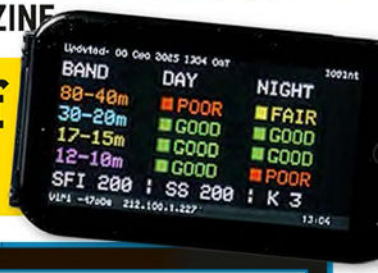
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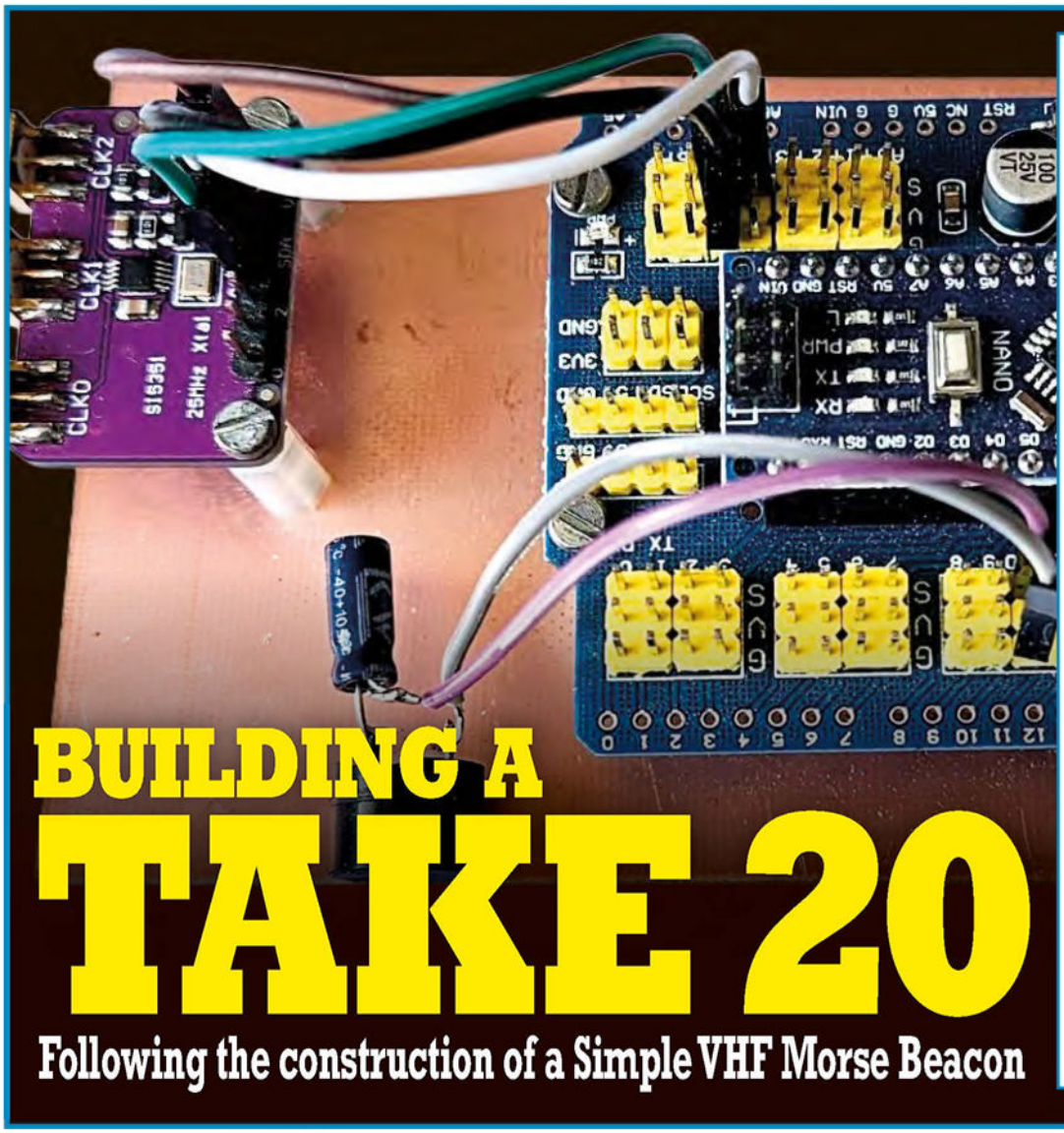
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Following the construction of a Simple VHF Morse Beacon



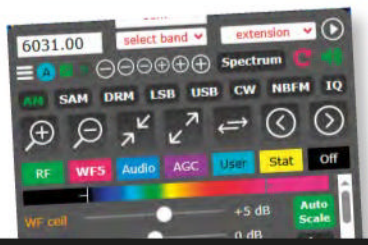
Morse from Uganda

The Editor relates the tale of his recent contest trip to Africa



A random copper stick

A design for a Lightweight Portable Multiband HF Vertical



FEATURE Getting started in amateur radio for free

This time we explore the possibilities of analogue signals on higher frequencies

REVIEW A fascinating accessory from Poland

We check out a replacement for the popular MFJ-890 beacon monitor

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

Editor
Don Field G3XTT
practicalwireless@warnersgroup.co.uk
Designer
Mike Edwards
mike.edwards@warnersgroup.co.uk

Advertising Sales
Alex Lyon **Tel: 07350 360313**
alex.lyon@warnersgroup.co.uk
Advertising Production
Kristina Green **Tel: 01778 392096**
kristina.green@warnersgroup.co.uk
Marketing Executive
Rebecca Abbott
rebecca.abbott@warnersgroup.co.uk
Marketing Assistant
Kirsty Westran
kirsty.westran@warnersgroup.co.uk
Publisher
Claire Ingram
claire.ingram@warnersgroup.co.uk

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Keylines

As I write this I'm back from Uganda and busy with all the events leading up to Christmas. We also have an early deadline for *PW* so that the good folk at Warners can have a break over the Christmas period, so we are a bit light on *News* and *Letters*. I have every confidence that plenty of material will arrive before the next issue of *PW*! Of course, by the time you actually get to read this, it will be mid-January, with the New Year in full swing.

My Uganda (5X1DF) report appears elsewhere in this issue. Just before going to press the raw (unadjudicated) scores for the CQWW CW Contest were published and I see I am World 9th on 40m High Power (unassisted), which I am more than happy with. The leading station, also from Africa, is ED9U, operating from Ceuta and Melilla, which is literally just across the Straits of Gibraltar from Europe, so he would have had a much easier time than me working both European and North American stations. In total during my visit I made around 4,000 contacts, many of them on 12 and 40m FT8, hopefully making many folk happy.

New Year resolutions

Did you make any resolutions for the New Year and, if so, were any of them related to your hobby? Personally, having been less active than usual in 2025, I want to get organised again and maybe try a return to the VHF and UHF bands (I was active on 2m and 70cm SSB and CW many years ago). I also have a new, fixed, Versatower to put up, to replace the trailer-mounted one I have been using for the past few years. And one of these days I really want to try the QO-100 satellite, but that may be more of a challenge although there seem to be quite a few DXpeditions working through the satellite nowadays so it can't be that difficult!

QSLing

I wonder how many of you have, in recent months, been receiving unsolicited confirmations from a couple of amateur radio websites, including qslworld. This is a new phenomenon and one that, for my part, is not entirely welcome – I don't actually want these electronic QSLs but qslworld obviously retrieves my email address from whatever source and keeps sending me confirmations. Of course, you may welcome them but the only confirmation I am interested in nowadays is for DXCC, usually via an automatic Logbook of the World (LoTW) confirmation. I occasionally still like to receive physical cards too, especially for rare expeditions, and I have been receiving quite a few QSL requests for physical cards for my recent Uganda operation. Of course, this is not such a straightforward process nowadays. Direct mail overseas has



become increasingly expensive and the QSL bureau has problems sending packages of cards to some countries. In any case, the current RSGB QSL Bureau manager is retiring and, at the time of writing, it is not clear what arrangements the Society will put in place to keep the service going. Time will tell.

This month

When I'm wondering what to write about in my *Keylines* I always look to the present issue for inspiration and this issue, and I hope you will agree, once again provides plenty of that. Four antenna articles, an area of our hobby that always provides plenty of scope for experimentation, two constructional articles, some amateur radio history and three articles related to getting on the air and operating. Not to mention the usual roundup of HF and VHF news and our regular *Data Modes* column.

The second part of **Georg Wiessala's** feature on propagation monitoring also has plenty to get your teeth into, for beginners there is the second article on getting a taste for hobby radio and **Roger G3LDI** continues his exhortations to learn Morse.

So, hopefully, something for everybody. And I have some great articles in the pipeline for the next few issues too. My thanks as ever to my both my regular and occasional contributors.

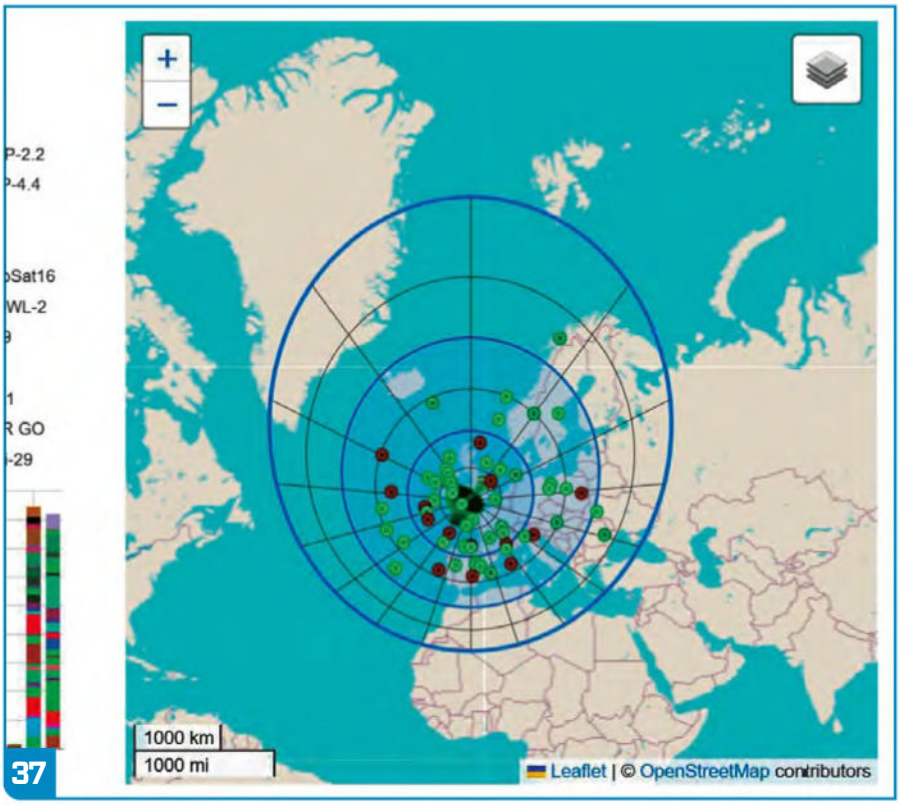
Correction

Georg Wiessala tells me that he has a correction to make to his recent Shipping Forecast article, to the effect that the Principality of Sealand is definitely in Sea Area Thames, as **Gus G3ZEZ** points out, not in Dover. I remember working Sealand many years ago, using a callsign prefixed S1 – definitely not a valid operation but, nevertheless, a curiosity!

Don Field G3XTT
Editor, *Practical Wireless* Magazine

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ARISS NEWS: (from *ICQ Podcast*) ARISS has released a new video promoting amateur radio on the International Space Station (ISS). Produced by NASA, the video features astronaut **Nichole Ayers KJ5GWI** aboard the ISS explaining how amateur radio plays a part in school contacts with astronauts on the ISS. Ayers explains many of the procedures and technical challenges that amateur radio operators must address during a school contact.

"It's a true privilege for me to be able to inspire the new generation of scientists and engineers through amateur radio."

www.ariss.org

In related news, the first HamTV transmission from the International Space Station (ISS) since 2018 occurred on 18 October 2025. As part of an ISS contact with the 1st Radford Semele Scout Group in the UK, HamTV was utilised in addition to FM voice over onboard amateur radio equipment.

ARISS has uploaded a compilation of video feeds received from ground stations in Europe. The HamTV setup on ISS has been out of commission for repairs since 2018, but was just recently brought back online in July.

ARISS HamTV Live:

https://live.ariss.org/hamtv



MUNICIPALITY AND LOS MOLINOS AMATEUR RADIO CLUB: The Municipality of Villa Alemana (Chile) signed a collaboration agreement with the Los Molinos Amateur Radio Club, an accord that will allow the municipality to reinforce its communications network in the event of potential emergencies and situations that could leave the commune isolated.

Mayor **Nelson Estay** highlighted that this joint effort is part of a sustained commitment within the municipal Cogrid (Communal Emergency Operations Committee). He recalled that the experience of the national power outage in February demonstrated the need for reliable alternative communication systems: *"We have been working for a while now. They are permanently part of the municipal Cogrid. We had an emergency last February, a blackout where we were completely blind across the entire country, and the only ones who were functioning and available were the amateur radio operators."*

The community leader valued the strategic scope of this alliance: *"The agreement we are signing today is very useful for facing any type of emergency that may leave us isolated or unable to communicate. They have amateur radio operators virtually throughout the country and the world, and connections with police, municipalities, firefighters, and whoever the emergency requires. I believe this agreement will improve any emergency situation that may arise, and we are happy to integrate them into the Cogrid."*

From the Los Molinos Amateur Radio Club, its president, **Lorenzo Passalacqua**, emphasized that the agreement formalizes a working relationship that had already been operating for some time: *"This agreement is to cover everything related to communications in case of emergency, to help, collaborate, and be at the disposal of the Municipality of Villa Alemana should they require our support. We have extensive coverage, both within Villa Alemana and outside the commune, for whatever the municipality may require, with whom we had already been working for quite some time."*

NEW RESTRICTIONS FOR SHORT-RANGE UHF RADIOS IN GERMANY: (from *ICQ Podcast*) In Germany, amateur radio may get an unintended boost following major restrictions that the nation's regulator has placed on the use of private mobile short-range hand-held radios known as PMR446.

PMR446, the popular short-range UHF radios enjoyed in much of Europe, could be enjoyed much less in Germany this month after changes enacted by the regulator BNetZa. The regulator will prohibit operators from using any external antennas with their radios and from using the radios as base stations.

PMR operators will also lose the ability to use their radios as repeaters or as internet gateways -- two functions widely available to amateur radio operators. The PMR radios, which operate on 16 frequencies within the 446MHz band, will only be permitted to be used for so-called 'peer-to-peer' or person-to-person mode.

Explaining these changes on his YouTube channel Funkwelle - the German word for radio waves - **Art Konze DL2ART** told viewers that he expected PMR operating to drop off, saying *"the only alternative that remains is to get into amateur radio"*.

He said that holders of the new N-class entry level licence have the ability to use relays and internet gateways and can communicate worldwide. Art reminded viewers that these changes closely follow similar restrictions placed earlier this year on Freenet, Germany's licence-free personal mobile two-way radio service.

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WINNERS OF THE 2026 HAMCATION AWARDS ANNOUNCED: For 2026 there are three award categories, the Gordon West Ham Ambassador of the Year, the Carole Perry Educator of the Year and a new category, the Amateur Radio Hero of the Year. The quality of candidates nominated for these awards was outstanding and the HamCation team is very excited to announce the winners.

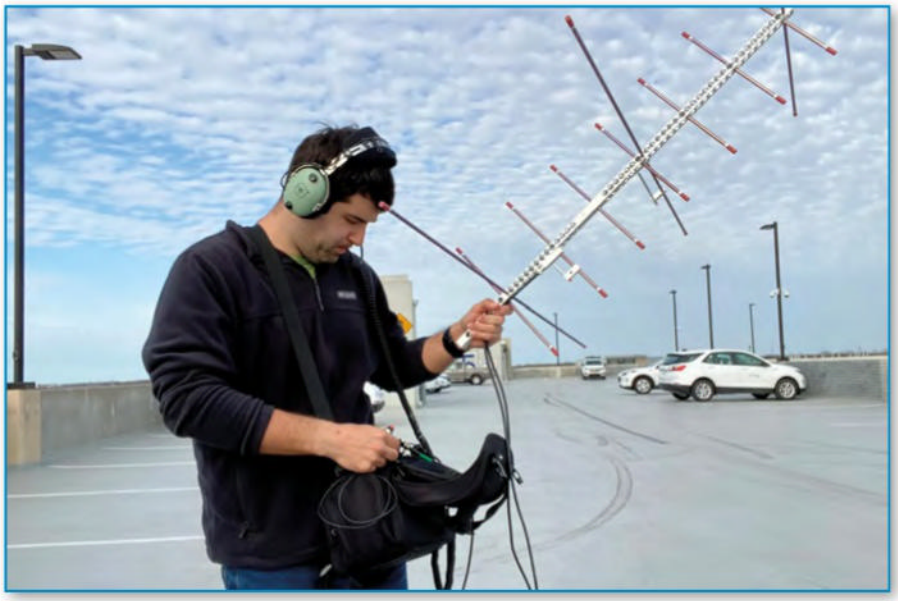
The 2026 Gordon West Ham Ambassador of the Year Award goes to **Tony Milluzzi KD8RTT**. The award recognizes his focused, long-term support and promotion of the Collegiate Amateur Radio Program (CARP).

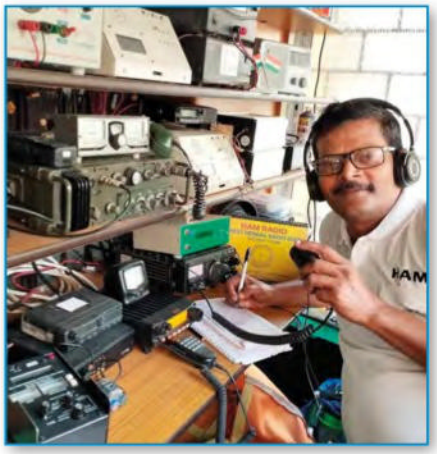
The 2026 Carole Perry Educator of the Year Award goes to **Dr. Nathaniel Frissel W2NAF**. The award recognizes his outstanding work with the HamSCI education program he created, grew and continues to expand.

The Amateur Radio Hero Award goes to **Ambarish Nag Biswas VU2JFA** located in West Bengal, India. The award recognizes his outstanding support of local and national emergency operations and law enforcement during life threatening events where lives were saved by his actions.

Each of these nominees has demonstrated outstanding dedication to promoting Amateur Radio by using radio to share knowledge, educate and provide vital communications. The HamCation team congratulates each of them for their award and the contribution they have personally made to Amateur Radio. HamCation 2026 will be held on .13/14/15 February.

www.hamcation.com/award





FUTUREGEO IS THE MOST IMPORTANT AMATEUR RADIO INITIATIVE OF THIS DECADE. WHY IS NO ONE TALKING ABOUT IT?

By **Cale Mooth K4HCK**: You might not know it, but plans are currently in progress to launch a geostationary amateur radio satellite that would provide multi-mode communications coverage to Europe and most of North America. Led by ESA and AMSAT-DL, the project is currently called futureGEO and would be the pinnacle of achievement for the amateur radio hobby.

futureGEO is likely to be very similar to the QO-100 satellite that covers Europe, Africa, the Middle East, and a large portion of Asia. The major difference of course would be the inclusion of North America within FutureGEO's footprint, opening up geostationary satellite operators to one of the largest ham radio populations in the world.

What makes futureGEO so compelling is the showcase of modern radio and software technology, as well as the relatively low barrier to entry to satellite communication. Like QO-100, futureGEO may feature analog and digital transponders as well as a fully integrated software defined radio stack. What that opens up is every existing ham radio mode, analog and digital, utilized through an easily accessible stationary satellite.

Beyond typical ham radio activities, QO-100 supports high-definition video nets through the use of amateur digital television. Wideband digital transponders open up the possibility of great experimentation from hams with a strong technical and especially software focused background. Imagine receiving amateur radio television with similar ease to that of DirecTV or Starlink.

Access to this technology is achievable. Everything required to access futureGEO from your own backyard can be possible for about the same cost as an entry level HF rig. Cheaper for those willing to build their own components. Very obtainable by the vast majority of hams. This is a technical achievement that would be out of reach for most hams just a couple decades ago due to cost.

Redefining the perception of amateur radio

Read just about any mainstream news article about amateur radio and it's inevitably framed as an old technology that's kept alive by a dedicated few. Maybe satellite-based video conferencing or high-speed data transfers without the use of the internet begins to change that old narrative. futureGEO also opens up entirely new educational outreach opportunities. Think ARISS but focused on satellite communications instead of the ISS.

Based on current progress and the pace at which QO-100 was implemented, we could see futureGEO become reality within the next 4-5 years.

So why is no one talking about this project? Why are most of the major ham radio organizations in North America absent from the conversation? Based on a presentation from ESA in 2023, the futureGEO concept was sparked by the IARU and supported by ESA, AMSAT-UK, and AMSAT-DL. For a proposed footprint that could cover most of North America, North American entities have largely been quiet. The exception being the formation of AMSAT-CA (Canada). (But even their website features only two sentences related to futureGEO and has yet to make public the referenced paper.)

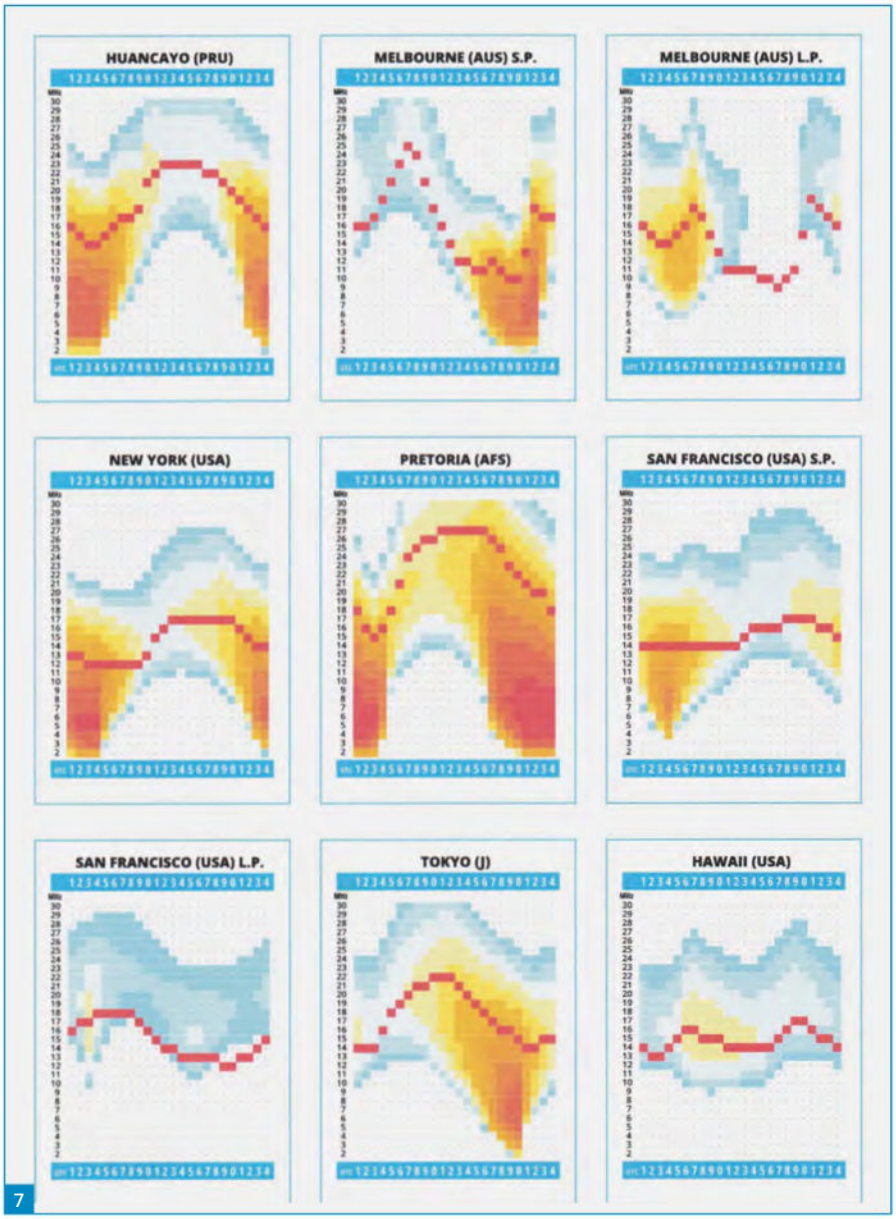
AMSAT-NA has relayed updates from AMSAT-DL and contributed to a proposal in 2023, but very little promotion has been published to their website. Earlier this year I asked about futureGEO updates at the AMSAT booth at both Hamvention and Huntsville but they weren't able to relay even basic talking points. IARU is credited with starting the conversation, but there's no mention of the project on their website.

Personally, I find this the most exciting active development in ham radio. To show my support I've become a member of AMSAT-UK and will continue to promote this project through both *Amateur Radio Daily* and *Amateur Radio Weekly*. If this project interests you, I'd highly encourage you to find a way to help promote it

https://hamweekly.com

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Georg Wiessala
wiessala@hotmail.com



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Tools & Ideas for Monitoring Radio Wave Propagation (Pt II)

Georg Wiessala continues his investigation of how you can monitor radio wave propagation conditions.

Last month (*PW*, January 2026: 52), we opened the 'radio window' in our atmosphere, and I attempted to offer an elementary overview of the basic physical mechanisms and ionospheric processes governing what is often called the 'Sun-Earth System'. I suggested using a few specific propagation resources, from hard-copy print and CD-ROM publications. We found several *direct* methods of sourcing up-to-date wave propagation forecasting data, such as observation, HF listening, and checking path propagation tables and circuit analysis diagrams. Finally, I included a few hints on some *indirect* ways of succeeding in propagation prediction, such as monitoring beacons – either dedicated propagation indicators or non-directional ones.

One of my key points last month was that you can choose to do this in a *traditional* manner – which, perhaps, means mostly 'offline' – or you may avail yourselves of the many *contemporary* digital and online resources for putting together your own forecast. To recap, I found another good example for both methods this month. On the one hand, **Fig. 7** is a paper propagation table from *QSP* (No. 5/2025) of the Austrian Amateur Radio Association (*Österreichischer Versuchssenderverband*). By contrast, **Fig. 8** shows a small ESP32 display, which can harvest live solar and HF propagation data from the internet. Which do you prefer?

A stormy space climate

Since I wrote Part One, the largest Solar Flare (**Table 1**) of the year erupted on 11 November 2025. It was, of course, noticed by all major radio groups. The X5.1-category flare peaked at 1004UTC on that day. It was imaged by the EUV cameras of all major solar satellites out there: *PROBA2 (SWAP), GOES (SUVI), Solar Orbiter (FSI and HRI), SDO (AIA)*, and *STEREO-A (EUVI)*. Many reported that the resulting solar storm (Table 1) was the strongest, so far, in the current 25th Solar Cycle (*STCE*, 17-23 November 2025: 2).

Many amateur radio astronomers shared their observations of this online. And then – just as I was sending this to press – thousands of *Airbus* planes were grounded for hours. The reason? A warning that solar radiation had interfered with, or even destroyed, the onboard flight control computers (**Fig. 9**). If any more evidence were needed about the impacts of space weather on us, this surely was it.

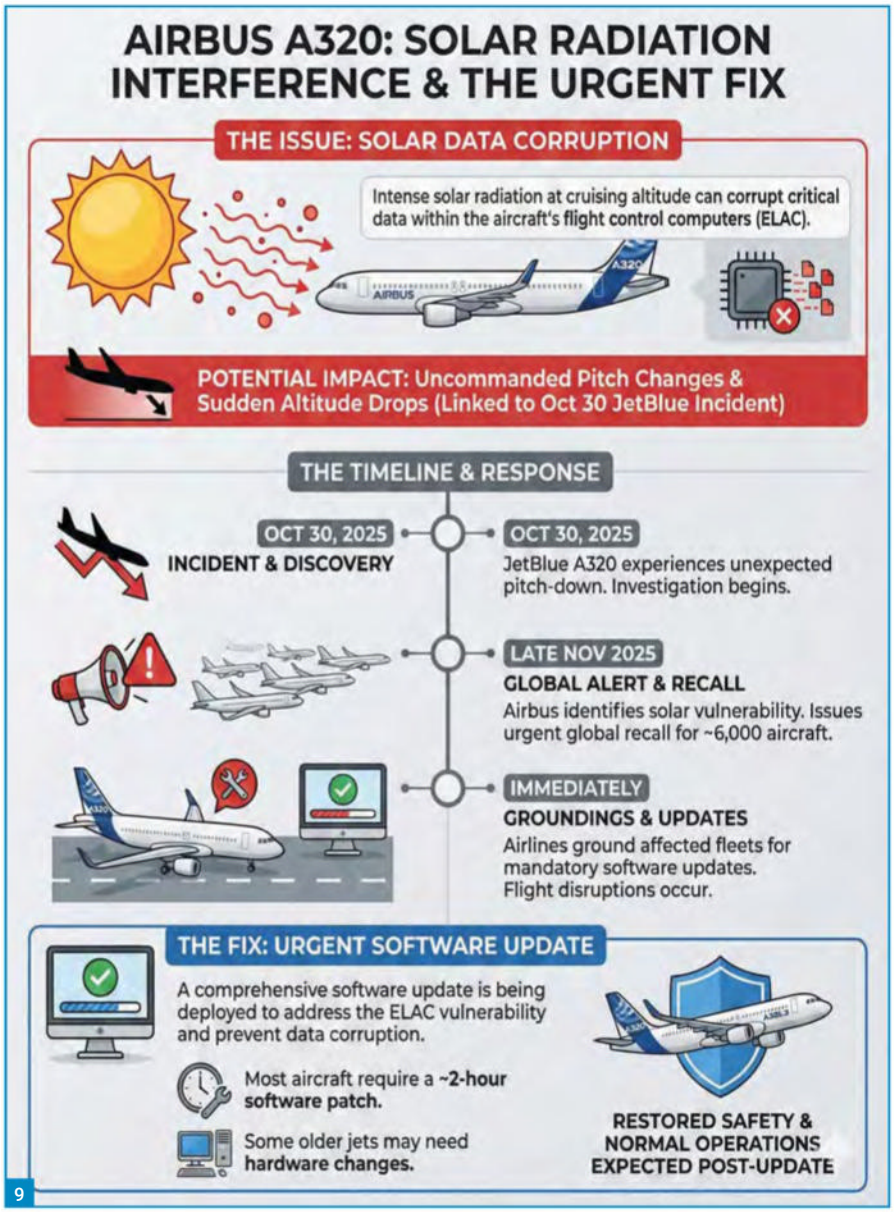
Inspired by a globally 'stormy' (in solar terms) November, the Alaska-based High-Frequency Active Auroral Research Programme (HAARP) and others got in on the act and produced new simulations and observations capturing the atmospheric physics at play throughout the E, D and F regions of the ionosphere. In particular, HAARP studied Artificial Periodic Inhomogeneities (API), i.e. irregular patterns see URL below). Strong space climate events like these stimulate new research – and not just in the STEM areas. For example, some are now retracing exactly how that layer was actually discovered, which **Oliver Heaviside (1850-1925)**, **Arthur Edwin Kennelly (1861-1939)**, and others described in 1902. But more on that in a later article.

https://haarp.gi.alaska.edu

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Fig. 7: A paper propagation diagram from *QSP No. 5/2025*. Very few of those are being published any more these days, it seems. Fig. 8: A new ESP32 display, collating live solar and HF propagation data autonomously from the internet. Fig. 9: A visualisation of the possible effects of the solar flare of 11 November 2025 on one area of air traffic.

This month, I am aiming to give you some more ideas on how you can use digital resources and specific online tools to predict propagation environments.

First, use what you have: magazines, CD-ROMs and downloadable propagation tools

Writing about propagation phenomena goes back a long time. I remember, for example, that my fellow authors **Keith Hamer** and **Garry Smith** contributed many articles on doing this through the popular medium of DXTV (e.g. 'Fun with Sporadic-E', *RadioUser*, June 2014: 50-57). In other magazine columns – past and present – the ionospheric processes were sometimes inferred by looking at various parts of the radio spectrum. To this end, some hams have studied signals in the Very Low Frequency (VLF) band (see below); others investigated special DX techniques or maritime and aeronautical radio– all to find out more about propagation.

You may already have a comprehensive resource on HF propagation at your fingertips, in the shape of the *PW* back issues and archive CDs of this esteemed magazine. These contain numerous articles on this topic, put together by a knowledgeable team of writers. Use them whenever you can and keep acquiring the archive CDs, you never know when you might need them! What is more, many older propagation resources used to come on CD-ROMs. Examples of those are the disks issued by some current and former *PW* authors. Fig. 6 in last month's feature shows an example. On older data carriers, you can still find a meticulously assembled collection of relevant propagation-related software. Therefore, do not throw them away!

Webpages, online blogs, and ham radio science

Realistically, though, the most widespread way of finding propagation data is now the internet, which for most of us is a firm part of our shacks anyway. Much of what you will find on the World Wide Web relates to HF, but there are some examples covering propagation on VHF/ UHF and even VLF. My first online port of call for gathering facts on propagation is the pages of national radio amateur and scientific bodies (NOAA, RSGB, DARC, ARRL). But many smaller regional radio clubs also offer valuable propagation information, often at radio rallies. This can be very good because it is often

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the result of the work of enthusiastic hobbyists.

Other than that, there is now a staggering wealth of propagation data online. The numerous solar-terrestrial data graphics, boxes, banners, dashboards and forecasts on many ham radio homepages, however, are not always easy to penetrate. Therefore, in Table 1, I am attempting a very short explanation of the main values. But bear in mind that I am no scientist; I never paid attention to Physics in school, preferring instead to learn English. Anyway, you'll find much more on some of the more established blogs, such as *Hard Core DX/Solar DXInfo*, *Space Weather/Solar Ham* (**Fig. 10**), and *QSL Net*.

Beyond that, there are accurate propagation prediction tools like *Proppy* (URL below). And a few Facebook groups can also be helpful (e.g., *HF Underground*, *Ionospheric Propagation)*. However, as is the case with all online content, do exercise discretion. Not all info is reliable, and you can easily be led down virtual rabbit holes and conspiracy theories. Sadly, there are sites out there peddling pseudoscience and misinformation, especially on VLF, space weather, the Sun and human health.

https://soundbytes.asia/proppy

On consulting official resources

Generally, though, online content is useful in providing resources on ionospheric physics and radio waves. Some sites allow you to even download software. Most are of a general nature; others have special remits, such as NDB hunting and grey-line propagation (*Dämmerungszonenausbreitungsprogramme – definitely* my favourite German radio word, that!).

In my experience, the most dependable online assets are those from 'official' or governmental sources and databases. For instance, check out the *RSGB Online Propagation Tools, Propagation Outlook* and *GB2RS Propagation News*, *Australian Bureau of Space Weather Services*, *Japanese Space Environment Service*, and the materials from the US *National Oceanic and Atmospheric Administration (NOAA)*. Closer to home, the Brussels-based *Belgian Solar-Terrestrial Centre of Excellence* (STCE, **Fig. 11**) is a dependable source of current space weather data, images and further information.

In addition to the STCE, the *European Space Weather and Space Climate Association (E-SWAN)* is an international non-profit association established in 2022. The mission of *E-SWAN* is to unite, sustain, and develop Space Weather and Space Climate activities in Europe (URL below). *E-SWAN* has a committed Education and Outreach Committee (EOCom), which aims at the space weather and space climate communities, as well as, increasingly, a radio hobby audience.

https://tinyurl.com/utk7388m

To that end, the Association is developing a range of booklets on real-world impacts of solar and geomagnetic activity, focusing on how these phenomena affect everyday activities, infrastructures and industries. The first (multilingual) booklets are on power blackouts and navigation failures due to solar flares, and the EOCom is continuously building new resources. The booklets are for non-specialists:

www.stce.be/shop

To finish this section, a few semi-professional blogs (e.g. *PropQuest*, *SunSpotWatch* and *SolarHam*) are also worthwhile tapping into. For example, I sometimes check in with **Tamitha Skov**, who self-identifies as the American 'Space Weather Woman' (**Fig. 12**). Please bear in mind that this is a volatile and fast-moving field, and new propagation resources come and go. And, once again, always double-check any information you may come across.

- **304A** (304Å; angstrom) **Value**: solar UV radiation at 30.4nm from ionised helium. (Any acronym after the '@' denotes the observing instrument).
- **A-Index**: linear measure of average geomagnetic activity in 24 hours; values of ca. 100-400; derived from the K-Index (see below).
- **Ap-Index** (0-400): the planetary equivalent of the A Index (see above): daily average long-term stability of Earth's Magnetic Field.
- **Aurora** (0 – 10+++): relative strength (Gigawatts) of F-layer, relating to cross-polar DXing.
- **Aurora Lat** (Aurora Latitude, 67.5 – 45.0): estimate of the latitude of an aurora, in Degrees (N).
- **Blackouts** (Radio Blackouts): disturbances in HF (High-Frequency) radio communications caused by solar flares.
- **Bz** (50 to -50: direction and strength interplanetary magnetic field vector, perpendicular to the plane of Earth's orbit.
- **CME** (Coronal Mass Ejection): eruption of bubbles of plasma and magnetic field on the Sun; causes geomagnetic storms and aurorae on Earth.
- **Electron Flux** (0 - unknown): density of charged electrons in the solar wind; this impacts the E-layer.
- **(Geo-)magnetic Storm**: a disturbance of the Earth's Magnetic Field; often leads to an Ionospheric Storm (see below).
- **G-Index** G-Storm (Geomagnetic Storm; G1-G5): the activity of Earth's magnetic field (based on the Kp-Index).
- **Ionospheric Storm**: a disturbance of the Ionosphere; can be preceded by a Geomagnetic Storm.
- **K-Index**: three-hourly measurement of the variations in the Earth's Magnetic Field.
- **Kp-Index** (Planetary K-Index, 0-9): short-term geomagnetic field disturbances averaged around the globe.
- **LUF** (lowest useable frequency): the lowest frequency that permits ionospheric signal propagation.
- **MUF** (maximum useable frequency): the highest frequency that permits communication by Sporadic-E propagation alone.
- **Noise Floor**: the noise contributed by various solar activities, e.g. solar wind, on reception.
- **OWF** (better: '**FOT**': *fréquence optimum de travail*): lower decile of daily values for operational MUF, at a given time, over a month.
- **Proton Flux** (0 to 'unknown'): the density of charged protons in the solar wind, caused by solar flares or solar wind; this impacts the E-Layer.
- **R-Index**: radio-blackout strength (R1-R5; see 'Blackouts').
- **S-Index**: Solar Radiation Storms; metric used to measure the intensity of solar magnetic activity (cf Mount Wilson Observatory).
- **Solar Flare**: flashes of X-rays/ UV light from active areas on the Sun (sunspots). 1-8 Å; arrives here in 8 minutes.
- **Solar Flux** (SFI): solar power per unit area of EM radiation ('radio noise'); 62.5-300; in watts/ m^2 @ 10.7cm wavelength (2800 MHz).
- **Solar Wind** (0 – 1000): proton/ electron particle flux from the Corona at ca. 400 km/s; values of 0-1000; lower is better; arrives here in a few days.
- **Sunspot number**: a measure of solar activity, calculated by adding the number of individual sunspots to ten times the number of sunspot groups.
- **X-Ray** (A0-X9.9): intensity of X-rays the Sun releases in the ionosphere. A, B, C, M, and X class values indicate magnitude.

There are other values too, such as meteor scatter, signal noise level, solar flare probability, and band-specific forecasts. So, for instance, if your propagation prediction source indicates *'R1-S0-G3'*, there is likely to be a minor flare-related HF disturbance, no major radiation storm, and a strong geomagnetic storm in progress

You can decode the ubiquitous propagation and band-conditions banners on many websites by looking at the summaries provided by NOAA, and hams like **Paul Herrman DM41UM, N0NBH** and **Doron Tal 4X4XM**, at the URLs below:

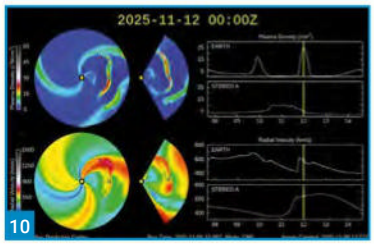
- Understanding the Band Conditions Banner: **https://tinyurl.com/495yshbn**
- Understanding the Condition Banner on HF Bands: **https://tinyurl.com/zmjker9e**

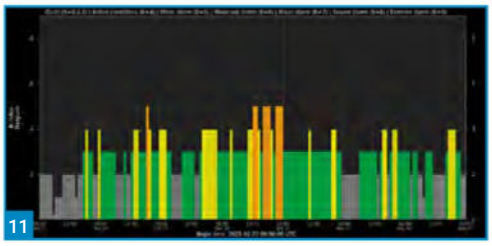
Table 1: How to Read Geomagnetic Indices: A-Z

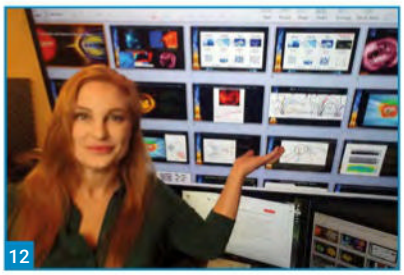
Remote observation and SDRs

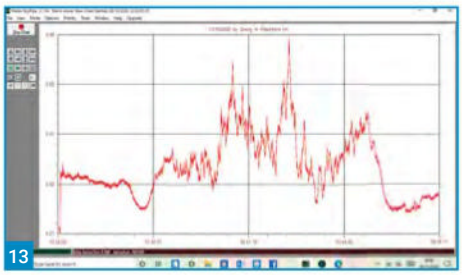
A relatively new hobby endeavour is the use of 'remoted' or standalone Software-Defined

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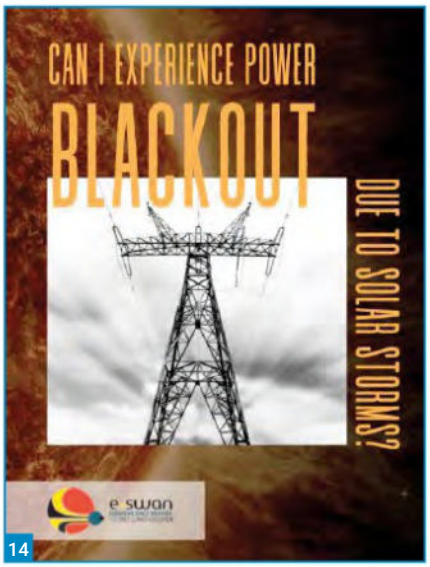


Fig. 10: A space weather graphic from the *Solar Ham* Facebook group (www.facebook.com/SolarHam/?locale=en_GB). Fig. 11 Some magnetic activity indices from the Belgian *Solar-Terrestrial Centre of Excellence (STCE)* for October 2025. Fig. 12: Tamitha Skov is the US Space Weather (Wonder) Woman. Fig. 13: A VLF loop, VLF receiver, logger, and software like *RadioSkyPipe* allow you to evaluate solar activity via its effects on VLF transmitters. Fig. 14: These new booklets by the *Education and Outreach Committee* of the *European Space Weather and Space Climate Association* can be a good starting point for learning how space weather might affect you as a radio amateur or DXer.

Receivers (SDR), like the Kiwi SDR/ Kiwi SDR-2, for the assessment of emerging ionospheric conditions:

http://kiwisdr.com

Other notable remote SDRs include the one at the University of Twente and the **Barry Davies** Memorial Receiver of the UK *Medium Wave Circle* (links below).

http://websdr.ewi.utwente.nl:8901
https://mwcircle.org/bdmr

Meanwhile, *PW* contributor **Nils Schiffhauer** has published some interesting work on DF (Direction-Finding) techniques using the TDoA (Time-Difference-On-Arrival) technique:

https://tinyurl.com/292wnczy

And for a comprehensive introduction to using internet-controlled SDRs, take a look at the *Klingenfuss 2025/2026 Guide to Utility Radio Stations* (Ch. 2.9, pp. 39ff.) or *2025 Shortwave Frequency Guide* (pp. 40 ff).

Finally, for this section, you could join citizen-science initiatives such as the *INSPIRE* VLF project, *PropNET* and the *School Amateur Radio Club Network (SARCNET)* in the UK, to get you started. There are many good newsletters you can subscribe to, like the one from the above-mentioned Belgian STCE. Here is a link to the (at the time of writing) most recent PDF & online issues:

www.stce.be/newsletter/newsletter.php

Some surprising extra options

To finish off this overview, there are unexpected ways of checking propagation. As an Airband enthusiast, you may obtain clues on space weather from **PE1NWL's** *DX Robot* in the Netherlands and from the VOLMET forecasts at Shannon, Gander or the RAF. These stations are a good resource for monitors wishing to check possible reception from various parts of the world. Moreover, for MW DXers, it is perfectly possible to evaluate atmospheric conditions in this part of the spectrum since the D layer is involved here. Take a look at the websites of the *Medium Wave Circle, Hard-Core-DXing (HCDX), Solar DX Info*, and others.

Of course, the monitoring of *terrestrial* weather conditions by receiving radio broadcasts, radio teletype (RTTY), and weather facsimile (Radio FAX/ WXFAX) can also be a great aid for the propagation student. In 2020, I called weather watching and radio 'natural bedfellows' (*PW*, October 2020: 46). Five years later, my claim still stands, especially in connection with receiving WEFAX and RTTY.

More generally, several SFTS (Standard Frequency and Time Signal Stations), such as HMV in Fort Collins, Colorado and WIWI on Kauai, Hawai'i, do more than broadcast the exact time. They are still transmitting data on solar-terrestrial data and propagation conditions. The frequencies in question are **2500, 5000, 10000, 15000**, and **20000kHz**. Several specific geophysical alerts are sent from WWV at 18 minutes past the hour and from WWVH at 45 minutes past the hour:

https://tf.nist.gov/stations/iform.html

The messages are short: less than 45 seconds in duration, but they get updated every three hours.

Sky-tuning: nature's own radio

Last but certainly not least, the regular monitoring of auroral and atmospheric sounds (natural radio) in the Extremely Low and Very Low Frequency (ELF and VLF) bands, such as *whistlers, hooks, tweaks* and *spherics*, can help the interested radio enthusiast understand a lot more about radio wave propagation, space weather, the Earth's Magnetosphere, and the layers of the atmosphere. Both **Shaun O'Sullivan** and I have written about this aspect before (*RadioUser*, January 2013 and 2014, respectively).

You'll need a dedicated ELF/VLF receiver, like those made and sold by the United Kingdom Radio Astronomy Association (UKRAA), or the *elettrofficina Wave Predator PIC-RXO* (0.1-10kHz; **https://tinyurl.com/yc8p7b5y**).

I have previously used the UKRAA single-frequency (23.4kHz) VLF receiver, in conjunction with software such as *RadioSkyPipe* and *Spectrum Lab*. You'll be surprised at what you can do with software and a dedicated VLF aerial (**Fig. 13**), especially if you are interested in more long-term observation and data logging.

Last but not least, check out the extensive 'natural radio' websites of **Stephen P. McGreevy N6NKS** and **Renato Romero IKIQFK** for the more specialised ELF and VLF aspects of propagation watching. The USA *INSPIRE-Project*, its dedicated VLF receiver and its publications are also great educational resources.

Conclusion and outlook

I hope you have enjoyed this initial foray into radio wave propagation and that I may have whetted your appetite for learning more about this absorbing topic (**Fig. 14**). This is where ham radio operation and DXing meet radio science, astronomy and physics. I shall be back a little later in the year with a look at some specific frequency areas and ionospheric events of interest to the radio amateur, DXer or citizen-scientist, as well as a little bit on the history of this subject. For now, though. I'll see you next month for another topic.

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Books

- Judge, P. (2002) *The Sun. A Very Short Introduction* (Oxford: OUP)
- Moldwin, M (2008) *An Introduction to Space Weather* (Cambridge: CUP)
- Nichols, S., G0KYA (2016) *Radio Propagation Explained* (Bedford: RSGB)
- Palmer, P. (2017) *The Atmosphere: A Very Short Introduction* (Oxford: OUP)
- Poole, Ian G3YWX (2004, repr. 2007) *Radio Propagation: Principles and Practice* (Bedford: RSGB)

Journals

- GEO Quarterly (Group for Earth Observation): **https://tinyurl.com/46ef8ua9**
- NASA INSPIRE Newsletter (VLF Observations): **https://tinyurl.com/2d546ym8**
- Radio Science (AGU): **https://tinyurl.com/5n8pdezj**
- Solar Physics (Springer): **https://link.springer.com/journal/11207**
- Space Weather Quarterly (AGU; until 2019): **https://tinyurl.com/52h932sr**

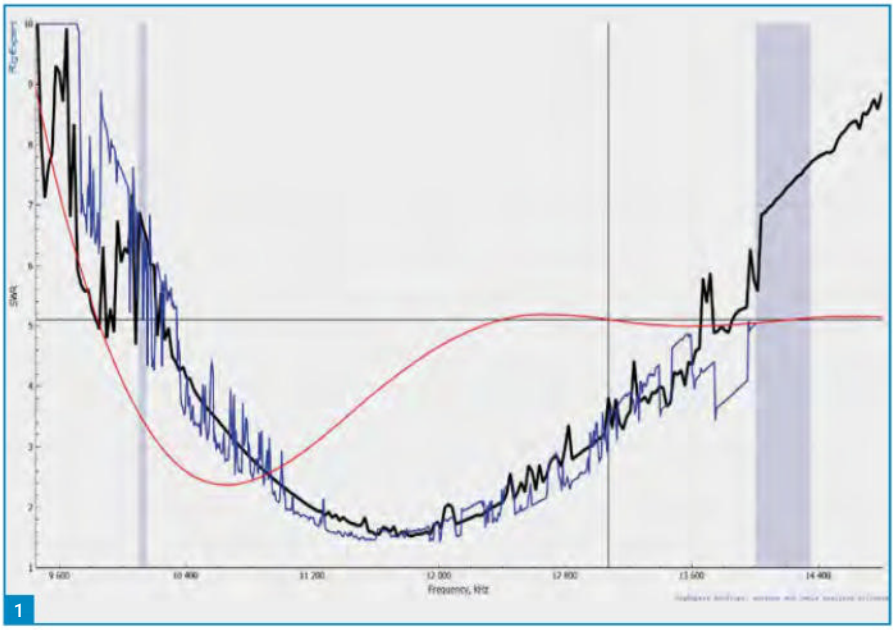
Articles

- Hamer, K., and Smith, G. (2014) 'Fun with Sporadic-E' (*RadioUser*, June 2014: 50-57).
- Hood, T. (2017) 'Space Weather, the Sun-Earth Connection and Radio Propagation' (*RadioUser*, December 2017: 8).
- Redwood, C. (2025) 'HF Propagation (Part I, *PW* August 2025; Part II. PW October 2025).
- Reeve, W. (2025) 'Sudden Frequency Deviation Observations' *PW* November 2025.
- White, S. G3ZVW (2019) 'Ionospheric Pioneers' *PW* July 2019: 16

Websites

- NOAA: **https://tinyurl.com/4jpbp3f6**
- Paul Herrman DM41UM: **www.hamqsl.com/solar.html**
- Solar Ham: **www.solarham.com**
- Solar-Terrestrial Centre of Excellence (Belgium): **www.stce.be**

Table 2: Selected Resources (a longer reading list is available upon request)



1

The Random Copper Stick

Frank Howell is back again, with a design for a Lightweight Portable Multiband HF Vertical.

Frank M. Howell, PhD, K4FMH
practicalwireless@warnersgroup.co.uk

Ever fancy taking a walking stick to operate portable HF radio? What if the 'walking stick' was a lightweight vertical antenna that would have low SWR on 80-10 metres? To boot, it also packs down into a two-foot long padded case for easy walking. Here is what I have done to build one.

Inspired by the Ham Radio Rookie YouTube presentation on his 'carbon fibre squid pole EFHW antenna', I began experimenting with it. The attractiveness of a multiband HF portable vertical using only a metallic tape applied to an inexpensive telescoping carbon fibre pole is compelling indeed.

Most hams operating portable are by now aware of the lightweight Faraday Cloth used as a counterpoise. **Ben VE6SFX** and I communicated through comments on his YouTube video where he said this was slow in further development but he might try it as a random wire. That is what seems to work very well in my continued experiments on his brilliant original idea! Here are my results to design and make this rather odd antenna that I was dubious as to if it would work at all.

Theory behind the Random Copper Stick Vertical

Faraday Cloth is comprised mostly of nickel with some copper into a composite weave cloth. Copper has a higher conductivity according to most charts: **https://tinyurl.com/w445eupx**

Copper tape is inexpensive and readily available in multiple widths, especially at hobby and craft shops, although Faraday tape may be less fragile. Instead of Faraday tape, I used copper tape at varying widths to follow the thinning telescoping pole sections. Wider radiators tend to offer greater bandwidth. As Ben VE6SFX also experienced, a metal radiator touching the carbon fibre material affects the relationship of the expected RF length versus the physical length. We do not know the velocity factor for this application of a metal tape so modelling the antenna is challenging without significant assumptions.

This aberration of the carbon fibre pole's influence on the radiating tape can nonetheless be leveraged positively. **Fig. 1** illustrates the effects of copper tape versus two alternate radiators. With the copper tape, the jittered readings using 1,000 points in this narrow bandwidth show how the carbon fibres in the pole have both imperfect

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conducting and dielectric properties (from **Dave G3PVH**, RSGB Technical Group). It lowers the resonant frequency from that expected by the standard physical length. As I will show, the RF sweeps of the 19-foot pole with copper tape are not resonant in any ham band. This led to my trying a 9:1 Unun transformer, which works splendidly for minimum SWR using an ATU. As Ben VE6SFX suggested to me, treating this is a random wire vertical proved to be the practical solution that makes this Random Copper Stick work.

Assembling the Carbon Fibre Pole

The parts to this antenna are illustrated in **Fig. 2**. Begin with the carbon fibre pole. I purchased one by Bakawa from AliExpress, fully extensible to 6.3 metres (or 20.6 feet). It has a 'stopper' cap on the top to hold each section in the outermost one when not in use. The pole comes with a metal screw-in cap that must be removed temporarily. It will later be used as the feedpoint of the antenna.

I removed each section from the bottom largest section to apply copper tape on the exterior. I completely removed the top two thinnest sections leaving a full length of 18.2 feet (5.4m). Take care to align the copper tape so that it runs straight along the outer shell of each section. I used wider width (1 inch) tape on the bottom sections but switched to narrower 1.25 inch tape higher up as the pole's sections got smaller in diameter.

The tape length on each section is folded just inside the inner ends of each section for better electrical contact. (It may be possible to use conductive paint on the respective inside and outside of each section's join to enhance the connection but I have not tried that yet.) To keep the smallest section from falling back into the larger ones, I used hot glue to attach a rubber cap that is slightly larger in diameter than the next larger section. This cap helps in pulling out the inner sections during setup.

I used the mast screw-in cap on the bottom section the pole to attach the radiating feedpoint cable. A drill press was used to make a hole in the cap allowing a bolt to be inserted from the inside out. On this threaded end, I attached a lock washer and nut. A ring terminal with copper stranded wire was attached.

I installed a rubber cap over the exterior nut to insulate from the Faraday Cloth if it is place on it (not shown in Fig. 2). On the other end, I installed a banana plug. This fits into the LDG 9:1 Unun that I chose to use for this random wire vertical. On the back of the Unun, I used adhesive squares to attach a C-clip made for hanging PVC pipe in plumbing. Be careful to purchase one that can easily pop onto the mast but not clasp it too tightly.

The black Super Clamp, used by photographers to place ad hoc lighting accessories on tubular tripod mounts, is used as a brace for the mast to a supporting object rather than a traditional ground





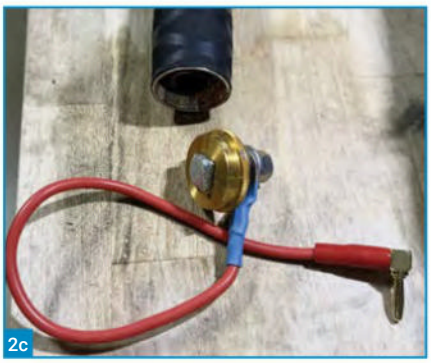
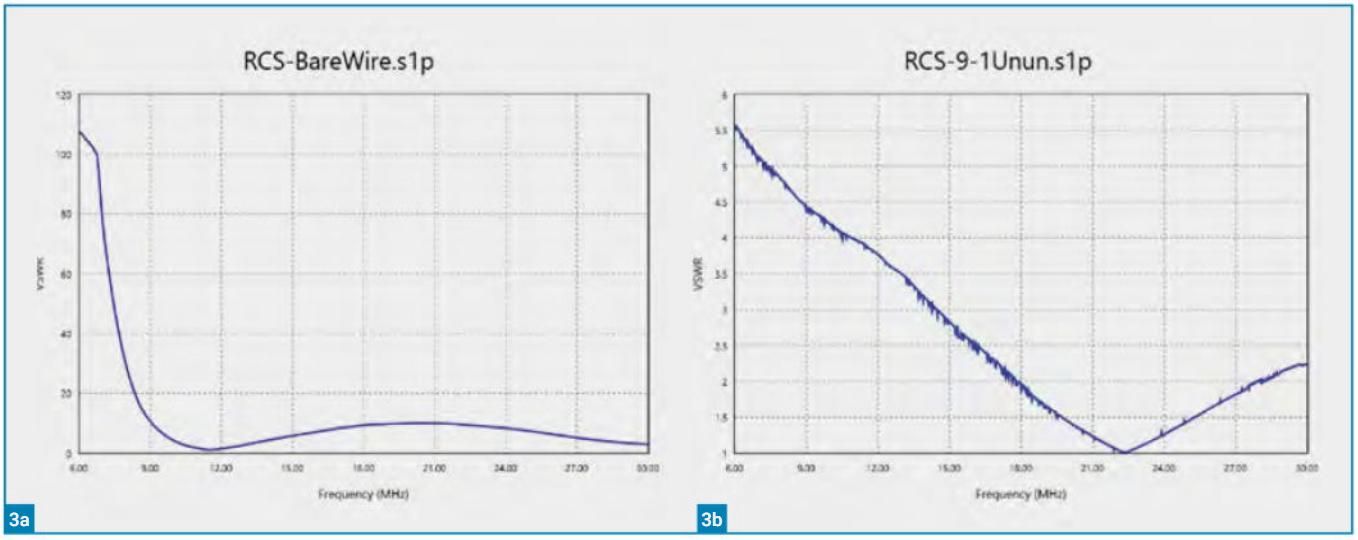


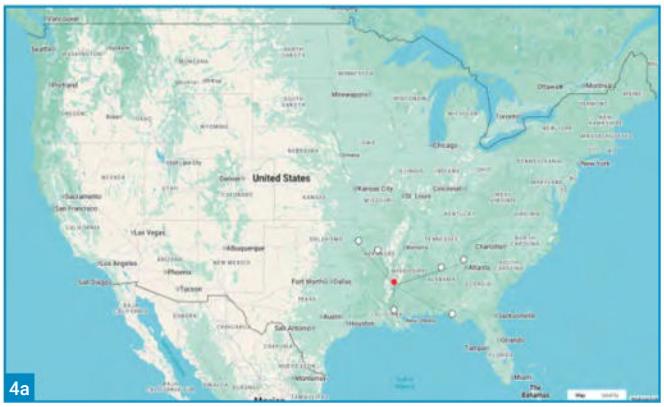




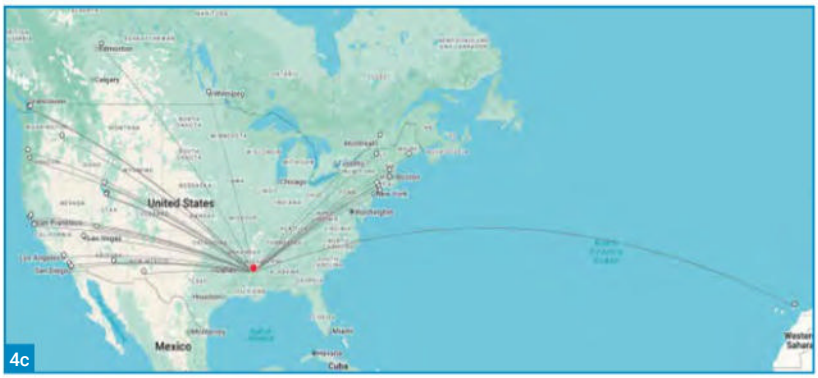
Fig. 1: RF Sweep of Random Copper Stick Illustrating Carbon Fibre Alteration of Radiator Length. This is an RF sweep using a RigExpert Pro Stick for a carbon fibre pole with three different radiating elements. The Blue line is copper tape applied along the length of the extended pole (~19 feet). The Black line is a wire taped to the pole. The Red line is a wire connected only at tip, reducing direct contact with the carbon fibre pole.
Fig. 2a: Copper tape applied directly to each section of the carbon fibre pole, lapping slightly inside. Metal cap with bolt from inside for feedpoint.
Fig. 2b: Unun with PVC pipe-hanger attached with adhesive squares. Slips onto lower part of mast (not over copper tape).
Fig. 2c: Metal cap assembly for feedpoint cable. Note bolt inserted from inside to accommodate ring terminal on feed line cable. Banana plug on opposite end of cable for insertion into Unun.
Fig. 2d: Deployment of Random Copper Stick vertical on author's patio with Faraday Cloth counterpoise. RigExpert Stick Pro attached for RF band sweeps
Fig. 2e: Completed parts for Random Copper Stick vertical. Rolled-up Faraday Cloth sheet for counterpoise. Blue cable with sturdy clip to attach to Faraday Cloth. Red LDG 9:1 Unun with banana plugs. Super Clamp to attach carbon fibre pole to a mount object. Carbon fibre pole slightly extended illustrating copper tape attached. Top section has rubber cap to prevent dropping into larger sections.

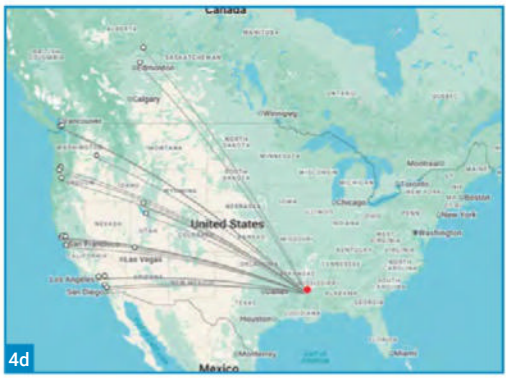
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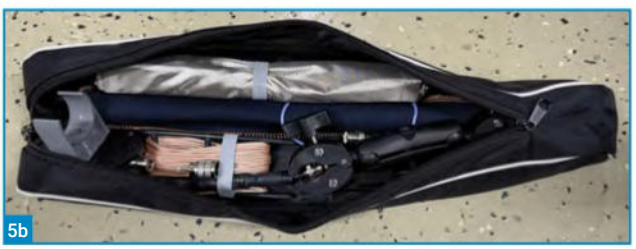


Fig. 3a: Antenna at bare wire feed point and counterpoise. Be aware that the antenna is not resonant on any amateur band.
Fig. 3b: Antenna with 9:1 Unun. **Fig. 4a:** WSPR spots, 40m (mid-day, 32 spots). **Fig. 4b:** 20m (late morning, 113 spots).
Fig. 4c: 15m (late-afternoon, 115 spots). **Fig. 4d:** 10m (mid-afternoon, 73 spots). **Fig. 5a:** Random Copper Stick packs down to small carrying case. Benro brand camera equipment bag is less than 2 feet in length, has handle and shoulder strap, and area for name plate.
Fig. 5b: Antenna system including Faraday Cloth counterpoise, Super Clamp mount, 9:1 Unun, and RG-316 coax with ferrite bead choke packs down inside of two feet with zippered access.

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mount. Take care to not apply too much pressure to the carbon fibre pole or it will crack. The plug keeping the smaller pole sections inside the largest one can be attached using a round Velcro attachment to the mast itself for safekeeping. If the feedpoint is to be placed on top of the counterpoise, I advise adding an appropriately sized rubber end cap over the bolt and red wire or it will produce a short across the input to the Unun. Do not forget the remove the Super Clamp during pack down at the end of the operation as I lost my first one this way.

I have included a picture of the antenna deployed on my patio near my BBQ grill. The grill's handle makes a perfect brace attachment, very similar to many objects available in parks and other public spaces. The Super Clamp can be twisted in a myriad of turns to accommodate a surprising array of mounting options when operating in portable. I have not noticed any directionality associated with the placement of the Faraday Cloth counterpoise itself but your experience may differ.

Measurements on the HF bands

Taking the advice of Ben VE6SFX that the Stick might well act like a random wire vertical, I provide two RF sweeps using a RigExpert Stick Pro in **Fig. 3**. These graphs show that this mast height does not resonate in any amateur radio band. On the left graph, the bare wire feedpoint has minimum SWR (and where X=0) at 11.52MHz. After adding the 9:1 Unun, the vertical resonates at 22.44MHz with minimum SWR and X = 0. These are both characteristics of a random wire antenna.

After inserting an LDG 9:1 Unun after the feedpoint, I used an FX-4CR transceiver and small ATU-100M ATU with latching relays to see how successfully the Random Copper Stick would work in the HF bands. (The latching relays keep the same match after a tuning cycle so that the RigExpert Stick Pro could sweep each individual band.) These results are shown in **Table 1**.

The efficiency of such an odd antenna is not examined in this article. We cannot readily even model how this antenna is expected to radiate at this point in the research and development. For instance, what is the Velocity Factor of the multiple strips of copper tape?

However, the resulting ATU match achieved in each of the HF bands is remarkable. All bands, including 80 metres, reach a minimum SWR of less than 2.0 for all or much of the band. For several, the minimum is less than 1.5 SWR. The bandwidth with

	Band Edge			
Metre Band:	Low	High	Min. SWR	BW <2.0
80	3.38	1.97	1.18	340kHz
60	1.56	1.29	1.21	All channels
40	1.90	1.33	1.05	300kHz
30	1.21	1.39	1.21	50kHz
20	1.39	1.42	1.31	350kHz
17	2.20	2.00	1.93	~50kHz*
15	1.24	1.51	1.21	450kHz
12	1.41	1.42	1.41	1.0MHz
10	1.38	1.98	1.38	1.7MHz

*estimate (see text)

Table 1: SWR beasurements for HF bands for Random Copper Stick.

SWR <2.0 is the dominant portions of all HF bands. The measurements for 17 metres are estimated as they remained very near the 2.0 mark but the graph (not shown) illustrates that about half the band is slightly below this figure.

For a further proof of concept for the Random Copper Stick, I have shown WSPR beacon receptions in **Fig. 4**. The bands include those most likely used in portable operation. These beacon measurements were taken during the mid-morning through late afternoon. This time frame has some impact on the results, especially for 40 metres which was regionally short during the mid-day period (32 spots). The 20-metre band reached the northeastern U.S. and the beacon was also received in the western states during this mid-morning test period (113 spots).

The 15-metre band results were during the mid-afternoon where that band performs best at my location, even reaching the coast of Western Sahara and several Canadian Provinces (115 spots). The East and West Coast were locations where this 0.2W beacon was consistently heard on this band. Finally, 10 metres was open to the West Coast of the U.S. during the mid-day window, reaching Southern California and Western Canada (73 spots). This did seem more directional than the other bands but the Faraday Cloth counterpoise was in the precise opposite direction so this is unclear.

In short, the Random Copper Stick both matches well from 80-10 metres for a random wire vertical using an inexpensive automatic tuner. It also radiates in the expected ways that a ground mounted vertical would, given the time of day and the band where the WSPR beacon was set.

In practice, I have used a 20-watt transceiver on SSB to work much of the East Coast in the U.S. from portable locations here in Central Mississippi. Many reports from operators I worked expressed great surprise at the signal strength using this antenna, even on days when many HF bands were not very open to typical propagation. Nevertheless, this antenna clearly emphasises ease of transport, setup, and take-down over absolute efficiency.

Packing and carrying the Random Copper Stick

For an 18-foot telescoping pole, the Stick packs down into a case that is no longer than a couple of feet. I purchased a second-hand camera tripod bag made by Benro, a maker of photography equipment. It cost $15 USD plus shipping on eBay. **Fig. 5** illustrates this small case, with a name plate for **Scott K0MD**, as I made this one for him. The second photo (Fig. 5b) shows that the parts of the system fit snugly into the small zippered bag. It would be suitable for airline travel (either inside a suitcase or as a carry-on). It is a breeze to carry with a backpack or other packed gear.

Locating a portable operating spot that will work with the Super Clamp has been surprisingly easy thus far. I do have a ground stake that will work if no existing objects are available and that are permitted. If picnic or other tables are too thick for the clamp, there are small spreader clamps used in woodworking that will work to give the Super Clamp something to hold onto for bracing the carbon fibre mast. Your creativity might easily surpass mine here.

Concluding remarks

This was an antenna project that I really thought would simply fail to provide a workable, lightweight, portable antenna. At times, showing that a specific approach is not feasible is a significant achievement for others to know about. I was surprised at how well approaching this simple vertical as a random wire antenna worked out. A 9:1 Unun resulted in a very good impedance range as with other random wire antennas.
The small ATU achieved a good match though the 80-10 metre bands. From a suburban patio near a brick wall and house, the WSPR beacon results were much like other temporary verticals I have deployed there. It packs down into a small zippered case with all the accessories needed for travel.

If you are 'taking a walking stick' to go portable operating on HF, this antenna system works better than any whip-style antenna for a QRP transceiver that I have ever used. For me, it is almost as easy to install and I much prefer the better signal. Have a good walk to your portable spot. This antenna was made for it! **PW**

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Tom Morgan G0CAJ (ex-ZS1AFS/ZT1T)
zt1tzs1afs@gmail.com



1

Verticals & Velocity Factor

Tom Morgan G0CAJ builds a two-element vertical array.

While recuperating from my hip replacements I started reading *Low Band DXing* by ON4UN. The idea of a 2-element end-fired phased array looked good. So, could I do it for 40m? Eventually, I decided on two elements with 90° (¼ wave) spacing. The Christman Method of phasing lines seemed to be the way to go. And I had read an article in *Practical Wireless*, by **Steve PJ4DX**. I was so inspired by its deceptive simplicity I obtained two Spiderbeam poles to install at roof height.

Constructing the verticals

Robertson in South Africa is a farming area where rust formation is slow. I used hose grips and strips of free bicycle inner tube rubber to cushion the fiberglass pole joints and antenna fittings were made from pieces of an aluminum fruit ladder leg - fittings costing pennies. Coaxial sockets came from the station stores. The socket is riveted to the U-channel and the upside (weather) side is under molded 'Pratley Putty' epoxy. It is important to ensure it's waterproof.

Fig. 1 is a photo of base plate with 60mm U-bolt, while **Fig. 2** shows it in place with two radials attached.

The holding brackets were made from angle iron and a piece of square fence post, donated by a farmer friend. Total cost with the fixings about £2 a go! Double-Overlay Velcro straps hold the poles. They are our son's invention, and used by Laser dinghy sailors, worldwide. The pole is cushioned (at each strap point) by two layers of rubber. Normally this comes in sheets used between metal plates on tractors. I paid about 50p for a long thin strip with lots to spare!

The poles were guyed from southwest through to northwest against the prevailing winds. In the UK, I would recommend guying all round. We used 6mm Dyneema and camel hitches, cushioned by rubber tubing at the guying points. Camel hitches prevent movement in either direction. With bowlines on each standing part, a range of angles can be accommodated. The photo of the guying arrangement, **Fig. 3**, was taken during refurbishment of an element (note, there are only three guys on this element).

Each vertical element was fixed at the top of the pole with insulating tape and black plastic cable ties and wound around the pole, one turn per section. I worked on a length of 9.55m plus 3cm for the connection. As can be seen from the photo, **Fig. 4**, taken during refurbishment, the brass tube (from a 'chocolate' block) holds the soldered joint that is finally covered with glue from a glue gun.

Each element was made up, with radials, and the SWR checked. Then, after final adjustment, the screws were removed and the 'joint' was soldered. Obviously, this was done before the phasing lines were connected.

Phasing should be fun

In the 5th edition of *Low-Band DXing* ON4UN cautioned about only cutting the coaxial phasing lines based on linear measurements. He recommended checking out the velocity factor of cable to be used. So, this is how I did it.

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Fig. 1: Base plate with 60mm bolt.
Fig. 2: Base plate attached to mast with vertical element and radials connected.
Fig. 3: Guying arrangement. Fig. 4: Connection between base plate and element.
Fig. 5: The online phasing calculator by VA7ST.

I asked the supplier what the Mini-8 coax velocity factor (VF) was. I was told 0.78. Using that value, I cut two 84° phasing lines using the VA7ST's 'Christman Phasing Calculator' [**2**], one for 7.0MHz and one for 7.1MHz. I entered the velocity factor and the operating frequency. Then, checked for minimum impedance, as prescribed in the instruction. The screenshot of the opening screen by G0EZN (my xyl), **Fig. 5**, shows the details.

My two vector network analysers were a mini-RS VNA and a Watson VAA-1. Of course, as 'indicating instruments' they can never have the accuracy of professional-grade equipment. The WATSON has better graphics than the mini-VNA but is more limited because it only stores one reading. The mini-VNA has proved to be more versatile. So how did I check the actual lengths needed?

Measuring the Velocity Factor (VF)

The phasing line of 84° at 7.00MHz is 90° at 7.500MHz. But this was not seen on either instrument. The frequency of lowest impedance of the 7.1MHz line was at 7.46MHz! Then I got to think, 'What if the VF is not quite correct?' Testing this could be beyond the scope of my equipment.

The mini-VNA has a facility for finding length of coax (great for finding breaks in coax up antenna towers, as well as yacht masts). But I needed to know the VF. Fortunately, the program runs continuously. So, one can vary the VF until the actual measured length 'pops up' - and that's what I did. Instead of 0.78 the VF came out at 0.7715, enough to make a difference!

As an exercise before checking the second coax, I tried two odd pieces of RG-58. Both were claimed to be VF = 0.66. Using this method they came out at 0.625 and 0.666, respectively. In hindsight, they could have been the same length for a definitive comparison. This aspect is not significant when a single cable goes to one antenna.

The Christman calculator

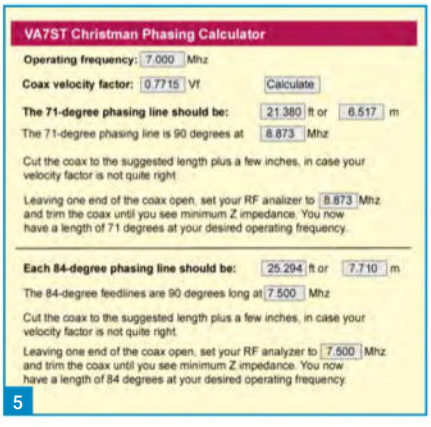
The Christman Method requires lines of a particular angle of phase [3] – and the velocity factor must be known. Checking the second 84° line for lowest Z it came out at 7.71m! Of course, this may have the same limitations as the first feedline – but it's consistent. Now I had two lines of 84°. I suspect the 'take into account the smaller details' in *Low Band Dxing* means just that.


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5

Then came the Big Dilemma

Do I just want to point long path (LP) or short path (SP)? I decided not to complicate things. Then if it works, the question is do I insert a relay to fire in opposite directions? The diagrams by **Sue G0EZN**, **Figs 6** and **7**, show the choices.

The decision was taken to fire long path. So, another length of coax had to be 155°. (84° + 71°) = 155°

For SP, the 155° line length needed at 7MHz is 18.45m.

That comes out to 90° at 4.0645MHz. Here are the calculations.

(155÷360) × 42.86m = 18.45m

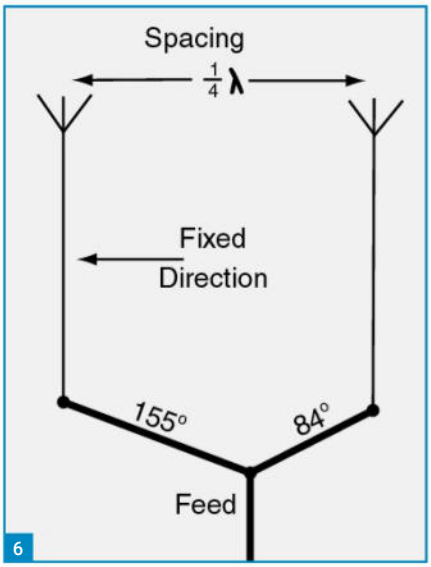
VF of 0.7715 gives a cable length of 14.234m
0.7715 x 18.45 = 14.234m

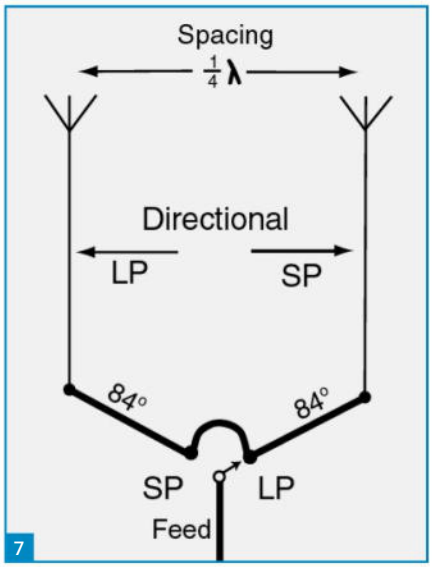
155° @ 7MHz is 90°@ 4.0645MHz

(90 ÷ 155) × 7.00 = 4.0645MHz

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Fig. 6: Arrangement for single direction.
Fig. 7: Bidirectional arrangement.
Fig. 8: The junction box.
Fig. 9: measuring using the VNA.







The published F/B ratios of these arrays are quite good. The plan was to set the array up for long path US West Coast in my winter and short path in my summer. Judging by consistency, I will not need to change too often. I could decide to put in a relay to change direction. The photo, **Fig. 8**, shows the simple 'junction' box.

From the Calculator Panel, the 71° length needed is 6.517m and it is 90° at 8.873MHz. Several bloggers warned about ensuring exactness. But I never found anyone who had actually suggested, or offered anything definitive, on how to measure a length of coax without at least one plug! Both my VNAs have BNC sockets. So, I measured cables with a plug on one end.

Warning: You need to match the feedpoint.

According the ON4UN's method the resultant feed of one of his examples has an impedance of 23.8 + j12.4Ω so the SWR will be of the order of 2.3 for a 50Ω line. Quote: 'You can use an L network or another appropriate matching system'. The choice quoted is: 'up to the user'. Comments like this are not too helpful! This aspect was dealt with in another section some hundred pages away. I must confess that I found the book difficult to manipulate, not least because of the weight – 1.8kg.

However, when I tested the SWR at the feedpoint (using the Christman feed method) – it came out at 1.5:1 on 7.1MHz down to 1.1:1 @ 7.2MHz! For a phone operator, in IARU Region 1, that was great! However, when we ran the MINI-8 from the shack, the SWR had shifted a little bit. Using an automatic ATU, this is not significant. See the screenshot, **Fig. 9**, using my VAA-1.

Feeder and counterpoises

At the feedpoint, six ferrite beads were threaded on and held close up to the plug using cable ties. As can be seen from the base plate photo there are four holes in the fitting. Three are used for counterpoises, and one for earthing to the metal roof, one to the main roof and one to the side roof of the guest quarters. (Roofing plates on each roof are riveted together.) Originally, there were only two radials: but additions do make a slight difference for the better.

Looking at the practicalities someone is bound to say, *"I don't have space for radials"*. That's not unusual in a small garden. But there is nothing to stop anyone bending the wires



around a wooden fence, or along a concrete wall. I read an article on the internet by **Rudy N6LF** about using an inductance to make a radial shorter, overall [**4**]. Amateur radio is about experimenting.

How did the array work in practice?

I worked Stateside, and Puerto Rico regularly – barefoot. I achieved Worked All States Award for 40m within a few months. Unfortunately, come daylight saving, many North American hams finish too early for propagation into ZS1 in my mornings. So, autumn was the time to turn the feeders around for long path US in the southern winter. I could insert a relay. But that's another story.

References

[1] pub. ARRL 2010, ON4UN's Low-Band Dxing, quoted in the foreword penned by David Sumner, K1ZZ, "this will be his final edition".
[2] On the Internet, try
www.va7ca/home
or
www.dxzone.com
and others.
[3] See *Low Band Dxing by ON4UN, 5th ed. (last)*, pp.11.9 – 11.11, and elsewhere on the internet.
[4] Short Radials for Ground-Plane Antennas, Rudy Severns N6LF. **PW**

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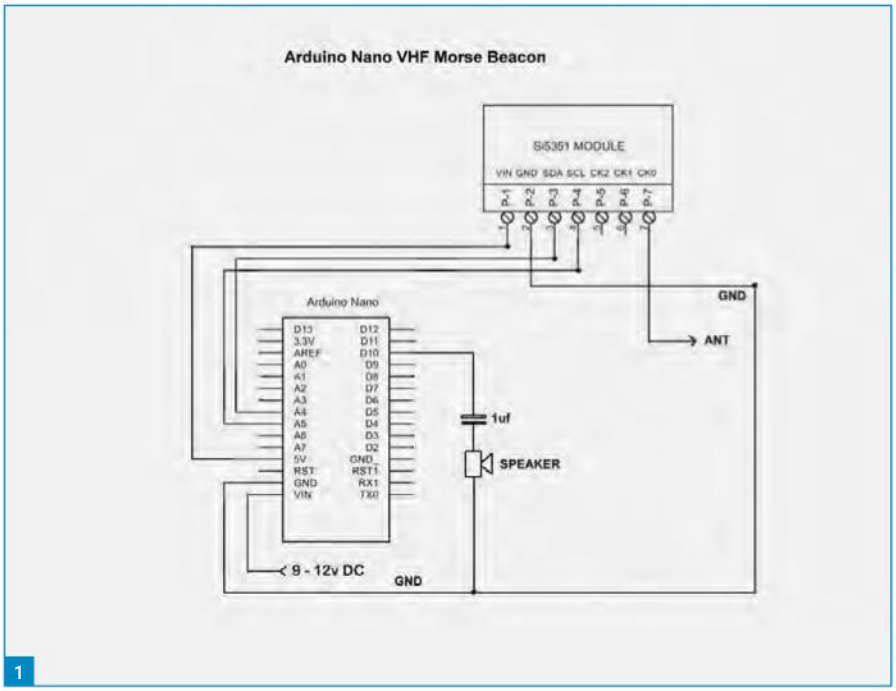
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Steve Macdonald G4AQB
g4aqb@outlook.com



1

A Simple VHF Morse Beacon

Steve Macdonald G4AQB describes the 144MHz beacon used in the recent HAB project.

The Bolton Wireless Club recently embarked on a project that involved launching a High-Altitude Balloon (HAB) to the edge of space carrying a 144MHz Morse beacon. The flight was very successful lasting for two and a half hours and reaching a height of 95000ft. During this time the beacon constantly sent Morse code and was received by many stations around the country. *(PW November 2025, p.24)*

I have been asked a number of times about the beacon circuit and software that I used, so I have presented the circuit and details as a construction project.

The VHF Beacon circuit is simple to build, uses fewer than 20 components and costs less than £20, an ideal 'Take 20' project for anyone who would like to construct and experiment with one. Although set to 144MHz, the software can easily be changed to other VHF bands such as 50MHz and 70MHz and would make a good signal source for testing equipment in the shack or out portable.

Circuit

The circuit uses an Arduino Nano Microcontroller SSD1306 and Si5351a Clock Module, **Fig. 1**. The only additional components (which are optional) are a small speaker or sounder coupled with a 1µf capacitor for monitoring the outgoing Morse code. The Si5351a can be set to any frequency between 10kHz – 160MHz with three separate outputs CLK0, CLK1 and CLK3. CLK0 is used for the output in this circuit. At present the software is set for an output of 144.480MHz on CLK0 and this is connected to a suitable antenna for the band being used. The output to the antenna is about 10mW.

Construction

The circuit could be built on a breadboard, but for a more permanent construction, it is built onto a single- or double-sided copper clad board 9cm x 7cm. I used an Arduino Nano Breakout Board for the Nano Microcontroller and some small nylon pillars to mount the Clock Module and DuPont connector leads are used to wire the circuit. The tiny speaker is glued to the main board, **Fig. 2**. The Si5351a module comes with three SMA sockets for the clock outputs that needs to be soldered.

The Nano Breakout Board is very easy to use. Simply plug the Arduino Nano into the socket ensuring that it is in correctly, check the pin labels on the Nano with that of the board. Each Data and Analogue pin comes out to yellow 3-pin plugs marked G (Ground), V (+5V) and S (Signal). The S pins are used to connect to while G and V give plenty of access to Ground and +5V as required. The board also has a socket to connect to an external 9 – 12V instead of using the Nano USB socket.

When we used the beacon for the High-Altitude Balloon project, this construction was used only for initial testing. The components on the board would have to be fully soldered and sturdy enough to withstand the stresses of the flight. A Version 2 board was constructed, this time the modules were soldered and hard wired onto a 7cm x 5cm double-sided Prototype Board. The optional speaker was not required. This construction method would make a good alternative for anyone more experienced with soldering, **Fig. 3**.

Programming

The original software Sketch is available at: **https://tinyurl.com/v6cnfcbv**

Click on the green 'Code' button and select 'Download zip'; save this on your computer. The Morse Code is generated within the software and all you need to do is change a couple of lines on the Sketch to add your own Morse beacon message and frequency.

First, you will need to have installed a copy of Arduino IDE and libraries on your computer. You can find it here: **www.arduino.cc/en/software**

Arduino IDE is used to upload the software that you need to the Arduino Nano.

You will also need to select the Arduino Nano library of boards. To do this, start up Arduino IDE and select 'Tools', 'Boards', 'Arduino AVR Boards'. You will then see a list of boards; select 'Arduino Nano'.

Now go to 'Tools', 'Processor' and select 'ATmega328P (Old Bootloader). If you get errors after compiling, then go back and select just 'ATmega328P' and compile again.

You now need to open the Sketch that you have saved on your computer into Arduino IDE. The Sketch file is the one ending with .ino.

If you are using Arduino IDE for the first time, you may need to install the necessary libraries required. To do this, look at the Sketch, these are the ones with #include at the beginning of each line. With this Sketch only one is listed ***#include "Si5351.h"*** Search for this using 'Tools', 'Manage Libraries' in Arduino IDE and download.

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Fig. 1: Circuit Diagram.
Fig. 2: Layout showing the Nano Breakout Board.
Fig. 3: Version 2 VHF Beacon Board.
Fig. 4: 2m Low Pass Filter.

When you are ready, select 'Sketch', 'Verify /Compile', the code will now be compiled and show up any errors. This may take a few minutes.

Once compiled, connect a suitable USB lead from your computer to the Arduino Nano board USB socket.

Go to 'Tools' and select 'Ports', choose the port that you are using. If you are not sure which port is in use, disconnect the USB lead and look again at the listed ports. The active port will not show, plug the USB in again and it will appear. Go to 'Sketch' and 'Upload' (This will take a few minutes to first compile again and then upload). If everything is correct the Nano LED will start to flash in Morse as the Beacon Message is sent.

Now that the sketch is working, you will want to make some changes to the code to input your own message and callsign, this is on Line 12 of the Sketch. This can be done by editing the Sketch with Arduino IDE and uploaded to the Arduino Nano.

Testing

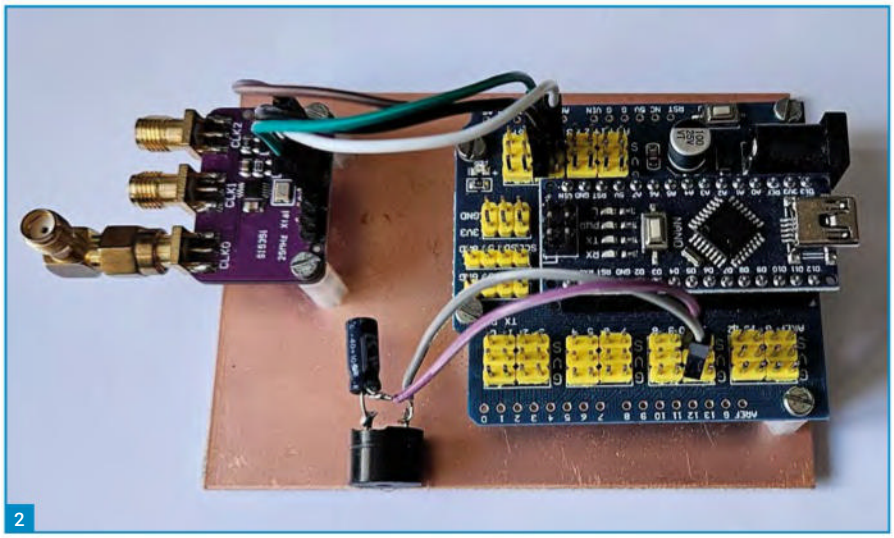
Once you have added your own beacon message, the circuit can be tested. To power the Arduino Nano, you can use either the USB or power externally using the socket on the breakout board.

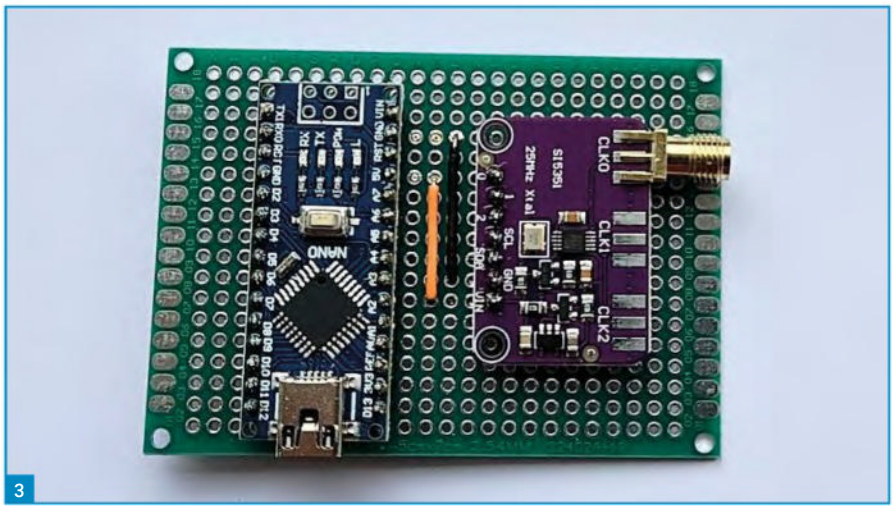
At power-up the Nano will immediately start to send Morse to the Si5351 Clock Module. An LED on the Nano will show the Morse code being sent. Connect a short piece of wire to CLK0 for an antenna and listen for the transmitted Morse message on 144.840MHz on a receiver. If you want to change the frequency to a different band or frequency, this can be done by editing line 11 of the Sketch.

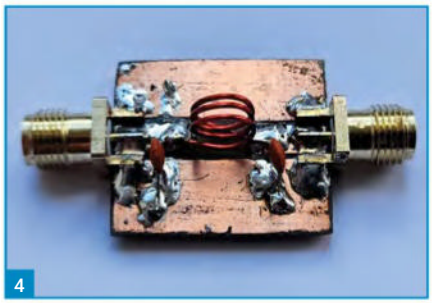
Note that the frequency may be slightly high or low of the specified frequency. This is because the crystal used in the Si5351a Clock Module varies depending on the manufacturer.

Filter

If the circuit is to be used on a larger antenna (or for an HAB), a suitable Band Pass Filter needs to be fitted as the output waveform from CLK0 is not sinusoidal and has harmonics. A simple 144MHz low pass filter consists of three turns of 28swg copper wire wound 7mm diameter with a 22pF capacitor across the input and output. This filters the harmonics to a reasonable level by about --34dB, **Fig. 4**.







Parts List

- Arduino Nano ATmega328P
- Arduino Nano Breakout Board
- Si5351a Clock module
- 10cm DuPont Connectors
- 9x7cm SS Copper Clad Board.
- 7x5cm DS Prototype Board (V2 Only)
- Stand-off Pillars
- Small speaker/sounder
- 1µf Capacitor

Conclusions

This is a very useful beacon or signal source for any of the VHF amateur bands. It can also be used on the HF frequencies, if required, by changing the frequency in the Sketch. The circuit will work happily from a small 9V battery, which you can plug into the socket on the Nano Breakout Board. If using a soldered prototype board, power would go to the Vin pin on the Arduino Nano. During the HAB flight we used four AAA Lithium batteries to cope with the very low temperatures experienced in the stratosphere and this worked fine.

A small antenna can be fitted into the CLK0 SMA socket, or by using a suitable adaptor, a handheld helical antenna for 2m or other VHF Band. During the flight we opted to use a simple 144MHz dipole made of thin wire.

References

TA2BGH Arduino Beacon Software:
https://tinyurl.com/v6cnfcbv
Using an Arduino Nano and Breakout shield:
https://tinyurl.com/3u2xtkay
The Beacon in use during the HAB Project:
www.youtube.com/watch?v=Csp_emHaxiE

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Roger J Cooke G3LDI
roger@g3ldi.co.uk



1

The four Ps

Roger G3LDI explains the four P's of Morse excellence.

Fig. 1: Malcolm G3PDH busy using Morse.

In the hope that my last two articles have had some impact on a few of those newly licensed who may have been persuaded to learn CW, I decided to write a follow-up type of article as a bridge that can be crossed to help those who would like to try the mode for the first time. I am not sure if it would carry the same attraction as it did when I was first licensed, but I can only hope!

In teaching Morse I do lean heavily on some Big P words. These are extremely important – I may have mentioned them before!

The Four P's: Your bridge from Practice to Performance

So, you took the challenge. Maybe you're one of the youngsters, or indeed a mature adult, who has taken on learning Morse over a period of a few months. It is a study that takes time for a certain standard to be reached.

If you have the Passion for learning and have reached a stage where you wish to test that learning, you are now up to this special decisive time to put it to the test. I am assuming that you have had some sending practice too, so you are now keen to put it to the test!

Now comes the moment that separates the brave from the crowd: *"Getting on the air"*.

I can hear the excuses already: *"What if I mess up?" "What if they're too fast?" "What if everyone laughs at me?"*

Let me tell you something I've learned in over 70 years of using Morse code: Every single operator you hear on the bands - every single one - had that same fear before their first contact.

The difference between those who became confident CW operators and those who gave up? Four words. I call them my Big P words:

Passion, Practice, Perseverance, Patience

Let me show you how these four principles will carry you from nervous beginner to confident operator.

PASSION - Remember Why You Started

Think back to what got you interested in Morse code in the first place. Maybe it was the challenge I laid down originally. Maybe it was watching a YouTube video of someone making a contact across an ocean with 5 watts and a piece of wire. Maybe it was the realisation that you could communicate when everything else fails.

That passion is still there. It's just transformed into nervous energy.

When I was young (yes, I was young once!), I fell in love with the idea that I could sit in my bedroom and talk to someone in Australia using nothing but dots and dashes. That passion got me through the learning curve, through the frustrations, through the moments when I wanted to give up.

Your passion got you this far. It taught you the alphabet. It made you practice when you could have been scrolling TikTok or Facebook. It made you different from 99.9% of your generation.

Don't lose that passion now. You're standing at the threshold of something genuinely amazing. The practice room is behind you. The real adventure is ahead.

But here's the truth: passion alone won't get you through that first contact. That's where the other three P's come in.

PRACTICE - You're More Ready Than You Think

"Am I ready?" That's the question every beginner asks. And here's my answer: *"If you're asking that question, you're probably ready enough"*.

You don't need to be perfect. You never will be perfect. I'm 87 and I still make mistakes! What you need is to be brave enough to try. The best operators in the world make mistakes. All humans are fallible and as long as you correct the mistake all is well.

What 'Ready' actually looks like

Can you:

- Copy your own callsign reliably?
- Recognise all the letters of the alphabet?
- Send at 10-12 words per minute?
- Understand basic Q-codes (QTH, QSL, QRS etc)?

If you answered yes to these, you're ready. Everything else you'll learn by making QSOs, gaining experience as you also gain more confidence.

The Essential Pre-Flight Checklist

Before you make that first contact, here's what you should practice:

1. The Basic QSO Structure

CQ CQ CQ DE [YOUR CALL] [YOUR CALL] K

Learn this pattern. It's how you call for a contact.

2. The Response

When someone answers you:

[THEIR CALL] DE [YOUR CALL]

TNX FER CALL UR RST 599 599

NAME [YOUR NAME] QTH [YOUR LOCATION]

HW CPY? [THEIR CALL] DE [YOUR CALL] K

3. The Magic Words When You're Struggling

- **QRS** = Please send slower
- **PSE QRS** = Please send slower (more polite)
- **SRI NEW OP** = Sorry, I'm a new operator
- **AGN** = Again, please repeat

Practice these until they're automatic. When you're nervous and your brain freezes, these will save you. I had one student who was very nervous. He printed out on a piece of paper what he would send. It was: *"Please excuse my CW this is my first QSO"*. He sent this on every QSO for six months! He is fine now, however, and spends ALL his time on CW.

The Secret Weapon: WebSDR or the CW end of 40m.

Before you transmit, listen. Do a lot of listening! Good operators spend a lot of time just listening.

Go to:

http://websdr.org

or the CW end of 40m and tune into the CW portions of 40m or 20m. Listen to real contacts. You'll notice:

- Many operators send at comfortable speeds

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• The format is predictable
• People are patient and polite
• Mistakes happen all the time and nobody cares

This is like watching others swim before you jump in the pool. It demystifies the whole thing.

Practice with a like-minded friend FIRST, off the air with your Morse keyer and Morse key, straight key or paddle if you can. Go through the whole routine:

• You call CQ
• They respond
• You exchange details
• You say 73 and sign off

Do this ten times and your first real QSO will feel familiar, not foreign.

PERSEVERANCE - Your First Contact WILL Be Messy

Providing you have some dummy contacts as described above, you should be fine, BUT nerves will play their part when actually on the air.

Here's what might happen:

• You'll miss their callsign
• They'll send too fast
• You'll forget what you meant to say
• Your hand will shake
• You'll send gibberish
• You'll want to quit right there

And that's absolutely normal.

I remember my first contact like it was yesterday, even though it was over 70 years ago. I was so nervous I forgot my own callsign halfway through. The other operator - bless him - simply sent *"UR CALL PSE"* and waited patiently while I gathered myself. I had only just received my licence that day after all!

That patient soul taught me something: The CW community expects beginners and welcomes them.

I've spoken to hundreds of operators over the decades. Everyone has a disaster story:

• The fellow who sent *"SK"* (end of contact/silent key) instead of *"K"* (over to you)
• The chap who answered a CQ and realised halfway through he'd called the wrong station

We've all been there. The difference between those who are now confident operators and those who quit? Perseverance.

When Things Go Wrong (And They Will)

If they're too fast:

Send *"QRS PSE"* (slow down please). Any decent operator will comply immediately. A good operator will adjust his speed to match yours anyway.

If you miss their callsign:

Send *"UR CALL AGN PSE"* (your callsign again please). Don't pretend you got it.

If your brain goes blank:

Send QRX and take a breath before you restart.

If you completely mess up:

Send *"SRI NEW OP TNX FER PATIENCE 73"* and try again tomorrow. The world won't end. See above about 'first QSO' note used for a long time!

The Beautiful Truth

Here's what actually happens after a messy first contact: You'll survive. You'll laugh about it. And the second contact will be easier. The tenth contact will feel routine. The hundredth contact will make you wonder why you were ever nervous.

Every expert was once a beginner who refused to quit.

PATIENCE - With Yourself and the Community

This is perhaps the most important P of all. You need patience with yourself, and you need to trust in the patience of the CW community.

Be Patient With Yourself

You're learning a skill that takes time to master. You wouldn't expect to play guitar like **Eric Clapton** after a month of practice. You wouldn't expect to speak fluent French after using Duolingo for three weeks.

Morse code is the same.

Give yourself permission to:

• Make mistakes
• Ask people to slow down
• Take your time responding
• Not understand everything
• Have contacts that don't go perfectly

Each contact is practice. Each mistake is a lesson. Each awkward pause is you learning.

The CW Community's Patience

Here's something that might surprise you: The CW community actively wants you to succeed.

Why? Because we're a dying breed without you youngsters coming in. We want fresh blood. We want new voices. We want Morse code to survive another generation.

That means we're incredibly patient with beginners. More than patient - we're delighted when someone new shows up.

Where to Find Patient Operators

Not all contacts are equal. Some operators are rushing through contests. Others are chatty and welcoming. Here's where to find the patient ones:

SKCC (Straight Key Century Club)
• Visit their Sked Page online
• Arrange contacts with operators who welcome beginners
• Everyone there is friendly and supportive

skccgroup.com

FISTS CW Club
• International club dedicated to promoting CW
• Regular slow-speed activities
• Members who actively mentor newcomers

fists.co.uk

QRP Operators
• Low-power operators tend to be more patient
• Often happy to chat rather than rush
• Look for 'QRP' in their information

Slow-Speed Nets
• Many clubs run nets specifically for learners
• Speeds of 10-15 WPM
• Structured format makes it easier

Give It Time

Rome wasn't built in a day, and you won't become a CW expert in a week. Here's a realistic timeline:

• First contact: Terrifying but exhilarating
• First ten contacts: Still nerve-racking, but you'll start to relax
• First month: Beginning to feel comfortable with basic exchanges
• Three months: Actually enjoying yourself
• Six months: Wondering why you were ever nervous

Trust the process. Every operator you hear on the bands went through exactly what you're going through.

Making That First Contact: A Step-by-Step Guide

Alright, enough philosophy. Here's how you actually do this:

Step 1: Choose Your Moment
• Pick a quiet time when you're not rushed
• Choose 40m or 20m (lots of activity, forgiving bands)
• Find the CW portion (usually the bottom of the band)
• Listen for ten minutes to get a feel for what's happening

Step 2: Find a Clear Frequency
• Tune around until you find empty space
• Ask if the frequency is in use: *"QRL?"* (is this frequency busy?)
• Wait for a response
• If no response, the frequency is yours

Step 3: Call CQ
• Take a deep breath
• Send: *"CQ CQ CQ DE [YOUR CALL] [YOUR CALL] [YOUR CALL] K"*
• Send it slowly - 10-12 WPM is fine
• Wait and listen

Step 4: Someone Answers!

Don't panic. They'll send their callsign. Even if you only catch part of it, write down what you hear.

Step 5: The Exchange

Keep it simple:

[THEIR CALL or what you heard] DE [YOUR CALL]
TNX FER CALL UR RST 599 599
NAME [YOUR NAME] QTH [YOUR LOCATION]
HW CPY? [THEIR CALL] DE [YOUR CALL] K

Step 6: Their Response

They'll send back similar information. Don't worry if you don't catch everything. Get their name and location - that's enough.

Step 7: Wrap It Up

[THEIR CALL] DE [YOUR CALL]
TNX FER QSO [THEIR NAME]
HPE CUAGN (hope to see you again)
73 ES GE (best wishes and good evening/morning)
[THEIR CALL] DE [YOUR CALL] SK

That's it. You've done it. Your first QSO.

The Moment After

Here's what will happen after your first contact:

1. Your hands will stop shaking
2. You'll realise you survived

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3. You'll want to do it again
4. You'll feel like you've joined a club

Because you have.

That first contact is your initiation. You're no longer reading about Morse code or practising Morse code. You're using Morse code. You're communicating across distances using a skill that 99.9% of people don't have.

You've earned your place at the key.

What Comes Next

Once you've made that first contact - messy, nerve-wracking, imperfect as it might be - something magical happens. The world of Morse code opens up before you.

There are DX contacts to be made, chasing rare countries across the globe. There are contests to enter, testing your speed and skill. There are CW clubs to join, where you'll find lifelong friends. There are awards to earn, mountains to activate, parks to work, challenges to conquer.

But all of that starts with one thing: Making that first contact.

The four P's will get you there:

- **Passion** to start
- **Practice** to prepare
- **Perseverance** to push through
- **Patience** to keep going

You have everything you need. The only question is: Will you do it?

My Challenge to You (Again)

I'm 87 years old. I've made tens of thousands of contacts. I've talked to people on every continent using nothing but dots and dashes.

I believe you can do this. Not because it's easy - it isn't. But because I've seen countless youngsters before you take this same leap and discover something extraordinary on the other side.

Your practice has prepared you. The CW community is waiting for you. The adventure is ready to begin. The only thing missing is you pressing that key.

You could soon be like **Malcolm G3PDH** in **Fig. 1** shown operating at Marconi day at Caister on Sea in Norfolk.

So, here's my challenge: Make one contact this week. Just one. It doesn't have to be perfect. It doesn't have to be long. It just has to be real.

And when you do, email me at **roger@g3ldi.co.uk** and tell me about it. I want to hear about your disaster, your triumph, your first step into the world that's been waiting for you.

The dots and dashes are ready. Are you?

Next time: The World That's Waiting - DX Contacts, Contests, CW Clubs, and Adventures You Never Imagined*

Remember: Every operator you hear on the bands had a terrible first contact. The difference is they made a second one. And a third. And now they're the voices you're hearing.

Now it's your turn. 73 and May the Morse be with you! Roger G3LDI' **PW**



1

Contesting from Uganda

Don relates the tale of his recent contest trip to Africa.

Don Field G3XTT
practicalwireless@warnersgroup.co.uk

In days of yore I would go, often with others, to the Channel Islands for the November CQWW CW Contest. Invariably the weather was dreadful so when I was invited in 1999 to join the Voodoo Contest Group's trip to Ghana for the contest I jumped at the chance. And I wasn't disappointed – getting off the plane in the African heat was a pleasant change from the British Isles in late autumn. Which started me on what has become almost an annual pilgrimage to warmer climes for the contest – a great way of catching some sun before the rigours of the British winter.

I'd headed to Uganda last year with the intention of making a single-band high-power entry on 40m, as there is no Uganda record for that category. Unfortunately, I had to cut my trip short when my wife was admitted to hospital. So, this year was my second try. I would go with **Alan G3XAQ** who would do a single-band low power entry on 15m.

I had my licence from 2024 – these days the application process is online and relatively simple – and had renewed it for 2025. A visa is also required for Uganda, again via an online process. We had booked the two villas overlooking Lake Victoria that we had used previously – one has a nice flat roof where Alan can install a scaffold pole with his two-band Moxon Yagi.

Normally my portable station consists of an Elecraft K3 transceiver and KPA500 amplifier. This time though, after some reflection, I decided to take my Icom IC-7300 as I planned some FT8 before and after the contest and that's a lot easier with the Icom with its direct USB interface. I took two SOTAbeams poles, a 10m 'travel mast' and a 7m 'tactical mini', the former to support my 40m quarter-wave vertical and the latter for whatever else I decided to operate outside the contest. Other gear included a switched

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mode PSU for the transceiver, a WinKeyer USB, headphones and my Begali Traveller Morse key. And plenty of coax, wire for antennas and radials, a selection of tools and connectors, etc.

The amplifier is quite heavy and travelled in a small suitcase, suitably wrapped in bubble-wrap and surrounded by my clothes. It soon came close to the 23kg limit. In my larger suitcase I packed the antenna poles, PSU, Morse key, most of the coax and wire, etc as well as my remaining clothes. Another (almost) 23kg. Fortunately, Ethiopian Airlines, who we were travelling with via Addis Ababa, has a two suitcase allowance. The IC-7300 went in my carry-on baggage along with my laptop – essential not only for logging but also for working on *PW* while away from home.

Arrival and first priorities

We flew from Gatwick, allowing almost two weeks before the contest to relax, get antennas up, check that everything was working OK (including checking for possible interactions between our two stations) and doing some pre-contest operating. In my case, very early on I used the shorter mast to put up an elevated vertical for the 12m band with two sloping radials. This proved to be very effective, both on FT8 and CW.

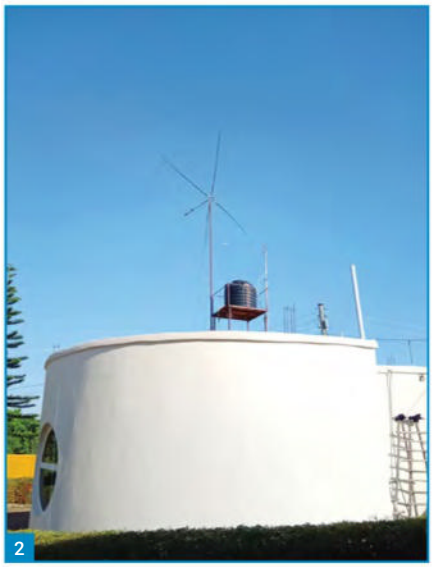
Quite early on we identified some serious noise problems, both during the day and at night. After some head scratching and a process of elimination, we concluded that the daytime noise problem was from solar panels on the main house (where the owner lives) and the nighttime problem was from (cheap Chinese?) security lights. After some negotiation with the resident staff member, they agreed to leave the solar panels and security lights off for the duration of our stay – it turned out that the solar panels were being used simply to charge some (very old) batteries, which would take over in the event of a power outage (an occasional problem but when the power was off we wouldn't be able to operate anyway as the batteries were only connected to the Wi-Fi router and some other lightweight applications).

In the lead-up to the contest we had a few meals out, visited Entebbe Zoo and did some other sightseeing and as well as finishing off the January issue of *PW*. I managed to get some serious reading sone and watched TV (thanks Netflix – amazing how I could access my account from Uganda!).

The contest

With the time difference (three hours ahead of GMT), the contest didn't start until 3am local so I managed to snatch a few hours sleep before getting on the band. But three hours or so later and sun came up, so just 250 contacts or thereabouts before closing for the night. Then it was back on Saturday evening for a 12 hour session, which proved to be a mixed bag, calling CQ fruitlessly at times and at other times having an enormous pile-up of stations calling, particularly at Japanese dawn when all of Japan seemed to be calling me but with Europe still coming in well and sunset arriving on the East Coast of the USA so getting some US callers as well. By the time I closed down shortly after dawn I had 673 contacts in the bag, with 75 countries and 26 zones.

Sunday evening (through till 3am local) proved hard work. The big Saturday opening to Japan just didn't happen and although I had a couple of reasonably fruitful hours (70+ contacts), most of the time it was hard work. Propagation seemed to come and go and despite running 500 watts, I obviously wasn't strong enough in Europe to prevent loud European stations taking over my frequencies (I say frequencies, plural, because I had to keep moving as I was driven off them). The end result (subject to checking, which will undoubtedly lose me some contacts and multipliers) was 972 contacts in 89 countries and 28 zones. It was nice to have KH6 (Hawaii) in the log but disappointing not to work New Zealand or Alaska, while Central and South America proved rather sparse – a long way from East Africa, of course, while Indonesian stations, along with India, China and Middle East, were invariably loud.


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Photo 1: Alan assembling the 10/15m Moxon.
Photo 2: The Moxon ready and in the air.
Photo 3: Don's verticals – 12m antenna in the foreground, vertical for 40m barely visible at the rear.
Photo 4: Don at his station.

Post contest

After catching up on sleep by way of a lie in on the Monday morning (December 1st), I reverted mainly to FT8 on 12 and 40m, which allowed me to send in my log and catch up on some *PW* work while keeping an eye on the radio – the wonders of modern digital modes!

Then it was time to take antennas down and pack for home. The good news is that I will have set a 40m record for Uganda which, hopefully, will stand for a few years. And the even better news is that I got lots of sunshine while the UK was enjoying wet, cold and windy weather (the M6T team in East Anglia reported that during the contest the weather kept them busy trying to keep antennas aloft)!

So, to the proverbial question – where to next year? **PW**

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Broadcasting history

Keith and **Garry** invite you on another expedition through their archives.

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

BBC Broadcasting House, London: Part VI

Perhaps one of the most interesting studios in Broadcasting House in 1932 was the large *Effects Studio, 6D,* **Fig. 2**, which had a subsidiary *Gramophone Effects Studio, 6E*, located behind the bow window. The main studio was equipped with machines for the production of every conceivable noise.

An important feature was a central elevating and rotating table, the top of which was fitted for the convenient manipulation of various small machines. The studio also included the following: a large tank for various *water noises*, just visible on the far right of the picture; an elaborate *electrical effects generator;* a *wind machine*; a *railway noises* section; an assortment of *floor materials* for special effects; a *compressed-air machine*, including hooters and foghorns; a small piano; a barrel-organ; special doors for opening, shutting, slamming, and squeaking; suspended metal sheets for *thunder.* There were also drums of various sizes.

Vintage radio equipment advertisement

This month's saunter through vintage copies of forlorn newspapers and magazines has unearthed an advertisement by *Lissen Limited* for their build-your-own wireless set called the *Skyscraper 3 Kit*, **Fig. 1**. A combined *Lissen Walnut Consolette Skyscraper Cabinet and Loudspeaker* system was also available. The advertisement dates from 24 September 1932.

The text has been left in its original format to reflect the spelling, grammar and punctuation of the time.

In the early 1930's, 'metallised screened grid' valves were used by wireless manufacturers for improved performance with a metal-coated internal surface for better shielding and electrical stability. They were used in radio receivers to amplify signals and prevent unwanted feedback by reducing the capacitance between the anode and the control grid. These were a precursor to later forms of pentodes. They were also produced in specialised 'variable-mu' versions to handle automatic gain control in superheterodyne receivers.

As the name implies, *Economy Power Pentode* valves used in Lissen's apparatus were designed to be energy-efficient due to the severe hardship felt by most people in the UK during the *Great Depression* from 1929 until around 1939.

Lissen Ltd. was formed in 1922 by **Thomas Noah Cole**. The company manufactured various parts for radio receivers including audio transformers and rheostats. By 1928, the company had 2,800 employees making wireless sets, batteries and other components at three large factories based in London. In the same year, the *Ever-Ready Trust and Finance Company* assisted the battery manufacturers, *Ever-Ready,* with the purchase of shares in *Lissen Ltd.* Thomas Cole continued as the company's Managing Director.

We are a little perplexed as to why anyone would pay one shilling (today's equivalent of 5p) for the advertised *Skyscraper Constructional Chart* when it was also available, free of charge, from Lissen!

100 years ago: February 1926

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

On 18 February 1926, the BBC's first *Chief Engineer*, **Peter Pendleton Eckersley**, wrote to the founding *General Manager*, **John Reith**, with the proposed costs of an experimental transmitter at Daventry to serve as a prototype for the 50kW transmitters needed for the *Regional Scheme*. The proposal was accepted. In 1934, the building was used to house the BBC short-wave transmitter, *G5SW.*

A majority share in the German national broadcaster, *Reichs-Rundfunk-Gesellschaft*, was taken over by the state-owned *Reichspost* authority on 26 February.

English comic actor, **Kenneth Williams**, was born on 22 February. He played many roles in BBC radio and television programmes in addition to well-known feature films. Kenneth died on 15 April 1988, aged 62.

One of the final rehearsals of the well-known 1926 revue, *R.S.V.P.*, presented at the *Vaudeville Theatre*, the Strand, London, on 23 February, was transmitted from the BBC studio one day prior to the official opening with the actual members of the theatrical cast taking part in the performance. This was the first occasion in the history of broadcasting that a production intended for the stage was heard in advance by radio listeners. The revue was written by **Archie de Bear**.



"The ONLY Metallised S·G·High-Mu Detector and Economy Power Pentode SET you CAN build for yourself!
FROM GREAT LISSEN
FREE CHART
POST COUPON BELOW FOR YOUR COPY - OR ASK YOUR DEALER
Lissen have published a 1/- Constructional Chart, giving the most detailed instructions ever printed for the building of a wireless set. Every part, every wire, every terminal is identified by photographs. This new ***LISSEN SKYSCRAPER KIT SET*** *is the only one on the market that you can build yourself employing a Metallised Screened Grid, High Mu Detector and Economy Power Pentode Valve. Around these three valves Lissen have designed and produced a home constructor's kit the equal of which there has never been before. It is the only battery set delivering such power - yet the H.T. current consumption is far less than that of the average commercially designed 3-valve set.*
You buy the Lissen Skyscraper Kit complete with valves - a Lissen Metallised S.G., a High Mu Detector, and a Lissen Economy Power Pentode Valve - and the price is only 89/6. Or you can buy the Lissen Walnut Consolette Skyscraper Cabinet and Loudspeaker combined as illustrated. It holds all batteries, and accumulator and loudspeaker as well. It makes everything self-contained. A special Lissen Pentode Matched Balanced Armature Loudspeaker of great power is supplied with the cabinet and the price of the Skyscraper Kit complete with valves, and this cabinet and loudspeaker is only £6 5s.
LISSEN SKYSCRAPER 3 KIT
POST THIS COUPON
Please send me FREE copy of your 1/- Skyscraper Chart.
LISSEN LTD. (Dept. P.R.1), WORPLE ROAD, ISLEWORTH, MIDDLESEX."

1

In Focus: The BBC Penmon transmitter – Part II

The Penmon transmitter played a vital role during World War II. Such was the importance of the radio transmitter, it was ringed with a barbed-wire fence, and a contingent of the **2nd Battalion Anglesey Home Guard** was assigned to make it secure.

With the outbreak of war on 3 September 1939, Penmon was retuned to 565kHz and was used to mask the Athlone station in Éire. However,

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Fig. 2: An advertisement, dated 24 September 1932, for the *Lissen Skyscraper 3 Constructional Kit* and their *Walnut Consolette Skyscraper Cabinet and Loudspeaker* system.
Fig. 1: The large *Effects Studio, 6D,* at Broadcasting House in 1932.
Fig. 3: The *American Forces Radio and Television Service* operated a radio station at Keflavik in Iceland between 1951 and 2006.

in 1940, Penmon was retuned to 767kHz and transmitted the *BBC Home Service*. At the end of the war, the station returned to the original 804kHz frequency, transmitting the *BBC Welsh Home Service*.

The frequency was changed once again, this time to 881kHz, on 15 March 1950. On 23 November 1978, the frequency was changed to 882kHz.

On 2 October 1955, a temporary VHF transmitter was brought into service, radiating the Welsh Home Service on 94.0MHz. This was replaced by a new transmitter at Llanddona which came into service on 20 December 1958.

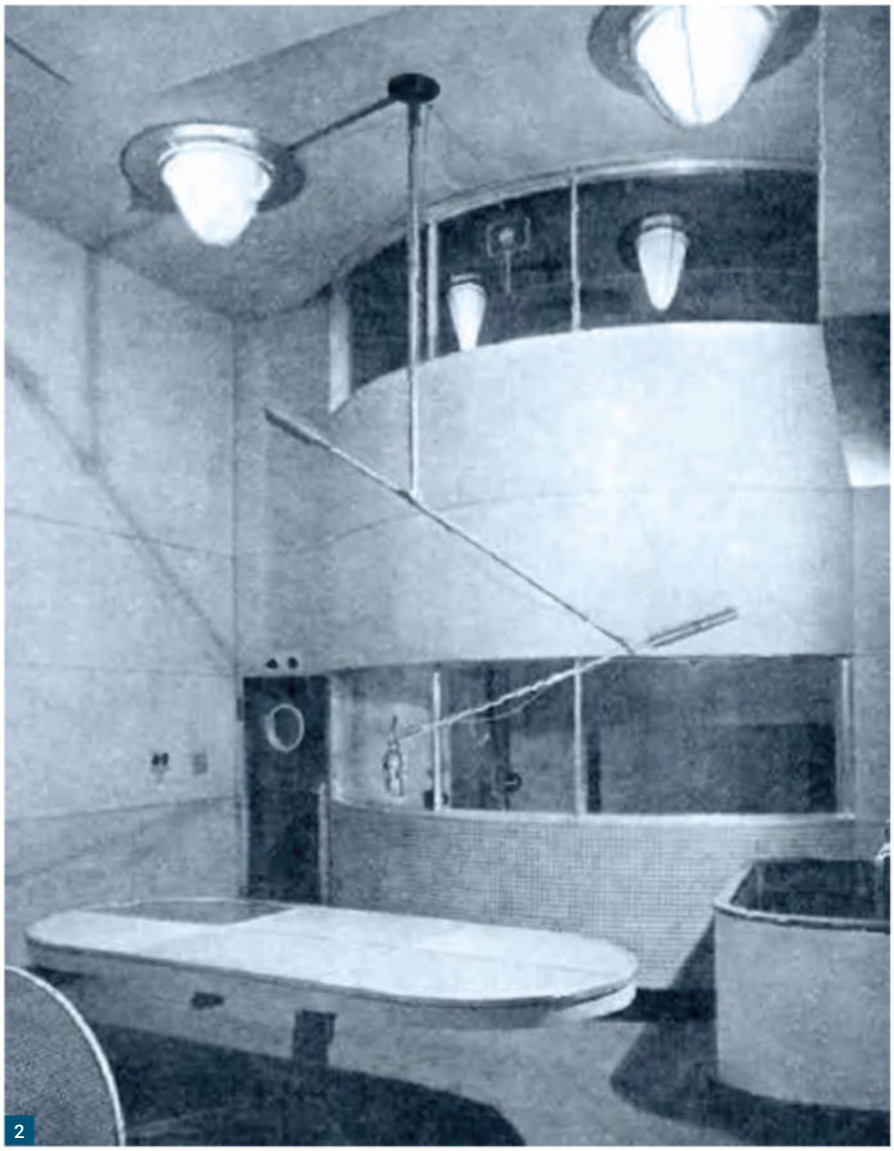
60 years of BBC-2: Part XXIII

A few days prior to the official opening of BBC-2 on Monday 20 April 1964, **Kenneth Adam**, *BBC Director of Television*, said: *"BBC-2 is not an invitation to watch more and become a television addict. Some religious and social leaders have said that this means more 'vegetating in front of the set. We shall become even more of a passive, peering people'. I would like to state quite firmly that BBC-2 seeks to give people more of what they really like, and some of what, so far, they have not had from television, at times more convenient to them, without necessarily increasing the total volume of viewing at all.*

*BBC-2 is not seeking, in partnership with BBC-1, to lure viewers away from ITV. There is no master plan designed to destroy the competitor. We pledge no sinister plotting between **Michael Peacock**, Chief of BBC-2, and **Donald Baverstock**, Chief of BBC-1, against the thirteen regional channels of ITV.*

BBC-2 is not seeking, either, to undermine or in any way diminish the importance of BBC-1, as critics outside London have suggested. We begin as we mean to go on, now in the South-East and when BBC-2 has spread countrywide, by providing between the two channels at any one time, programmes which are either sensible alternatives to each other or entirely different in kind. The new channel will have no monopoly of new ideas or talent."

We're not sure whether that statement actually soothed the nerves of the executives of the thirteen regional channels of ITV who must have viewed the start of BBC-2 with some trepidation!


2

Service information, Iceland: Part II

Between 1951 and 2006, the *United States Armed Forces* operated a radio station at their Keflavikur base in Suðumes. The station was called *Radio TFK*, but known by Icelanders as *Kanaútvarpið*.

The station was intended to broadcast entertainment for the soldiers and other military personnel at the various military bases in Iceland. The programmes were mainly repeats of popular American radio shows, but part of the schedule consisted of special information inserts produced by the *Pentagon* which, to many, appeared to have some propaganda undertones.

The channel also broadcast its own programmes. These were mainly news and weather reports. The station was part of the *Armed Forces Network* (*AFN*) that still operates at USA military bases around the world.

The station in Keflavik was the responsibility of the *Broadcasting Detachment of the Navy Media Center* (*NMC*). Most of the station's content was sourced from the *American Forces Radio and Television Service* (*AFRTS*), **Fig. 3**.



3

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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Mike Richards G4WNC
practicalwireless@warnersgroup.co.uk



1

Mike's Hotch Potch

Mike G4WNC has a hotchpotch of goodies for you this month, starting with a cheap GPS antenna splitter, followed by the release of a new Ham Radio Linux package. He also has some tips on using ChatGPT, with a worked example, and finally, a look at the future of AI in amateur radio data modes!

The wide availability of low-cost GPS receiver chips has led to ever more amateur radio equipment and test gear being supplied with built-in GPS receivers. It seems only a short time ago that we were buying GPS-tempered clock oscillators to provide stable clock sources for transceivers and test equipment. We were also investing in 10MHz distribution amplifiers to provide buffered and filtered feeds within the shack.

The new problem we're facing is how to share GPS antennas between devices with their own GPS receivers. On the face of it, we can solve this with a simple power divider. However, most GPS antennas are active units that require a 3.3V bias-tee DC supply. As a result, there is demand for dedicated GPS antenna splitters, but these seem very expensive, with many commercial units priced around £100. However, there are plenty of cheap versions available on eBay, so I decided to try one. The model I purchased was '1 to 4 GPS Beidou Navigation Signal Antenna Power Splitter for L band'. These sell for £12.47 each with free postage from China. I ordered mine on 22 November, and it arrived on the 29th, which was impressive.

As shown in **Fig. 1**, the splitter is smart and very compact. The internal views show the PCB-based construction with numerous vias to secure the ground plane **Fig. 2**. This is particularly important at microwave frequencies. The very low component count would also explain the low cost. There was absolutely no paperwork with the unit, and their eBay site was full of conflicting data. As a result, I decided to take it apart and measure the performance over the 1GHz to 1.5GHz range used by positional satellites. I was pleasantly surprised to find that the insertion loss was as expected, with 6.4dB at 1GHz and 7.6dB at 1.5GHz. I also measured the matching by checking the SWR. This showed better than 1.45:1 over the 1.0GHz to 1.5GHz band. I've shown a schematic in **Fig. 3**.

The splitter's solution to the power feed problem is to include a small diode in series with the signal lines for each port. Not the most sophisticated system, but it seems to work sufficiently well. If I can find the inspiration, I might modify mine to replace the port 1 diode with a link and replace the remaining diodes with a suitable SMD capacitor.

After a closer look at the PCB, I think the splitter probably uses a modified dual-Wilkinson splitter configuration. The shaped PCB tracks provide the inductors, while the termination resistors use 100Ω surface mount devices.

As a practical test, I connected my primary GPS antenna to the splitter and used one of the splitter outputs to feed the Web-888 receiver. The unused ports were terminated with 50Ω loads to simulate the connection to other GPS receivers. I checked the number of satellite locks both with a direct antenna connection and via the splitter. In both cases, 24 locks were achieved, suggesting the splitter has minimal effect on GPS decoding performance. If you want to order the same model, the eBay supplier was 'topfashionlife', and the item name is: '1 to 4 GPS Beidou Navigation Signal Antenna Power Splitter for L Band Frequency'.

Andy's Ham Radio Linux

I haven't mentioned this system before, but I noticed a new release, so I thought it might be timely to share some details. This is basically a huge collection of amateur radio software for Linux, brought together by **Andy KB1OIQ**. Early versions were supplied as Linux disk images, complete with an operating system and preinstalled software. However, in recent releases, Andy has changed to a script-based distribution. The benefit here is that you can add this suite of software to an existing installation rather than starting from scratch with a new operating system. The change also makes the download much smaller at 685MB.

On the same website there is a GETTING STARTED download. This is vital reading; you must follow these instructions to ensure a successful install. If you have a Pi 5 (recommended for best performance), you can speed up compile time from around 2½ hours to about 1½ hours by amending the number of processors field in the install_ahrl script. Near the top of the file, you will find instructions for doing this. Basically, you find the line NUM_CPUS=1 and change it to 4. If you decide to do this, you must ensure your Pi has good cooling, as all

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Fig. 1: Low-cost 4-way GPS antenna splitter.
Fig. 2: 4-way GPS splitter PCB.
Fig. 3: 4-way GPS splitter schematic.
Fig. 4: Andy's Ham Radio Linux script installation selection.

four processor cores will be operating at 100% at times. In my tests, I ran a resource monitor (details elsewhere in this column) and recorded peak CPU core temperatures of 65°C, with the case open and the Official Pi Active Cooler fitted and running flat out. If you don't have adequate cooling, the processor will likely overheat and throttle back, which will make the installation very slow and risk damaging the processor.

You can also edit the install_ahrl script to choose which programs to install. By default, all programs will install, but you can save compile time and disk space by skipping programs you're unlikely to use. As you scroll through the install script, you will find a section containing the installation list, **Fig. 4**. Each line in this section begins with INSTALL_ followed by the program name. To install a program, set the end-of-line to 1 to skip the program; set it to 0 to install it. Here's an example for FLDIGI:

INSTALL_FLDIGI=1 This will install FLDIGI
INSTALL_FLDIGI=0 This will skip FLDIGI

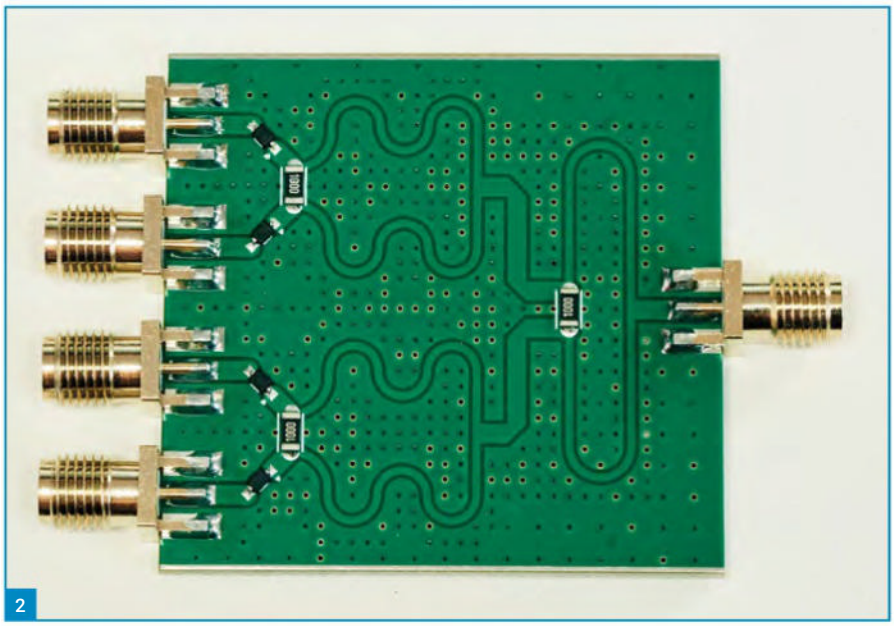
When you start the installation, expect it to take about 2½ hours with one CPU or about 1½ hours with four CPUs. You need to be around for the first 15 minutes or so of the installation, as there are a few simple questions you will need to answer. When it completes, you will get a message confirming completion. You must restart the Pi to complete the installation. When it reboots, you will find a new multi-level menu that allows you to access the newly installed software **Fig. 5**.

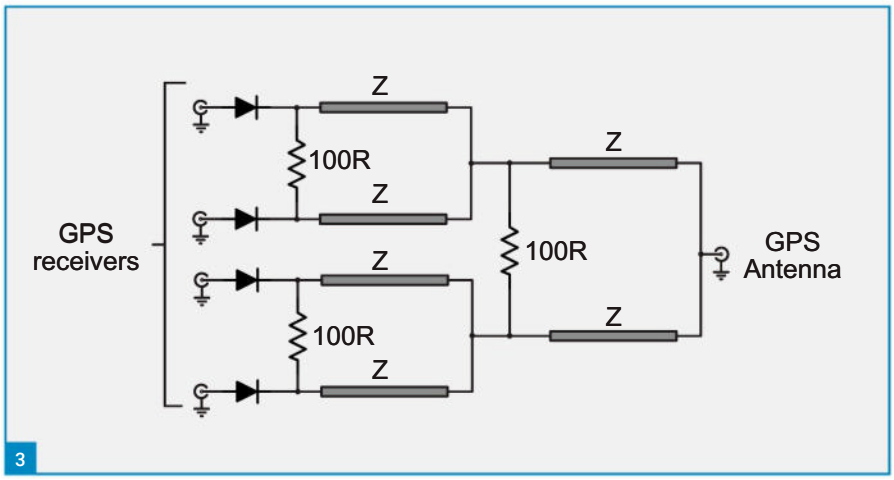
ChatGPT programming

I introduced this concept a few months ago, but I have been using ChatGPT regularly to write utility programs for me. This has been a great time saver, so let me give you an example. While testing the installation of Andy's Ham Radio Linux project, I wanted to log the Raspberry Pi's system load by recording parameters such as memory usage, disk usage, processor load, and processor temperature. Instead of wasting time poking around to find a solution, I went straight to ChatGPT with the following question:

Raspberry Pi 5. I want to log the use of computing resources to a CSV file suitable for analysis in Excel or a similar tool. Could you either direct me to an existing program or write a suitable Python script? The resources I want to monitor on a minute-by-minute basis are: processor core temperature (°C), processor core activity per core, GPU activity, RAM usage, and hard disk (SD card) usage. Can you do that?

I've shown the helpful response in **Fig.**



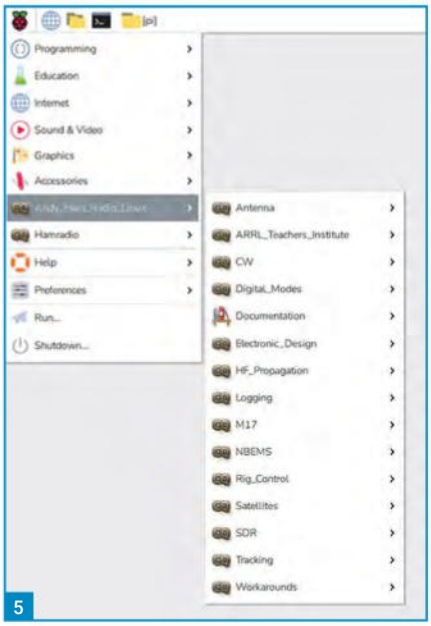



```
#################################################################################
# These can be changed by the user as desired.  These enable (1) or disable (0)
# the installation of the respective programs.
#################################################################################

INSTALL_AA_ANALYZER=1
INSTALL_AHRL_DOCS=1
INSTALL_AHRL_MENUS=1
INSTALL_AHRL_VERSION=1
INSTALL_AIS_CATCHER=1
INSTALL_ANTSCOPE2=1
INSTALL_ARDOP=1
INSTALL_ARDUINO=1
INSTALL_ATLC=1
INSTALL_BACKDROPS=1
INSTALL_BROWSER=1
INSTALL_CHIRP=1
INSTALL_COIL64=1
INSTALL_COUNTRY_FILES=1
INSTALL_CQRLOG=1
INSTALL_CWWAV=1
INSTALL_DIREWOLF=1
INSTALL_DREAM=1
INSTALL_DUMP1090_MUTABILITY=1
INSTALL_EBOOK2CWGUI=1
INSTALL_ESP_HAMCLOCK=1
```

4

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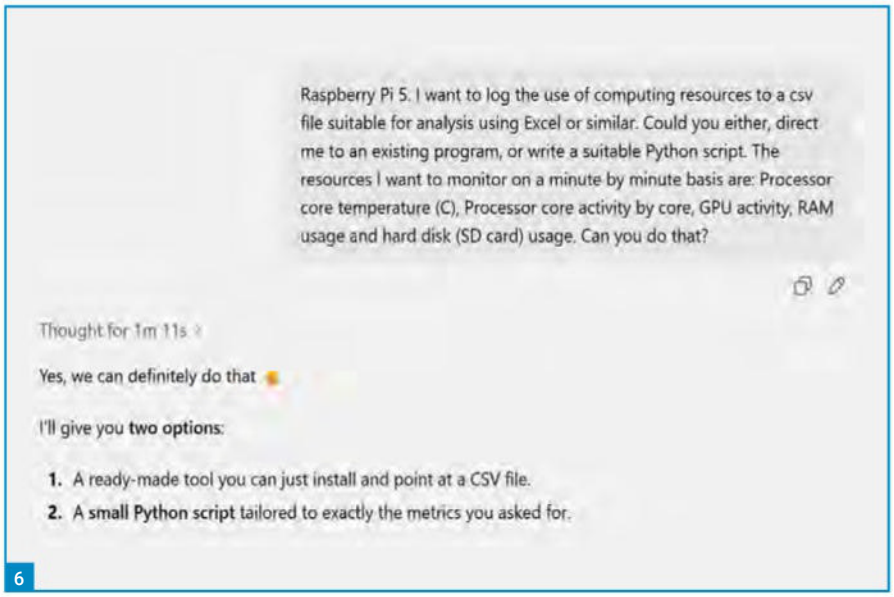


Fig. 5: Andy's Ham Radio Linux Raspberry Pi menu system. Fig. 6: Example of the helpful response from ChatGPT.

6. The response recommended Glances as a readymade solution, and gave me the following command-line installation instructions:

sudo apt update
sudo apt install glances -y

Followed by this command line to run the software and log the output to a CSV file that I could analyse in Excel:

glances --export csv --export-csv-file /home/pi/glances_log.csv

That was a straightforward solution. However, ChatGPT also pointed out that, due to the Pi's hardware configuration, Glances can't provide an actual % processor usage. It then developed a dedicated Python script to provide a custom solution. In addition to supplying the script, ChatGPT provided the commands to install the dependent software and to run it. The script is too long to publish here, so I've made it available on my website:

https://photobyte.org/raspberry-pi-5-resource-logger

ChatGPT also suggested modifications to the program to run automatically at boot as a systemd service and to provide an Excel pivot table template to display the collected data. All this was completed in a matter of seconds, which was very impressive.

As you can see, ChatGPT provides an expert programming service at your fingertips. I also recently used ChatGPT to help compare the decoding performance of different versions of WSJT-X. In that case, I wanted a script that would process the ALL.TXT file, separate the reports into time slots and unique callsigns, and output the results in a CSV file ready for further analysis. While I could have spent an hour or so writing a script, ChatGPT produced a very tight Python script for the solution in just a few seconds. I've found that the key to getting good results is to make your question as specific as possible. Don't worry about long questions; the more information you provide, the better your chance of getting the right solution the first time. I try to give very descriptive questions and include all the information I can think of. You must remember this is just a machine, so it will generally try to do whatever you ask, regardless of how dumb that is!

The future of Data Modes

As we ease into 2026, it seems appropriate to look ahead at what new technologies might impact our equipment and the data modes we use. Recent years have been dominated by rapid advances in error correction, DSP (Digital Signal Processing), and SDR (Software-Defined Radio) technologies. This has resulted in phenomenal performance from the top-end rigs. Also, devices such as the sub-£300 Web-888 receiver, which enables up to 12 online receivers that can be tuned between LF and 60MHz while being shared across the World via a web browser. That's remarkable, especially for us old timers who started with crystal sets and home-built TRF receivers!

So, what comes next? There is no doubt that AI is here to stay and will be affecting many aspects of amateur radio. In my second hobby, photography, AI has completely transformed post-processing for digital photographs. The sophisticated AI-powered selections enable automatic detection and improvements to eye and skin textures, as well as the replacement of backgrounds, skies, etc. AI noise reduction has also transformed high ISO photography. Whereas high ISO (digital sensor sensitivity) usually resulted in significant noise and detail loss, the latest AI noise reduction has virtually eliminated noise as a problem. Whereas I used to limit my working ISO to 3200, I can now operate at 32,000 ISO, safe in the knowledge that the image detail will be recovered using AI. I think this is the area where AI will have the most significant impact on radio data systems. With the ever-increasing spread of unregulated technology into our homes, we are all suffering from worsening local RF noise levels.

AI noise reduction for photography is relatively easy because each image is static, so the software can iterate over it many times to extract detail. In the case of my photos, reducing the noise from a 61-megapixel image file takes around ten seconds with a powerful GPU (Graphics Processing Unit) working flat out. Performing noise reduction on a radio signal requires a different approach because the noise floor and signal are ever-changing. However, if we broke the incoming audio into smaller packets with restricted bandwidth, those powerful GPUs could handle a lot of data. In addition to general noise reduction, I'm sure we will see new modulation systems better suited for AI code generation, demodulation, and noise reduction. So, to conclude, I think there's plenty to be excited about as we embrace AI and get it working for us. I shall be actively on the lookout for AI developments and will ensure they are mentioned here. **PW**

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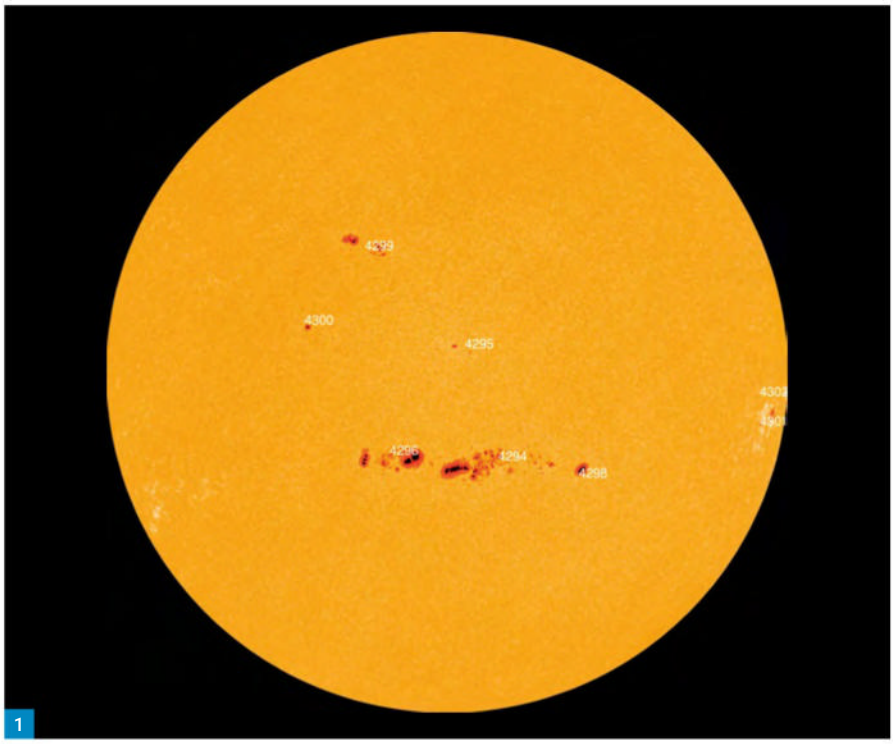


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Steve Telenius-Lowe G4JVG
teleniuslowe@gmail.com



1

Bouvet & why I like RTTY

Steve G4JVG has the usual round-up of HF news, with an item from our regular columnist Roger G3LDI on why he is an RTTY enthusiast.

Welcome to the February *HF Highlights*. Once again, the sun was very active during the month under review. On 6 December the solar flux was at 206 units while the sunspot number rose to 131 by 8 December, caused largely by the massive sunspot complex shown in **Fig. 1**. The Spaceweather website commented: *"If there's no X-flare this weekend, it will be a waste of a truly monstrous sunspot... Even **Richard Carrington** would be impressed"* (Carrington being the 19th century British astronomer after whom the 'Carrington Event', the most intense geomagnetic storm in recorded history, was named).

spaceweather.com

In the November 2025 column I speculated that solar cycle 25 might have two peaks. It now seems that the first peak has already occurred, probably in October 2025. In the *ARRL Solar Update* of 5 December, **F K Janda OK1HH** commented that *"the significant increase in solar activity since the beginning of December has finally confirmed the original assumption that the current 25th eleven-year solar cycle will have two peaks... It was only after the large solar flare on November 11, 2025, which was the largest since October 3, 2024, that it was possible to estimate that the second maximum was approaching."*

All this means that propagation on the higher HF bands should continue to be generally good this year, particularly around the spring and autumn equinoxes – except when there are major solar flares, of course!

arrl.org/news/the-arrl-solar-update

Why I like RTTY

Roger Cooke G3LDI has been operating on RTTY for a remarkable seven decades: *"I was licensed in 1956, when chasing DX on CW was the main interest of most amateurs... Listening around the short-wave bands... [we heard] commercial 850Hz FSK RTTY stations broadcasting propaganda, plus news from AP, UPI, Reuters, Peking and such like... I am also a musician and the sound of 850Hz shift RTTY fascinated me... Along with **Bill Brennan G3CQE** we used to hear **James Hepburn VE7KX** over the pole, a huge RTTY signal... We had to make everything, strip the teleprinter and service it, build the terminal units, ST5 and ST6, adjust polar relays, FSK the VFO and set it up, all great fun!*

"Since then we abandoned 850Hz and now use 170Hz shift, but the musical sound – often referred to as 'jingle bells' – still attracts me. Being in a shed isolated me from my parents, which obviously pleased them, because the mechanics of the Creed 7B chuntering away is the unattractive *sound associated with RTTY. I met one life-long friend **Dick Bendicksen W7LPM** later **N7ZL** and we visited with each other, both RTTY and CW enthusiasts.*

"Time marches on and some years later when I was married my station looked like **Fig. 2(a)**. *I was able to afford the Drake C line then with my home-brew linear in the corner, a pair of 3-500Z. To the right of my right hand are the G3PLX VDU RTTY unit and a 19in portable much-modified TV set as a monitor."* **Fig. 2(b)** shows Roger's 21st-century RTTY station. The monitor on the right is displaying RTTY during a contest. *"I love chatting on the keyboard on RTTY so why not give a few calls out; it's an easy mode to use these days, of course. You never know who is listening!"*

QSL from yesteryear

As DXers wait, with bated breath, for the 2026 3Y0K Bouvet Island DXpedition, this month's QSL from yesteryear is from the 1989 – 1990 3Y5X operation. My contact was on 7 January 1990 at 1212UTC on 28MHz SSB and the front of the four-sided QSL is shown in **Fig. 3**. The operators were **Einar LA1EE**, **Kåre LA2GV**, **Jin JF1IST**, **Jacky F2CW** (now ZL3CW) and **Willy HB9AHL**. I met Einar in Sweden before the 3Y5X operation and was sad to hear that he had become a Silent Key in 2025.

Bouvet Island (*Bouvetøya* in Norwegian) is located at 54º 25' S, 3º 21' E and is about 9km by 6km in size. It was named after French sailor Jean-Baptiste Bouvet, who first sighted the island in 1739.

The team landed on the island by helicopters from the *M/V Aurora*; in addition to the radio amateurs there were two scientists, a film team of two, a helicopter crew of two and a camp assistant. The 3Y5X QSL stated: *"The scientists mapped the census of penguins and seals and studied the behaviour of penguins. The film team shot seven hours of 16mm film for cinema and TV. The 250th anniversary of the discovery of Bouvetøya was celebrated and a commemorative plaque in the honor of Consul Lars Christensen* [who claimed the island for Norway in 1927 – ***Ed***] *was bolted to a rock on the western shore."*

The 16-day radio operation started on 28 December 1989, netting the group nearly 50,000 QSOs on CW, SSB and RTTY and on all bands from 1.8 to 28MHz. Before this operation only around 2500 QSOs had been made from Bouvet, by 3Y1VC and 3Y3CC in 1977 and 3Y1YC and 3Y5DQ in 1978 – 1979.

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Fig 1: The giant sunspot complex 4294-4296 on 6 December (photo credit: NASA/SDO). Fig. 2: Then and now: the RTTY station of Roger G3LDI. Fig. 3: The 1989 3Y5X Bouvet DXpedition QSL. Fig. 4: ARRL's 'America250' WAS certificate (photo: ARRL *QST*). Fig. 5: The FT-818 and Moonraker SPX100 antenna of Martin G1EOJ on French St Martin. Fig. 6: The Hustler 4-BTV vertical antenna at the station of Martin VK4CG – with a major electrical storm incoming!


2a


2b



3


5



4


6

WWA 2026

Nick Totterdell G4FAL of the RSGB Contest Club has announced that the club will be activating seven special callsigns for the third World Wide Award (WWA 2026) during the whole of January. They are GB0WWA (from the Isle of Man), GB1WWA (Guernsey), GB2WWA (England), GB4WWA (Scotland), GB6WWA (Wales), GB8WWA (Northern Ireland) and GB9WWA (Jersey).

The bands in use are 80, 40, 30, 20, 17, 15, 12 and 10m and every QSO made is being logged in real-time and sent directly to the Hamawards server. More information is at:

https://hamaward.cloud/wwa

America250 WAS

2026 marks the USA's 250th anniversary and the ARRL is celebrating with a year-long 'America250 Worked All States' award. Amateurs making contacts with all 50 US States during 2026 and that are confirmed on the ARRL's Logbook of The World (LoTW) may apply for the special certificate, **Fig. 4**. Full details are at:

arrl.org/america250-was

The month on the air

There were plenty of contest DXpeditions for the CQWW CW contest at the end of November, most of which were also active on other modes before or after the contest weekend. One such was **Jamie M0SDV**, who was active from Grenada as J38W between 23 November and 2 December on CW, SSB and FT8.

www.m0sdv.com

What to look for in January-February

A multi-national team plans to operate as AU7RS from Agatti Island (IOTA AS-011) in the Lakshadweep group between 10 and 22 January.

www.vu2rs.com/vu7r

The 'big one' is 3Y0K, Bouvet Island, the most remote uninhabited island on the planet. The team's ship is scheduled to leave Cape Town on 1 February, returning five weeks later. 3Y0K should be active from Bouvet for three weeks. The Norwegian-led team of about 20 operators from all over the world plans to operate mainly on CW and SSB, but will also be active on FT8, RTTY and the QO-100 satellite. More information at:

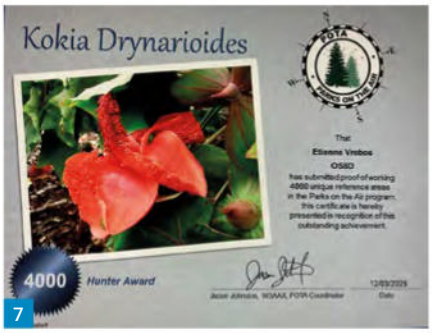
https://3y0k.com

Readers' news

It's always good to have new contributors to the column, so a warm welcome to **Martin Kay G1EOJ**, who wrote *"I visited St Maarten in November, an island split half French, half Netherlands. We stayed on the north French side... Spent a week there with my FT-818 and just the Moonraker SPX100 on the back* (**Fig. 5**). *Probably <5W given I was using internal battery only. A week of not being heard, despite many stations booming in, was rewarded when LU1XAW in Rio Gallegos answered my call. Pleased with Argentina, I didn't realise until I looked this was a crazy 7700km distance! Later on a PV8 replied but we couldn't really get each other's full calls. I visit Aruba, Curacao and Bonaire a few times and the rig will be going there next."*

Owen Williams G0PHY lamented *"Alas, very little activity here due to two weeks spent in Cornwall. In fact, only five QSOs were made: three DX contacts and two with Hungarian special event stations. I got a new band slot on 21MHz from TO9W* [St Martin, FS – ***Ed***]. *They were very active on SSB at the start of their DXpedition but appear to be concentrating on digital and CW for the last couple of days. I've*

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7


8

just received the latest Practical Wireless *and was interested in your 'QSL from yesteryear': I worked R1MVZ in October 1999 during the CQWW Phone contest. This was the same year that I became active and it got me hooked on working DX."*

Martin Burch VK4CG sent in the photo in **Fig. 6** showing a major electrical storm approaching his Hustler 4-BTV vertical. He commented that *"the storm season is revving up over here (about 20km south of Brisbane)... Just a few hours before this storm the radio atmospherics were jumping all over the place with very strong signal then severe QSB."* On 26 November Martin wrote: *"Had some more storms head through last night. HF conditions flat as a pancake this morning across all bands here in Queensland."*

Jim Bovill PA3FDR was another who experienced some of the many geomagnetic disturbances this month. *"After the improved DX reception on the upper HF bands last month it was disappointing having nothing to report this month for 10m and not much for 12m. When I switched on the radio on 6 December there was absolutely no reception on any band above 20m and apart from one DX QSO (UN7AB) on 80m, a band I very rarely use, all other activity was from local EU stations. For several days around that date there were reports in the news channels of exceptional aurora borealis activity and it is likely that the geomagnetic storms that cause the aurora were also responsible for the very uncommon reception I had experienced. On 24 November I had the same experience, with reception only on 30m and lower. Hopefully things will improve this month."*

Etienne Vrebos OS8D said: *"I finally reached more than 4000 POTA (Parks) in one year* (**Fig. 7**)*, mostly from USA in a limited time, late afternoon from 1400 to 1800UTC. I'm missing some difficult States such as AK, MT, SD, WA... As the weather becomes seriously wet my next activations will be by car as standing outside for hours near the bike is less comfortable than sitting in the car. Especially by motorcycle, standing and logging happens on paper and a too cold pen and freezing fingers. The fibreglass pole is difficult to slide in with heavy cold and it must slide in as it's otherwise difficult to transport by motorcycle."*

Carl Gorse M8HPI wrote to say that this month he activated *"around 10 parks in Southport, Chester and the Lake District with the QRP (tr)uSDX transceiver. I also activated a number of new POTA parks in the north-east running the Yaesu FT-817ND"*, **Fig. 8**.

Fig. 7: Etienne OS8D achieved this certificate for working 4000 POTA parks. Fig. 8: The M8HPI/P station with Yaesu FT-817ND at Bracken Hill Wood Nature Reserve, GB-3871.

28MHz beacons

Neil Clarke G0CAS said that *"calling the 28MHz beacons report for November 'unusual' is putting it mildly"*: Sporadic E was much more prevalent, while F2 propagation was well down, compared with what was expected.

Sporadic E openings took place on most days, although the vast majority were small, localised and short-lived. For example, OE3XAC 28188 was logged on the 3rd, 7th, 12th and 17th. DL0IGI 28205 was heard on the 5th and 12th, along with SQ4HWI 28193 on the 3rd. The only opening to Spain took place on the 1st, when ED4YBA 28263 was heard, along with C30P 28256 from Andorra. During the mid-evening period on the 12th, DK0TEN 28257 was logged with a number of other beacons including ON4NY 28207, which was heard only for the fourth time this year. The vast majority of the openings took place to Italy and occurred on ten days. Not bad at all for November!

Now a look across the Atlantic to North America which was very disappointing for this stage of the sunspot cycle. There was not one day when beacons from all ten call areas were heard. On 28200, 4U1UN (New York) was only heard on 11 days and W6WX was not heard at all. For the same month last year the same beacons were logged on 23 and 19 days respectively. Call areas 4 and 5 were heard the most, at 17 and 22 days respectively.

Paths to South America were even worse, with both LU2DT 28193 and PY4MAB 27271 logged on only nine days. It would appear that LU4AA 28200 was off the air from around the 8th. From New Zealand, ZL3TEN 28228 was heard on five days. Interestingly, on the 10th this was the only beacon heard in the world for a short time around 0800 till 0830, when 4X6TU 28200 came up out of the noise. As I said, very strange propagation at times throughout the month.

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).

Owen G0PHY (HS): 14MHz SSB: TO9W (=FS). **21MHz SSB:** TO9W. **28MHz SSB:** EA9KB.

Martin VK4CG (MS): 14MHz SSB: 4U1A, E51JD, G2YT, G0VQO, W2GGI, YE9CPN. **21MHz SSB:** 7L3ETZ/3. **28MHz SSB:** KE5ZR, JI1HAC.

Jim Bovill PA3FDR (MS) 3.5MHz FT8: UN7AB. **10MHz FT8:** A93MO, 3W9T, 4L4DX. **14MHz FT8:** UF8C. **18MHz FT8:** 9U1RU, VK3WRE. **21MHz FT4:** RA9LL, UN7LEW, VU2DCC. **21MHz FT8:** PV8AA, PZ5TW, UN/OH7O, ZW5B. **24MHz FT4:** EK/RX3DPK. **24MHz FT8:** 5Z4VJ, A61DI, R9JAU, ZS2DL.

Etienne OS8D (HB): 14MHz SSB: VK4IM, VP9NT. **21MHz SSB:** KH0/KC0W, KP4YAT, P40MC, VK2PH, ZD7VJ. **24MHz SSB:** 4J/SP9DLM, CP7DX, D44PM, TO9W. **28MHz SSB:** 5J0EA, 5V7RU, 9U1RU, AU2JCB, BG3ILY, BG5IOG, PU5DFR, S79/OK6RA, YN9H.

Carl M8HPI (MS) 14MHz SSB: VA1SEA, W1OW. **18MHz FT8:** A71UN/P, NC4VA. **21MHz FT4:** J88IH. **28MHz FT8:** KF0QR. **28MHz FT4:** 5R8IC.

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 April issue the deadline is 11 February. 73, Steve G4JVG. **PW**

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Daimon Tilley G4USI
practicalwireless@warnersgroup.co.uk



1

Budget satellites

Daimon G4USI explains how to build a TinyGS satellite ground-station for £20.

In a recent *RadCom* I was reminded of some of the uses of the LoRa modes, including Meshtastic and others. One of those modes, which I had read about before but not pursued, was TinyGS – standing for 'Tiny Ground Station'.

TinyGS is software developed by three Spaniards a few years ago, initially designed as a project to receive telemetry from a Spanish satellite known as FossaSat. Since then it has grown considerably into a quite sophisticated network of over 7,000 members and nearly 2,000 active monitoring stations around the world. Members of the community activate a station and the data received is uploaded via Wi-Fi to an online database. You can see which satellites you have received and who else within the community has received them, as well as stats concerning the distance, angle of elevation, etc. You can also see the telemetry data that has been transmitted by that satellite over LoRa, viewing information such as the state of charge of the satellite batteries, temperature and power output of the transmission. In the 25 days my station has been operational, it has received well over 11,500 packets, with a maximum satellite distance of 3,254km. I am told by other community members that various academics and institutions make use of this community data to aid their studies.

In this article I am going to explain how you can become a member of this community for around £20 plus stuff from your 'junk box.' But first, a little more about the community. The developers have created a web-installer for easy download of the source code to your chosen LoRa board, and a number of popular boards are supported. There is also a Telegram app user-group. You use this group, via an automated Bot, to register your device to the network, and the TinyGS website (URL below) which allows you to see what each of the nearly 2,000 stations are receiving, including your own.

www.TinyGS.com

The Telegram group also has a useful community to help you troubleshoot and ask questions. Finally, as your board is connected to your Wi-Fi network, you can directly access your board's key settings via its own IP address and your web browser. You can get an idea of what the public web dashboard for an individual station looks like by viewing mine at this link:

https://tinyurl.com/7b4w45x

Gathering your parts together

First you need an appropriate board. A list of supported boards, along with detailed installation instructions, can be found at the organisers GitHub page here:

https://github.com/G4lile0/tinyGS

I used a Heltec Wi-Fi LoRa 32 board, version 3.2. This particular version is not listed as supported, but does work fine. I paid about £17 for mine. IMPORTANT – make sure to order the 433MHz version, as 868MHz tends to be the default option. Many more satellites use 433MHz, which are also easier to receive. A V2 board is shown in **Fig. 1**.

The board usually comes with a little pigtail antenna lead and a tiny helical antenna. It is a good idea to connect this when flashing the firmware, but you will need a better antenna for real-world use.

You will also need a means to power the unit - solar power is possible but I used a 5m long USB cable and USB mains adapter – a more effective antenna, and antenna mount. I will describe how to make these later. Once you have your board, download the Telegram app to either your phone or computer and download the firmware to your chosen board using the web installer. I won't repeat the instructions available on the GitHub installer page, but the process is fairly simple. I suggest you follow 'Path 1' which is for Automatic Setup. In this process you connect your board to your Wi-Fi network, and then use the Telegram Bot to enable your device as a new station on the network. The connection to Wi-Fi serves three key purposes. Obviously it allows your station to report the satellites received, but it also receives automatic instructions from the web to change frequency and mode in order to receive the next predicted satellite pass for your location, based on your latitude and longitude. Finally, it allows both 'Over the Air' software updates and also access to your own board's dashboard page where you can make your own configuration changes.

Once the software on the board is installed you get a fancy set of scrolling screens on the OLED display, which are interesting to look at initially, but when you come to mount the station permanently, you may wish to disable the screen to save power, by setting screen brightness to '0' in your web dashboard.

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Fig. 1: A Heltec v.2 board.
Fig. 2: The author's GP antenna.
Fig. 3: Physical assembly complete.
Fig. 4: Physical construction and connection completed. Fig. 5: Mounting bracket and pole.
Fig. 6: Completed installation.

So, having the software installed, with the little whip antenna, you may put it in the window and receive some packets, but that didn't work for me! It is highly recommended you install a proper antenna and use the shortest length of decent coax cable you can. Three metres of Messi & Paolini Aircell coax has been recommended by one group expert as the maximum for decent results. Certainly, when I connected mine using 10m of RG58 to a Slim Jim, results were very poor indeed due to cable losses. Remember that the signals you are receiving are travelling up to around 3,000km using only about 1 watt on average and coax becomes more lossy as frequency increases.

My setup

So, I decided that I was going to make an antenna with the LoRa board mounted in a weatherproof box, immediately beneath the antenna. This used only about 12 inches of coax. Any long lengths of cable would be restricted to the 5V USB power supply. I already had a 5m USB power cable left from another project and a 5V charging plug. I decided that the plug would go in my detached garage and I would mount my antenna on the rear eaves at about 4m above ground. The length of the thin power lead did not seem to result in a voltage drop that bothered the board.

The antenna

One of the simplest antennas, effective for this purpose, is a quarter-wave ground plane. They are cheap, simple and benefit, as a vertical, from a low angle of radiation, which is of benefit as most passes are low on the horizon. My antenna is shown in **Fig. 2**. To make this antenna I used a SO-239 square bulkhead connector – the type with four mounting holes – some 14SWG (not critical) copper wire, four crimp terminals, nuts and bolts and a PL259-to-Male SMA connector.

First, cut five lengths of your chosen stiff copper wire to 165mm long and scrape back the enamel on one end of each to reveal the copper. Next, solder one to the centre pin of the bulkhead adapter, using a large solder tip, and then crimp the bare end of each of the other four wires into a suitable ring crimp connector, before soldering them together. You then secure the four ring connectors to the four holes of the bulkhead connector tightly and bend the four pieces (the radials) to an angle of about 45°. That is your antenna finished! There is no real need to tune the antenna any further, but if you wish you could tune it to 433MHz using a VNA or similar. I didn't bother.


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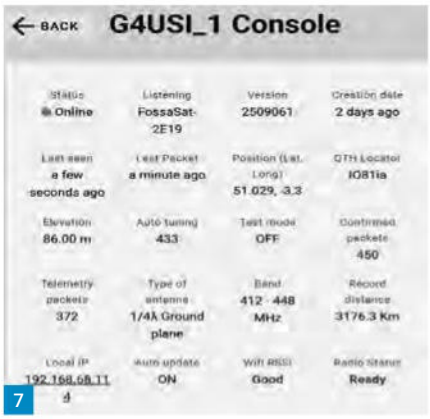
You then screw in the PL259-to-SMA plug on the bottom and the antenna is ready. At this stage, to ensure I had a working setup, I connected the LoRa board directly to the antenna using the supplied pigtail, added USB power from the garage mains, and placed the lot in an upturned bucket for rain protection on the ground overnight. There was a smaller bucket underneath to hold the electronics off the ground. The morning examination of my dashboard revealed about 30 packets had been received overnight, so I decided to press ahead and make the installation permanent.

I gathered together the additional items needed. These include an old cheap TV antenna mount, a short length of aluminium pole, a short length of 21mm white PVC pipe and a waterproof junction box. I also used a drill, 10mm drill bit and hot-air gun. I determined, that as well as the short pigtail supplied, I would need about another 12in of coax so I once again visited the station supplies and found an SMA-to-SMA patch lead of the type used with VNA's. I connected one end of this to my antenna and then sealed the antenna end to make it watertight. I applied self-amalgamating tape to the coax connections at the antenna and liquid electrical tape to the junction of the vertical radiator to the centre pin of the bulkhead connector.


6

My idea was that I would use about 12in of the white PVC pipe. At one end I would mount the antenna, allowing the coax to run down the inside and out of a drilled 10mm hole, before forming a drip loop and entering the bottom of the junction box. The USB power lead would come up from the bottom of this pipe and out of a similar hole, before also entering the junction box. I fixed the junction box to the pipe in a diamond formation,

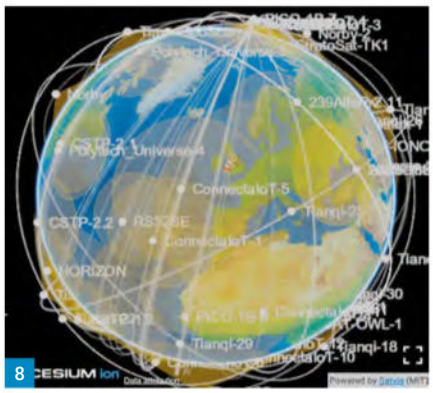
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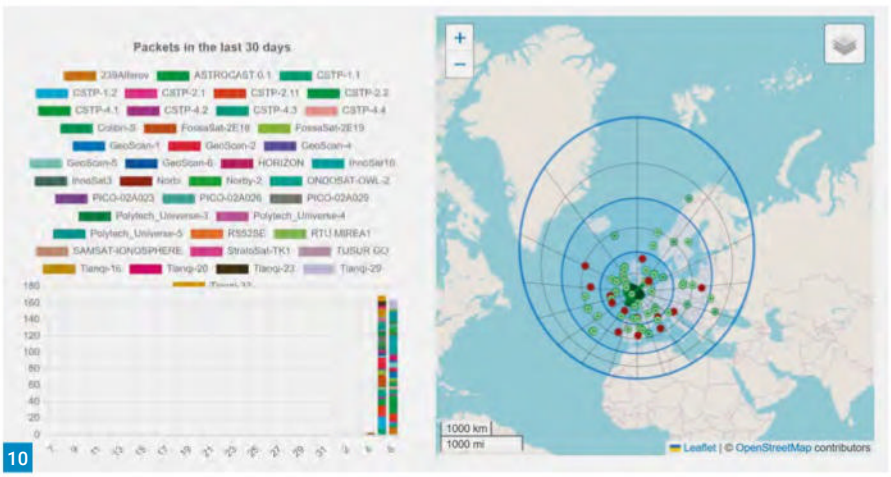
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using two self-tapping screws to fix the box to the pipe. After trial fitment I removed the screws, cut them shorter to allow the cables to pass by without damage and re-fixed the box.

Fig. 3 shows how I used the hot-air gun to gently soften the PVC pipe, enabling me to push the PL259 connector and waterproofed coaxial connections all the way in the pipe until the pipe was flush with the underside of the bulkhead connector. Be careful here, you don't need much time with the hot air at all, and my first attempt caused the end of the pipe to buckle as it was so soft! If you don't have a hot-air gun, you might also be able to use a gas flame or boiling kettle, but please be careful!

I then passed my USB power cable up the inside of the aluminium pole, and the PVC pipe and out through a hole in the PVC. I then heated the bottom end of the PVC pipe and was able to push that down over the aluminium pole for a nice tight fit.

The grommet holes on my junction box had a soft membrane covering them, so I poked holes in the bottom two and forced the USB and SMA connector through them. As they enter from underneath I did not add waterproofing grommets, deeming them unnecessary. The membrane was tight enough around the cables to prevent spider ingress etc. and the Heltec board was connected and fitted snugly, without the need for any mounting points, **Fig. 4**. The bottom half of the antenna mount – an old TV antenna bracket and a length of the old aluminium tube (before cleaning) can be seen in **Fig. 5**, and it is the top end of this aluminium pole that is inserted into the bottom of the PVC pipe. The whole construction is shown mounted on the eaves of my garage in **Fig. 6**.

Fig. 7: TinyGS console 1. Fig. 8: TinyGS console 2. Fig. 9: TinyGS console 3. Fig. 10: TinyGS console 4. Fig. 11: TinyGS LoRa board dashboard. Fig. 12: UK ground stations on 433MHz.

In use

Well, what a difference mounting the antenna away from the ground made! No surprises really, but I was delighted to see that within the first 24 hours of installation I had received over 450 individual packets from various satellite passes, with the farthest satellite being some 3176.3km distant! Sometimes you will receive three or four separate packets during the time the pass is 'visible' at your location, other times, only one. There is plenty of information to be gained from the web dashboards and a small sample is shown in **Figs 7** through **11**. Visit the website and browse the stations list, and you will be able to explore the range of data available for yourself.

Finally, take a look at **Fig. 12**, which is taken from the TinyGS website and shows the UK ground stations monitoring 433MHz. By zooming in, I count roughly 175 active stations on 433MHz, with some sizable gaps in large parts of the country. Why not build a station yourself and perhaps fill a gap?

Until next time, happy satellite hunting and 73! **PW**

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Chris Murphy M0HLS
practicalwireless@warnersgroup.co.uk

Impedance

Jeff helps Natalie to understand impedance.

Jeff, as usual was already at his desk when Natalie arrived. *"Morning Jeff"*, she called out as she walked in. *"Morning Natalie"*, Jeff replied. *"Good day at college?" "Yes"*, Natalie replied. *"We covered impedance twice yesterday. First in electronics with Archie and again in engineering science with Arthur. Although Archie also covered series alternating current circuits as well". "Lucky you"*, Jeff replied. *"But I suppose that you will want a third lesson at lunchtime". "Yes please"*, said Natalie. *"Oh, and by the way, the notes that you write for me and that I pass on to the others are getting famous". "How come?"* Jeff replied. *"Well"*, Natalie explained, *"We've got a new lab technician called Seth who writes the instructions for the experiments that we do and he's thinking of using some of the notes that you give me in those. If that's OK with you of course". "Fine by me"*, Jeff replied, *"Glad to be of help"*.

Lunchtime arrived and after they'd eaten their lunches and Jeff had brewed himself another mug of tea, he went back to his desk and found Natalie sat waiting for him. *"So, what did you say you did at college"*, Jeff asked. *"Impedance and series alternating current circuits?" "Yes"*, Natalie replied. *"But before we talked about those, Archie went through some examples of how we can calculate currents and voltages in reactive circuits. A bit like Ohm's law". "Yes, you can"*, said Jeff. *"Basically, you just substitute resistance for reactance in the equations. So, we can write three basic equations"*:

$$X = V/I \qquad I = V/X \qquad V = I \times X$$

"Here, X can be inductive or capacitive reactance. As with Ohm's law for direct current circuits you can construct a triangle to help you work out the value that you want to know." [**Fig. 1**]

"And it's also important to remember that the voltage and current are not in phase. In other words, the maximum values of voltage and current don't happen at the same time". "Can we do a couple of examples please", Natalie asked. *"Yes OK"*, Jeff replied. *"Let's say that we want to know the current flowing in an inductor that has a reactance of one kilohm and a voltage of twenty volts across it. Then"*, Jeff wrote down the formula:

$$I = V/X$$
$$\text{So } I = 20/1000$$
$$I = 0.02\text{A or } 20\text{mA}$$

"And let's say that we want to know what voltage will result in a current of one milliamp flowing in a five microfarad capacitor working at a frequency of five hundred Hertz. Here, the first thing we have to do is to work out the reactance. So":

$$X = 1/2\pi fC$$
$$X = 1/2\pi \times 500 \times 5.0 \times 10^{-6} \quad X = 66.63\Omega$$

"And now we can calculate the voltage"

$$V = I \times X$$
$$V = 0.001 \times 63.66 \quad V = 0.064\text{V or } 64\text{mV}$$

"Yes, I'm quite comfortable with those calculations", said Natalie. *"OK"*, said Jeff. *"Well, the next step is to look at how to carry out calculations with various combinations of resistance, capacitance, and inductance in series. Both Archie and Arthur have taken a good approach here as it's usually easier to do the calculations for series circuits rather than parallel". "Why, are parallel circuits difficult?"* Natalie asked. *"Not really"*, Jeff replied. *"But one way of doing the calculations is by using what are called complex numbers, which is just a name for them. They're not really complex at all. In fact, you can also use them for series circuits", "Oh, OK. Neither Archie or Arthur covered those yesterday, although we have done complex numbers in maths with Reggie"*, Natalie replied.

"OK", Jeff continued, *"Let's start by looking at an alternating current circuit containing two resistors in series"* [**Fig. 2**]. *"If we look at the waveforms for voltage and current* [**Fig. 3**], *we can see that they are in phase and both reach their maximum values and pass through zero at the same time". "Yes, I see"*, said Natalie. *"OK"*, Jeff continued, *"If you think back to when we talked about phasors, we came up with a couple of equations like this"*. Jeff wrote down the equations:

$I_t = I_{Max} \text{Sin}\omega t$ *for the current, and for the voltage*

$$V_{R(t)} = V_{Max} \text{Sin}(\omega t + \theta)$$

"Where Theta, θ is the phase angle, and because the voltage and current are both in phase, Theta is zero and we can reduce the equation for voltage at some point in time to"

$$V_{R(t)} = V_{Max} \text{Sin}\omega t$$

"Now, since we're dealing with voltages and current that are in phase and of the same frequency, and reach their maximum values and pass through zero at the same time, we can apply Ohm's Law to the circuit, and so the resistance will be given by the voltage divided by the current"

$$R = V/I$$

"And from this we can deduce an expression for the voltage as"

$$V_{R(t)} = RI_{Max} \text{Sin}\omega t$$

"And putting all this together, we get for a purely resistive alternating current circuit this" [**Fig. 4**].

"So that's resistors in an alternating current circuit covered", said Jeff. *"But before we move on, don't forget that not all resistors are purely resistive". "Do you mean ones like wire wound resistors that may have some inductance as well?"* Natalie asked. *"Yes"*, Jeff replied, *"Whilst some inductance isn't usually a problem, it can become important at high frequencies. And as we'll see shortly, inductors are not purely inductive and will have some resistance that may be needed to take into account".*

"Anyway", Jeff continued, *"We've already looked at how inductors and capacitors behave in alternating current circuits in previous sessions, so we don't need to cover that again now. But let's have a look at what happens when we have a combination of resistors, capacitors, and inductors in a series alternating current circuit". "OK"*, said Natalie.

"Let's start with a resistor and inductor in series like this" [**Fig. 5**]. *"Now for an inductor and resistor in series in an alternating current circuit, the total voltage across the arrangement will be the phasor sum of the voltage across the resistor,* V_R *and the voltage across the inductor* V_L *It's important to realise that you can't just simply add* V_R *and* V_L *together". "Yes, I understand that"*, said Natalie. *"You can't just add them together because they aren't in phase". "Correct"*, Jeff replied. *"Since it's a series circuit, the current flowing through both the resistor and inductor will be the same and in phase with each other. And whilst the voltage across the resistor will be in phase with the current, the voltage across the inductor will be leading the current". "Or we can say that the current is lagging the voltage"*, Natalie put in. *"Correct"*, Jeff replied. *"So, let's draw a phasor diagram to show the relationships between the voltages and currents. Since the current is the same in both the resistor and inductor, we can use this as the reference vector"* [**Fig. 6**]

"Now from the phasor diagram", Jeff continued, *"We can construct what is known as a voltage triangle like this"* [**Fig. 7**]. *"Now, because the voltage triangle is a right-angled triangle, we can solve it by using Pythagoras' theorem. We could of course solve it by drawing a scale diagram, but we'll stick to the calculations. So, for our voltage triangle, we have"*

$$V_S = \sqrt{V_R^2 + V_L^2}$$

And the phase angle will be $\varphi = \tan^{-1} V_L / V_R$

"OK, but before we go any further, can we do an example please?" Natalie asked. *"I'm pretty*

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Fig. 1: Triangle of values for voltage, current and impedance. Fig. 2: Circuit with two resistors and alternating current. Fig. 3: Voltage and current for Fig. 2 in phase. Fig. 4: Showing current and voltage from Fig. 2 on same time axis. Fig. 5: Circuit with resistor and inductor in series. Fig. 6: The voltage vector for circuit of Fig. 5. Fig. 7: Voltage triangle for Fig. 5. Fig. 8: Triangle of values for voltage, reactance and current. Fig. 9: Impedance triangle, showing impedance, resistance and reactance.

confident about this because we've covered it with both Reggie in Maths and Arthur in Engineering Science, but I just want to be certain". "Yes, OK", Jeff replied. *"Let's say that the voltage across the resistor is five volts and the voltage across the inductor is eight volts. Then the supply voltage V_S will be":*

$$V_S = \sqrt{5^2+8^2}$$
$$V_S = \sqrt{89}\ V_S = 9.43V \text{ and}$$
$$\Phi = \tan^{-1} 8/5 = 57.99°$$

"So, as you can see", said Jeff, *"The supply voltage isn't simply the sum of the voltages across the resistor and inductor". "Yes, understand that",* Natalie replied. *"Anyway",* Jeff continued, *"As we know, in a direct current circuit, the ratio of the voltage and current, in other words the voltage divided by the current, V/I is called resistance. For alternating current circuits, the voltage divided by the current is called impedance. We give impedance the symbol capital Z and like resistance it is measured in Ohms. So, we can say that":*

$$Z = V/I$$

"And as with resistance we can use the magic triangle to help work out what it is we want to know" [**Fig. 8**].

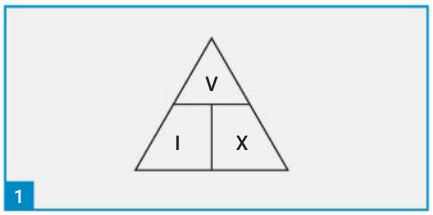
"OK", said Natalie looking at what Jeff had written. *"That tells us how to find the impedance if we know what the voltages and currents are. But can we find the impedance if we only know what the values of the resistor and inductor are? Like we can calculate total resistance for resistors in series and parallel?" "Provided that we know what the frequency of the supply is, then yes we can",* Jeff explained. *"If we go back to our voltage triangle and divide both V_R and V_L by the current, I, we will get the following equations":*

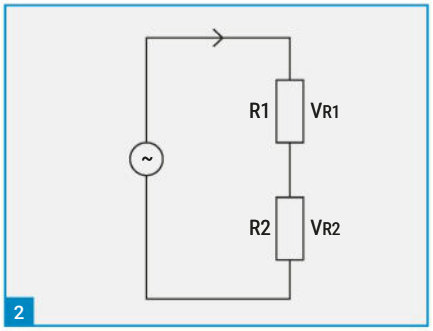
$$V_R/I = R\ \ V_L/I = X_L \text{ and } V_S/I = Z$$

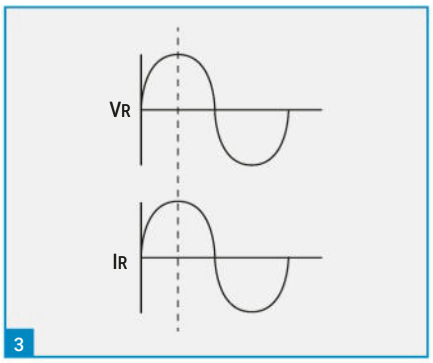
"And we can now draw what is known as an impedance triangle" [**Fig. 9**]. *"And in the same way that we worked out the voltages, we can say that":*

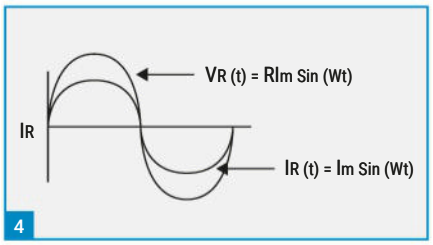
$$Z = \sqrt{R^2 + X_L^2} \text{ and}$$
$$\Phi = \tan^{-1} X_L/R$$

"Let's do an example. Let's say that we have an inductive reactance of twenty Ohms in series with a a resistor of forty Ohms. Then, the impedance will be":









$$Z = \sqrt{R^2 + X_L^2}$$
$$Z = \sqrt{40^2 + 20^2}$$
$$Z = \sqrt{2000}$$
$$Z = 44.72\Omega$$

"And the phase angle is":

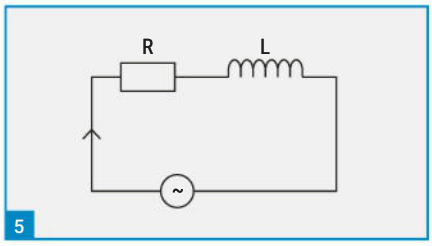
$$\Phi = \tan^{-1} X_L / R$$
$$\Phi = \tan^{-1} X_L / 20/40$$
$$\Phi = 26.56°$$

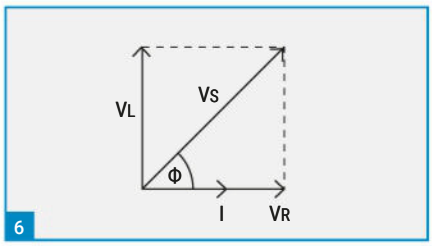
"And, because it's an inductive circuit, the current will be lagging the voltage". "Or voltage leading", said Natalie. *"Correct",* Jeff replied. *"And, of course, we can manipulate the equation to find either the resistance or inductive reactance by":*

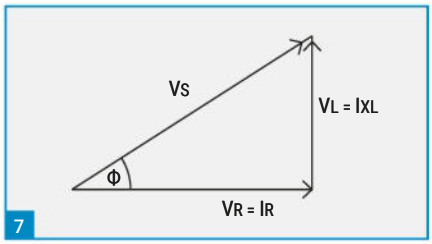
$\sqrt{R} = Z^2 - X_L^2$ and $\sqrt{X_L} = Z^2 - R^2$

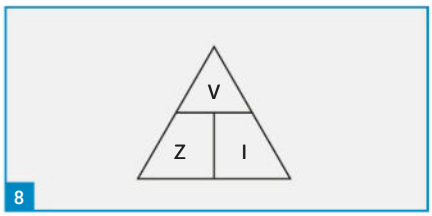
"Try them out for yourself using the example that we've just done". "OK", said Natalie.

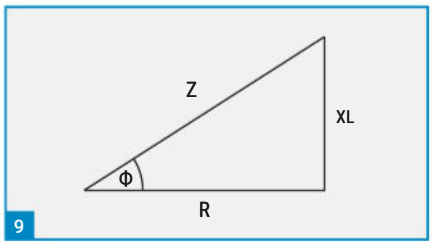
"OK, so far we've looked at an example where both the resistance and inductive reactance are known. Now let's take things a bit further and say that we











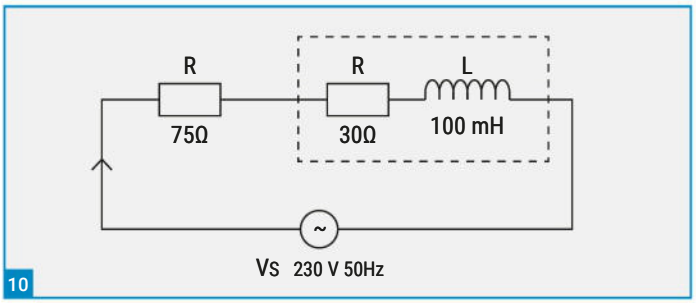
only know the values of resistance, inductance, and the frequency of the supply". "I assume that we have to work out the inductive reactance first", Natalie suggested. *"Yes, that's right",* said Jeff. *"Let's do an example. Let's say that we want to know the impedance of a fifty microhenry inductor connected in series with a one hundred Ohm resistor, when the supply frequency is ten kilohertz. As you say Natalie, the first thing to do is to work out the inductive reactance. So"*

$$X_L = 2\pi fL \text{ so}$$
$$|X_L = 2\pi \times 1.0 \times 10^4 \times 5.0 \times 10^{-5}$$
$$XL = 3.142\Omega$$

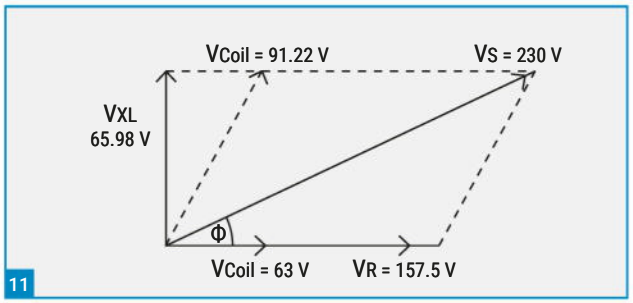
"And to find the impedance, we say that"

$$Z = \sqrt{R^2 + X_L^2}$$
$$Z = \sqrt{100^2 + 3.142^2}$$
$$Z = 100.05\Omega$$

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"That's pretty much the same as the resistance", said Natalie. *"Yes"*, Jeff replied. *"You'll quite often find that either the resistance or inductive reactance dominates the result for impedance. Let's try another one with a much bigger inductance, say two Henrys. For a two Henry inductance at ten kilohertz, the reactance works out to be about one hundred and twenty-five kilohms"*, said Jeff punching the numbers into his calculator. *"And the impedance is about the same. So, in this case, the inductance dominates the result for impedance"*.

"Hmm, I see", said Natalie, looking at the figures that Jeff had written down. *"But don't forget"*, Jeff continued, *"We only calculated the impedance. We didn't look at the phase angle"*. *"No, we didn't"*, Natalie agreed. *"So"*, Jeff continued, picking his calculator up again, *"For the first example, where the resistance is dominant, we have a phase angle of one point seven degrees, so the voltage and current will almost be in phase, and for the second example where the inductance is dominant, the phase angle is eighty-nine point nine five degrees, which isn't far off ninety degrees. Both of these figures are what you'd expect from purely resistive and inductive circuits"*.

"Anyway, time's getting on", said Jeff looking at his watch, *"We'll have to look at resistors and capacitors in series another time. Maybe tomorrow"*. *"OK"*, Natalie replied. *"Will you write a few examples that I can share with Poppy, Isla, and Tommy as usual?"* *"Yes, of course"*, Jeff replied. *"But before we finish, let's look at one more example, one that's a bit harder"*. *"OK"*, said Natalie.

"Let's say that we have a coil with an inductance of one hundred millihenrys and a resistance of thirty Ohms connected in series with a seventy-five Ohm resistor across a two hundred and thirty volt, fifty Hertz supply" [**Fig. 10**]. *"Find the impedance, the current in the circuit, the phase angle, and the voltages across the resistor and coil. Then draw the phasor diagram"*.

"I suppose the first thing to do is to find the reactance of the inductor", Natalie suggested. *"That's right"*, said Jeff, *"So"*

$$X_L = 2\pi fL \quad X_L = 2\pi \times 50 \times 0.1 \quad X_L = 31.42\Omega$$

"Now we can find the impedance, but first we must find the total resistance in the circuit. That is the resistance of the resistor plus the resistance of the inductor, so the total resistance is"

$$R_T = 75 + 30 = 105\Omega$$
$$Z = \sqrt{105^2 + 31.42^2} \quad Z = 109.60\Omega$$

"The current is found by dividing the voltage by the impedance so"

$$I = V/Z \quad I = 230/109.60 \quad I = 2.10A$$

"The phase angle is"

$$\Phi = \tan^{-1} X_L / R \quad \Phi = \tan^{-1} 31.42/105 \quad \Phi = 16.66° \text{ Lagging}$$

"The voltage across the resistor is found by Ohm's law, so"

$$V_R = I \times R \quad V_R = 2.10 \times 75 \quad V_R = 157.5V$$

"The voltage across the coil is a bit more difficult. First, we need to find the impedance of the coil"

$$Z_{coil} = \sqrt{R_{coil}^2 + X_L^2} \quad Z_{coil} = \sqrt{30^2 + 31.42^2} \quad Z_L = 43.44\Omega$$

"And so, the voltage across the coil is"

$$V_{coil} = I \times Z_{coil} \quad V_{coil} = 2.1 \times 43.44 \quad V_L = 91.22V$$

"So, that's everything the question asked for, but before we can draw the phasor diagram, there are two more things that we need to find, and that's the voltage across the resistive part of the coil which we can find by multiplying the resistance of the inductor by the current"

$$V_{Rcoil} = 2.10 \times 30 = 63V$$

"And the voltage across the reactive part of the inductor, V_{XL}, which we find by"

$$V_{XL} = IX_L$$
$$V_{XL} = 2.1 \times 31.42$$
$$V_{XL} = 65.98V$$

"And now we can draw the phasor diagram" [**Fig 11**].

"Mmm", said Natalie looking at what Jeff had drawn. *"But I assume that we could use Pythagoras' theorem to find the supply voltage and so on"*. *"Yes, but you need to be a bit careful as to what voltages across the resistor and inductor that you use. The voltage across the inductor will be the inductive reactance multiplied by the current, and for the resistor, we need to work out the voltage across the total resistance so"*

$$V_{XL} = I \times X_L$$
$$V_{XL} = 2.1 \times 31.42$$
$$V_{XL} = 65.98V$$
$$V_{RT} = 2.1 \times (75 + 30)$$
$$V = 2.1 \times 105$$
$$V = 220.50V$$

Fig. 10: As Fig. 5 but now accounting for resistance of the inductor.
Fig. 11: The phasor diagram for Fig. 10.

"Now we can use Pythagoras theorem to calculate the supply voltage. So"

$$V_S = \sqrt{V_{RT}^2 + V_{XL}^2}$$
$$V_S = \sqrt{220.5^2 + 65.98^2}$$
$$V_S = 230V$$

"Which we know is correct". *"OK, I see"*, said Natalie. *"Just one last question. When we talked about resistance we said that there is a reciprocal of resistance called Conductance and in our sessions about Reactance we said that there is a similar thing called Susceptance. What about impedance, does that have a reciprocal?"* *"Yes, there is"*, Jeff replied. *"It's called Admittance and we give it the symbol capital Y. Like Conductance and like Conductance and Susceptance it's measured in Siemens"*

$$Y = 1/Z \text{ Siemens}$$

"OK, thanks", said Natalie. *"I'll pass the notes on to Poppy, Isla, and Tommy as usual"*. *"OK"*, Jeff replied. *"We'll look at resistor and capacitors in series another time"*.

Jeffs questions

1. A resistor and inductor are connected in series. If the voltage across the resistor is 25V and the voltage across the inductor 60V. What is the supply voltage? (65V)
2. A 200Ω resistor is connected in series with an inductor which has a reactance of 700Ω. Calculate the impedance. (728Ω)
3. For the circuit in Q2, calculate the admittance. (1.4mS)
4. For the series circuit in Q2, what current will flow if the supply voltage is 90V? (0.124A)
5. An inductor with a reactance of 300Ω and a resistance of 10Ω is connected in series with a 470Ω resistor. Calculate the impedance. (566Ω)
6. A coil with an inductance of 15mH and resistance of 5Ω is connected in series with a 24Ω resistor across a 18V, 1kHz supply. Calculate:
a. The reactance of the inductor (94.25Ω)
b. The impedance of the coil (94.38Ω)
c. The impedance of the circuit (98.61Ω)
d. The current in the circuit (183mA)
e. The phase angle (72.9°)
f. the voltage across the resistor (4.39Ω)
g. the voltage across the coil (17.27V) **PW**

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Colin Redwood G6MXL
practicalwireless@warnersgroup.co.uk



1

A Holiday-Style DXpedition to Lanzarote

Colin G6MXL writes up his presentation from the 2025 RSGB Convention.

In October 2025 I gave a presentation at the RSGB Convention in Milton Keynes describing a holiday-style DXpedition to Lanzarote I made in September 2024. Several people in the audience asked that I do a write-up, hence this *What Next* – a condensed version of my presentation. Much of this *What Next* might also be of interest to POTA and SOTA etc. activators.

Holiday-style?

For me, a holiday-style DXpedition contains elements of a holiday and a DXpedition. It might be termed a light-touch DXpedition - operating interspersed with holiday activities such as sightseeing, walks, swims etc. Others no doubt take a different view and perhaps tack on some operating in the evening to a normal family holiday for example.

Why Lanzarote?

I was looking for somewhere that was easy to get to yet be far away enough to count as DX (another continent). Lanzarote is one of the Spanish Canary Islands, which ticks the box being considered in Africa for amateur radio purposes. Having a full licence I could operate under CEPT T/R 61-01. If you have a Foundation or Intermediate licence, you generally cannot operate abroad, however there are plenty of islands around the coast of Britain that can make for a DXpedition.

https://docdb.cept.org/download/4541

Equipment

My choice of equipment was essentially dictated by a combination of weight and airline regulations. It might be summed up as what might be taken on a SOTA or POTA activation but with a mains electrical supply instead of a battery. **Table 1** shows the weight of most of the equipment I took.

Why mains?

While I could have a taken a small LiPo battery, the IATA regulations for passenger planes are very strict in respect of batteries, limiting the maximum capacity to 100Wh as carry-on luggage and not checked in. So, the peak voltage x Ah rating must be below 100, so 14V x 7Ah = 98Wh is the limit.

https://tinyurl.com/5h2d4ybt

As I was planning to operate from where I was staying, so that I could operate at any time of the day or night that I chose, there seemed no reason to be constrained by a small LiPo battery when a mains supply was readily available. I chose a small lightweight switch-mode power supply. It has meters on the front for measuring voltage and current being drawn, which I found useful as I didn't want to take an RF power or SWR meter with me (and less weight). I also took a mains lead terminated in continental mains plug. I prefer to use continental mains plugs rather than incur the weight of an adaptor and it's one less thing to forget!

Transceiver

I looked around at various transceivers and decided on the Yaesu FT-891, chosen as it was the lightest (1.9kg) 100W HF transceiver available at the time of purchase a few years ago.

Antennas

To save adding the weight of an ATU, I used resonant band-hopper antennas from SOTA beams. SOTA beams don't currently advertise a version covering 15m and 17m, but I managed to acquire a second band-hopper antenna at a silent key sale at my local radio club and pruned it to be resonant on 15m and 17m. I operate the band-hopper antennas in an inverted-V configuration using a SOTAbeams Travel Mast to support the central feedpoint. The mast can extend to 10m high and collapse to just 67.6cm, enabling it to fit diagonally into my suitcase. I bought the case a few years ago having taken the mast into the shop to make sure it could accommodate the mast (**Fig. 1**). I use reusable cable ties to tie it to whatever is available in my operating location. I've used table legs, fence posts, and trees over the years.

Using another band-hopper equipped with 20m I found that I got poor results. I concluded that I couldn't get enough of the antenna above the height of the roof line to be effective. So, I stuck to mainly 15m and to a lesser extent 17m (**Fig. 2**). I also found that I could radiate a reasonable signal on 12m. I didn't try any LF bands.

In addition to the band-hopper antennas, I also took a dipole for 10m with me. I encountered some EMC issues with this antenna. 10m would get into the external computer mouse and freeze it. I didn't have time to fully investigate this, but I observed that the 10m dipole didn't have a balun. Re-routing the feeder away from the mouse and raising the height of the 10m dipole both helped.

I still need to get to the bottom of the problem. I intend to try a choke on the mouse, perhaps a wireless mouse, and putting a balun at the feedpoint of the 10m dipole.

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Fig. 1: The suitcase with all equipment, before clothes etc. being packed. Fig. 2: The antenna and pole being blown by the strong winds. Fig. 3: The operating position on the kitchen table.

Feeder

The band-hopper antennas come supplied with 10m of RG174 feeder terminated in a BNC plug. The feeder is lightweight and flexible and only 2.8mm outside diameter. Although in comparison with other feeder the losses are higher, I find them acceptable at HF (**Table 2**). I try to avoid the need for RF adapters, as they are all too easily forgotten. If I really need them, then I attach them either to the rig or feeder before leaving.

Data-modes

I aimed to operate principally using FT8 and FT4. Accurate time is vital for data-modes such as FT8 and FT4. It needs to be better than ±2 seconds (ideally <±1 second). After two days' operation, my computer clock was out by >1.5 seconds and getting worse. Having tried several synchronising servers without success, I couldn't synchronise time over the otherwise excellent Wi-Fi. The reason is not known, in fact I had the same problem in the same area in another property on a subsequent visit. I worked around the problem by setting up my mobile phone as a Wi-Fi hotspot and synchronised over local 4G phone network once a day. This work-around worked well.

Laptop

I took a medium-size laptop computer with me. It has a lithium battery in it, so I took it as carry-on luggage on the plane. I used mains to power it, with the mains lead again terminated in a European plug and a cloverleaf connector at the other end to suit the laptop's power supply unit. I also took a very lightweight continental 2-way mains adaptor in case there was a shortage of mains sockets near the operating position.

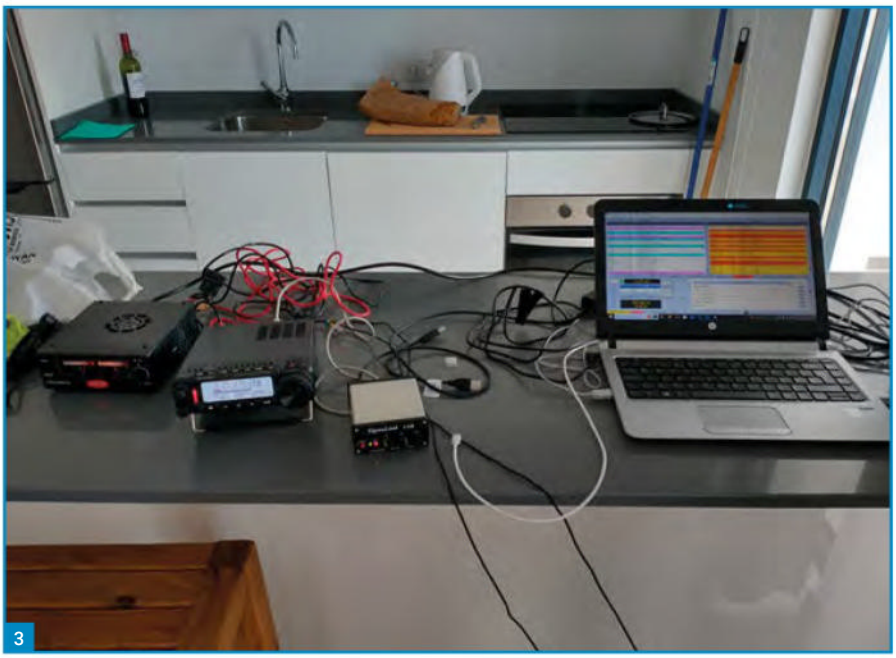
Tools

I try to avoid taking tools with me. I can't really justify the weight. The only tool I took was a small Swiss Army knife, which incorporates a normal and cross-point screwdriver and scissors. It has helped me stay operational in various ways over the years without adding significant weight or taking up too much space in my case.

Before departure

Before leaving, I created an entry on QRZ.COM, requested and installed an additional certificate for Logbook of The World (LoTW) and set up the location on my home computer.


2


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I then backed-up my LoTW certificates etc. onto a USB drive. I then restored these to my laptop. I added EA8/G6MXL to my Club Log account. I also made pdf copies of my licence, the CEPT T/R 61-01 document and stored these along with pdf copies of all equipment manuals on my laptop.

Nothing missed?

I mentally think through the various parts of the station, making sure I have packed everything I need. These include the power sources to the transceiver and computer, the audio to/from transceiver (including data and leads), the antenna to transceiver (including RF adapters). In addition, I took suitably terminated 5m and 10m feeder extension leads, just in case the antenna ended up being further from the operating position than I hoped.

Before my first operation away from home,

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By Continent

Africa:

#	CALL	Score
1	CT3MD	313
2	ZS2DL	282
3	ZS1A	246
4	ZS4JAN	240
5	EA8TR	235
6	ZS2PS	221
7	EL2BG	193
8	5H8HZ	192
9	ZSLIS	160
10	EA8/G6MXL	149

5

Fig. 4: Locations of stations worked on 15m.
Fig. 5: Provisional (pre-adjudication) results of the CQDX Marathon Contest 2024 showing the author's 10th place.

Item	Approx. Weight
FT-891 + DC Lead	1.9kg
PSU	1.5kg
Antenna pole etc.	1.3kg
Antenna guys	0.36kg
3 x antennas (including feeder) @ 0.5kg each	1.5kg
Data interface & leads	0.19kg
Headphone/boom microphone/footswitch	0.5kg
Paper logs, pens	0.1kg
Misc leads, adapters, tools etc.	0.3kg
TOTAL	**7.65kg**

Table 1: The main equipment taken with approximate weight (in most cases from manufacturers' specifications).

Frequency	Loss dB per 10m
1 MHz	0.25
10 MHz	0.82
50 MHz	1.92
100 MHz	2.81

Table 2: Feeder loss of RG174 at various frequencies.

Band	20m	17m	15m	12m	10m	Total
FT4	0	0	223	0	49	272
FT8	3	136	596	123	80	938
Total	**3**	**136**	**819**	**123**	**129**	**1210**

Table 3: Contacts made by band and mode during the week.

I laid out all the equipment and even did a dummy run in the garden. It's very tempting to take extras ('just in case') but just adds weight.

Typical day

I operated on the kitchen table (**Fig. 3**). On a typical day, I operated for an hour before breakfast, and then ate breakfast and uploaded the log from the previous day to QRZ.COM, Club Log and LoTW. I prefer to upload logs in the morning rather than risk a finger slip if I'm tired at the end of the day. I'd then operate until mid-morning before heading to the local shops for food / drink. I then operated until lunchtime, before having a break for a light lunch.

After lunch I operated until early afternoon before taking another break for a walk and swim. Then I operated until early evening before going out to dinner. After dinner I operated until bedtime. I did not operate overnight, although I did a couple of early mornings operating sessions. Using data modes meant that I could operate silently.

Results

I didn't have any target number of QSOs in mind before setting out. I made just over 1200 QSOs working 113 DXCC entities, with sufficient subsequently confirmed to obtain DXCC for my operation. The split of contacts by band and mode is shown in **Table 3**. **Fig. 4** shows where stations I worked on 15m were located. I had hoped to make some SSB contacts as well, but I found that I had incorrectly configured the FT-891, so I wasn't getting out on SSB, and didn't want to spend time investigating and resolving, and potentially putting at risk a working data-modes station.

CQDX Marathon

At the airport on the way back, I had some time to kill before my flight. On the spur of the moment, I decided that I would submit my log to the 2024 CQWW Marathon. For those unfamiliar with this, it is a year-long 'contest' to work as many countries and CQ zones as you can.

Each country & CQ zone counts only once. All bands (including 60m & WARC) from 160m to 6m are permitted as are all 'traditional' modes (CW, phone, data). No satellite or digital voice modes are permitted.

www.dxmarathon.com

Scoring is very simple, it is a count of the CQWW entities (DXCC entities plus a few extra) worked plus a count of the CQ zones worked, regardless of band or mode. You can just submit a log of all your contacts for the year, and the adjudicating process will remove duplicate entities and CQ zones, thus making submission very easy!

When the raw (pre-adjudication) results were published, I was staggered to find that my entry from one week's operating came tenth in the African continent (**Fig. 5**). Unfortunately, the published results only show the top five entries for Africa, so I don't know whether I maintained my place following adjudication.

Conclusion

Hopefully I've encouraged a few readers to try a holiday-style DXpedition. 2026 would be a good time to plan one, while the HF bands remain reasonably active. **PW**

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Keith Rawlings G4MIU
keith.g4miu@gmail.com



1

Further Two Port Measurements Using the NanoVNA

Keith Rawlings G4MIU continues with last month's advice on uses for your VNA.

Last month I described a couple of ways to measure the effectiveness of Common Mode Chokes which could be used on the coaxial line between the antenna and operating position.

Two methods were shown, one using a jig (or fixture) which connected the VNA to the outer braid of the coax cable on the choke and the other method where the VNA leads were clipped to the choke's RF connectors on the 'ground' side, where in the example, the leads were clipped to the outers of the BNC sockets used on the choke.

In both instances the chokes were formed with coaxial cable wound over toroid cores and, as just mentioned, the VNA was connected to the outer of the coaxial cable as this is where common mode currents will flow.

The NanoVNA was set to read LogMag as this would measure the insertion loss of the choke in dB and I suggested the often-quoted 25dB of attenuation (or loss) being the minimum value considered to give adequate rejection of any common mode currents.

Of course, it is not always possible to wind coax line over a toroid core, or at least get the number of turns needed. A typical case could be a pre-made line with something like PL259 or Type-N connectors on each end which will restrict the number of turns it is possible to wind through the hole in the core.

It is not only coaxial feeder where we might find this problem. If we take the case of Audio/Hi-Fi systems, most of these will have cables with preformed plugs and sockets and if it is necessary to fit ferrite over them due to breakthrough issues, then we can have a similar problem, the connectors restricting the number of turns we can get through a toroid ring. To get around this we can use clip-on ferrite cores and these can be placed directly over and leads as necessary.

Three small cores may be seen in **Fig. 1** with the largest here being a snug fit over RG213 cable.

It is common to see mains PSU's with a small core placed over the output lead. Sitting next to me here on my desk are the 'wall wart' supplies for both my FT-817 and THF7E. They are both of a similar vintage but one, the Kenwood, has a core fitted over the DC lead while the Yaesu does not.

Clearly the Kenwood engineers deemed this core necessary and that just the one, placed over the wire, was good enough to reduce any RFI on the lead to an acceptable level. Interestingly the core is free to slide along the cable so I imagine it is more to stop noise getting into the THF7E than from radiating off the cable itself.

The next section describes how to evaluate the effectiveness of an audio lead with clip-on ferrite cores.

A practical example!

Some years ago my son was suffering with my transmissions on the upper HF bands finding their way into his home recording studio in his bedroom! This started after he added something to his setup. I can't remember what this was now but it plugged into the mixer console. The lead was about 750mm long with phono plugs fitted to each end and it ran along the table from the new device to the back of the mixer. Disconnecting the lead from the device made little difference but unplugging it from the mixer caused the breakthrough to stop.

The lead itself was a single 3mm dia lead (as opposed to a stereo twin lead) which was a screened audio line. To try and fix the issue I placed a single clip-on core over the lead. The core came from a random box of cores that I had acquired somewhere down the line and was of an unknown type so may not have been entirely suitable for the job. Well, it made no difference, and neither did adding two more cores to the line.

Reverting to plan 'B' I took one of the larger 10mm cores and wound four turns of the wire over the core and clipped it together. This had the desired effect as the breakthrough was reduced dramatically. I then added another core in exactly the same way and the problem was cured.

My son and his equipment have long moved out but I still have that lead, and while I was writing last month's column, I decided to dig it out and test it on my VNA-3G (another version of the NanoVNA) to see just exactly what it looked like at HF.

The setup can be seen in **Fig. 2**. Here you can see that I used the 'pig tails with croc clips' lead connected to the VNA and these are clipped on to the outer ground ring of the connector. The inner pin has been covered with insulation tape in case the clip fouls on the pin.

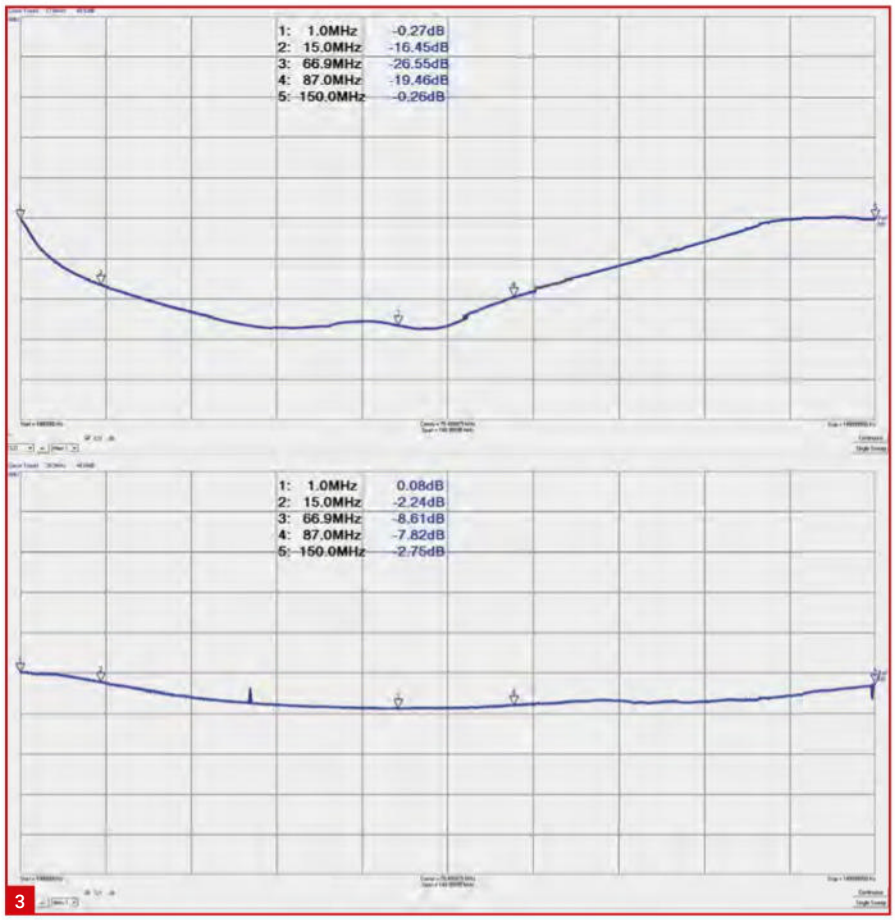
As described last month the Calibration was performed at the clips. **Fig. 3** (top) is the response of the filtered lead with two cores fitted over it. As can be seen it has no effect at 1MHz, has 15dB of attenuation at 15MHz, 26.55 at 66.9MHz and 0.26dB at 150MHz. The attenuation is considerably less than the 25dB benchmark but in this case was enough to

Fig. 1: Clip-on Ferrite cores.

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Fig. 2: **Audio lead measurement setup.**
Fig. 3: **Response of the audio lead. two cores (top), single core (bottom).**

cure the problem. Fig. 3 (bottom) is the same lead with one of the cores removed. The drop in attenuation is noticeable except at 150MHz where it has increased to 2.75dB. However, I am not sure how accurate these measurements are above HF and into the VHF region using this method.

According to Fig. 2 the maximum attenuation was 27.45dB at 35MHz. It was also noted that these figures altered somewhat when the filter was moved so the proximity of the lead may have an effect on its ability to attenuate common mode current, something to bear in mind.

As I said, these cores were of an unknown variety and they may not have been ideal for use in that particular application. By using a similar method we can use the VNA to assess the suitability of individual cores before we use them.

Clip-on core evaluation

The setup for assessing single cores will be very similar to what we have just used, but, in this case a short and reasonably stiff wire, preferably insulated, is gripped between the clips and the core placed over it. The VNA then reads the attenuation found along the wire. The calibration process however is slightly different.

I recalibrated the VNA, keeping the 1-150MHz sweep, maximum number of sweep points and trace still set to LogMag (dB). The Port 0 lead was shorted back to the SMA plug to perform the Short calibration, the leads left open and well apart for the Open, for the Load the clip was connected across a dummy load, all pretty much as described previously.

The Through calibration was a little different; previously I had connected both clips together to perform this part of the calibration. In this case the levels we will be looking at may be a few fractions of a dB so it is important that we don't have anything else influencing the readings, such as the wire itself.

So, in this case the Through is performed with the wire we have added in place between the two clips, so we calibrate out the effects of the wire even though these effects will be likely be quite small. See **Fig. 4** which shows the wire used (16swg copper wire) and a core in place.

With the VNA sweeping the core is placed over the wire and the attenuation read from the VNA. Although the sweep width I used was to 150MHz you can just sweep the frequency range that may be of interest. Markers may be set on the trace to read the attenuation at set points over the sweep and also the trace position itself may be used to indicate any attenuation. The trace on the screen needs to be set to a suitable position and the trace scale would also need to be set to a suitable level. Setting the trace to 1db will give a better resolution and you will be able discern what effect the core is having over the sweep range.

We now have the question of what is a suitable level of attenuation for a core to be deemed 'suitable'. Well, I'm not sure!

The easiest way is to compare an unknown with another core that is known to be suitable for the application. The type of mix of the core will affect how it well it works at a particular frequency. For HF a 31 mix is popular as is a 43 mix, albeit the latter are better suited to higher

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Fig. 4: Setup for measuring attenuation of a single core. Fig. 5: Response of the single core. Fig. 6: Setup of the DC choke evaluation. Fig. 7: Response of the DC choke.

frequencies (the size of core will come into the equation as well).

So, if you have a box of cores of unknown types, as I do, it would probably be worth buying a couple of cores of 31 and 43 mix to compare them to.

As a comparison I evaluated one of the unknown 3mm cores that I initially used (unsuccessfully) on the audio lead and you can see from **Fig. 5** that it gave 2dB of attenuation at 14MHz. The scale is 5dB per division.

Alternatively, cores can be sorted to find those that give a better attenuation level.

While not antenna related a further use of a VNA is with common mode chokes used on DC power supplies, notably switched mode types (SMPS). There are good SMPS and there are bad SMPS and some can be very bad!

Writing these notes on chokes has coincided with me having a clear out of my garage and in amongst the junk are some ex-PMR SMPS made by Nokia.

These are quite useful 7A 12V (variable from about 7-15V) units. However, they have a European 2-pin non-earthed mains lead and create a lot of noise over the HF bands. This would not have been a problem in service as they were intended to be used on the Nokia RC/D58 VHF/UHF PMR sets.

Before they went to the dump I thought I would have a go at reducing the noise coming from one of them and if successful, they might survive a little longer!

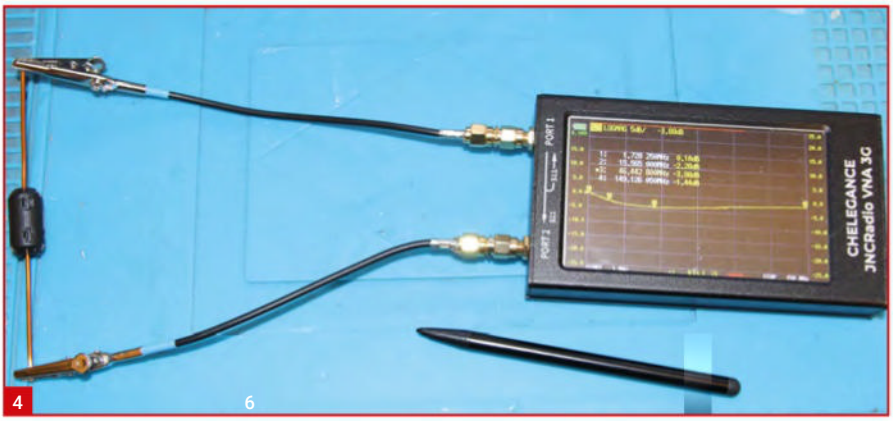
Modifying the AC lead with 3-core cable and earthling the PSU while improving safety, did little to reduce the QRM as a lot seemed to be radiating off the DC lead.

The PSU has a right-angle DIN type of plug used for the DC connection so it is not possible to get many windings through a toroid. Also, due to the size of the lead not many turns could be put through any of the clip-on cores I have available. I have some FT140-43 toroid cores and I wondered if I used some twin speaker lead I have to wind a choke which could be squeezed inside the case.

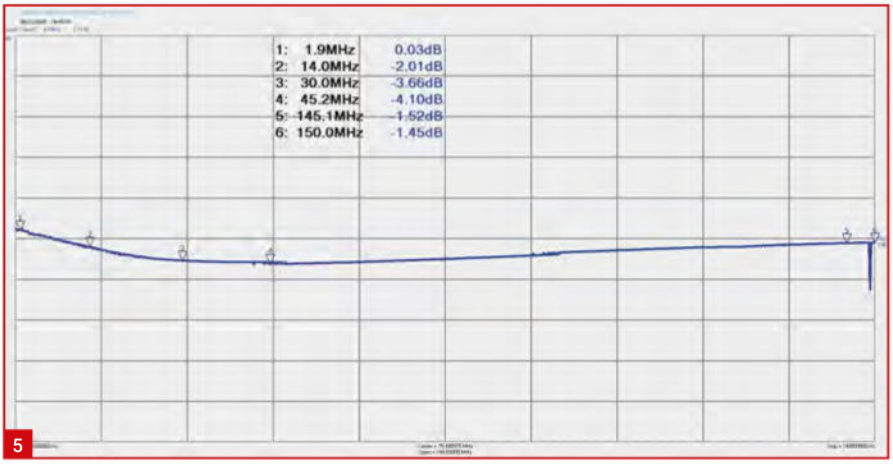
To see what sort of attenuation I could expect I wound 13 turns over the core and measured it with the setup as in **Fig. 6**. The result can be seen in **Fig. 7**.

At 1.9MHz the attenuation through a single wire was over 25dB and at 30MHz 31dB with the other measuring very similar. As I write I have not had time to see if this will help tame these noisy supplies but the figures returned from the choke look promising.

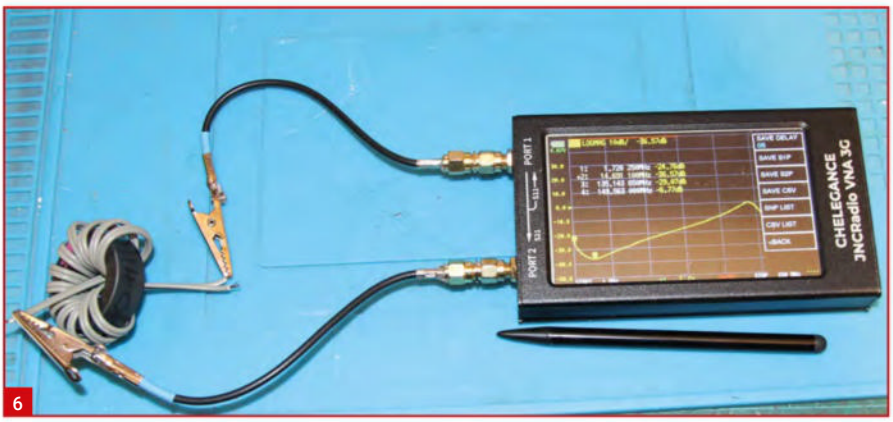
That's it, see you next time. **PW**



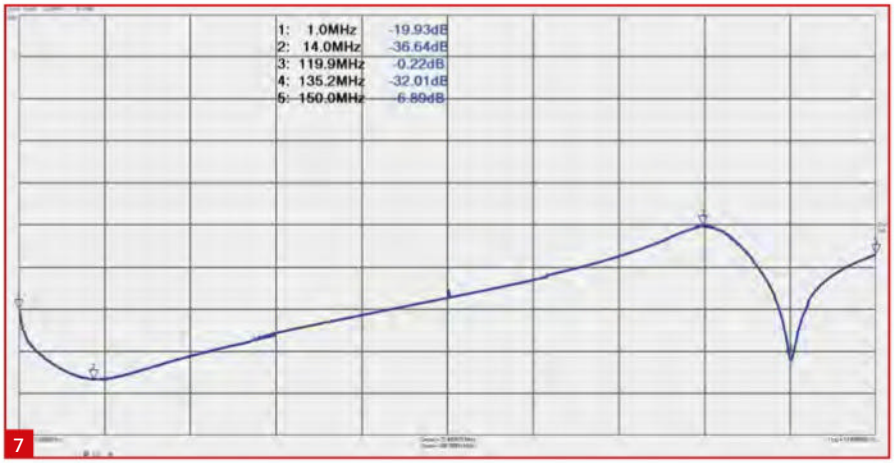
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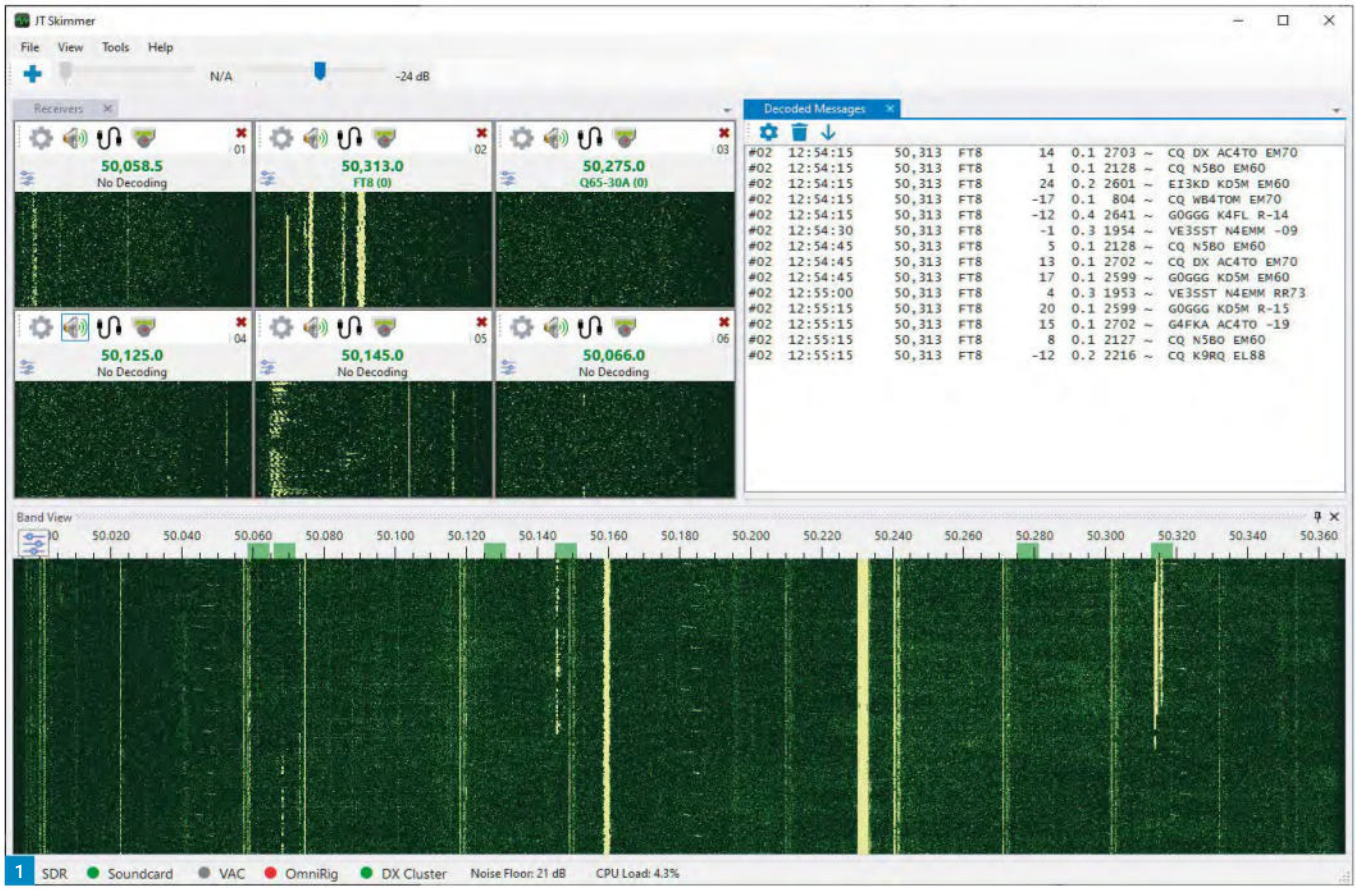


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Tim Kirby GW4VXE
gw4vxe@icloud.com

Extending 145 Alive

Tim GW4VXE starts with the latest 145 Alive news before covering other topics and band reports.

Mark Savage M0XIC wrote, saying, *"The next scheduled 145 Alive Event is entitled **145 Alive (+more 144)** and will take place on Saturday 7 February 2026 from 12 noon to 3pm local.*

"We have added 144 SSB at the request of a number of operators within the group and we will review its success or otherwise after the event. With over two months to go I am pleased to say that we already have 22 FM stations and 16 SSB stations agreed. We have organised the SSB stations in a different way, wherein we have just placed one SSB station in a Maidenhead Square, whereas we allow at least two or three FM Stations per Maidenhead Square. The SSB stations will all be operating vertically polarised to not burden those stations with the additional costs of purchasing a Yagi etc and again we will review this aspect after the event.

*"We are always looking for more stations FM and SSB, so anyone interested should contact me using **145aliveuk@gmail.com**. You may also be interested that a spin-off 145 Alive Norway have run their first very successful event and are looking to run the next, also on 7 February 2026. Additionally, I have been contacted by a radio operator in the US who is also interested in doing something similar in the near future".*

The 145 Alive concept has been very successful and generated a lot of interest. On the Facebook group there has been a constant 'drip, drip' of people asking about SSB, so it will be interesting to see what the take up is and how the results work out.

Thanks to Mark and to **John Alexander M0XJA** for the work that they continue to do, not forgetting **Tim Hughes G5TM** who had the original idea. Thanks too to everyone who takes part in the events. It's great to see interest in 2m operation being promoted.

Noise!

Dave Edwards G7RAU (Lizard, Cornwall) writes, *"I built a heavy-duty version of the GM3SEK mains filter (Schaffner 30amp double filter, one large ferrite for the lower bands and two oval ferrites for the higher bands and 30amp mains cable). Then, I removed the earth from the mains feed and created my own earth. I put this between the shack and the house mains (in the garden so I hope my sealing is very good, time will tell!).*

"I did it to remove a mains-borne noise on the lower HF bands from someone's inverter local to me but I got a nice surprise on 6m/4m where nearly all the sprogs have disappeared and on 2m some of the sprogs/noise around the lower part of band have disappeared. On 24/28MHz the background S2 of noise has totally gone as well! The parts were quite expensive and it was fiddly doing the windings and I am still covered in OB1 sealant but, wow, is this worth the effort! I should have done this ages ago. Next is to build the 16amp version to put between the security cameras feed and the shack and then I think I have done all I can do reduce mains noise.

"I still get noise on sunrise and sunset from a local solar installation if I beam at it on 6/4/2. It is bearable but noisy near sunrise/set and on cloudy days due to switching, I notice it on full moon nights as well".

JT Skimmer

Jef VanRaepenbusch ON8NT drew my attention to the JT Skimmer software written

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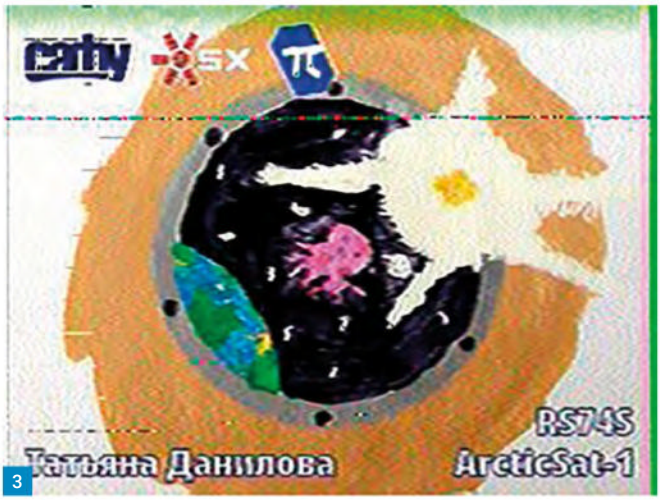


Fig. 1: A screenshot of the JT Skimmer software written by Alex VE3NEA. Figs 2 to 4: SSTV images received by Endaf N6UTC from the ArcticSat and Vizard-Meteo satellites. Fig. 2: 4 Dec 25, VizardMeteo. Fig. 3: 3 Dec 25, ArcticSat-1. Fig. 4: 4 Dec 25, ArcticSat-1.

by **Alex VE3NEA**, **Fig. 1**. VE3NEA describes the software as follows, *"JT Skimmer is a freeware, open source 64-bit Windows application for Radio Amateurs. Its main purpose is to monitor the band for digital signals and decode multiple WSJT-X modes, on multiple frequencies, 24 hours a day - and help the operator catch band openings and activity from the rare entities. This is especially useful on 6m because of its unpredictable propagation, but the program may be used on any band."*

The software is interesting because it monitors a number of different frequencies and modes. You can read more about it and download it at:

https://ve3nea.github.io/JTSkimmer

I use a similar approach on 10m using the SparkSDR software (URL below) and an SDRPlay receiver. That allows me to monitor and decode FT8, FT4 and WSPR and I could, if I wanted to, set up virtual receivers for CW and SSB (although I haven't done this as I don't think the computer it's running on would cope!).

www.sparksdr.com

FT8: How long do you call CQ for?

Well personally, on VHF generally, I call CQ for around three periods, or long enough to try and get picked up on PSK Reporter and see where I'm being heard. If that shows something unusual or 'interesting' I might call a little longer. Calling CQ endlessly, unless you are in a rare location, is probably unlikely to get you very far and is more likely to lose you friends! Of course, propagation can vary from minute to minute, so there's nothing to stop you putting out another three or four calls every so often – but a continuous CQ is more akin to a beacon, which probably isn't helpful on one of the FT8 frequencies which can be busy enough as it is.

The 8m band

Roger Lapthorn G3XBM (Cambridge) says that although he no longer has a TX permit or dipole, he still monitors FT8 occasionally and has spotted CT, EA and G on 8m using his end-fed wire. Roger says he has withdrawal symptoms!

It was good to see that another experienced VHF operator, **David Harris G0CER** now has a permit for the band. David is running 20W from an FT-897. David's currently using a 20m dipole in the loft and an ATU but is planning a dipole outside on the mast. David mentions that he's already been heard in the Dominican Republic and the USA as well as by the Verulam Club G8VER in St Albans.

The 6m band

Roger G3XBM says that most times when he comes on to the band, on FT8, using 5W to his V-2000 vertical he still gets spotted around Europe and wonders about the propagation mechanism? Es? Could be, or depending on whether the decodes are 'one period wonders' maybe it could be meteor scatter. Interesting. Roger's highlight was being spotted in South Africa when running 5W to his vertical.

Phil Oakley G0BVD (Great Torrington) has had a fairly quiet month on the band, working only GI6ATZ (IO74) and GM3PPE (IO85) – both tricky distances from Devon on 6m.

Dave G7RAU says that he has still found some reasonable openings and on 4 December it was open to PY/LU/CE from 1900UTC and was still going when he went QRT just before midnight.

It was nice to hear from fellow *PW* columnist **Colin Redwood G6MXL** who reported working EA7TN and F5ODA on FT8 during the Aurora on 12 November. Colin wondered about the propagation mode and whether it could be Auroral Es? My experience of Auroral Es, which I have to say is limited, is that AuE paths tend to be more northerly. But it would be surprising to me if it was 'regular' Es as generally that type of Es doesn't usually form if the K is above 3, which it was at that time (6). I don't know! I saw the same propagation as Colin and wondered about it too. Any ideas will be very welcome. Every day is a school day!

Here at **GW4VXE** (Goodwick, Pembrokeshire), I found the odd Es opening. I worked CN3A (IM52) for a new square on the evening of 23 November and saw the station again the following evening at the same time. On 24 November, I worked IK8BIZ (JN70), S57TW (JN75) and EA4LO (IN80). Signals were good from South America the following day and I worked PY2XB (GG66) and PY4AQA (GG88).

The 2m band

Roger G3XBM says he sees plenty of activity on FT8 in the monthly activity period but feels that perhaps there is less activity during the SSB UK Activity contest.

Andy Adams GW0KZG (Letterston, Pembrokeshire) is one of those who has been enjoying working **Yuri UT1FG/MM** from various squares. Readers who were with us last month may remember that Yuri had travelled from Montreal to Waterford. He then went onto Amsterdam, then to Helsinki from where he has headed back through the English Channel, the Western Approaches and is now heading for Panama. Andy made meteor scatter QSOs using the FSK441 mode with Yuri from the following locator squares: IN68, IN55, IN41 and IM27.

Several others, including **Reg Woolley G8VHI** (Nuneaton) and **Tony Collett G4NBS** (Cambridge), were able to work a number of new squares as Yuri sailed through the North Sea.

Here at GW4VXE I was pleased to work UT1FG/MM from IO60 – not far away from me, but I've not heard it before.

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Jef ON8NT (Aalter) reports working G8EEM (IO93) and G0JCC (IO82) on FT8 on 5 November

The 70cm band

As well as being active on 2m, Yuri UT1FG/MM has been active on 70cm, on FT8, JT65C and sometimes on Q65C. As Yuri sailed through the North Sea and the English Channel he was on from squares such as JO35, JO25, JO24, JO12, IN68 and IN67. Reg G8VHI has been working Yuri and getting some new squares, starting off with JO25 worked on JT65C, then JO24 and IN68. Reg also managed some squares as Yuri continued his journey across the Bay of Biscay. Reg is up to 197 squares worked on 70cm now, which is quite an achievement!

The 23cm band

Dave G7RAU writes, *"I was on for the Nov 23cm UKAC, I managed 12 with my best DX at 505km being G7LRQ in JO03. I wasn't on for long and quite surprised how many I worked from down here on a miserable WX evening! I was also on for the 23cm up microwave contest on Sunday 9 November for a very short while and worked nine stations, F6DKW being my best DX at 555km; this contest was well supported in UK with plenty to work".*

FM and DAB

Simon Evans (Twyning, Gloucestershire) writes, *"FM & DAB DX have been absent here too. The really keen folks have been recording the whole of Band 2 and finding some MS stations.*

"Here, I have taken a look at the UHF Satcom part of the spectrum where there are still open transponders that people use. I did this with my RTL SDR, SDR# and my 2m/70cm vertical [Comet GP3] although the signals are circular. I found Spanish and Portuguese conversations going on NFM. Here's a couple of frequencies where I found activity: 253.750MHz and 253.825MHz.

"Here's a site with more info about UHF-Satcom":

https://uhf-satcom.com/satellite-reception/uhf

A lot of what Simon mentions here is pirate activity, some originating from Brazil and some from Portugal.

Satellites

Patrick Stoddard WD9EWK (Phoenix) sends his usual interesting summary of satellite activity from North America. He writes, *"In November, an ISS SSTV activity started, then quickly ended due to issues with the Kenwood radio in the Russian service module. The SSTV activity shifted over to two Russian amateur satellites – Vizard Meteo (RS38S)* [**Fig. 2**], *and ArcticSat-1 (RS74S)* [**Figs 3** and **4**]. *These satellites have 70cm downlinks, adding a larger Doppler effect to the SSTV images. ARISS reports there are plans to put the radio in the Russian service module back into operation, while another Kenwood radio in the European Columbus module continues operating as a cross-band FM voice repeater.*

"The Japanese launched five satellites from the ISS in September, four with amateur payloads (DRAGONFLY, GHS-01, RSP-03, and STARS-Me2). Not much from these satellites so far. Another Japanese amateur satellite, BOTAN, has been operating as a packet digipeater on 145.825MHz, operating on a schedule for approximately eight hours a day when active. The German SONATE-2 satellite, which had been serving as a 145.825MHz packet digipeater for a few months, is now sending SSTV images.

"AMSAT-EA recently reported that SO-124 (HADES-R) is nearing the end of its life. Orbital predictions show its re-entry in a few weeks. SO-124 has been a popular FM satellites, along with its 'brother' SO-125 (HADES-ICM). Both of these AMSAT-EA satellites also operate as D-STAR repeaters, like a few other FM satellites in recent years (AO-27, INSPIRESat-7, the original TEVEL satellites, and UVSQ-SAT).

"The University of Arizona's CatSat satellite recently had its microwave transponder activated. With a 5GHz uplink and a 10GHz downlink, it has only recently been made available for amateur use. For those with gear on those bands, I hope the transponder can be opened up more often.

"ARISS recently posted a video, showing how scheduled contacts are done using the Kenwood radio in the Columbus module. NASA astronaut ***Nichole Ayers KJ5GWI****, who was on the ISS earlier in 2025, explains the process. The video is available at:*

https://youtu.be/egnzgGG3wwE

"Nichole participated in a few scheduled contacts during her ISS tour, and was one of the astronauts (along with another NASA astronaut, ***Jonny Kim****) who operated as NA1SS during ARRL Field Day in late June 2025.*

"As winter approaches, satellite operators continue operating. Some are still going out to other places. On Black Friday (29 November 2025, the day after the Thanksgiving holiday in the USA), ***Endaf N6UTC/MW1BQO*** *and I made quick road trips to other locations. N6UTC operated from grid DM24 east of Los Angeles, and I went to grid DM42 near Tucson in southern Arizona. Among other contacts we made, we worked each other from our respective locations. A video with some of our activity, using the SO-125 (HADES-ICM) satellite, is available at":*

https://youtu.be/qu6apAubRXc

Jef ON8NT monitored the ARISS contact on 19 November with astronaut **Zena Cardman KJ5CMN,** answering questions from students in Mexico (Escuela Jose Marti, Mexico City), via the ARISS telebridge ground station IK1SLD at 1534UTC on145.800MHz.

Jef has also been active on the RS-44 satellite, using FT4, and reports working the following stations: F5RRS (JN36), F6HRO (IN88), N1NAZ (FN42), KB1HY (FN31), SM1/UA1CBX, PD1B (JO32), K0LB (FM18), OZ3AEV (JO55), EA3DME (JN01), DL3NGN (JN59), DL3SDE (JN48) and W2GDJ (FN32).

Final

That's it for this month – thanks to everyone for their contributions which I always enjoy reading and often find inspiring. I hope you, the reader, enjoy them too. See you next time. **PW**

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Ian Cortina EI3LH
qsl@ei3lh.eu


1

Let's Make 270 CW Great Again

Ian Cortina EI3LH makes a plea for using CW on the VHF bands.

"We are just entering what may be called, 'the field of vibrations', a field in which we may find more wonders than the mind can conceive of". You might have come across this quote from **Guglielmo Marconi** before, and what an enthralling and inspiring collection of words it is too.

How dismayed Marconi would be then if in 2025 he tried to call in on a local repeater, only to be greeted by the sound of crickets and the occasional passing tumbleweed. Worse, I'd wager **Samuel Morse** would be cataclysmically distraught, all the time *weeping* while 'pounding brass' on 144.050. I don't think **Dr. Samuel Johnson** has any words left in his dictionary to describe the reaction Morse might give if he tried calling CQ on 70cm CW.

What has gone wrong? Given the decades of popularity that amateur radio has enjoyed (plus its recent revival), cheaper radios from the Far East, the plethora of lightweight portable HF 'go bags' and so on, it is easy to see why voice and HF DX are the preferred modus operandi for the radio enthusiast. Yet interest in CW, specifically on VHF and UHF, seems to have never really taken off en masse.

Why is that?

Several countries grant access to VHF and UHF at the entry point of their respective examination tiers. With access readily available, and a market flooded with relatively inexpensive VHF/UHF FM radios, the cost barrier to entry should not pose a catastrophic threat.

The result? Silence.

Don't get me wrong, there is activity out there! The **FISTS CW Club** organises several events each year as well as VHF/UHF and microwave activities you can find on their Groups.io reflector. The **RSGB** has the (UK only) **VHF CW Championship** in November, plus several VHF/UHF events scattered throughout the year. The **ARRL** has VHF Contests held in January and June (50MHz and up). I'm sure there is more that I've missed, but my point is it just doesn't seem to be well publicised. For a newcomer, you really must dig into the research to find the answers, by which time an event may have come and gone.

What if contests are not your cup of tea? What if you just want to buy a radio to get on the air and give CW on 2m and 70cm a try? Therein lies yet another hurdle. In 2025, you have two (possibly three) options. Either go vintage, or buy an IC-705, FT-991A or FTX-1F – there is the IC-7100 (discontinued?) and IC-706 (discontinued) too. That's essentially it.

If you go vintage, you run the risk of sketchy reliability and the head-melting prospect of sourcing parts. Not to mention trying to find someone who has the skill and the time to dedicate to performing said repair(s). There are just 28 active cobblers left here in Ireland. I'd wager there is likely less than that who are actively performing vintage transceiver repairs in EI.

Choose to go modern and the choice is extremely limited, both in the range of transceivers and more importantly, their price. For many just wanting to dip their toe *specifically* in to the mysterious waters of VHF and UHF CW it may be simply too cost prohibitive, or too much of a gamble. Particularly when it is reasonable to assume the bands are deftly silent. Who wants to take that chance?

Step forward option three. The super budget-friendly **Quansheng UV-K5** and **UV-K6** handheld radios. Beloved by many as the portable, hackable, chuck-it-in-your-bag-able handheld that costs a pittance yet punches well above the weight of competitors many times its RRP.

It is thanks to the community efforts of Quansheng users that the dream of easily accessible, cost-effective CW on 2m and 70cm has become a reality. Notably thanks to two custom firmwares, **IJV Mod** and **CEC**. Both firmware flavours have their respective caveats, but *both* afford the 270 CW-curious HAM the chance to get on to 2 and 70 and *pound brass* quickly, (relatively) easily and *cheaply*.

With a quick flash of the firmware and an

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2



3

Photo 1: Eamonn EI7LC is using a homebrew solid state key by Tony EI5EM and Paraic's EI2LH ICOM IC-705 on 2m and 70cm (IRTS Hamfest 2025). Photo 2: Ian EI3LH is using a Quansheng UV-K5 running IJV Mod 2.65 and a 'no name' straight key from Amazon UK (IRTS Hamfest 2025). Photo 3: The 'Make 270 CW Great Again' campaign posters, made by EI3LH using AI prompts, are based upon the WW2 war effort imagery and the UK public information campaigns of the 1970's and 1980's. The idea being to inspire enthusiasts to get into CW for 2 metres and 70cm.

(optional) removal of a resistor you can simply plug in a straight key, dial in your calling frequency of choice and you're off and running!

The result? Silence.

We've finally made it on the air and yet we find ourselves back at square one again. Nothing but your very own dits, dahs and the sound of crickets for company. This is where I feel we need to turn it around. This is where we need to pick up the mantle and get on the air. You only need to look at recent news to see that commercial interests are creeping in to the 70cm band and satellite interests are shrinking the 23cm band. What happens next? As the saying goes, 'use it or lose it', so outside of events like 145 Alive, 433 Alive and contests, let's make a more concerted effort to switch on our VHF and UHF radios. Call in to a repeater for more than just a signal report – perhaps a tourist is looking to make contacts, or a newcomer is finding their way? There may be people simply looking for some contact and some company to brighten their day too. Amateur radio is all about connecting, discovering and sharing after all.

It isn't all glum reading though! Have a look around social media, particularly YouTube, and you will discover a plethora of content promoting CW on 2m and 70cm (or 270 as I like to call it). Thanks primarily to the advances made with custom firmware for Quansheng handsets. It has opened the 270 CW floodgates and amateurs and content creators alike appear to be taking full advantage. Well, in the USA at least.

You'll likely find very little 270 CW content coming from the UK and EU, or the rest of the world for that matter. What little there is is mostly archive footage several years old. The new wave appears to be driven by a younger audience, with some fantastic light-hearted output from **Forrest Stephenson KI7QCF** – just have a look at Forrest's 'BKG' (Brass Knuckle Gang) 2m CW movement for starters! See: **https://www.youtube.com/shorts/9WAIJbqGIMQ** and the folks at **SOTA+** (**Mark KD7DTS**, **Ara N6ARA**, **Di KO6BTM** and Ormoo the Cat!) with their variety of exceptionally well-made and very interesting videos and podcasts.

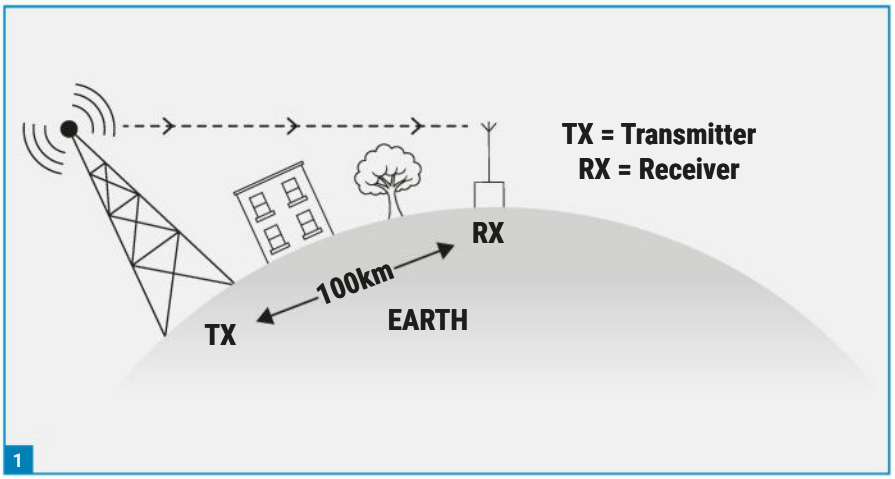
Feeling boundlessly encouraged, I've decided to pick up the slack here in EI. I'm trying hard to ignite interest in CW for 270 with a wider audience. I made my first four QSO's on 2m and 70cm with **Paraic EI2LH** and **Eamonn EI7LC** at the recent IRTS Hamfest in Mullingar and I'm hungry for more! I've put together a little campaign of my own via a blog (URL below) I've just started under the tongue-in-cheek motto of 'making 270 CW great again'.

www.ei3lh.eu

Are you up for the challenge? If the amateur radio community embraces it, perhaps yes, we can make 270 CW great again. **PW**

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David Howard M0BGR
practicalwireless@warnersgroup.co.uk



1

Starting Hobby Radio for Free (Pt II)

David M0BGR continues his introduction to hobby radio.

In the first article we looked at using online SDR receivers as a starting point for Hobby Radio. In that article, we saw how Medium Wave stations from around the world can be received with just a computer with an Internet connection using the Kiwi SDR platform [**1**]. In this article we will stay with Kiwi but start to explore analogue signals on shortwave (also called 'High Frequency', HF). The aim of these articles is to give you tasters of what hobby radio can offer so I will not go into great detail so leaving you room to explore the many different aspects of the hobby. Eventually, you may want to buy equipment of your own so use free SDR receivers to find out which areas of the hobby you enjoy. For my part, there are some aspects I love, but others leave me cold, but I am always ready to try new things and learn as I go.

Before I move on to the main part of this article, I must mark your homework on the medium wave experiment I described last time. To recap, I asked to see what happens to medium wave transmissions during the day and at night using a remote SDR receiver ('Day' and 'Night' refer to times at the receiver). You may have noticed the range of medium-wave signals during the day is quite short – perhaps 100km, **Fig. 1**, but when it is nighttime at your chosen receive much more distant stations could be heard. This is because charged particles from the sun strike the gases high up in the atmosphere causing them to ionise (become electrically charged).

There are several distinct layers of ionised gases but the 'E' and 'F' layers are important for us. As it is electrically charged, the F layer refracts some radio waves thus allowing them to return to earth and so travel much further, **Fig. 2**. The F layer builds up in daylight but fades slowly after dark. Unfortunately, the E layer absorbs some radio waves. It is very strong during daylight hours and stops our medium wave signals reaching the F layer, **Fig. 3**. The E layer disperses rapidly as dusk approaches but the F layer persists for longer enabling distant medium-wave signals to be heard after dark.

Shortwave

What is 'Shortwave'? It is the piece of the radio spectrum, above the medium wave, covering about 3,000kHz to 30,000kHz. As we discovered in the previous article, Medium Wave transmissions have quite a short range, typically 100km or less, particularly in daytime hours. On the other hand, shortwave transmissions can travel much further when propagation conditions allow. This is because they are refracted by the F layer in the atmosphere but normally less susceptible to absorption by the E layer, Fig. 2. The strength of the F layer depends on the sun's activity, which varies day by day or even hour by hour so HF signals are very variable. The sun's activity goes in an 11-year cycle from peaks of activity, through troughs and back to peaks again. At the moment the sun's activity is near its peak so conditions for shortwave listening can be very good; it will be a different story in five years' time! One day, when I was researching this article, I tried a local SDRs on HF but hardly heard anything. There was a Geomagnetic Storm which wiped out almost all shortwave radio signals [**2**]. (These storms also cause the Northern Lights.)

So, let's jump in and see what we can do with the shortwave radio signals. Once again we will use the Kiwi platform – others are available so I will describe them in later articles. I suggest starting with AM broadcasts as these are the easiest. Allocation of frequencies is determined by international agreement and broadcast station use specific frequency bands – **Table 1**. Unfortunately, some of the stalwarts of English language broadcasts – Voice of America, the BBC World Service and Radio Moscow have drastically cut their shortwave transmissions, but there are still plenty to listen to.

Let's open our Kiwi SDR map and chose a receiver close to your home. Generally, higher frequencies work best in daytime and lower frequencies at night. This is a gross simplification but should get you started – remember it is the time of day at your chosen receiver that is important.

It is long after dark when I write this and I have chosen a receiver close to home. The 19 and 25 metre bands are dead, some activity on the 31m and 41m bands but 49m is lively with lots of stations to choose from. This is because the F layer has weakened but is still strong enough to refract lower shortwave frequencies. So, listen to a few stations (ideally, bright red on the Kiwi waterfall) and see what you can hear. But what are you hearing, especially if the station is broadcasting in a foreign language?

Most stations will identify themselves on the hour and half hour, but you will need sharp ears if this is not in English. Fortunately, there are databases that will help you identify the stations you hear [**3**]. On this website you can input the frequency of the station you are hearing (from the top left of the Kiwi control panel) and it will give you a list of the stations that use that frequency and their schedules. The frequency needs to be accurate so zoom in to get the yellow tuning trapezium right in the middle of your station. Usually, stations are spaced 5kHz apart, so 6020 is a valid frequency; 6019 probably isn't. Some Kiwi sites have stations identified with flags above the waterfall – these are not always complete or accurate so do listen for the station to identify itself or check the database.

The website [3] also gives you the broadcast schedule and transmitter site. You will notice that some transmitters are not in the home country of the broadcaster – for example Radio China International has transmitters in Europe. Before we move on from the shortwave broadcast bands, I would point out that there are other broadcast bands you can use. On the top of the Kiwi control panel you will see a drop-

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Fig. 1: Ground waves travel relatively short distances because of the curvature of the earth.
Fig. 2: 'F' Layer refracts some radio waves so they can be heard further away.
Fig. 3: Unfortunately, the 'E' Layer absorbs medium wave signals during daylight.

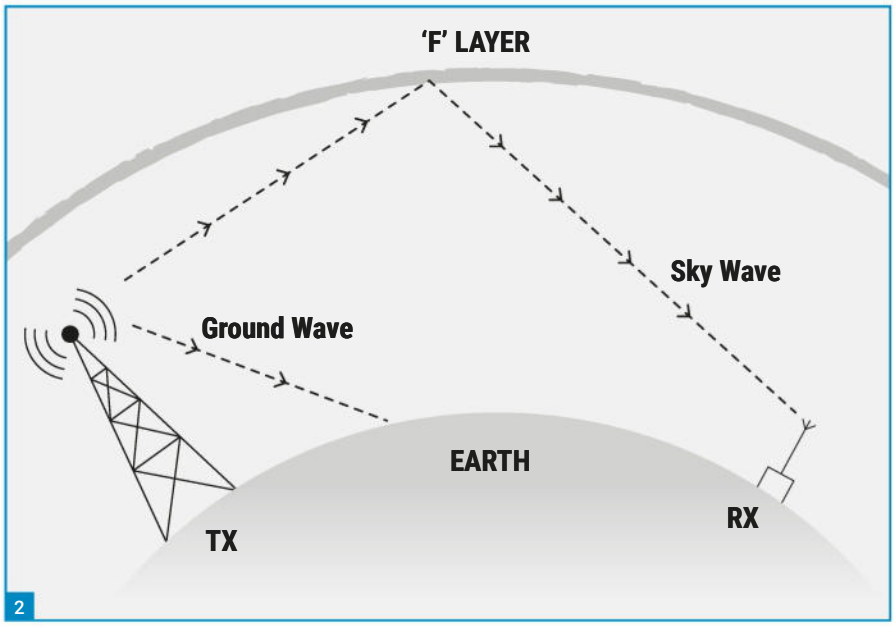
down menu marked 'select band', **Fig. 4**. You can try other bands, but for now, stay with the 'Broadcast' bands - we will soon move on. Try other SDR receivers, for example if you want to try the higher bands and it is night where you are move to one that is in daylight. If you hear warbles, chirps and cheeps, these may be data signals and I will show how some of these can be decoded in a future article.

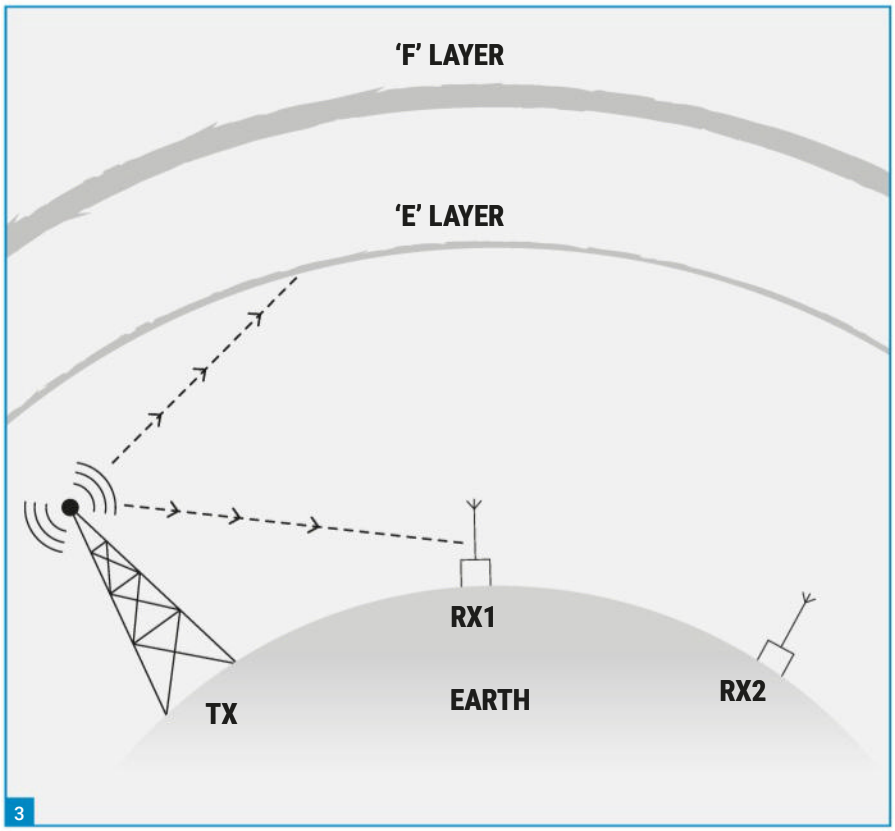
Next, we will move on to the Amateur Radio (Ham) shortwave bands. These vary slightly in different regions but the most important shortwave bands used by amateurs in Europe (Region1) are shown in **Table 2**, with apologies if I have omitted your favourite band! A detailed description of these bands can be found on your own national amateur radio society website (eg. RSGB in UK [**4**]). The structure of most of these bands is similar. The lower end is usually 'CW'. This is Morse code, which we still use today on the amateur bands. I have an App on my mobile phone that decodes Morse code rather well in real time – useful if you don't want to learn Morse code just yet. Above this is 'Data' which I will describe in another article. Above that is 'SSB' – Single Sideband voice.

Single Sideband (SSB) is a more efficient way of transmitting voice signals than AM that we used for our Medium Wave experiment, but it comes at a cost. It is much trickier to get an intelligible signal on your receiver and this will take practice, but be patient. Open a Kiwi SDR receiver near you and go to the 'Select Band' drop down in the control panel. Scroll down past 'Broadcast' and 'Utility' then select 40m under 'Amateur' and look for stations on the waterfall between 7.1 and 7.2MHz. – you may only hear one side of the conversation so the periods of speech may be brief. If the voice sounds like Donald Duck you are tuned too high – use the middle minus, below the 'Select Band' drop-down to move down carefully. If the speech sounds as though the speaker has his head in a bucket of water, you are too low so move up with the middle plus.

If you want to use an amateur band above 10MHz (eg. 20m band), speech uses Upper Sideband (USB) so the tuning is opposite to the above. If the voice sounds like Donald Duck, you are tuned too low so use the middle plus button to move up until it intelligible.

But what are they talking about? Firstly, let's identify the stations. Amateur radio stations use callsigns to identify themselves. The format is Prefix followed but the Suffix. The

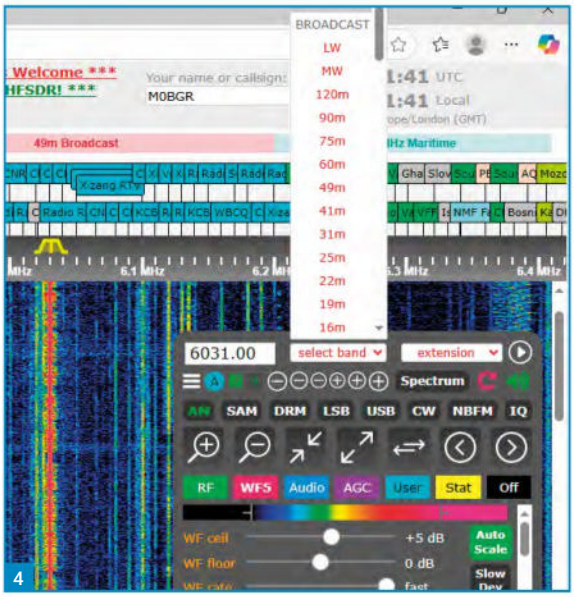




Prefix, which is assigned by the International Telecommunications Union, is used to identify the country of the station and is usually one or two letters followed by a number. For example, my callsign is M0BGR. The M0 identifies me as an English station. Some prefixes are fairly obvious eg. F* is France, I* is Italy. Some are far from obvious, eg. LA* is Norway! Fortunately, there is a list of prefixes to help you [**5**]. The suffix can be one, two or three letters (occasionally more) and give a unique identifier for each station.

Once we have identified the nationality of the stations we can listen to their conversation. Usually, they will exchange signal reports. This is two numbers, the first being the 'readability' on a scale of 1 to 5. The second is the signal strength on a scale of 1 to 9. (You will notice you have your own signal strength meter at the bottom of the Kiwi control panel, **Fig. 5**.) So '59' is a great signal – fully readable and strong. '31' is difficult to read and weak. The station may add

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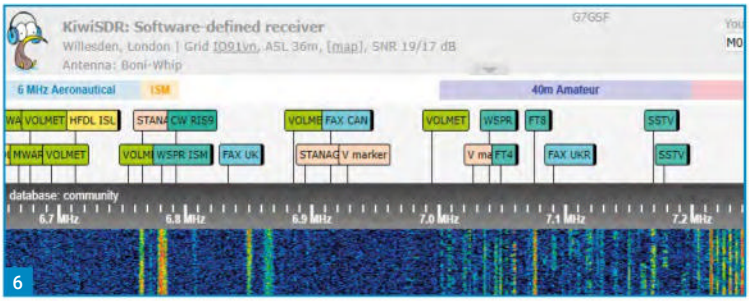


Fig. 4: Drop down menu for selecting bands.
Fig. 5: Kiwi SDR signal strength meter.
Fig. 6: Kiwi's flags and banners can help identify stations.

to the report. For example, '+20' is 20dB stronger than S9. QSB – the signal is subject to fading. QRM – the signal suffers from interference. A list of Q-Codes used by Amateurs is at [**6**]. These codes were originally intended to speed up transmissions in Morse code but are now widely used for voice as well.

Stations may give names, location (QTH), and exchange information about their equipment, antenna etc. and go on to a longer conversation about almost anything, particularly on the 80m and 40m bands. At weekends, you may hear contests in progress. The objective is to exchange set information as quickly as possible so exchanges can get a bit frantic!

If you hear a station saying *"CQ CQ CQ …"* followed by its callsign it is asking for any other station to reply. There may be suffixes added, for example *"CQ DX CQ DX …."* In which case they only want stations a long distance away to reply. Or *"CQ Asia, CQ Asia …."* They only want to speak to stations in Asia. If the call *"CQ Contest…"* they are only interested in other stations taking part in the contest.

Before we leave this area, let's take a look at the 'Aeronautical' bands. When planes are over, or near to land they will use VHF frequencies (which we will come to in later articles). For transoceanic parts of the flight they may use HF to talk to air traffic control. These days voice conversations on HF are few and far between as pilots also use data and satellites but you can catch them sometimes. You can almost always find 'Volmet' transmissions, which are the aeronautical equivalent of Shipping Forecasts. A complete list of these is at [**7**] but let's home in on Shannon, in Western Ireland.

Open the KiwiSDR map and in Western Ireland you will find nice clusters of receivers ('Ireland North West' and 'EI6IZ'). Open one of these and input a frequency of 3413kHz in the top left box of the Kiwi control panel. Also click USB and you should hear the weather reports. Now move up to 5505kHz then 8957kHz followed by 13264kHz. You should hear them OK but the last two may be weaker. This is because you are almost certainly receiving Ground Wave signals and higher frequencies are attenuated more than lower frequencies.

Title	Lower Frequency kHz	Upper Frequency kHz	Notes
60m Band	4750	5060	Usually good after dark
49m Band	5910	6200	
41m Band	7200	7450	
31m Band	9300	9900	
25m Band	11600	12100	Usually good in daytime
19m Band	15100	15800	Usually good in daytime

Table 1: Important Shortwave Broadcast Bands

Title	Lower Frequency kHz	Upper Frequency kHz	Notes
80m Band	3500	3800	Good after dark. (SSB Uses LSB)
40m Band	7000	7200	Work-Horse Band (SSB Uses LSB)
20m Band	14000	14350	Work-Horse Band (SSB Uses USB)
15m Band	21000	21450	Good in Daylight (SSB Uses USB)

Table 2: Some of the Amateur Radio Bands in Europe

Homework

For this month's homework try more distant receivers– how about SW England? Netherlands? Italy? Finland? USA East Coast? Try the different Shannon Volmet frequencies at different distances by night and day and see what you can learn about how shortwave signals travel so make a note of your findings. Bear in mind, the behaviour of HF signals can vary greatly depending on what is happening on the sun [2]. Volmet transmissions are a great resource for studying radio signals on shortwave bands travel as they are predictable and identify themselves regularly. Some Volmet stations share frequencies, in different timeslots [7], so listen to the identification to make sure you are listening to the station you think you are.

There are many other stations to be heard on the shortwave bands and, unfortunately, I cannot cover them all so you will have to explore for yourself. The flags and banners at the top of the Kiwi waterfall, **Fig. 6**, will help you find things that may be of interest. You should, of course, subscribe to *Practical Wireless* magazine, which will give you new ideas about what to listen to.

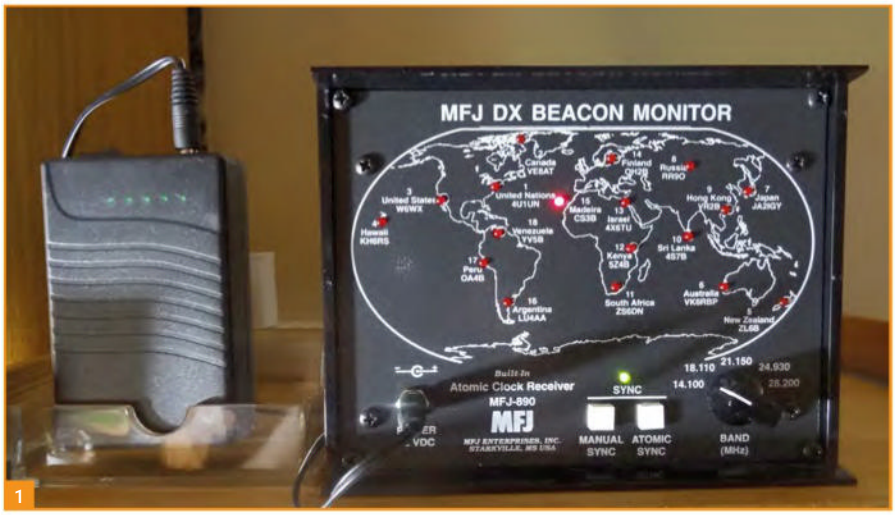
Next time, we will look at other types of SDR web receivers and start to decode some of those mysterious warbles and chirps that are digital signals. We will also look at other frequencies, such as VHF and higher. **PW**

References

[1] **kiwisdr.com/public**
[2] **https://tinyurl.com/mphzxw6j**
[3] **https://shortwave.live**
[4] **https://tinyurl.com/yckj32sw**
[5] **https://tinyurl.com/2a82aha7**
[6] **www.nadars.org.uk/qcodes.asp**
[7] **www.dxinfocentre.com/volmet.htm**

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Georg Wiessala
wiessala@hotmail.com



A Great New Tool from Poland

Georg Wiessala checks out a replacement for the once-popular MFJ-890 beacon monitor.

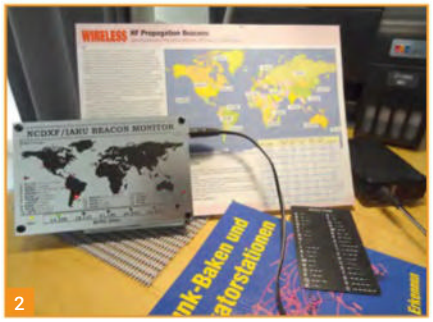
In many ways, I still like the 'old' ways of doing things. For example, listening to weather forecasts on a vintage radio still gives me joy (*PW* December 2025: 14). And, in terms of getting an idea about prevalent HF propagation conditions (*PW* January 2026: 52), I often use one of my best-loved shack accessories:

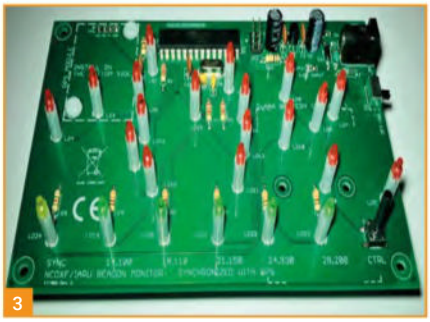
The MFJ-890 Beacon Monitor from the (now-defunct) MFJ Enterprises (**Fig. 1**) is remembered by many simply as the 'Beacon Clock'. It is linked to the *International Beacon Project (IBP)* coordinated by the *Northern California DX Foundation (NCDXF)* (**Table 1**). With the *MFJ-890*, users with their radios tuned to five particular frequencies (**14100, 18110, 21150, 24930**, and **28200kHz**) can evaluate HF band conditions every three minutes. Many placed the beacon monitor on top of, or near, their transceivers or receivers. The image in **Fig. 2** also shows the collectable data card from the September 2016 issue of *Practical Wireless,* illustrating the NCDXF system.

However, I have now newly acquired a sleek and updated version of the *MFJ-890*: Meet the *NCDXF/IARU Beacon Monitor KT-003* from makers *KRAIT Technologies* in Poland (Fig. 2). This new kind of monitor comes ready-built or as an easy-to-make kit (**Fig. 3**). It has an inverse colour scheme to the old MFJ-890, and sports black lettering on a silver metallised background plate. It is just a little smaller than the MFJ-890. The single pushbutton at the bottom-right allows the individual manual selection of the five NCDXF beacon frequencies (see above).

The KT-003 is 'updated', in a very important way: it does not derive time signals from some selected global VLF transmitters, such as **MSF** (Rugby-Anthorn) or **WWVH** (Hawai'i) anymore. Instead, it has a small built-in GPS receiver in the top-right corner of the PCB, with a time reference of its own. This GPS connection obviates the need to find a 'sweet spot' for the synchronisation of the unit in your house or shack. With the old MFJ-890, this could be a bit of a pain occasionally.

Conversely, though, because it does not rely on VLF Standard Frequency and Time Signal (SFTS) stations, the KT-003 does not have the function of flashing in synch with time signals from an atomic clock, like the *MFJ-890* did. However, this is not a big deal. You can mount an external battery case (3xAAA) by means of two pre-drilled holes at the rear of the device. This makes the unit really portable. Or use a 12V power supply from the dozens sleeping the sleep of the discarded in your drawers. I connected a Lithium-ion battery (*TalentCell YB1203000-USB*), and the *KT-003* ran all day. The battery case and a simple frame for the monitor come as optional extras.





The *KRAIT Technologies KT-003* made contact with a GPS satellite here in under a minute. It worked flawlessly with both my hardware HF receivers and SDRs. But remember that this is *not a receiver as such*, but a simple *aid to checking propagation conditions* on certain bands, against the NCDXF/ IARU beacon transmissions. If you can hear a specific beacon – especially at the lower transmission powers – it is a safe bet that amateur radio and broadcast DXing bands will also be wide open to that region. The clock also looks cool in the shack.

At zł (zloty) 495.61(around €/£100, including postage), the *KT-003* is not expensive, and the information that comes with it is comprehensive. It arrived from Poland after about a week.

All in all, the *KRAIT Technologies KT-003 Beacon Monitor,* Fig. 1, is a well-made, practical, shack accessory. It might also come in handy if you are on a DXpedition or teaching radio in schools, at rallies or for amateur radio clubs. **PW**

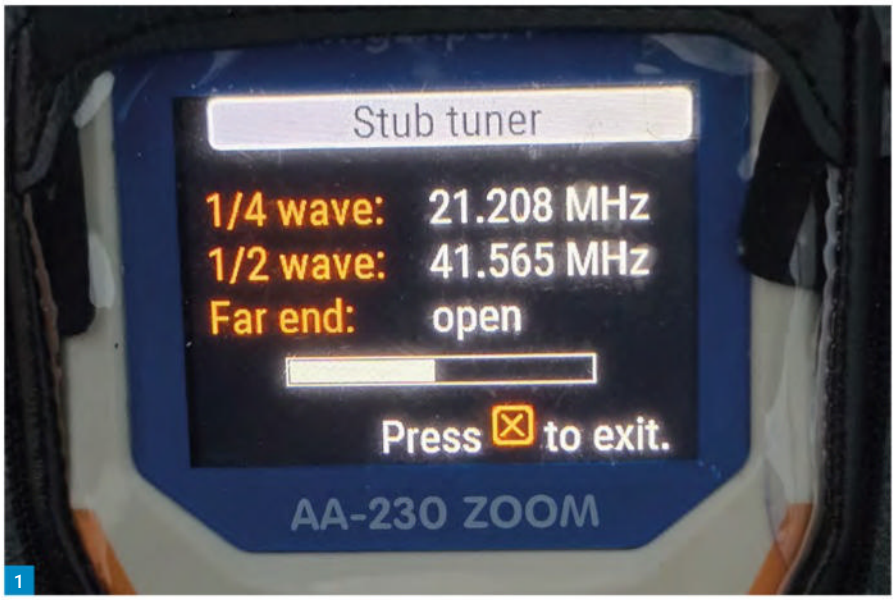
Fig. 1: The *MFJ Enterprises MFJ 890 Atomic Clock Receiver and Beacon Monitor (UK)* worked with VLF time signals like 60kHz (Georg Wiessala).
Fig. 2: The *KRAIT Technologies KT-003* acquires its time data from GPS satellites via the built-in GPS receiver (Georg Wiessala).
Fig. 3: The PCB of the *KT-003* with the individual LED beacon indicators mounted (Georg Wiessala).

- Frissell, N.A. (et al): 'Ionospheric Sounding [...]' *Space Weather* Vol. 12, No. 12; December 2014:
  https://tinyurl.com/45s7yvwu
- IARU (Beacons):
  www.iaru.org/on-the-air/beacons
- KRAIT Technologies KT-003:
  http://krait-technologies.com/kt-003.pdf
- Mannion, R. (2002) 'MFJ-890 HF Beacon Monitor (Review)' *Practical Wireless*, December 2002

Table 1: Resources

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Billy McFarland GM6DX
gm6dx@outlook.com



1

DXpedition Loop Antenna

Billy GM6DX returns with a design for a portable loop antenna.

Planning antennas for our next DXpedition was interesting as our trip to ZC4 was going to be limited by weight due to flights as well as the operating style. We are running barefoot and need every antenna advantage that we can get. I decided to build a set of loop antennas for station 2. They give more gain over a dipole and of course they are directional. This could be handy to help deal with local EMC issues or to help with multi-radio RF breakthrough. Unlike my usual self-build loops I had to construct a loop which is light as possible but also so that it was fail proof.

Parts needed

To build the loop I used:

- 1 x length of RG6U (75Ω)
- 1 x PL259 plug
- 1 x electrical connection block (2 connections)
- Some hot glue
- 1 x roll of wire (1-1.5mm car auto wire)
- 55mmx 45mm piece of 20mm thick HDPE
- 1 x flexible chopping board (3mm thick) cut up for guy rope attachments.
- 1 x 10m Spiderbeam mast (700mm approx. when collapsed)

The build

The first step was to fit the PL259 plug onto the length of the RG6U. Next, we need to cut the coax so that it is a workable length. A simple calculation of 300 / frequency = wavelength, so 300 / 21.2MHz = 14.15m, now divide this by 4 = 3.5m (gives us a quarter wave). This length is good enough to work with. Connect this to your antenna analyser such as the RigExpert and look for the stub tuner tool. Scan the length of coax and then keep trimming until the analyser shows the length of coax to be a quarter wave long at the desired frequency (21.2MHz) as seen in **Fig. 1**. If you don't have an analyser, then the theoretical length works out to be spot on. So, 300 / 21.2 = 14.15m, divide this by 4 = 3.5m (same as above). However, we now need to include the velocity factor of the coax, RG6U is 82% so 3.5m x 0.82 = 2.87m. If you are cutting the coax based on the theoretical figure, then it is important to fit the PL259 plug first before trimming to length. Now we have the length correct it is time to get it ready for our wire loop. Trim about 25mm back from the end of the coax and separate the centre and braid of coax as seen in **Fig. 2**. Apply some solder and then fit into the electrical connection blocks as seen in **Fig. 3**. I applied lots of hot glue in and around the connection joint to prevent wires being pulled while being set up and taken down at the operating site.

Take a piece of the HDPE and drill a 22mm hole through the centre of it. If you are using the 10m Spiderbeam pole, then for the 40/30/20m bands use an 18mm hole while for 17/15/12/10 use a 22mm hole. Once the main hole is drilled turn the block on its side and drill a 6mm hole through it. This is to allow the loop wire to pass through when on the mast. Have a look at **Fig. 4** which shows this to make sure you don't drill the hole in the wrong place.

Cut 2 x 75mm long x 30mm wide strips of the flexible chopping board and about 20mm in from each edge drill a 4mm hole. This allows the loop wire to pass through and to attach the loop guy cord to. **Fig. 5** shows these beside the top supporting block.

To work out the length of the actual wire loop, visit:

https://tinyurl.com/2p9nhxja

Which is an online calculator. Type in the frequency you need and it tells you the overall wire size. For the 15m band the total wire loop size is 14.45m. Now cut the car auto wire to this length and connect to one side of the connection block. Now we are ready to set up and tune the loop. Find your location and tape the connection block and coax to your mast, which for the 17/15/12/10m bands, on a10m mast, will be about head height. **Fig. 6** shows this. Now feed the wire through one guy pad, then through the top support block and then through the other guy pad. Finally terminate the wire into the remaining connection on the connection block. This is the loop electrically complete. Slide the top support block over the mast and erect the mast. Pull out the guys so the loop looks symmetrical (or as best as you can get it) as seen in **Fig. 7**. When erected at the actual operating site you can spend a bit more time making sure the wires are tight and everything is all taped down, but for tuning it just needs to be good enough to get it tuned.

Connect the end of the coax to the analyser and scan. If the SWR dip is too low in frequency, then trim small amounts (about 1 inch or so) at a time until you see the dip at the frequency you want. You only need to disconnect the connection block at one side, trim the wire loop and then reconnect. **Fig. 8** shows the SWR scan of my loop during tuning.

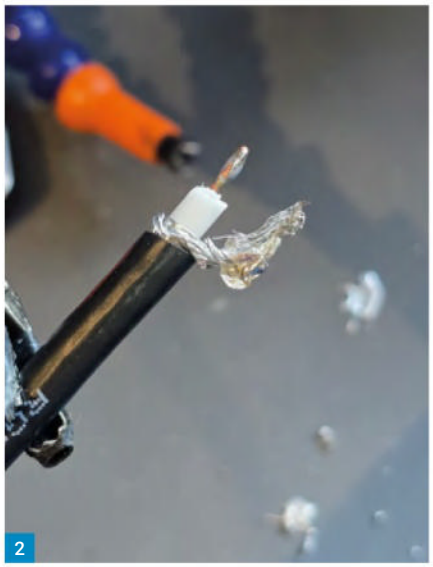
You can now hot glue the wire connections in place to prevent them from being pulled. If using 1mm car auto wire, then it is a good idea to only glue one of the wire connections in place and leave the other so that it can be disconnected, as the 1mm can easily get twisted and knotted.

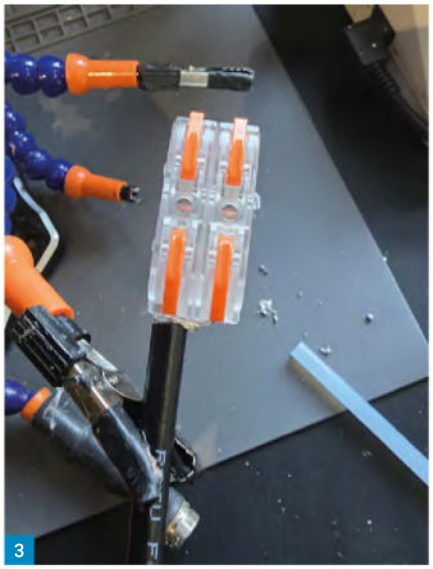
Fig. 9 shows all my loops for the trip complete, packaged up and weighed.

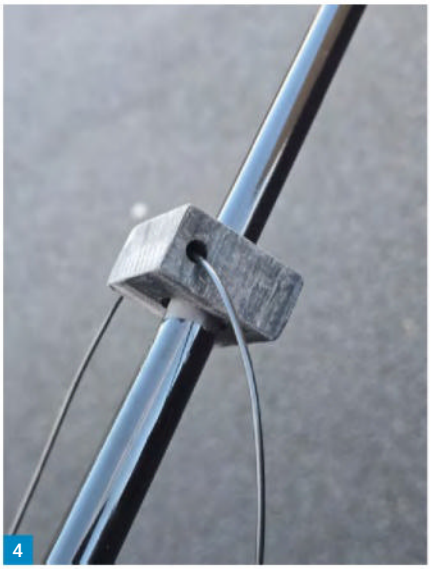
Fig. 10 shows the items needed to make and assemble one complete antenna.

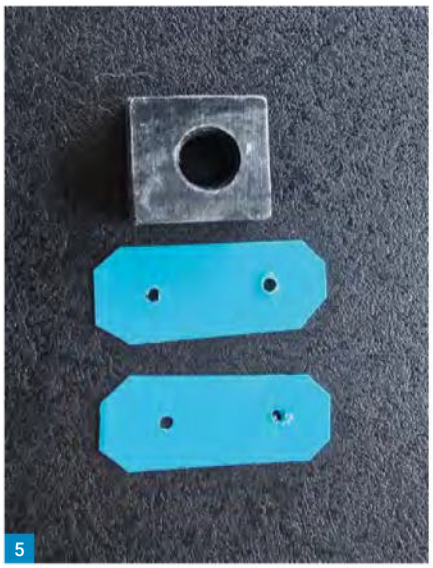
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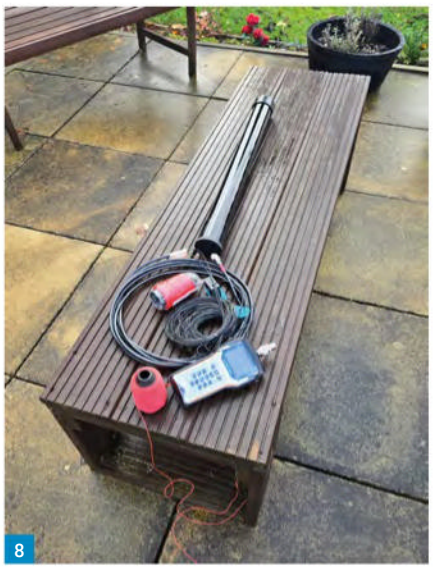

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4


5


6


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10

Fig. 1: Measuring a quarter wave using the antenna analyser. **Fig. 2:** Separate centre and braid of coax. **Fig. 3:** Fitted to the connection blocks. **Fig. 4:** Hole drilled through block to take the antenna wire. **Fig. 5:** Top supporting block and two strips for the loop guy cord. **Fig. 6:** Connection block taped at correct height. **Fig. 7:** The loop adjusted to be as symmetrical as possible. **Fig. 8:** The parts to assemble one complete antenna. **Fig. 9:** SWR scan of loop during tuning. **Fig. 10:** Loops packed up and ready to go.

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Above: Radio pioneer, Oliver Heaviside.



Above: Messier 87, a supermassive black hole.

JanuaryPW

Dear Don,

Well, that piece all about **Oliver Heaviside**, written by G7ETW, sort of whetted my appetite. And the funny thing is, I was contemplating a short piece about Heaviside myself a few months ago. So having got wind of **Tony's** efforts, I put it on the back-burner. Reading through his article, perhaps it was a good idea to put my scribbles on hold.

My interest in Heaviside was the fact that like a few other less well-known pioneers, I thought he deserved the oxygen of publicity (as Tony pointed out, why he remained *"bitter for most of his life"*). If only because of his Heaviside Layer with the help of his collaborator **Arthur E Kennelly**. And unlike some of today's armchair physicists, he used mathematics as a tool - rather than a crutch. For that, I applaud him. Oh, **Andrew Lloyd Webber** used the Heaviside Layer as a mythical destination for cats to be 'reborn'. I wonder what Oliver would have thought about that?

Heaviside slid into the theory of **Mr Newton's** gravity. More appropriately, the theory of falling bodies. But probably the less said about that the better.

Yes, he definitely was an 'ideas man' - a classical physics fan - results from real life hands-on experiments. His early work with electromagnetic radiation was, at the time, remarkable.

Don's (editor) mention of **Professor Brian Cox** and **Jeff Forshaw**, their book regarding Black Holes, sent a tiny shiver down my spine. Given Cox's beliefs about the so-called existence of imaginary black-holes, and the subsequent equations that apparently describe them, they are incomprehensible for a good reason, to hide the truth, that it's just a smoke and mirrors concept.

That *Delta Vee AutoLoop* (K4FMH), looks interesting. I love a loop. Can't get enough of them. Come springtime, I will knock one up. It's given me an idea for a permanent variation.

Enjoyed meeting the RSGB President. And yes, Guernsey is a beautiful place. Been there lots. With a rig. And my better half of course.

Ray Howes G4OWY/G6AUW
Weymouth, Dorset

*(**Editor's comment**: Thanks as ever Ray. I agree with much of what you write, but I do happen to think that Black Holes are real, though weird! But then, so is much of cosmology, quantum physics and the like. But without taking quantum effects into account, our transistors wouldn't work and neither would GPS. **Einsten** famously said* "God doesn't play dice" *but it seems that maybe he does!)*

Fake plugs & Compactrons

Dear Don,

The (f)useless mains plug (*PW* December 2025, page 56) looks frightening enough. **Chris M0HLS** kindly sent me one and it's labelled 10A. Within the limits of my measuring resolution, I estimate the cross-sectional area of the conductors in the flex to be sixfold too small for this rating. Then, is the 'Wall-plug PSU' (in the photo) really any better? I corresponded with the IET about the lack of fuse and received only an unsatisfactory response. It makes me wonder if the increased profit margin (from omitting any fuse) is actually a false economy. Here's my solution. I plug the PSU into the mains outlet



Chris Murphy M0HLS
practicalwireless@warnersgroup.co.uk

While browsing the internet I recently came across a two-metre handheld that also incorporated a general coverage receiver including airband. For around £30 it looked a bargain so I ordered one. When it arrived a couple of weeks later, I unpacked it and examined the contents of the package which included a battery charger. The first thing I noticed was that the charger wasn't fitted with a mains plug conforming to the UK standard BS1363, **Fig. 1**.

Part one of The Plugs and Sockets (Safety) Regulations 1994, which is an act of parliament and hence law, says that a Standard Plug for electrical equipment in the UK, and in particular domestic equipment, that operates at a voltage of 200V or more must be supplied with a plug that conforms to BS1363. It goes on to say that the plugs must be tested and approved by a notified body to ensure compliance to BS1363.

From various electrical forums it's becoming clear that there are quite a few electrical goods on the market, usually on the various online shopping sites, that are supplied with plugs that do not conform to BS1363. According to Trading Standards, around £30m of counterfeit electrical equipment enters the UK market every year. With a lot of amateur radio equipment, as well as accessories such as extension leads becoming available on the online shopping sites, I had the thought that it might be worth writing a short article for *Practical Wireless* pointing out the most common departures from BS1363 and the related dangers.

History of BS1363

Before we look at counterfeit plugs, let's have a look at the history and some of the main requirements of BS1363. The origins of the 13A plugs and sockets as we know them today, along with the ring main wiring, go back to the Second World War, with the official specification, BS1363 being issued in 1947.

It is also worth explaining some terminology. When describing mains electrical plugs and sockets, the terms Live and Neutral are often used to describe the connections in the plugs and sockets and the conductors connected to them. This is not strictly correct as the term 'Live' describes any conductor that carries current, and this includes the neutral conductor. The correct term for the conductor that takes current to the equipment from the supply is 'Line'.

The BS1363 requirements for plugs are quite detailed, but less so for sockets. In this short article, we will only look at a few of the requirements, and specifically those that enable the end user to determine whether or not the plug is likely to be a counterfeit.

Current Requirements

Firstly, markings. As stated above, the Plugs and Sockets act says that in order to demonstrate compliance to BS1363, they must be tested and approved by a notified body. In addition, they must have the approval marks and licence numbers of the approving body marked on them. The most common approving body is The British Standards, but there are others such as ASTA and Nemko. Their symbols are shown in **Fig. 2**. One mark that is NOT required on a standard plug however is the CE mark. Any plug bearing the CE mark should immediately set the alarm bells ringing as it will most likely be non-compliant to BS1363.

BS1363 is quite specific about the manufacture of the pins. All pins must be made from solid metal, usually brass, and the line and neutral pins must be sleeved in an insulating material for a length of 9.5mm from the base of the pin. The earth pin must never be sleeved. In order to open the shutters covering the line and neutral apertures in the socket, the earth pin must be longer than the line and neutral pins. BS1363 gives quite precise dimensions for the pins. Obviously without some form of accurate measuring equipment the dimensions of the pins are difficult to check, and there will be more obvious signs as to whether the plug is counterfeit or not. The dimensions are provided in **Table 1** just for completeness. The pins must be rectangular and of good surface finish and have a minimum distance of 9.5mm between the outer surface of the pin and the edge of the plug body.

Moulded plugs on equipment that doesn't need to be earthed may have an earth pin made of plastic. Rewirable plugs however must always have a metallic earth pin.

The plug must have provision for a fuse to be fitted. In the case of rewireable plugs the fuse will be fitted internally within the base of the plug. For moulded plugs it will be fitted by means of a fuse carrier usually accessed in the bottom of the plug between the line and neutral pins and the earth pin. For rewireable plugs, the screw that holds the top and bottom together must be retained in the bottom section of the plug when it is undone. Screws that can fall out tend to get lost leading to the temptation to hold the two halves of the plug together using Sellotape and suchlike.

There is often confusion about approval markings on equipment such as phone chargers where the plug forms a part of the

Fake Plugs

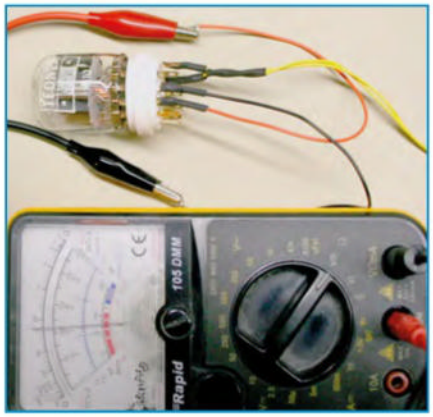
Chris Murphy M0HLS takes readers through the pitfalls of non-compliant plugs, sockets and fuses.

	Line & Neutral	Earth
Length	17.7mm	22.73mm
Width	4mm	7.93mm
Distance between centres	22.2mm	

Table 1: Correct pin dimensions.

Above: Chris Murphy M0HLS's article, showing the plug with no fuse or approval markings.





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through a fused multiplug, into which I have already inserted a (proper BS1362, adequate rupture current breaking capacity) 1A fuse. Why 1 amp? 'Cos they don't make 'em with any lower rating!'

On another subject, it's not always appreciated that thermionic valves can operate at low anode voltages, albeit handling only tiny signals. The photo is of the Compactron in my collection, one of its pair of diodes conducting as shown by the reading on the ohm-meter that also provides the mere 3V power. This thermionic diode shows readings on the meter that look the same as if it were a semiconductor rectifier.

My example valve is a 6B10 and seen mounted in its proper base. Other examples of this range of miniaturised thermionic devices were also referred to by **Geoff G8BMI** when repairing a CRT device (PW December 2025, page 43).

And finally, the ionosphere is ... 'not'... directly made by sunspots. It is there even on the night side of the Earth when there are no sunspots and intensifies when irradiated by solar UV and Xray flux. This solar activity increases at times of sunspots.

Godfrey Manning G4GLM
Edgware

*(**Editor's comment**: Thanks Godfrey, words of wisdom as always and thanks for the photo of the Compactron. I must admit to never having heard of this device! But, then, many of our newer readers won't even be familiar with valves!)*

Rallies & Events

All information published here reflects the situation up to and including **11th December 2025**. 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**

25 January 2026
LINCOLN SHORT WAVE CLUB WINTER RADIO RALLY: The Festival Hall, Caistor Road, Market Rasen, LN8 3HT. Doors open at 10.00. Admission £3.00. Tables £10.00. Indoor event ample free car parking. Hot refreshments including our famous bacon butties. Card payments accepted.
To book tables and further details, please contact:
Steve M5ZZZ, Mobile: 07777699069
Email: m5zzz@outlook.com

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.
Bill G7AKJ, Mobile: 07511522092
Email: Billwrench213@btinternet.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. For more information see our website:
Email: https://darc.online/rally

To get your event on this list, email the full details, as early as possible, to: practicalwireless@warnersgroup.co.uk

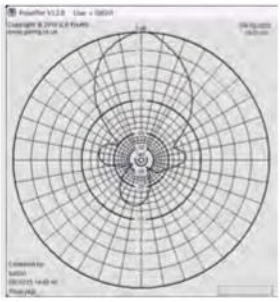
21st June
EAST SUFFOLK WIRELESS REVIVAL (IPSWICH RADIO RALLY): Kirton Recreation Ground, Back Road, Kirton IP10 0PW (just off the A14). Doors open at 9.30am and the entry fee for visitors is £3. The venue has free car parking. Trade tables are from £10. There will be trade stands, a car boot sale, a Bring & Buy, special interest groups, GB4SWR HF station and an RSGB bookstall. On site catering available.
Kevin G8MXV, Mobile: 07710 046 846
www.eswr.org.uk

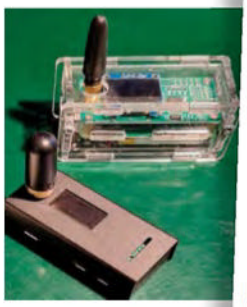
25 October 2026
GALASHIELS RADIO RALLY: The Volunteer Hall, St Johns Street, Galashiels, TD1 3JX. Doors open 11:15 ,disabled access 1100 ,admission £3. There will be traders ,bring and buy and refreshments.
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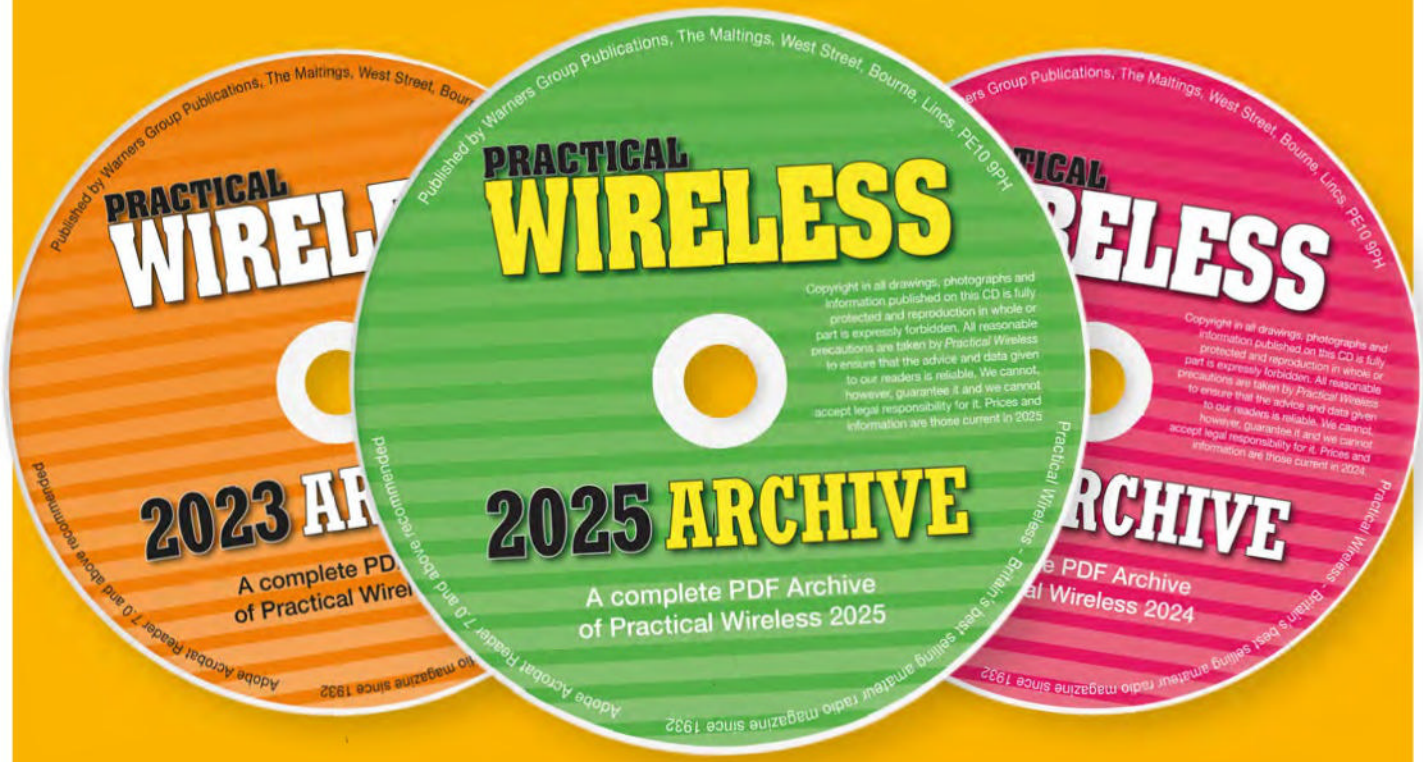


- **METEOR SCATTER:** Tim Kirby GW4VXE describes this unusual propagation mode.
- **THE RADIO VAGABOND:** Henryk Kotowski SM0JHF's tale of a Maidenhead squares activator, SP7VC.
- **MARCONI'S SHORT WAVE BEAM SYSTEM:** Michael Jones GW7BBY looks at this historical approach.
- **AN EXPATRIATE RADIO OPERATOR:** Francisco Garcia Carreras EA5VD describes operating as an amateur from Saudi Arabia.
- **MEASURING ANTENNA PATTERNS WITH A TINYSA:** Ross Wilkinson G6GVI uses an inexpensive measuring tool to check out antenna patterns.
- **A CLUB'S JOURNEY INTO THE ABYSS:** Tim Booth GM4YTD describes the efforts of a small club to build reliable inexpensive communications for members and visitors, and have some fun along the way.

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* Photo shows the FT-710 AESS

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