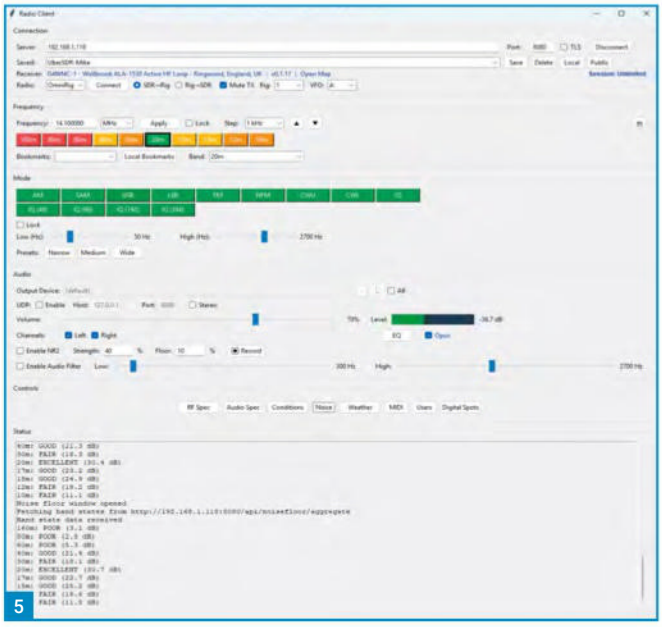


Fig. 5: UberSDR Windows client main screen.
Fig. 6: UberSDR Noise analysis graphs.

it bootable. My favourite free app for this is Rufus:

https://rufus.ie/en

Once Rufus is installed, use it to transfer the downloaded ISO to your USB stick.

When installing the server on your host PC, we will wipe its existing hard drive. If you want to keep the OS or any data on that drive, either replace the drive or clone it.

Installing the Ubuntu server on your PC:

1. Connect a monitor, keyboard and Ethernet cable to the PC you'll be using.
2. Insert your bootable USB drive and power up the PC.
3. Watch the start-up screen and press whatever key takes you to the boot menu.
4. Choose to boot from the UEFI USB stick.
5. Select Try or Install server.
6. Select the correct keyboard.
7. Choose Ubuntu server.
8. Select the network, normally Ethernet.
9. Skip proxy address.
10. Stick with the default mirror.
11. Choose to use the entire disk and the default LVM setting.
12. Enter your name and choose a username and password.
13. Skip Ubuntu Pro.
14. You need to install Open SSH server, so select that entry and press space to activate it.
15. Server snaps. No need to select these, so skip.
16. The server will now finish installing the software.
17. When complete, remove the USB stick and reboot the PC.

At this point, you have installed the Ubuntu server operating system and can proceed to install UberSDR. This installation is much simpler than the server's because the authors have provided an installation script that loads all the requirements and completes the initial setup. The script can be found on the UberSDR website here:

https://ubersdr.org

I've shown the command at the time of writing here, but I recommend visiting the UberSDR website to get the latest version. You will find this under the Build Your Own section.

curl -fsSL https://ubersdr.org/install.sh | bash

The script requires no user input, but may take a while to complete, depending on the PC you're using. For the final part of the installation, the FFTW benchmarking will run. This benchmarks many FFT algorithms to find which run best on your machine. The best results are stored in a Wisdom file and used by ka9q-radiod. This helps the ka9q-radio daemon run efficiently across a wide range of hardware. When the installation completes, it will display the admin password; ***make a careful note of this***. If installation fails, as it did with me a couple of times, try rebooting the PC and rerunning the script.

Accessing UberSDR

UberSDR is accessed over your local network, and you'll find it at:

http://ubersdr.local:8080

I've shown a screenshot of the interface in Fig. 1. You can also use the Windows or Linux clients as shown in **Fig. 5**.

However, before you start using the receiver in anger, you need to complete the setup via the admin page at:

http://ubersdr.local:8080/admin.html

The first time you access the receiver, it will guide you through the configuration screen where you can add your callsign and station details. You can also decide whether you want to share your receiver online. If so, the simplest way to do this is to use the integrated tunnelling system.

This appears to work very well and is much simpler than setting up port forwarding. During setup, you also have the opportunity to activate the built-in decoders and extensions. I suggest you hold off on this decision until you've had a chance to test your receiver to ensure it's working OK. The decoders and extensions can be activated individually later by revisiting the site Admin and selecting the Extensions or Decoders tab.

Once your receiver is configured you will be amazed at the features built into the client software. Just to whet your appetite, take a look at the noise graphs, **Fig. 6**. These provide a detailed analysis of the noise across all the bands and provide historical tracking. The noise measurement is carried out in the ka9q radio modules by averaging noise over an extended time to produce a more accurate figure than the spot noise you often see used.

That's all I have space for this time, so next month I'll show you how to make the most of your UberSDR and optimise the configuration. In the meantime, my UberSDR is running 24/7, and you're very welcome to try it. You will see it listed as a running instance with G4WNC-1 as the call on the UberSDR website here:

https://instances.ubersdr.org

My receiver is also contributing receive reports for FT8, FT4, and WSPR on all bands from LF to 30MHz. **PW**

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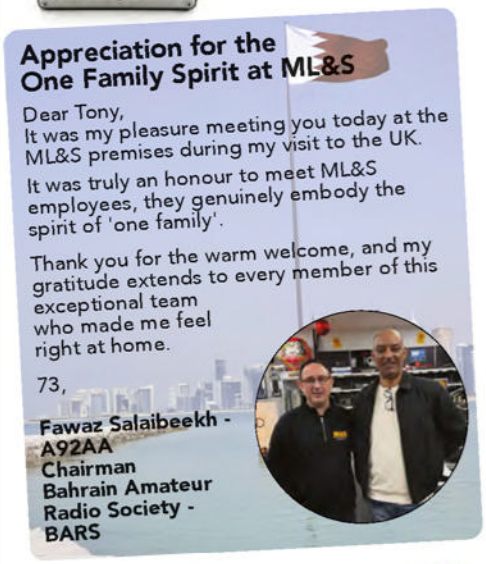

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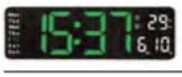

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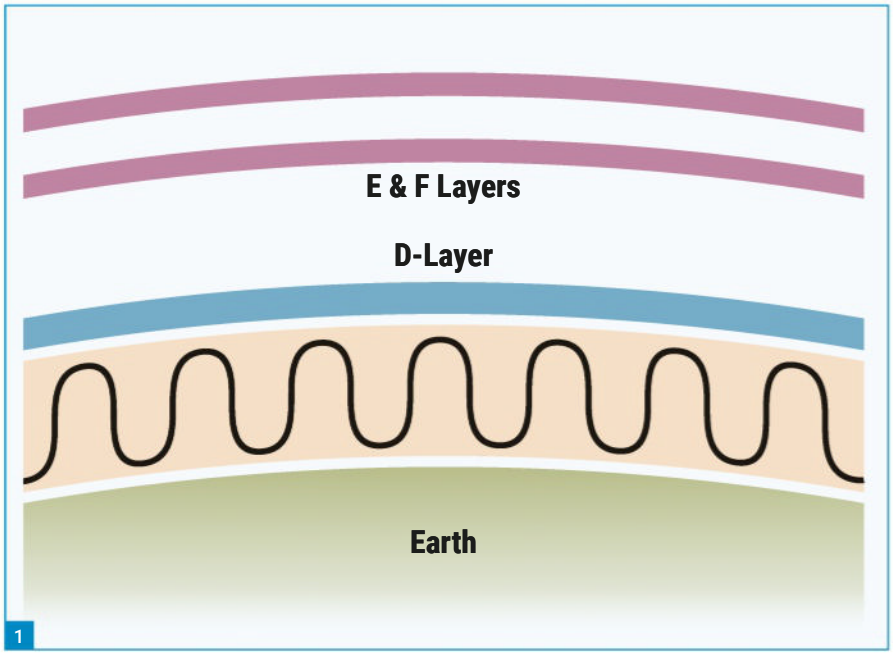

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Marconi's Short Wave Beam System (Pt I)

Michael Jones GW7BBY has Part I of two articles about the classic Marconi beam system, used for working the World.

Even before **Marconi** bridged the Atlantic in 1901, his wireless was being embraced by shipping. Technological advances at the beginning of the 20th Century were rapid. Spark transmitters were evolving, antenna technology was improving, tuning systems were being explored and valve technology was on the horizon. If spark is considered as the first generation, then the advent of the valve marks the start of the second and the birth of electronics. Wireless was set to dominate worldwide communications.

In the years before the First World War, the British Empire was linked to the motherland by an extensive system of undersea telegraph cables. While this all seemed well and good, in government circles there was unease: the cable systems were slow (40 – 100 wpm at best), unreliable, expensive to install and maintain, strategically they were susceptible to damage, accidental or intentionally cut by an enemy.

The fragile political situation in Europe focussed minds on these matters and the consensus in government was to set up wireless links to the Empire. The prevailing technology meant that this would be a Long Wave (LW) system using either Low Frequencies (LF: 30 – 300kHz) or Very Low Frequencies (VLF: below 30kHz).

VLF/LF propagation

At the VLF frequencies then favoured for long distance communication, propagation is principally by waveguide mode where the surface of the earth is, theoretically, a perfectly conducting surface, as is the underside of the D layer of the ionosphere, **Fig. 1**. At these low frequencies the wave does not enter the D layer so it is neither absorbed nor refracted. The wave is effectively trapped because the wavelength (30km – 3km) is a significant function of the height of the base of the D layer (75km – 90km) so the wave travels as a ground wave ducted, or contained within the waveguide formed between the earth and the ionosphere. This is particularly true on the lower VLF frequencies or longer wavelengths, say <15kHz (20,000m). Consequently, path losses at these frequencies are very low, 2–3dB per 1,000km. Conversely higher frequencies incur greater losses as they have to traverse the lower D layer where absorption takes place and are then refracted by the E or F layers before returning to earth, having traversed the D layer again. Because VLF wavelengths are large compared with the size of many obstacles they can diffract around large structures and are not blocked by mountain ranges. As they propagate as ground waves following the curvature of the Earth they are not limited by the horizon. In practice, of course, neither the earth nor the ionosphere are perfect: losses are different over land to those over sea; conditions in the ionosphere will vary according to latitude and diurnal changes during daylight versus night. In the longer term, Solar activity such as flares, magnetic storms, and sunspots also affect the properties of the ionosphere.

As frequency is increased towards the LF range (30kHz – 300kHz) the wavelength shortens (10,000 – 1,000m) to become a less significant fraction of the height of the ionosphere and wave hop or skip starts to occur. At first the downward wave hop will interfere with the ground wave that will still be significant out to 1,000km or so after which hops will become the dominant mode of propagation, **Fig. 2**.

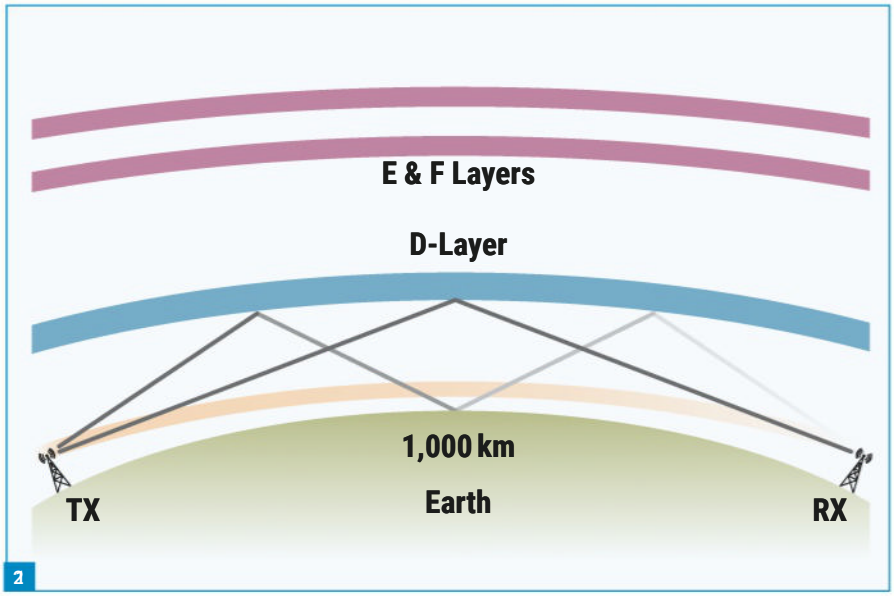
During the daytime VLF propagation as described above tends to be reliable and stable with absence of fading and little atmospheric noise. At nighttime the D layer disappears so then VLF and LF waves will travel up to 90 – 120km above the earth to be reflected from the bottom of the F layer. This does not prevent a long-distance circuit from operating, but the path can become unstable and suffer increased atmospheric noise.

We know all this now as a result of the pioneering work of early 20th century engineers and scientists such as Heaviside [**1**] and Kennelly [**2**]. Back in the early 1900s and into the 1920s the choice of wavelength was largely based on empirical experimentation.

Despite low path losses VLF antennas are very inefficient: at 15kHz (20,000m) a quarter wave is 5 kilometres, so all VLF antennas are a compromise, the transmitters too were inefficient. As a consequence, immense amounts of power were needed to reach far flung colonies. In fact, Australia would only be reached by a number of relay stations. If this wasn't enough, the prospect of sending high quality speech was poor owing to the severely limited bandwidth. A 10kHz Amplitude Modulated speech channel would occupy one third of the available VLF band and there would be other issues owing to the high *Q* of the antenna as the sidebands could not be contained within the bandwidth of the antenna.

The *Q* of an antenna is a measure of its bandwidth against its frequency of operation. As an antenna is made smaller relative to its wavelength, its *Q* increases and the bandwidth decreases. At VLF wavelengths of maybe

Fig. 1: VLF wave (orange) ducted between ionosphere and earth.
Fig. 2: As frequency increases into the LF region both ducting and skip occur.



20km, the antennas are very much shorter than optimum and so have very high *Q* and very narrow bandwidth. A feature of these antennas is that they have a long time constant requiring a number of cycles to establish oscillation on key down and a similar number of oscillations to dissipate the stored energy at key up. This limits the data rate that can be transmitted to around 15 – 20 words per minute.

Imperial Wireless Scheme: The Long Wave stations

Marconi had been operating a Long Wave service to Canada and America from his powerful Irish station at Clifton since 1907, his company thus had the experience to propose in 1910 an Imperial Wireless System comprising 18 Long Wave stations. This scheme was revised and in 1912 the Post Office accepted a contract for Marconi to build six stations at a cost of £60,000 each to link the UK with Australia, via India and with South Africa. This would require stations in the UK, Egypt, East Africa, South Africa, India and Singapore. The Australian Government decided to proceed independently with the construction of a station to link with the Imperial Scheme via Singapore.

Unfortunately, there was a scandal surrounding the Marconi company concerning insider trading of Marconi shares, this delayed ratification of the contract until 1913. Work commenced on the first two stations at Leafield in Oxfordshire and Abu Zabel near Cairo but was suspended at the outbreak of the First World War. Work on the Australian station was also suspended.

After the war work resumed, Leafield transmitting station opened in 1922 on 12,350 metres (24.3kHz) using a 250kW Poulsen arc transmitter. Leafield's companion receiving station was at Banbury. The state of technology dictated that transmitting and receiving stations be separated by some tens of kilometres to prevent the powerful transmitters interfering with reception.

(Note as the transmitting and receiving stations were in different locations, I shall adopt the following convention: Transmit Station/ Receive Station, for example Clifden/Letterfrack or Leafield/Banbury.)

It was determined by the Government Committee in 1923 that the Post Office would own and operate all wireless stations for communications with the Empire. However, Marconi was able to negotiate separately with the dominion governments to build the reciprocal stations in Australia, South Africa and India. Each of these stations had a 1,000kW transmitter operating on wavelengths from 20,000 – 30,000m (15 – 10kHz) with self-supporting 800ft masts. The cost per installation was about £500,000.

It is worth noting that in the immediate post WWI years in addition to Leafield there were five major Long Wave stations operating in the UK: Clifden to Canada and America, Caernarfon to Canada and America, Ongar to Paris, Berne and Madrid operated by Marconi; Northolt to Cairo, Prague and Halifax, Stonehaven to Warsaw, Estonia and Iceland operated by the GPO.

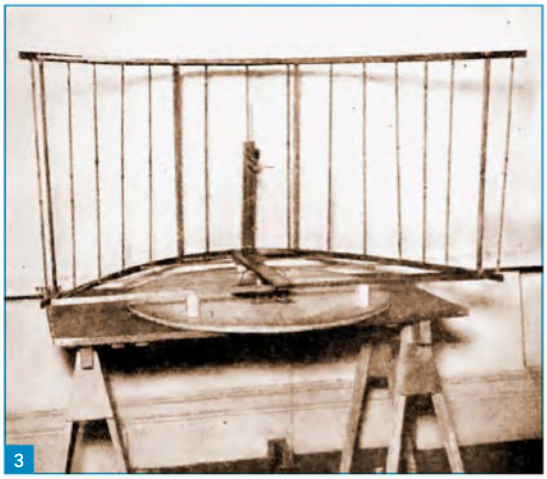
In 1923 the Post Office commenced erection of what was to become the world's biggest, most powerful Long Wave wireless station at Rugby, which opened in 1926.

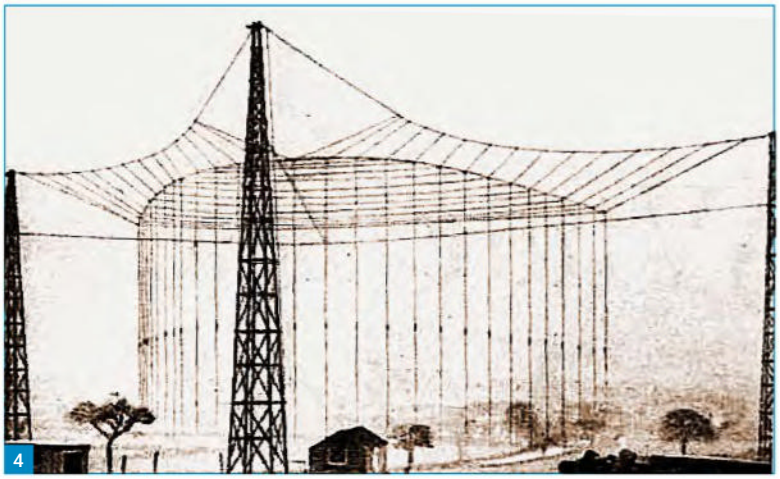
Short waves (HF) re-discovered

The majority view in 1920 was that LF and VLF were the only viable frequencies for long distance communication and the 'useless' higher frequencies, above 300kHz (100 metres) were assigned to Amateur Experimenters. Some of these experimenters achieved communications over extraordinarily long distances with surprisingly little power. One of the most significant were the trials carried out by the ARRL in 1921. These trials were organised by **Fred Schnell**, of the ARRL, and **Philip Coursey** of the Wireless Society of London (forerunner of the RSGB). The first tests in February 1921 failed because understanding of the ionosphere was in its infancy, only three short sessions were scheduled at inopportune times on a frequency of 1.5MHz (200 metres): a higher frequency would have been better. All this, of course, is said with the benefit of hindsight.

Undeterred, a second series of trials were undertaken from 8 to 17 December 1921 using 200 – 250 metres (1.5 - 2MHz). For these tests the ARRL saw fit to send over a distinguished American amateur, **Paul Godley**, with two of his own receiving sets. These transatlantic tests were described in detail in *Practical Wireless* of December 2021 [**3**]. It is notable that Godley [**4**] was feted by the local Marconi International Marine Communications Company (MIMCO) representative at Southampton. Having found interference levels in the London area intolerable, he moved his equipment to Ardrossan on the west coast of Scotland. He was met at Glasgow by two MIMCO representatives who helped him to obtain necessary equipment. Furthermore, at Ardrossan **D. E. Pearson** of MIMCO assisted Godley throughout the tests and was able to validate his reception log book. Good results were also achieved by British amateurs using less sophisticated equipment who received 11 of the American stations, several of them using less than 50 Watts output.

The use of short wavelengths, higher frequencies, had been in Marconi's thoughts from the early days. By 1916 following trials in Italy at 150MHz that showed the efficiency achievable at higher frequencies and the feasibility of building beam antennas, **Fig. 3**, his ideas were beginning to coalesce. It should be understood that although Marconi himself was actively engaged in wireless experiments, he had by this time the backing of his company and very significantly two of his most senior engineers: **C. S. Franklin** [**5**] and **H. J. Round** [**6**]. In 1917 Franklin demonstrated that short wave signals were viable for distances in the order of 100 miles. He used a frequency of 20MHz (15 metres) to send signals between Caernarvon and Kingston Harbour, Ireland (78 miles), and between Hendon and Frankley, Birmingham (97 miles). For his trials Franklin used a vertical,





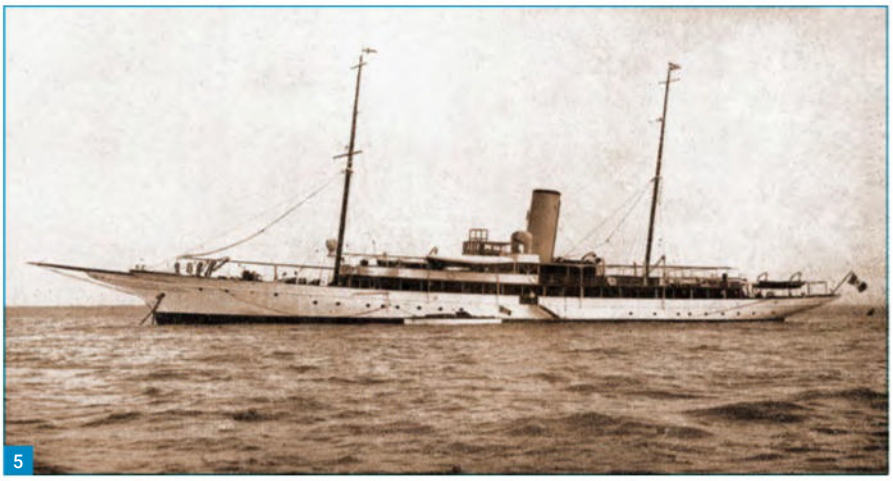


Fig. 3: Marconi's experimental 150MHz parabolic beam antenna. Fig. 4: Franklin's HF parabolic beam antenna at Hendon. Fig. 5: Marconi's steam yacht, *Elettra*. Fig. 6: Waves a and b travel different distances

parabolic beam antenna of his own design, **Fig. 4**, **[10]** to give a forward gain of 13dB (20 times). Meanwhile Round was sending telephony signals using a frequency of 3MHz (100 metres) between Zandvoort in Holland and Southwold in Suffolk.

Short wave trials, Cape Verde etc

Clearly Marconi was aware of the Amateur trials and those of Franklin and Round and he set about his own experiments with Short Waves. In May 1922 he called upon C. S. Franklin, by now Chief Engineer and Personal Assistant, to design a 12kW transmitter and beam antenna system at Poldhu. Marconi had his steam yacht *S. Y. Elettra*, **Fig. 5**, equipped with short wave receivers and measuring equipment. They initially planned to make detailed studies of the propagation of all wavelengths between 100 metres and 15 metres (3MHz – 21MHz). However, as all the necessary equipment was not readily available they decided to concentrate on 97 metres (about 3.1MHz).

In April 1923 Marconi set sail for Cape Verde (now known as Cabo Verde) off the west coast of Africa and anchored at San Vicente, about 4000km (2,500 miles) from Poldhu. He observed that after about 2000km (1250 miles) the 97 metre signals from Poldhu disappeared during daylight. By night he found that the signals were significantly stronger, even stronger than signals from the powerful long-wave transmitters at Leafield and Caernarvon. Even when the Poldhu transmitter power was reduced from 12kW to 1kW it was stronger than the long-wave stations.

He further observed that the signals lasted for a while after sunrise at Poldhu and they became audible again at dusk at Cape Verde. He surmised that this was a phenomenon attributable to the altitude of the sun. He was right but it would be another year until **E. V. Appleton** **[7]** proved conclusively the existence of the ionosphere. (In 1902 Kennelly in America and Heaviside in Great Britain had predicted the existence of a reflecting layer.)

The tests carried out were thorough and included:

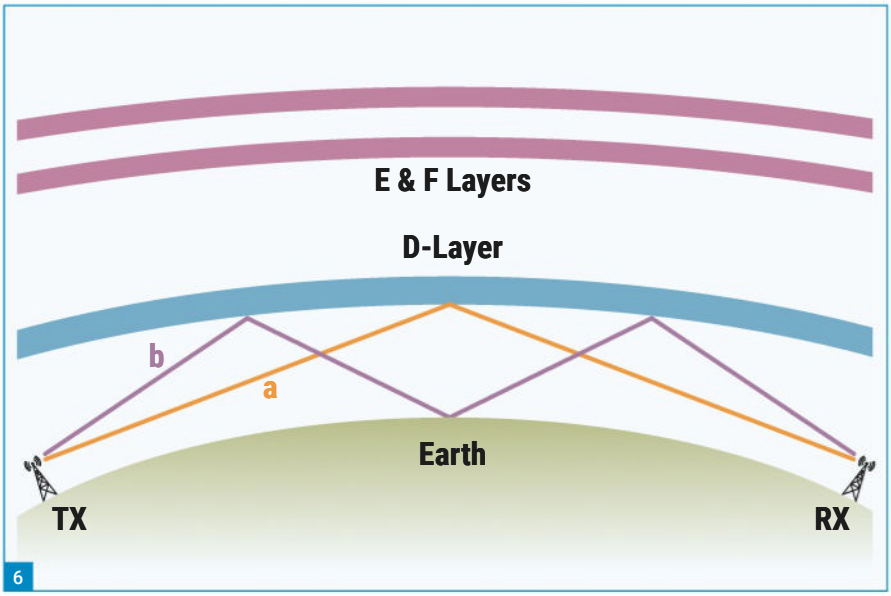
1) Plots of Polar curves of field strength on land and at several wavelengths from Poldhu.
2) Field strengths measured on *Elettra* at different distances up to the maximum practicable.
3) Measurements were taken across the beam to determine beamwidth and variations in strength across the beam.
4) Signal reports were also received from other stations in various parts of the world.

These trials continued through May to the beginning of June 1923.

In his report on 12 June 1923 Marconi wrote, *"I have little doubt, however, that with our present knowledge. and with stations using only 12kW, it would be possible to maintain daily, a 10 to 14 hour communications service between Europe and Brazil, and perhaps with the Argentine"* **[8]**.

He then had the Poldhu transmitter re-designed to produce 17kW on a wavelength of 92 metres (3.3MHz). The antenna was re-arranged to omit the reflectors so that transmissions were omnidirectional. This enabled reports to be received from numerous locations. The *SS Cedric*, on the Atlantic route, was fitted with a receiver operated by a Marconi engineer, **Mr G. A. Mathieu** **[9]**. His reports confirmed Marconi's theory that field strength was related to the altitude of the sun. The daylight range on this frequency was 1400 miles but at nighttime good clear signals were received in New York and in Australia between 5 and 9pm, and between 6:30 and 8:30am GMT. To cap off this series of trials Marconi succeeded in sending a speech signal to Sydney from Poldhu.

He sailed to the Mediterranean in September 1924 to carry out a further series of trials on a number of different wavelengths: 92, 60, 47 and 32 metres (3.3, 5.0, 6.4 and 9.4MHz) in order to understand the performance of different wavelengths in relation to the time of day. He concluded that daylight reception over long distances improved with shorter wavelengths or increased frequency. Indeed, from the harbour of Beirut he was able to pick up clear signals from Poldhu, a distance of 2,400 miles (3,860km),



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on 32 metres or 9.4MHz during daylight hours. From this and his earlier results he concluded that long distance communications over distances of at least 4,000km were viable over a 24-hour period if the wavelength is changed daily from 97 metres during the night to 32 metres during the day.

In October 1924 the Poldhu transmitter was reduced to 12kW and continued to use the omnidirectional antenna on 32 metres. Good signal reports were received from Montreal, New York, Rio de Janeiro, Buenos Aires and Sydney. Oddly Sydney was able to receive signals on this wavelength (9.4MHz) for 23 out of 24 hours. Oddly, because 1924 was just in the trough at the beginning of Solar Cycle 16: the sunspot count was just starting to rise out of the minima at the end of Solar Cycle 15. The Smoothed Sunspot Number in October 1924 was 34 against a minima of 9 in July 1923.

Fading

Unlike LF frequencies where atmospheric noise is the dominant source of interference, HF frequencies suffer from fading: a significant problem for commercial services. Marconi identified two forms of fade: 1) long fades lasting half an hour to many days and 2) short fades lasting maybe a second to a minute. Some relief from long fades might be found by changing frequency, but on the whole, since they are caused by magnetic storm activity, there is little that can be done. Short fades are different. These occur when signals arrive at the receiver by more than one route, usually when the signal has reflected from the ionosphere at different points, see **Fig. 6**, wave b travels further than wave a. It must be remembered that the signal radiated from an antenna, even the best beam antenna, is not a singular entity. The signal spreads out, imagine it as a number of beams. If two arrive at a receiver having been reflected from different points on the ionosphere, their time of arrival at the receiver will be different, this will result in a phase difference. We know that two waveforms when mixed will sum so that at one extreme if they are both in the same phase, they will add to make a strong clear signal. At the other extreme, if they are 180° out of phase, they will subtract and cancel out leaving no signal. Then there all the phase differences in between. Under these conditions the fade can be quite rapid: seconds or fractions of a second, or it can be slow taking a minute or so to go full cycle.

As amateurs we might put up with it, but this is a serious problem when operating a commercial service at up to 400 words per minute: dropouts and repeat transmissions are not only annoying they are expensive too.

Marconi found that if two receivers with their own antennas were spaced a short distance apart, maybe only a few tens of metres, they would not suffer the effect simultaneously. This was to be the basis of Space Diversity. An experiment was carried out with three antennas one mile apart. The resulting signals were combined and fed into one receiver and the effects of fading were minimised.

Marconi had also been looking at the problem from a different angle as he had noticed that fading was not coincidental on slightly different frequencies. This is what we now know as Frequency Diversity. For telegraphy he modulated the transmitter at two different frequencies, 7 and 9kHz thus producing sidebands at 14 and 18kHz apart. At the receiver the sidebands were filtered and re-combined, vastly reducing the effects of fading. Although effective at reducing fade, this was wasteful of bandwidth, requiring, with guard frequencies, 20kHz bandwidth. **PW**

Notes & Bibliography

[1] Oliver Heaviside: (1850–1925). In 1902, Heaviside proposed the existence of what is now known as the Kennelly–Heaviside layer of the ionosphere. Heaviside's proposal included means by which radio signals are transmitted around the Earth's curvature

[2] Arthur Edwin Kennelly: (December 17, 1861 – June 18, 1939) was an American electrical engineer and mathematician. In 1902, he investigated the ionosphere's radio spectrum's electrical properties, resulting in the concept of the Kennelly–Heaviside layer.

[3] *Practical Wireless:* December 2021; A Transatlantic Centenary; p 48.

[4] *The Wireless Age,* March 1922, The Far Call by Paul Godley, pp 17 – 25.

[5] Charles Samuel Franklin (1879-1964). At 20 years old in 1899 he joined Marconi's Wireless Telegraph and Signal Co., and was continuously associated with research and development at Marconi's until 1935. He worked directly under Marconi at Poldhu on the development of trans-Atlantic radio. He was responsible for 65 Patents, beginning in 1902 with the disc capacitor, followed by ganged tuning and variable coupling devices, and the regenerative valve circuit. He designed the first transmitter for the BBC station 2LO. In 1917 Franklin filed patents for the Franklin oscillator, the series-fed antenna, the coaxial feeder, and, in 1923, the curtain antenna beam array. He designed the first beam transmitter, the SWBI, in 1924. Franklin's last major work was the television aerial and feeder system at the Alexandra Palace. Franklin retired in 1939 and was appointed a research consultant to the Marconi company. He was made a CBE in 1949, and in the same year was awarded a Faraday gold medal.

[6] Captain Henry Joseph Round MC (2 June 1881 – 17 August 1966): Round was an English engineer and one of Marconi's personal assistants. He joined the company in 1902. Round made important contributions to the development of the first valves. He patented the first design for an indirectly heated cathode. He led Marconi's valve research and developed the triode at roughly the same time as Lee De Forest in the US. He discovered feedback (regeneration) independently and simultaneously with Alexander Meissner and Edwin Armstrong. He built some of the first AM valve radio transmitters. Round became Chief Engineer at Marconi's Wireless Telegraph Company in 1921, but left to set up his own consultancy. During the Second World War he worked on ASDIC (Anti-Submarine Detection Investigation Committee) commonly known as SONAR.

[7] Sir Edward Appleton GBE, KCB, FRS (1892 – 1965): awarded the 1947 Nobel prize in Physics for his investigations into the ionosphere.

[8] *The Marconi Review*: October 1928; A Chapter in the History of the Marconi Beam; p 6.

[9] Gaston Mathieu: (No dates found) A Belgian engineer and one of Marconi's closest personal assistants responsible for among many other things, the Short Wave Beam receiver design and the development of Multiplex signalling enabling a telephone message together with two telegraph signals to be sent on the same channel.

[10] *Popular Science magazine*: Vol. 112, No.1, January 1928; Marconi tells what radio needs.

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7Z1VD – The Journey of an Expatriate Radio Operator in the Middle East

Francisco EA5VD describes life living in and operating from Saudi Arabia.

When I first discovered radio back in the 1980s with my very first CB rig, I could never have imagined that I would one day end up living in a true DX country – let alone enjoying radio in such an intense and unique way, surrounded by the stunning landscapes of the Red Sea.

I entered the hobby through the citizens' band at the age of fifteen, quickly earning my Spanish amateur licences: first as EC5, then EB5 for VHF and UHF, and eventually EA5VD. I remained active for many years, but like many of us, family responsibilities and the arrival of the internet gradually pushed radio into the background for a while.

Fate, however, had a different plan. My company offered me the chance to relocate to Saudi Arabia as an expatriate – an opportunity I accepted despite the understandable fears and uncertainties of moving to a country so different in religion, traditions, customs, and language.

Once settled in Jeddah and having obtained my Saudi residency, I became eligible to take the exam required to obtain a Saudi amateur licence, as there is no mutual recognition agreement with Spain. These exams are normally held once a year in Riyadh, and I decided to dust off my old textbooks and notes to prepare thoroughly. From the moment I arrived in the Kingdom, I received invaluable support from local operators in Jeddah – HZ1SK, HZ1HZ, HZ1CY, HZ1MD, HZ1DS, HZ1BH, 7Z1CQ, 7Z1TT and many others – who welcomed me warmly and offered their first pieces of advice.

After several months of study, I flew to Riyadh for the exam. I was received as if I were part of the family, something I truly appreciated given my nerves. Waiting for me were 7Z1SJ, HZ1MX, and especially the representatives of S.A.R.S.: HZ1DG, along with Their Highnesses HZ1BF and HZ1SF. The exam was challenging, but the preparation paid off. I passed and was granted the callsign 7Z1VD. For sure the first Spanish person to obtain such privilege and one of the few non-Arabs that have ever got a licence.

Activity in Jeddah

Although I have been able to meet several times with amateur radio friends in Jeddah, there is not a club station where we could meet or operate. Aside from occasional gatherings for tea and discussions about the latest DX and expeditions, most of my activity depends on the little free time left by work and family.

My first setup of dipole antennas was installed at home inside a compound where Western expatriates live. However, once the sun went down, QRM on nearly all bands rose to S9, making communication almost impossible. The interference seemed to come from transformers, LED lighting, and other unknown sources.

That's when I remembered my friend **Duncan EA5S**, and his many successes operating mobile from the Port of Valencia. On a trip to Spain, I bought several mobile antennas to begin experimenting, such as magnetic mounts, a screwdriver antenna, mono-band antennas for 20m, 40m and 10m, and especially a couple of MFJ-1979 whips, which continue to serve me extremely well. Later I added coils to adapt the telescopic antenna for 40m. Radio is still not very popular in Saudi, and therefore equipment is not easy to find, nor technical services to fix rigs, so I usually bring whatever I need from Spain.

Operating mobile

Over my almost five years already in Saudi Arabia, I have tested countless locations operating from the car, moving from one spot to another for various reasons. On some occasions I have been politely 'invited' by the authorities to relocate, while at other times I moved simply to avoid attracting attention – particularly when the 20m telescopic antenna is fully extended.

Fortunately, having all my paperwork in order – amateur licence, station permit, and residency documents – has always ensured that interactions with authorities remained friendly. At most, they showed interest in what I was doing or kindly asked me to operate elsewhere.

Operating as 7Z1VD/M has taken me deep into the most remote desert areas and to the very edge of the Red Sea, with the water almost touching the wheels. The results are consistently spectacular. It is well known that seawater provides excellent conductivity, acting as a mirror for radio waves and offering remarkable signal improvement both on transmit and receive. Even in the desert, far from the coast, propagation has often been excellent, likely thanks to the unobstructed horizon and very low take-off angle.

I have also collected a few unforgettable

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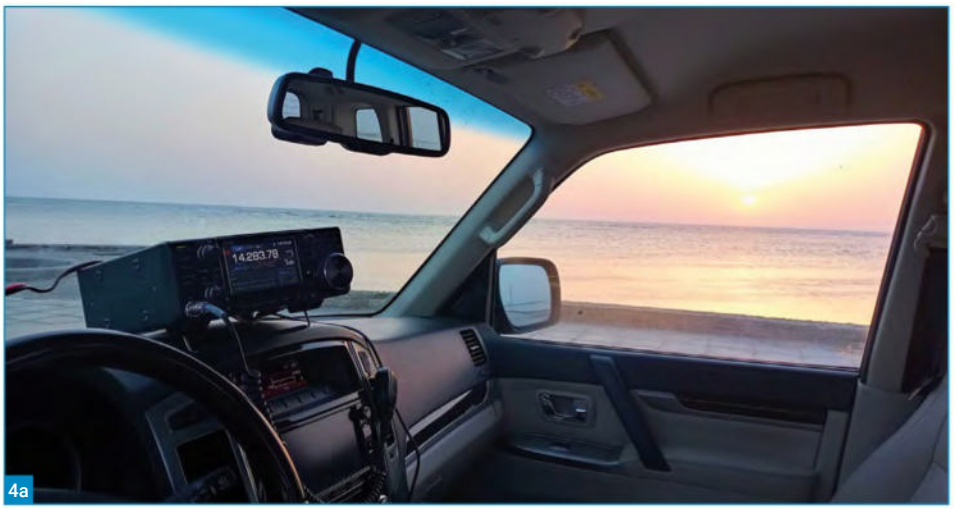

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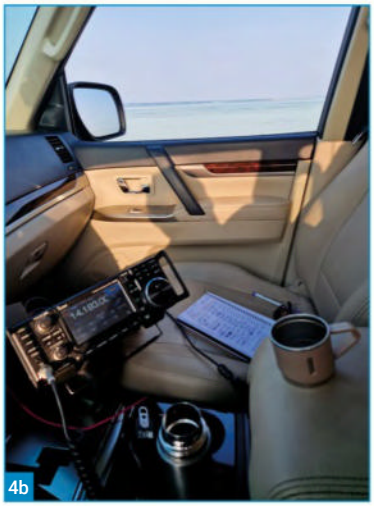

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anecdotes – like the night I became distracted, drained the car battery while transmitting, and had to rely on the help of some friendly Arabs that I found nearby who not only helped restart my car but insisted on inviting me to dinner with them right there in the desert. Saudi hospitality is famous for a reason.

Equipment

I initially operated with a first-generation ICOM 706, but soon discovered that the pile-ups generated by my callsign in this region were too much for its cooling system, especially in the Saudi heat. About a year and a half ago, I brought an ICOM 7300 to the Kingdom (with all proper documentation). It is bulkier than the 706 for mobile use, but its powerful fan, built-in tuner, and overall performance make it an outstanding primary rig.

I don't use an amplifier, something I am often asked about given the strong reports I receive. When pile-ups last too long, I sometimes reduce power to 90 or even 80 watts, which is more than enough. On occasion I enjoy lowering power to 5 watts or less to test how far I can go under good conditions.

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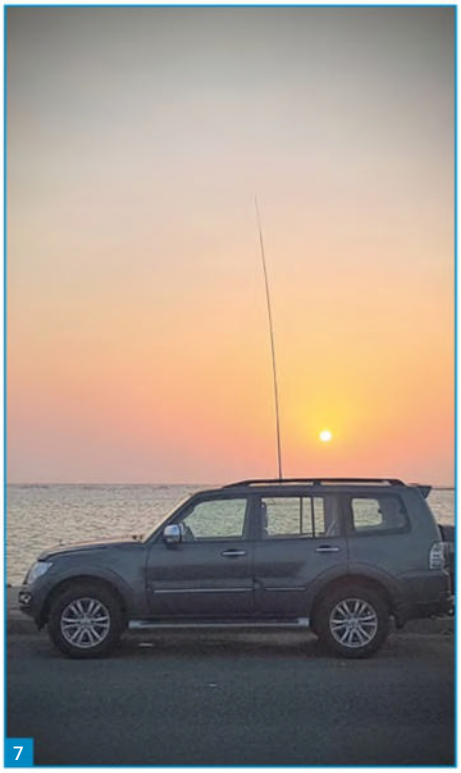
Photo 1: Active from my car as 7Z1VD/M. Photo 2: Portable from the Al Wahbah volcanic crater. Photo 3: Certificate for the 7Z1VD & HZ1HZ mixed multi-operator entry in CQ WW SSB. Photo 4: Operating from my car. Photo 5: One of the surprises encountered during mobile operations.



When operating mobile (7Z1VD/M), I always use car-mounted antennas. Sometimes I operate portable with a dipole and telescopic mast powered by a small generator, calling as 7Z1VD/P to differentiate.

For 10 to 20m, the car body provides an excellent counterpoise. For 40m, I deploy a long-wire radial. Since I like to move often when operating mobile, I usually prefer the 10 to 20m bands, especially my two favorites: 12m and 17m.

Contest activity and special callsigns

Operating from such a unique DX location is thrilling, but doing so in major international contests is even more exciting. Although not many Saudi amateurs regularly participate in contests, those who do are outstanding operators.

Despite competing with low power (100W), I have achieved excellent results, often ranking first nationally in major events (see certificate). I also had the pleasure of joining my good friend **Laila HZ1HZ**, in what became the first mixed multi-operator team from Saudi Arabia composed of a man and a woman to enter the 2024 CQ WW SSB contest, achieving a great score and finishing as number 1 in Saudi Arabia despite high noise levels at her QTH.

I also collaborate actively with S.A.R.S., operating special event calls such as 8Z3FD (Foundation Day), 8Z92ND (National Day Anniversary), and others like HZ1CPCF, HZ1WED, HZ1WARD, HZ1QATAR, HZ1KWT and HZ1OMAN – often in coordination with brother organizations across the Middle East. Each year, we gather during the S.A.R.S. annual meeting that gives us the chance to meet for amateurs from the Gulf.

Photo 6: Receiving a recognition certificate from Prince Badr Al-Faisal Saud.
Photo 7: One of my operating spots on the Red Sea. Photo 8: Contesting and special callsign operations

The future of radio in Saudi Arabia

In recent years, Saudi amateurs have shown growing interest in satellites – where they are true pioneers – as well as in digital modes. The Society actively supports newcomers, promotes licensing through agreements with universities and institutions, and has facilitated the import and sale of equipment to make radios more accessible across the country.

As for me, I will remain active for as long as I live in the Kingdom, although work trips or personal matters sometimes keep me off the air for periods of time. Now I am also exploring QRP and uSDR small transceivers. **PW**

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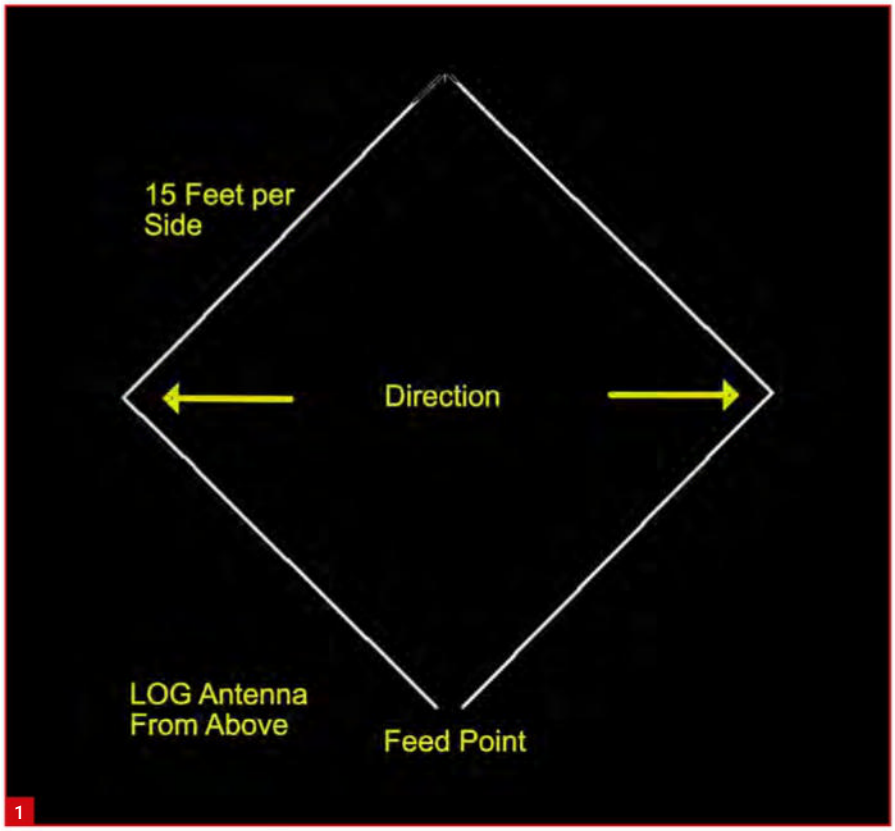

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RadioUser LoG Revisited

Keith G4MIU returns to an antenna that he played with back in 2021.

As this issue goes comes out Christmas 2025 will be a distant memory. However, I am compiling this month's missive during the run up to Christmas and as is now usual for this time of year every house for miles around seems to be covered in very pretty looking LED Christmas lights. While visually attractive the situation within the invisible RF spectrum is a bit different and some of these lighting sets can be very dirty at RF and emit quite high levels of QRM, adding to the already often high levels RF smog. And that is unfortunately the case here!

In the last few days I have found that, in the evenings, the lower HF bands are suffering from an erratic buzzing every few 10's of kilohertz, the tone of which alters every few seconds with an amplitude of around S8.

I went out with my little Tecsun PL-330 to see if I could find the source, not with the intention of trying to do anything about it, if indeed it was merely Christmas lights, as they would stop in the New Year anyway(hopefully) but more as an exercise.

I didn't need to look far, or even take the Tecsun with me. A nearby house had its whole front cascaded with lights that were alternating in colour just over every second or so.

There were also lights all over the front garden and all in all looked quite spectacular, although I doubt there was a valid conformity marking to be seen anywhere!

The QRM has been disappearing around 11:30pm so isn't really a major issue, especially so as none of the 'buzzers' appear on an FT8 frequency, which presently is my main operating mode.

I have been using an FT-857D for FT8 but as my FT-990 has a receive antenna input, and for a bit of fun over the festive period, I decided to retry a Loop on Ground receive antenna very much like the one I reported on in the August 2021 *RadioUser*.

Back then I found the one I made to be a useful antenna, considering it just sat on the lawn. Indeed, I had a lot of feedback from readers who also found this antenna to be a solution to QRM issues, not just in the UK but from South America, South Africa, Europe and also the Middle East.

Despite having a serious QRM issue here I eventually took my loop up as grass cutting and a boisterous black Labrador called Dylan made the antenna less than ideal in my case!

So, while by now the festive QRM is hopefully gone until next year there are still plenty of other sources 24/7 so I thought I would revisit the idea and make up a new antenna. The grass presently does not need cutting and Dylan has calmed down a bit.

Description

The LoG is a really simple concept and has been explained in good detail by **Matt Roberts KK5JY** at the URL below and elsewhere.

www.kk5jy.net/LoG

The loop element in Matt's design consists of a square loop of wire which will just lie on the ground and has 15ft sides, so 60ft of wire in total. It is fed in a corner with any reasonable length of either 50Ω or 75Ω coaxial cable, **Fig. 1**.

To provide a match at the feedpoint a small transformer is included in the design.

Matt has modelled the LOG using EZNEC and has found that at lower frequencies there are bi-directional lobes off the points of the loop 90º to the feedpoint.

Construction

The transformer is simple to make: It consists of a 73-mix FairRite 2873000202 binocular core with just a few turns of insulated wire. The high-impedance (antenna) winding uses five turns if 75Ω feeder is being used (6.25:1 ratio) or six turns for a 50Ω feeder (9:1 ratio).

The LoG itself is not grounded. The transformer provides DC isolation so should reduce any Common Mode Current. If the feeder is grounded as it enters the building, then this will provide a certain degree of lightning and static rejection. (But that said, always disconnect antennas during storms!)

As Matt points out, the LoG antenna is not resonant (by design) and therefore feeder selection is not critical.

Low-loss 75Ω cable such as RG6 should be more than adequate for most installations. It is also feasible to use F connectors with this antenna, which, along with RG6 cable, makes this antenna a very cheap option.

The loop itself can use any suitable, preferably insulated, wire. It is laid on the ground with 15ft each side.

I rebuilt this second LoG using a 3D-printed transformer enclosure that I had lying around spare (so it is a bit larger than really needed). Commercially made cases are of course available! The Evatron RX3009 is a cheap little box for jobs such as this; however, it is not waterproof and would require some waterproof sealant around the base to keep out moisture. Another is the Hammond RP1025 Polycarbonate box. The RP1025 is IP65 rated and is probably a good choice for something that may lie on or near the ground. I have often supplied these to

Fig. 1: Loop on Ground diagram. Fig. 2: Completed Transformer Box. Fig. 3: AN-SOF predicted radiation pattern at 3.5MHz. Fig. 4: Transformer response with 450Ω load.

customers when a weatherproof enclosure was required.

Matt used the Hammond 1551RBK for his LoG; these are IP54 rated so not quite as ideal to cope with the UK climate.

All of these cases are available in the UK from Rapid Electronics and I believe that Mouser and Digikey supply them also.

My completed transformer box may be seen in **Fig. 2**.

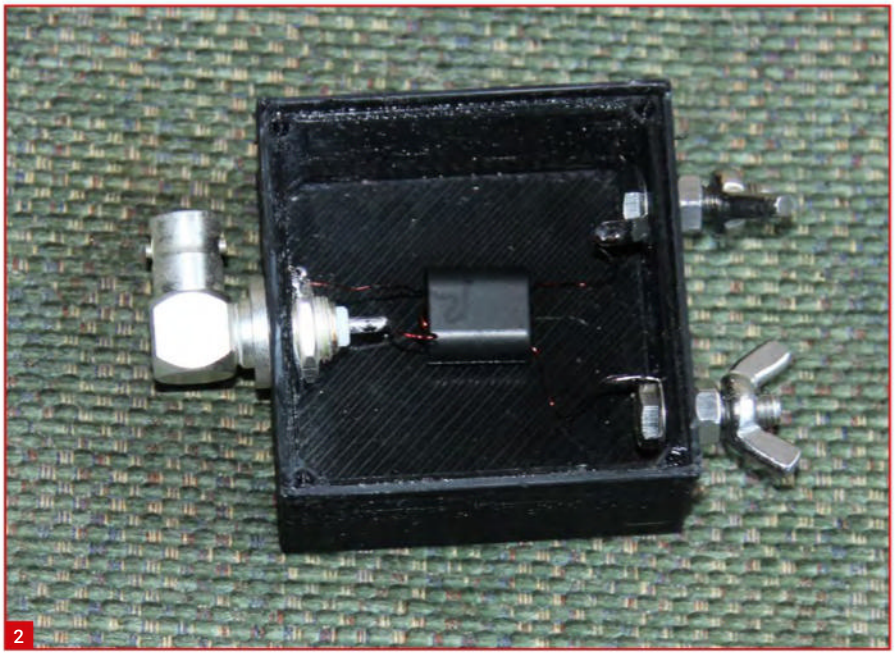
For the feeder connection I have used a right-angle BNC and this is purely because I have a boxful of them and they incorporate a rubber seal which I thought would be useful in keeping moisture out.

The antenna element is connected to two M5 studs, which are merely two M5 A4 stainless steel bolts fixed through the case sides and A4 stainless wingnuts to lock the wire. A2 grade are more than suitable in most cases.

The transformer is set into the case using hot melt glue. I wound the transformer using 26swg enamel copper wire using 2T/6T to match the 50Ω RG58 that had been run out to the antenna. One turn is a thread of wire through one hole in the core and back through the other.

I dug out the original wire element I used for my previous LoG incarnation and decided to use that rather than cut a new piece. This wire is simply light gauge hook-up wire which I have had for years.

To peg the wire down I used some 3/32 (2.4mm) mild steel rod that I have in a vast quantity (no matter how much I use or what I use it for the bundle never seems to go down!). I just snipped off a few suitable lengths then formed the ends over to make a peg. How, or if indeed, the use of mild steel does affect the loop, I don't know.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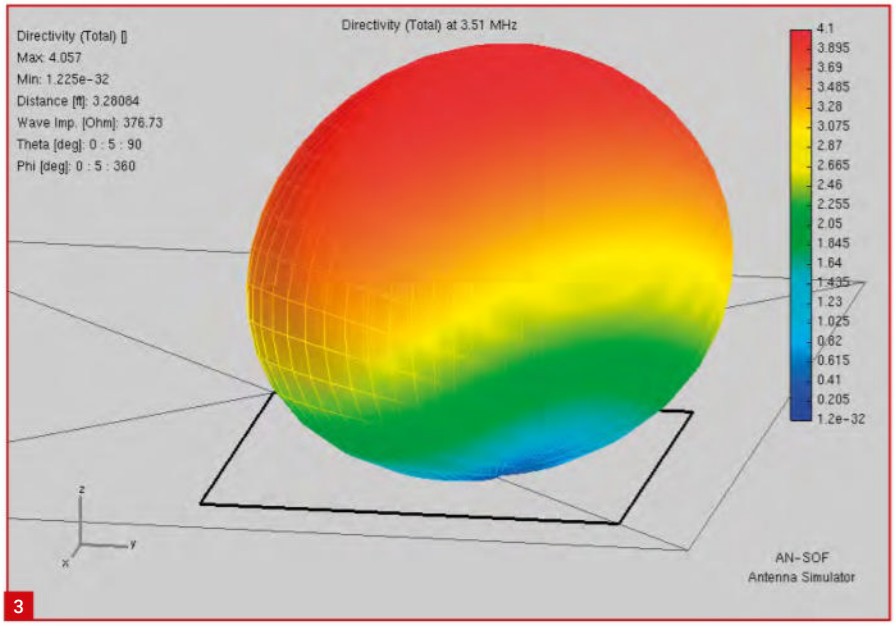

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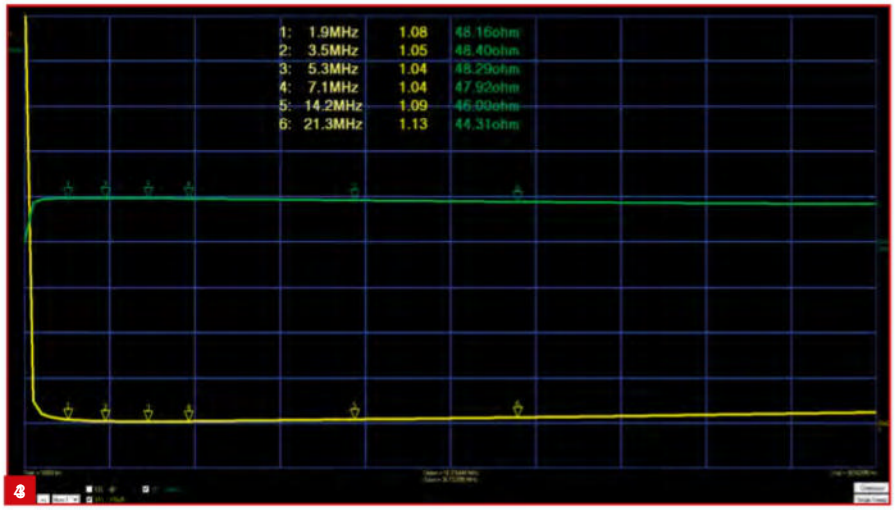

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Evaluation

The antenna was evaluated mainly on SSB and CW with it staying in place all over the Christmas period and comparisons were made with my version of the 'ARRL design' End Fed.

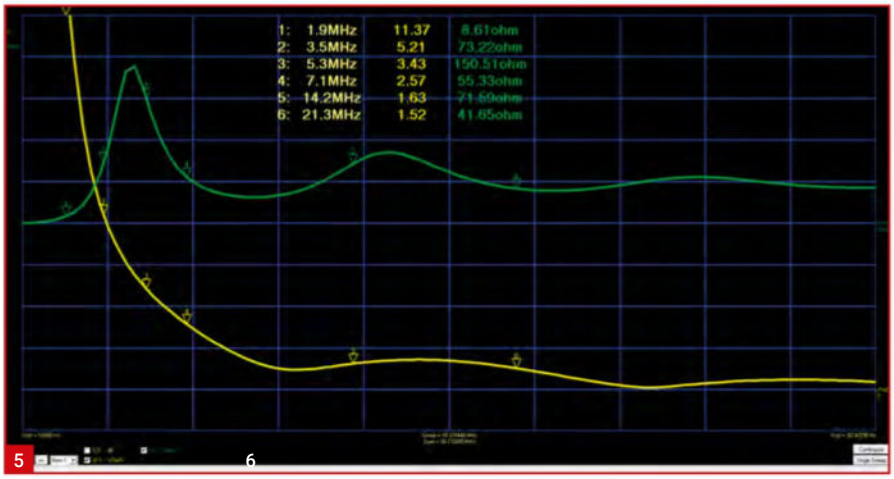
www.arrl.org/end-fed-half-wave-antenna-kit

The end -fed is around 66ft long and is presently set up at 20ft.

First off, and it should be obvious, expect that signal levels on a LoG are going to be considerably lower than those from a half decent antenna which is up in the clear and that both antennas will have differing radiation patterns that will vary with frequency.

I ran an AN-SOF model to compare with that of Matt's EZNEC plots on his website and they are similar. The AN-SOF predicted radiation pattern

Fig. 5: Actual transformer response connected to loop. Fig. 6: Deployed Loop on Ground.



at 3.5MHz modelled over moderate ground can be seen in **Fig. 3**. As frequency is increased the pattern becomes more unidirectional with the angle becoming more vertical.

I made comparisons on all bands from 160m to 10m using an A/B switch to instantly compare signals. As the FT-990 is a steam driven pre-SDR I have no waterfall displays to provide details of the effects of switching. So, what I have used are relative signal strength readings off the set's S-meter and audible comparisons to assess the SNR. Remember, what we are looking for is a better signal-to-noise ratio (SNR) and this is what the LoG is capable of providing.

On 17m and above most signals seemed to be 3-4 S points down on the LoG but everything heard on the end-fed was also heard on the LoG. On 17m mid-band the noise floor rose to S8 on the end-fed with some signals being lost while these were perfectly audible on the LoG with a noise floor of just S2.

On 15m the LoG did not perform quite as well. Weak signals just heard on the end-fed were not always heard on the LoG. On 10m the overall SNR was much better on the LoG even though levels were lower.

On 20m the LOG performed surprisingly well with everything heard on the end-fed heard on the LoG but with a much reduced level of background noise making reception less tiring.

30m performance was similar to 20m. Just out of band RTTY station DDK9 averaged S9 on the end-fed dropping to S5 on the LoG but with much better SNR, making a marked difference.

Where the LoG really shone was on 40m to 80m, both during daylight where the antenna's high radiation angle no doubt aided NVIS and also after darkness where background noise was much reduced. While signals were down compared to the end-fed, signal readability was markedly better with signals lost in the noise perfectly readable on the LoG. Some signals on 80m, S8 and readable with difficulty, dropped to S3 but fully readable.

On 160m I felt that the LoG might have been running out of puff as the differences between the two antennas was small. That said, the noise floor was lower on the LoG. Perhaps a pre-amp is needed here, or perhaps a bigger loop or even the use of an AMU?

On the HF broadcast bands I found that, ironically, the LoG was picking up non-notched PLT QRM slightly more than the end-fed, bearing in mind the different radiation patterns of the antennas.

Medium Wave reception on the LoG was poor during daylight; again perhaps, a bigger loop is needed. Probably because of the high radiation angle of the LoG this improved during darkness.

Overall, I found many weaker stations easier to copy on the LoG.

After construction I used the FA-VA6 analyser to firstly check the transformer by displaying the VSWR and Z using a 450Ω load. The VA-6 result being displayed via the VNWA software in **Fig. 4**. We can see a good flat response over the whole MF and HF bands. The actual matching of the LoG may be seen in **Fig. 5**.

The VSWR is quite high at 5.2:1 on 80m rising to 11:1 on 160 and this may explain its indifferent performance on 160m and also MW. Perhaps when the weather is warmer this is something I might to look into. **Fig. 6** shows the deployed loop.

Conclusion

Does the LoG work? Yes, and in my view the LoG can be considered as a viable receive antenna for those suffering from QRM. Signal levels may well be down compared to the conventional antenna but so will the QRM and in most cases those weaker signals will be easier to copy.

Pretty much everything I could hear on the end-fed could be heard on the LoG, often with better clarity and there were quite a few cases where signals could only be heard under the QRM using the LoG.

Performance of a LoG will depend on your local environment, soil type, ground moisture and a number of other factors. It is, I think, worthy of more experimentation such as orientation and loop size for example.

The antenna plots are provided as a guide. With the antenna sitting on the ground and probably with other objects nearby it will be difficult to say definitively that the actual radiation pattern will exactly match the model. It will also make a difference on what type of ground you have and its condition, i.e. is it dry or perhaps wet.

That said, this design must be one of the cheapest to make antennas out there, probably the easiest to implement and easiest to build too. If you decide to try one, please let me know how you get on! I have kept to imperial measurements to compare with KK5JY's loop details. **PW**

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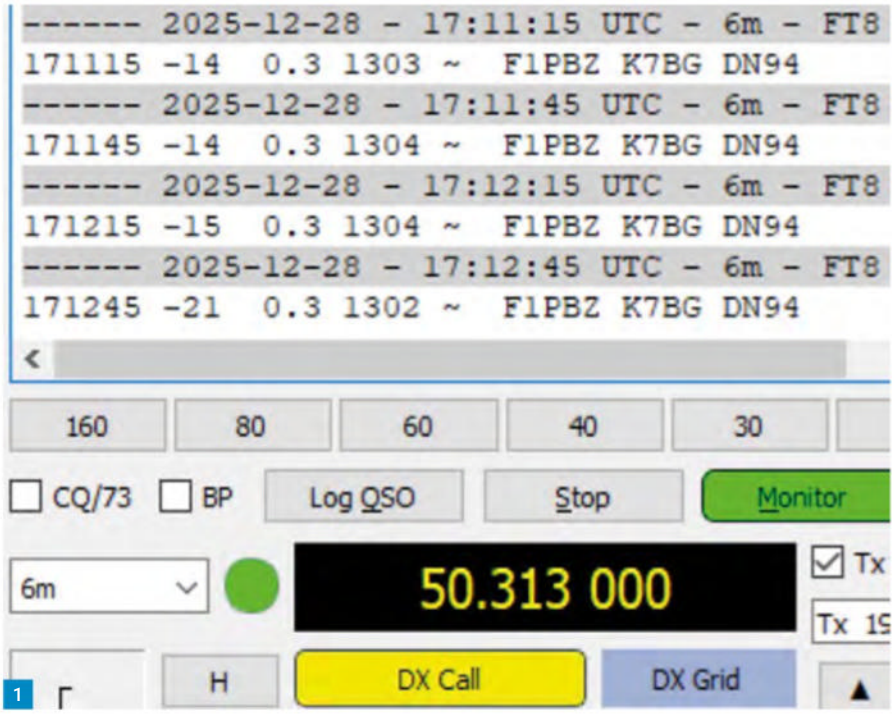

Storm Damage!

Tim GW4VXE reports that some serious VHF ops suffered significant antenna damage as a result of the recent storm.

I'm writing the column a couple of days after Storm Goretti passed through the UK. It's not often, thankfully, that I hear the words 'Hurricane Force' on the marine band, warning ships to take precautions, but this was one occasion when I did. Fortunately, here in West Wales although the winds were strong, they were not extreme.

In the south west of England, though, things were much worse and I am aware that a number of friends of this column suffered significant damage to their property and stations. I'm sure all readers will join with me in wishing them well for the work that is to come.

A good QTH for DX often has its challenges from weather.

VHF/UHF SOTA Challenge for 2026

Many thanks to **Simon Davis-Crane G7WKX** for highlighting the details of a new VHF/UHF SOTA Challenge for 2026.

The introduction to the press release from the SOTA Management Team reads, *"The MT believes this provides a great opportunity for interesting QSOs in the coming year. Many activators and chasers will have access to equipment already for these bands and modes - whether the old faithful FT-817 and FT-857s or newer options like the 2m option for the KX3, the timely CW modification to the cheap and cheerful Quansheng handhelds or the ubiquitous 2m transverter kits available on various auction sites for relatively low cost. Many antenna options are available, whether lightweight yagis, hentennas, oblongs, quads, flowerpots or J-poles (slim or otherwise). Many propagation modes are available. This should provide an interesting and challenging year for each individual participating, where the activators and chasers will have their work cut out to make QSOs under different conditions and via different means"*. You can read the details of the challenge for yourself at **https://tinyurl.com/267fvk8b**

This is great news though and I hope it will lead to some more VHF/UHF activity from some good locations. 2m FM activity in SOTA areas is high and I'm lucky enough to hear much of the VHF activity from Eryri (Snowdonia) here in West Wales. It'll be good to see if activators take to the challenge. Even a simple Quansheng handheld that you can stick in your pocket on the way to the summit will 'do' some DSB or CW, which given the elevated position, ought to be audible for a considerable distance. I'm looking forward to hearing how it goes!

FreeDV RADE

Jef VanRaepenbusch ON8NT mentions this mode and says he did some tests with ON4LX on 2m and ON4PN on 70cm. They found that they could reduce power to much less than a watt and still have armchair copy with excellent audio. Jef says that ON4LX made some RADE QSOs on QO-100 using 1W and a 1m dish in his living room.

Ian Bontoft G4ELW has been trying RADE out too and writes, *"I finally got around to configuring my FT-991A – if you are already configured for WSJT-X, then it's really not hard. After a couple of QSOs on 60m I decided to try it on 2m so arranged a QSO with **John G4HUK** in Ilminster.*

"Ilminster is not that far from Westonzoyland, so we both used just 10W to collinears. John has his collinear on a Racal extendable mast but that had frozen up in the cold weather so was quite low (around 2m). Mine is on top of the house but given that we are at less than a metre a.s.l. it was no surprise that neither of us was a particularly strong signal.

"RADE performed brilliantly. I've often heard the phrase "you sound like you are in the same room as me" *on the inter G 60m nets and that was one of the first things that John said to me. I use C4FM occasionally and the audio quality was far better than that, so I assume that the same applies to D-STAR and certainly DMR. In terms of signal strength, John occasionally dropped down to -2dB SNR and yet there was no break up. Interestingly John could also not hear my RADE signal on analogue but also did not experience any drop-out.*

"So, I am wondering where this all fits in to things on VHF. Certainly, the fact that RADE is open source appeals. I sometimes feel that we allow ourselves to be tied to different manufacturers by their proprietary modes. It's also interesting to read their thoughts on RADE over Baseband FM":

https://freedv.org/radio-autoencoder

It's interesting that both Jef and Ian note good performance for quite low signal strengths – I wonder if the mode will become popular?

The 6m band

Six metres is full of surprises! Here at **GW4VXE**, on 28 December, I was in the shack but playing around on HF CW. I glanced up at the 6m FT8 screen and was rather surprised with what I saw – several periods of K7BG (DN94) calling a French station, **Fig. 1**. This was a particular surprise, as my 6m beam was pointing towards the south-east. Needless to say, I didn't notice this until it was too late, but I took the opportunity to email **Matt K7BG** (South Dakota) to give him a reception report at least. Matt replied quickly to say that for him, too, the opening had come out of the blue, he'd been CQing and suddenly saw decodes from two

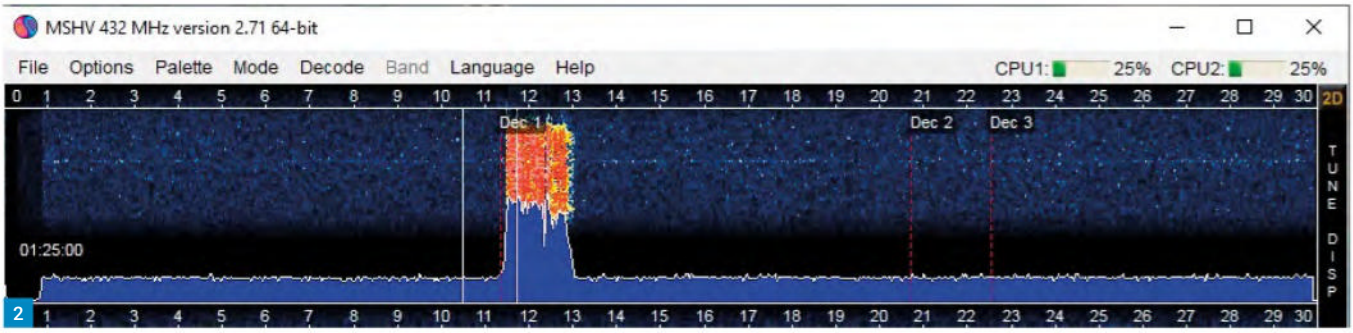

Fig. 1: A screenshot of K7BG on 6m as received by GW4VXE in a brief opening on 28 December.
Fig. 2: A meteor burst from OK1TEH on 70cm as received by G4NBS.
Fig. 3: Endaf N6UTC operating satellites from the DM15/DM16 grid line.

French stations who he started to call, but the opening was a fleeting one. Looking at the path, I was fascinated to see that I was directly on the great circle path between K7BG and the French stations. As far as I could see from PSK Reporter, no-one else had copied K7BG away from the great circle path. Hoping that this might be a 'regular' opening, both K7BG and I tried for a couple of days following this, but without success. Discussing this later online, I could only agree with **Andy G4PIQ** who said that this was just the sort of propagation that FT8 is so good at highlighting.

I caught a good Es opening on 19 December with around 40 stations being worked on FT8. The highlight was working my first stations from Belarus: EU1KY (KO33), EW3EO (KO22) and EU3A (KO12).

On 6 January, the band opened to the east and I was pleased to work UR5LAK (KN89) at 1645UTC. I had to go QRT, but a little later, around 1900UTC, **Dave G0CER** reported that the band was open briefly to the US and Canada.

Roger Lapthorn G3XBM (Cambridge) says he's got little to report although most times that he goes on FT8 on the band he seems to be heard quite widely across Europe, which isn't bad going with 5W to a V-2000 vertical. Roger thinks it may be Es but it's hard to say.

The 4m band

It's good to hear from **Franz Van Velzen OE3FVU** who brings the news that the first 70MHz licences have been issued in Austria. Franz says that he knows licences have been issued to OE1SOW, OE8MPR, OE6BME, OE4EIE, OE6VIE and himself. The licences are valid for a year and power is limited to 25W between 70.150 and 70.175MHz. Frans says that several of the stations have already been able to work some DX. Frans says that he has been active on meteor scatter and has worked PA, OZ, SM, ON, OH, GM and G using 25W and a 6-element beam.

The 2m band

Roger Greengrass EI8KN (Co Waterford) enjoyed the tropo in late December. He said it was very frustrating watching people further east work lots of DX when it wasn't available to him! Fortunately, the propagation finally arrived on 28 December when Roger worked a good number of stations including DG1BHA (JO73), SM7KOJ (JO66), SM7WW (JO65) and OZ1EFW (JO56). Next day, Roger worked HB9EFK (JN46) and F6GHG (JN28). During the Quadrantids meteor shower, Roger was active on MSK144 and made some nice QSOs including F4VTP (JN14), UA2FZ (KO04), LA0GE (JO59), SM4KYN (JO69), SP7VVB (JO91) and IV3NDC (JN65). Roger was particularly pleased with the QSO with UA2FZ in Kaliningrad at 1848km which was a new 2m DXCC (#50) and a new square. Roger found the best reflections to be on the Saturday afternoon (3 January).

Jef ON8NT (Aalter) enjoyed the December tropo too. On 23 December he worked M0PNN (IO82) but the opening got going on 27/28 December when Jef worked DK2AM (JO43), EI4ACB (IO62), EI5HHB (IO63), EI8IQ (IO62), EI8KN (IO62), G0CER (IO82), G4APJ (IO83), G4EEM (IO93), G4HGI (IO83), G4ZAL (IO80), G6WRW (IO82), G7RAU (IN79), G8KUZ (IO83), GI4FUE (IO74), GI4KSO (IO64), GI4OWA (IO64), GI6ATZ (IO74), GM1DSK (IO86), GM3AND (IO86), GM3DRA (IO86), GM3SEK (IO74), GM4VYQ (IO76), GM4YXI (IO87), GM7PKT/P (IO64), GM8DOR (IO86), GW4HDF (IO81), GW4SHF (IO82), GW7SMV (IO81), M0GME (IO94), M0PNN (IO82), M0XVF (IO94), M9DJN (IO82), MI0IHH (IO74), MM0CEZ (IO75), MW0AXA (IO81) and OZ1IIL (JO74). On 29 December, Jef worked HB9EFK (JN46) and MD0MAN/P (IO74) on FT8 and GW4SHF (IO82) on SSB.

Tony Collett G4NBS (Cambridge) enjoyed the late December tropo working DL1SMA (JN48), DL2ALY (JO63), DG1BHA (JO73), F1DUZ (IN97), F1JBN (JN06), F1UPT (IN98), F4JRI (IN98), G0CNN (IO94), G8KBM (IO92), GM0HLV (IO88), GM0HTT (IO89), GM3DRA (IO86), GM4GZW (IO86), GM7PKT/P (IO87), LA6GKA (JO29), OV3T (JO46), OY9JD (IP61), OZ1KEF (JO56), OZ9FW (JO65), SM6BFE (JO68), SM6MUY (JO67), SM6VTZ (JO58), SM6YNO (JO67), SM7EYW (JO65), SM7VUK (JO66), SM7WW (JO65) and SP2FRY (JO83).

Tony was active during both the Geminids and Quadrantids meteor shower working the following stations; CT1HIX (IN52), EA1IW (IN83), EA1TX (IN71), EA2BFM (IN83), EA2DR (IN83), EB5EA (IM99), HA2NP (JN97), I3FGX (JN55), IN3UPQ (JN56), IV3GTH (JN65), IW1ACL (JN35), LA0GE (JO59), OK1JBR (JN79), OM1DK (JN87), OM5CM (JN98), SM3XGV (JP81), YT7KW (KN05) and YU7SMN (KN05).

Peter Atkins G4DOL (Dorset) made some random MS QSOs on 14 December during the Geminids using a 5-element Yagi to work EA2LU (IN92), EA3EHQ and EA1IW (IN83). Peter

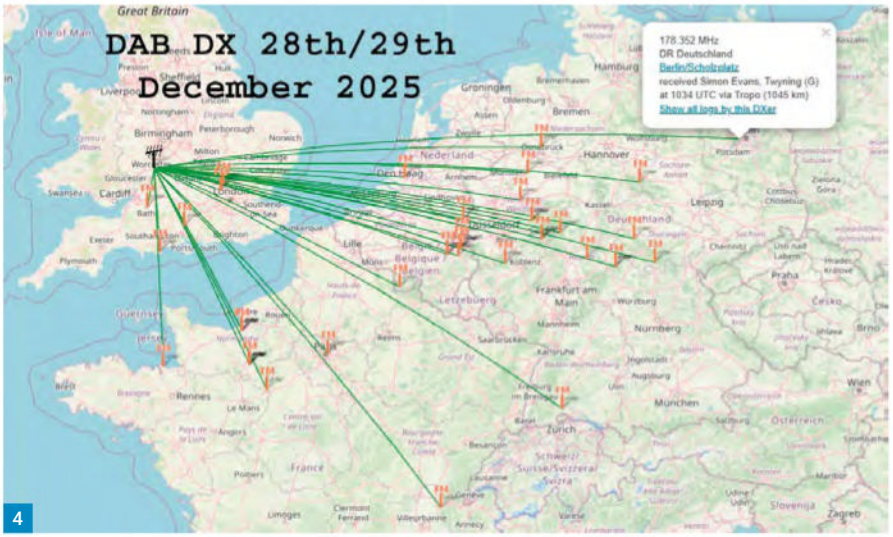

Fig. 4: DAB DX as received by Simon Evans during the late December tropo.

checked the band during the Quadrantids on 3 January and made one random QSO with CT7ABA (IN60).

The 70cm band

Roger EI8KN had a great time with the late December openings, working many stations, the highlights of which are: OZ6HQ (JO45), DL2AKT (JO50), DK5WMA (JO60), OK1VUM (JN79), ON8NT (JO11), OK1JBR (JN79), OZ1SKY (JO56), DJ8MS (JO63), OZ1FKZ (JO56) and OZ7UV (JO65).

On 28/29 December Jef ON8NT worked EI3KD (IO51), EI8KN (IO62), GI4SNA (IO64), GI6ATZ (IO74), GM4FVM (IO85), GW3ATZ (IO83), GW3TKH (IO81), GW4HDF (IO81), GW4SHF (IO82), M0DSR (IO82) and MI0IHH (IO74), all on FT8.

Tony G4NBS found the late December tropo very productive, working the following: DF1EO (JO31), DF1VB (JO31), DK7UY (JO44), DL6ED (JO31), F1JBN (JN06), G1EXK (IO95), GI4SNA (IO64), GM4FVM (IO85), HB9EFK (JN46), M0IOY (IO93), MW1BAJ (IO71), OZ1FKZ (JO56), OZ2ND (JO46), OZ4VW (JO45), OZ5AGJ (JO47), OZ6HQ (JO45), OZ7UV (JO65), OZ8ZS (JO55), OZ9GE (JO66), PA7RP (JO22), SM6FBQ (JO67) and SM6MVE (JO67).

Tony writes *"During a 2m sked during the Quadrantids I was seeing so many reflections thought it worth a try on 70cm so sked with YO2NAA started at 2330 and completed in 40 minutes. I only had a few weak & short pings and FSK441 was a bit of a jigsaw to get the required info.* ***Ady*** *though was receiving more of me and even decoded my final 73 complete with my locator.*

"That was followed with OK1TEH [**Fig. 2**]. *First 40 minutes nothing decodable seen by either of us so we switched from HOT B (88 degrees) to HOT A (107 degrees) and instantly got several strong reflections – screengrab shows just how strong, that was the longest one I saw. From then on I regularly saw* ***Matej*** *still sending the same report but he took another 35 minutes before he received my RRR".*

Really great 70cm QSOs. Meteor scatter on 70cm is hard going and historically contacts have been few and far between so these results are spectacular!

The 23cm band

Roger EI8KN was also active on 23cm during the late December tropo, working G7RAU (IN79), GI6ATZ (IO74), PA5DD (JO22) and EI3KD (IO51).

Satellites

Jef ON8NT monitored the RS-38S SSTV transmissions between 3 and 13 December and says that out of the 34 pictures only eight were of acceptable quality. He mentions that getting good quality pictures from RS-38S is much harder because the transmit power of the satellite is much lower than the ISS. Jef also received SSTV from Arcticsat-1 on 25 December. On RS-44, Jef was very active working a lot of stations on FT4: AC9DX (EN45), DL3NGN (JN59), EA6AOT (JM19), F5LMG (IN88), G1YEF (IO83), KB1HY (FN31), LZ1ZM (KN32), N1NAZ (FN42), N2YZH (FN22), OZ3EAV (JO55), PA3AIW (JO21), PD9FVW (JO32), R5AO (KO86), RC6ZT (KN98), SA7AHC (JO76) and W2GDJ (FN32).

It's great to hear from **Patrick Stoddard WD9EWK** (Phoenix) giving his summary of satellite activity in North America and beyond. Patrick writes, *"Before 2025 ended, I made one more road trip to work satellites. I went first to San Diego, operating from locations in grid DM12, including the Cabrillo National Monument, which overlooks San Diego harbor and some of the US Navy bases in the area. Then a drive up the Pacific coast to Los Angeles and meeting up with* ***Endaf N6UTC/MW1BQO*** *for our annual trek to the Mojave Desert northeast of Los Angeles to work satellites.*

"Before I met up with N6UTC, I spent a day and a half operating in and around San Diego, in grid DM12. I started at a point in the desert east of San Diego, on the DM12/DM22 line, for a few hours. Then I drove into San Diego and planned a visit to the Cabrillo National Monument for more operating before the drive to Los Angeles. Despite being next to a harbor, a few military bases, and other airports, the monument is a good place for working satellites.

"After driving up to Los Angeles, N6UTC and I set out for the small town of Trona, on the northern end of the Mojave Desert northeast of Los Angeles. We have made this trip over the past few years, heading to the DM15/DM16 grid line and a most quiet spot to work satellites [**Fig. 3**]. *We had a productive day out there. For the final day out there, we drove to the town of Boron and the DM14/DM15 grid line, next to Edwards Air Force Base. Boron is next to a county line, separating Kern and San Bernadino counties. I operated on the DM14/DM15 line in Kern County. N6UTC parked on the DM14/DM15 line a couple of miles east of me, in San Bernadino County. We worked each other, along with other stations around North America, before driving home. Another fun radio trip!*

"As I write this, SO-124 (HADES-R) is still operational. AMSAT-EA had reported it is near its end of life, with re-entry happening in the next couple of months. SO-125 (HADES-ICM), its twin, is also still operational. PO-101 (Diwata-2) has been reappearing in the New Year, still operating well after several years in orbit. SO-50 continues its long life in orbit. The Kenwood radio on the Russian side of the ISS is not in service right now. A reset is planned, to see if it can be brought back to life. The Kenwood radio in the European Columbus module still provides the cross-band voice repeater many hams enjoy using. For SSB satellite operations, four satellites (AO-7, AO-73, JO-97, and RS-44) continue to serve those operators. And QO-100, for those in its large footprint..."

FM and DAB DX

Simon Evans (Twyning) found the broadcast bands interesting on 28 and 29 December, **Fig. 4**. On FM, Simon's best DX was SWR3 from Germany on 101.1MHz at a distance of just over 750km. On DAB the best DX was DR DE on 5E from Berlin over a distance of 1045km.

And finally

That's it for this month. Thanks to everyone who has contributed, it's much appreciated. See you next time. **PW**

1

Telegraphy Meets Cryptography

Georg Wiessala discusses Cooke, Wheatstone and the Playfair Cypher.

Georg Wiessala
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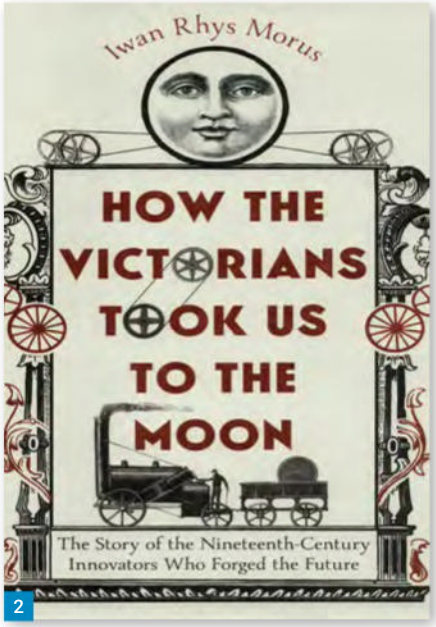
Welcome back to the amazing world of radio history. As I write this, I am investigating the fascinating history of radio and cryptology, hoping to share more on this with you here soon. I also enjoy learning about early radio equipment (**Fig. 1**). Plus, I am currently inspired by three books you might enjoy as much as I did. *50 Codes That Changed the World*, by **Sinclair McKay** (2023), *How the Victorians Took Us to the Moon*, by **Iwan Rhys Morus** (2022; **Fig. 2**), and *The Victorian Internet*, by **Tom Standage** (2024; **Table 1**). To cap things off, I am always intrigued by unusual and 'weird' signals (e.g., *TSM* January 2025: 27). For me, covert transmissions, clandestine stations and cryptography are bedfellows. This month, I'd like to invite you to time-travel back with me to meet some electric, and eclectic, inventors, pioneers and entrepreneurs in this field.

Less than halfway through the revolutionary age that was the 19th century, we meet two gentlemen of great engineering talent and sharp business acumen, **Charles Wheatstone** (1802-1875) and **William Fothergill Cooke** (1806-1879) (**Fig. 3**). On 10 June 1837, these two were granted a patent for their *Electric Five Needle Telegraph* (**Fig. 4**). Thus, the Victorian 'Internet' was born. Wheatstone and Cooke made the Victorian heart beat to the click of their telegraph and coding machines. The Victorian Age was 'turbo-charged' by the widespread use of telegraphy, the growing railway network, and the global undersea cables.

When one looks even just a little more into technology, telegraphy and metrology (measurement) throughout the Victorian era, one cannot help but come across Charles Wheatstone. Not only was he one of the fertile brains behind the telegraph, but he also devised ground-breaking cryptologic devices and systems, among them, the eponymous *Wheatstone Cryptograph* (**Fig. 5**), the *Playfair* Cypher (of which more below) and the *Wheatstone Bridge*, by which an electrical balancing of currents could be achieved. Wheatstone and Cooke must surely count as two of the most innovative scientists of the Victorian Age.

Victorian genius genes: innovation and spectacle

But high-tech 'progress' was in the age's DNA. Victorian technology expert Rhys Morus notes (2022: 145) that, *"the appreciation of innovation was ingrained in Victorian culture"*. The notion of progress through an *electrical* future, and the desire to make a 'spectacle' of new machineries, are not unique to our times. They were utterly characteristic of the Victorians. The 'spectacle' happened during events, such as the *Great Exhibition* (1851)



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3a


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3d

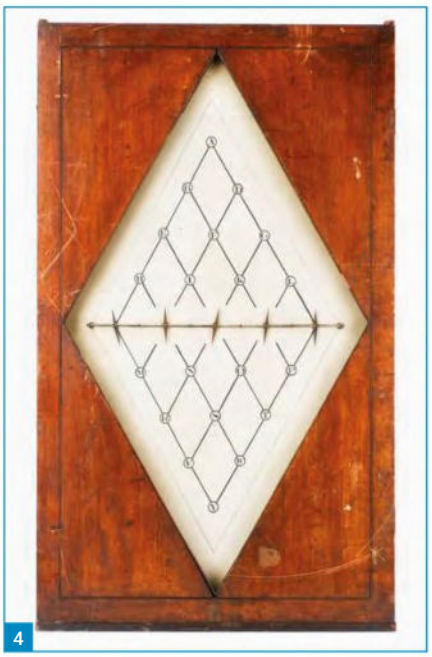
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Fig. 1: I am fascinated by early radio and cypher equipment, such as this Cooke and Wheatstone's ABC Telegraph Transmitter. Fig. 2: This is one answer to the question of "What Have The Victorians ever done for Us?" Fig. 3: William Fothergill Cooke (a) and his contemporaries: Frank Ives Scudamore (b), Charles Wheatstone (c), and Charles Tilston Bright (d). Fig. 4: An early Cooke-Wheatstone Five-Needle Telegraph at the Science Museum in London. Fig. 5: The Wheatstone Cryptograph Circular Coding Machine. King's College, London, is a repository of knowledge about Wheatstone.

and *Great London Exposition* (1862), for which Wheatstone, by the way, had invented an 'electric turnstile' to keep track of visitor numbers.

One example of Victorian ingenuity relevant to this article may suffice: The *Wadsworth Cypher Disk* is thought to be one of the first disc cyphers of the modern age. **William Friedman**, of the *Hamden Historical Society*, discovered it in Connecticut in the 1940s. The device was invented around 1817 by **Decius Wadsworth** (1768-1821), a Colonel in the United States Army Ordnance Corps. The disc looks impressive and was a part of the *Cipher-Wheels* exhibits at the National Cryptological Museum of the USA (**Fig. 6;** NSA FB Post by **Terry K. Bendell**; 26/27 April 2024).

The *Wadsworth Cypher Disk* and other ingenious vintage encoding devices made me think of what more such apparatus there might be, from early cypher wheels to the famous devices of World War II (1939-1945), like the *Enigma*, *Lorenz* and *Bombe* machines. What I would like to know now is how 19th-century technology lives on in our time. For example, how did the invention of the electric telegraph reverberate throughout the ages, into our times? My provisional thesis is that our modern technology is heavily indebted to its Victorian antecedents – the former being unthinkable without the latter.

Victorian ingenuity and modern cryptography

Here is just one story: When **Lt. John F. Kennedy's** *PT-109* patrol boat was sunk by the Japanese cruiser *Amagiri* in the Solomon Islands in 1943, the future US President came ashore on the Japanese-controlled Plum Pudding Island. From here, he was able to transmit an emergency message by telegraph. In so doing, he used a code based on the *Playfair Cypher* method (see below). Kennedy sent his S.O.S. from the isolated hut of an Allied coast guard to arrange for the rescue of his crew. He saved many, becoming an instant war hero, which must have boosted his political career. He might not have known, though, that the *Playfair Cypher* was invented by Wheatstone around a century earlier. Check out these URLs for more on this story:

Nova Online:
www.pbs.org/wgbh/nova/decoding/playfair.html
Tuscaloosa News:
https://tinyurl.com/424ca54h

In more recent times, the halcyon days of 'secrecy and radio' are said to be the postwar era. What instantly comes to mind for observers of my generation are the cyphers, decoders and one-time pads used by covert operators during the Cold War, the famous 'number' stations, and the machines built for their encoding. For many who, like me, grew up in a divided Germany, it is hard to forget such devices as the (East) German *Sprach-Morse Generator* (Speech-to-Morse Generator, **Fig. 7**). As an undergraduate, listening to East German radio and number stations became a hobby of mine, using my much-missed Grundig 650 Satellit '*Europa*' radio. Today, special groups (*ENIGMA2000*, *Priyom*) can help take the slog out of researching and updating the increasing number of crypto-radio transmissions.

ENIGMA 2000:
www.signalshed.com
Priyom:
https://priyom.org

The *ENIGMA* Group takes its name from the encoder developed by **Arthur Scherbius** (1878-1929) from 1918 onwards, for use in World War I (*Iron Cross Magazine* No. 22, December 2021: 39; *The Spectrum Monitor*, July 2024). As you will know, *Enigma* consisted of a blend of mechanical and electrical subsystems and was deployed and decoded during World War II (1939-1945). And, while Scherbius is unknown today, you might be more familiar with the American **Edward Hugh Hebern** (1869-1952).

In terms of radio and encryption, Hebern is a personified link between the 19th and 20th Centuries; he bestrode the lifetimes of both Wheatstone and Scherbius. He invented a clever 'electro-mechanical machine', in which the 'key' was embedded in a rotating disc – a 'rotor-machine'. The gears inside encoded a substitution table that changed every time a new character was typed. Hebern and his contemporaries stand in a direct line of succession, so to speak, to the creative Victorian telegraphy inventors and cypher disc makers.

The Cold War is covered disproportionally well when it comes to spy radio, encryption and coding. In fact, I've lost count of the stuff available on Nazi Germany, Bletchley Park, **Alan Turing** (1912-1954), and the *Enigma* and *Bombe* devices. Plus, observers like **Paul Beaumont** and **H. J. Hagerman** have contributed extensively to our knowledge about modern radio spy craft (*RadioUser*,

2018). However, there is an imbalance: the surfeit of materials on British or Allied codebreaking is not matched by anything near as much on German or Continental European cyphers. One notable exception to this is, perhaps, the recent account *The Third Reich is Listening*, by **Christian Jennings** (Osprey, 2019).

The Crypto-World surfaces

Many of the early radio and coding contraptions referred to above can now be seen in international museums, such as the International Spy Museum, the London Science Museum, the National Cryptologic Foundation, the National Maritime Museum, and many others. Engaging exhibits and galleries enable visitors to travel back to the 19th century. Next to the stunning devices themselves, however, there is a cultural context to be mindful of.

In the Victorian Age, the electric telegraph, telephone, and railways were as transformative as Artificial Intelligence (AI) and the internet are today. Iwan Rhys Morus argues (2022: 17) that the new telegraphic medium at the time played freely with notions of time and space – a bit like quantum mechanics today. More than that, behind the radical technical advancement of the Victorians lay a practical, business-driven purpose, i.e. the need for better transport, greater speed and more accurate measurement.

Measurement (Metrology) and radio, in particular, are useful frameworks for examining electricity, telegraphy, radio communications and cyphers. After all, the Victorian era promoted – worshipped even – mechanisation, transport, industrialisation and communication. These were all components of the first and original World Wide Web, and no work of art speaks to this more loudly than **Joseph Mallord William Turner's** painting *Rain, Steam, and Speed*.

Measurement and commerce

Beyond great art, there is also the scientific impetus, and **James Vincent** reminds us (2022: 12, 187/8) that, in Victorian times, "*the ability to accurately measure and meter electricity allowed for its commercial application in lighting, communication and more*". Here then, is the handmaid of telegraphy: it is commerce. Because, for electricity to be bought and sold, it had to be accurately quantified. After all, the standardising of units of electrical resistance, for example, was crucial to the laying of telegraph lines.

It was no coincidence that Wheatstone was a member of the *Committee on Electrical Standards* of the *British Association for the Advancement of Science*. He appears to have been *"an evangelist for accuracy and precision"*

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(BAAS; Rhys Morus, 2022: 176). Wheatstone's invention of the electric turnstile (see above) for the measurement of visitor numbers is, perhaps, a case in point.

But it was not 'all work and no play' for the promoters of the telegraph. In April 1845, for instance, a team of chess players in London took on a 'correspondence-chess' team in Gosport. They communicated by using an electric telegraph. An example, perhaps, of early 'online-gaming'?

https://tinyurl.com/2rh3btrh

However you see it, we would not have *Sailmail* and satellite phones today without all this.

A practical polymath

Against this cultural and technical background, a young Charles Wheatstone first learnt from his uncle, who was a manufacturer of musical instruments. Young Charles became interested in science after buying a book on the experiments with 'animal electricity', by **Alessandro Volta** (1745-1827), one of the electrical giants of a previous age. Music never left Wheatstone completely, and he later became famous as the inventor of the concertina, of all things (*Patent No.: 10,041, 1844*).

As a mine of information, Wheatstone was interested in lots of things: optics, time measurement, and even the physical properties of sound. He worked on the further evolution of generators, turnstiles and motors. He built a dynamo, invented such audiovisual novelties as the 'stereoscope' and 'kaleidophone' and sought to determine the velocities of light and electrical current. His interest in electrical capacitance and inductance in submarine wires led to the laying of the first-ever underwater telegraph cable across Swansea Bay in 1844 (Kiewe, 1973: 111 ff.). But this is another story altogether.

Wheatstone was one of the first multilingual electrical engineers in Victorian science, joining the illustrious ranks of others who can be said to have laid the groundwork for us to fly to the Moon (Rhys Morus, 2022), more than a century later. He was also extremely well-connected; he would surely be on *LinkedIn* today. He knew of and became friends with eminent scientists, the likes of **George Stephenson** (1781-1848), **Michael Faraday** (1791-1867), **Ernst Chladni** (1756-1826), **Hans-Christian Ørsted** (1777-1851), **John Herschel** (1792-1871), and a plethora of other luminaries of the Age.

For sure, there had been 18th-century telegraphy experimenters before Wheatstone. But he and Cooke turned out to be the ones with the right ideas at the right time. Interestingly, Wheatstone is also said to have

been shy in public, at times running away from his own public speaking engagements (**Forbes** and **Mahon**, 2014: 102). All new lecturers will appreciate this phenomenon. Notwithstanding this, Wheatstone was appointed first Professor of 'Experimental Philosophy' (Science) at King's College London in 1834.

Electrical showmanship and the ownership of expertise

We know that the telegraph was also the brainchild of William Fothergill Cooke, with whom Wheatstone joined up, acquiring the patent mentioned at the beginning of this article in 1837. The early story of their partnership was one of harmony, as has been detailed brilliantly in J.L. Kiewe's 1973 volume *Electric Telegraph*. The connection between the two electrified the whole world, in more ways than one: it helped to promote the idea of telecommunications delivering printed messages around the globe; the email of the day.

This push for such global interconnectivity stemmed from the predominant attitudes of the Victorians towards 'progress' and 'modernity', which have already been hinted at. This was coupled with a very Victorian desire to 'show off' and celebrate any new inventions. And this, in turn, sparked what has been termed *"a rush to the patent offices and exhibition halls"* (Rhys Morus, 2022: 197). The same author also noted earlier (2019: 25) that, *"The telegraph system that Cooke and Wheatstone patented was the direct product of the era's fascination with scientific – and especially electrical – spectacle*".

The Five-Needle (Hatchment) Telegraph emerged from the Wheatstone-Cooke team. Later versions sported fewer needles, but the five-needle variant was the first one to be in widespread use. However, like in many other areas of radio, egos got in the way. Kiewe (1973: 40) depicts this as follows: *"Wheatstone wanted scientific glory, with, if possible, substantial monetary reward as well. Cooke wanted commercial success with a fair proportion of scientific acclamation"*.

Consequently, it became disputed *who* had invented *exactly what* and to whom credit was due. The dispute became bitter, and the case had to go to external arbitration. To cut a very long story short, it was decided that Cooke had introduced the telegraph as a *workable instrument*, and Wheatstone had helped to establish the *intellectual, economic and social foundations* for its wider reception. The *Arbitration Report*, co-authored by **Marc Isambard Brunel** (father of **Isambard Kingdom**, 1769-1849) and chemist **John Frederic Daniell** (1790-1845), was – it has to be said – a veritable masterclass in electrical diplomacy. Alas, it was an uneasy truce.

Fig. 6: A Wadsworth Cypher Disc, an early coding device. Fig. 7: The Sprach-Morse Generator (Speech-to-Morse Generator) was emblematic of FRG-GDR Cold War crypto-activity. It would be unthinkable without the inventions of the 19th-century pioneers. Fig. 8: A simple illustration of the workings of the Playfair Cypher. Fig. 9: Key crib to the One-Needle, Two-Needle and Five-Needle Wheatstone Telegraph.

In 1837, Wheatstone and Cooke jointly demonstrated their telegraph system in public by stringing up a long line along the railway tracks between Camden and Euston and successfully transmitting and receiving messages. At the *Second International Exposition* in 1862, visitors marvelled at the Wheatstone telegraph, termed a 'magnetic telltale', which was on display there (Rhys Morus, 2019: 4; 2022: 81/2). Wheatstone went SK in 1875 and left his collection of more than 2,000 items – books, scientific papers and instruments – to King's College London. It is worth visiting the *Foyle Special Collections Library* there. Some items here were later transferred to the *Smithsonian Institution* in Washington DC.

Let's playfair and books of secrets: The Playfair cypher

During an already impressive career, in 1854, Wheatstone topped it all by inventing a cypher system that made waves: the *Playfair Cypher*, hinted at earlier. It worked through a method called 'digraph substitution'. This technique used a table in which one letter of the alphabet was omitted, and the letters were arranged in a simple five-by-five grid. Typically, the 'J' was removed from the alphabet, and an 'I' took its place in the text that was to be encoded. The method encrypted pairs of letters, instead of single ones, and was harder to crack. Wheatstone's system came to be known as the *Playfair Cypher*.

It is said that it was named for his friend **Lyon Playfair**, GCB PC FRS, First Baron Playfair of St. Andrews, who popularised and promoted the cypher and served on Select Committees of the House of Commons (Kiewe, 1973: 183). *Playfair* was in use as a field cypher until well into the 20th century. Remember the Kennedy-story from earlier on? British Forces also deployed the cypher in both the Boer War and World War I. Several other armed forces also used it as an emergency (backup) cypher in World War II. It is still possible to appreciate the elegance of a typical coding page used with Cooke-Wheatstone machinery (**Fig. 8**). Today, *Playfair* is still taught. It stands out by three cryptographic characteristics; it is:


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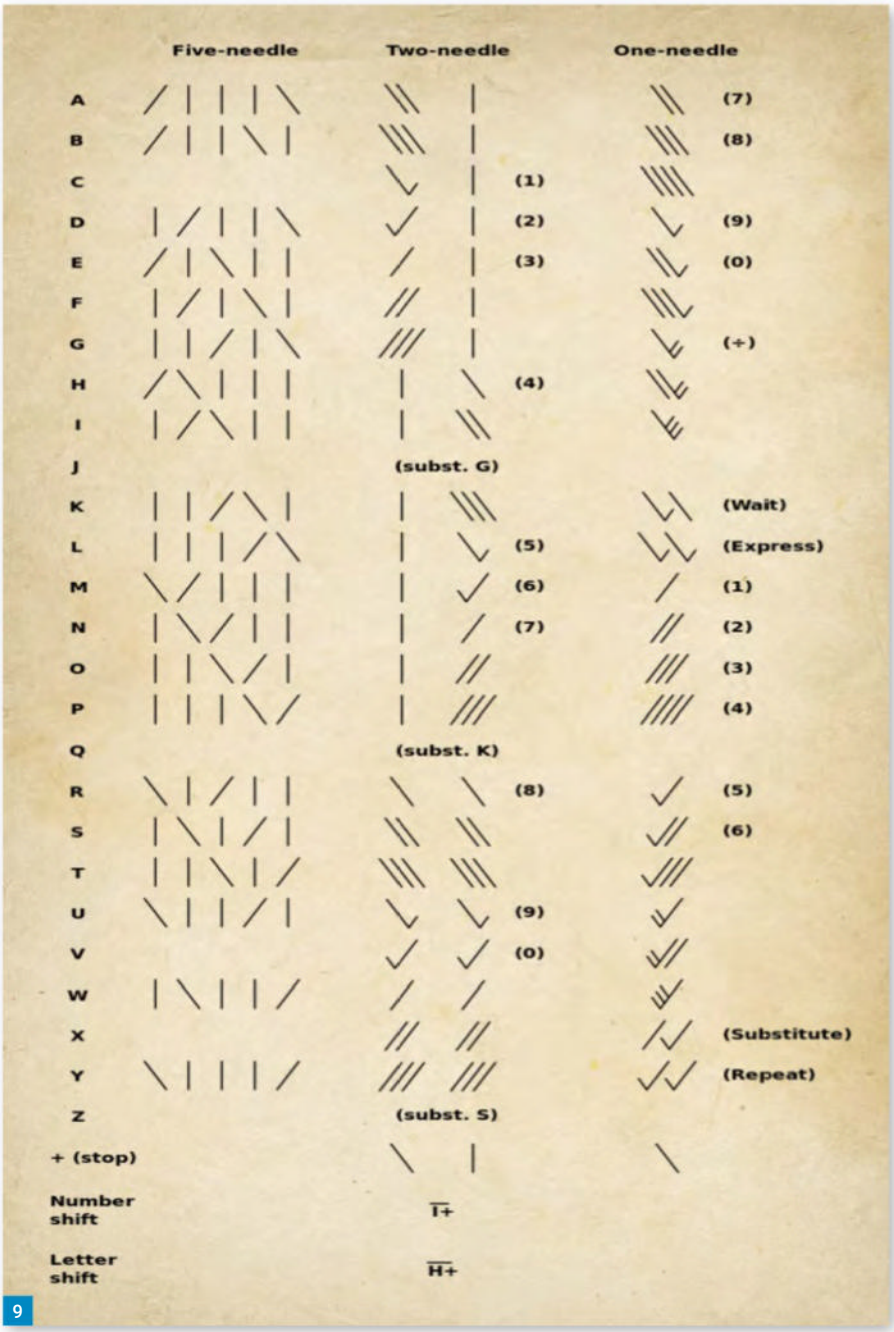
- The first literal diagram substitution cypher.
- A manual-symmetric encryption technique; and
- A multiple-letter encryption cypher.

Playfair is fast to use and requires no special equipment. It forms a *substitution cypher*, operating with pairs of letters, rather than individual ones. This makes it more resistant to (frequency analysis) attacks. The cypher employs a square grid, known as a 'key square' (Fig.8), to determine the substitution of letters in plaintext. The 5×5 grid of letters encrypts a message by breaking the text into pairs of letters and swapping them, according to their positions in a rectangle within that grid: for



example, 'HI' becomes 'BM'.

When it was developed, *Playfair* was initially declined by the British Foreign Office because of its perceived complexity. Wheatstone offered to demonstrate that three out of four boys in a nearby school could learn to use it in 15 minutes, but the Under Secretary of the Foreign Office responded, *"That is very possible, but you could never teach it to attachés":*

https://en.wikipedia.org/wiki/Playfair_cipher

Baeldung:

www.baeldung.com/cs/playfair-cipher

Interesting Engineering:

https://tinyurl.com/e3kdwdks

Playfair Cypher Encoder-Decoder:

www.boxentriq.com/code-breaking/playfair-cipher

Last but not least, for all you lovers of books and films out there, it may also be noted that the *Playfair* Cypher appeared in the *Lord Peter Wimsey* adventure (*No. 8*) *Have His Carcase*, by **Dorothy L Sayers**. It has also been referenced in the 2007 feature film fantasy *National Treasure 2 – Book of Secrets*, starring **Nicolas Cage**. And, last but certainly not least, if you are in London, there is a very fine chalk portrait of the great man in the *National Portrait Gallery* (NPG 726: URL below). It appears that the communications legacies of the Victorian pioneers can still reverberate, instruct, inspire and entertain.

https://tinyurl.com/ycva5k7f

Books

- Bowers, B. (1975-2001) *Sir Charles Wheatstone* (IEE / Science Museum/ HMSO)
- Garratt G. R. M. (1993) *The Early History of Radio* […] (Institution of Engineering and Technology)
- Jennings, C. (2018) *The Third Reich is Listening: Inside German Codebreaking 1939–45* (Osprey)
- Kiewe, J.L. (1973) *The Electric Telegraph: A Social and Economic History* (David & Charles: Newton Abbot)
- McKay, S. (2023) *50 Codes that Changed the World* (Headline)
- Rhys Morus, I. (2019) *Nikola Tesla and the Electrical Future*; (2022) *How the Victorians Took Us to the Moon* (London: Icon)
- Standage, T. (2014) *The Victorian Internet* (Bloomsbury/USA)

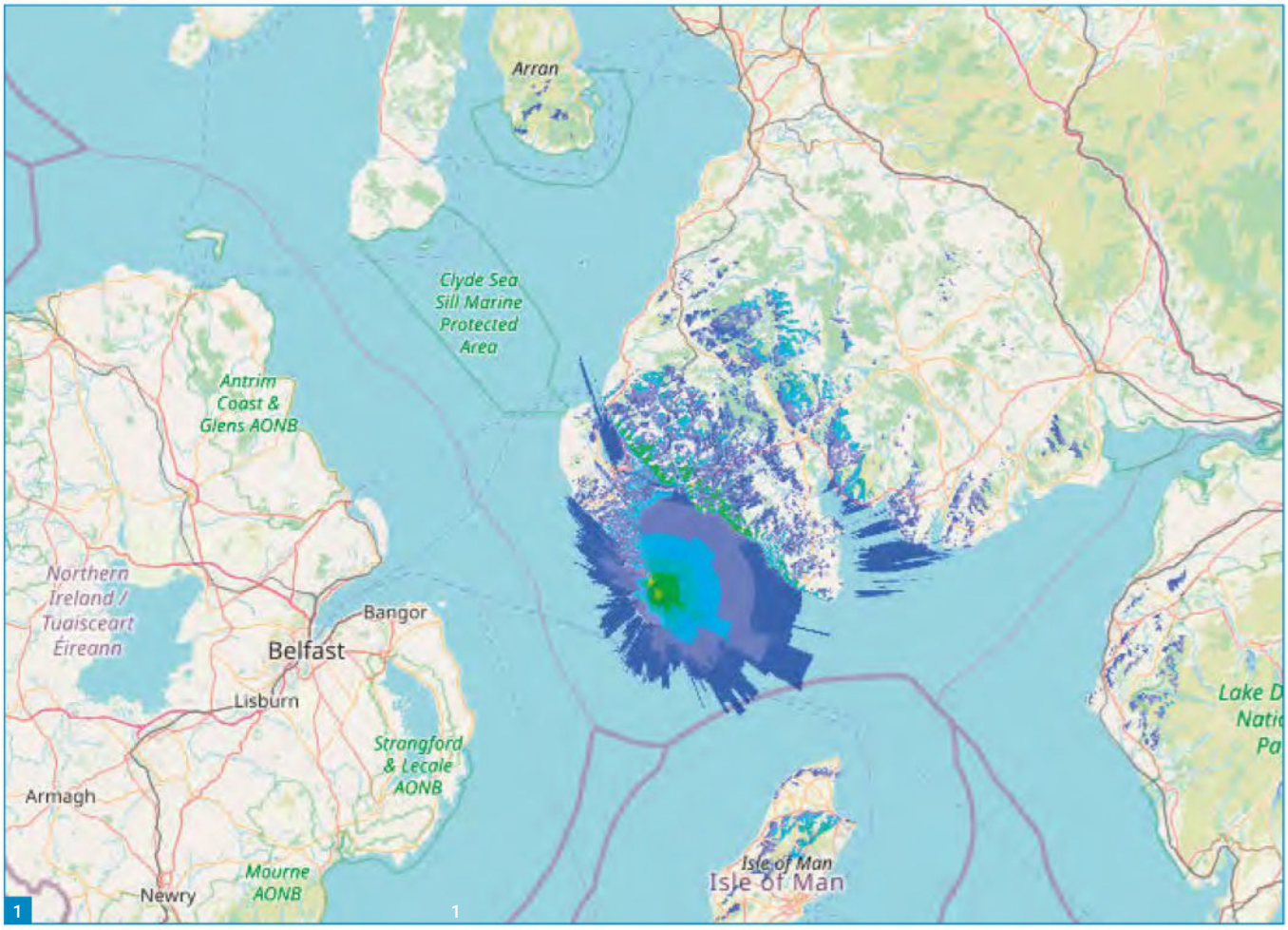
Websites

https://tinyurl.com/y6acj4rf
King's College London:
https://tinyurl.com/yjkecfyv
National Cryptologic Museum (USA):
https://tinyurl.com/yx4hm7ae
National Portrait Gallery (UK):
https://tinyurl.com/4ha4bj6z
NSA (Wadsworth Cypher):
https://tinyurl.com/37kv7dte
Playfair Cypher:
Science Museum London:
https://tinyurl.com/6s3usrej
The Engineer:
https://tinyurl.com/yc5bayt6
Wadsworth Cypher Disk:
https://tinyurl.com/2fxzr6ah

Audiovisual

- BBC World Service (2004) Masterpiece: The Concertina Man: **www.bbc.co.uk/programmes/p03cgdc6**
- BBC In Our Time – Cryptography: **www.bbc.co.uk/programmes/p004y272**
- IET Mini Documentary: **www.youtube.com/watch?v=9gSB6k3BW7s**
- National Geographic Films (2002): The Search for Kennedy's *PT-109:* **www.imdb.com/title/tt1844084**

Table 1: Further Reading (A much longer reading list is available on request)



DMR Digital Mobile Radio

Tim GM4YTD describes what he calls "One club's journey into the abyss".

Tim Booth GM4YTD
practicalwireless@warnersgroup.co.uk

While not everybody's cup of mead, DMR (Digital mobile radio) is another facet of the fascinating hobby we share and enjoy.

This article is not intended to poke the sleeping bear, or to preach about converting the World onto digital modes, rather a story involving the forgotten corner of Scotland known as Dumfries and Galloway, and the efforts of a small club to build reliable inexpensive communications for members and visitors, and have some fun along the way.

Wigtownshire amateur radio club GM4RIV was formed in 1980 and operates out of the town of Stranraer, South West Scotland, members regularly attend the Thursday night zoom meetings from Scotland, England and America. In person meetings at the club shack are now also becoming more frequent and offer a chance to exchange ideas and meet friends in person.

Back to the story

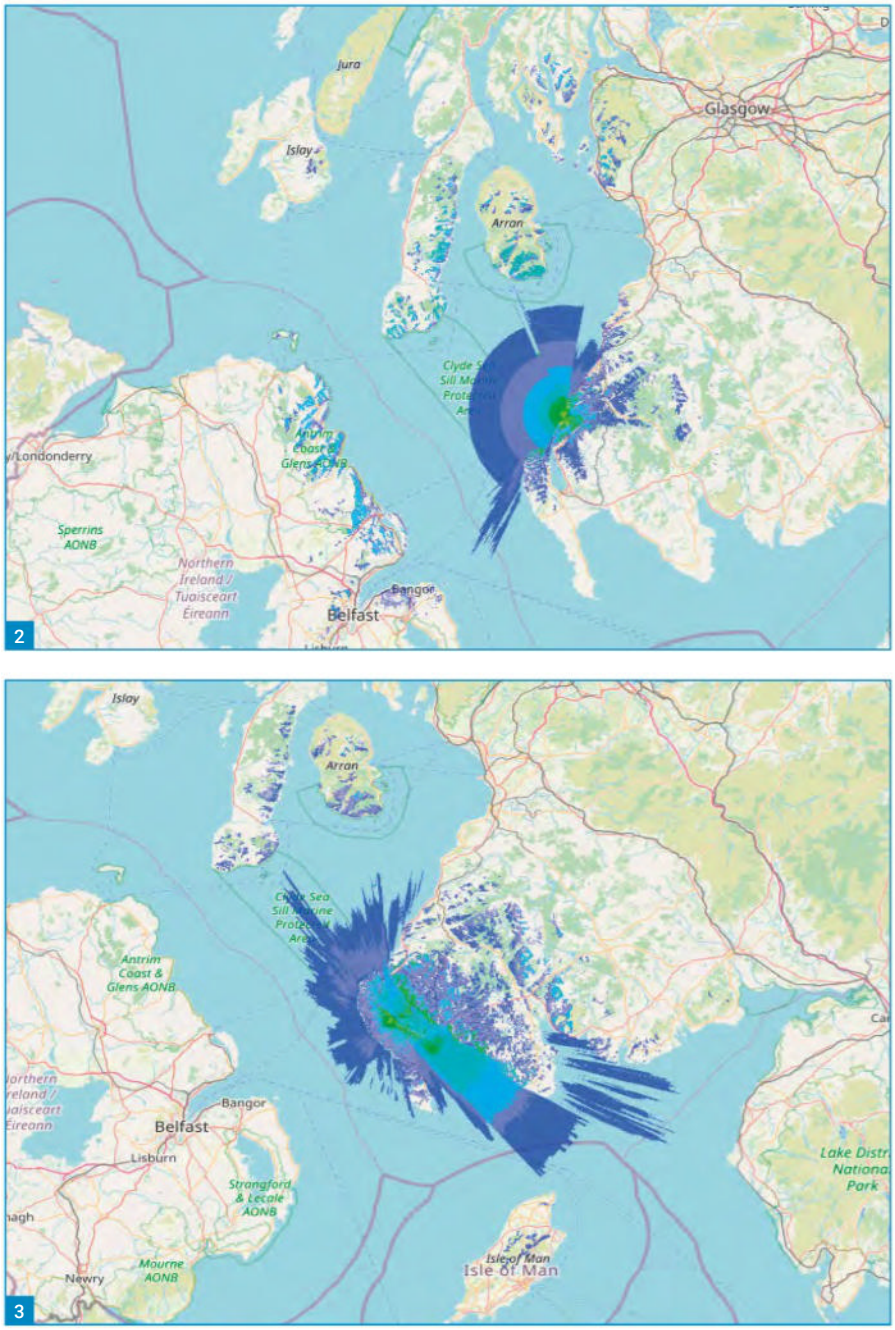
Storm Desmond swept through the area recently causing widespread damage, power outage and total collapse of the telephone network (landline and mobile). The County resilience teams organised food trucks and fresh water to the outlying areas, but without the telephone system could not get the word out to householders that help was available.

Eddie MM6EDB, President of the club and long-time digital system user suggested trialling a digital radio solution as a club project. Looking into the technology proved frustrating with so many options and methods to achieve the outcome we thought we wanted. Enter at this point **Saint Alister (GM7RYR)** from Edinburgh, DMR Scotland, knight in shining armour, and very patient mentor. With Alister's guidance and advice it was decided to enter the World of DMR via the Brandmeister network, the reason for this threefold, Edinburgh and Glasgow already had a growing network of users on this system, basic code plugs and assistance were freely available, and ex PMR equipment was relatively inexpensive but robust. It was suggested that we create our own talk group for the region which we did – Solway chat can be found on talk group 234140 (regular Monday night net, 8pm).

Club take-up of the technology was very encouraging, mainly due to the relatively low cost of the equipment. A Baofeng radio, pre-built and configured hotspot and our club code plug giving access to the Scotland region and Global talk groups has started many people on the journey into DMR for around £60 or less. The look on the faces of new users when Australia, Indonesia and other exotic locations appear out of the speaker of a basic handheld radio is priceless.

With club and regional communication now commonplace via hotspot, the next step was to offer access to an increased footprint. Three ex-PMR repeaters were purchased, configured and set up by Alister, who incidentally gave

Fig. 1: Coverage map of GB7DG.
Fig. 2: Coverage map of GB7ZT.
Fig. 3: Coverage map of GB7RG.



up a lot of time to assisting personally in the installation and testing of the kit. The locations for the repeaters through careful planning, now offer the forgotten corner of Scotland reliable communication spanning Cumbria, West Coast Scotland, Isle of Man, Isle of Arran, Parts of Islay, Jura and the Mull of Kintyre.

The repeaters are:

- GB7DG – Drumore (**Fig. 1**)
- DG7ZT – Ballantrae (**Fig. 2**)
- DG7RG – Stranraer (**Fig. 3**)

With a fourth repeater currently under negotiation intending to bridge the West coast RF gap up to Glasgow.

The repeaters are all ex-PMR Motorola or Hytera units offering low cost and reliable access to the Brandmeister network.

The prime location of GB7RG in Stranraer, and the coastal location of GB7DG is helping to push coverage into Northern Ireland and the Isle of Man and is regularly used by Cumbrian stations via the sea path over the Solway.

The learning curve has been very steep, but in the spirit of the hobby, within the club, we now have the ability to create and edit code plugs, understand the programming and use of different types of radio, and can navigate the Brandmeister network both as users and sysops, all made possible by self-learning, Alister, and the team of volunteers he works with.

As a club we have code plugs in regular use for the Baofeng DM-1701, Anytone 868, Hytera PD365, and Hytera PD865 (**Fig. 4**). The code plugs contain zones for accessing talk groups via repeaters and hotspots, and also direct messaging functionality between club members.

For people wanting to try DMR without the expense, for local amateurs we have loan equipment, all we need is your DMR ID and a free user account from Brandmeister, help is available on the process for achieving this. Anybody can listen into the chatgroups by navigating to:

https://hose.brandmeister.network

Talk group 91 is the Worldwide talk group and often has (from the UK) exotic stations active such as Korea, Australia, New Zealand, Chile, Pakistan etc, worth a listen if you have the time. Free mobile phone apps are also available – Droidstar is popular, and uses mobile data to access the network, from here RF and internet relays will get you to the talk group you want to use.

Also worthy of note and a listen is the RSGB News presented by **Gordon 2M0PIJ** at 10am every Sunday on Talk group 23550 Scot West, I guarantee that you will have never heard an RSGB news bulletin quite like it.

In conclusion

While DMR is not for everybody it has given many people in the area access to ham chat from locations where external antennas are not possible, flats, care homes and even hospitals, and comments live on air are generally positive, with several people suggesting positive boosts to their mental health and wellbeing.

Wherever a system user is, we can now relay safety messages to a central point and get the word out into the community should a repeat of Desmond happen again.

So where do we go from here? Next steps for the club include:

- Fitting battery backup and solar panels to the repeaters.
- Fitting Starlink internet backup.
- Installing and commissioning our LoRa APRS repeater.
- Installing and commissioning our Meshcore repeater.
- Building a better antenna system for the club Kiwi receiver (GM4RIV – Stranraer).

Users can go as far down the rabbit hole as they feel comfortable, many are happy to just use preconfigured equipment, those of a curious disposition get involved in building and configuring hotspots, radios and repeaters, writing code plugs, and getting involved in

Fig. 4: DMR radios in use. From the top least expensive Baofeng 1701 (Amateur), 2nd from the top Anytone 868 (Amateur), 3rd from top Hytera PD365 (Commercial grade PMR), Bottom Hytera PD865 (Commercial grade PMR).

Fig. 5: A selection of hotspots. Top Internal battery MMDVM Ras Pi hotspot, Middle (Black unit) MMDVM Ras Pi external powered hotspot – least expensive, Bottom left Openspot Pro hotspot.

Fig. 6: Typical tree style layout of a Baofeng code plug.

the inner workings of the networks. The self-teaching (and frustration) levels are without boundaries.

As stated at the beginning of this article, DMR is not for everybody, each to their own as they say, just add it to the arsenal of communication methods, or ignore it completely if you would rather. As a club the majority have embraced the challenge and are now enjoying all the hard work and benefits alongside more traditional methods.

For a small group we feel proud of the system we created and would encourage other clubs and groups to do something similar. Representing the entire club and all users in South West Scotland, I would like to publicly thank Alister for his help, enthusiasm and friendship throughout this journey.

Tim GM4YTD, on behalf of the club members of the Wigtownshire amateur radio club. **PW**

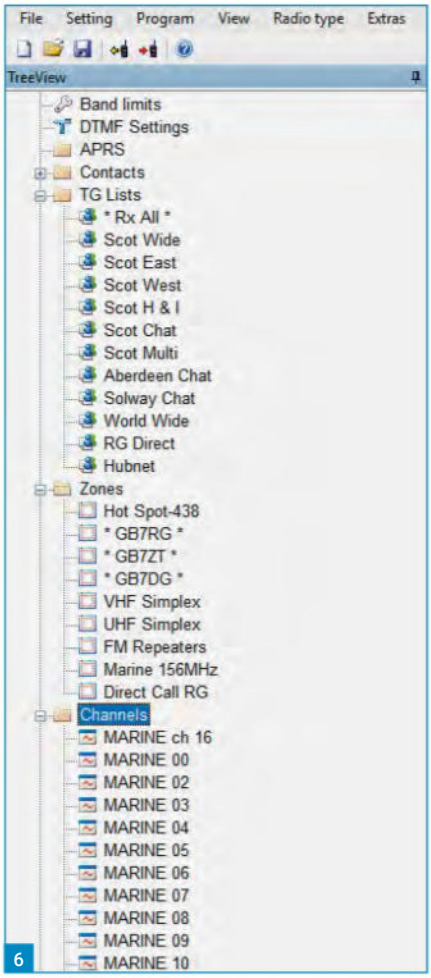
Notes

DMR radios predominantly transmit and receive in the 70cm amateur band, while transmitting RF, network access is achieved by an RF to internet connection bridge. Popular interfaces are usually DMR repeaters, or hotspots.

Hotspots are a small portable bridge device that on one side communicate by RF in the 70cm band to handheld or mobile radios, and on the other side connect to the internet by mobile data or WiFi connection. Hotspots range in price from around £30 to over £300 for sophisticated network bridging devices, **Fig. 5**.

Code plugs are in effect configuration files that are uploaded to the radio to tell it what to do, how to communicate, and which talk group to connect to, **Fig. 6**.

Talk groups can be thought of as a closed room where people would enter via the door, in this case a talk group number. Once inside, all participants can hear and speak to each other via whichever method they wish to use – hotspots, phone apps and repeaters are the most common method of accessing talk groups.



Photographs courtesy of Przemysław Gołembowski SP7VC

1

Thirty-two thousand four hundred entities to chase

Henryk Kotowski SM0JHF describes the DXing life of **Przemek SP7VC**, while activating grid squares.

Henryk Kotowski SM0JHF
practicalwireless@warnersgroup.co.uk

It is a hundred times more than on the current DXCC list. Imagine, what to do when you have reached the DXCC Honor Roll and nobody is willing to spend a million dollars to go to a place you need? There is an alternative - start chasing Maidenhead Locator System grids. The British invention, called also WWL, is unbiased and clear. The Earth is divided into 324 fields, which in turn have 100 squares each. Easy to determine the location of each station and to compute the straight-line distance between two squares. Radio waves do not always travel in straight lines, but it is of no concern in most cases. Except when natural, or artificial, satellites, or meteors, aircraft and rain clouds are enslaved by earthlings to bounce 'em off. The grid square designation should be used by all amateur radio operators, instead of e.g. the obsolete CQ zones. There are 32400 grid squares on Earth and the majority are on water. The dry land is not always inhabitable, so the number of potential grid squares to be contacted is not huge. Some areas are densely populated with radio amateurs. There are some individuals who have interest for those regions, which are more or less void of them. Scandinavia in Europe is a region with a few large metropolises, while the northern latitudes to a great degree is sheer wilderness, and **Przemek SP7VC** has been drifting there for a few years now, with a load of radios, amplifiers and antennas.

The challenge

Hunting the grid squares on HF is effortless. Using the FT8 mode on 14MHz, one can put a hundred of them in the computer log in an hour. The challenge is to do it on frequencies above 30MHz. These waves are tricky and long distance (DX) capability is not widespread. Handheld radios are popular, but will not do. It takes more power, directional antennas and good receivers. Here enters Przemek SP7VC. Since he wants to be called Mek on the air, I will refer to him, from now on, as Mek.

Starting out

Mek is not a newcomer to amateur radio. He got his first licence 35 years ago, at the age of 25. Ten years later, he was already a seasoned contest operator and a member of a few multi-operator teams in Poland. In 2004 he went on his first radio expedition abroad and liked it so much, that in the ensuing years he visited 99

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Photo 1: OZ/SP7VC on the air on 70MHz LOC JO66EC on the northern tip of Sjæland island – summer 2022. **Photo 2:** A steady stream of caravans from the south of Europe on the Norwegian roads - summer 2022. **Photo 3:** Norwegian police officer reporting: Captain, we have handcuffed a Caucasian suspect cruising in a vehicle with mysterious radio equipment. The captain: Must be Mek LA/SP7VC. We follow him on DX Summit, let him go. Summer 2022. **Photo 4:** SP7VC/MM in the North Sea transmitting on 70 MHz, with the permission from the skipper, on ferry boat from Denmark to Faroe Islands - summer 2023. Mek has a history of activating "wet squares". **Photo 5:** OY/SP7VC on the air on 50 MHz, 70 MHz and 144 MHz. Faroe Islands, summer 2023. **Photo 6:** TF/SP7VC - on the air on 50MHz and 70MHz, perfect location and pristine weather. Iceland - summer 2023.

countries. The 100th country was supposed to be Iceland, but the Covid-19 travel restrictions held it up. So he just bought a motor caravan, called sometimes a Recreational Vehicle (RV), in 2020 and fitted it with radios, amplifiers and antennas. Initially he toured Poland and in 27 days he managed to roll the distance of 5300km and transmit on VHF/UHF and Microwaves from many locator squares, known for scarce or no activity at all. Mek works full-time and the statutory annual paid leave is 26 days, hence he often makes weekend trips, frequently attending meetings and rallies. The first long journey abroad was, via Denmark and Sweden, to Norway in the summer of 2022.

In 30 days he drove 9200km, going as far north as Narvik. The following summer, 2023, Mek was competent enough in RV travelling to go to Iceland. The trip took 30 days, including a stopover on the Faroe Islands. Iceland was Mek's 100th explored country. Summer of 2024, he was busy filling his logbooks while circumnavigating Finland. In October 2024 he spent a weekend on the Åland Islands, OH0. Finland again in 2025, but taking the western route, along the Baltic Sea and the Bay of Bothnia, to northern Norway and North Cape (Nordkapp).

Photo 7: OH/SP7VC at LOC KP49BH in the very north of Finnish Lapland, close to Norway and Russia. The freestanding antenna is an 8-element Yagi for 70MHz. Summer 2025. Photo 8: LA/SP7VC at KQ21VA on Magerøya (island), connected with the mainland through an undersea tunnel. North Cape is located on this island. Summer 2025. Photo 9: OH/SP7VC and OH/SQ7OYL at the Polar Circle in Rovaniemi, Finland - summer 2024. Photo 10: A map showing the European grid squares where Mek SP7VC, has been on the air from in the recent years.

Mek had been to all these Nordic countries before, except Iceland, driving a station wagon car and renting accommodation. He used to share his on the air time between HF bands and the VHF. Currently, it is mostly 50MHz, 70MHz and 144MHz using MSK144, FSK144 and FT8. Sometimes, when on an island listed for IOTA, he gets also on the HF bands using SSB and FT8. Mek observes usually favourable propagation conditions to the UK on VHF from the Nordic countries.

Getting serious

It takes a lot of generosity and a dose of altruism to ramble in the wilderness, confront Murphy and curious autochthons, as well as their law enforcement officers, and 'give away grid squares and IOTA islands' to strangers far away. In between, Mek gives presentations of his trips, shares tips and advice at amateur radio gatherings in clubs, or in the open air. A couple of years ago, he self-published a 430-page volume, a diary of his travel experience in the pre-caravan era - ISBN 978-83-957722-4-5. I guess my approbation of Mek's radio caravanning is partly because of my own experience, driving around 150,000 kilometres in the same manner, some 30 years ago. **PW**

Broadcasting history

Keith and **Garry** invite you to stray once again through their archives.

Keith Hamer
Keith405625.kh1@gmail.com
Garry Smith
Garry405625.gs@gmail.com

Three money-making stars from the DECCA range

• DECCA MODEL 66 four-waveband table radio receiver

A de-luxe radio receiver designed and built to an ideal. A high grade amplifier together with two speakers and separate bass and treble controls ensures that full justice is done to the superb quality of V.H.F.-F.M. transmissions (B.B.C. Home, Light and Third), and that the very best reproduction of long, medium and short wave A.M. transmissions is achieved. In addition, the handsome, walnut finished cabinet makes the set a piece of furniture which will enhance the appearance of any room. Power Output - 3 watts. Mains Supply - 100-125 or 200-250 volts, A.C. only, 50 cycles. Total Consumption - 60 watts. Pick-up Input - suitable for crystal pick-up. Dimensions - 16" high by 20" wide by 9" deep.

Price 39 gns.*(Tax paid).*

• DECCA MODEL DMC/D18 Console television receiver with VHF-FM

This de-luxe television receiver, elegantly presented in a bow-fronted console, finished in selected walnut, has full length doors to cover the 17-inch screen when it is not in use. Decca TV is noted for offering the highest all-round standard on every point of performance ; the DMC/D18 has the added attraction of a V.H.F.-F.M.radio unit. Three positions on the 12-position turret tuning switch are pre-set for the B.B.C.'s Home, Light and Third F.M. transmissions, one position is spare, and 8 channels are therefore left for TV. There is a 10-inch P.M. speaker, and the set also has automatic anti-fade control.
Mains Supply - 200-250 volts, A.C., 50 cycles ; or 200-250 volts, D.C. Dimensions - 35" high by 23" wide by 20" deep.

Price 108 gns.*(Tax paid).*

• DECCA MODEL RG103 four-waveband console radiogramophone

As well as normal long, medium and short wavebands, this model has a tuner for the reception of the B.B.C.'s Home, Light and Third transmissions on V.H.F.-F.M. The record playing equipment comprises a Garrard triple-speed auto-changer with a capacity of up to 10 records of any one size and speed ; and Decca ffrr interchangeable magnetic pick-up heads with sapphire styli. Really first class reproduction from all these sources is assured by the high fidelity 5-valve audio push-pull amplifier with separate bass and treble controls, feeding one 10-inch P.M. and two electrostatic speakers. The well-proportioned bow-fronted cabinet is finished in hand polished walnut, and incorporates two record storage compartments with a total capacity of over 100 records.
Power Output - 6 watts. Mains Supply - 100-125 or 200-250 volts, A.C. only, 50 cycles. Total Consumption - 100 watts. Dimensions - 33" high by 34¾" wide by 18" deep.

Price 102 gns.*(Tax paid).*

All these models have VHF-FM radio
Hire purchase terms over 12, 18 or 24 months are available on all Decca models.
DECCA RADIO AND TELEVISION
1-3 BRIXTON ROAD, LONDON, S.W.9

1

BBC Broadcasting House, London: Part VII

In addition to the large main *Special Effects Studio, 6D*, mentioned in the previous column, there was also the *Gramophone Effects Studio, 6E*. This was equipped with six turntables, which were used for mixing a variety of noises such as crowds and applause, **Fig. 2**. Nowadays, a digital system is employed whereby 'virtual' applause is added to some BBC programmes such as *Have I Got News For You* (the authors contributed to the programme broadcast on 5 December 2008) and *Mock The Week*, where there are no visible studio audiences present!

The Gramophone Effects Studio, 6E, was supplemented by the *Secondary Effects and Gramophone Studios, 7D* and *7E*, which were similar to Studio 6D, but were fitted with special microphone arms suspended from points in the ceiling based on a newly designed principle which allowed the microphone to be pulled out in any direction, where it remained automatically balanced without any further adjustment.

Vintage radio & television advertisement

This month's rummage through vintage copies of unkempt newspapers and magazines has unveiled an advertisement by *Decca Radio And Television Limited* for their *Model 66 four-waveband table radio receiver*, *Model DMC/D18 Console television receiver with VHF-FM*, and *Model RG103 four-waveband console radiogramophone*, **Fig. 1**. The advertisement dates from October 1955.

The *Decca Record Company* was established in the UK by **Edward Lewis** in 1929. The description of the *Model RG103 four-waveband console radiogramophone* in their advertisement includes the term 'ffrr'. To be honest, one of the authors, namely **Keith**, hadn't a clue what 'ffrr' denoted. However, quick as a flash, **Garry** explained that it was a Decca slogan meaning *full frequency range recording*, and, as if by magic, produced a 45 r.p.m. *extended play* record featuring **Mantovani and his Orchestra** in ffrr from the authors' extensive sound archives!

100 years ago: March 1926

This series details some of the events, technical achievements and personalities associated with the world of broadcasting from exactly 100 years ago this month.

On 5 March 1926, the *Crawford Report on Broadcasting* was published. The parliamentary committee recommended establishing a new public authority, the *British Broadcasting Corporation* (*BBC*), to replace the original *British Broadcasting Company, Limited*. The new organisation would be established under *Royal Charter*. The main recommendations included funding through a licence fee, operating as a *Public Service Trustee* for the national interest, and continuing a policy of impartiality without direct political control.

On the 25th, an international wavelength plan was submitted to the *Council of the Union Internationale de Radiophonie* (*UIR*) in Brussels based on a spacing of 10kHz between European transmitters to minimise co-channel interference. The plan allowed for every country to have at least one exclusive wavelength.

In focus: The BBC Penmon transmitter – Part III

The BBC transmitter at Penmon on Anglesey was brought into service at midday on 1 February 1937, signalling the beginning of the *BBC Welsh Regional Programme*, **Fig. 3**.

The transmitter operated on 804kHz and opened in time to broadcast the Coronation of **King George VI** and **Queen Elizabeth** to the Welsh nation on Wednesday 12 May 1937. The installation played a vital role during World War II and had a significant part in the development of Welsh broadcasting. During the war, Penmon broadcast the *BBC Home Service* and later, the *BBC Welsh Home Service*.

In more recent times, the transmitter was owned by *Arqiva Limited*, a British telecommunications company which provides infrastructure, broadcast transmission, and smart-meter facilities. The company was established in 2005.

For some time, Arqiva had wanted to demolish the iconic transmitting site which they called the *Penmon MF* (*Medium Frequency*) station. An application for the demolition of the steel lattice mast was lodged with *Anglesey County Council.* The application for the decommissioning of the structure stated: *"The removal of 'No. 1 mast' which is no longer required for operations. Arqiva has identified a requirement to remove the existing mast, this being comprised of No. 1 steel lattice mast, stay lines, stay blocks and ancillary equipment. Following the demolition and removal of equipment, the area will be restored to an open*

Fig. 1: An advertisement by *Decca Radio And Television Limited* for their *Model 66 four-waveband table radio receiver*, *Model DMC/D18 Console television receiver with VHF-FM*, and *Model RG103 four-waveband console radiogramophone*. The advertisement dates from October 1955.
Fig. 2: The BBC's *Gramophone Effects Studio, 6E*, at Broadcasting House was equipped with six turntables which were used for mixing a variety of noises such as crowds and applause.
Fig. 3: The historic BBC transmitter at Penmon on Anglesey was brought into service at midday on 1 February 1937. It was demolished by Arqiva on 22 August 2025.

grass field." Lamentably, the council gave Arqiva permission to destroy the legendary installation.

The historic former BBC Penmon transmitter was duly demolished by Arqiva on Friday 22 August 2025.

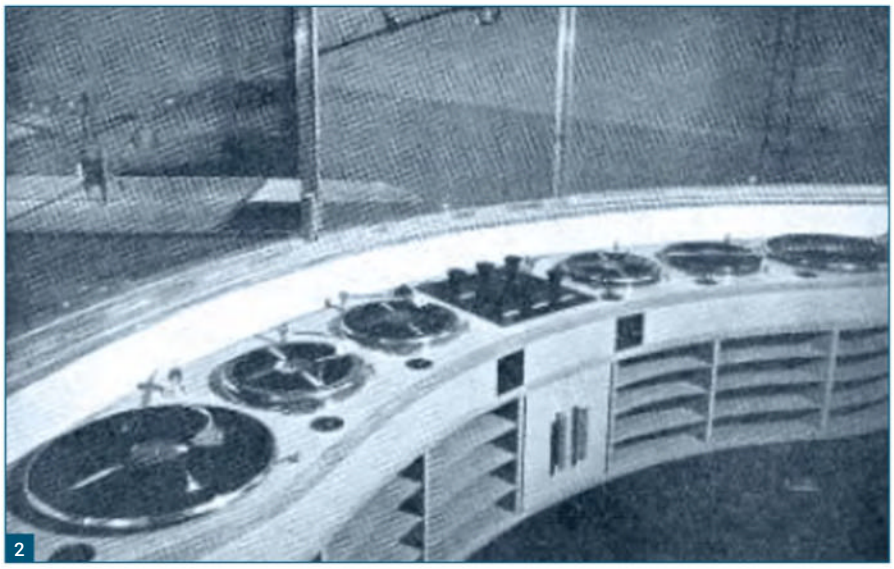
60 years of BBC-2: Part XXIV

Long before BBC-2 took to the airwaves in April 1964, a huge advertising campaign was mounted to attract potential viewers to the new service. The key characters chosen to charm the public were two bouncy kangaroos. Basically, the mother kangaroo represented *BBC Television* from which the baby was about to leap out of the pouch in the form of *BBC-2*.

As early as 1963, the BBC kangaroos became quite famous and names had to be conjured up for them. One name sprang to mind at the *BBC-2 Information Service* (formed in August 1963) without too much head-scratching – *Hullabaloo* because there was certainly going to be a lot of that about as the expected opening date for BBC-2 approached (20 April 1964). However, there was apparently a great debate concerning the other name which had to complement 'Hullabaloo'. What could the smaller kangaroo possibly be called? 'Hullabaloo' and... what? All sorts of suggestions were put forward, but none of them really seemed quite right. In the end, after a lot of heated discussion, some bright spark made an off the cuff remark: "*Why don't we call it 'Custard' because custard goes with any* [expletive] *thing!*" So *Custard* it was. The next task was to find an artist to draw the two kangaroos.

Service information, Iceland: Part III

In 1959, following some disquiet by local Icelanders regarding the existence of an American Forces television station operating on the island, two members of the Icelandic government submitted a proposal to close the AFRTS service, but it was not accepted. In 1961, the station requested an increase in transmission power and permission was granted on 17 April of the same year. When the station started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broadcasting more programmes in the following year, the issue arose again in *Alþingi* – Iceland's *Supreme National Parliament*, usually written as *Althingi* outside of Iceland. It is the oldest surviving parliament in the world, dating back to 930 AD.

Stay tuned!

The photos are once again from Keith and Garry's collection. Please send archive photographs, information or suggestions for future topics via the email addresses shown at the top of this column. **PW**

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E-mail: practicalwireless@warnersgroup.co.uk

Black holes

Dear Don,

Ray Howes G4OWY comments that **Professor Brian Cox** has beliefs about the *"so-called existence of imaginary black holes"* and that the *"equations that apparently describe them"* are incomprehensible to hide the truth that they are a *"smoke and mirrors"* concept.

Well Ray, bold statements! Firstly, the equations may be incomprehensible to you and I but are perfectly understood by many cosmologists and, indeed, university students. Just because you don't understand something doesn't mean it doesn't exist. While black holes, by their very definition, aren't directly observable their effects on surrounding matter, by virtue of their immense gravitational fields, most certainly are. Astronomers are now in agreement that most, if not all, galaxies have a supermassive black hole at their centre and **Don** helpfully showed an image of Messier 87, a galaxy of trillions of stars with a supermassive black hole with a mass of some 2.4 billion times our sun at its centre.

As Don commented, black holes are certainly weird and quantum theory is even weirder but, at this point in our knowledge, the theories best describe our observations. As our knowledge improves the theories may prove to be incorrect and will be replaced by something else but to dismiss the work of many great minds, including names like **Einstein** and contemporaries such as Brian Cox, *as "smoke and mirrors"* is to do them a great disservice and, I'm sorry Ray, is a little arrogant.

Tim Kearsley G4WFT
Rushden, Northants

*(**Editor's comment**: Thanks Tim. This is a subject well beyond the scope of* PW *so we should probably leave it there although, from a more recent letter, Ray certainly feels strongly about this one! The two of you will have to agree to differ.)*

Lab tutorial

Dear Don,

May I use the *PW Letters* page to issue an apology to readers who read the *Lab Tutorials* pages please? It seems that in the tutorials for phasors and impedance, I have been inconsistent with the symbol for phase angle. Sometimes I have used Theta and sometimes Phi.

Both are used to represent the phase angle in electronic circuits but it's best to stick with one or the other. From now on I will use Phi.

Also, a couple of items from the last *Tutorial* have come to light, unfortunately too late to correct in the text: Top of middle column on first page values should be X_c = 63.66 and V = 63.66mV. Third line up from bottom of third column of first page the symbol for phase angle should be lower case phi. In Fig. 4 the I'm in both equations should read I_{max}. About halfway down the centre column on last page the result for the calculation of the impedance of the coil should be Z_{Coil} not Z_L.

Apologies for the above.

Chris Murphy M0HLS
Derby

Propagation

Dear Don,

Sadly, another serious error has been printed (*PW* Feb p.10 bottom left corner of Table 1), presumably escaping the technical review process. MUF isn't the highest frequency *"... that permits communication by Sporadic-E ... alone"*. Thinking about it, were it sporadic then MUF wouldn't exist most of the time.

A clear definition is in **Benbow**, *RAE Manual 6th ed* p.64 (RSGB). It is *"...the maximum frequency ... reflected by the ionosphere over a given path... The MUF varies according to the layer which causes the reflection..."*

You might wonder why I'm sufficiently concerned to take the trouble to write in when I spot such errors. An SWL could look at *PW* as background reading when studying for the licence exam. They won't have the experience to identify errors, instead learning what they read. This could lead to avoidable and frustrating exam failure which harms the hobby and discredits the magazine.

Unfortunately, reading further in to the magazine reveals yet another ionospheric misunderstanding that might confuse a licence examinee. Feb p.55 figures and accompanying text don't acknowledge the D-layer. It is this layer that requires direct solar radiation (insolation), so it disappears soon after dark. It also practically fully absorbs medium wave. Once the D-layer has gone, there's no longer any absorption and medium wave can refract off any higher layer that's there. Now, the E-layer too requires insolation for its full density, so tends to weaken after dark but might persist sufficiently to refract MW. If not, there's always the good old F-layer (now a single layer in the dark) to fall back on.

Godfrey Manning G4GLM
Edgware

*(**Editor's comment**: Thank you Godfrey. I should definitely have picked up on these, especially as the author had made a similar mistake regarding MUF in the previous issue and I had corrected it, explaining MUF as "the highest frequency reflected on a given path between two distant stations". Unfortunately, they slipped through my less than eagle eye for the February issue. My apologies.)*

Unsolicited QSLs

Dear Don,

I was interested in the comments you made in your editorial in *PW* February 2026 on the above subject.

Unsolicited QSL confirmation struck a chord with me and jogged my memory a bit. Twice, in recent months, I have received two confirmation requests. Both from the same callsign and both via an online source. The strange thing is that the requests related to a band (10m) and mode (PSK) that I hadn't used together.

The clincher was the date. The requests were dated BEFORE I obtained my full licence and yet were addressed to my full licence callsign!

I'm wondering whether someone is trying to 'create' contacts that never happened for some nefarious purpose? (Such as obtaining an award they're not entitled to) Or perhaps it's a simple mistake?

In the light of your editorial, I'm now wondering how widespread this is?

With all good wishes,

Guy Howard M0ISK
Kettering

Rallies & Events

All information published here reflects the situation up to and including **23rd January 2026**. Readers are advised to always check with the organisers of any rally or event before setting out for a visit. To get your event on this list, email the full details, as early as possible, to: **practicalwireless@warnersgroup.co.uk**

1 March 2026
EXETER RADIO RALLY: New Venue, The Kenn Centre, one mile from the end of the M5. Free car parking. Entry fee £3. Bring & Buy. Disabled facilities. Catering. Trader's entry 8am. Public entry 10am.
Contact Bill G7AKJ, 07511522092
Billwrench213@btinternet.com

7 March 2026
LAGAN VALLEY AMATEUR RADIO SOCIETY RALLY: Hillsborough Village Centre, 7 Ballynahinch Rd, BT26 6AR. Doors open 1030. More details at:
lvars.uk

8 March 2026
HACK GREEN MILITARY SURPLUS & MILITARY RADIO HANGAR SALE: Hack Green Secret Nuclear Bunker, Nantwich, Cheshire CW5 8AL. Sale of electronic equipment, amateur gear, components, military radio items and vehicle spares. Contact
coldwar@hackgreen.co.uk
www.hackgreen.co.uk
News will appear on the Facebook Page:
www.facebook.com/HGsecretbunker

15 March 2026
RIPON & DISTRICT AMATEUR RADIO SOCIETY RALLY: Great Ouseburn Village Hall, Lightmire Ln, Great Ouseburn, York YO26 9RL. Doors open for traders at 0730 and to the public at 1000. Admission £5. Free parking, refreshments and bacon butties available. Tables available at a cost of £10 each, please book early.
radars.rally@gmail.com

22 March 2026
2026 DOVER AMATEUR RADIO CLUB RALLY: 10:00 – 14:00. Our spring Rally All the normal facilities, Eastry Village Hall, High Street, Eastry, Kent CT13 0QB. Entrance fee as £3. Tea, coffee and bacon rolls available onsite. Tables are £15 each, maximum 2 tables per vendor. What 3 words locator ///townhouse.supper.struggle Google maps. More information see our website:
https://darc.online/rally

22 March 2026
CALLINGTON RADIO AND ELECTRONICS RALLY: Town Hall, New Road, Callington, Cornwall, PL17 7BD. The venue is booked from 08.00am until 1.30pm with public access from 10.00am until 1.00 pm. Entry is £2 each with no charge for those under the age of 16. A comprehensive selection of traders, clubs and societies from the South-west will be present along with a 'Bring and Buy' stall and our usual excellent catering service. The venue has disabled access, toilet facilities, and ample parking in a nearby car park with up to one hour's parking free. Although all tables in the main hall have now got confirmed bookings or are reserved, there is a waiting list should there be any cancellations. Charges for tables are 6ftx2ft (£5), 5ftx2ft (£4) and 4ftx2ft (£3). There is an adjacent room available (~50sq.m) with no tables at a cost of £45 for a single occupant. Pre-booking is essential, so please contact Alastair M0KRR at alastair.kerr1@btinternet.com or by phone on 01503 262755 . Check our website for further information.
www.callingtonradiosociety.org.uk

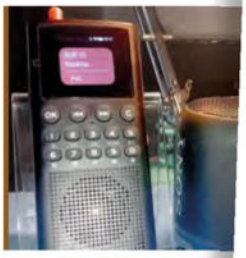
11 April 2026
2026 QRP CONVENTION: Yeovil Amateur Radio Club are delighted to announce that the 2026 QRP Convention will be held at Digby Hall, Sherborne on the 11th April 2025, doors open 09.30. Talks are: Lecture on Drake Receivers by Adrian Dening, and a talk by Steve Hartley.

12 April 2026
NORTHERN AMATEUR RADIO SOCIETIES (NARSA) EXHIBITION (BLACKPOOL RALLY): Norbreck Castle Exhibition Centre, Blackpoool FY2 9AA. Details from Dave M0OBW,
01270 761608, 07720 656542.
dwilson@btinternet.com
narsa.org.uk

19 April 2026
LIMERICK CLARE AMATEUR RADIO CLUB RALLY AND IRTS AGM: Treacy's Oakwood Hotel, Shannon, Co. Clare V14NH97. Doors open 10.30AM. Traders 8.30AM. Entry €5 as in previous years. Free parking. Refreshments. Trader stands and bring and buy sales. Monster Raffle. Pre-booking of tables via email to dermotgleeson1@gmail.com by 15 March is essential. IRTS AGM to follow at 2.00PM.
limerickclareamateurradio@gmail.com

Next Month

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



- **OP AMPS:** Tony Jones G7ETW has an introduction to Op Amps.
- **IMPROVED CAR PORTABLE CABLE ACCESS:** Steve Clements G1YBB tackles the challenge of a weatherproof solution for car-portable operation.
- **TALKING THROUGH THE TREES:** Ray Howes G4OWY/G6AUW introduces readers to a little-known but very influential figure from the past.
- **THE CHOYONG WT2 PORTABLE TEF6686 TRANSCEIVER:** Georg Wiessala takes a look at this Chinese handheld.
- **THE WAVE CASTER:** Frank M. Howell, PhD K4FMH has yet another antenna design, this time for a Vertical Multiband HF Antenna for Portable Operations.
- **REMOTE CONTROL CONSOLE FOR AN EXPERT AMPLIFIER:** Steve Clements G1YBB builds this useful accessory.
- **STARTING HOBBY RADIO FOR FREE, PART 3:** David Howard M0BGR continues with this introductory series.

There are all your other regular columns too, including HF Highlights, World of VHF, Data Modes, Antennas, The Morse Mode, Vintage TV & Radio, What Next and Amateur Radio on a Budget as well as your Letters, the latest News and more.

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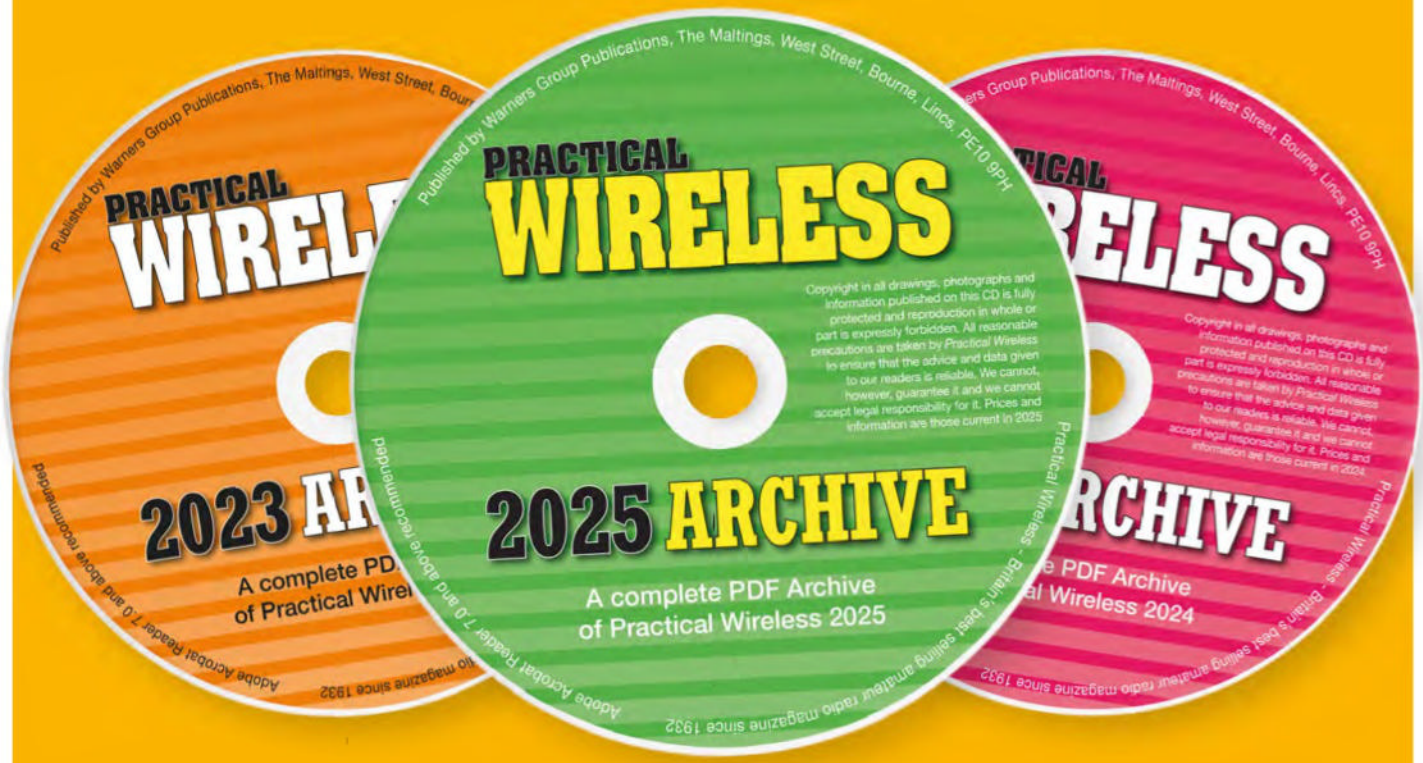

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