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Keylines

This issue completes my first ten years (!) as editor of *PW*, my first issue having been December 2013. The time seems to have flown by although, for the life of me, I'm at a loss to know how I've managed to fill 120 editorials! I do hope I haven't bored all of you, the readers, to death.

What has happened in the hobby in those ten years? The licensing system has been updated in various ways and, thanks to COVID, you can now qualify for a licence without the practical aspects, a development which many would regard as a step backwards, but there you are.

There have been many new radios coming available, particularly software defined radios (SDR), both those you control from your PC (such as the Flex range) but also those that look like a conventional transceiver of old but are built on SDR technology. This has kept prices down as far as I can see, building on the ready availability of PC hardware. We are also seeing an increasing number of radios from China, not just VHF/UHF handie-talkies but, increasingly, HF sets too.

It seems to me we have a much bigger selection of antennas available, too, largely I suspect because good antenna modelling software is increasingly within the price range of small vendors, not just confined to military contractors and the like.

On the operating side, there is no doubt that the biggest change has been the widespread adoption of the WSJT modes, which make weak-signal DXing accessible to a much wider range of operators, with modest stations and, in some cases, because the operators concerned are not well versed in English but can use WSJT to make QSOs anyway. WSJT has pretty much killed traditional RTTY other than for the occasional contest. Has it also reduced the use of SSB and CW? I suspect so, at least on some bands, particularly the 'edge' bands such as 160, 60 and 6m. But I suspect many operators will return to SSB and CW as the novelty of WSJT wears off and as HF propagation in particular starts to peak over the next few years.

Incidentally, when I took on the editorship, having taken early retirement from BT several years before, I said I would stay with the role for as long as it gave me pleasure – I had no intention of it becoming a chore. To my (very welcome) surprise, I still very much enjoy the job, even after so long. For many years previously I had undertaken various voluntary roles in the hobby, particularly by way of RSGB committees and Board, and never really received any recognition – just complaints when folk weren't happy with something! But *PW* is still appreciated

by the wider amateur radio community, even those who are not regular readers, simply for being there on the bookshelves when other magazines serving the hobby have come and gone.

Ofcom Consultation

The RSGB reports that by the deadline of 4 September, Ofcom had received 1400 responses to its survey from the amateur radio fraternity. It seems a shame that the response rate was so low, with over 100,000 amateur licences in existence in the UK nowadays – we can only assume that most amateurs are happy with the proposals being made, are not interested in commenting or, perhaps, are currently inactive in the hobby. Anyway, we await the next steps from Ofcom and will, of course, report them here in *PW*.

G3JRD SK

Rob Dancy G3JRD's daughter wrote recently to let us know that her Dad passed away, following a short illness, on Thursday 24 August. He was in hospital at the time and took the decision to refuse further intervention. Rob was always a great supporter of *PW* and had written for us on a number of occasions, with a recent piece in our September issue, for which he refused payment – he said that he simply wanted to make a contribution to the hobby. I still had one more article from him in the pipeline and am including it in this issue by way of a tribute to a lifetime of amateur radio activity and enthusiasm. I hope you enjoy it.

Don Field G3XTT
Editor, *Practical Wireless* Magazine

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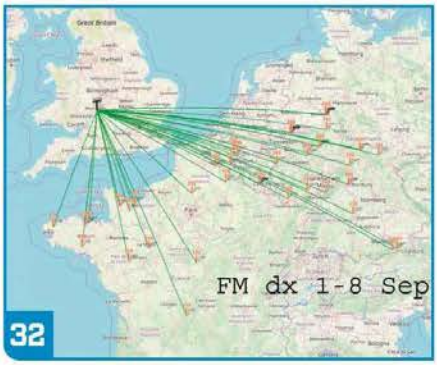

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Newsdesk

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

New in and in stock from Moonraker

The RFinder 100W Multi USB Charger Hub PD Quick Charge 3.0 Qi Wireless Charger with 8 USB Ports makes a great gift for everyone. Put one in your shack, in your office, kitchen or on your bedside table. Will charge all RFinder products, including tablets. The price is £49.95.

https://moonrakeronline.com

bhi cut the price of their noise cancelling headphones

bhi have dramatically reduced the price of their NCH noise cancelling headphones (ANC). They are now only £29.95 including VAT (were £39.95).

The bhi NCH active noise cancelling headphones (ANC) reduce the effect of external ambient background noise enabling you to have a more enjoyable listening experience. The over-ear style NCH headphones also give good passive audio isolation from external noise.

They are an excellent choice for those wanting to reduce aircraft cabin noise, air conditioning noise, train noise, ambient background noise and similar types of continuous environmental noise so that they can enjoy a much improved listening experience. They are especially good to use on a train or aeroplane whilst listening to audio or watching a video.

The adjustable headband and soft over-ear pads make sure that the headphones are a comfortable fit. The NCH headphones require one AAA alkaline battery (supplied) and the active noise cancellation can be easily switched on and off, and a green LED indicates whether it is active or not. They come supplied with a detachable plug-in 3.5mm stereo audio lead.

Contact bhi on 01444870333 or go to their website

https://tinyurl.com/5xwhwfj6

WRTC 2026 becomes an RSGB affiliated Special Interest Group

United Kingdom is delighted to have been awarded the hosting rights for the 10th WRTC taking place in July 2026.

Every four years, much like the Olympic Games, the World Radio Sport Team Championship, known as WRTC, relocates itself to a new host nation. WRTC is a radio contest event, designed to provide a platform for high-achieving amateur radio contesters to compete on a level playing field in the same geographic region using identical antennas, output power and other operating conditions.

Each team will have had to qualify over a significant period of time by participating and scoring extremely well in a collection of HF radio contests from October 2023 to March 2025. In July 2026, 50 qualifying teams comprising 100 operators, will come to the UK from all over the world and will represent their home countries, much like the style seen in the Olympic Games.

Each team of two will be assigned a Referee, for which there will be an application process. The team draw their operating site, their referee and callsign and then they all go off and operate the 24-hour IARU 2026 Contest. There will be live scoreboards available, which will add to the excitement of this competition.

WRTC is a means to demonstrate international goodwill and friendship in the true ham spirit. It also allows youth operators to demonstrate their skills within this highly competitive event. WRTC UK 2026 will focus not only on providing a fair and enjoyable event for those who qualify either as a competitor or referee, but will also provide engagement to spectators all over the world.

The Organising Committee are focused on enabling those not involved with amateur radio to see the excitement and fascination around our hobby so that we can build foundations for individuals, schools and clubs to move forward with establishing training platforms and taking their licence.

www.wrtc2026.org

NEWS EXTRA

SUMMER SOTA FEVER: I think it's fair to say that I along with many others in the world of amateur radio really enjoy leaving the confines of our home shack to get out and operate portable. It adds a new dimension to our hobby and often gives us the tangible benefit of a very low noise floor in comparison to the increasingly polluted home environment.

There are several schemes that encourage us to do just this, including POTA, HEMA etc. This article focuses on one of the more popular schemes, which is of course SOTA or Summits on the Air and the second annual GW SOTA party and Hog Roast held in Mid-Wales, which took place on Saturday 8 July. There are a number of SOTA events that take place around the UK, with this one organised and run by Ben Lloyd GW4BML.

The first Mid-Wales SOTA party took place in the summer of 2022 and was a huge success, attracting many activators and chasers both from Wales and much further afield. Could the 2023 event go even further? I have to give a spoiler alert at this point and say wholeheartedly YES! The 2023 GW SOTA party was amazing.

Ben had been busy organising this event for several months, making sure that it was well known in amateur radio circles, while also arranging the venue for the post activation party, chasing sponsors for raffle prizes, arranging catering and a whole host of other details. He was a busy lad!

The day itself was split into two parts. The morning was purely about SOTA activating and chasing, with many amateur radio enthusiasts travelling to local and distant summits in Wales and beyond, all hoping to make contact with others taking part in the event with a 'Summit to Summit' contact, and indeed, with the many chasers from around the World who call in during these activations.

Ben himself set out at 5am for North Wales to activate from GW/NW-009 Cader Idris, while many others, including myself, travelled to parts of Mid Wales to activate various summits there. It's fair to say the bands were very busy with the call of *"CQ SOTA"*. But wait! There was more.

The GW event also coincided with the Irish SOTA weekend. Spinning the VFO was a true pleasure, as whichever open band you settled on, there were both activators and chasers.

While some operators were active quite early in the day, many aimed to set up and start activating around 1100UTC. We also managed to get on air around this time, and given the rain had stopped, we had a great time filling our logbooks while actually staying dry.

I can't overstate just how many summits were active. Call after call came in from other SOTA summits and chasers. I concentrated on VHF with Mal GW6OVD, while another of our team worked mainly HF and it was non-stop fun. Thankfully the bands were in better shape than they have been of late and 40m, 20m and 2m worked well with great reports coming in from the UK, Europe and beyond.

Many other activators had the same experience, with numerous calls logged on CW and phone. Most of those taking part in the event continued operating until around 1330UTC, then made their way down from the hills for the drive to the SOTA party event being held near Ben's previous QTH not far from Welshpool, Powys. Our trio decided to pack up when the heavens finally opened and gave us the traditional GW SOTA party soaking. While our activation proved to be good fun with 100 or so contacts logged between us, the prize for top operator deservedly went to Ben himself with 114 contacts, 39 of which were summit-to-summit calls. Good going that man! Many others also filled a few pages in their logbooks.

The post activation get together was the second part of this amazing day, and once more it proved to be fantastic. Last year, Ben arranged a BBQ to close the event. This year, he arranged for JP Hog Roast to provide the catering along with dishes made by Ben's wife Martha and decadent chocolate brownies from Jillian MW0OVW. There were also Welsh cakes and other treats.

When we arrived, the field was full of cars and people were already enjoying the food while socialising with friends both old and new. A couple of marquees had been set up along with ample seating, tables and toilet facilities and there were many smiling faces. I think it's important to emphasise this part of the GW SOTA event, as often activators and chasers only get to socialise with other SOTA operators over the radio. Here, everyone had the chance to meet in person, enjoy an amazing social atmosphere and put a face to the callsign.

It's also great to see how many new operators are becoming interested in operating outdoors and taking part in SOTA. We had a relatively new ham in our group (Matthew MW0KAX) and he has truly been bitten by the SOTA bug. I know a number of others who have also become interested in our hobby because of the possibility of crossing an existing love of the outdoors with amateur radio.

As the afternoon progressed and everyone stuffed themselves on Hog roast and sweet goodies, Ben called everyone's attention to the raffle draw. He had managed to arrange some great prizes this year with a Yaesu FT-4X handy being the top prize. Other prizes included items from Icom, a 6m Tactical Mini from SOTABEAMS, 2/70 antenna from Spectrum Communications and a 7m mast from Radio World. In total there were 15 prizes and 15 winners. Congratulations all! Ben himself was also presented with a gift from the SOTA management team by Tom M1EYP for organising the event and promoting SOTA and Amateur Radio.

In total, the party raised £315 towards the running costs of the SOTA scheme, and drew 40 people from Wales and beyond. Of course, it's impossible to calculate how many amateur operators took part that didn't attend the party, but we know 26 activators took part from Wales alone. I hope everyone enjoyed chasing the many GW stations that were active.

Read more radio news and reviews at www.radioenthusiast.co.uk/news

Rallies & Events

All information published here reflects the situation up to and including **24th September 2023**. Readers are advised to always check with the organisers of any rally or event before setting out for a visit. The Radio Enthusiast website **www.radioenthusiast.co.uk** has the latest updates, please check it regularly. To get your event on this list, e-mail the full details, as early as possible, to: **practicalwireless@warnersgroup.co.uk**

13 to 15 October
RSGB 2023 CONVENTION: Kents Hill Park Conference Centre, Milton Keynes. Lectures, Buildathon, discussion forums, special interest groups, etc. Overnight accommodation. (BA CR CS FP L LB RF RSGB SIG)
https://rsgb.org/main/rsgb-2023-convention

15 October
HORNSEA ARC RALLY: Driffield Showground, YO25 9DW. Organiser: Les, 2E0LBJ.
Tel: 01377 252 393
e-mail: lbjpinkney1@hotmail.co.uk

15 October
DARTMOOR AUTUMN RADIO RALLY: Yelverton War Memorial Hall, Meavy Lane, Yelverton, Devon, PL20 6AL Doors open 10am, Admission £2.50, Free Parking (FP).
Contact Roger
07854 088882
e-mail: 2e0rph@gmail.com

22 October
GALASHIELS RADIO RALLY : Volunteer Hall, St Johns Street, Galashiels, TD1 3JX. Doors open at 11 am. (BB | CR | TS).
Contact: Jim Keddie, GDARS Secretary
mail@gm7lun.co.uk

4 November
CARMARTHEN SURPLUS EQUIPMENT SALE: Cwmduad Community Hall, which is on the A484 just north of Carmarthen, SA33 6XN Limited parking is available.
Visitors are recommended to park out on the main road and walk in to the hall. A limited bus service is also available (Route 460). Doors open at 8am for sellers to set up tables, the event opens at 10am for buyers, and the venue will remain open until 5pm.
A maximum of 3 tables of any combination may be purchased by any one seller at £10 per big table or £5 per small table. There will be a £2 entry fee per person and there will be light refreshments available as well.
There will be surplus equipment, test equipment, projects, and lots of components available to buy. (BB CR).
For info, contact Andy GW0JLX, Chairman & Communications Officer.
www.g0jlx.org.uk/gw0jlx/
T: +44 7768 282880 (EE)
Email: G0JLX@mail.com

18 November
ROCHDALE & DISTRICT AMATEUR RADIO WINTER RALLY: St Vincent de Paul's Hall, Norden, Rochdale, OL12 7QR. Doors open at 10am with entry still at only £3. Usual Traders and caterers. Plenty of free parking. Contact Dave G3RIK – details below Please note that all proceeds from this rally will be given to a local charity. Last time we were able to give £1000 to the Rochdale Springhill Hospice. (CR FP TS).
Dave Carden G3RIK, Secretary
email: dave@cardens.me.uk
Tel: 01706 633400 Mbl: 0781 367 1296

25 November
WILTSHIRE WINTER RADIO RALLY [SATURDAY]: Kington Langley Village Hall and Playing Field, Kington Langley, Wilts. SN15 5NJ. Open 9 am to 3 pm. Traders Welcome. Entry is £3, indoor tables £10. Depending on the weather, there may be a small car boot section. (CS D FP RSGB SIG TS WiFi)
Further information (see also: 30 July).
Chairman@Chippenhamradio.club
www.chippenhamradioclub.co.uk

9 December
MID-DEVON AMATEUR RADIO & COMPUTER FAIR: The first Mid-Devon Amateur Radio & Computer Fair will be held on December 9th at * Winkleigh Sports & Recreation Centre, Mid-Devon EX19 8HZ from 09:00 – 14:00. Entrance £3, no charge for partners & under 16s. Easy access from the A3124, ample parking, hot food and refreshments available. A chance to pick up hard-to-find electronic components, two-way radio and computer hardware. Traders £5 per 6 foot frontage + £5 if you require physical table(s), first-come-first-served, pre booking advance recommended. Mains electricity should be available to most traders FOC. Talk-in on S22 and the South West Cluster (DMR TG950 slot 2) repeaters. *What3Words ///focal.fountain.laminated
(CR FP TS) To pre-book please contact: Phil G6DLJ
07990 563147
email philbridges@hotmai.com

28 December
SPARKFORD WIRELESS GROUP TABLE TOP RALLY: (in aid of RAIBC). Davis Hall, Howell Hill, West Camel, nr Yeovil, Somerset BA22 7QX. 0930 till 1300, entry £3, free parking, refreshments. (CR FP). Bob G8UED
email: wjh069@gmail.com

BA Buildathon **BB** Bring-and-Buy **CBS** Car Boot Sale **CR** Catering / Refreshments **CS** Club Stalls **D** Disabled visitors **FM** Flea Market **FP** Free Parking **LB** Licensed Bar **L** Lectures & Demos **MS** Meeting Spaces **RF** Raffle **RSGB** (RSGB) Book Stall **PW** PW in attendance **SIG** Special-Interest Groups **TI** Talk-In (Channel) **TS** Trade Stalls **Wi-Fi** (Free) Wi-Fi

NEWS EXTRA

MEDIUM AND SHORT WAVE LISTENERS CONTEST: We have been asked to draw attention to this contest, which is about hearing medium and shortwave broadcast stations during the period 01 November to 31 December 2023. This contest is open to SWLs all over the World. There are four categories of entry, depending on, for example, whether you use a receiver and antenna at home or an internet-based SDR. Prizes include various radio receivers. Full rules are at:
https://tinyurl.com/9n5vs3aj

WORLD RADIO CONFERENCE 2023 WILL IMPACT AMATEUR SATELLITE SERVIC: The World Radio Conference in 2023, WRC-23, will take place 20 November to 15 December 2023 in Dubai, United Arab Emirates. Some decisions made during the conference will affect Amateur Radio and the Amateur Satellites service.
Representing Amateur Radio at the conference is the IARU, the International Amateur Radio Union. The two most pressing issues affecting the Amateur Satellite Service are:
Additional measures to protect the radionavigation-satellite (space-to-Earth) in the 1240 - 1300MHz band from amateur interference. As in most microwave allocations, the Amateur Service is secondary and must avoid interfering with primary services operating in the band, even if they are introduced later. An ITU Radiocommunication sector Recommendation that contains guidance for administrations is in the final stage of development. If an agreement is reached prior to WRC-232, it should complete work on the item.
Identification of the 10 - 10.5GHz band for International Mobile Telecommunications in ITU Region 2, including a primary allocation to the mobile service. The IARU opposes the introduction of IMT in the band and has some allies among administrators within and outside Region 2.

IARU REGION 1 GENERAL CONFERENCE: IARU Region 1 will hold its next General Conference from 1 to 4 November 2023 in Zlatibor, Serbia.
A wide range of papers and proposals are now available online and the RSGB welcomes comments on these.
Topics include: general reports; organisational and budget proposals; the new HF Bandplan; VHF, UHF and SHF changes; and consideration of WRC-23, the World Radiocommunication Conference, which follows shortly afterwards.
Other themes include: strategic projects and progress, accommodating digital technologies, contests, EMC and other spectrum matters.
Comments should be forwarded to the relevant RSGB HF, VHF or Microwave spectrum manager, by Thursday 12 October 2023.

Read more radio news and reviews at www.radioenthusiast.co.uk/news

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Richard Constantine G3UGF
practicalwireless@warnersgroup.co.uk

Yaesu FTM-500DE

Richard Constantine G3UGF takes a closer look and a deeper dive into Yaesu's new flagship, described as "A high-end communication package".

Yaesu's much anticipated dual-band System Fusion, C4FM and FM transceiver arrived with me recently. As someone who still owns earlier models, I've been eager to find out just what more enhancements and benefits can be packed into a mobile radio ...apart from SSB and CW, that is.

If you've read previous reviews, you'll be aware that Yaesu has been developing not only the technical capabilities of their radios but also in a big way the customer/user interface.

The early FTM-100D was conventional in appearance with C4FM capability. Radically different, the two-part FTM- 400D was designed for remote mounting only, either in a vehicle or on a desk with limited space. The large touchscreen being easy to see and use.

On the downside, despite twin receivers C4FM was only available on the upper display of the FTM-400D and I like to keep VHF and UHF bands separate. Mostly menu driven its user interface wasn't the easiest to navigate. Nonetheless it was and remains desirable. Despite being an all-time best seller, it's now discontinued as Covid and component supply issues put paid to production.

Yaesu's until now flagship FTM-300D reviewed in October 2020 (time flies) can decode a single C4FM transmission on either upper or lower displays. The FTM-500D's all new dual CODEC design can decode 2 x C4FM signals simultaneously.

Like the others, the FTM-500D uses Yaesu's de facto standard Funnel Air-Convection Conductor heatsink (wind tunnel) construction. Upper and lower circuit boards sandwich the one-piece alloy chassis and rear panel.

The entire chassis forms the heatsink for this 50, 25 and 5W selectable output radio, ensuring cooler running for ragchews and increasing worldwide temperatures. Air is drawn through the underside of the radio via multiple grooved channels and extracted by a near silent rear mounted fan.

Familiar but different

At first sight the package looks familiar, same main body with SO239 antenna connector. The same data port plus the really excellent and substantial slide-locking cradle that mounts either above or below the transceiver body that doubles as a desk stand. What immediately strikes you is that the radio is significantly deeper front to back by some 40mm and the front panel taller by some 20mm than its predecessors.

This new radio also comes with an unusual feature. You can angle the head unit upwards by means of two side screws. It's not a gimmick. Now you can both use it and see the display on a normal height desktop, on a car seat or without having to place it on a higher shelf. I haven't seen one yet but for extra ease of use, there's an optional swivel bracket allowing the remotable head unit to be angled towards the operator.

Here I have to point out that in the standard package you don't get a separate mounting bracket or remote cable for the control head. These are now optional accessories. Surely an oversight and a significant disappointment for an otherwise high spec package.

Fortunately, I was able to use an 8-way RJ connector cable from my FTM-300D and fabricate a simple bracket and screw arrangement to permit head-up display mounting in my campervan.

Super sound

Yaesu has incorporated it's *Aess* enhanced audio system into the design, with speakers in both the head unit and the main body. At last a front-mounted speaker, not to mention a microphone that connects to the display and not to the main body when remote. Finally, someone has been listening – see previous moans.

Photo 1: Dashboard, Mic/Bluetooth.
Photo 2: Desktop -angled head.
Photo 3: Side view with new angle facility.
Photo 4: Satellites in view.
Photo 5: Altitude tracking.
Photo 6: Compass North Up.
Photo 7: VE call copied on Fusion.
Photo 8: Desktop with band-scope display.

There are two horizontal slots beneath the front of the control head that resemble air intake scoops on cars. Unlike cars these have been created to push sound forward, not suck air in.

The *Aess* system is capable of varying the phase, output balance and frequency characteristics of the received audio. It definitely produces even higher quality audio than previous radios. I smiled when I read in the handbook that it *"reduces fatigue for sustained communication"*.

Press and hold the Vol/Squelch knob auto-selects menu 18 allowing both front and main body speakers to be adjusted separately for flat/high/low pitch response. An audio bandpass filter is incorporated plus the *Aess* phase time delay that's adjustable between 1.25ms-200ms. The user can now to set up the radio's audio for best results and personal taste.

I first encountered *Aess* when reviewing Yaesu's FT-710 HF transceiver. At the time I wrote that you didn't miss it until you disconnected the extra speaker and the same applies here. You can turn it off but I wouldn't advise it, it's really great.

With up to 6 watts of audio available at the front and a further 3 watts from the rear, the system is so clear and potentially so loud you'd hear it in a tank. Michael Caine and 'blowing doors off' springs to mind. It's the best audio in C4FM mode that I've ever heard. As part of the design the radio also has two 3.5mm external speaker sockets on the rear of the main body.

House style

While previous VHF/UHF models had a unique interface layout, owners of Yaesu HF radios will be more than familiar with the house style of a large VFO control surrounded by a cluster of buttons, plus very useful colour coded display and LEDs.

It has a larger and excellent resolution 2.5in colour screen. However, this time the touch sensitive operation differs. The big change is a Main and Sub-Band approach rather than a touch or press to activate upper or lower frequency. Whatever is showing on the top display is now the active transmit band, controlled by the main dial. The lower sub-band is less prominently illuminated and operates in receive/monitor mode only. The sub-band frequency can still be changed by rotating the smaller control, bottom right.

The dual-conversion superhet has two front ends with first IF's at 55MHz and 56MHz. Both feed a common second IF at 450kHz allowing for simultaneous reception. The FTM-500D has an easy-to-access up/down button on the top edge of the control head to rotate the sub to active and vice versa.

2


3

Many buttons make light work

Completely new is the provision of six buttons along the top edge, easier and quicker to use than the smaller cramped buttons of the FTM-300 A big improvement and a real benefit when mobile. From left to right they are:

GM. closed Group monitor

The *GM* button can assign/select up to 99 individual two-digit Digital Group identity numbers for individuals or groups. One-to-one or group calls can be ideal for family, club or Raynet group activity, using C4FM. GM function is going to become increasingly important as System Fusion moves forward. I hope to tell you more soon so...*Watch this space!*

DX. mode

Sequentially pressing this button changes the communication mode manually between C4FM, conventional FM or, Automatic Mode Selection. The *AMS* setting permits the radio to auto-select the same mode as that of the incoming station. When monitoring Air traffic, the radio becomes AM only. Dual action, it also connects the C4FM radio to *'Wires-X'* via a local internet-connected repeater or node station. Incidentally, the number of access points is fast approaching 300 in the UK alone, with more coming on-line all the time. Connected worldwide links/rooms appear on-screen. Pressing the microphone PTT announces your pre-programmed callsign on-screen to others. Call, listen or join an existing conversation... It's always QSO time somewhere in the world.

S-DX: super DX

Increases sensitivity for weak signals just breaking the squelch threshold or can achieve fully quieting for those with a little background noise. The Rx best sensitivity measures 0.2µV for 12dB SINAD on both 2m and 70cm and is more than adequate. Signals appear to jump up around 4-5dB if the display is to be believed. Useful at the edges of repeater coverage the signal increases but so too does the noise level. I haven't quite made my mind up as to its usefulness. Above the main dial there's a small white LED that illuminates to remind you when S-DX is in operation.

Up/Down key

As mentioned earlier this simple, *one-touch* quick button swaps around the main and sub channels, not the touchscreen as before (I kept poking the screen until I remembered).

DISP display

I love this button! Press and the sub-channel is replaced by the fixed centre band scope with a choice of either 61 or 31 channels displayed. In memory mode, 21 or 11 search channels. Although with comprehensive scanning facilities, a quick look at the screen shows you exactly where any active

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channels are plus their relative signal strength. Next use what Yaesu calls *Touch-and-Go*. Simply press the wanted signal bar on screen and the wanted channel bursts into life. It's particularly useful for Air and Marine monitoring where voice calls are short. Visually and practically much quicker than just scanning the band or memory banks. Using AMS you can jump directly to the frequency and mode. It's particularly useful mobile to quickly identify unfamiliar repeaters or simplex QSOs when standing by at home (see also *PMG*).

On/Off/Lock

Lastly, it's nice to see a separate clearly visible on/off/dial lock button. On some radios I've often found myself forgetting, pushing the wrong rotary knob and finding everything's changed.

There's more ... much more.

The four buttons that flank the main dial and similar the HF range are equally useful. Clockwise, the *PMG* or Priority Memory Group button and now a standard Yaesu feature is for me the ace-in-the-hole. Press and the active channel is stored in one of five quick memories. Road tripping, I was able to one-press store active repeaters on the outgoing journey for easy retrieval on the return. Later, I moved some to more permanent storage for my next trip as, once five locations are filled, the memories overwrite. In *PMG* mode the screen display changes to amber.

I could write a book on the memory choices and multiple scanning modes. Let's just say memories and scanning can be a 'voyage of discovery'.

The headline here is *MAG* that is, Memory Auto Grouping. If you've never owned a Yaesu, this is excellent. Pushing the *Band/M-V* button bottom left, cycles through five major banks that contain previously stored frequencies by press and hold. Channels are retrieved sequentially according to their frequency range, i.e.: All Memories / Air band (AM) / 144MHz / 430MHz / Other, i.e. 174MHz-400MHz & 480MHz-999.95MHz.

Sounds complex but it's really simple. A display legend changes colour with each band reminding you which bank you're in.

Bottom right is the *Back* button – A real favourite in the early stages of getting to know this radio. Pressing it returns you to the previous screen without messing anything up.

The bottom left *Band* button quickly accesses all five operating bands. Bands can be temporarily locked out using the VFO Band Skip Function in menu 24.

If only 2m & 70cm floats your boat with the occasional *Air-band* earwig, setting this up makes for a quicker transition from one band to another. You can ignore 220MHz and 850MHz for a start.

I have to mention the *Function* control, top right as this gives access to the main Menu option used for set up/changes of the radio's configuration

Don't be alarmed when I tell you there are 127 main menu choices Gone is the 'tile' screen display. Cycling through the function you wanted was easily missed. It's replaced by a traditional scroll list with complete words.

Menu items are split into manageable chunks with headings according to what they control. Dip in and out, scroll up and down, set and forget, change what you need as and when. If you get lost in the menus, simply press the really useful *Back* button or admit defeat and read the handbook.

Thoughtfully, Yaesu has provided a short cut readout of the screen/mode settings on the main display. Press *CFL* and the Customised Function List appears showing eight of the current programmed settings. Typically, you'll see Repeater Shift info/CTCSS Tone/ Squelch, level/ Power level etc. What's shown can be customised or changed directly and without resorting to the main menu, e.g. switch the power level or quickly change the CTCSS tone. On this screen I decided to change the default '*Scan*' setting to that of menu item 7. It then gave me quicker access to the choice of GPS displays, notably Compass, Altitude, Satellites and Backtrack (see later).

Of course, memories can be tagged with names and not forgetting that the radio comes with an excellent glow-in-the-dark programable/customisable and comprehensive hand microphone with DTMF tone keyboard for such as the Echolink system.

Bluetooth & VOX

I was an early convert to Bluetooth use with radio, long before the manufacturers caught on. It just seemed to make sense to me; no trip-up wires in the shack, headset dragging you back when you step out of your car, no one hand on the PTT while driving. You can listen to the locals in one ear on journeys with the speaker automatically muted while your passenger enjoys their music *or* simply chews your other ear off.

A range of Bluetooth headsets will pair with FTM-500D. I thoroughly recommend the Yaesu/Vertex SSM-BT-10. It's USB-C chargeable, has integral PTT or VOX plus great sound quality. Forgetful me has one at home plus another in the car.

P.S. I have it on good authority, although not tried

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it yet, that the on-board Bluetooth allows mobile users to link directly to Bluetooth-enabled car audio systems.

SD card and voice recorder

A 32GB max memory card can be installed on the left-hand side of the head unit. This enables back-up of the radio's data and information, memories, group messages, Wires-X and GPS log data. It also provides voice recording in .wav format with date and time logging. I can think of many uses and possibilities – perhaps Raynet, Air & Marine monitoring, emergencies etc. What about recording DX contacts or abuse and illegal activity on any frequency? It should be noted that you can't simply clone your older software into this new transceiver. It's worth starting again to take advantage of the latest upgrades.

Clever stuff

The radio has an interesting facility for calling a friend or group with similar radios in FM-only mode. A two-tone CTCSS personal code can be set. When activated the receiving station or group can be alerted by a bell sound and a 'called' legend is left on the screen if not answered.

The transceiver is equipped with a fully functioning GPS receiver In C4FM mode displaying the compass either heading-up or North-up display for real time navigation and current position becomes available.

This is only the tip of the iceberg in terms of possibilities. Start point and way-point entries allow the *back-track* system to operate for logging and return.

It's fascinating when operating with a similarly equipped C4FM station in *V/D*, Voice Data mode and Wires-*X* to see readout of bearing distance between stations or the number of satellites in view, Latitude/Longitude, Altitude, Timer/Clock and there's even a countdown timer. I'm not sure how much use the lap timer might get. I can see some of these facilities being used in conjunction with other mobiles and handhelds by Raynet or search and rescue, etc.

APRS

Which leads me on to APRS as GPS is an integral part of the Automatic Packet Reporting system. I would love to delve further into what the FTM-500D can do in this department. I'm aware that APRS isn't everyone's cup of tea and space doesn't permit. What I can say is that studying what it can do and how it's displayed on the FTM-500D has been a real eye opener.

There's much more to APRS than simply tracking a suitably equipped mobile. Yaesu's website has five freely downloadable separate manuals for the FTM-500D. The APRS manual is second only to the complete advanced manual at 55 pages and best digested slowly. It's a packet type data system providing not only enhanced information and tracking to the GPS screen but also a 67-character messaging facility. Using a beaconing network of fixed and mobile stations, including the FT-500D itself, data can be transferred and displayed on mobile screens or via computers using the 10-pin data jack and an optional interface cable. APRS is definitely addictive.

Dilemma

I'm in something of a bind here, having already given a maximum 5 stars to its predecessor. There's no sixth star so I'll have to be content with at least the same score.

My impression is that someone at Yaesu has sat down with a blank sheet paper (screen) and considered what's good, what's not so good and what 's required in a new model. Maybe they've listened to feedback; maybe a *PW* review? I can dream. The FTM-500D is a clear re-think from an operational/usability standpoint. This radio is different and a pleasure to use.

It shines when used mobile, especially where the control head is in the eye line and easy to reach. If I'm being picky, I would have liked to have seen access to the GPS readout assigned to a single switch and rotary control. It may be there and I just haven't found it yet – there's so much to explore.

P.S. Not in the handbook, it has the ability to cross-band repeat.

As a desktop fixed station, it's attractive especially with its angled display. Being a seriously premium product it's perhaps reasonable to have expected a remote cable and head stand as part of the package. At the factory gate the additional cost would likely be minimal but the buyer's satisfaction even better.

My final thoughts – the FTM-500D isn't just a dual-band radio, it's much more than that. It's a gateway into the fast developing and maturing world of System Fusion.

The crunch question has to be, would I buy it? Based on what I've learned and what I know is coming with System Fusion, I've already raided the piggy bank!

My grateful thanks to Yaesu UK Ltd for the kind loan of this transceiver. The FTM-500D package is circa £629.00 at time of press. **PW**

Read more radio news and reviews at www.radioenthusiast.co.uk/news

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2023 PW 144MHz QRP Contest Results

Our indefatigable adjudicator **Colin Redwood G6MXL** has the results for the 2023 PW 144MHz QRP Contest.

2023 saw 51 entrants submit logs in the 40th *Practical Wireless* 144MHz QRP contest held on Sunday 11 June. The entrants made a total of 1951 valid contacts with stations in 33 different squares (**Fig. 2**). In every respect (entrants, contacts, squares worked) the numbers were up on 2022.

2023 winners

The overall winner, leading single operator and leading Welsh station is the **Hereford VHF Contest Group GW1YBB/P** operated by Steven Clements G1YBB from Pen-Y-Gadair (800m asl), the second highest peak in the Black Mountains in South Wales IO81KW (**Fig. 3**). He used a Yaesu FT-817 transceiver and a 9-element DK7ZB antenna.

Runner up and the leading English station is the **Warrington Contest Group M0ICK/P** operated by Michael Heywood operating from IO93AD.

The leading fixed station is **Steve Macdonald G4AQB** from IO83TN.

The leading Scottish station is again the **Galashiels and District Amateur Radio Society GM4YEQ/P** operating from IO85MM.

The leading GI/EI station is **Martin Hunter MI0CLP/P** operating from IO64QF.

The leading GJ/GU station is again **Chris Rees GU3TUX** operating from IN89VR.

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

Check logs were received from **Stewart Wilkinson G0LGS, Roger Piper G3MEH** and **Frank Laanen PE1EWR.**

Weather

Many participants were greeted with good weather, with blue skies and sun, although others had to contend with thunderstorms. One station thought the amber weather warnings may have caused some stations to pack up early. In South Wales, the weather for Sunday was warm, about 22°C but very overcast.

Members of the Newport Amateur Radio Society were at about 520m above sea level but couldn't see the neighbouring hilltops because of the conditions. **Peter Everett MW0EJE/P** only made one contact as it started thundering as soon as he got to his chosen summit so he only stayed for ten minutes.

Propagation

Michael White G4HZG/P says that the contest started well, with GM4ODA/P in Shetland (IO99 square) giving him a 55 report off the back of the beam. There was some fading in signal strength but numerous squares were 'bagged'.

Summer QRP Festival

The Halifax & District ARS used it as the opening event in a summer QRP Festival that they organised to try and get more QRP and /P activity going. They managed to field five members who actually took part in the contest, and no doubt others gave points away, so they are very pleased with the result! **George (Max) Townend G4SDX/P** says, *"It was a fantastic day!"*

Logging accuracy

There was generally a high level of accuracy. A few stations lost points due to inaccurate locators, reports and missing /P from some callsigns. I suspect some of these may have been due to errors in transcribing from paper logs to computers or stations not using phonetics (N instead of M for example). Some stations logged locators as IO80XR rather than IO80XR for example. The first two characters of locators are always letters. One station's initial log did not include any serial numbers sent or received.

Preparation & midges

Winner Steve Clements is a member of the Hereford VHF Contest Group. He was onsite at the top of the Black Mountains in South Wales in time for the sunrise. As can be seen in **Fig. 3** he already had his mast erected. This left him with plenty of time to assemble his antenna, shelter and the rest of the station. Steve says that, *"This year's PW Contest was 'blessed' with high temperatures and zero wind. Sounds perfect for the portable contester, no flapping tent doorway over the mast turning bar, no howling wind and lashing rain to need headphones and a relaxed setting up of the mast and antenna without having to put rocks on kit bags to stop them heading back to England. For the first time ever on my spot I was plagued by midges. The entrance to my tent seemed to be their allotted meeting point and I was breakfast and lunch. They brought with them many other hideous looking flying things that needed immediate eviction mid-QSO very often."* **Simon Gosby GW8OVZ/P** said he also had to contend with midges when he was packing up.

RF conditions

At least one station felt that *"RF conditions in the West were poor cousins to the East who seemed to be enjoying good paths across the sea"*. **Andy Webster G7UHN** thought there were fewer stations on than last year and conditions seemed slightly harder with a few stations he worked mentioning heavy QSB. Perhaps the uncertain weather forecast didn't help. **Ruaridh Maclean GM4ODW** thought that conditions were better than last year but he still had to contend with QSB.

Julian Cleak submitted the entry on behalf of the **Newport Amateur Radio Society GW4EZW/P**. When they arrived at the location the beacons were coming in quite strongly but by the time they start-

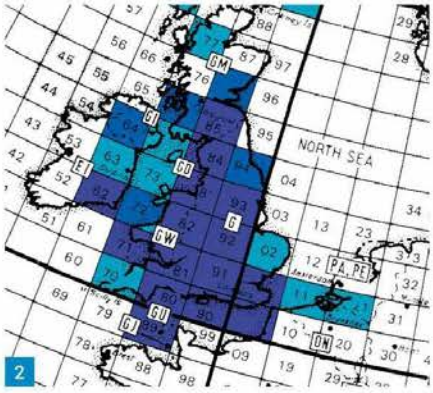

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Fig. 1: Sunrise in South Wales at the Hereford Club's single operator entry GW1YBB/P.
Fig. 2: Map showing locator squares of stations that entered (in dark blue) and other stations worked (light blue).
Fig. 3: Clear take-off in all directions at G3UGF/P.
Fig. 4: Burton Amateur Radio Club G3NFC/P installing the new winch.

ed to operate the beacons had all but disappeared. It was a very disappointing day contact-wise but otherwise quite an enjoyable day out with the club.

Returning

Spen Valley ARS G3SVC/P returned to the contest after a 'short' break of about 30 years. Their first challenge was to find a location to operate, as their former location is now a housing and industrial development. They dusted off their old equipment and quickly refreshed their contest operating skills. Using the Armstrong rotator to good effect, they made plenty of contacts to the South but only worked one GM station and were disappointed not to work any GI or GD stations. They managed to work 75 stations. Their best DX was GM4ODA/P at 687km, with PA0WMX the second most distant at 592km.

Pleasure

It was a particular pleasure to receive a log from **Neill Taylor G4HLX/P** who submitted a log for the first time in 18 years. Longstanding participants may recall Neill was the instigator of the *Practical Wireless* 144 MHz QRP contest 40 years ago. Neill rightly believed that in those days there was a gap in the contest calendar for a 144MHz QRP contest that could introduce newcomers to contesting using nothing more than a 3 Watt transceiver such as the Yaseu FT-290R or Icom IC-202. While other low power portable contests have come along since then, the *PW* contest still remains popular, with only minor changes to the rules. Thanks to Neill for coming up with such a popular and easy to enter contest format.

Description	Name/Team	Callsign
Overall Winner	Hereford VHF Contest Group	GW1YBB/P
Runner Up	Warrington Contest Group	M0ICK/P
Leading Fixed Station	Steve Macdonald	G4AQB
Leading Single Operator	Hereford VHF Contest Group	GW1YBB/P
Leading Multi-Operator	SADGITS	G4RLF/P
Leading English Station	Warrington Contest Group	M0ICK/P
Leading Welsh Station	Hereford VHF Contest Group	GW1YBB/P
Leading Scottish Station	Galashiels And District ARS	GM4YEQ/P
Leading GI/EI Station	Martin Hunter	MI0CLP/P
Leading GJ/GU Station	Chris Rees	GU3TUX

Table 1: Leading Stations.

Square	Name	Call	No. entries
IN89	Chris Rees	GU3TUX	1
IO62	EI3ENB	EI3ENB/P	1
IO64	Martin Hunter	MI0CLP/P	1
IO71	Simon Gosby	GW8OVZ/P	1
IO72	Carmarthen ARS	GW4YCT/P	1
IO75	Bill Ward	GM0ICF/P	1
IO80	SADGITS	G4RLF/P	1
IO81	Hereford VHF Contest Group	GW1YBB/P	3
IO82	Peter Wilkes	M0VTS/P	4
IO83	Dave Hewitt	GW8ZRE/P	8
IO84	Dene Hunsdale	G4ZOI/P	4
IO85	Galashiels and District ARS	GM4YEQ/P	1
IO86	Ruaridh Maclean	GM4ODW/P	1
IO90	Andrew Vare	G4XZL/P	2
IO91	Neill Taylor	G4HLX/P	5
IO92	Burton Amateur Radio Club (BARC)	G3NFC/P	6
IO93	Warrington Contest Group	M0ICK/P	8
IO94	Hambleton ARS	G0JQA/P	1
JO00	Keith Bareham	G1RRR/P	1
JO01	Invicta Contest Group	G5H	2

Table 2: Leading stations in each square.


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Pos	Call	Name	Single	QSOs	Squares	Score	Locator	Transceiver	Antenna	Ht. m asl
1	GW1YBB/P	Hereford VHF Contest Group	S	168	24	4032	IO81KW	Yaesu FT-817	9-ele homebrew	800
2	M0ICK/P	Warrington Contest Group	S	130	22	2860	IO93AD	Icom IC-9700	8-ele LFA	450
3	G4RLF/P	SADGITS		114	24	2736	IO80WX	Trio TS770 + LNA + Processor	13-ele Yagi	5
4	G3NFC/P	Burton Amateur Radio Club (BARC)		81	19	1539	IO92EQ	Flex 5000 Transceiver DEMI TVTR	2 x 15-ele LFA Yagis	100
5	G4ZOI/P	Dene Hunsdale	S	78	17	1326	IO84IH	Yaesu FT-817ND	10-ele Yagi	573
6	G3XNO/P	Otley Amateur Radio Society		75	17	1275	IO84VB	Yaesu FT-991A	Cushcraft Boomer 13-ele Yagi	487
7	G4XZL/P	Andrew Vare	S	74	16	1184	IO90MX	Icom IC-705	Homebrew 9-ele DK7ZB Yagi	270
8	G3SVC/P	Spen Valley ARS		75	15	1125	IO93BR	Icom IC-706MkIIG	Ancient ZL Special	250
9	GW8OVZ/P	Simon Gosby	S	52	21	1092	IO71OW	Yaesu FT-817ND	6-ele DK7ZB superlightweight	4
10	G4CZB/P	John Cockrill	S	61	15	915	IO92KG	Icom IC-705	9-ele Tonna	59
11	M0XMX/P	Mike Lewis		72	12	864	IO93AD	Yaesu FT-857D	Wimo Big Wheel	489
12	G7UHN/P	Andy Webster	S	53	16	848	IO90OW	Yaesu FT-817, DG8 pre-amp	6-ele Yagi	225
13	M0KPW/P	Chris Leviston	S	56	15	840	IO84KF	Icom IC-705	5-ele Yagi	330
14	GW8ZRE/P	Dave Hewitt	S	55	15	825	IO83JF	Yaesu FT-817	7-ele ZL Special	261
15	GW6PVK/P	Gwil Jones	S	43	15	645	IO83LC	Yaesu FT-817ND	12-ele Tonna	920
16	G8HXE/P	Keith Haywood	S	45	14	630	IO83RO	Yaesu FT-817	SOTABEAMS SB5 antenna. (5-ele Yagi)	380
17	G4HLX/P	Neill Taylor	S	49	12	588	IO91GN	Icom IC-705	3-ele delta quad	220
18	M0NDA/P	Al Saje	S	45	12	540	IO92FM	Kenwood TS-790	8 ele yagi	150
19	G3UGF/P	Richard J Constantine	S	39	13	507	IO93AS	Icom IC-9700	10-ele Yagi	412
20	G0WRS/P	Warrington Amateur Radio Club		49	10	490	IO83XG	Icom IC-9100	8-ele horizontal beam	460
21	G0FCA/P	Iain Groom	S	36	13	468	IO83VS	Icom 7000	5-ele Ifl beam	325
22	GW4YCT/P	Carmarthen ARS		27	16	432	IO72WA	Icom IC-7100	2m 6-ele quad	400
23	G0JQA/P	Hambleton ARS		32	13	416	IO94IJ	Icom IC-9700	11-ele Tonna	292
24	M0GQB/P	Martin Cox	S	35	11	385	IO93BQ	Yaesu FT-991	ZL-Special with 5 directors	235
25	G0OIW/P	Mark Palmer	S	32	10	320	IO91LO	Icom IC-202S	9-ele Tonna	230
26	M0VTS/P	Peter Wilkes	S	29	10	290	IO82XS	Icom IC-7000	3-ele portable Yagi	245
27	GW4EZW/P	Newport ARS		28	10	280	IO81KR	Icom IC-705	6-ekebeam	520
28	G4SDX/P	Max Townend	S	27	10	270	IO93BP	Icom IC-705	Homebrew DK7ZB 6-ele Yagi	346
29	GM4YEQ/P	Galashiels and District ARS		23	11	253	IO85MM	Yaesu FT-991	7-ele beam	365
30	GM0ICF/P	Bill Ward	S	21	11	231	IO75OR	Yaesu FT-817ND	5 over 5 slot fed Yagi + masthead preamp	240
31	G4AQB	Steve Macdonald	S	20	10	200	IO83TN	Yaesu FT-991a	5-ele Yagi	34
32	G6EPN/P	Peter Knight	S	20	9	180	IO91DL	Icom IC-705	5-ele Jaybeam Yagi @ 8m above ground	253
33	G8FMC	Dave Keston	S	21	8	168	IO91NW	Elecraft K3s + ME2T Pro TVTR	8-ele Powabeam (G4CQM)	115
34	GU3TUX	Chris Rees	S	16	9	144	IN89VR	Icom IC-705	5-ele Yagi 6m agl	70
35	G4HZG/P	Mike White		22	6	132	IO93BM	Icom IC-9700	12-ele Yagi	0
36	MI0CLP/P	Martin Hunter	S	14	9	126	IO64QF	Yaesu FT-818	Tonna 9-ele Yagi	365
37	GX2UG/P	Halifax & District ARS		14	7	98	IO83XR	Icom IC-705	Diamond 10-ele 2m Yagi bem.	4
38	G0HXR	Geoff Martin	S	12	8	96	IO92UU	Yaesu FT-818ND	6-ele Yagi	2
39	M1AEA	Mark Waldron	S	15	6	90	IO82WM	Yaesu FT-817	Diamond X30	219
40	G0EIY	Simon Pryce	S	17	5	85	IO82OR	Kenwood TS2000	10-ele Yagi	77
41	G5H	Invicta Contest Group	S	12	6	72	JO01EK	Icom IC-7400	5-ele LFA	75
42	G0LDP	Kevin Starkey	S	10	7	70	IO92FL	Yaesu FT-290	Homemade Turnstyle	124
43	EI3ENB/P	EI3ENB	S	9	7	63	IO62EA	Icom IC-7100	Diamond A144S10R2 10-ele Yagi	200
44	G0KRS	Keighley Amateur Radio Society		10	6	60	IO84VC	Yaesu FT-817	5-ele Yagi	388
45	G0NZI	Carl Peake	S	10	5	50	IO92GM	Yaesu FT-225RD	2-ele Moxon	94
46	GW8HEB	Tom Brady	S	8	5	40	IO82KP	Yaesu FT-817ND	BM200P MkII Dual Band Vertical	149
47	GM4ODW/P	Ruaridh Maclean	S	5	5	25	IO86DR	Yaesu FT-817	8-ele Yagi	4
48	G4TJE	Keith Lewis		4	3	12	JO01BH	Yaesu FT-817	3-ele Yagi	185
48	M0TMR	Mark Gilchrist	S	6	2	12	IO93CR	Yaesu FT-857	Diamond X50	170
50	G1RRR/P	Keith Bareham	S	1	1	1	JO00BS	Yaesu FT-817	Yaesu provided whip antenna	69
50	MW0PJE/P	Peter Everett	S	1	1	1	IO83JE	Kenwood TH-K20e	Diamond RH770	440

Table 3: Full Results.

New equipment

Simon Gosby GW8OVZ/P used a voice-keyer built into the microphone (Sotabeams/DH8BQA), which allowed him to call CQ with no effort at all. He reports that it worked well and he felt it was a good addition to his station. **Bill Ward GM0ICF/P** decided to upgrade the antenna system this year. He used 12m of Belden 9913 coax with a vintage 1973 era Jaybeam 5-over-5 slot-fed Yagi plus a GaAsFET masthead preamp. He concluded, "*After the very disappointing results last year what a difference it made! The preamp really helped. I could hear many more stations, but still struggled to work stations in southern England, QRP has its limits. I was pleased I could hear them this year though!*" **Burton Amateur Radio Club G3NFC/P** installed a new winch on their tower for the contest (**Fig. 4**).

Activity

Leading fixed station, **Steve Macdonald G4AQB** thought that the band was busy around lunchtime and sounded more like VHF NFD was back in the 1980s with lots of portable stations.

Duration

The reduction by one hour in the length of the contest doesn't seem to have reduced the number of entries and there were no comments on the contest duration this year, so I think the duration is about right. **PW**

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Thermionic valve testing

David Hodgkinson GI7TPO describes using a tester to check out thermionic valves, old and new.

Many years ago, when I was still at school, I purchased a number of military surplus radios and bundles of valves. I soon realised that I needed a means of checking which of the valves were working satisfactorily. Obtaining a professional valve tester was totally beyond the reach of my finances and even today second-hand valve testers command high prices.

Encouraged by an article in (probably) *Practical Wireless*, I built a valve tester for my own use and, now 60 years on, it still provides a very useful functional service in my shack, **Photo 1.**

This article will describe ways of checking Thermionic Valves to establish if they are performing within normal limits or if they are faulty. It will discuss ways of detecting and testing for various potential faults leading to a series of building blocks that could form the basis of a valve tester. It concludes with a description of the valve tester that I constructed and a description of its use.

The article is not intended to be an academic treatise on how valves operate, but rather a practical guide to enable those interested in repairing or preserving old valve equipment to check that the individual valves are functioning correctly. The accuracy of any test results obtained will depend on the accuracy of the supporting test equipment. However, the results should be consistent and will confirm whether or not a valve is likely to perform satisfactorily in normal use. The results will also allow matched pairs of valves to be selected.

Safetyissues

In these days where most equipment operates from either 5 or 12 volt supplies it is easy to misjudge the dangers posed by the high voltage supplies needed by equipment using valves. Such equipment will contain high voltage DC supplies ranging from 250 to potentially over 500 volts. These voltages can be **LETHAL**. Furthermore, there will be large capacity electrolytic capacitors used to reduce ripple on the supply. These capacitors can maintain a high voltage for some time after the equipment is switched off.

Another well-documented hazard is that many commercial radio receivers and TVs were constructed without any isolating transformers so that one side of the mains supply was effectively connected to the chassis. Depending on the plug connections, this could be either the live or the neutral feed with the chassis possibly at 240 volts AC to earth! **[1] [2]**

These sets were also frequently wired with all the valve heaters in series with a dropper resistor across the mains. If a valve heater fails, then part of the heater wiring will be at full mains potential.

Before any repairs are attempted, it is essential that the set is disconnected from the mains and all capacitors are discharged.

Any testing with power applied should not be undertaken until the locations of all high voltage wiring and connections are clearly identified. All measurements and adjustments should be made with one hand only. The other hand should be kept well clear of the equipment (e.g., behind the back). The chassis should always be assumed to be live.

Valves are designed to operate at high internal temperatures and as a result the envelope can be hot enough to cause burns during and just after normal operation or testing. Valves should always be allowed to cool down before being removed or touched. This will also reduce the risk of internal damage occurring.

Failuremodes

Probably the most common total failure mode is when the valve heater filament becomes open circuit, usually as the result of age or a violent shock. There is no way of recovering a valve with a failed heater.

Another total failure mode is when an internal short circuit occurs; this could be the result of electrical or mechanical abuse. If the valve is subjected to a significant mechanical shock, then the internal parts could move, causing either a short or open circuit condition. A large

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incorrect voltage applied to an electrode could cause internal arcing leading to a permanent internal short circuit. For example, this can occur when an inter-stage coupling capacitor fails, allowing the anode voltage of the first stage to be applied to the control grid of the second. Likewise, the failure of a cathode bias resistor or capacitor can remove the grid bias voltage, resulting in excessive anode current, overload and valve failure.

A common form of internal short circuit is between the heater and the cathode; depending upon the circuit configuration, the valve may appear to operate normally, or introduce mains hum or distortion.

Wear-out mechanisms

Low emission/gain

The heated cathode of a valve emits electrons by thermionic emission; these electrons are attracted to the positively charged anode. The flow is controlled by a negative charge on the control grid positioned between the cathode and the anode. Over time the cathode source of electrons will gradually become depleted, resulting in a lower current flowing with the same voltages applied.

Internal leakage

A valve normally contains a high vacuum to avoid contamination of the electrodes. Internal contamination can cause current leakage between electrodes. This contamination may be the result of damage or deterioration of the seals around the pins or connection leads, or from the transfer of electron emitting material from the cathode [3]. Such leakage may degrade the performance.

Microphonic effect

If the internal electrodes are not securely retained, they can respond to external vibrations and turn the valve into a microphone. This may be due to a design failure or the result of an external shock load or repeated internal thermal cycles.

Concepts of valve testing

Before any electrical checks are undertaken, a careful visual inspection can confirm or rule out external physical damage or corrosion. A white area on the inside of a glass envelope may indicate the presence of gas.

A simple test with a multimeter will confirm the continuity of the heater element. Likewise, a multimeter can detect internal short-circuits or leakage, although this test is better done with power applied to the heater and the valve at operating temperature.

Tests for emission and gain require the valve to be supplied with its normal operating conditions and be at normal operating temperature. These conditions can be supplied by a dedicated valve tester or may exist in the equipment containing the suspect valve.

Testing by the substitution of a 'Known Good' valve raises a number of issues eg:

How is the substituted valve known to be 'Good'?

If the piece of equipment under test is faulty and has caused the valve under investigation to fail, then the substituted valve will probably also be destroyed.

Therefore, before a substitution test is undertaken it is wise to check that all the passive components associated with the particular stage are functioning satisfactorily.

Photo 1: The author's original valve tester in use. Photo 2: A selection of guides with valve data. Photo 3: Main unit. Photo 4: The interconnection panel with multiple valve bases. Photo 5: Operating instructions. Photo 6: Valve data from the Radio Valve Data book. Photo 7: Further valve data from the book. Photo 8: Patch leads connected for testing an EF80. Photo 9: In use, testing an EF80.

Building blocks

The prime elements needed to test a valve are:

Operating information for the valve in the required application, including pin connections.

A multi-output power supply, with suitable metering, to supply the required operating conditions.

A means of connecting the power supply outputs to the valve under test.

The design of a complete valve tester will be covered later in this article; however, if testing of only a limited number of valve types is required, then a dedicated valve tester may not be required.

Valve data

Datasheet information for the valve is essential before any testing can be undertaken. This can usually be obtained from a web search. Alternatively, books such as *Radio Valve Data* [4], or early editions of the ARRL *Radio Amateur's Handbook* [5] contain details on a plethora of valve types. These may be found on online auction sites or at rallies. **Photo 2** shows a selection of guides.

Simple tests

Straightforward DC multimeter testing as described earlier can be used to rule out some catastrophic failures. Testing for a microphonic valve is easiest carried out with the valve in a working circuit where a gentle tap (with a pencil) on a faulty valve will be amplified.

Power supplies

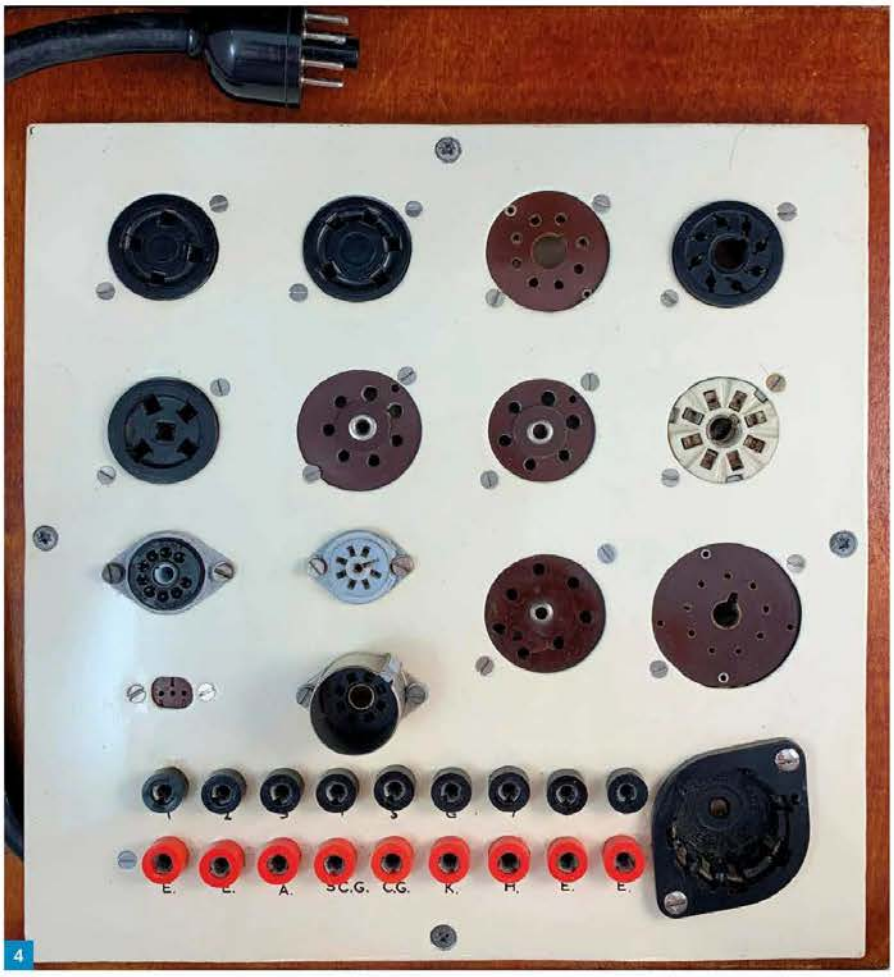
Heater: Valve heaters are normally designed to operate from an AC supply. The most common heater voltages in recent use are 6.3 and 12.6 volts; small transformers with two 6V windings that would meet this requirement are available for less than £10 from component suppliers. However, if the full range of possible heater supplies were needed, then a dedicated transformer or variable supply would be required.

Control grid bias: The control grid draws a negligible current, so the grid bias voltage can be produced from a small transformer (costing £3-£4) feeding a diode bridge, smoothing capacitor and potential divider circuit.

High voltage for anode and screen grid: An adjustable HT supply is required. This needs to be capable of supplying the maximum anode and screen grid voltages at sufficient current for the valves to be tested. This supply will be similar to that integrated into valve powered equipment. Although new transformers designed to operate valve equipment are not readily available, used examples may be found at rallies or online.

Alternatively, isolating transformers with 230V outputs are available from component suppliers (e.g. CPC offer a 25VA unit for about £33). Such a transformer could be used to feed a diode bridge and smoothing circuit to produce around 250V DC.

Connection to the valve under test: The range of valve bases required will depend upon the range of valve types to be tested. Unfortunately, in addition to a wide number of base types, there is little standardisation of valve pin connections even within the same base type. Therefore, a means of connecting various valve bases and pin configurations to the power supplies is required.



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Integrating the blocks into a complete valve tester

As I had a large variety of valves that might require testing, I decided to design and build a comprehensive tester capable of generating most of the operating conditions for this range of valves. The following paragraphs contain a brief description of the design and construction of the valve tester.

Final design requirement

I decided that the basic requirements for the valve tester were:

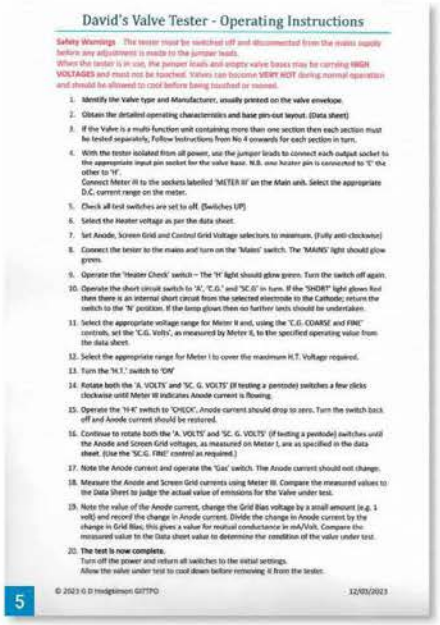
- To produce adjustable operating supplies for normal valve operation:
- Heater - covering all likely heater voltages from 1.5 to 50 volts.
- Negative bias for control grid - up to minus 30 volts.
- Anode - up to 350 volts.
- Screen grid - up to 350 volts.
- That the voltages of the supplies should be either metered or accurately controlled.
- That the current drawn by anode and screen grid should be measured.
- To test for internal short circuits before high voltages were applied.
- To check for the continuity of the valve heater.
- To test that the valve met the manufacturer's specification for emission and gain.
- That a means of testing for control grid contamination (e.g. gas/loss of vacuum) be included.
- That the tester should be capable of testing valves with many different base types.
- The tester should include a means of connection between the power supply and the valve bases that allowed any supply to be uniquely connected to any pin.

Design solution and construction

I constructed the final design in two modules, a Main unit and an Interconnection panel containing valve sockets. The design met each of the design criteria as follows:

Main unit (Photo 3)

A multi-output power supply was built as the heart of the tester (the main unit). An existing wooden box was repurposed to house the main unit chassis. A matching lid containing the array of valve bases (the interface panel) was also constructed. The chassis of the main unit was connected to mains earth and the power outputs were all isolated from the chassis. The mains input feed and the HT supply were pro-



David's Valve Tester - Operating Instructions

Safety Warnings The tester must be switched off and disconnected from the mains supply before any adjustment is made to the jumper leads.
When the tester is in use, the jumper leads and empty valve bases may be carrying HIGH VOLTAGES and must not be touched. Valves can become VERY HOT during normal operation and should be allowed to cool before being touched or moved.

1. Identify the Valve type and Manufacturer, usually printed on the valve envelope.
2. Obtain the detailed operating characteristics and base pin-out layout. (Data sheet)
3. If the Valve is a multi-function unit containing more than one section then each section must be tested separately. Follow instructions from No 4 onwards for each section in turn.
4. With the tester isolated from all power, use the jumper leads to connect each output socket to the appropriate input pin socket for the valve base. N.B. one heater pin is connected to 'E' the other to 'H'.
Connect Meter III to the sockets labelled 'METER III' on the Main unit. Select the appropriate D.C. current range on the meter.
5. Check all test switches are set to off. (Switches UP)
6. Select the Heater voltage as per the data sheet.
7. Set Anode, Screen Grid and Control Grid Voltage selectors to minimum. (Fully anti-clockwise)
8. Connect the tester to the mains and turn on the 'Mains' switch. The 'MAINS' light should glow green.
9. Operate the 'Heater Check' switch – The 'H' light should glow green. Turn the switch off again.
10. Operate the short circuit switch to 'A', 'C.G.' and 'SC.G.' in turn. If the 'SHORT' light glows Red then there is an internal short circuit from the selected electrode to the Cathode; return the switch to the 'N' position. If the lamp glows then no further tests should be undertaken.
11. Select the appropriate voltage range for Meter II and, using the 'C.G. COARSE and FINE' controls, set the 'C.G. Volts', as measured by Meter II, to the specified operating value from the data sheet.
12. Select the appropriate range for Meter I to cover the maximum H.T. Voltage required.
13. Turn the 'H.T.' switch to 'ON'
14. Rotate both the 'A. VOLTS' and 'SC. G. VOLTS' (If testing a pentode) switches a few clicks clockwise until Meter III indicates Anode current is flowing.
15. Operate the 'H-K' switch to 'CHECK'. Anode current should drop to zero. Turn the switch back off and Anode current should be restored.
16. Continue to rotate both the 'A. VOLTS' and 'SC. G. VOLTS' (If testing a pentode) switches until the Anode and Screen Grid voltages, as measured on Meter I, are as specified in the data sheet. (Use the 'SC.G. FINE' control as required.)
17. Note the Anode current and operate the 'Gas' switch. The Anode current should not change.
18. Measure the Anode and Screen Grid currents using Meter III. Compare the measured values to the Data Sheet to judge the actual value of emissions for the Valve under test.
19. Note the value of the Anode current, change the Grid Bias voltage by a small amount (e.g. 1 volt) and record the change in Anode current. Divide the change in Anode current by the change in Grid Bias; this gives a value for mutual conductance in mA/Volt. Compare the measured value to the Data sheet value to determine the condition of the valve under test.
20. **The test is now complete.**
Turn off the power and return all switches to the initial settings.
Allow the valve under test to cool down before removing it from the tester.

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tected by panel mounted fuses. The outputs of the power supply were as follows:

To cover all likely heater voltages, a dedicated transformer was designed and wound. It produced 15 different output voltages from 1.5 to 50 volts. As a suitable 15-way switch could not be sourced commercially, one was constructed from a disc of Perspex, copper rivets and an old potentiometer spindle.

The grid bias supply was taken from a tapping on the heater transformer, rectified, smoothed and fed to potentiometers for coarse and fine control.

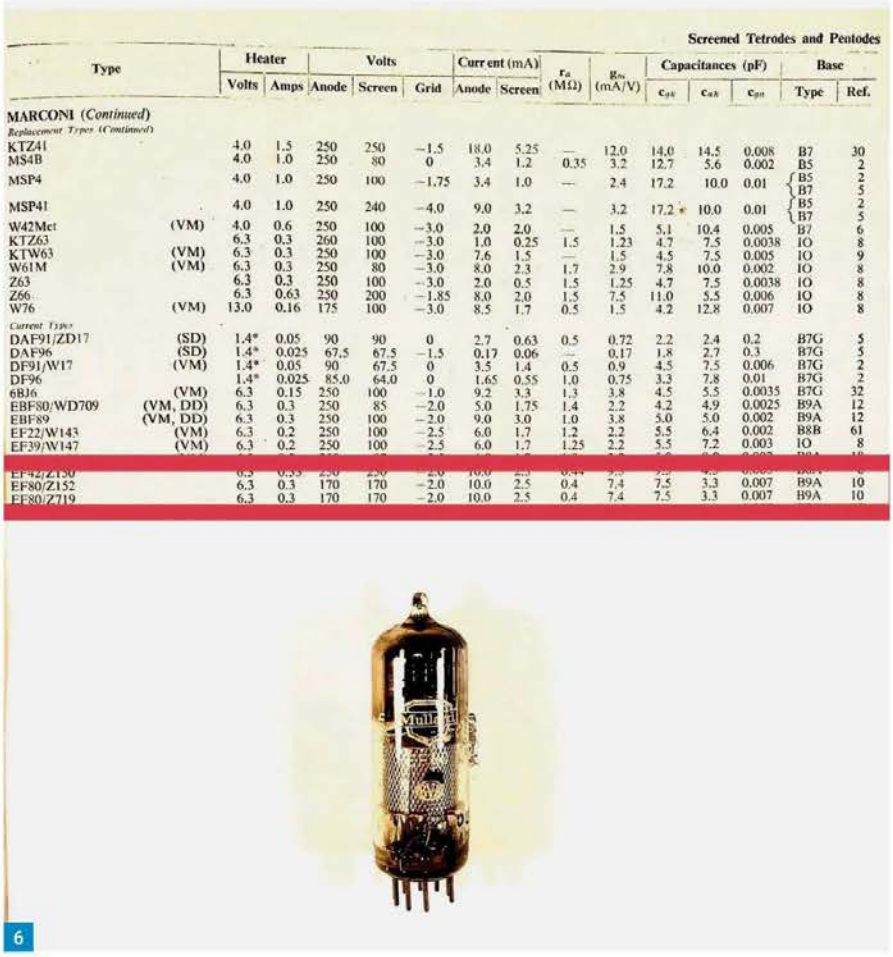
The high-tension supply (HT) for both anode and screen grid was taken from the mains input through an isolating switch and transformer, rectified, smoothed and fed across a series chain of 13 high-wattage resistors. A commercial single-pole 14-way rotary switch was used to select the appropriate voltage step.

The screen grid feed used another 14-way rotary switch across the HT resistor chain with the addition of a variable series resistor for fine control.

Two surplus milliamp meters were converted into voltmeters by calculating and fitting suitable series resistors for each voltage range. One meter (Meter 1) was used for the HT voltages and the other (Meter 2) to measure the grid bias supply.

An AVO 7 was used for current measurements and two sockets were fitted to the panel for interconnection (Meter 3). A multi-pole lever switch was used to switch the AVO between the anode and screen grid feeds. The switch was arranged so that there was no interruption to either feed during switch-over.

A low voltage feed from the heater transformer was fed through a rotary switch and a red test lamp to check for short circuits between anode,



Screened Tetrodes and Pentodes

Type		Heater Volts	Heater Amps	Volts Anode	Volts Screen	Volts Grid	Current (mA) Anode	Current (mA) Screen	r_a (MΩ)	g_m (mA/V)	Capacitances (pF) c_{gk}	c_{ak}	c_{gp}	Base Type	Ref.
MARCONI *(Continued)*															
Replacement Types (Continued)															
KTZ41		4.0	1.5	250	250	−1.5	18.0	5.25	—	12.0	14.0	14.5	0.008	B7	30
MS4B		4.0	1.0	250	80	0	3.4	1.2	0.35	3.2	12.7	5.6	0.002	B5	2
MSP4		4.0	1.0	250	100	−1.75	3.4	1.0	—	2.4	17.2	10.0	0.01	B5 / B7	2 / 5
MSP41		4.0	1.0	250	240	−4.0	9.0	3.2	—	3.2	17.2 *	10.0	0.01	B5 / B7	2 / 5
W42Mct	(VM)	4.0	0.6	250	100	−3.0	2.0	2.0	—	1.5	5.1	10.4	0.005	B7	6
KTZ63		6.3	0.3	260	100	−3.0	1.0	0.25	1.5	1.23	4.7	7.5	0.0038	IO	8
KTW63	(VM)	6.3	0.3	250	100	−3.0	7.6	1.5	—	1.5	4.5	7.5	0.005	IO	9
W61M	(VM)	6.3	0.3	250	80	−3.0	8.0	2.3	1.7	2.9	7.8	10.0	0.002	IO	8
Z63		6.3	0.3	250	100	−3.0	2.0	0.5	1.5	1.25	4.7	7.5	0.0038	IO	8
Z66		6.3	0.63	250	200	−1.85	8.0	2.0	1.5	7.5	11.0	5.5	0.006	IO	8
W76	(VM)	13.0	0.16	175	100	−3.0	8.5	1.7	0.5	1.5	4.2	12.8	0.007	IO	8
Current Types															
DAF91/ZD17	(SD)	1.4*	0.05	90	90	0	2.7	0.63	0.5	0.72	2.2	2.4	0.2	B7G	5
DAF96	(SD)	1.4*	0.025	67.5	67.5	−1.5	0.17	0.06	—	0.17	1.8	2.7	0.3	B7G	5
DF91/W17	(VM)	1.4*	0.05	90	67.5	0	3.5	1.4	0.5	0.9	4.5	7.5	0.006	B7G	2
DF96		1.4*	0.025	85.0	64.0	0	1.65	0.55	1.0	0.75	3.3	7.8	0.01	B7G	2
6BJ6	(VM)	6.3	0.15	250	100	−1.0	9.2	3.3	1.3	3.8	4.5	5.5	0.0035	B7G	32
EBF80/WD709	(VM, DD)	6.3	0.3	250	85	−2.0	5.0	1.75	1.4	2.2	4.2	4.9	0.0025	B9A	12
EBF89	(VM, DD)	6.3	0.3	250	100	−2.0	9.0	3.0	1.0	3.8	5.0	5.0	0.002	B9A	12
EF22/W143	(VM)	6.3	0.2	250	100	−2.5	6.0	1.7	1.2	2.2	5.5	6.4	0.002	B8B	61
EF39/W147	(VM)	6.3	0.2	250	100	−2.5	6.0	1.7	1.25	2.2	5.5	7.2	0.003	IO	8
EF42/Z150		6.3	0.3	250	250	−2.0	10.0	2.5	0.4	7.4	7.5	3.3	0.007	B9A	10
EF80/Z152		6.3	0.3	170	170	−2.0	10.0	2.5	0.4	7.4	7.5	3.3	0.007	B9A	10
EF80/Z719		6.3	0.3	170	170	−2.0	10.0	2.5	0.4	7.4	7.5	3.3	0.007	B9A	10

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screen grid, control grid and the cathode.

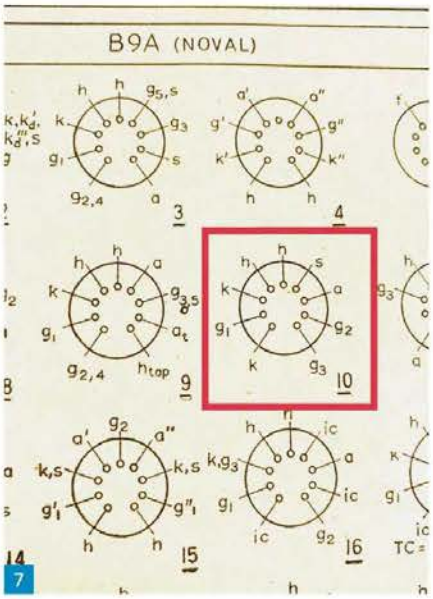
Heater continuity was checked by a low voltage filament lamp in the heater circuit with a switch to short circuit the lamp during the remaining testing.

Contamination or gas may cause internal leakage **[3]** possibly resulting in a small control grid current. A high ohmic value resistor with a bypass switch was included in the feed to the control grid to test for such current. If the grid were drawing current, then switching in the resistor would change the grid bias voltage and hence the anode current.

The tester can be adjusted to supply all the voltages specified in the manufacturer's data and the resulting anode and screen grid currents measured. These currents are compared to the specification to confirm that the cathode emission meets, or is close to, the specification. By making a small change in the control grid bias voltage and observing the resultant change in anode current, the mutual conductance (gain) can be assessed in mA/volt and compared to the published specification.

Interconnection panel (Photo 4)

A total of 15 different valve bases or sockets ranging from 3-pin to 9-pin types were obtained. These were fitted to an aluminium panel and



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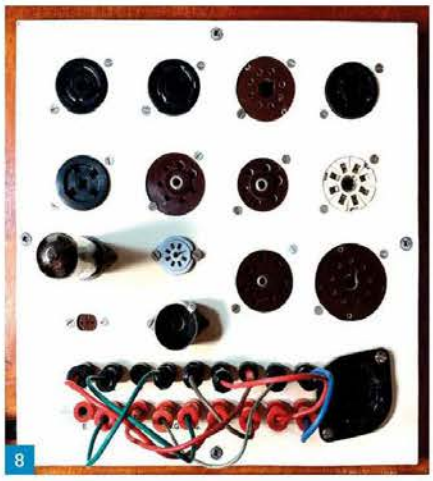
wired in parallel to a set of nine banana plug sockets labelled from Pin 1 to Pin 9. This interconnection panel was mounted on to plywood to form a lid for the box containing the main unit.

Various ways of connecting the outputs of the main unit to the valve bases were considered, including rotary switches and even an ex-Air Ministry bomb selector panel containing multi-



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ple rotary switches. However, the final decision was that a patch panel using short flexible leads between banana plug sockets was the simplest, most reliable, and easiest solution. It also eliminated any risk of two different supplies being connected to the same valve pin. A further set of nine sockets was fitted to the interconnection panel and connected to a multi-way lead terminated in an octal plug to plug into the main unit.

Operation

A full set of operating instructions for the tester were produced in the form of a laminated card, this includes appropriate safety warnings, **Photo 5.**

A summary of the test sequence is as follows:

Before testing can commence, the appropriate operating data for the subject valve must be obtained. An example of the data required, taken from ***Radio Valve Data*** compiled by the staff of Wireless World and published by Iliffe Books Ltd **[4]** is shown in **Photos 6** and **7.** Alternatively, the data may be sourced or supplemented, as necessary from the internet.

With the mains power off, the jumper leads are inserted into the interconnection panel in accordance with the valve data. **Photo 8** shows the connections for testing an EF80.

The heater voltage is set, power applied and heater continuity and short circuit tests completed.

Operating voltages are applied as per the specification and the resulting currents recorded and checked against the specification. **Photo 9** shows the unit testing a rather tired EF80, the anode current is specified at 10mA and the valve is only drawing 7.3mA.

Small changes are applied to the control grid bias voltage and the resulting changes in anode current recorded. This gives an indication of the mutual conductance (gain) of the valve.

If matched pairs are required, then a number of valves can be tested under identical conditions to select a pair with closely matched parameters.

Possible enhancements

Safety

The original tester was constructed at time when most radio, TV, and amateur equipment used valves. Those working on this equipment were familiar with the high voltages required and the associated risks and safety precautions. The operating instructions for this tester commence with a Safety warning and the test sequence is designed to eliminate any risk of shock. However, further mechanical protection could be included.

A removable cover for the interconnection panel would preclude the risk of accidental contact with connections carrying high voltages during operation. An interlock could be fitted to isolate the HT supply when the cover was removed.

Either an internal ammeter could replace the AVO 7 reading anode current, or an alternative connection fitted with shrouded terminations should be used.

Features

A more elegant solution to producing a variable HT supply would be to feed the isolation transformer through a small variable autotransformer.

The analogue meters could be replaced with digital. However, these may need careful calibration as the current measurements from a number of small combined voltage and current modules have been tested and found to be wildly inaccurate.

The present design tests a valve under steady-state DC conditions, which has proved to be adequate under most circumstances. A possible enhancement would be to provide a means of dynamic testing, perhaps by injecting a small audio or radio frequency signal into the control grid of the valve under test, and then measuring the resulting signal across an anode load resistor. This would probably not perform well with the current valve base array because none of the wiring is screened, which could allow crosstalk and possibly cause oscillation. However, the modular design with the interface panel plugging into the main unit of the tester means that a new plug-in interface could be constructed to test valves under AC conditions.

Conclusion

The valve tester, as described above, has provided many years of reliable service. The only repair needed was to replace Meter 2, which failed due to internal corrosion following a period of storage. The box and the panel marking have both stood the test of time.

Although calibration cannot be traced back to National Standards, the tester has proved invaluable in detecting not only gross failures but also valves that are just 'tired'. It is also ideal for selecting matching pairs from a group of identically numbered valves.

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[2} Harry Leeming, 2022. 'Valved Radio Repair Memories'. *Practical Wireless*, Sept 2022. Page 69.

[3] Staff of ARRL, 1986. 'Troubleshooting and repair'. *The ARRL 1986 Handbook*, Page 26-6.

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[5] Staff of ARRL, 1967. 'Vacuum Tubes and Semiconductors'. *The ARRL 1967 Handbook*, Page 603 et.seq. **PW**

Tune in to Ray Clark

This month **David Harris** turns to the memoir of someone who has made a career with the pirate broadcasters and, more recently, local radio.

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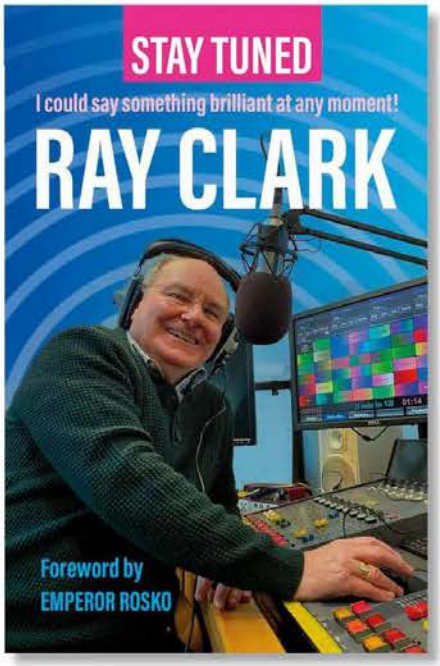
Ray Clark (b.1954) is a BBC Radio Essex presenter and can also be heard on Radio Caroline. Back in 2014 he wrote *Radio Caroline: The True Story of the Boat that Rocked.* This was one of the first books I reviewed when I started writing for *RadioUser* in June 2015. *Stay Tuned* is Ray's autobiography, which charts his love of radio and his attempts to break into the radio industry.

Ray was born in Burnham-on-Crouch, Essex and grew up in the golden age of pop music. He enjoyed listening to Radio Luxemburg and watching Juke Box Jury on television. His love of music and radio prompted him to buy a cheap tape recorder and he began recording music and taping his own voice. His infatuation with radio really took off in 1964 when offshore pop station Radio Caroline started broadcasting from the nearby Thames Estuary. This was followed by Radio Sutch and Radio Invicta who broadcast from offshore forts. These stations were followed by a number of other offshore stations, including the very professional sounding Radio London. Suddenly pop music and slick, American style radio presentation was on the airwaves 24 hours a day.

The golden age of pirate radio lasted from 1964 -1967 when the Marine Offences Act effectively closed down offshore stations with the exception of Radio Caroline, which limped along in various guises until 1991. Ray (and millions of other young people) were not impressed with BBC Radio 1, which was launched in September 1967 as a legal alternative to the pirates. He starts to get more involved in music, buys his first set of DJ equipment and starts running discos in the local area.

Ray leaves school in 1970 with few qualifications but writes to the BBC asking for a job. Much to his surprise they take him on and for the next 18 months he puts up with the long and expensive commute from Burnham to central London. He works in radio programme accounts and gets to meet many famous performers. If this book followed the trajectory of many other media biographies, Ray would have worked his way up through the BBC, got his big break standing in for an established presenter and then would have become a regular Radio 1 DJ. Eventually he would have moved to Radio 2 and perhaps done bit of television and become a household name and maybe even a national treasure.

However, he gets tired of the commute and jacks it all in to become a bus conductor back in Essex. Ray stays in public transport for 15 years eventually getting his PSV licence and becoming a coach driver. Ray runs his mobile disco and avidly listens to offshore stations such as RNI, Mi Amigo, Atlantis and Caroline, which all can easily be heard in the Burnham area. Ray becomes a bit of a radio anorak and attends Flashback 67, an early pirate radio convention and visits the pirate radio ship *Mi Amigo*. For a brief period he tries his hand at making radio commercials but goes back to coach driving



Stay Tuned. I could say something brilliant at any moment! By Ray Clark. Pop Publishing. 2023. Pbk. 339 pp. £11.99.
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poppublishing@gmail.com
www.rayradio.co.uk

His career as a radio presenter does not actually start until 1987 when he joins the flagging Radio Caroline for six weeks. He broadcasts under the name of **Mick Williams** (all Caroline presenter used assumed names as this was an illegal activity).

This 'work experience' was sufficient for Ray to start picking up work with commercial radio stations, which were then quite prolific across the UK. Ray works Invicta Sound, Kent (now part of the Heart network) and then moves nearer to home with Breeze AM, which was an oldies station based in Southend, (now part of Global Gold network)

Ray finally makes it in radio by becoming station manager of Breeze and recruits legendary American radio presenter **Emperor Rosko**, who had worked for radio Caroline and BBC Radio 1. Ray and Rosko became good friends and Rosko has contributed the foreword for this book. Ray also begins broadcasting for KDKA, Pittsburgh, USA where he becomes their unofficial UK correspondent.

The viability of local commercial radio stations came under threat in the late 1990s and a process of takeover and mergers began, which has resulted in almost all commercial radio stations in England belonging to three main companies: Bauer, Global and News Group. By 2000 Ray is redundant but picks up work with publishers Tindle Group who at the time owned several local stations. He then joins Chelmer FM (now part of the still independent Radio Essex)

In 2001 he gets another break by re-joining the BBC that he left in1972. He gets work with BBC Radio Cambridgeshire and BBC Radio Essex. At last Ray has come home to what seems to be his dream job as a presenter with his local BBC station. Amongst his achievements with BBC Radio Essex was the production of a documentary about Radio Caroline, which was broadcast in 2004 which was Caroline's 40th anniversary.

In 2014 Ray retires from full time radio presenting but carries on doing some programmes for BBC Radio Essex and Radio Caroline. In 2020 he helps start up Caroline Community Radio, which serves the Maldon area of Essex on 94.7 FM.

This extremely readable and amusing book will appeal to anyone who has ever dreamed of presenting a radio programme. It is also a valuable contribution to the history of radio in the UK over the last 50 years. Ray is very honest and open in his book and at various times he admits his own self-doubt. He could have been another **Ken Bruce** but perhaps did not push himself enough. However, he seems to have had a very happy life and to have fulfilled his radio dreams. Highly recommended. **PW**

Read more radio news and reviews at www.radioenthusiast.co.uk/news

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1

Push the Button

Billy McFarland GM6DX builds a simple external keypad suitable for use with several modern transceivers.

The new line of Yaesu transceivers such as the FTdx10 or the FT-710 offer users the ability to connect an external keypad via the 3.5mm stereo socket labelled *Remote*, which is located at the rear of the rig. The obvious benefits for this are for use during contesting or when on a DXpedition and you are looking to make use of the rig's built-in memory messages. Yaesu produce the FH-2 keypad, which has buttons for the five memory messages, up, down, left, right as well as memory programming and comes at a cost of around £35. The Yaesu built keypad has a few flaws. Mainly the buttons are very small to press and it has too many buttons for practical use. Most people will use this external keypad function's ease of access to the memory messages and will not exceed four of the pre-recorded messages. There is an answer and that is to make your own four-button external keypad that is practical and cheap. To make the keypad you will need a few parts detailed as follows:

- 4 x 16mm momentary push buttons
- 1 x 100 x 75 x 25mm project box (or as close as you can get to these sizes)
- 2 x 820Ω resistor
- 1 x 47Ω resistor
- 1 x 330Ω resistor
- 2 x 1kΩ resistor
- 1 x 1.8kΩ resistor
- 1 x 220Ω resistor
- 1 x 470Ω resistor
- 1.5m length of 2-core cable
- 5 x hot glue sticks and hot glue gun
- 4 x sticky rubber feet
- 1 x 3.5mm stereo jack plug

Fig. 1 Shows all the parts needed to make this simple project.

Take your project box and mark out the positions for the switches. On this 100mm long box I positioned switches 1 and 4 about 15mm from each end and then switches 2 and 3 about 22mm from switch 1 and 4. This can be seen on **Fig. 2.** Once the switch positions are marked, drill a 4mm hole for each switch and thereafter drill each hole out to 16mm using a cone drill bit. It is of note that you are better to drill the holes with the lid on the box to keep the shape of the box to prevent splitting or cracking. Once each hole is drilled out as big as it can with the lid attached, remove the lid and finish off each hole to the 16mm size. Finally drill a 6mm hole on the side of the box for the cable to fit through as seen in **Fig. 3**. Now that is the box prepared, fit each 16mm momentary switch into the box. Place some hot glue around the nuts and switches to stop them becoming loose in transit or when on trips. Also ensure all the switch connection tabs are inline as seen in **Fig. 4.**

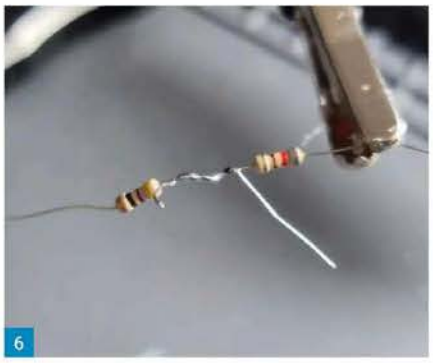
Each switch requires a level of resistance in order to activate them. The resistor value for each switch can be seen in the basic wiring diagram, **Fig. 5.**

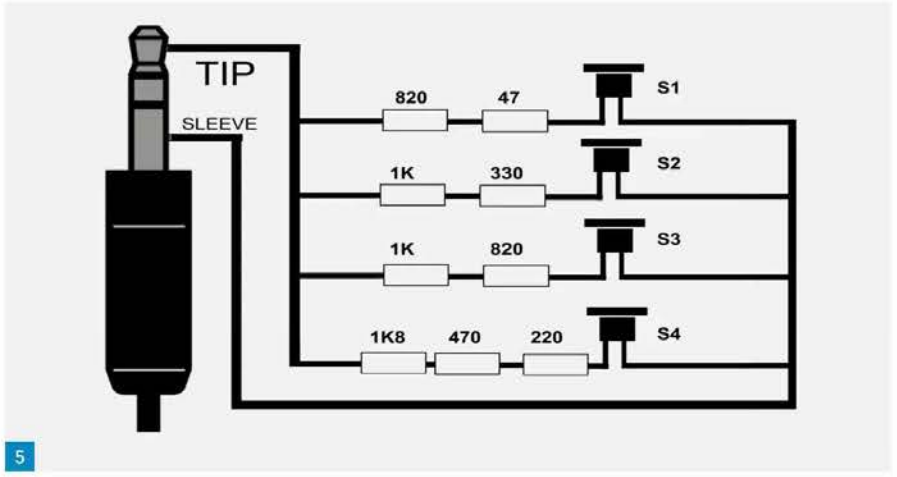
Collect the resistors needed for each switch and solder them in series as seen in **Fig. 6**. This prepares them for install and makes an easier overall process than trying to solder in series when fitted in the box. Take your cable and feed it into the box through the side hole and tie a knot in the cable to stop it being pulled through the box. Once you have done this, take the ground wire (that will get connected to the 3.5mm stereo jack sleeve) and solder this along the connection tabs, on all switches as seen in **Fig. 7.** Now take each pre-assembled group of resistors and solder them to the switches' remaining connection tab. Once they are all soldered onto the switches connect all remaining legs of resistors in parallel to the remaining wire of the cable as shown in **Figs 8** and **9**. This connection goes to the tip of the 3.5mm stereo jack. Hot glue all resistors in place, fit the enclosure lid and install the four sticky rubber feet to the base of the box. The final connection is to install the 3.5mm stereo jack to the remaining end of the cable. Ensure you have the ground of the switches going to the sleeve connection and the cable from the resistors attached to the tip connection as seen in **Fig. 10**.

Once the jack connector is installed that is the completion of the keypad as seen in **Fig. 11**. Should you wish to make a five-button keypad, then the resistor value for switch 5 is a total of 3240Ω using three resistors at 2.2kΩ, 820Ω and 220Ω. To watch a step-by-step video of me making a five-button keypad follow this link:

https://tinyurl.com/4wxv8dsu

As always should you have any questions then drop me an email at: **gm6dx@outlook.com**





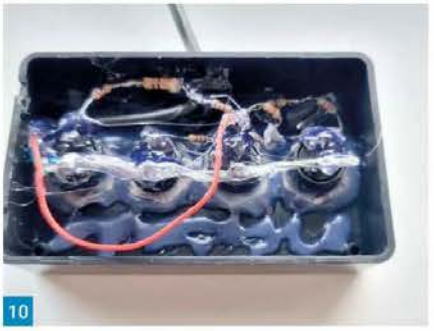
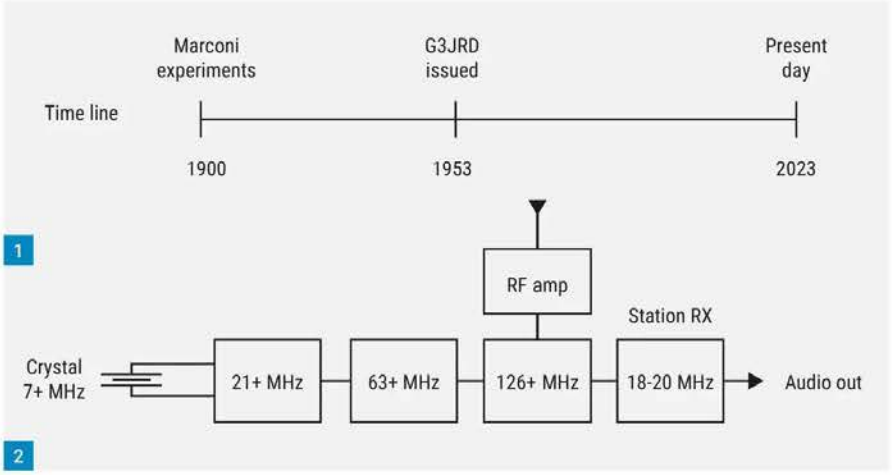


Fig. 1: The parts needed for the project.
Fig. 2: Marking the switch positions.
Fig. 3: Switch and cable holes drilled.
Fig. 4: Switches mounted with connection tabs aligned.
Fig. 5: The basic wiring arrangement.
Fig. 6: Resistors soldered together for the correct value.
Fig. 7: The ground wire connected.
Fig. 8: Connecting the resistors.
Fig. 9: Ready to go.
Fig. 10: Connections to the plug.
Fig. 11: The completed keypad.

Rob Dancy G3JRD



Two metres in the 1950s

As a tribute to **Rob Dancy G3JRD** who recently passed away (see Keylines), we publish this final piece from him.

No apologies for yet another delve into history. After all, we are still very interested in ancient Egypt, though there is no information written by anyone living there, then. Here are some aspects that put things into perspective for newcomers to our wonderful hobby, by some one who was there, then. For amateur radio, the 1950s were nearer to the start of all radio activity, commercial or amateur, than we now are in the 2020s, **Fig. 1**.

To get on to the 144MHz band during the 1950s was quite difficult, as it was a big jump from 28MHz to 144MHz – I don't think there were any intermediate bands then *[the UK lost the 5m band in 1947 and gained the 4m band in 1956 – **ed**.]*. There were no commercial equipments available, so it was all back to the drawing board and starting from scratch on homebrew equipment.

The receiver I built mainly followed a published design, using valves, as semiconductors capable of VHF were not readily available. A VFO would not have been feasible because it would have too unstable, so a crystal of around 7MHz in a tripler configuration at 21+MHz was followed by tripler and doubler multipliers, taking it up to around 126MHz, which was used to beat with the amplified incoming signals to produce from 18 to 20MHz, fed to the station SW receiver, tuning that range, **Fig. 2**.

There were plenty of cheap ex-military crystals available (a selection is shown in **Fig. 3**). Not exactly miniature, and some could be taken apart, and the crystal gently lapped down if a slightly higher frequency was required. To give an idea of scale, the larger ones are about 2cm across.

Construction & Testing

Before construction began, a lot of metal bashing was necessary, and the layout of valves and components decided. Sheet aluminium had to be cut and bent into shape, valveholder holes cut and the holders put in, and anti-feedback sheet divisions inserted. Inevitably something was overlooked and had to be put right when the final stage, the wiring, was conducted.

One thing to be learned was that the length of wires involved with the VHF signals had to be short. At HF the tuned inductors had multiple turns, even at 28MHz, and wiring lengths were unimportant, but at VHF only a couple of air-spaced turns were needed, and signal wire lengths were significant.

My first transmitter used an ex-WD crystal of a little above 8MHz, with an overtone oscillator working on the third harmonic of the crystal taking it up to a little over 24MHz. The next stage was a tripler to 72MHz, and the next a doubler to somewhere between 144 and 146MHz. The doubler and tripler stages were similar to the oscillator except the input was a link from the previous stage, replacing the crystal. The final output was amplified and fed to the PA, a Mullard QQV04-20 double-beam tetrode. The transmitted frequency was very haphazard, somewhere within the two megahertz of the band!

A speech amplifier with an output of about 30 watts was used to amplitude-modulate the RF – we had no SSB or FM.

Fig. 4 shows a typical valve harmonic oscillator of the time – the output at C5 and L2 was three times the crystal frequency.

This was the only time I ever used Lecher Lines, **Fig. 5**, to check that the transmitter was somewhere inside the 2m band. A Lecher line is a pair of parallel uninsulated wires or rods held a precise distance apart, forming a short length of balanced transmission line. They were used to measure the wavelength of radio waves, mainly at VHF, UHF and microwave frequencies. The separation is not critical but should be a small fraction of the wavelength, and lines used for measurement are generally several wavelengths long. Before frequency counters were developed in the 1960s, they were used to measure the frequency of radio waves by physically measuring the distance between nodes of the standing waves on the line, giving the wavelength.

Watching the current meter to the PA stage of the transmitter, a big increase in current occurs when the sliding short circuit is at a node, and measuring the distance between nodes gives the wavelength, and hence the frequency.

It was lucky that the QTH was an old farmhouse with large attics and plenty of room to set up the Lecher Line. Tests showed that the transmitter frequency was very near to the centre of the band, confirmed later when operating.

Operating

Putting out a CQ, one would end with *"Tuning high to low"* or *"Low to high"* to give the other operator some idea of how long it was going to take for him to be found somewhere in the 2MHz that had to be tuned across. If his frequency was towards the bottom of the band, and you said you were tuning high to low, he knew it would take longer to find him. There were no fixed channels as we now have. Once established, a QSO would be cross-band with the transmitters on the two different frequencies.

When searching for a CQ signal, switching on the BFO on the station receiver made it easier, as there was a better chance of noticing a fairly weak signal.

No directional antenna was used – contacts would have been even more random and difficult if the direction of a signal also had to be taken into account.

Looking back through the logbook, my first 2m contact was with a member of the West Kent ARS, a friend, **Laurie King G4IB**, who had paid a visit to my home, and on leaving used his mobile homebrew transmitter and receiver. Signals started at 5/9, fading slowly until we lost contact after he was about

Fig. 1: G3JRD issued about halfway through the life of radio! Fig. 2: Mixing scheme for the first G3JRD 144MHz receiver. Fig. 3: A selection of ex-military crystals. Fig. 4: Circuit of a typical valve harmonic oscillator. Fig. 5: Sketch of a Lecher line, originated by Ernst Lecher in the 1880s.

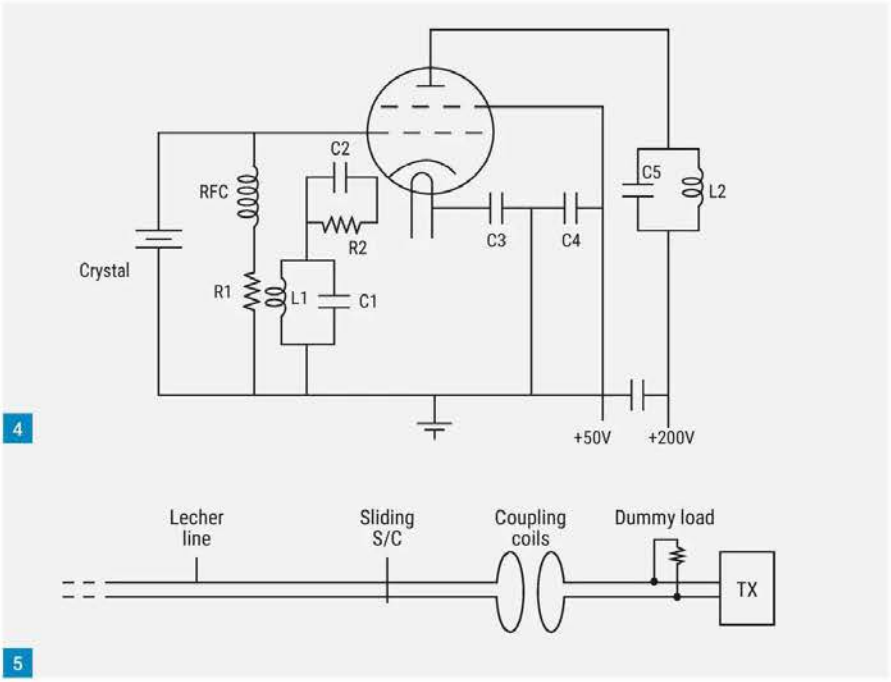
ten miles away.

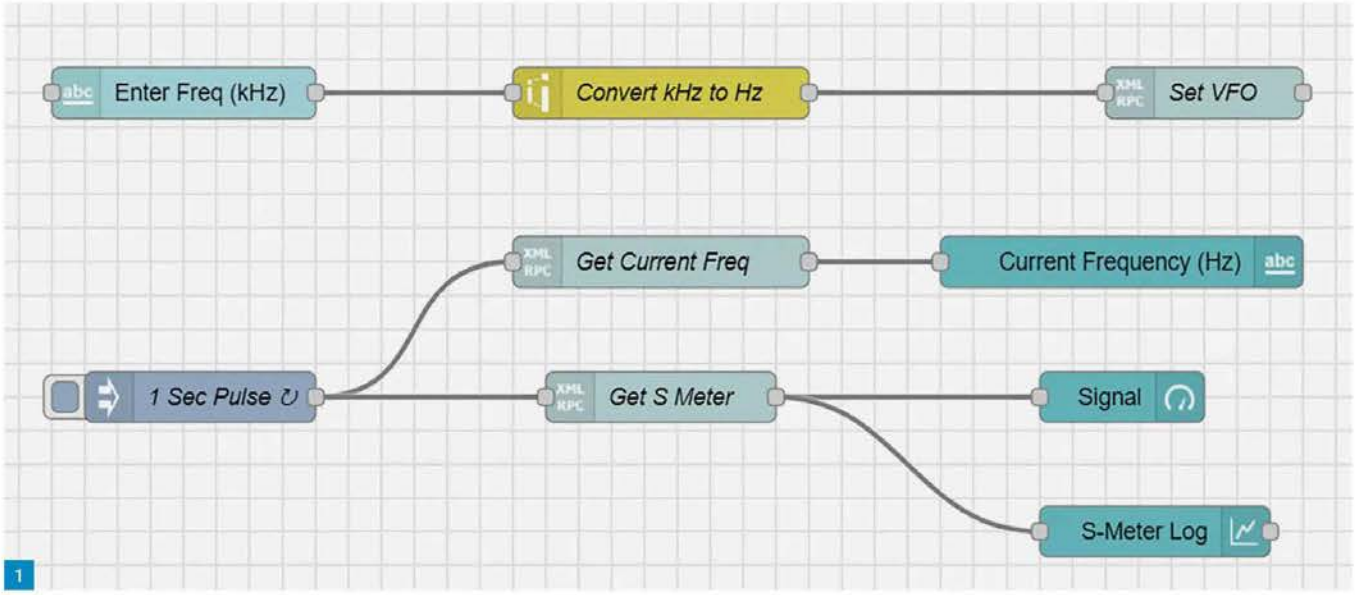
Once a number of others went to all the toil of getting on 2m in this way, regular skeds could be organised, as we made notes of where we could all find each other on the band, doing away with the haphazard searching, and also directional beams could be used to increase range.

Then a few years later the Police and Ambulance services, among others, updated their radio transceivers and their old ones, Pye Cambridge and Westminster VHF transceivers, came on the market. Their operating frequencies were close to the 2m band, and it was quite easy to retune a set to it.

The only people interested in those that came on the second-hand market were probably amateurs. I had one, but cannot remember where it came from, or how much it cost, but it was not expensive. It served me well for some years in the 1970s. Again, memory fails me (it was quite a while ago!) but it probably had pre-set channels.

Life was simpler in some ways then and more complex in others. But it was a lot of good fun, and hopefully there will continue to be just as much enjoyment in amateur radio in the future, though so very different now compared to the 1950s. **PW**





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Rig control with Node-RED

Mike Richards G4WNC starts by explaining the use of Node-RED, then moves on to the latest incarnation of the RTL-SDR dongle.

One of the great benefits of modern rigs and ancillary equipment is that many include remote control facilities. This has enabled many stations to relocate far from the ever-increasing urban noise problems. In addition to remote operation, these controls can be helpful within the shack to aid day-to-day operations. For example, if you have multiple antennas available, having a small App on your desktop could be beneficial to control the switching. The problem with this line of development is the requirement for programming skills combined with the ability to design a suitable Graphic User Interface (GUI). Most programming languages have a steep enough learning curve to deter many from this approach. There is one exception, and that's Node-RED. I've been covering this for the RSGB through a Tonight@8 presentation and a short series of articles, but it's also relevant to this column.

Node-RED stands apart from many programming languages because its programs are created by interconnecting functional elements in a flow chart, **Fig. 1**. Using this technique, it is possible to build complete programs with little to no code. IBM's Special Projects team created Node-RED, which has been fully open-sourced and benefits from continuous development. Its original purpose was to help the Special Projects team develop custom software applications for IBM's clients. However, once released as open source, it has been recognised as ideal for many automation projects. At the heart of Node-RED is a standard messaging system to send information between program elements (called Nodes). The message system is JSON (Jave Script Object Notation), a simple but highly versatile system. It has the additional benefit of being human-readable, which can be particularly helpful when troubleshooting.

Getting started

While you can install Node-RED on any PC, a popular option is to use a Raspberry Pi Model 3B or 4B. Installation on a Pi is straightforward as follows:

1. Start by getting the latest Raspberry Pi OS from: **www.raspberrypi.com/software**
2. Follow the instructions to download the Raspberry Pi Imager software and use that to burn the recommended Raspberry Pi OS (32-bit) to a new SD card (16GB or 32GB is plenty).
3. Connect a keyboard, mouse and monitor and power-up the Pi.
4. Follow the instructions to complete the initial configuration and connect the Pi to your home network.
5. Open a browser and navigate to: **https://tinyurl.com/msd5k275**
6. Here you will find the Node-RED installation script. Select and copy the script to the clipboard.
7. Press Ctl+Alt+F4 to open a terminal session.
8. Right-click, paste the script into the terminal and hit Return.
9. Follow the instructions to complete the installation.
10. For the final step we need to note down the Pi's IP address. You can see this by hovering the mouse pointer over the network arrows in the top right of the screen or by entering hostname -I in a terminal session.

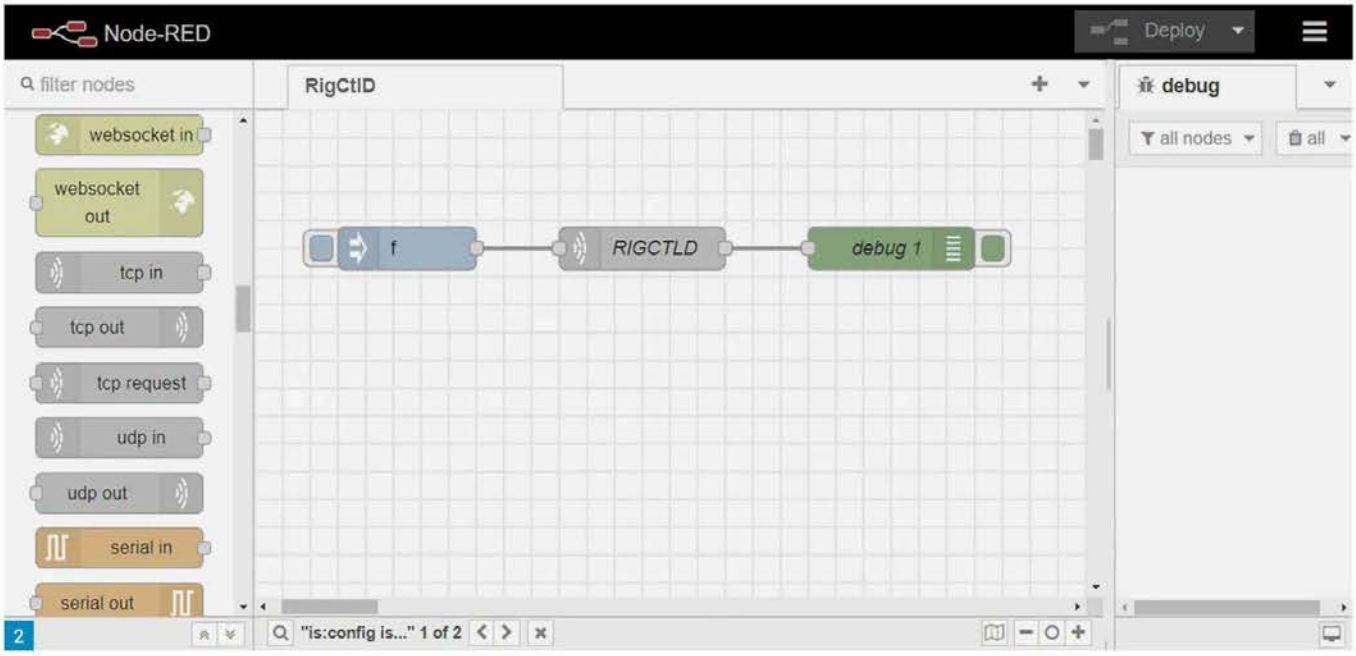
Once the installation has completed, you can start Node-RED by typing node-red in the terminal or using the Pi menu button and navigating to Programming – Node-RED. Although we now have Node-RED running on a Pi, we can use it to interact with anything on your local network. In most cases, it's more convenient to run the Pi headless. By that, I mean we remove the keyboard, mouse and display. This is possible because Node-RED uses a browser interface, so we just need the IP address of the Pi hosting Node-RED and we can access and program Node-RED from any PC. When running headless, we need Node-RED to start automatically as the Pi boots. Fortunately, the install script included a service file to facilitate this. To activate it, open a terminal session and enter the following:

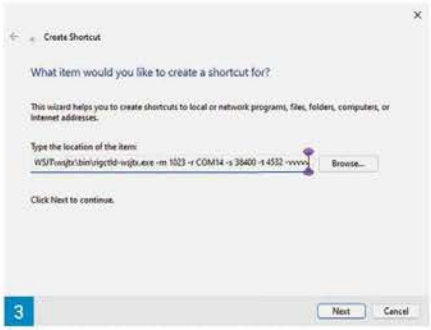
sudo systemctl enable nodered.service

Next time you restart the Pi, Node-RED will be running. When running as a service, Node-RED will automatically attempt a restart in the event of a crash.

Rig control

Now that we have Node-RED installed and running let's look at a simple rig control application. For this example, I will use the popular Hamlib package that's included with WSJT-X, JTDX and a few others. Many rig control systems only support one connection at a time. This is because you can create a situation where programs conflict for control. However, there may be occasions when you want to tweak your rig's settings. Hamlib provides





a way to do this using the rigctld application. Rigctld is a daemon that handles control requests via TCP sockets. With this daemon, it's possible to build a program that adjusts settings on your rig while it's still connected to WSJT-X or JTDX. For this to work successfully, you must use the rigctld version included in the WSJT-X installation. For Windows users, that is usually in C:\WSJT\wsjtx\bin. When running rigctld, you need to add some parameters at the command line so that it knows which rig to use and the appropriate communication protocol to use. Here's an example of the Windows command for a Yaesu FT897:

./rigctld-wsjtx.exe -m 1023 -r COM14 -s 38400 -t 4532 -vvvvv

-m This is the rig model number. You can see a list of supported rigs by entering: ./figctld-wsjtx.exe –list

-r This is the port where the radio is connected

-s This is the baud rate for the connection

-t This is the TCP port that will be used to talk to rigctld

-v This is the verbosity of reporting from rigctld. Using five v, you will see full message reporting in the terminal where you started rigctld. This is very useful when setting up a connection, as you can see all the traffic. Once everything is working, you can reduce to -vv, which will only report errors. For convenience, I've created a desktop shortcut to run rigctld on my system. This is easy to do in Windows 10/11, as follows:

1. Right-click on an empty area on the desktop and choose New – Shortcut
2. This will open a wizard, where you can use the Browse button to C:\WSJT\wsjtx\bin\rigctld-wsjtx.exe
3. Now you can add the command options after the .exe. I've shown mine in **Fig. 3.**
4. Click Next, choose a name for the shortcut and then finish.
5. That's it!

If you need to edit the command line, just right-click on the shortcut and choose Properties.

Before we can start, we need one more piece of information: the PC's IP address that's running rigctld. The quickest way to get that is to open a terminal, enter ipconfig and make a note of the IPv4 address. At this point, we have everything in place to start controlling the rig. To access Node-RED on the Pi, open a browser on any PC on your local network and enter the IP address of your Pi immediately followed by :1880

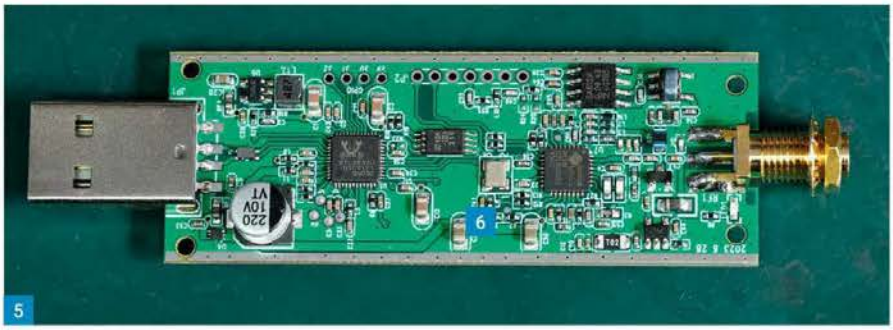
For example, on my system, I enter: 192.168.1.237:1880

If all is well, you should see a blank Node-RED workspace.

Let's conclude this month by building a basic flow to test the system. Here are the steps:

1. From the left-hand panel, drag an Inject node onto the workspace.
2. Next drag a Debug node onto the workspace.
3. Scroll down to the Network section and drag a TCP request node onto the flow.
5. Left-click and drag on the wiring points to connect the nodes as shown in **Fig. 2**.
5. Double-click on the Inject node to reveal the Properties and click in the box next to msg. payload and choose string then add the single character f and click Done to finish.
6. Double-click on the tcp request node and enter the IP address of the PC running rigctld and port 4532. Set the Return to String and click Done to finish.
7. Click Deploy in the top right corner to deploy the flow.

Using that simple flow, you can retrieve the current frequency of your rig. To see this working, go to the right-hand panel of the workspace and click the bug symbol to show the debug window. Next, click the button to the left of the Inject node, and you will see the rig frequency ap-



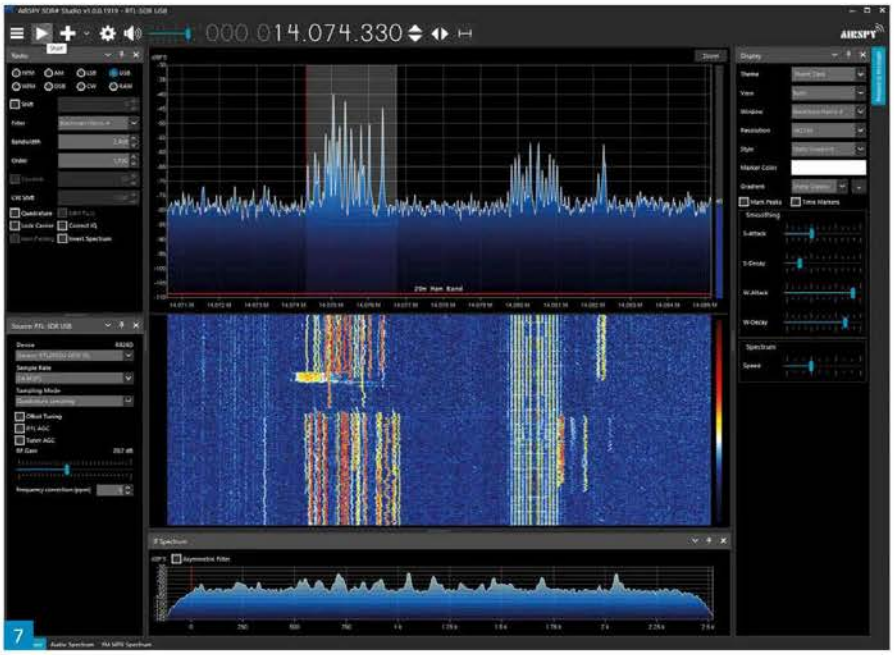


Fig. 1: Typical Node-RED flow chart. Fig. 2: Node-RED flow for rigctld. Fig. 3: Shortcut wizard. Fig. 4: The new RTL-SDR Blog V4 dongle. Fig. 5: RTL-SDR Blog V4 internals. Fig. 6: RTL-SDR - Improving screening continuity.. Fig. 7: RTL-SDR Blog V4 receiving FT8 on 14MHz.

pear in the debug window. You can now experiment with the full range of commands in rigctld. Documentation for rigctld can be found at:

https://man.archlinux.org/man/rigctld.1.en

Next month I'll show you how to add a simple GUI to bring your project to life.

RTL-SDR.COMV4

Since **Antti Palosaari**, **Eric Fry** and **Steve Markgraf** discovered that the Realtek DVB-T TV dongles could provide raw IQ signals, cheap SDR receivers have become widely available. The discovery opened the market for low-cost SDRs, and the SDR dongle has gone through many iterations. Throughout this period, the team at RTL-SDR.com have developed a reference design that has evolved to deliver the best possible performance from the combination of a wideband RF tuner and the RTL2832 chip. This device has the rather odd title of RTL-SDR Blog dongle, and the latest version, V4, has just been released. I ordered mine on the release date, **Fig. 4**. Development of the dongle has continuously increased the number of features and squeezed all the best improvements into a clever new device. Here's a summary of the headline features:

- Improved HF reception using an upconverter.
- Improved filtering with three separate tuner inputs software switched to the single antenna socket.
- Notch filters for common interference bands.
- Phase noise from strong signals improved.
- Runs cooler.
- 1PPM TCXO

Cheaper!

The new version utilises an R828D tuner with three RF inputs, one of which connects to an SA612A mixer/local oscillator that provides upconversion for the HF band coverage. In previous iterations of the dongle, HF coverage was only possible by using the direct sampling modification. This is where the antenna is fed directly to one of the IQ inputs of the Analogue to Digital Converter (ADC). Direct sampling was a compromise solution, and the performance was usually poor. In the V4 dongle, the upconverter provides better HF performance than the earlier dongles. This is further aided through the provision of an RF gain control. The internal use of separate RF inputs for different frequency bands also helps reduce the risk of strong signal overload from out-of-band stations.

As with previous RTL-SDR Blog dongles, the receiver is housed in a very compact metal case to provide some screening and to help with heat dissipation. The PCB is with a large heat conducting pad to transfer the heat from the PCB to the case. I've shown an internal photo of the dongle in **Fig. 5**. As often happens with this type of case, the painted/adonised finish prevents a good ground connection between the PCB and the case. To overcome this and improve the screening, I made a few minor modifications to mine. I've used a fine abrasive paper (400 grit) to remove the finish from the ends of the case and the inward-facing side of the end cheeks, **Fig. 6**. I didn't sand the outer side of the panel around the antenna socket because the supplied star washer cut through the finish to provide a good ground connection. When reassembled, I used a multimeter to check that I had a low resistance between the outer of the SMA socket and all parts of the case. To penetrate the case finish I used ProbeMaster sharp probes on the multimeter. I'm still testing the V4 dongle, but the initial performance looks very good, and you'll see a screenshot of the dongle monitoring the data section of 14MHz with SDR Sharp in **Fig. 7**.

I've just heard that **Simon Brown** has updated SDR-Console to include support for the V4 dongle, which is good news. If you want to buy one of the new dongles, I suggest you go to the RTL-SDR Blog site and buy through their shop. There will inevitably be poor quality clones on the market soon, but you can avoid them by using the RTL-SDR blog site at:

www.rtl-sdr.com

If you're already using an RTL-SDR dongle and changing to the V4, you must update the drivers. This is a simple process, but I suggest you follow the guidance on the RTL-SDR Blog, as they always have the latest drivers and instructions. The price is a reasonable $39.95US, which includes shipping via China Post and Royal Mail. Mine took ten days to arrive, which seemed very reasonable. **PW**

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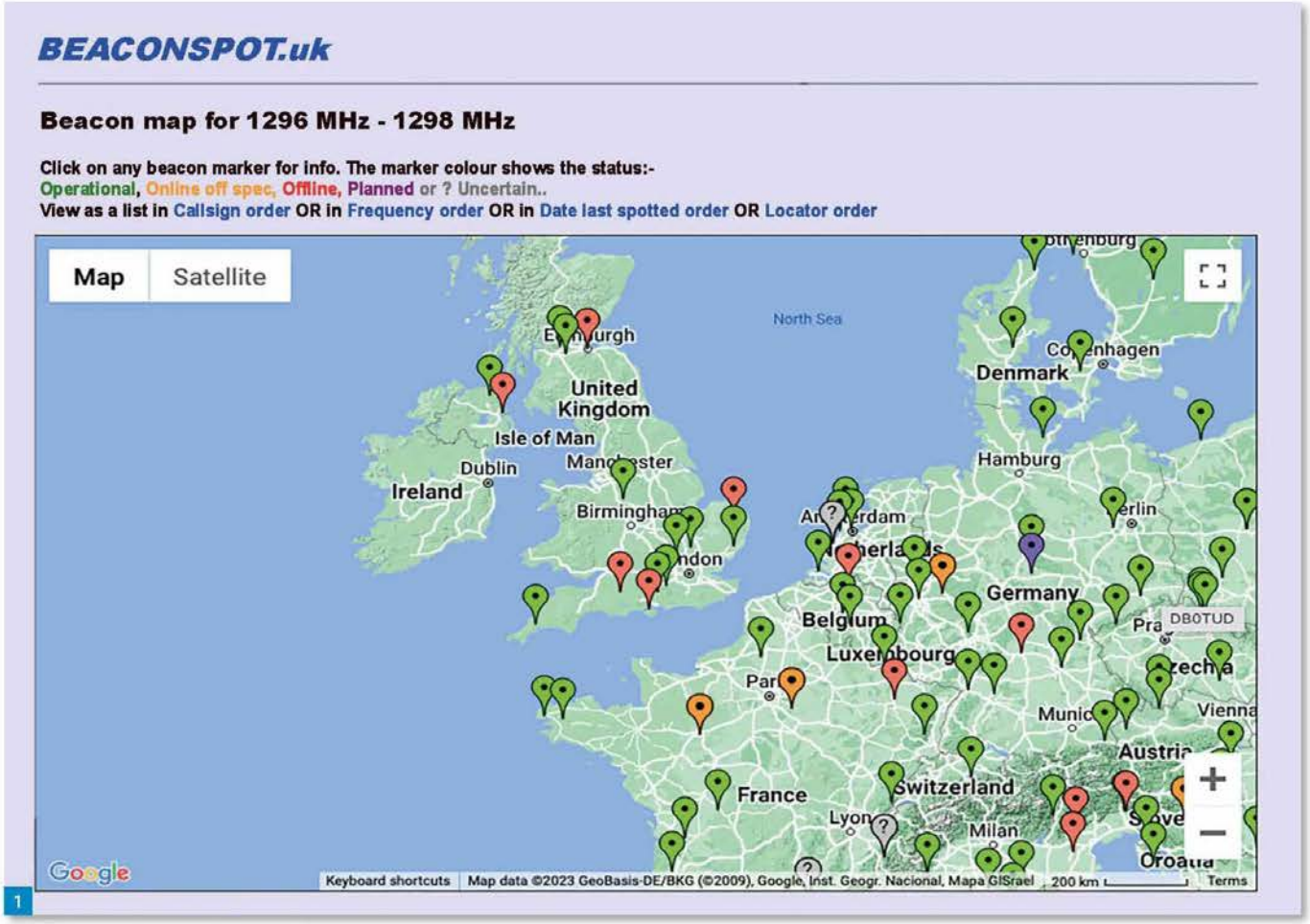


1

Beaconspot website

Tim Kirby GW4VXE starts his monthly roundup of VHF/UHF news with mention of a useful website.

Tim Kirby GW4VXE
gw4vxe@icloud.com

Dave Thorpe G4FKI says 'can you give a mention of the BeaconSpot website, **Fig. 1**?' Of course! The site, run by the UK Microwave Group can be found at:

www.beaconspot.uk/index2.php

It covers beacons from 6m to 76GHz. In the introduction, it says *"Beaconspot.uk presents an accurate picture of microwave and VHF/UHF beacons in Europe, plus 6m beacons worldwide. Data may be retrieved for a particular beacon, for analysis. Maps show beacon distribution by band, and spots coverage of every beacon. DXCluster incoming real time spots are collected, and outgoing spots can be sent to the DXCluster. Beacon keepers are able to maintain data on their beacon(s), and keepers can opt for email alerts whenever their beacon is spotted. ODX is recorded for every beacon, and distance to every beacon is shown for every spot for registered users. Spreadsheets (or CSV) can be downloaded for beacons and spots.* ***Alain ON4KST*** *supplies beaconspot.uk with real time DXC spots, in addition to the spots supplied by* ***Pascal F5LEN.*** *Thanks to both of them".*

Presumably owing to misuse, you have to register to use the site and even to see beacon listings, which is a shame, but registering only takes a moment. Dave also mentions that the GB3VHF and GB3UHF beacons in Kent are currently off air, owing to a power surge, but should be back on again shortly.

A manual for FT8CN

I recently included details of a FT8 program to run on Android devices, FT8CN. **Jef VanRaepenbusch ON8NT** writes that there is now an excellent manual, written in English by PA1AIS. The manual can be found at:

https://tinyurl.com/ys49ye35

The Quansheng UV-5K on 70MHz – too good to be true?

In the October *World of VHF* I mentioned the Quansheng UV-5K and how it seemed to be working on 70MHz. When I wrote the article and did the tests on the rig, I was away from home and the tests were perhaps a little more rudimentary than they should have been.

Although, when connected to the power meter, hitting the PTT causes a power of around 3W to be shown, what I had failed to notice, owing to a schoolboy error, was that the majority of power was actually on the second harmonic of 70MHz – ie around 140MHz. Given that the rig is designed for 144 and 432MHz, it's not too hard to imagine why this might be.

So, although the UV-5K will transmit on 70MHz – it's looking like milliwatts output on 70MHz and a big second harmonic on 140MHz. This is clearly a bad idea – even with a fairly inefficient antenna such as is supplied with the rig.

Nothing to stop you using the UV-5K as a receiver on 70MHz, but it looks like I advised you incorrectly about its transmission capabilities. My apologies for the error – where enthusiasm triumphed over diligence. A lesson learned!

My grateful thanks to **Bernie DF4NR** for pointing out my error.

Fig. 1: A map from the Beaconspot website showing beacons on the 1296MHz band.
Fig. 2: Allan GM4ZUK's portable station for the September 2m trophy contest
Fig. 3: FM DX received by Simon Evans in early September.


2

The 8m band

Both Jef ON8NT and **Roger Lapthorn G3XBM** report the exciting news that the 40MHz band is available to full licence holders (HAREC) in Belgium. 5W ERP is permitted using CW, FM and SSB as well as FT8 and WSPR. You can read the full text from the Belgian National Society, UBA, at:

www.uba.be/en/news/40-mhz-band-belgium-0

Roger G3XBM says that all reports of his 2.5W and dipole have been either Es, aircraft or local. He says that Es has definitely dropped off although he is still regularly heard in Eire, most likely by aircraft scatter. Roger is waiting for the F2 season to really get going.

The 6m band

Sam Jewell G4DDK (Ipswich) wrote, *"I thought the Sporadic E and multiple Es was poorer this year compared to recent years. I have still failed to break the 10,000km barrier. My best was 9900km to PY5KD. The short path multihop SpE to Japan is in the region of 9000km".*

Kevin Hewitt ZB2GI found a number of 6m Es openings through the month; on 6 August with the band open to Germany, 10 August to Spain, France, England, Wales, Switzerland, Italy and the Faroes, 12 August to Spain, Italy and Denmark, 22 August England, Montenegro, Germany, France, Isle of Man, Scotland, Wales, Italy, Austria, Belgium, and the Netherlands,

During the ILLW, Kev was part of the team from the Gibraltar ARS who activated Europa Point Lighthouse (GI001), including some 6m operation. Running 40W to a homemade 2-element Yagi, stations worked were 3A2MW (JN33), 7X2KF (JM06), DJ5FI (JN49), DL8RB (JN39), EA1IOK (IN62), EA1NL (IN52), EA7/YL3GS (IM76), EA7L (IM86), EA8AQV (IL28), G3XHZ (JO02), G7RAU (IN79), GW0KZG (IO71), HB9ALO (JN45), HB9RUZ (JN47), IK0FTA (JN61), IT9IPQ (JM78), IU5IFM (JN53), IV3XPP (JN65), IW0CUK (JN62), IW1CHX (JN35), IZ3KVD (JN65), ON7HLU (JO10), ON8DM (JO10), PA3KUS (JO21), ZS4TX/6 (KG46) and ZS6NK (KG46).

Jef ON8NT caught an Es opening to the north on 12 August, working TF/SP7VC and OY9JD (IP62). Jef runs 10W to a V-2000 vertical.

Steve Telenius-Lowe PJ4DX wrote from Bonaire (FK52) to say that he found 6m *"extremely disappointing"* this last month. *"In fact I have only made a single QSO on 6m, with 3C3CA in Equatorial Guinea on FT8 on 29 August. On the same day I also decoded a station in Canada but did not make the QSO. Since then - zilch! I gather that some stations further north in the Caribbean have started to work into Argentina and Chile by TEP but, if there have been any TEP openings here, I have missed them all. Let's hope for better things next month as we pass the autumn equinox".* Shortly after submitting his report, Steve emailed again to say that he had managed to work a single Cuban station and a few US stations. The US stations were managing to work deep into South America, but Steve says that nothing was heard from South America at his location.

Here at **GW4VXE** (Goodwick) I was very happy to catch a couple of TEP (+Es) events on 3 and 4 September between around 1930 and 2130UTC. On 3 September, I worked CE3SOC (FF46), LU8GMM (GG02), CE3SX (FF46), PY2XB (GG66) and on 4 September, I worked CE6TK (FF31) and CE3SOC (FF46). I was particularly pleased to work CE6TK who was a new grid and a distance of just over 12000km. Not much transatlantic propagation, although I worked VO1CH and VO1SIX on 25 August.

The 4m band

Kev ZB2GI caught a very brief opening on 22 August between 1820 and 1824UTC, working MI0BOT (IO74) and S57A (JN65).

The 2m band

It was a pleasure to work Sam G4DDK on FT8 recently. After our QSO, Sam and I swapped emails and he wrote that he has started chasing 2m squares once again and is now up to 171. He continues, *"with 6m now a bit quiet, I thought I might try 2x9ele YU7EF. These were made for me by G4ERO, but I only ever got round to putting up one. I lacked a suitable combiner and the will. After nearly 10 years I thought I ought at least to assemble the second one! It all seems to be there. The mice in the garage loft haven't run off with any part of it. Something has to come off the mast to accommodate the two and that will be the YU7EF 6/4, 5+5 element Yagi (also made by G4ERO) for the time being.*

"Since 1 January 2023, on 2m, I have worked 123 stations over 500km, 10 over 1500km and 5 over 2000km. The best was TA1BM (KN40) at 2463km (from my locator to centre of the KN40 square) during the SpE opening on 15 June. This is extreme, although possible, for single hop 2m Sporadic E and might suggest some tropo enhancement".

Kevin ZB2GI operated from the top of the Rock during the Perseids meteor shower, running 50W to a 5-element dual-band 2m/70cm Yagi. Kev used the FSK441 mode and worked CT9/OM3RG (IM12), IQ5MS (JN54), IV3GTH (JN65) and S51AT (JN75).

Jef ON8NT worked G7RAU (IN79) on 23 August using FT8.

During the 2m trophy contest on 2/3 September, **Allan Duncan GM4ZUK** (Aberdeenshire) operated from the Cairn O'Mount (IO86RW), **Fig. 2**. Best DX to the south was F5SGT/P (IN88), with DR9A (JN48) and DK0NA/P (JO50) worked to the south-east. There was an aurora during the event too, but activity was relatively poor, so that Allan was only able to work a couple of Swedish stations; SM0IJS (JO89) and SM4HFI (JP70)

Phil Oakley G0BVD (Great Torrington) also enjoyed the IARU 2m trophy on 2/3 September. Highlights of his log include GD2T (IO74), TM5R (JN19), GM4ZUK/P (IO86), PI4CC (JO21) and GM6MD/P (IO75). Best DX was GM4ZUK/P at 677km, which was a new square for Phil. Phil has been busy setting up his IC-9700 for data modes and hopes to be fully active on FT8 shortly.

Ian Bontoft G4ELW (Bridgwater) says that bits of tropo kept bubbling up during the month. On 22 August, Ian worked F5LMG (IN88), F6DBI (IN88), F4DXX (IN97), F6GLQ (IN98) and EA1HRR (IN83). On 23 August there was F5CBU (IN88), DL5DAW (JO31) and F1DZP/P (JO00) and then on 3 September, F4FWT (JO00). Ian says that during the week commencing 4 September, most time was spent looking on enviously as the Eastern

half of the country seemed to be working well into Europe, but Ian did work GU4EON (IN89), F8BON (IN86), F6DBI (IN88) and F3DJG (JN09) on the 4th, GU8FBO (IN89) and F1UPT (IN98) on the 6th and finally, on the 7th, propagation moved enough to allow Ian to work DF2ZC (JO30), ON8IM (JO00), DF7KF (JO30), DC6KI (JO30) and ON5UE (JO11). Ian runs 15W to a 5-element Yagi, 4m off the ground from the Somerset Levels.

At GW4VXE I have only had the vertical available for 2m, but kept an eye on the band during the month. Stations of note worked on FT8 included EI3IS (IO53), G4PEM (IO70), MW0UAX (IO71), EI2EUB (IO52), G4DDK (JO02), GW0WZL (IO73), GI6ATZ (IO74), G4DKB (JO01), EI4ACB (IO62) and G4GUG (IO81). It's surprising what's possible with just a simple system if conditions are right. I have also noticed a number of meteor bursts from well into the continent over the month, outside the main Perseids dates. I was delighted to be heard, myself, via meteor scatter, in Germany, when using just 50W to the V-2000 vertical.

Stewart Wilkinson G0LGS (Cheltenham) was pleased to work OE2JOM/2 (JN67) on 7 September. Initially Stewart heard him quite weakly, but fortunately signals built up nicely and Stewart was able to work him on SSB, exchanging 59/55 reports. The Austrian station was running 400W to 2 x 8 element Yagis at 1200m ASL. Other stations working into Austria included M0BUL, G4ASR and G4ILI.

Although this month, I haven't received any reports from the east coast, it's understood that the opening was excellent and stations such as LY2WR were worked (on 70cm too).

Peter Hyams GW4OZU (Pembroke) wrote to say that the GB7PD 2m (FM/C4FM) repeater is now running completely on renewable energy. He says, *"yesterday we added a wind generator to the previously fitted solar panel at the GB7PD site. **Ian MW0RRW** and I put up the wind generator, kindly donated by **Evan GW4AKZ**, who also donated the solar panel. GB7PD is now truly running only on renewable energy!"* For those of you in Wales, Ireland or southwestern England, do listen for GB7PD. It is well sited on the Preseli Hills near Maenclochog. You can find the output on 145.7375 with a CTCSS tone of 94.8Hz on FM.

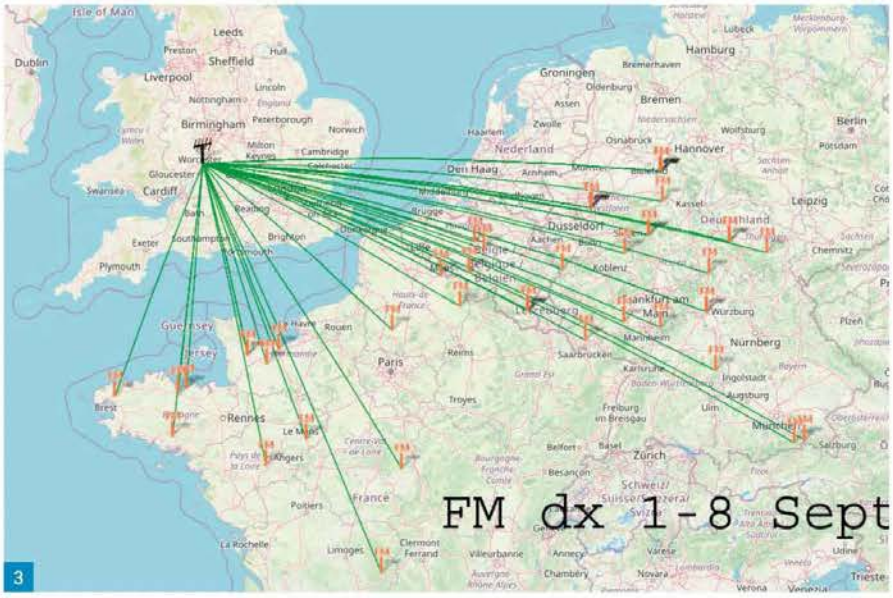
The 70cm band

Jef ON8NT worked G8EEM (IO93) and GW7SMV (IO81) during the FT8 Activity session on 9 August.

The 23cm band

Jef ON8NT uses 10W from his IC-9700 and a WIMO flat panel antenna. On 15 August, Jef could hear the Martlesham beacon GB3MHZ (JO02) and worked **John G3XDY** (JO02) on CW. Next day, during the FT8 Activity session, Jef worked ON5UE (JO11) and G7LRQ (IO91).

During the tropo on 5 September, Allan GM4ZUK took a 23cm antenna and a receiver to the top of the Cairn O'Mount and heard the GB3MHZ, DB0VC, PI7ALK and OZ5SHF beacons on the band. Allan sent me a video of the PI7ALK beacon and it was a rock crushing signal!



FM and DAB

Allan GM4ZUK also took his laptop, SDR dongle and a Band III dipole to the Cairn O'Mount during the tropo on 5 September. He could see many DAB signals on the spectrum but could not decode them all, he surmises because there were multiple signals on the same channel. He decoded MTVNL (Netherlands) ensembleID 8181, Channel 7d; NcastleGateshead (UK) ensembleID C1D2; Channel 8A; 8B N-H (Netherlands) ensembleID 808B, Channel 8B; TynemthSShields ensembleID C1D1, Channel 9B; 9C (Netherlands) ensembleID 809C, Channel 9C; Derbyshire (UK) ensembleID C1BD, Channel 10B; Norfolk (UK) ensembleID C1AY, Channel 10B; DAB2 N (Denmark) ensembleID 9002; channel 13B; DAB2 S (Denmark) ensembleID 9003, Channel 8B.

Adam Wisher (Cheltenham) writes, *"There were a couple of small Es openings to end August, I logged Germany, Austria and Hungary on 27 August, which was the most interesting one.*

"Since then though, there's been the intense tropo of the last week during the very hot weather. On FM as well as France and Belgium, I logged Germany - NDR Kultur from Stadthagen in Lower Saxony, and a few stations from Großer Feldberg in Hesse a couple of days later. Denmark also made an appearance with DR P4 Syd on 99.9 early in the morning on 5 September.

"DAB was pretty interesting, with the first reception of French multiplexes I've had here. 8D Amiens-Étendu from two sites in north eastern France on 4 September - that one made it down to me a couple of times despite the hills to my south and east! Up on the hills to the south of Cheltenham I also logged 5B Côte d'Opale from Boulogne and Calais, and 8A Lille Étendu, probably from the transmitters in the same area.

"Otherwise, I had a fair few of the new UK small scale multiplexes appear in overnight scans using the QIRX software, including the Leicester multiplex on 9B received in the early hours of 5 September, with audio decoded. The single transmitter for this ensemble apparently only puts out 20W ERP!"

Simon Evans (Twyning) writes, *"As is usual at this time of year, attention turns to tropo propagation rather than Es and we haven't been disappointed although there have been a few Sporadic E days as well. I have now received FM from 33 ITU countries. Most recent addition being Malta"*. During the tropo at the beginning of September, Simon received FM signals from well into Germany.

Simon continues, *"Tropo propagation in Band III is much rarer than Band II, but some DX can be found. The attached jpg* [**Fig. 3**] *shows the last month with the furthest being from Hessen in Germany. I use the QIRX program with my original RTL-SDR. Please note QIRX identifies the TX you are receiving. All of those had good audio coming through as well"*.

It's interesting to note that Simon mentions that Band III tropo is much rarer than Band II. DAB in Band III is around 200MHz. After all, higher frequencies quite often exhibit tropospheric propagation before lower ones (for example, you'll often notice an opening on 432MHz before you'll see it on 144MHz). It'll be interesting to see what further monitoring determines.

That's it for this month. Thanks to everyone who has been in touch. Remember, I'm always happy to hear from you about any aspect of VHF/UHF or microwave activity. If you've been planning to write but haven't got around to it, please do drop me a line. Thanks, as ever, to all the regular contributors. See you next month. **PW**

We're sorry we didn't see you all at the Newark Ham Fest this year, but hopefully the 2-day event will be up and running for 2024. The 'Fest' has become the UK's largest & best run show for Amateur Radio and it's definitely my favourite. To compensate for no show in 2023, I've told the lads to work on mad prices for kit during our Open Day on the 25th of November.

The store will be set out like our famous rally stands - **tons of gear all stacked up and marked DOWN in price**. So rather than sitting at home and getting bored on a Saturday, grab some friends and pop down to see the Lynch Mob and be fed and watered for **FREE**.

Not sure there will be an actual hog again this year (£2k for a hog anyone??) so we've invited back the best burger man in west London to feed all your smiley faces. Judging by the amount eaten last year I'd say it was a hit.

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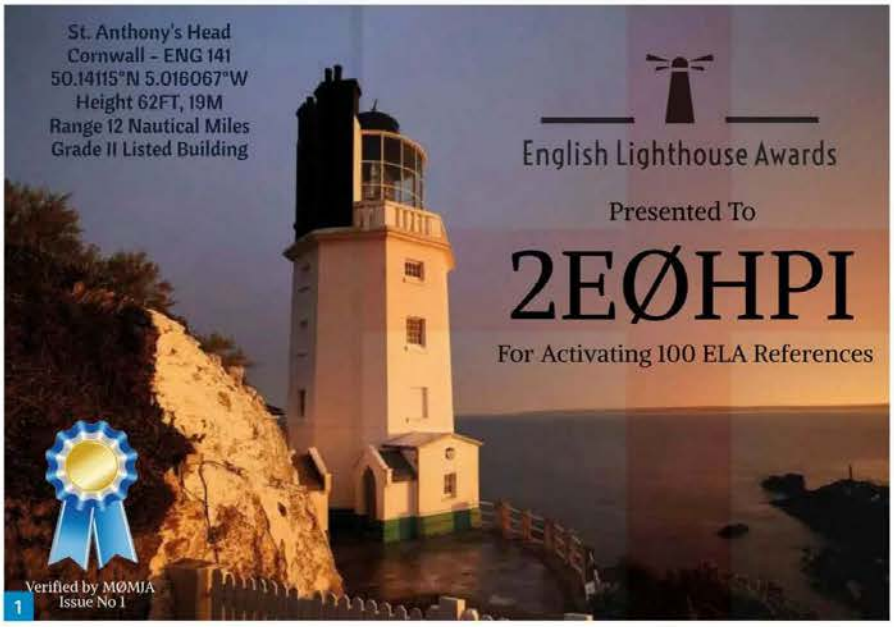

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Lots to look forward to

Steve Telenius-Lowe PJ4DX reports that October and November will see lots of DXpedition activity.

August was a rather strange and unexpected month as regards the 28MHz propagation beacons, reported **Neil Clarke G0CAS**. In general, the number of beacons heard via Sporadic E was well down compared to August last year but the number of DX beacons heard via the F-layer was up, obviously because of the continued rise in the sunspot cycle. This bodes well for the coming DX season this winter. The daily average number of beacons heard via Sporadic E was nine, compared to 14 last August. The daily average of DX beacons heard was seven compared to only two last August. The first USA beacon heard (excluding 4U1UN 28200) was on the 14th when AA1SU 28234 from Vermont was logged. On the 30th beacons from W call areas 2, 3 and 4 were heard. On the 31st the W6 call was logged thanks to K6FRC 28300. VA1VDM 28174 was heard on the 22nd, 23rd and 29th: this was the only Canadian beacon heard. From South America LU2DT 28193 and PY4MAB 28270 were heard on 26 and 20 days respectively. Looking on 28200 towards North America 4U1UN was logged on seven days and W6WX only on the 31st, while down in South America LU4AA and OA4B were logged on 24 and 11 days respectively. Nothing was heard from YV5B. Finally, 4X6TU was heard on 22 days.

The month on the air

The International Lighthouse Lightship Weekend was held on 19 and 20 August. Our reporters **Carl Gorse 2E0HPI** and **Kev Hewitt ZB2GI** sent in reports of their lighthouse activations (see 'Readers' News'). Carl has now activated 100 English lighthouses and recently received the certificate shown in **Fig. 1.**

Vlad OK2WX was active as **9Q2WX** from the Democratic Republic of Congo from 23 August to 9 September. He made nearly 27,000 QSOs, with over 50% on FT8.

E51D was active from Penrhyn Atoll in the North Cook Islands between 22 August and 8 September using three 'RIBs', one local and two remotely-operated. A RIB ('Radio In a Box') is an amphibious vehicle that can be landed on remote islets and its use helps to decrease the environmental impact of DXpeditions.

November DXpeditions

In last month's *HF Highlights* I said that there would be a huge amount to look forward to in October and it looks like November will also be a bumper month for DX chasers. Once again, there are too many operations to be included in any detail, but here are a few highlights.

One of the biggest DXpeditions will be 4W8X from Timor-Leste, with more than 20 operators and a huge amount of equipment and antennas being shipped to the island. As far as I know the precise dates were not announced by the time of going to press but it should be pretty clear when 4W8X fires up!

http://timor-leste-dx.de

A 14-strong international team from the Mediterraneo DX Club will be active as TJ9MD from Cameroon from 2 to 15 November. They have announced that *"at least four stations will be on air round the clock on CW, SSB, RTTY and FT8, 160 through 6m."*

www.mdxc.support/tj9md

A large French group plans activity as TX7L from the Marquesas Islands between 4 and 19 November. They will have four stations on all HF bands and will use SSB, CW, FT8, FT4 and RTTY.

tx7l.com/home

Six operators from Washington state plan to be active as H44WA from the Solomon Islands from 15 to 29 November on 1.8 to 28MHz SSB, CW and FT8. (Confusingly, a different group will sign H40WA from Temotu Province between 26 October and 9 November, as reported last month.)

www.h44wa.com

Five French operators will be active from Vientiane, Laos (**Fig. 2**) as XW4DX during the *"second half of November"*, until 27 November. There will be no activity on 80, 60, 30 or 6m, as those bands are not permitted in Laos, but they will be using the five high bands plus 160 and 40m.

https://xw4dx.f4bkv.net

Look for **Chris GM3WOJ** and **Keith GM4YXI** to be active as VK9XGM from Christmas Island from 21 November until 5 December. They plan to have two stations active using SSB and CW plus an additional station on FT8/FT4.

Shabu M0KRI hopes to be active as 9L5M from about 23 November to 6 December using a Hexbeam and vertical antennas. This will be a one-man operation but signals from Sierra Leone to the UK should be good.

At the time of going to press the exact dates are still not known, but PR0T is expected to be on the air from the very rare entity of Trindade and Martim Vaz in November. The island of Trindade is located around 1200km east of the Brazilian coast and is a restricted area, transportation being provided by the Brazilian navy.

www.pr0t.com.br/home

A shout-out to the DX-World website and the 425 DX News bulletin, both great sources of information on current and forthcoming DX activity:

dx-world.net
www.425dxn.org

Readers' news

Carl Gorse 2E0HPI/P went to Seaton High Tower Lighthouse (UK-0198) at Hartlepool Marina, **Fig. 3**, for the International Lighthouse Lightship Weekend (ILLW). He made around 100 QSOs using a Yaesu FT-891 at 50W to a Slidewinder vertical antenna *"with the latest multi-section whip"*. As Carl said, *"It's nice to see some DX coming*

Fig. 1: 2E0HPI/P certificate for activating 100 English lighthouses. Fig. 2: Look for XW4DX from Vientiane, Laos. Fig. 3: Location of 2E0HPI/P at Seaton High Tower Lighthouse (UK-0198). Fig. 4: Europa Point Lighthouse (GI-001), from where ZB2LGT was active. Fig. 5: OS8D/P activating another Belgian castle in August. Fig. 6: The harbour at Willemstad, capital of Curacao. Fig. 7: The station of Martin VK4CG near Brisbane.Fig. 8: GW0VSW's QMX transceiver kit. F

through".

Kevin Hewitt ZB2GI wrote that the Gibraltar Amateur Radio Society activated Europa Point Lighthouse ZB2LGT (GI-001), **Fig. 4**, for ILLW. GARS members Kev, **John King ZB2JK, Ronnie Payas ZB2RR, Rodney Pereira ZB3P, Ernest Stagnetto ZB2FK** and **Steven Harte ZB3Z** took part in the event, assisted by club regular **Andy**. One interesting aspect was activity on 14MHz SSTV: *"I transmitted six Martin 1 images of the Europa Point Lighthouse, three recent photos and three historic images, two courtesy of **Cess Davies GW3OAJ**, photos of the Lighthouse taken by him in 1946 when he was posted in Gibraltar."* ZB2LGT made around 1400 QSOs during the weekend, using SSB, FT8, CW as well as SSTV.

Tim Kirby GW4VXE, operating as **GW4MM**, enjoyed working several ILLW stations on 40m, ranging from GB5TLV on the Thames Light Vessel to GB1OL on Orkney and GB2EL in Northern Ireland and a good number in between. More distant lighthouses were also heard and worked on the higher bands from the US, Germany, Greece and Slovenia. Tim said *"I've noticed that conditions have been changing over the last week or two, from the summer conditions towards more interesting autumn ones... It's always nice to work Hawaii and KH6LC was very active during the Hawaii QSO Party – I was pleased to get them in the log on 20m CW. It was interesting to work V31CQ, also on 20m CW: the operator **Scott K5PS** was operating remotely from home in Texas. You wouldn't have known – there were no delays. Following a 15m CW QSO with **Lessa PP5IP**, no sooner had I sent my final 'dit dit' than the computer dinged with an email QSL card from him – it was half a second at maximum between the end of the QSO and the arrival of the QSL email!"*

We welcome new contributor to the column **Ben Nock G4BXD**, who nevertheless will be well known to many *PW* readers from his articles in the magazine. *"Taking a break from microwaves, I bemoaned the fact I only had a 135ft doublet antenna to use on the HF bands and thought it useless on 15m. Nevertheless, I gave it a go and to my surprise worked a few including JH0QEV, JE3WUK, JI2KXK, W9NY, KB0EO, V51MA, 7Z1VD/M, 9K2GR, VO1CH and even PJ4DX in the space of a few days. Maybe my bit of wire is not so bad after all, though I still dream of a tower and beam!"* Ben added: *"I have just put the AL-811 amp on the bench so have 600W available but the ATU is only [rated at] 300W so I now need to get a better ATU, then a better antenna, then a better rig* ad infinitum: *never-ending hobby!"*

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Etienne Vrebos OS8D had *"a quiet DX month"* but provided another update on his Belgian castle activations: *"Reached nearly 200 castles and 16,000 QSOs this year. Still my favourite passion for the moment and exciting as the chasers/hunters become more and more active to reach high amounts of chosen castles: two, one Belgian and one Italian, reached 1000 unique castles (unique means never activated before) and as I only activate ATNOs [All-Time New Ones], pile-ups are huge."* **Fig. 5** shows OS8D/P activating another castle on 24 August.

Jim Bovill PA3FDR said that he *"found that propagation in the 12m and 10m bands this month followed the pattern of previous months, with only four DX QSOs on 12m and six on 10m respectively... However, 10m did provide me with one new DXCC entity, the lovely island of Curacao (PJ2MAN)* [see **Fig. 6**]. *This pleased me especially as Curacao is the only Caribbean island my wife and I have visited, some years ago – happy memories. The other new DXCC entity this month, again from the Caribbean, was the island of Dominica (J73ESL). This month by far the most DX activity was in the 17m and 15m bands, including contacts for only the second time with the Cayman islands (ZF2OO) and Western Malaysia (9W2BAF). Noteworthy were also ten QSOs with Australia, the most I have ever made in one month."*

Owen Williams G0PHY was a welcome contact for me in the Worked All Europe contest, which took place on 9 and 10 September. Owen wrote:

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"Thanks for the QSO yesterday evening... I thought conditions were good on 21MHz with plenty of signals from the USA, Caribbean and South America... Some good DX worked including FO/F4FJH for a new DXCC. He was a good signal in the early mornings on 14MHz, bearing in mind that he was only using 100W and a vertical multi-band antenna... I had three QSOs with VK stations, the best was VK3BWP/P who was running 100W to a home-brew Moxon."

Down under to **Martin Burch VK4CG** (**Fig. 7**), who wrote from near Brisbane to say he was hoping to upgrade his antenna system to either a trib-and Yagi or a Hexbeam. Meanwhile, *"I have laid down some 16 swg coated wire 6 x 5 metre lengths to the base of the Hustler 4BTV, which has brought me up about 2 S-points until I lay a comprehensive wire matt under the lawn. Still hard work when it is busy so I am looking forward to a beam down the track but the Hustler is an improvement in some areas compared to the sloping wire."*

Finally, **Carl Mason GW0VSW** reported *"A package arrived this week with my QRP Labs QMX transceiver kit* (**Fig. 8**). *I am looking forward to putting this together and seeing how well it performs... I had a little more time to operate this month, especially with digital modes and have been using FT8 most days. My new Hustler 6-band vertical is now up and working but does need more work to fine tune each band, especially for 80m. A compromise antenna maybe but it gives me another option which might just improve the chances of working some DX again."*

Band highlights

Carl 2E0HPI/P: 14MHz SSB: KH6WI, VK5LA, VK5PAS, VK7JON/M, W1ARR. **18MHz SSB:** CO8LY, JA7EMG, JG3OYH, VK7JON/M, VY2FU, WH7T, ZB2LGT. **21MHz SSB:** 4Z1NB/LH, TC100TC, VK2FR, VK5LA, WB2QJ, ZB2LGT. **24MHz SSB:** K9ICP.

Gibraltar ARS ZB2LGT: 5MHz FT8: KA1J. **7MHz FT8:** K5YDD, VK3BD, VK4MA, ZL1IM. **10MHz FT8:** G3UQW. **14MHz SSB:** HS0ZEX, K4IOR. **14MHz CW:** K7BX. **14MHz FT8:** FK8HM, K6JJ, KL5EX. **18MHz SSB:** FK4QX, KO4TCL, PY3AR, VK2WD. **18MHz CW:** AC8TN, HK1MW. **18MHz FT8:** K3APW, VK3OM, VK4LW, YB3GIF. **21MHz SSB:** 6Y5OM, AA7G, HS0ZEX, KP4PK. **21MHz CW:** LU2DPN, PW7T, W6OAT, XE2AD, ZP5KO. **21MHz FT8:** LX8FTDM. **24MHz SSB:** MM0XNC. **24MHz CW:** K4DY. **24MHz FT8:** AA7G, CE2EC, CO8LY, CP6CL, CX8FB, FG5GP, HC1E, HI6M, HK5FX, K6BV, LU6ET, OX3LX, PP5DZ, VK2OV, VK5JR, VP9GE, XE1YD, YV4BCD, ZL1MTO. **28MHz SSB:** FY5KE, KP4PR, PY2KPP, PY3KD, ZP6MLF. **28MHz FT8:** 7Q7EMH, 8H78N, 8J1RL, BG8SRK, DS4AOW, JH1HHC, JH3CUL, JR4OZR, LU5FPJ, PU2RTO, VK3KJ, XP3A, YC1JEL, YC2SSD, YD3AVB, YV1DIG, ZS2EZ, ZS6AIH.

Kev ZB2GI: 14MHz SSB: 6Y5HM, HS0ZEX, K7CIR, KP2B, KP4CMT, PJ2MAN, PJ4KY, TI2MOT, VE3VEE, WP4JP, XE2SMG. **21MHz SSB:** MW1BZJ/P. **21MHz FT8:** CX1AAX, K7WE, PS7LN, VE6KQ, YY3ARO. **24MHz FT8:** JA1ILA, JF3KON, W7DO. **28MHz FT8:** 6D5C, CE2PSM, CX2DAJ, K6HLH, K7ACT, KB8FLI, LU3CQ, PT2ND, VK3KJ, WP4PNT, XE1H, YY1PHS, ZL1ECG.

Tim GW4MM: 14MHz CW: KH6LC, OA1/DL1CW, V26K, V31CQ, VK2GR, VK5GG, WC7Q (WA). **18MHz CW:** OA1/DL1CW, TZ4AM. **21MHz CW:** 4K5DHC, A61Q, CO8NMN, CX5FK, K7QA (MT), NG7M (UT), NT6Q (CA), OX3XR, P40W, UN6G. **24MHz CW:** OY1CT. **28MHz CW:** FY5KE, LU7HN, OA1/DL1CW, WP3C, XQ6CF, ZD7BG.

Etienne OS8D: 14MHz SSB: EK8A, FO4BM, UK8OCU. **18MHz SSB:** BD7BM. **21MHz SSB:** 8I78A, AP2HA, DU3/F4EBK, JH0QEV, PJ2MAN, YB1RDM, YC2DOT. **24MHz SSB:** 4L4GB. **28MHz SSB:** CD6LHE, CW5X, KP4SFA, PP1XX, PU2WDX, S79VU.

Jim PA3FDR: 7MHz FT8: N5QS. **10MHz FT8:** CO8ZZ, JA4FKX, N8NQ, T45FM. **14MHz FT4:** AI9T, JF3PNQ, R80WKB, V31MA, VK4AFU. **14MHz FT8:** BG4UCZ, BV7RR, JH4BYZ, RA9USA, UK8IF, V31DL, VK2LAW, VK3BD, VK5NEX, VK6RK. **18MHz FT4:** JA7CSS, W9ILY, YB9UA. **18MHz FT8:** 7Z1IS, 9W2BAF, BG2LAU, BH6LIG, HI3K, J73ESL, JA5BDZ, JA8JAK, N7QT, PY7XC, RA0QK, UN7ZAG, UN8PC, VK2BGL, VK3AWA, VK7AC, W5ADD, YB2DX, YB9WIC, YC5NBY, ZS2DL. **21MHz FT4:** CX1AAX, JA8BMD, JE2GEG, K0PLQ, LU4DRH, UA0AV, YB1PT, YD6AJL, ZF2OO. **21MHz FT8:** 5Z4VJ, 9K2YM, A65MR, JE1NZZ, JH2KKW, PY1XA, R0SCA, T77BL, VP2ETE, YC9RRR, ZL3IO. **24MHz FT8:** 7L2QAD, JJ1LBJ, PP5ZP. **28MHz FT8:** HI6M, LU2NI, PJ2MAN, RA9ACA, UN7FGZ, V31DL.

8

Owen G0PHY: 14MHz SSB: BH7FFR, FO/F4FJH, JY5FA, PY2JY, VI25AREG, VK3BWP/P, VL4U, TI1E. **21MHz SSB:** FY5KE, JA7NVF, NP2X, PJ4DX, TO7K (Reunion), WS7X, ZW2N.

Carl GW0VSW: 3.5MHz FT8: CS8ABF. **7MHz FT8:** EA8CZ. **10MHz FT8:** KC1RLS. **14MHz FT8:** TF3VG. **21MHz FT8:** TA1NGE. **24MHz FT8:** OD5ZZ. **28MHz FT8:** 4X1UF.

Martin VK4CG: 7MHz SSB: VK9DX (Norfolk I), **14MHz SSB:** DF0HQ, EA8NF, F5PAU, FK4UJ, FY5KE, IK4GRO, YB9YSS. **21MHz SSB:** JI1ICF, JN2AMD, ZL2AB. **28MHz SSB:** DV7DRZ, JA7OWD, JE6RPM.

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 January 2024 issue the deadline is 11 November. 73, Steve PJ4DX. **PW**

CW Bandpass Filter Design

In Part II of his article, **Alpar Cseley HA8KT** builds and test some filters based on the work described in Part I.

Alpar Cseley HA8KT
alpcseley@yahoo.com

In the first part of this article the design methods of the multiple feedback bandpass filters (MFBF) were described. Worked out examples proved that both calculation methods I presented yield the same result. Here, in this part the measurements necessary to evaluate the filter's performance are explained and demonstrated using two actual filter modules.

Building the filter, measuring the performance

Component selection (capacitors, resistors)

The quality (or sharpness of the passband), the bandwidth of the filter(s) is greatly affected by the selection of the components used. The main requirement here is the close tolerance: 1-2% spread of their values from the designed one of both the capacitors and the resistors alike.

The MFBF needs two identical capacitors (C1 = C2), preferably of polyester type. On the circuit diagram (see Part 1) **C** marks both.

Finding two identical capacitors (matched within 2%) and not standard values is not easy, therefore the design should start with the available capacitors having equal values within tight (1-2%) tolerance. The four resistors of the circuit, for example, could be selected from the E48 (2% tolerance) or E96 (1%) standard metal film resistor series.

The designed peak gain of the filter sets the minimum open-loop gain requirement of the op-amp for proper functioning. Two ICs were used in testing the filters: uA741 and TL071. The f_{unity} of the uA741 is 1MHz, the less noisy TL071 is markedly better with 5MHz f_{unity} (where the gain gets 0dB). For constructing the filters, the TL071 was chosen due to its lower noise.

Measuring the filter's performance

After number-crunching, the time came to build and test the designed filters. Using a plug-board test panel and having scraped together the components, the circuit was ready within a short time. The test instrumentation consisted of an audio generator/counter and a Telequipment scope, as no wobblerscope was available. First tests indicated the presence of low level 50Hz hum on the AF signal at all times, when a mains operated power supply was used. When I changed the AF generator and the filter supply to a 9V PP battery, the hum disappeared.

Filter properties to be measured: passband centre frequency, -3dB point (frequencies) on the response curve, bandwidth at -3dBpoints, *Q*. For measuring these parameters one needs either an AF generator (with accurate frequency readout) or PC based (software) generator and an AF voltmeter (FET). A tracking generator and scope (wobblerscope) could provide the filter's amplitude vs. frequency response curve.

Early, while testing the filter's breadboard (i.e. the test panel) prototype, both the AF generator/counter and the Telequipment scope gave up – according to Murphy's law (*if something can go wrong, it will*). Fortunately, though, a makeshift manually tuneable, simple AF oscillator came to rescue. This oscillator was used to quickly find the centre frequency of the passband, and sweeping with up/down tuning created the frequency response curve with the **Soundcard Scope** PC program (**Figs 1** and **2**).

Later, a software audio generator was used to automatically provide the AF signal sweep between 300Hz - 3kHz in loops, continuously, until the filter's amplitude response curve became smooth enough. Creating a smooth response curve takes one to three minutes.

This versatile AF generator and the scope software were found on the web, and downloaded free.

The **Audio SweepGen** as its name implies, provides sine wave (among others) sweeping from 20Hz to 20kHz **[3].** For our purpose, the ***Speech*** frequency range 300Hz - 3kHz was selected.

A PC soundcard (software-) based scope replaced the failed one. The **Soundcard Scope** has, among other facilities, the frequency analysis capability using FFT (Fast Fourier Transform analysis) **[4]**. FFT is a mathematical process, changing the data captured as amplitude vs. time data into amplitude vs. frequency series: E = t(time) into E = f(frequency).

In order to hear the filtered audio, initially an LM386 amplifier was attached to the filter, later the AF generator (headphone socket) and the scope input (mic socket) were directly connected to the filter PCB.

While the **Soundcard Scope** program provides numerous possibilities for analysing various signals, evaluation of the filter response (namely the bandwidth and passband centre frequency) by measuring the frequency at -3dB points is not straightforward. The cursor (dotted line) could be moved by clicking on the left/right arrows buttons on the PC keyboard. However, it does not move smoothly, but in 8.33Hz steps. Therefore, setting the cursor exactly to the -3dB amplitude points ('magnitude' reading) is usually not possible. The peak frequency reading is approximate, but accurate enough for finding the passband centre frequency and the A_{max} signal amplitude (see Fig. 6 again). Note however, the passband's centre frequency (by definition) is the geometric mean of the frequencies at the -3dB points. The amplitude at these points is $0.707 \times A_{max}$. Moving the cursor stepwise to the frequencies (and corresponding amplitudes) bracketing the -3dB value amplitudes, results in two pairs of f_{low}, f_{high} frequencies and the corresponding A_{low}, A_{high} values on both wings of the response curve.

The problem is that the frequencies at -3dB amplitude points mostly fall within two frequency/amplitude pairs. Because the response curves are almost straight between the data points around the 3dB values, linear interpolation is used for finding the corner frequencies on each side of the graph. By specifying the –3dB amplitude ($0.707 \times A_{max}$), the corresponding f_L and f_H corner frequencies could be calculated. On the logarithmic frequency scale, the passband center frequency is the arithmetic mean:

$$\text{Log } f_c = (\log f_L + \log f_H)/2$$

but on linear scale it is the geometric mean:

Making the measurements

SweepGen settings: Sine, Speech 300Hz-3kHz, Sweep mode: linear, speed: Fast (smooth)

SoundcardScope settings:
Frequency tab: Automatic scale, peak hold, grid, frq. scale:log
Settings tab, scope: On/screen values update 50ms
Average time 500ms

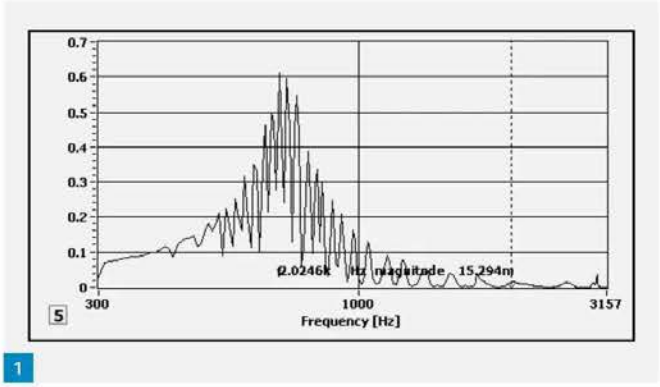
Importing **.csv** data:

Open the Excel spreadsheet where you want to save the data and click the ***Data*** tab. In the ***Get External Data*** group, click ***From Text***. Select the **.txt** or **.csv** file you want to convert and click ***Import***.

The FORECAST function of Excel contains linear regression. Applied on two pairs of data, the results are identical to the linear interpolation.

Fc=FORECAST(V_{-3dB}, f1:f2, V1:V2)

V_{-3dB}= -3dB down from V_{max}



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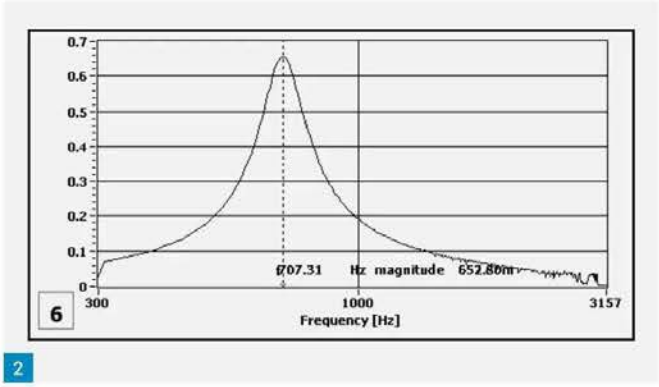

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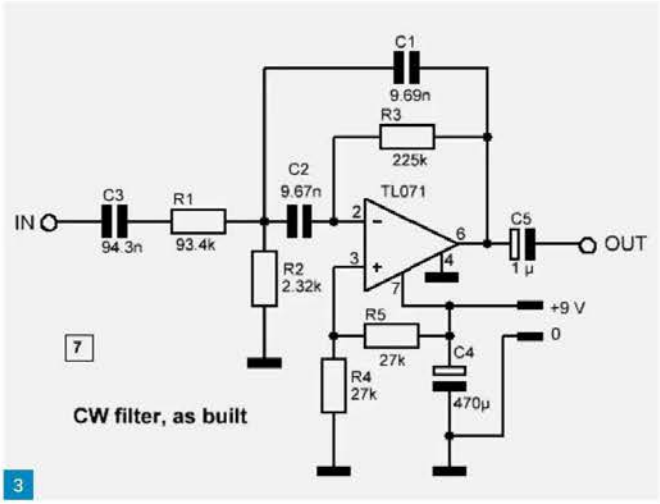

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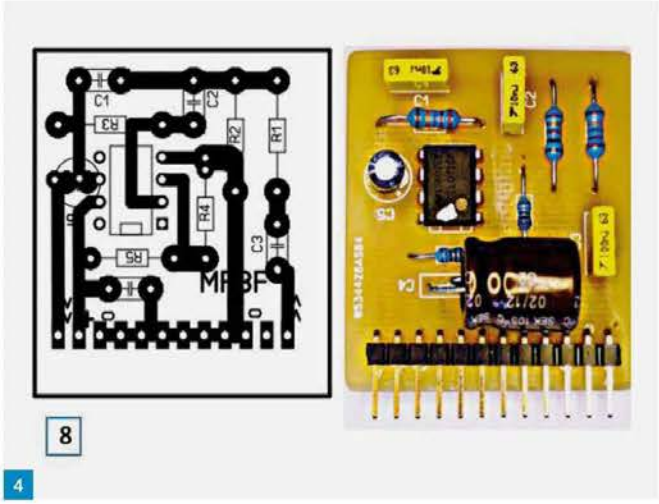

4

BANDPASS FILTER EVALUATION			
Frequency Hz	Amplitude V	A. max V	A. -3 dB V
633.213678	0.042335	0.06327	0.044732
641.545437	0.045068		(0.707 x)
783.185339	0.046771		
791.517098	0.044448		
fc low Hz	640.5		
fc high Hz	790.5		
Bandwidth, Hz	150.0	21.1 %	
Center frq Hz	711.6		
Q	4.74		

Table 1: Evaluation of the first filter design.

BANDPASS FILTER EVALUATION			
Frequency Hz	Amplitude V	A. max V	A. -3 dB V
674.872473	0.034341	0.050724	0.035862
683.204232	0.038311		(0.707 x)
758.190062	0.03641		
766.521821	0.032667		
fc low Hz	678.1		
fc high Hz	759.4		
Bandwidth, Hz	81.3	11.3 %	
Center frq Hz	717.6		
Q	8.82		

Table 2: Evaluation of the second filter design.

$$fc = \sqrt{(f_L \times f_H)} \quad [Hz]$$

Bandwidth: $BW = f_H - f_L$ [Hz] or $BW_\% = 100 \times BW/fc$ [%]

Luckily, after stopping the program, a 'save' function is available. Clicking on this sign on the screen results in the graph (both in colour and b/w) and a data file saving them to a given file location. The data file consists of the frequencies and corresponding filter response amplitudes, in semicolon separated **.csv** data file format. The **.csv** file could be imported into an EXCEL spreadsheet (see the sidebar at the end of the article) and further analysed. The file contains a series of amplitude = f(frequency) data, where the frequency changes by 8.33Hz steps.

Looking onto the amplitudes, we could pick up the maximum one. Multiplied by 0.707 results in the 3dB down value. By finding the bracketing amplitude values and the frequencies belonging to them (higher and lower from the max. amplitude), we collect the frequencies and amplitudes above and below the 3dB amplitude points (see **Table 1**). EXCEL has a built-in function for linear interpolation: *FORECAST* (see details in the Sidebar). Entering the collected data into an EXCEL spreadsheet, the filter main parameters are calculated automatically.

After the 'homework' was done, the time came for testing the theories. An MFBF module was designed, the PCB (size 35 x 40 mm) etched and populated with the components (**Figs 3** and **4**.).

Fig. 1: Amplitude response after one manual frequency sweep. Fig. 2: Amplitude response after multiple frequency sweeps. Fig. 3: MFBF circuit as built. Fig. 4: MFBF PCB and module. Fig. 5: Filter response, Q = 4.74 BW = 150Hz. Fig. 6: Filter response, Q = 8.82 BW = 81.3Hz.

This filter is designed for 700Hz, *Q* = 5. The calculated component values are:

R1: 113.68kΩ R2: 2.32kΩ R3: 227.36kΩ R4: 27kΩ R5: 27kΩ C1: 10nF C2: 10nF C3: 100nF

The components on the PCB are slightly different from the designed ones. R1 replaced with 93.4kΩ and R3 is a standard value, still giving a satisfactory result. R4 and R5 are for setting the offset bias.

The capacitors are smaller than the nominal 10nF (manufacturing tolerance) – thus the measured centre frequency is higher than 700Hz. Due to the component value spread, the *Q* is somewhat less than the designed 5. The 150Hz bandwidth definitively gives some audio filtering.

The amplitude/frequency graph shows the filter's character (**Fig. 5**).

Further experimenting with this filter, I redesigned one for *Q* = 10, being curious about the filter's character, the sharpness. Another MFBF was built onto another PCB and tested. The components were:

Continued on page 45

Keith Rawlings G4MIU
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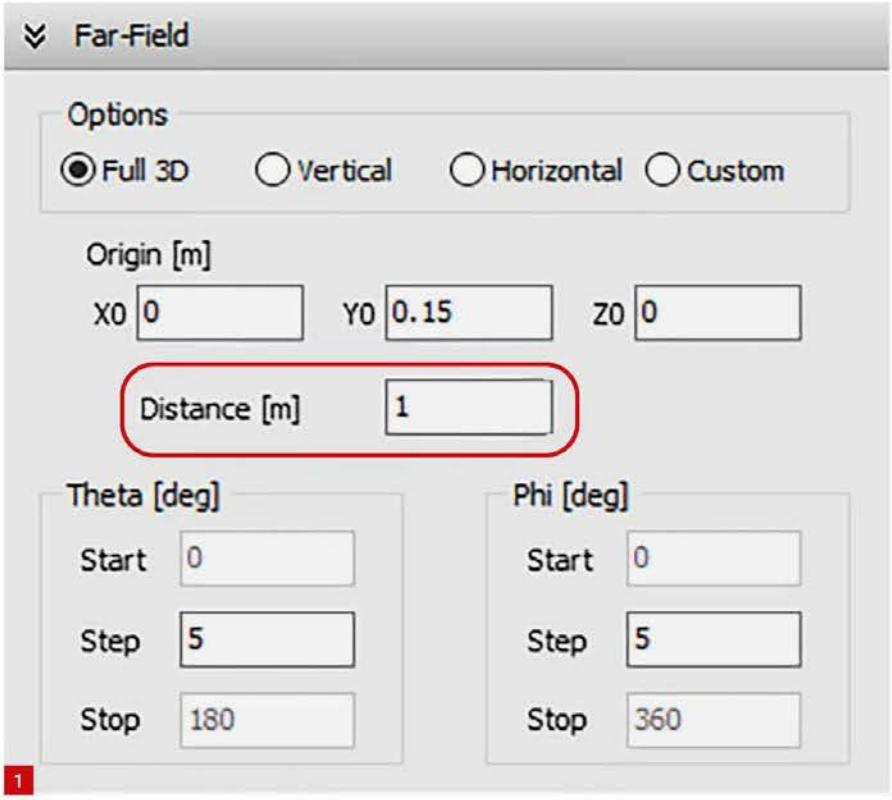


1

Modelling and EMF

Keith Rawlings G4MIU offers some thoughts on antenna modelling and EMF compliance.

In the August edition of *PW* I reported that the latest version of the AN-SOF calculation engine, 8.20, had successfully completed validation for accuracy in accordance with the IEC FDIS 62232 standard.

I added that while it was not something I had investigated I thought that AN-SOF should be accurate enough to model Electro Magnetic Field (EMF) compliance for antennas or antenna configurations.

I stated that where possible, the RSGB calculator should be used but if an antenna was not in the calculator, then an AN-SOF model could likely be accurate enough to give some idea if it will be compliant or not, especially in cases of HF antennas which have ground radials or are close the ground as this is something NEC-2 can struggle with. (But not NEC-4/5)

I contacted **Tony** at AN-SOF for his thoughts on this subject and I have reproduced his reply below describing how this could be done using AN-SOF.

From Tony: *I wanted to share some preliminary analysis I conducted on the EMF compliance topic. I'm sending you the information so you can consider advancing with a column if you're interested.*

*1) EMF compliance in terms of 'acceptable' thresholds is established based on the **Effective Isotropic Radiated Power (EIRP)**. This figure is well defined in the **far-field region** of antennas and can be directly obtained in AN-SOF using the formulas:*

Average EIRP = $4\times\pi\times R^2\times P_{av}$

Peak EIRP = $4\times\pi\times R^2\times P_{max}$

*Here, 'R' is the distance to the antenna as defined in the Far-Field panel, **Fig. 1,** and 'P_{max}' and 'P_{av}' are the maximum and average power density (W/m^2) respectively. Setting **Distance = 1 metre** in the Far-Field panel (or its equivalent in other length units, e.g. Distance = 3.28 ft), the EIRP can be obtained by multiplying 'P_{max}' and 'P_{av}' by $4\times\pi$ (approximately 12.57). You can find the values of 'P_{max}' and 'Pav' (of the model) in the Power Budget table, **Fig. 2**.*

*In the RSGB calculator, I see that the thresholds in the UK are as follows: **average power (average EIRP) <= 10W** and **peak power (peak EIRP) <= 100W**.*

In the example that I show in Fig 2, we have:

Av. EIRP = 12.57 × 0.795 = 9.99W

Peak EIRP = 12.57 × 5.96 = 74.9W

Therefore, these values are OK since they are below the established thresholds.

*2) **EIRP is independent of distance in the far field.** Note that the power density 'P' decreases with the square of the distance (R^2) in the far-field zone, and when multiplied by R^2, a constant value is obtained (it only varies with frequency for a given antenna, ground plane, and physical-geometric parameters). However, in the **near field**, EIRP becomes a function of the distance to the antenna, 'r', and the direction of observation, '(theta, phi)':*

$EIRP(r,theta,phi) = 4\times\pi\times r^2\times P(r,theta,phi)$

The near field zone varies significantly from one antenna to another, making it challenging to establish specific thresholds. As a result, most compliance standards set limits in the far field zone. Determining where the far field zone begins can be complicated. I've covered this in more detail in this article.

https://tinyurl.com/t3jw5awv

*3) You can adjust the **input power** to the antenna in the 'Excitation' panel under 'Set Input Power', **Fig. 3**.*

As you change the input power, you'll notice corresponding changes in the EIRP values.

4) I haven't had the opportunity to test some examples mentioned in the RSGB EMF Calculator, but it appears to be based on far-field approximations for each type of antenna. This is logical as it is a calculator that incorporates known mathematical formulas for each case, rather than an antenna simulator.

*AN-SOF also incorporates the calculation of the transmission line used to feed the antenna ('Feed Line' tab), similar to the 'Feeder' feature in the RSGB calculator. This calculator mentions that its values might overestimate EIRP values, but **this claim should be verified**.*

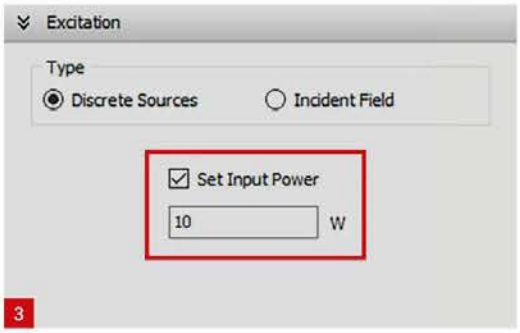
My sincere thanks to Tony for his explanation.

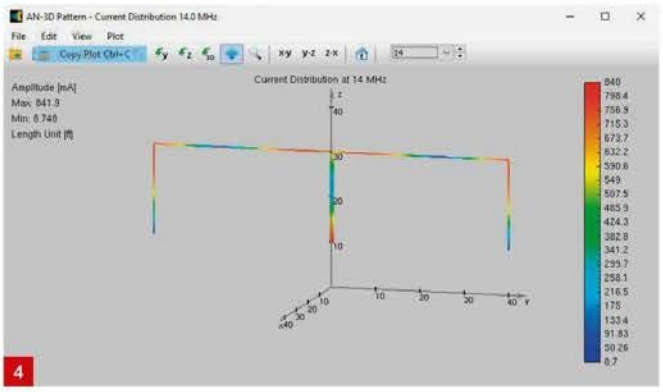
While this may be considered an advanced method to determine if an antenna is likely to be compliant or not, it demonstrates that it is possible. However, I am not suggesting that it is essential as in the majority of cases, for UK amateurs, the RSGB calculator is sufficient.

This being said, where there is no data for an antenna this information describes that, in this case using AN-SOF, it is possible to assess antennas compliance. It can also be interesting and great fun to do too! Remember though, that to fully assess compliance users will have to make their own calculations for Mode, Duty Cycle etc.

Incidentally the software can easily calculate and demonstrate currents likely to be found on any part of an antenna and **Figs 4** and **5** show estimates of current as a 'heat map' on my old doublet, (described below) on 14 and 28MHz.

This model does not take into account any surrounding objects.





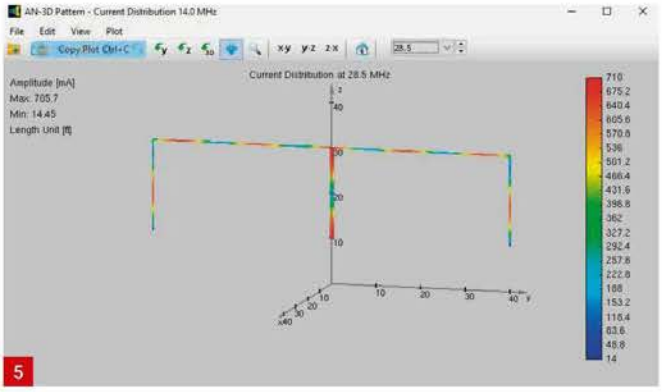


Fig. 1: Setting the Far Field distance in AN-SOF. Fig. 2: Average (P_{av}) and maximum (P_{max}) power densities in the Power Budget table. Fig. 3: Inputting the Power Level for a Simulation. Fig. 4: Calculated Currents on my Doublet 14MHz. Fig. 5: Calculated Currents on my Doublet 28.5MHz. Fig. 6: Damaged Remains of my PA0RDT Mini Whip.

Considerations

As amateurs it is important not to get too tied up on the subject of EMF. OFCOM are happy to accept figures based on the RSGB calculator and that is all we need to worry about.

I know many have had to make changes to their stations, and I am one of them. I used to have a doublet where the ends hung down, one end by the side of the house, and the other hung from a tree in the back corner of the garden, the wire ran down to my fence where it was affixed to a post. Just behind the rear fence a neighbour has access to his garage and often parks his car close to the fence and so comes within a couple of feet of the end of the wire. It is the same with next door. I can't be certain that there won't be anyone in that corner of their garden.

Also, where the wire came down next to my house it is probably no more than about four feet away from the boundary that side, again I have no control over who goes near that area. So, before I put a transmitting antenna back up I have some thinking to do.

There are positives to being EMF compliant. If there are any issues with neighbours on RF levels, we can now confidently state that we are compliant with the national regulator's permitted levels and that our stations are safe to operate. Also, should there be objections to a planning application for a mast or antenna where claims are made about RF exposure levels then, once again, we can demonstrate we comply to the regulators safe permitted levels. Not that I think EMF or RF levels are a matter in planning anyway.

So, do the calculations, file the results as required, make adjustments if needed, and get on the air!

Measuring levels

There seems to be a general consensus amongst a number of amateurs that cheap EMF meters that are offered on places like Amazon etc are best avoided. Most have been found to be very inaccurate and few seem to have any calibration figures.

If you or anyone else are serious about making EMF measurements, then I expect one of these would be useful!

https://tinyurl.com/tf6vsh68

The bare analyser alone costs £8480 and that price is probably plus VAT too!

This is a random selection from a look on the R&S website and, OK, it is a bit of an extreme example but it may well be representative of the type of equipment that a regulator may use if they were to assess EMF levels. Also, their engineers will have the training and experience to assess each individual situation to ensure measured levels are accurate.

How did that happen?

Sherlock Holmes stated that *"There is nothing more deceptive than an obvious fact."* Well, I don't know if what follows is 'obvious' but I can't think of another explanation.

Earlier on in the year I came out of my garage into the back garden to find a pigeon lying on the lawn. There were a few odd feathers spread around and the unfortunate bird looked quite dead.

Having dead pigeons around the place is not an uncommon event here as we have had a number of occasions over the years where Sparrowhawks have either taken down pigeons mid-air right in front of us or brought them into the garden to have a feast on. The last occasion this happened I managed to video one of these hunters tucking into its meal no more than a metre or so away from my front door! However, in all the occasions this has happened there is always a circle of feathers strewn around the carcase where the Sparrowhawk has pecked away at its prey.

On this occasion there was no sign of damage to the pigeon, no circle of feathers, in fact it looked quite 'peaceful'. Not knowing how the bird reached its demise I put it down to a cat, picked it up, put it in a bag, and took it over to a nearby farm where there is a nesting box in a barn, and this has a family of Kestrels living in it. The farmer will often leave various 'morsels' nearby to help the adults feed their young. An inspection revealed that my pigeon had a broken neck and was therefore safe to leave out for the Kestrels.

This, I thought, might rule out the theory of a cat catching the pigeon. I went home had another look around the garden, saw nothing obvious and left the pigeons demise as a mystery.

Sometime after this episode I returned to an in-

EMF links of interest

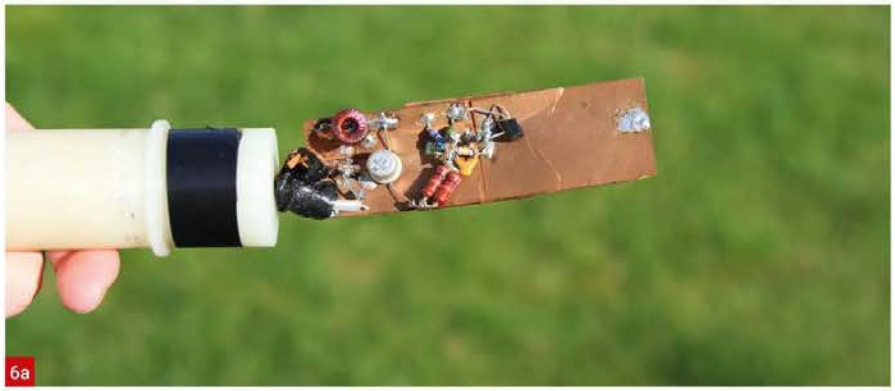
OFCOM Electromagnetic field measurements near mobile base stations:
https://tinyurl.com/ftaxyutw
https://tinyurl.com/2p5jpwtu
RSGB:
https://tinyurl.com/4r5jsz7d

terference problem here where a source of noise has appeared that causes a problem with reception from below 100kHz and into the MW band. It is intermittent in nature and levels can vary from low to severe with the highest levels around 800kHz and 1500kHz.

It is very annoying on the NDB band, which I enjoy listening to, mainly, during the winter months although I do also casually listen during the summer.

Being bad on my 66ft end fed and also my Wellbrook loop I placed my PA0RDT Mini Whip back into position on its pole to see what the QRM levels were like on that. Sadly it was equally as bad.

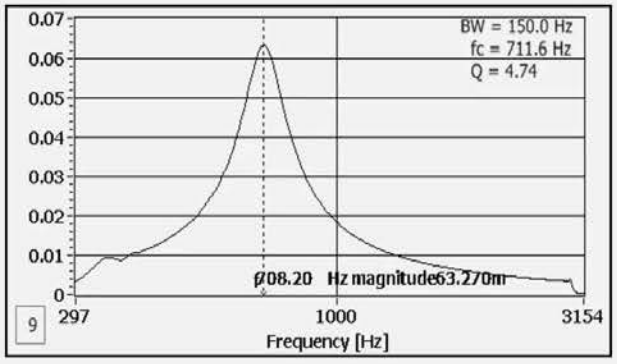
As I said, I came back to investigating the issue and found the Mini Whip was dead, no signals from it whatsoever. Clearly it had become faulty. I took it down for inspection, disassembled its housing, and to my amazement, I found the PCB to be smashed, **Fig. 6**. The antenna has a sturdy machined base that fits into the pole being used and the antenna itself is housed within some


6a


6b

35mm waste pipe with a cap on the end, which itself is sturdy. The piece of PCB glued to the rear of the board was there for the very intention of strengthening it at the cut in the track on the other side. Going back to Sherlock: *"How often have I said to you that when you have eliminated the impossible, whatever remains, however improbable, must be the truth?"* So, was there a collision involving the Pigeon?

See you all next month. **PW**



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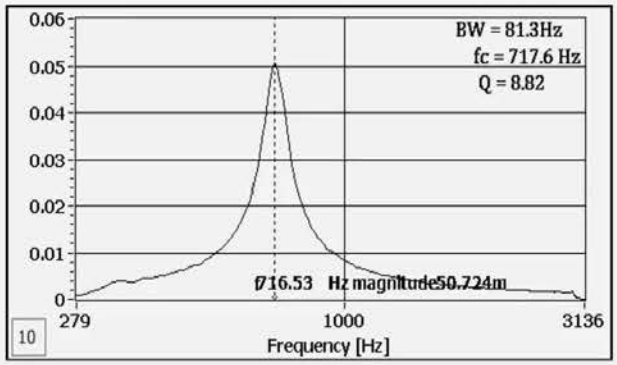

6

Continued from page 42

R1: 225kΩ R2: 1.12kΩ R3: 455kΩ R4, R5: 26.9kΩ C1=9.15nF C2=9.22 nF

The results are shown in **Table 2**. The bandwidth became narrower than before. The centre frequency is slightly off from 700Hz, because the capacitors (again) are smaller than 10nF used in the calculations. All in all, the total effect is that the *Q* is less than the designed 10, but the filter's response is definitively sharper (**Fig. 6**).

Working through the design methods presented in the first part of this article gives a good basis for creating MFBF filters to suit to one's need in passband frequency and bandwidth. Using the free PC based tools, SweepGen and SoundcardScope, enables us to analyse the built filter's responses. Beyond that, these programs should belong to the toolbox of those who still enjoy pursuing new ideas by drawing up unique circuits, soldering parts to PCBs and studying the behaviour and character of their pet projects.

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[4] Soundcard Scope v1.47:
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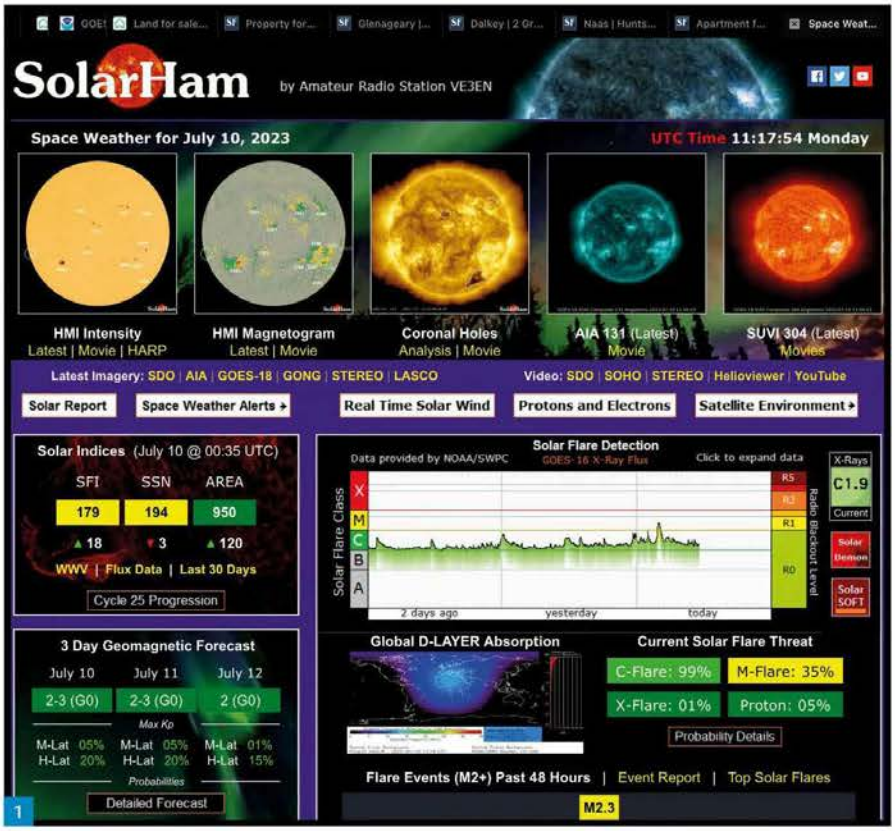

Moving forward

Joe Chester M1MWD assesses the threats and progresses his station development.

I do not want to be considered an alarmist. So, I am going to temper this piece with a note of laidbackness (sorry Don, terrible word, but it fits!). Last month I outlined the technical details of my start on the off-grid station – a full-on portable amateur radio station, powered only by rechargeable batteries, and these recharged by renewable resources. This month, I would like to get to the heart of the main rationale for this discussion – the Prepper argument. The project progress report, and more detailed amateur radio technical discussion, is at the end.

I assume you know the Prepper argument. Just in case you don't, I will summarise it like this. Civilisation as we know it is about to experience a catastrophic breakdown. Well perhaps, and maybe not. I propose to leave aside events knowns as Extinction Level Events (ELEs), such as major unexpected asteroid strikes, the Moon falling, or a widespread killer pandemic with no cure. These are too extreme to worry about in amateur radio terms. On a lighter note, this also means ignoring a possible zombie apocalypse although I have met people who believe in this; zombies are just a movie thing for me. And I am also going to ignore arriving aliens too. I can entertain you for hours with my arguments against their popping up in this corner of the Universe any time soon, but let's not go there for now.

Which leaves us to ask for what are we prepping? It can be a long list, but I will stick to a few specifics and a generalisation, all under the umbrella term TEOTWAWKI. This is shorthand for 'the end of the world as we know it', and it's a phrase in common currency in the United States, from which I returned relatively recently. Leaving aside the extremist arguments, like the ELE preppers, which seems a pointless exercise to me, we come to a list of plausible catastrophes that could precipitate a general collapse of human society. And climate change may be one of these, but it's not yet certain if and how this would happen. These include events on a scale less than that of an ELE, e.g. an asteroid strike like in the movie *Deep Impact*, or a limited nuclear war, or a devastating pandemic. In the Prepper world, these are more or less likely, depending on your mood, and we need to start making plans to survive, i.e. prepping. Let me say straight off that I have no idea if TEOTWAWKI is imminent or not. Others are more convinced of this. But I can give you statistics, based on real science, if you're interested.

Assessing the risks

Let's deal with the risk of an asteroid strike. Did you know, that the chances of being personally hit by an asteroid is many, many orders of magnitude (powers of 10) less that your chances of winning the Lotto? This begins to give you some appreciation of the numbers involved here. This is not a scientific journal, so let me just list the highlights. We have been searching the skies for significant incoming asteroids for decades now – digital cameras expanded this effort exponentially. So, we are as sure as science can be that there are no significant risks of a large asteroid hit this century, or at least as far ahead as our computer ability can calculate. No, you don't have to believe me but it's true (go do your own research on credible websites, not the rubbish pushed by unqualified 'activists').

Which brings me to the pandemic risk. COVID was a wakeup call. Inquiries, and more importantly, scientific analysis have ramped up many-fold. Yes, there is a risk of mankind being hit by some catastrophic medical emergency, but it's not really on the scale, say, of your risk of breaking your leg falling off a footpath (one of the main risks of death for people my age and older). And the COVID experience has created a whole new category of mRNA drugs, which are amazingly potent at targeting nasty stuff. Which brings me to the risk of a catastrophic nuclear war, or incident even. Many, many people worry about this professionally; they have invented a doomsday clock as their indicator of their concern. It has stood at a few minutes to midnight for many decades now, due to various instabilities in the world. So far, it has never reached midnight. And we have to live with this as their best prediction for the future. So, it's possible but ask another question. If you are not a multimillionaire with a fully stocked cave system somewhere safe, and even if you are, then would you really want to survive a nuclear war? For how long?

Which finally brings me to what I perceive to be the biggest risk of TEOTWAWKI. Which is our friend the Sun. No, it's not going to explode next year – science knows enough to dismiss this conjecture. But the Sun does throw off enormous streams of charged particles on a regular basis. This, in my view, is potentially a much more serious issue. Look at SolarHam, **Fig. 1**, and you will see this activity for yourself. Space weather scientists monitor this activity 24 hours a day using deep space satellites. Their work gives us propagation forecasts, such as the K-index, and forecasts of coronal mass ejections (or

Fig. 1: The SolarHam website.
Fig. 2: FT8 signals being copied.
Fig. 3: The RA3OA antennas.

CMEs as they are known). It's CMEs that cause auroras, and severe ones can disrupt satellite communications, and even produce power spikes in power grids. Although not caused by a CME, the event known as the Northeast Blackout of 2003 [1] disrupted a huge portion of the eastern United States, which had the unintended consequence of a spike in the birth rate nine months or so later! **Rick Lindquist** [2] wrote an important piece in *QST* about amateurs providing communications services during this blackout. Writing in *Scientific American*, June 2023, **Rebecca Boyle** reminded readers of a CME in 2022, which caused 40 newly launched Starlink satellites to lose altitude and burn up in the atmosphere. So, CMEs are dangerous. And power grids, by and large, are not really protected or 'hardened' to resist these kinds of incidents.

Darrall Cutting from Australia, in the same issue, mentioned what science knows as the greatest ever CME. It happened in 1859 and resulted in a great deal of disruption, including fires in telegraph stations at the time. This event is named after the astronomer who witnessed and reported the solar eruption that led to that CME. It's called the Carrington Event. Boyle then goes on to say *"that solar activity does not need to be that severe to have an impact"*. So, what we have is the unpredictability of the Sun's activities, with the risk of severe disruption to satellites and worldwide power grids on Earth. Which in turn will have catastrophic impacts on communications services. Or to put it another way, effectively, the possible end of the internet and the world wide web. And how much of an inconvenience would that be?

So, to communications

Given the evident push by all kinds of organisations, state controlled as well as business, to move more and more services online, and the de-skilling of branch staff and closures of local offices, then we have a recipe for a potential catastrophe. Recipe mind, NOT FORECAST! It's a possible scenario of which we should be aware. Which brings me back to Preppers, and their plans to survive a major breakdown in the systems on which our lives depend, especially our communications infrastructure. Plans in which we, as communications systems experts should and must participate. Its surely a sort of obligation for us? If we ever come to a breakdown in the social structure of society, then communication is the first essential for restoring social contact and thereafter a restoration of normal service. And maybe even a return to the ubiquitous use of Morse – yes, I've seen the movie *Independence Day* too! Which in turn brings me to my project.

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RAYNET has been providing voluntary and emergency communications services for over 60 years, essentially covering the same issues as the Preppers

I believe that every, yes every licensed radio operator should have a go-bag, and be willing and able to set up emergency communications if such is required, either at local or community level. This need not be a full sized QRO system, with backpack SteppIR antenna and rotators; but surely a QRP /P rig is not too much to ask, with maybe a few lengths of wire for antennas and counterpoises. Which brings me to practice, rehearsal if you like, by going out to a field site, park, beach or wherever, and setting up and making QSOs, HF or otherwise. This is not only fun, but also good operating procedure. It first of all makes sure that your go-kit has all the pieces you need, but also makes sure that you know how to operate the equipment. You don't want to be in the middle of an emergency and needing to read the manual to find the RF power knob!

I will leave this topic with a mention of RAYNET, which has been providing voluntary and emergency communications services for over 60 years, essentially covering the same issues as the Preppers. And governments around the world are beginning to take these issues more seriously too.

My friend **Simon GM0SCA** told me about a preparedness project he was involved with in Scotland, which involved radio amateurs setting up a coast-to-coast radio service as part of this test. Called *Exercise Mighty Oak*, it was organised by the UK and Scottish Governments *"to support the development of a national response to a National Power Outage"*. Classic Prepper agenda? Yes! So, maybe the Preppers are really on to something.

Progress report?

It's going very well, thank you for asking. Only a few know what I am at, so the occasional blessing is much appreciated. All the new equipment is here – well, not quite, but that will keep for a later report. And all the software has been downloaded on to the old laptop, and to the new tablet PC. Tests with the IC-7300 using the laptop ironed out a few issues, which I mentioned last time. And the new IC-705 is working, HF and VHF. Of course, the D-STAR issue is still ahead, but the first steps in that direction are now completed, with thanks to **Jerry** in Icom UK, who quickly registered my callsign on the GB7IC D-STAR gateway. We had a chat about some other stuff, relevant to operations on D-STAR (and elsewhere), and I will get to them in due course.

Then, one evening, I decided to jump through a few steps in one go. With the IC-705 running,

and WSJT installed on the tablet, I decided to connect these two devices together. Now there is something really interesting further down the road, but one test at a time. The IC-705 has a micro socket as well as the USB-C only for charging. The tablet has a USB-C connector. To connect them I needed the right cable, i.e. USB-C to micro; but all the micro cables I had are USB-A. This is an issue going forward, because there are lots of things that might need connecting to that single USB-C port on the tablet. A disk drive, for instance, and USB sticks. So, I bought a 9-1 adapter, with a range of ports. There were three USB 3 ports for instance. So, I plug the adapter into the tablet (nice design, by the way), and plug the USB A end of the micro cable into this.

But of course, there is one more step before this – download and install the USB driver for the IC-705 on the tablet. Easily done; then check the Device Manager to find the right COM port (it's COM 4), and check that there were new audio devices also installed. Then boot up WJST, enter the callsign, locator, select IC-705 in the drop-down menu, and select the new audio devices. Check CAT link – worked. Then Transmit – that too. Click OK, and there are the FT8 signals in the waterfall, and decoding in the relevant boxes, **Fig. 2**. Just a brief caution – check that the baud rate of the COM port you are using is the same as that being used by WSJT.

Of course, it wasn't an evening without a hiccup. I had forgotten what I knew about system updates on Windows machines – like hit 'update' and then go off for a week's holiday, sort of thing. And in the middle of this test, the tablet went into full-on automatic update mode. Fortunately, it finished after a few hours, so I got to finish the test. Note to self – turn off automatic updates!

So, I have just completed my first test of my main off grid station – IC-705 connected to the tablet PC with the right cable, and FT8 running fine. All on batteries. And with that length of wire on one of the wardrobes as an antenna. If it goes that well /P, I will be very happy. And with this setup, I can also run HF, and with a 2m/70cm antenna V/UHF QSOs, simplex or through a repeater. But I am not done yet. Because I don't actually need that USB cable!

The IC-705 comes with WiFi on board. For those who are not aware of this, you need the latest firmware version, available to download from the ICOM website. This means it can be connected to a WiFi network, of which more later. It can also be used to allow WiFi enable devices to connect to the IC-705! You need an app to get the most out of this – the main one being that supplied by ICOM, RS-BA1. The issue is that you can only buy this from a registered ICOM dealer, on a CD. I asked them about this, and the answer I got was that this is to protect their investment by preventing people putting it on the web for free. But the rest of the world does this rather differently, by bundling! Clearly ICOM accountants don't want to do this. So, I wait for the post to get around to delivering the CD. It also means that I will need a rather old-fashioned device in order to use this – a CD drive! But there is another solution.

SDR-Control allows me to run the transceiver from my iPad without any wires attached between them

There is an alternative to the ICOM app. In the interest of the readers of this magazine, I decided to check this out. It's called SDR-Control, by **Marcus Roskosch**, available on the Apple App Store. And it works, allowing me to run the transceiver from my iPad without any wires attached between them. This means making HF or VHF QSOs, using the iPad microphone and speaker. Of course, at my current QTH this is just not quite feasible (but see below) because of my antenna restrictions. But this app is downloadable, and you can run the radio over the internet with it, i.e. full remote operation, if this is allowed by the terms of your licence. This app is very useful, and has the benefit of being downloadable, and even of being less expensive than ICOM's official product. And it's fun to play with. It is also much easier to install than the ICOM product, which requires multiple entries in a dozen setup screens (I have been doing my homework!). But I have a doubt about it, functionally, compared with the alternative. And it's an IOS product, when most amateurs are already invested in the Windows world, because of the amount of free software available for that system.

The National Radio Centre (NRC), while not necessarily typical of most amateur radio stations, is still not atypical in this regard. We have six PCs there, all wired up to the radios and to large screen displays. So, my wait for the postman continues.

While waiting, I decided to set up outdoors and make my first SSB QSO with the IC-705. There is a park nearby, and a contest on, so there is plenty of activity on the bands. Unfortunately, it was the morning after the night before, 19 March to be exact (work it out for yourself!), and there was a bone chilling drizzle in the air. So, I decided to sit it out at the QTH. I listened around and checked a web SDR for activity.

On the IC-705 I saw a few strong signals on 28MHz so I moved up the band a bit, and found a good match with my wardrobe slung wire, then tuned into a strong signal. Usual procedure, I listened for a few minutes to check the contest


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exchange; he is RA3OA, and then pounce in a gap. First time 'EI6IHB 59 VR' came back immediately. I gave him 59 001. And decided I needed a strong coffee. Because this is ridiculous. Ten watts, manual tuner, and a piece of wire, indoors. I looked him up on QRZ, **Pavel**, in Voronezh, straight line over 3000 miles. And, for your amusement, I copied this image from his page, **Fig. 3**, a look at his antenna explains why he heard me. Thank you Pavel, it was great to make contact.

Summing up

To sum up. Much done, much more to do. My off-grid station is coming together nicely. All the radio related bits anyway. I have made an SSB QSO, and got FT8 and JS8 up and running. And my tablet PC is running well, with all the software installed. And everything runs off batteries. I have yet to try RTTY, and SSTV. And I still have two major issues to address. One is D-STAR, and the other, and rather more important is the power equation. More next month.

References

[1] **https://tinyurl.com/yrz6ccns**
[2] Rick Lindquist N1RL (*QST* October 2003). *Hams a Bright Spot during Power Blackout.* **PW**

1

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Jim Bacon G3YLA

Roger Dowling G3NKH meets a radio amateur who has always had his head in the clouds.

The weather here in the UK may not have improved much over the years, but the same thing cannot be said of the presentation of television weather forecasts, with their sophisticated real-time graphics and computer predictions. But his month we wind the clock back a few decades to meet a long-time radio amateur who was a familiar face on BBC Television weather forecasts in the 1980s when, as we shall see, the graphics were decidedly more basic.

Jim Bacon G3YLA, **Fig. 1**, hails from the small fenland village of Feltwell, west Norfolk. He attended Thetford Grammar School and recalls working on local farms during his school holidays, which was the traditional source of pocket money for youngsters in that rural part of the country. From school, he joined the Met Office, then a division of the Ministry of Defence and nowadays part of the Department for Science, Innovation and Technology. Because of the need for weather information for aviation, the Met Office located many of its observation and data collection points on RAF airfields and Jim has happy early memories of travelling to local RAF stations such as Mildenhall and Honnington on his Lambretta scooter where he would brief crews assembled in the hangars before they departed on their flying missions. He also worked at Stansted airport for a period.

Early radio memories

Always keen on radio, Jim taught himself CW, studied for the RAE and became the proud owner of the call G3YLA in 1969. He recalls spending some of his first wages on a Heathkit SB101 10m-80m transceiver, **Fig. 2**, which he really enjoyed building and which gave him an interest in home construction that he has retained over the years. On the right of the photo is his Top Band AM/CW rig, a traditional design from the **F G Rayer G3OGR** period, which acquitted itself very well indeed.

Life at the Met Office

In due course, Jim gained a promotion, which saw him moving to Bracknell as a Fortran programmer and which in turn led to him being sponsored by the Met Office to take a degree in Applied Meteorology at the University of Reading – a highly respected course that in more recent years has produced such familiar television weather presenters as the BBC's **Tomasz Schafernaker** and ITV's **Laura Tobin**.

Jim's involvement in television and radio forecasting came about by accident. *"I certainly had no thoughts of working in television,"* recalled Jim. *"The Met Office said that the BBC were looking for new presenters and I really went along to make up the numbers, attracted by a day out of the office and possibly a cake and a glass of wine."* At the end of the trials, the avuncular **Jack Scott** who was in charge of the session

Read more radio news and reviews at www.radioenthusiast.co.uk/news

Fig. 1: Jim G3YLA in his shack today, using his favourite Bengali Sculpture paddle key. Fig. 2: Newly licensed in 1969 using his home-assembled Heathkit SB101. Fig. 3: Magnetic symbols in the BBC weather studio. Fig. 4: More modern technology in the BBC Look East studio in more recent years. Fig. 5, 6: Two views of the G3TXQ Hexabeam and added 40m element, with a 2m and 23cm array underneath. Fig. 7: Typical Propquest propagation prediction chart.

noted that Jim seemed to have missed out on the fun and invited him to have a go himself. In fact, Jim found that talking to viewers about the weather was very similar to the hangar briefings he had been doing at the various airfields, so the audition went off well and Jim became a BBC weather presenter – though still employed by the Met Office.

The broadcasts came from the BBC Television Centre at White City, which had formally come into service in 1960. Perhaps surprisingly, the centre had no purpose-designed weather studios; it had been designed in the 1950s when it was considered mildly adventurous to point a camera at a smudgy small map with a few words of explanation about the rain in prospect. But it did have two 'presentation studios' to enable in-vision announcers such as **Macdonald Hobley** and **Syvia Peters** (remember them?) to give cosy introductions to the evening's viewing.

In the event, by the time Television Centre opened, the fashion for in-vision presentation was already on the wane; but the two studios proved ideal for a range of small-scale productions.

As a result, the so-called 'Pres A' became the home of BBC Television weather forecasts. Meanwhile, programmes like *The Old Grey Whistle Test* were being produced in the adjacent 'Pres B'. *"There was something slightly surreal to me, as a young chap from the Fens, suddenly finding himself working alongside these top musicians and bands!"* recalled Jim.

By the time Jim arrived, the technology had moved along a little from the days of smudgy maps. These were the days of the magnetic weather symbols, generally credited to Jack Scott who had noted with interest the use of magnetic rubber seals in refrigerator doors. He came up with the idea that these could be used in association with steel-backed maps to provide a range of symbols to represent clouds, rain and sunshine, plus the all-important isobars to show pressure patterns, **Fig. 3**.

"The symbols were fine – to a point," said Jim. *"But they did suffer from the problem that under the effect of the hot studio lights they tended to curl and lose their adhesion. They would even occasionally fall on the floor, to the great amusement of viewers!"*

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Back at London Weather Centre

In addition to television and radio forecasting for the public Jim's work at the London Weather Centre also involved providing forecasts for the gas and electricity industries – vital information for them so that they could anticipate power demands. There was also an offshore bench, providing forecasts for the oil and gas rigs in the North Sea that were very active at that time. Unless preventive measures were taken, a severe storm could easily result in pipe fractures, and it was not unknown to receive calls in the middle of the night from anxious rig captains seeking the latest weather predictions.

By 1985. when Jim's twins **Holly** and **Christopher** were born, the awkward Met Office 12-hour shifts working in central London were becoming a problem, and Jim took a big decision to move back to East Anglia. He became a member of the Anglia Television weather team until 1997 when Jim rejoined the Met Office for a period before joining forces with two colleagues to set up Weatherquest Ltd, a private company based at the University of East Anglia, which provides a range of weather services to sectors including media, agriculture, transport and wind energy.

Jim continued to work as a television weather forecaster and was a regular presenter for BBC *Look East* in Norwich, **Fig. 4**, until he finally retired in 2019. *"Fortunately, the world of magnetic symbols had given way to more sophisticated chroma-key computer animations by that time!"* said Jim.

Amateur radio

Despite his busy life as a meteorologist, Jim has never lost his interest in amateur radio – and in CW QRP in particular. His main rig today is a Flexradio FLEX-6500, which he describes a *"a great rig for CW"*, in conjunction with his Begali Sculpture high performance paddle. For QRP work, Jim speaks highly of a QRPLabs QCX kit, which has provided him with a very effective low-cost 20m transceiver. This has given an excellent account of itself in QRP CW contests.

Jim's antenna for 20m - 6m is the popular G3TXQ broadband Hexbeam, a full size 2-element Yagi beam with bent wire elements. The photographs **Figs 5** and **6**, taken on a frosty morning, shows up the bent wire elements very well, with a 2m and 23cm array underneath. The mast is in its lowered position, as shown, for most of the time and is usually just elevated for contests and similar occasions. *"The Hexbeam works very indeed for a multiband antenna even when at reduced height,"* said Jim.

Jim is a long-time member of the active Norfolk Amateur Radio Club, which has been very successful over the years at contest and field day events. A CW trainer himself, he enjoys nothing more than a 25 wpm ragchew on the key and has regular QSOs with his Hitchin-based brother **Dick G3WRJ**.

Propquest

As one might expect, Jim's work as a professional meteorologist has resulted in many enquiries over the years about tropospheric conditions, which has led to a deep interest in weather-related propagation modes. He is an active member of the RSGB Propagation Studies committee and also presented many papers to conventions and other amateur radio gatherings over the years, particularly with respect to Sporadic E propagation on the 6m band..

These have led to his development of his real-time propagation tool Propquest [URL below], **Fig. 7**, which takes data from digisondes ('digital ionospheric goniometric ionosondes'), an ionospheric radar system that uses high-frequency radio waves for the remote sensing of the ionosphere to determine the critical frequency (known as foF2) at which signals launched into the ionosphere are just returned back to earth. This in turn makes it possible to estimate the maximum useable frequency available at any given time for different path lengths.

propquest.co.uk

Also available on Propquest, from May to August is Jim's daily 'Sporadic E' (Es) blog, which provides plots at 6-hourly intervals of weather conditions that may lead to openings in the Es season. It's a topic that has long fascinated him, since the days of the old 405-line TV transmissions when he used to have to apologise to viewers for summer-time interference problems.

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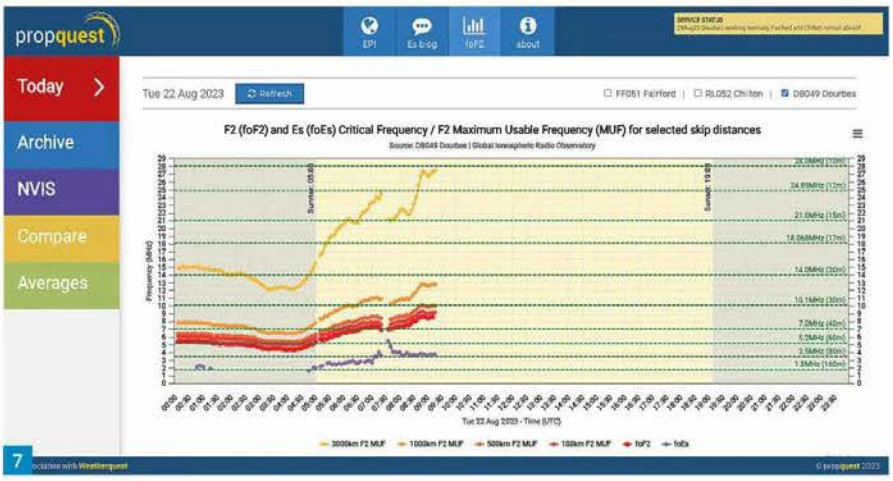

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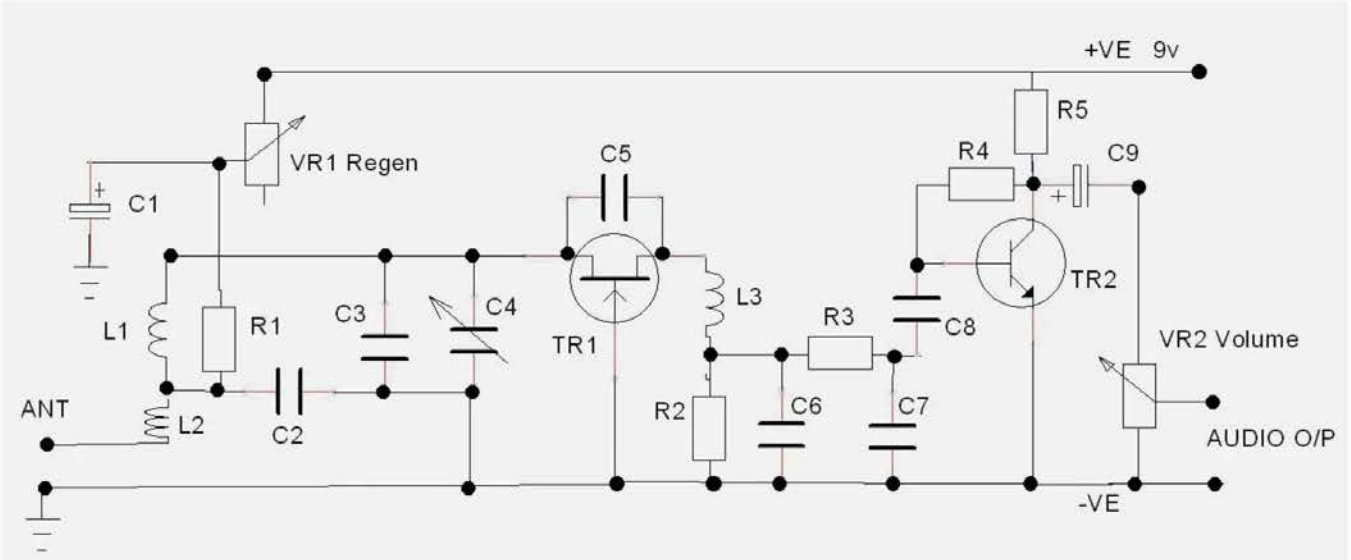
Beyond amateur radio

Jim has numerous interests outside amateur radio, including playing his guitar and gardening. *"I've been involved in raised-bed organic gardening for decades,"* he told me. What's the attraction of gardening? *"Well, I suppose it's just another form of propagation,"* he replied with a smile. **PW**



1

A Simple VHF Receiver

Steve Macdonald G4AQB revisits an old favourite, but with modern-day components.

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Back in the early 1970s receivers for VHF were difficult to make, valves were still being used and sometimes the only way of listening on bands such as 2m and 4m involved modifying PMR equipment. In 1969 a simple VHF receiver was published in *PW* called the 'CQ2'. This was a Super Regenerative receiver that used a JFET, which at the time was very new. Some readers will remember building one of these receivers as their first ever receiver for listening to stations on 2m and PMR stations. I built one on a piece of plywood and heard my very first AM station on 2m!

As a way of bringing back these memories and encouraging readers to have a go at constructing a project, I have written this as a ***TAKE 20*** project based on the original CQ2 receiver.

Circuit

The circuit, **Fig. 1**, uses two stages, the first stage is a JFET and this is the regenerative part of the receiver. The JFET is made to oscillate by feedback between the source and drain with a small value capacitor C5. The oscillation is controlled by the regen potentiometer. This allows the circuit to set the JFET to just before full oscillation. When oscillation occurs, you will hear a loud hissing noise. The stage becomes very sensitive and stations can be tuned in even without a proper antenna. The frequency is determined by the coil L1 and by using different numbers of turns of wire it can be tuned to any VHF band, including FM Broadcast stations. The second stage uses a general purpose, bipolar transistor and this serves as the detector. The circuit will only detect AM modulation (which was used on 2m in those days). FM stations can still be heard using 'slope detection', which basically means that you tune to one side of the centre frequency of the station to detect the audio. Components C6, R3 and C7 act as a filter, while R4 provides negative feedback to the bipolar transistor, hence keeping it stable. Audio is sent to a headphone socket via a volume control. This can either be used for headphones or provide an output to an audio amplifier. Ready built or kits of simple audio amplifiers are available on eBay for just a couple of pounds.

Construction

The original version of the receiver was constructed on a piece of plywood, which worked well at the time, but I have experimented building the circuit using copper-clad board. As the leads need to be short to reduce any stray capacitance, my first attempt was built on a piece of copper-clad board of approximately 100 x 70mm, **Fig. 2**. The potentiometers and tuning capacitor are mounted directly to the board. A small jack socket was used for the headphones or audio output and an SMA socket for the antenna. A couple of choc-block connectors can be used to mount the tuning coil, this allows swopping coils for different frequencies. I used some coloured Perspex and pillars to finish off the project, **Fig. 3**.

After completing this project, I experimented building a printed circuit board version, at first with single-sided board and later with double-sided copper board. I found that the double-sided board worked best, with one side as an earth plane. Components connected to earth are soldered on both sides of the board. I also used a varicap diode for tuning rather than a variable capacitor as these are sometimes hard to find, **Fig. 4**. The printed circuit board was made using traditional etch resist pen and Ferric Chloride. The layout is shown in **Fig. 5**. The PCB is approx. 100 x 70mm, the same as the previous version.

Components

The original CQ2 circuit used a 2N3819 or MPF102 JFET. This was at a time when JFETs were new to the component market and relatively expensive. However, although JFETs such as the J310 and similar are in abundance now, they are not suitable for this circuit. Original 2N3819s are few and far between. Beware of these advertised as new as some simply do not work in this circuit as I found out. The only JFET that can be used as a replacement is the BF256B. These work fine and are easily available. I got mine from CPC components for a matter of pence.

The feedback capacitor C5 may need a little experimentation. It can be a fixed capacitor of around 2 - 10pF, a small trimmer capacitor of about the same, or a twisted pair of wires sometimes called a gimmick capacitor. You need to have enough positive feedback to send the circuit into oscillation depending on stray capacitance in the layout.

The variable capacitor only needs to be a value of about 5 or 10pF. They can be found at rallies or in junk boxes, but new ones are quite expensive. It is possible to modify a larger value variable capacitor by removing most of the vanes and just leav-

ing one or two. Alternatively, why not use a varicap diode with a potentiometer instead of a variable capacitor, **Fig. 6**. Simply connect in place of C4 in the circuit. I used this with the printed circuit board version and it works well.

The tuning coil L1 depends on the band that you want to tune to. **Table 1** shows the ones that I used.

L2 is a single or half turn, which pushes into the earthy end of L1. For L3 a miniature 1.8µH choke was used, but the value is not critical.

Testing

First, we need to check if the super regenerative circuit is oscillating at switch on.

Connect the circuit to a 9V battery and plug in some headphones or connect to an amplifier and turn up the regen control until just before full oscillation occurs. You should hear a loud hiss. If not, check the feedback capacitor C5. If you have used a trimmer, then adjust until it starts to hiss. If you are using a fixed capacitor, try different values. Once the circuit produces a loud hiss, the circuit is oscillating. Adjusting the regen control determines how strongly the circuit is oscillating and hence the sensitivity.

Testing the original CQ2 receiver was quite tricky and used a lot of guesswork to determine what frequency you were tuned to, Although the number of turns are specified for the coil, this depended a lot on layout and stray capacitance.

Nowadays we have aids that can help to tune the receiver to the wanted frequency.

As the super regenerative circuit is oscillating on the frequency that it is tuned to, we can use an SDR receiver such as the RSP 1A or SDR Dongle to find the frequency at which it is oscillating. Another way is to use a Tiny Spectrum Analyser to display the oscillating frequency, **Fig. 7**. Once this has been done it is easy to adjust the number of turns on the coil; adding a turn will lower the frequency, removing a turn will increase the frequency. You can 'fine tune' by squeezing or stretching the coil to the correct frequency.

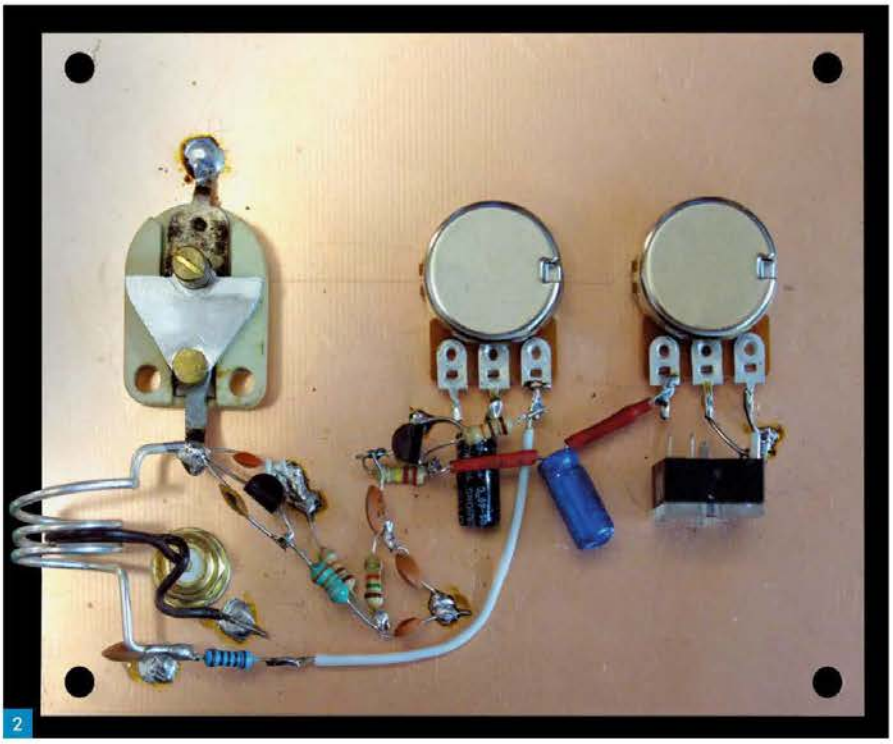
The super regenerative receiver does radiate a small amount of RF, but as the regen circuit uses a small signal JFET, the radiation is very small.

The receiver is sensitive enough to pick up strong stations even without an external antenna. A low power handheld transceiver can be used to check that the receiver is operating. Adjust the small antenna coupling coil by pushing it in and out of the tuning coil to find the strongest signal.

Conclusions

The CQ2 was built by many amateurs as a way of listening to the VHF bands back in the day. It needs a little patience to set up and operate, but it is fun to build and the satisfaction of hearing your first station is worthwhile.

I have three of these receivers, one tuned to 2m, one to 4m and one to the VHF broadcast band.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However, it is easy to change the coil on a single receiver for any band that you wish.

Tip: Try making the receiver tuned to the VHF broadcast band first, the stations can be heard easily, then change the coil for 2m or 4m when you know that it is working.

The receiver is very sensitive and is subject to close proximity objects (like your hand) so care needs to be taken if you are planning to put the receiver into a case. I have kept mine open with just a coloured Perspex base suitably spaced from the board.

References

- CQ2 VHF Receiver first published in *PW* September 1969 by M J Gordon.
- How to substitute a 2N3819 with BF256B: **https://tinyurl.com/3m7ft4b5**

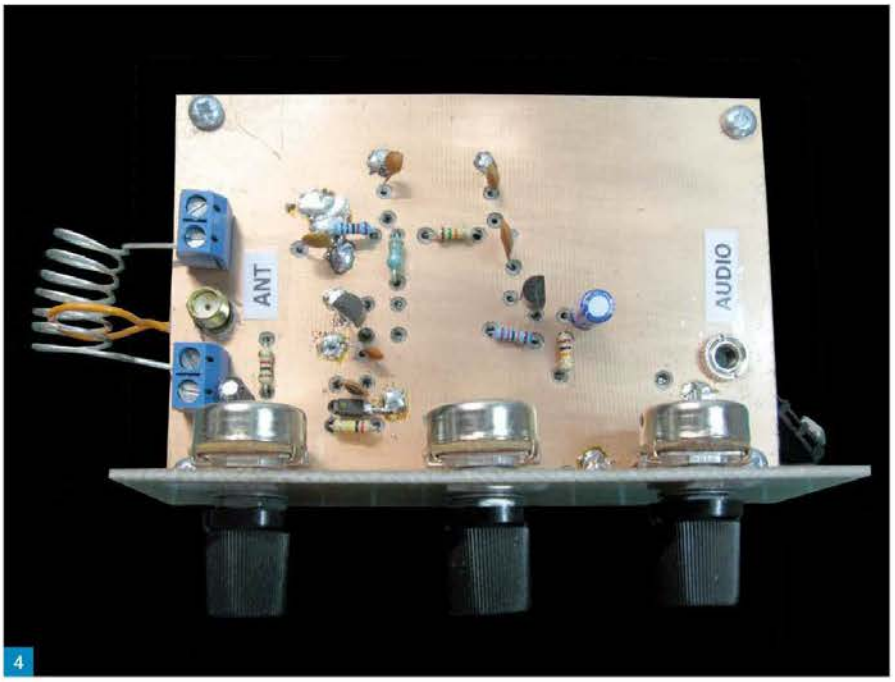

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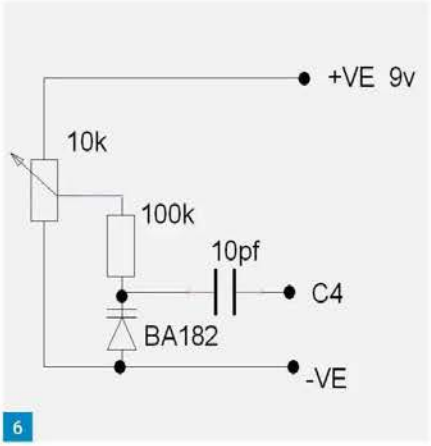
Fig. 1: Circuit diagram.
Fig. 2: Construction on copper clad board.
Fig. 3: Completed super regen receiver.
Fig. 4: Printed circuit version of the receiver.
Fig. 5: PCB layout.
Fig. 6: Varicap tuning modification.
Fig. 7: TinySA showing oscillating frequency.



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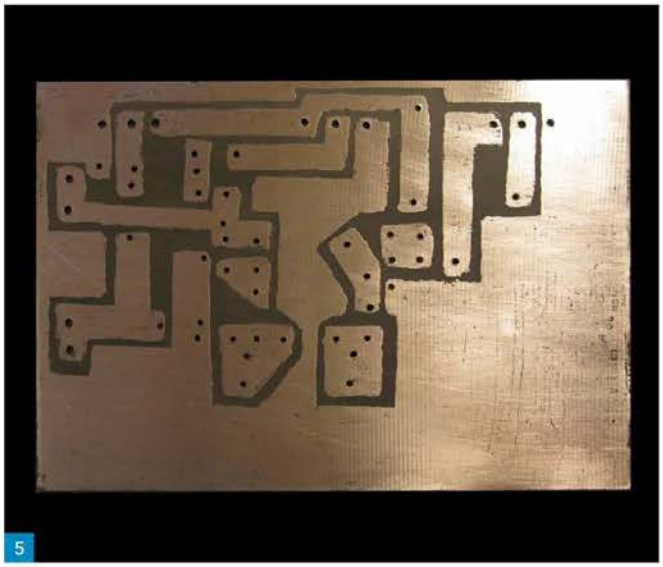
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Components List

Semiconductors

TR1	BF256B
TR2	BC547 or similar

Capacitors

C1	47µF
C2	1nF
C3	5pF
C4	10pF Variable
C5	See Text
C6	4.7nF
C7	10nF
C8	100nF
C9	10µF

Resistors

R1	1kΩ
R2	10kΩ
R3	15kΩ
R4	220kΩ
R5	10kΩ
VR1, 2	10kΩ Lin. Variable

Coils

L1, 2	See Text
L3	1.8µH chok

Turns for tuning coil, L1

4m Band	7 turns	1cm int. diameter
2m Band	3 turns	1cm int. diameter
FM Broadcast	3 turns	1.5cm int. diameter

18 swg tinned copper wire.
The number of turns required depends on the layout and may need adjusting.

Table 1: Turns for tuning coil, L1.

John Warburton G4IRN
g4irn@dxdx.co.uk

Tips for Building a Remote Station

John Warburton G4IRN shares some ideas about how to set up and operate a remote station.

Modern connectivity and radio technology make the prospect of operating remotely a real possibility for radio amateurs. Being able to access a home station when travelling, accessing a friend's station, or building a station at a quiet rural location – there are lots of permutations but there are similar, underlying technical challenges needing consideration.

Following a house move two years ago, I decided the best way to have a reasonable HF DX and contesting station was to build a remote station away from home. After lots of hard work, I now have a station consisting of two radios, an amplifier, tower, various antennas and rotator, all operated by controls and switches over the internet and 4G (at the remote site), which essentially means I can operate from anywhere in the world. However, there is no single solution for remote operation and this article provides an overview of possibilities.

The first consideration when operating a remote station must be the licence conditions. The applicable rules will be those of the country where the remote station is located; you will need a valid callsign for that country. Note that CEPT does not allow the use of your callsign in a member country unless you are physically present, so that is not an option.

Essentials

Power and connectivity are needed as a minimum. A remote kill switch on the radio's power supply is essential and there is a wide choice of internet switches to choose from – just make sure you don't put the network equipment (providing connectivity) on the same kill switch as the radio equipment. Internet and 4G are widely available around the UK. However, there are two important factors to consider: network latency (delay) and network jitter (the variation in latency). Latency can cause Morse characters or spoken words to be missed on transmit changeover while jitter tends to cause momentary dropouts on the audio stream, therefore the audio stream needs to be buffered.

A point-to-point radio link is of course another option, though more complex, but do check your licence terms. Depending on the use, a network latency of 100mS is just about acceptable if the variation (jitter) is not too great, however the FT* modes are more forgiving since there is a pause between transmissions.

Controlling the radio

IP (Internet Protocol) devices, usually with an Ethernet port on the rear, are the easiest to operate remotely – they have an IP address and with some basic networking knowledge, remote operation is made easy. This is why the Flex radios have proved popular among the remote operating community. However, most of us still live in a world of serial ports, USB ports and analogue audio streams, so remote operation is more challenging.

For remote control there are several radio functions that need to be fulfilled, e.g. power on/off, frequency control, audio in, audio out, PTT and CW (e.g. Morse code keying). Most modern radios have a serial port and use a CAT protocol to provide control.

To operate the remote radio most users will either use a detachable, physical front panel, or a software 'soft-panel' on a PC. Dedicated front panels include the Flex Maestro, Icom IC-7100, Elecraft K3/0 and Yaesu FT-857 to name a few. Some radio manufacturers provide programs to remote control their radios, e.g. Yaesu SCU-LAN10, Icom RS-BA1, Flex SmartSDR etc. and there are several very good third party programs around too, e.g. HRD, Win4IcomSuite and Win4K3Suite for instance.

If you have a remote head for the radio, it will be likely to access the radio via Ethernet (with an IP address connected over the Internet) or there will be a serial port connection. For the latter, the Microbit 'Remote Rig' units have proved very popular; these days they are in short supply but there are alternative approaches to be explored.

Connectivity

Depending on your requirements, the general rule to operating remotely is transfer as little data as possible. If the radio does not provide IP connectivity (i.e. no Ethernet port), then the control-side 'soft-panel' running on a PC will usually need to connect to the radio via a serial port. This presents options:

Run a PC at the radio-side connected directly into the radio and use remote desktop software to access it from wherever you are, e.g. Google Desktop, AnyDesk, VNC, Team Viewer. You could also run your logbook, data-modes software (e.g. WSJT-X) and rotator control software etc. on the same PC, all accessed via the remote desktop program. Some remote desktop programs will transfer audio each way too, so voice modes can be used with a PC headset at the control side. This approach is the most favoured due to its relative simplicity, though CW will be restricted to sending pre-defined Macros or keyboard typing.

Run a PC and 'soft-panel' radio at the control-side and use 'serial port over IP' technology to connect to the radio. This will work but may present the challenge of transferring audio, PTT, radio on/off control and CW if required.

When the station increases in complexity, additional controls may be required, e.g. amplifier and rotators are often controlled by serial port or USB. Serial port over IP is addressed below but USB over internet can be more challenging – 'USB over Ethernet' software exists but I have not explored it; most people control USB devices through a radio-side PC and remote desktop software.

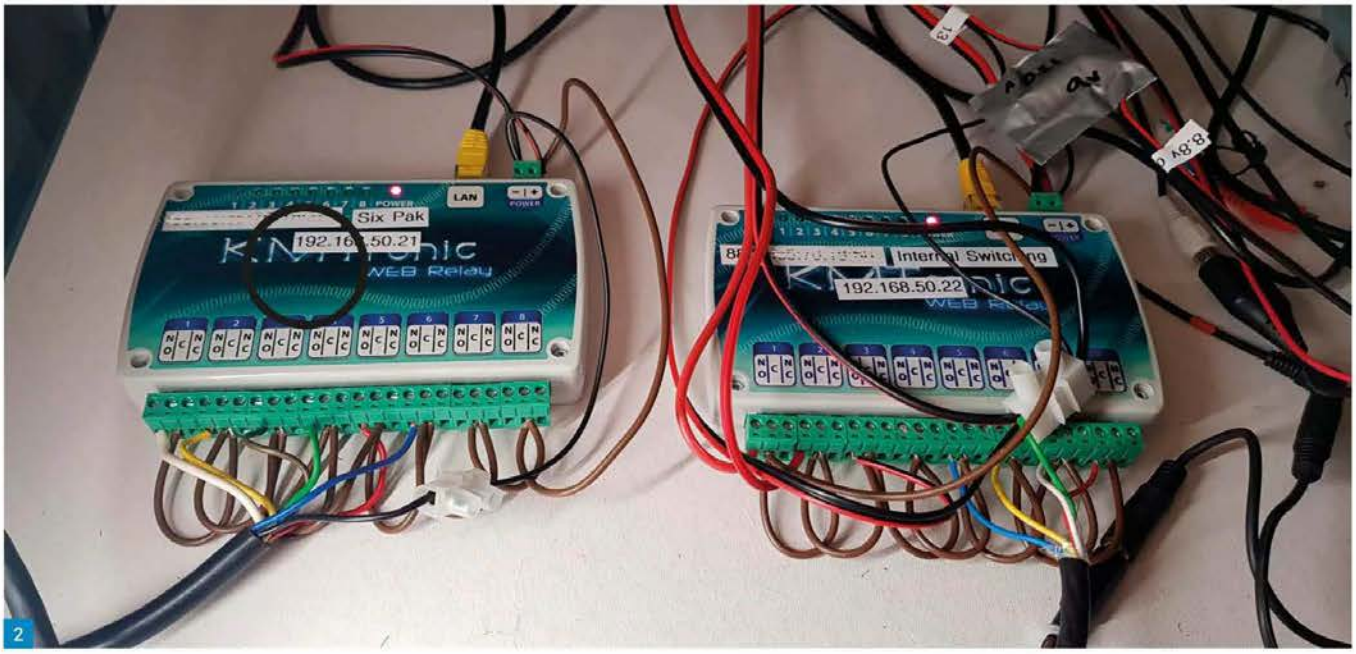

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Photo 1: Node Red dashboard.
Photo 2: Relay board.
Photo 3: G4IRN remote antennas.
Photo 4: G4IRN remote shack.

Serial port over IP

To remotely access serial ports on the radio, rotator and amplifier I use two PUSR N510 Serial Port Servers but similar devices are available from other manufacturers. Programs such as VSPE by Eterlogic can provide a software client/server arrangement between the remote PC and the control PC, however I have not tried this over a remote link.

Audio over IP

If your radio and software solution do not transfer audio, then potential solutions can be found using Windows or Raspberry Pi programs at each end of the link. 'Remote Audio' by DH1TW is excellent and has very low latency, although a little technical to install. 'RemAud' by DF3CB is easy to install but comes with noticeable latency. Other low latency VoIP (Voice over IP) programs are available.

CW and keying

Character timing is essential for coherent Morse code. Remote links with network latency and jitter do not lend themselves to accurate transfer of CW, this is why many remote operators use remote desktop and send CW macros or typed CW from the radio-side PC. Potential solutions (not tried here) for hand sending CW from the control side are the WKRemote application by K1EL and RemoteCW by DF3CB; both use the K1EL WinKey device. These and other possibilities are listed under weblinks.

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Switching

Aside from switching mains on and off, it's likely you'll want to enable PTT, switch antennas and devices on and off. For example, many radios have a remote On/Off socket at the rear. I've found the best approach is to use web-enabled relay boards like those available for the Raspberry Pi – these can be switched through a web interface at the control side, though as the station becomes more complex, dedicated and larger web-relay boards might be preferred.

Station dashboard

It helps to have a consolidated view of station controls and status. Node Red is a free programming framework using drag and drop functions to build automated process flows. It takes a little learning but there are lots of videos available on YouTube and a dedicated Groups.io email reflector for amateur radio users.

Overcoming 4G restriction

4G operators often use 'Carrier Grade Network Address Translation' (CGNAT). In these situations, a public IP address is not available to the user. If the remote station is using 4G, there are a few work-around solutions based on VPN software to overcome this, e.g. ZeroTier, TailScale and SoftEther are solutions I am aware of.

Top tips

- Document everything you do. When your radio is remote, it is 'out of sight and out of mind' – I guarantee you will forget how things are connected!

- Minimise data transfer, e.g. better to decode data modes at the radio side than transfer the audio stream and decode at the control end.
- Choose your radio carefully if bandwidth is limited or costly. Spectrum displays consume lots of data.
- Remote CW is tricky – Remote Rig units provide a good solution but there are other solutions based on K1EL's WinKey or Arduino.
- The radio-side PC should always start up after loss of power or use 'wake on LAN' (BIOS settings).
- Don't put the network hardware on the same kill switch as the radio.
- Ideally, the radio side should regularly check for internet connectivity and reboot the router if lost.
- Network 'jitter' must be acceptable – check before you spend.
- Some remote desktop software is more reliable and less data hungry than others – I use TightVNC.
- Apply enhancements in small steps – big changes at a remote site often lead to return visits.
- Connect radio side and control side to the same NAS or Cloud storage drive so data is easily transferred.
- Never forget the risks to safety when at a remote site alone – I always share my location on WhatsApp with my wife.
- Remote operation gives a new perspective to our hobby - in my case I wanted more space for antennas but the option to operate while away from home or the prospect of lower noise may be an incentive for others to try this approach.

Websites

I am not particularly endorsing any of these products, use them at your own risk.

PUSR Serial Port Servers:
https://tinyurl.com/mryufa9t
Microbit Remote Rig:
www.remoterig.com/wp
Remote Audio by DH1TW:
https://github.com/dh1tw/remoteAudio
RemAud by DF3CB:
https://df3cb.com/remaud
K1EL WinKey:
www.k1elsystems.com/keyers.html
NB Winkey emulators are available from G4ZLP:
www.g4zlp.co.uk/unified/DigiMaster_CW.htm
K1EL Remote Control program:
https://hamcrafters2.com/WKremoteX.html
Remote Morse Key by IW7DMH:
https://tinyurl.com/3kmhyz5c
Local CW Keyer for Remote Keying:
https://tinyurl.com/39d8x4xv
RemoteCW by DF3CB:
https://df3cb.com/remotecw/documentation
Node Red email reflector:
https://groups.io/g/nodered-hamradio
Node Red tutorials by AA0Z:
www.youtube.com/@AA0Z/playlists

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Read more radio news and reviews at www.radioenthusiast.co.uk/news

BBC coronations, Part VII

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Garry Smith
Garry405625.gs@gmail.com

Keith Hamer and **Garry Smith** continue the special series looking back at the BBC's coverage of Coronations since 1937. There is also a Coronation vintage wireless advertisement from the archives, including a description of their popular V.2 receiver. Also featured is the concluding part of the saga detailing 100 years of BBC Scotland-Alba. We are particularly delighted to begin a new series about Roland Pièce, the pioneer of Swiss radio broadcasts, based on personal memories and archive family photographs, specially presented to the authors by his Grand-Nephew, and PW reader, Pierre Yves-Pièce. We also continue our usual series about the development of Swiss Radio and Television since 1922.

For the Coronation of **King George VI** and **Queen Elizabeth** in 1937, the BBC had to develop a special type of microphone for the occasion. Because of the huge cheering crowds and the resulting noisy background, it was necessary to speak very closely into the microphone. Even then, the listener could often hear much more of the background noise than was really wanted. The *Lip Microphone* was designed by the BBC to overcome this problem, **Fig. 1**.

A metal guard-ring at the front of the microphone gave a precise speaking distance of 2.5 inches when pressed against the top lip. Sounds coming from further away than this distance tended to cancel each other out. The design was improved in 1951 and has since been refined still further.

The BBC reported that the 1937 Coronation was watched by over 10,000 people. For the first time in history, the public were able to follow the entire Coronation ceremony on television with unprecedented views of Westminster Abbey, the Coronation Service, the *Thrones of the King and Queen*, their *Chairs of State*, and *King Edward's Chair*, in which the King was anointed and crowned.

In its first year, the mobile Outside Broadcast unit went on to broadcast events such as *Wimbledon*, *The Lord Mayor's Show*, *The Armistice Day Ceremony*, and an *Omnibus Pageant* at Chiswick.

This concludes our detailed account of the Coronation of King George VI and Queen Elizabeth in 1937. Next time, we will turn our attention to the Coronation of **Queen Elizabeth II** in 1953.

Vintage coronation wireless equipment

This month's wander through vintage copies of tattered newspapers and magazines has elicited an advertisement by the *Marconiphone Company Limited* for their very impressive 'Mastergram', which was released to the public in time for the 1937 Coronation, **Fig. 2**. The advertisement dates from 7 May.

The equipment featured a world-radio receiver, an auto-change record-player, and even a television with a viewing mirror fitted inside the lid!

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

This is the full description of the 1937 ***Marconiphone Mastergram***.

MARCONIPHONE INTRODUCE FIRST 'MASTERGRAM'

New Instrument Combining Television, World Radio and Automatic Gramophone

Triumphant Outcome of 50 Years' Radio Research

ALL-IN-ONE ENTERTAINMENT, LATEST MARCONIPHONE MASTERPIECE

THERE has been speculation in the Home Entertainment Industry for some time as to the introduction of an entirely new instrument called the "Mastergram". The mystery of the "Mastergram" has now been solved with the announcement of the Marconiphone Company's new "All-In" model comprising Television, All-wave World Radio and Automatic, Electric Gramophone.

The Marconi "Mastergram" can be truly described as the triumphant outcome of 50 years' Radio research in Television, Sound Radio and the electrical reproduction of Gramophone music. This amazing new instrument is the logical development of the tremendous advances in Home Entertainment experienced since the beginning of this century. Since the introduction of the first hand-operated Gramophone, we have experienced in rapid succession, the great improvement of the electric Gramophone, the miracle of sound Radio and that greatest scientific wonder of our age – Television. Now the Marconiphone Company, with superb skill, have combined these 3 essentials of modern Home Entertainment in one attractive and compact piece of furniture.

The rate of progress in recent years has been almost breath-taking. One wonders what the early Victorians, who had to content themselves with amateur and often painful performances upon the piano and violin, would think of the marvels of our modern entertainment, which we accept so nonchalantly.

Sees, Hears, Acts.

The Marconi "Mastergram" sees, hears and acts. Indeed, it may be said to have eyes, ears and hands. On its Television side it gives you clear and detailed reception of the splendid Television programmes that are being broadcast daily by the B.B.C. Newsreels and current events will, in future, be seen as well as heard in every up-to-date home within the Television area.

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There is nothing elementary or experimental about these pictures. They are comparable with any good photograph or any cinema reproduction. The thrill of Television as the Marconiphone Company have presented it to us, has to be experienced to be believed. It is uncanny in its reproduction of events with which it has, of course, no tangible connection.

World-wide Range.

As an alternative to the Television entertainment it offers, you can have world-wide reception on its superb 6-valve Superhet Radio equipment. Here there are 4 wavebands to choose from, which place at your command practically every worth-while Radio broadcast in the world including, of course, intriguing communication with aircraft and shipping. The Marconi "Mastergram" sees nothing extraordinary in switching on to America, Australia or other remote parts of the world.

For the Individualist.

For the man who likes to choose his own music there is, in this same magical cabinet, the very lat-

Fig. 1: The 'Lip Microphone' was specially designed by the BBC for the 1937 Coronation. Fig. 2: The Marconiphone 'Mastergram' was an impressive piece of equipment featuring a world-radio receiver, an auto-change record-player, and even a television. Fig. 3: A poster advertising flights between Paris and Lausanne in 1921. Fig. 4: The first BBC Scotland Identification Symbol was radiated on 14 March 1952. Fig. 5: The Gaelic-language station, BBC Alba, commenced broadcasting at 7:00pm on Friday 24 February 2017. Fig. 6: The Radio Basel studios in 1940.

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For the man who likes to choose his own music there is, in this same magical cabinet, the very latest in Electric, Automatic Gramophones; an intricate engineering masterpiece which plays eight 10-inch or 12-inch records in succession and repeats or rejects at

Enquiry form

Full details of the Marconiphone "Mastergram" can be obtained by filling in this coupon and sending to The Marconiphone Company, Ltd., Radio House, Tottenham Court Rd., London, W.1.

NAME .....

ADDRESS .....

..... R.T. 21.11.37

ALL - IN - ONE ENTERTAINMENT, LATEST MARCONIPHONE MASTERPIECE

the touch of a switch. This section of the "Mastergram" thus provides about half an hour's continuous music of your own choice. Many of the most popular operas, concertos, sonatas, etc., have now been recorded by the principal gramophone record manufacturers in special sequence for use on automatic gramophones. These are termed "automatic couplings" and lists can be obtained from any record dealer. The Automatic Gramophone is, of course, particularly useful in maintaining dance music without the trouble of constantly changing records.

One of the most amazing things about the Marconi "Mastergram" is the skilful way in which so much has been successfully housed in a cabinet which is both beautiful and of convenient dimensions. The "Mastergram" is finished in fine walnut with handsome quarter panels on the front and lid. As a piece of furniture it would make a pleasing addition to the most exclusive home.

A WELCOME SURPRISE.

Contrary to expectations, the "Mastergram" is priced at a figure which compares very favourably with the recent cost of Radio-gramophones. All ideas of it being primarily a rich man's investment are removed by the extended payment facilities which are available. The price is 120 guineas and, considering it offers the home complete entertainment in every sense of the word it is, of course, a proposition which should receive immediate consideration from every family man, every club and every hotel.

NOW IS THE TIME.

The time has also come, surely, when an instrument such as this forms an essential part of the equipment of any business house, for there are many occasions during the year when information over the Radio and the reproduction of current events in pictures and in sound would prove an asset to any business organisation. Furthermore, it is not difficult to conceive that an instrument such as this might become an all-important link with central authority in time of national emergency.

The Marconiphone Company regard the "Mastergram" almost as "finality" in Home Entertainment. In the matter of a mere 15 years, the Marconiphone Company have developed this amazing Radio achievement from the original little "V.2" 2-valve, crystal receiver which sold in thousands during the first days of public broadcasting. Their crystal receiver which sold in thousands during the first days of public broadcasting.

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est in Electric, Automatic Gramophones; an intricate engineering masterpiece which plays eight 10-inch or 12-inch records in succession and repeats or rejects at the touch of a switch. This section of the "Mastergram" thus provides about half an hour's continuous music of your own choice.

Many of the popular operas, concertos, sonatas, etc., have now been recorded by the principal gramophone record manufacturers in special sequence for use on automatic gramophones. These are termed "automatic couplings" and lists can be obtained from any record dealer. The Automatic Gramophone is, of course, particularly useful in maintaining dance music without the trouble of constantly changing records.

One of the most amazing things about the Marconi "Mastergram" is the skilful way in which so much has been successfully housed in a cabinet which is both beautiful and of convenient dimensions. The "Mastergram" is finished in fine walnut with handsome quarter panels on the front and lid. As a piece of furniture it would make a pleasing addition to the most exclusive home.

A WELCOME SURPRISE.

Contrary to expectations, the "Mastergram" is priced at a figure which compares very favourably with the recent cost of Radio-gramophones. All ideas of it being primarily a rich man's investment are removed by the extended payment facilities which are available. The price is 120 guineas and, considering it offers the home complete entertainment in every sense of the word it is, of course, a proposition which should receive immediate consideration from every family man, every club and every hotel.

NOW IS THE TIME.

The time has also come, surely, when an instrument such as this forms an essential part of the equipment of any business house, for there are many occasions during the year when information over the Radio and the reproduction of current events in pictures and in sound would prove an asset to any business organisation. Furthermore, it is not difficult to conceive that an instrument such as this might become an all-important link with central authority in time of national emergency.

The Marconiphone Company regard the "Mastergram" almost as "finality" in Home Entertainment. In the matter of a mere 15 years, the Marconiphone Company have developed this amazing Radio achievement from the original little "V.2" 2-valve, crystal receiver which sold in thousands during the first days of public broadcasting.

Enquiry form

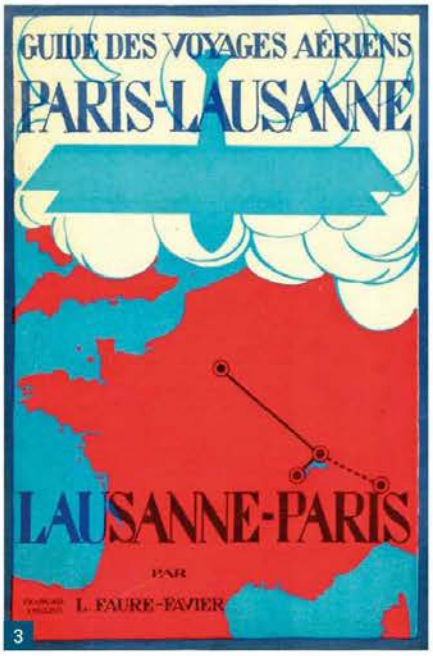
Full details of the Marconiphone "Mastergram" can be obtained by filling in this coupon and sending to ***The Marconiphone Company, Ltd., Radio House, Tottenham Court Rd., London, W.1.***

Following **Guglielmo Marconi's** extensive pioneering work in developing world-wide radio communications, the focus eventually moved to the production of equipment for public service broadcasting. In 1922, the *Marconi Wireless Telegraph Company, Limited*, created a company called *Marconiphone* to provide equipment for radio broadcasting. Marconiphone's first products were radio receivers for domestic listeners, including the 'V.2' which is mentioned in the advertisement.

A Marconiphone invoice dated 4 July 1922 confirmed that Messrs. Watshams of Covent Garden, London, ordered 5,000 Marconiphone Type V.2 receivers. These were made initially at the Chelmsford Works.

The *British Broadcasting Company, Limited*, was formed on 18 October 1922. One of the broadcaster's legal requirements was to regulate and licence wireless radio equipment for use in the UK. Before the BBC was established, there was a prohibition in the UK against the use of a particular type of circuitry called 'regeneration', which – while being more sensitive – could cause interference with other sets. Marconiphone V.2 receivers manufactured between July and November 1922 were not equipped with a plug-in 'Regeneration Unit'. Early V.2 receivers were fitted with type 'R' valves (4V, 0.65A filament) or LT1 and LT3 'Dull Emitters' as standard.

The BBC/PMG (Postmaster-General) regulations in 1922 stated: *"The V.2 model has been constructed to meet the new Post Office requirements, which specify that the receiver must not be capable of radiation. Reaction is not employed,*



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but a throw-back circuit is utilised by means of which additional low frequency magnification is obtained. The 'grid condenser' method of rectification is employed, and a novel method of tuning is used in which the inductance of a fixed coil is varied by means of a copper spade. Inductance units are interchangeable. The set has been so designed that either 'R' or 'Dull Emitter' valves can be fitted, the latter permitting the operation of the set from dry cells instead of accumulators. This receiver has a guaranteed range of 50 miles from a broadcasting centre, on the broadcasting wavelengths."

Following extensive experimentation, Marconiphone engineers devised a method of applying regeneration to only the second stage, thus avoiding any interference to other nearby receivers.

The Marconiphone V.2 wireless was made from a variety of materials, including mahogany, glass, nickel, Bakelite, ebonite, celluloid and steel.

Roland Pièce Archives: Part I

Our series of articles about the start of Swiss radio and television began in March 2023.

We were recently highly surprised, delighted, and indeed honoured, to receive correspondence from **Pierre-Yves Pièce** whose Great Uncle was none other than **Roland Pièce**, the pioneer of radio broadcasts in Switzerland.

Pierre-Yves writes, *"It was with great interest that I read your article on the beginnings of radio in Switzerland, and particularly the chapter devoted to my Great Uncle, Roland Pièce.*

I will shortly be travelling to Florence to present a paper on Roland Pièce at the History Of Electrotechnology Conference (HISTELCON 2023). I am sending you further information about Roland.

I wish you all the best,

Pierre-Yves Pièce, Grand-nephew of Roland Pièce."

We are indebted to Pierre-Yves Pièce in Bex (Canton Vaud, Switzerland) for sending extremely rare archive information about Roland Pièce and the start of Swiss broadcasting. This series of articles is based on the paper which he delivered in Florence at the *History Of Electrotechnology Conference* in September 2023.

The first unofficial radio broadcast in Switzerland was on 14 October 1922, as reported by the authors in the March column. All other reports inaccurately state the date as being 26 October 1922. The broadcast was from the *Blécherette Aerodrome* near Lausanne.

The beginnings of Radio Broadcasting in Switzerland are linked to the development of the first aeronautical liaison between Paris and Lausanne, **Fig. 3**. To ensure the safety of flights on this route, which was officially inaugurated on 28 October 1921, radio communication was necessary between the pilot and the airfields. Two people are at the forefront of the creation of the first radio station in Lausanne: **Professor Paul-Louis Mercanton** and **Roland Pièce**, who was his student.

This series of articles will retrace the milestones of this broadcasting adventure, from the first experimentation of wireless telegraphy in Lausanne in 1911 to the first 'live' broadcast of a vocal and instrumental concert at the official inauguration of the *Champ-de-l'Air* station on 14 October 1922.

BBC Scotland-Alba Centenary, Part VII

Television in Scotland officially began on Friday 14 March 1952, using the 405-line system from the Kirk o'Shotts transmitter. The first BBC Scotland Identification Symbol is shown in **Fig. 4**.

Currently, BBC Scotland broadcasts three television services to Scottish audiences. *BBC-1 Scotland* is a separate channel able to opt-out of the BBC-1 network feed in order to broadcast its own schedule of regional programmes in addition to networked productions. The flagship news programme is *Reporting Scotland*.

BBC Scotland also operates *BBC Alba*, broadcasting programmes in Gaelic. The channel is available solely in Scotland on Freeview as well as across the UK via satellite and cable services. When television programmes are not being transmitted, BBC Alba simulcasts the Gaelic radio station *BBC Radio nan Gàidheal* with an in-vision overlay of graphics. Prior to the digital switchover, some Gaelic programmes were carried on BBC-2 Scotland. However, this was discontinued following the switchover.

The new Gaelic-language station, BBC Alba, commenced broadcasting at 7:00pm on Friday 24 February 2017, **Fig. 5**. Two days prior to the launch, BBC Director-General, **Tony Hall**, announced plans to launch a dedicated English-language BBC Scotland channel in 2018, which would replace the BBC-2 Scotland opt-out. It would broadcast from 7:00pm until midnight and feature a line-up composed entirely of new, and archived, Scottish material, including a new hour-long weeknight news programme at 9.00pm. This would be produced in Scotland. He also announced that the BBC would increase its annual overall spending on factual and drama productions in Scotland by £20 million. The BBC Scotland channel was approved by the broadcasting regulator, Ofcom, in June 2018. *BBC Scotland* subsequently launched two years to the day after BBC Alba on Sunday 24 February 2019.

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BBC Scotland's headquarters are currently located in Glasgow at *BBC Pacific Quay* on the banks of the River Clyde. The studio centre was constructed between 2004 and 2006 and was opened in 2007. Designed by **David Chipperfield** and reportedly costing £188 million, the centre contains three television and five radio studios as well as the first High-Definition newsroom used by the BBC.

Until 2010, a high number of Gaelic programmes were broadcast on BBC-1 Scotland and BBC-2 Scotland before transferring to BBC Alba. The station's original flagship programmes, which both started in 1993, were *Dè a-nis?* and *Eòrpa*. The latter continued to be broadcast on BBC-2 Scotland as the only Gaelic-language programme on the channel until 2019.

BBC Scotland now makes a wide variety of programmes for numerous networks, including five network radio stations and digital television channels such as BBC-1, BBC-2, BBC-3, BBC-4, CBeebies and the CBBC channel.

To celebrate the BBC's first radio broadcast in Scotland 100 years ago, the current BBC Director-General, **Tim Davie**, attended a special event held at Pacific Quay. The *BBC Amateur Radio Group* and the *West of Scotland Amateur Radio Society* ran an event which featured the callsign *5SC*, which was originally announced by **John Reith** in 1923. In those days, most listeners tuned-in on their free-to-operate 'cat's whiskers' crystal wireless sets.

More than 300 radio amateurs from 37 different countries, as far afield as India, China and Brazil, made contact with the special event callsign GB5SC in the HF, VHF, and UHF radio bands plus the geostationary amateur satellite, QO-100.

The event operated from a temporary radio base on the fifth floor of BBC Scotland's centre at Pacific Quay and was officially inaugurated on Saturday 4 March 2023.

Service information: Switzerland, Part IX

The *Radiogenossenschaft Basel* (*Basel Radio Association*) was originally formed in 1926, but in 1940 the station was relocated to a new studio in the city's Bruderholz district, **Fig. 6**. Meanwhile, a new radio studio was officially opened in Geneva on Boulevard Carl Vogt.

1941 marked the 650th anniversary of the foundation of the Swiss Confederation. In honour of the occasion, Swiss radio embarked on its biggest-ever project. This comprised a total of 40 separate programmes and 14 different soundtracks. Programmes marking the anniversary were broadcast on all three national stations, as well as the short-wave service.

In the following year, the Swiss Army decreed that weather forecasts on radio should be announced as being *"for agricultural use"*. A well-known satirical magazine called *Nebelspalter* was quick to mock the new announcement, and the idea was soon dropped!

A dispute with Post Office management in 1943 prompted **Félix Pommier** to resign as head of the Geneva studio. He went on to publish a pamphlet entitled *La radio sans mystère* (loosely translated as *Unravelling the Mysteries of Radio*), which caused further controversy.

In 1945, the Swiss *Zeitungsverlegerverband* (Newspaper Publishers' Association) and the *Verein Schweizer Presse* (Swiss Press Association) demanded the abolition of the morning news service, which had been temporarily introduced in 1939. In the end, all bulletins produced by the official Swiss press agency, *Schweizerische Depeschenagentur* (SDA) continued to be broadcast on radio, but the SDA was paid a higher fee for producing them. Programmes such as *Echo der Zeit* (Echo of the Times), and *Le micro dans la vie* (Life with a Microphone) began in 1945. They were followed by the Italian-language programme *Il Quotidiano* (The Daily) in 1948. SRG began to develop a network of correspondents, operating in Switzerland and abroad.

DX-TV & FM news

The latest DX news, plus details of changes to broadcast television and radio services, is available on-line via the *Radio Enthusiast* website by searching for the *Latest Articles* section.
www.radioenthusiast.co.uk

Stay tuned!

All photos this month except Fig. 3 (courtesy of Pierre-Yves Pièce, Bex, Switzerland)) are by Keith and Garry or from their archive collection. Please send archive photographs, information or suggestions for future topics via the email addresses shown at the top of this column. **PW**

Dr Bruce Taylor HB9ANY
bgtaylor@ieee.org

1

Two for the Road

Dr Bruce Taylor HB9ANY describes a versatile pair of 144/432MHz mobile transceivers.

The Sommerkamp FT-480R and FT-780R are matching microprocessor-controlled FM/CW/SSB VHF and UHF transceivers that were manufactured by Yaesu Musen in the early 1980s. Their rugged construction, compact size, wide temperature operating range and 13.8V power make them very suitable for mobile use, and when they are operated in combination they make an effective home station for full duplex satellite working, **Fig. 1**. Many of these sets were imported to Europe by **Wolfgang Sommerkamp** and branded with his own name. In the UK, Sommerkamp equipment was sold and serviced by several competing dealers, such as the charismatic 'Bandit' **Bill Lowe G3UBO** in Matlock. UK prices in 1981 were around £380 for the FT-480R and £450 for the FT-780R, plus £63 for the optional FP-80A mains supply, **Fig. 2**, that could power either model. Sommerkamp amateur and CB radio equipment became popular and Bill's turnover grew from £50,000 in 1971 to £3 million in 1983.

Initially operating from Düsseldorf as **DJ2YJ**, Wolfgang later relocated for tax reasons as **HB9XSO** to Lugano in Switzerland's Italian-speaking Ticino region. After being hit by the CB radio slump, Sommerkamp SAS closed in 1986 and Wolfgang retired to Tenerife, where he continued operating as **EA8YS**. He became SK shortly before his 88th birthday in September 2021. Today, FT-480R and FT-780R transceivers in good condition can be found at very reasonable prices on eBay, at hamfests, mobile rallies and SK sales.

Apart from their operating bands, the two companion transceivers have very similar specifications. Transmitter power input is 30W DC on FM or CW and 30W PEP on SSB, with carrier suppression better than 40dB and spurious emissions at least 60dB down. Receiver sensitivity is 0.5µV for a 20dB S/N ratio, image response is better than -60dB, and SSB and FM speech quality is excellent. The case of the UHF FT-780R is slightly deeper than that of the FT-480R, and on transmit it draws 4A, as against 3A for the VHF radio. Both sets draw 0.5A on receive.

While these transceivers lack the menus, bells and whistles of more modern radios, they both have very satisfactory performance and with the addition of a CTCSS encoder they include all the essential features required for enjoyable terrestrial and satellite QSOs. The instruction manuals are freely available online from several sources, such as RadioManual.eu:

https://tinyurl.com/FT-480R
https://tinyurl.com/FT-780R

Coverage

Be sure to check the Model Type before purchasing one of these transceivers. For the five FT-480R models, the frequency coverages are as follows:

A 143.5-148.5MHz
B 144.0-146.0MHz
C 143.5-148.5MHz
D 144.0-146.0MHz
E 143.5-148.5MHz

The repeater offset is ±600kHz for all models. If the restricted digital mode allocation 146-147MHz is not required, Model D is the most appropriate version for use in the UK. In FM mode it has a medium synthesiser step of 12.5kHz, whereas the US Model A has a medium step of 20kHz. Although Model B has the same 144-146MHz frequency coverage as Model D, it has a coarser medium step of 25kHz instead of 12.5kHz.

Many of the FT-480R transceivers supplied in Europe were Model E and these can be converted to Model D simply by unsoldering or cutting out the 1SS53 diode D4011. As this component is mounted on the underside of the pcb of the PLL control unit, it is not identified by serigraph printing. The location of the required break is shown arrowed in **Fig. 3**. With suitably fine tools, the modification can be made without any disassembly, apart from removing the lower cover of the transceiver. After conversion, in addition to the range change to 144-146MHz, the preset frequency on power-on becomes 145MHz instead of 147MHz.

The frequency coverages of the three FT-780R models are:

A 430.0-439.99MHz
X 440.0-449.99MHz
B 430.0-439.99MHz

The Model B was the most popular version sold in Europe. It has a repeater offset of ±7.6MHz, while the US Model A has an offset of ±5MHz. Other repeater offsets, such as the 1.6MHz shift common in the UK, can be accommodated with the dual VFOs. The synthesiser steps are the same for all three models.

Tuning

The IF frequencies are 10.81MHz and 455kHz for the FT-480R, and 67.61MHz, 10.7MHz and 455kHz for the FT-780R. In both transceivers the PLL circuits comprise three oscillators, each with a reference crystal oscillator, a programmable divider, a prescaler and a phase comparator, which give synthesiser steps of 10Hz, 100Hz and 1kHz on CW and SSB, although the 10Hz digit is not displayed. The adjustment of these circuits is quite critical. Frequency stability is ±10ppm from -10°C to +60°C. A microprocessor in the PLL Control Unit drives the display and controls the operating frequency, up/down scanning, priority channel or memory channel selections. For safety, it disables transmission if any VCO becomes unlocked. Two VFOs allow for split frequency operation as well as different repeater offsets, and when the SSB/CW clarifier switch is pressed with the 10Hz or 100Hz tuning rate selected, the receive frequency can be offset by up to ±10kHz from the frequency indicated by the digital display.

The main tuning control uses optical coupling and, as with the other controls and switches, has a fine positive action. The PRI switch enables the automatic checking of one of the memorised

frequencies for activity every 7 seconds while tuning with the main dial. The SCAN switch selects scanning stop on either a busy or a clear channel in FM mode and manual scanning stop is also provided on all modes. Pressing the DIL switch returns control to the main dial after memory, scan or priority operation, while the F-SET switch clears all the digits of the operating frequency below the step frequency in use.

Accessories

When buying a used transceiver, ensure that any required accessories are included. Both the FT-480R and the FT-780R were supplied with the same YM-40 hand microphone having a PTT switch, up/down scanning controls and a tone call button for repeater operation. A microphone holder was included. Although nominally the same, some microphones branded Yaesu have been found to give somewhat sharper speech quality than those carrying the Sommerkamp name. For base station use, the YM-38 desktop microphone is compatible if 600Ω impedance is selected.

For mobile use, a convenient universal mounting bracket, **Fig. 4**, was supplied with all the required fixing hardware. The bracket can be fitted above the transceiver for dash mounting, or below it on the transmission tunnel, and once it has been installed the transceiver can easily be slid in and out on its side guide rails. The transceivers and power supply were also provided with simple wire stands, which should always be fitted when the units are placed on a desktop to protect the switches under the case and to ensure adequate circulation of cooling air. Heatshrink tubing can be applied to the stands to avoid scratching the table surface. In the case of continuous operation with a digital mode, it would be wise to direct a small external fan towards the PA heatsink at the rear. Note that the FP-80 power supply is only rated for a 50% duty cycle at 4.5A.

Other accessories included a 5A fused power cable, a 4-pole P0090174 miniature connector for an external access tone generator, and 2-pole 3.5mm jack plugs for the key and external loudspeaker sockets on the rear apron, which are unlabelled. The upper socket is for the key, which draws about 1mA when closed, and the lower one is for an 8Ω loudspeaker capable of handling 2W. The unlabelled switch beside the power input connector on the rear apron controls the memory backup power. When it is in the up position, backup power is supplied to the memory, mode and tuning circuits even when the transceiver is switched off. However, if the DC power is removed, the memorised frequencies are lost.

The FT-780R (only) is also provided with a 3-pole P0090188 accessory connector for an external signal strength/power output meter and a control line that is grounded by spare relay contacts on transmit. Although this relay is also present on the main unit of the FT-480R, it doesn't have spare contacts in that radio. However, external equipment can be controlled by the 13.8V output that is provided at the Tone In socket during transmit via another relay in the PA unit. New GX16-2 aviation locking power plugs and GX16-8 microphone plugs are readily available for less than £2.

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Fig. 1: The companion FT-480R (left) and FT-780R (right) transceivers are ideal for full duplex satellite working.
Fig. 2: The FP-80A mains power supply matches the transceivers.
Fig. 3: Disconnect this diode to convert an FT-480RE to Model D.
Fig. 4: The R0062900 universal mounting bracket engages the side rails of the transceivers.


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Station Console

Yaesu manufactured a Model SC-1 station console in the form of a desktop plinth that supports an FT-480R and an FT-780R transceiver side by side. In the UK, the SC-1 cost about £135 in 1981, and today they are offered on eBay for much less. Like the FP-80A, the 13.8V power supply fitted inside the SC-1 is a linear design that


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Fig. 5: The SC-1 console supports and powers an FT-480R and FT-780R pair.
Fig. 6: With the covers removed the transceivers are very accessible for maintenance.
Fig. 7: Fully steerable crossed Yagi antennas reduce polarisation fading during satellite working.
Fig. 8: Additional switches for satellite, scanning and tone burst control are located underneath the case. Fig. 9: Modification to allow SSB power switching. Fig. 10: Trimmer VR1012 allows the low power level of the FT-480R to be adjusted over a wide range. Fig. 11: Trimmer VR1010 controls the low power level of the FT-780R.

generates no switching noise. But since it is rated at 5A with a 50% duty cycle, it can only power one unit transmitting and one receiving at the same time. In the Yaesu publicity photo, **Fig. 5**, neither unit is transmitting – the LED S/PO bars just indicate that they are both receiving S9+ signals.

The console has scan and tone call switches, so that it can be used with desk microphones such as the Model YM-34 that do not have these. A select switch connects the single microphone socket and the scan and tone call switches on the console to the chosen transceiver. The console also incorporates an LCD digital clock that is powered by an AA battery, and a full 16-key two-tone encoder keypad for autopatch or equipment control purposes that injects DTMF audio tones into the microphone socket of the selected transceiver.

Reliability

The transceivers are readily accessible for service and realignment when the guide rails and upper and lower covers are removed, **Fig. 6**. The internal foam packing is usually stable with time and the large screening cover of the PLL unit simply prises off with a flat-bladed screwdriver. The original Yaesu Serial No., which is different from the Sommerkamp Serial No. on the case, is indicated on a label on the right side of the chassis.

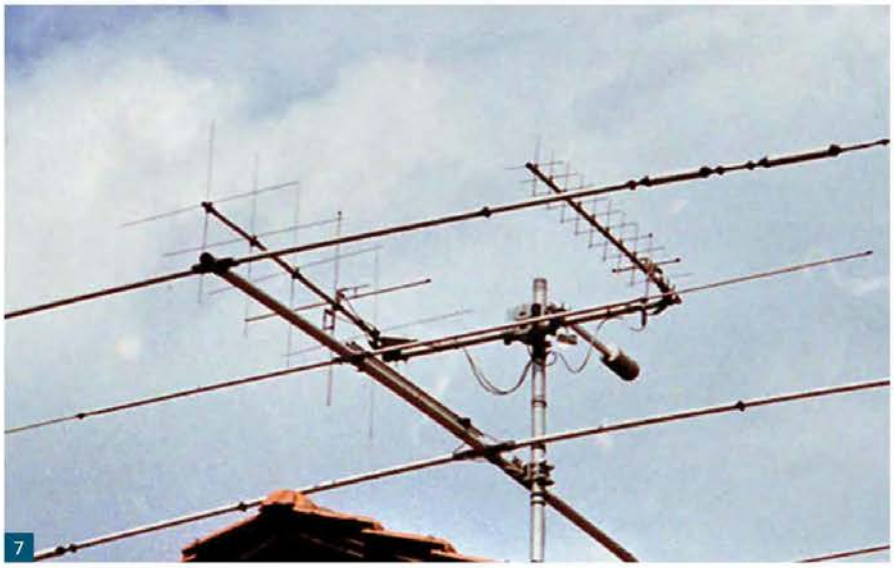
Although the sets each contain over 250 individual transistors, ICs and diodes, they were built with high-grade components and unless they have been stored or operated in unfavourable conditions they prove very reliable, although the occasional dry solder joint may be found. By means of directional couplers (a toroidal transformer in the FT-480R and stripline in the FT-780R) the forward and reflected transmitter power at the antenna socket is monitored. An ALC circuit prevents overdrive, and to protect the final amplifier an AFP circuit reduces the output power if the VSWR exceeds 1.5:1.

The 7-digit fluorescent digital displays maintain their brightness over the years and are less temperature-sensitive and prone to fading than some early LCDs. The relatively large Sumida radial electrolytic capacitors fitted to the units rarely give trouble, unlike many miniature surface-mount electrolytic capacitors of this vintage, which have a tendency to leak or dry out with age. Moderately priced kits of modern electrolytic capacitors are available for owners who wish to do a complete precautionary recap.

On delivery in 1981, my FT-780R was found to have a defective PLL, which resulted in spurious frequency jumps of 1kHz when 10Hz steps were selected and the least significant digit changed from 0 to 9 on SSB, or from 7 to 8 on CW. The unit was replaced by the supplier under guarantee. The transformer in one new FP-80A power supply emitted an excessive humming noise after warmup, and this was also exchanged without charge. Since then both transceivers have proved trouble free, except when a lightning strike to the antenna put the FT-480R out of action. This proved to be due to damage to the audio output amplifier Q1029, which I replaced with an inexpensive Fairchild TDA 2002V IC. The first replacement IC failed after one minute; the second replacement from the same batch has lasted over 40 years.

Satellite Operation

A pair of independent VHF and UHF transceivers allows maximum flexibility and operating convenience for full duplex satellite working. To minimise cross-coupling in this mode, the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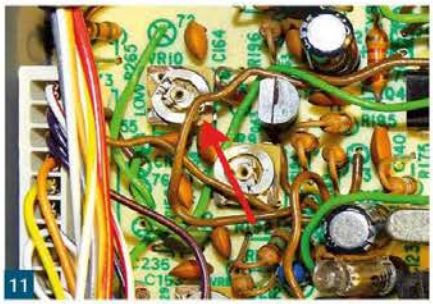
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2m and 70cm antennas should preferably be mounted separately on a horizontal boom, as shown in **Fig. 7**, rather than on a common axis. The use of a balancing counterweight reduces the stress on the elevation rotator and allows both antennas to be mounted entirely forward of the boom without obstruction. Fully steerable crossed Yagi antennas reduce satellite signal polarisation fading, but at the expense of a small gain loss when working horizontally polarised terrestrial DX. High quality low-loss coax is a worthwhile investment, and masthead preamplifiers are beneficial unless the feeder run is very short.

As RF amplifiers, the transceivers employ dual-gate FETs (a MOS 3SK59Y for the FT-480R, a GaAs 3SK97 for the FT-780R) that have excellent rejection of cross modulation and intermodulation. The PA of the FT-480R incorporates a Mitsubishi M57713 power module, while the FT-780R has the higher frequency M57716 version. These modules are rated for a power output of 17W but are driven conservatively to 10W output. The FT-480R has an SO-239 antenna socket, while the FT-780R has a 50Ω N connector. The output power monitor is calibrated such that with a correctly matched antenna, nine of the ten LEDs of the S/PO indicator will light up at full power output with a 13.8V supply.

Signals relayed via an orbiting satellite are subject to Doppler frequency shift, so that your downlink frequency may be around ±3-4kHz from the predicted value. Normally the transmit frequency is locked during transmission but both transceivers are equipped with SAT switches located under the case, **Fig. 8**, which allow the operating frequency to be changed while transmitting. This allows netting while listening to one's own signal on the satellite downlink frequency. However, note that neither VFO A/B TXA nor the receive clarifier function work when the SAT switch is placed in the ON position. Repeater shift is also disabled.

When sharing a linear satellite transponder, stations should use the minimum transmitting power required to make a satisfactory QSO. (Note that the AO-73/FUNcube-1 transponder uses only 300mW PEP, yet can be received strongly). The

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HI/LOW switches on the transceivers reduce the output to 1W, but they are active only on CW and FM. To modify the FT-780R such that the switch also reduces the output power on SSB, link the green 'CW FM GND' wire at connector J4001 on the upper side of the PLL control unit to the black chassis ground wire at the end of the connector, as shown arrowed in **Fig. 9**.

For the FT-480R the position of the required link on J4001 is the same, but in this case the 'CW FM GND' wire is white instead of green. Even lower power output than 1W may be required to drive other external equipment, such as a transverter. The actual low power levels can be adjusted over a wide range by the trimmer potentiometers VR1012 for the FT-480R, **Fig. 10**, and VR1010 for the FT-780R, **Fig. 11**, which are located on the undersides of the main circuit boards.

Tone access

In FM simplex or repeater shifted mode, a 1750Hz tone burst of 0.5-1 second duration is generated when the PTT switch is pressed. (1800Hz for the FT-480RA and the FT-780RA and X Models). This tone signal can be suppressed by setting the BURST switch under the case to the OFF position, Fig. 8 again. The tone signal is also generated for as long as the CALL switch on the microphone or the T.CALL switch on the front panel is pressed.

Today, the repeaters in most countries use CTCSS rather than tone burst access. Both transceivers have a 4-pin Tone In connector that was intended for use with a CTCSS tone encoder such as the Yaesu FTS-64E, or with an external tone burst generator for frequencies other than 1750Hz. A sinewave signal level of about 200mV at the Burst input is required for the tone burst, while a 350mV signal at the Tone input (which has much higher attenuation) will produce the reduced deviation for a continuous CTCSS tone.

FTS-64E tone encoders are now quite rare. For mobile operation a very compact CTCSS module, such as that described by **Andrew Woodfield ZL2PD** (see *Practical Wireless, June 2022*), could be accommodated inside the transceivers. But for home station use it is more convenient to house the encoder in a small external box, **Fig. 12**, that can be plugged into different

Fig. 12: An external CTCSS encoder can be connected via the Tone In socket.
Fig. 13: Modification to allow rapid repeater input frequency monitoring. Fig. 14: FT-480R modification to allow sidetone muting.
Fig. 15: FT-780R modification to allow sidetone muting.

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transmitters. I used the inexpensive CTCSS47 encoder kit supplied by DJS Electronics, which includes a Microchip PIC16F627A programmed to generate 47 tones. A subset of the nine UK standard repeater tone frequencies (plus 100Hz, which is avoided in countries with 50Hz mains) are grouped together for convenient switch selection. The transceiver PTT signal is not provided at the Tone In connector but the encoder can be enabled by the 13.8V output that is present only when transmitting. I found the accuracy of the tone frequencies to be better than ±0.02%.

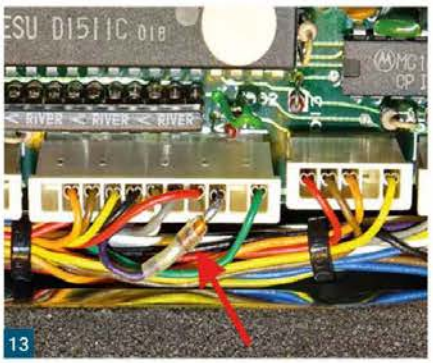
Modifications

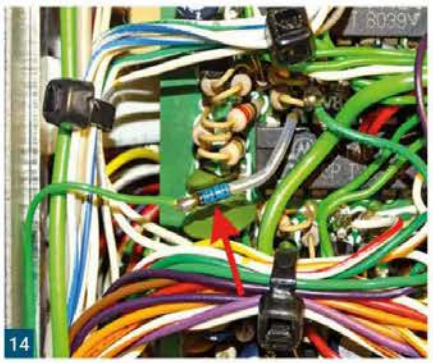
When receiving a station via an FM repeater, it can be very useful to have a method of quickly checking whether the signal from the transmitting station can be heard directly on the repeater input frequency. If so, this allows both stations to QSY, freeing up the repeater for other users. Since the CALL push switch on the microphone is not required when receiving, it can be used to shift the receiver tuning to the repeater input frequency momentarily when pressed.

In the FT-480R this can be achieved simply by wiring a 1N914A or similar small signal diode in series with the mauve PTT wire where it enters connector J4003 on the upper side of the PLL control unit, as shown arrowed in **Fig. 13**. The anode of the diode should be soldered to the connector contact. This modification does not affect the generation of the tone burst when the CALL switch is pressed while transmitting.

Both transceivers are designed to generate an 800Hz sidetone when the key is closed in CW mode. In satellite operation, it is useful to be able to mute the sidetone temporarily while netting one's own signal on the downlink frequency. Since the noise blanker is of little use except for ignition noise, the SSF-22-55 NB switch S04 can be wired to perform this function.

Initially one pole of this DPDT switch is unused. In the case of the FT-480R, connect the centre terminal of this pole to ground and wire a 1N914A or similar diode between the 'NB on' terminal and pin 13 of MC14011B IC Q1061 on the underside of the main pcb, as shown arrowed in **Fig. 14**. The anode of the diode should be connected to the IC pin. In the case of the FT-780R, connect the anode of the diode to pin 3 of MC14069UB IC Q1059 on the underside of the main pcb, as shown in **Fig. 15**. In both


13


14

15

transceivers, you may find that the wiring of the used pole of the NB switch is configured a little differently from that shown in the manufacturer's schematics, with the centre terminal connected to ground, but the functionality is unchanged. The operation of the noise blanker on FM and SSB modes is unaffected by these modifications.

Conclusion

The FT-480R and FT-780R are well engineered transceivers with excellent build quality and performance. They are cheap to purchase and they are made mostly with discrete leaded components and SSI ICs. Their comprehensive instruction manuals include schematic and block diagrams, component lists, alignment instructions and detailed circuit descriptions.

Hence they are ideal for amateurs who enjoy learning about the design of their radio equipment, and experimenting with it without the prospect of devaluing an expensive modern black-box set. Aquiring familiarisation with electronics in this way can be a very worthwhile and rewarding facet of amateur radio activity. **PW**

You might be interested in a series of articles on WWII military radio that our sister magazine, *The Armourer*, is currently running. To find out how to order this magazine, visit **www.armourer.co.uk**

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Keys and Keyers

Dear Don,

I have an RSGB Centenary iambic Morse key. It worked well when I had an FT-3000 but I got tired of all the menus and things I did not use or need so I went back to my FT-101Z and my TS-530SP as well as the FT-107M (cream facia) and FT7B. Bit of a retro rebel. I used a straight key but not the RSGB key.

I was not able to use my RSGB key as those rigs did not have a keyer chip. I discovered the MFJ 407E keyer. You plug in your iambic keyer to it, take a lead to the rig and away you go. There are internal jumpers inside the box to swap for solid-state rigs (FT-107M and FT7B). For valve PA rigs you swap the jumpers for grid block keying and away you go. Most excellent piece of kit for those who have iambic keys but valve PA rigs they cannot use.

Ross Bradshaw G4DTD
Cornwall

*(**Editor's comment**: Thanks Ross. I have used various keyers with my iambic key over the years, having started with an AEA Morsematic MM-1, but have now settled on a Winkey, which interfaces to the PC as well. Whether it works with valve rigs I don't know although an external relay would certainly take care of any issues.)*

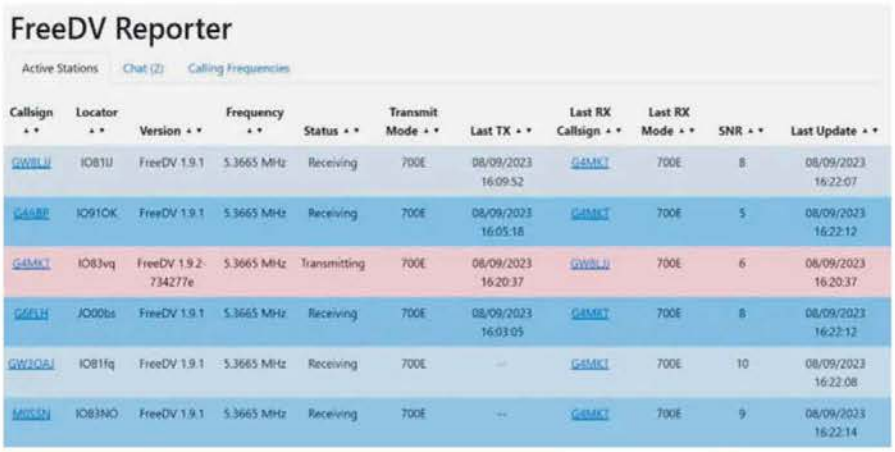
Digital Voice on HF

Dear Don,

Digital voice is very much alive on the HF bands (I refer to your *Keylines* in the October issue) and as a bonus is free to use. The name as suggested is FreeDV.

There is activity every day on several bands and I am on at 1600hrs local time with several UK and sometimes joined by non-UK stations, all using FreeDV ..

The accompanying screenshot shows a list of regular users of the 1600hrs net.



FreeDV Reporter

Active Stations | Chat (2) | Calling Frequencies

Callsign	Locator	Version	Frequency	Status	Transmit Mode	Last TX	Last RX Callsign	Last RX Mode	SNR	Last Update
GW8LJJ	IO81IU	FreeDV 1.9.1	5.3665 MHz	Receiving	700E	08/09/2023 16:09:52	G4MKT	700E	8	08/09/2023 16:22:07
G4ABP	IO91OK	FreeDV 1.9.1	5.3665 MHz	Receiving	700E	08/09/2023 16:05:18	G4MKT	700E	5	08/09/2023 16:22:12
G4MKT	IO83vq	FreeDV 1.9.2-734277e	5.3665 MHz	Transmitting	700E	08/09/2023 16:20:37	GW8LJJ	700E	6	08/09/2023 16:20:37
G6FLH	JO00bs	FreeDV 1.9.1	5.3665 MHz	Receiving	700E	08/09/2023 16:03:05	G4MKT	700E	8	08/09/2023 16:22:12
GW2OAJ	IO81fq	FreeDV 1.9.1	5.3665 MHz	Receiving	700E	--	G4MKT	700E	10	08/09/2023 16:22:08
M0SSN	IO83NO	FreeDV 1.9.1	5.3665 MHz	Receiving	700E	--	G4MKT	700E	9	08/09/2023 16:22:14

The RSGB news is also read out using FreeDV on 3.643MHz using LSB on Sunday mornings at 0900hrs local by **Matt G6WPJ**.

The table is a snapshot currently on air using FreeDV. There are many more and this list is only showing those using the reporter option with the latest software.

Much more information can be found at:
www.freedv.org

There is also a freeDV article in the September issue of *QST*
https://tinyurl.com/5n7sfetr
Eric Edwards GW8LJJ
Barry

SPE 1k-FA Amplifier

Dear Don,

Are you able to advise re the repair of the above amplifier? It would appear that SPE will not supply circuit diagrams or spares to UK engineers or dealers.

It begs the question, how many amateur radio products sold in the UK are not supported locally? Maybe a question to be posed in *Practical Wireless*?

Brian Payne G4CJY
High Wycombe

*(**Editor's comment**: Thanks Brian and quite worrying. When Vine Electronics first imported these amplifiers **Ross GW3NWS** was able to effect repairs but, as far as I am aware, no longer does so. One would hope that major importers would have repair facilities in place. Have other readers experienced problems with getting amateur radio gear repaired and serviced?)*

Callsign	Locator	Version	Frequency	Status	Transmit Mode	Last TX	Last RX Callsign	Last RX Mode	SNR	Last Update
W7BL	DN05wh	FreeDV 1.9.1	7.1780 MHz	Receiving	700D	--	--	--	--	07/09/2023 08:33:15
F6HOY	JN13UJ	FreeDV 1.9.0	14.2360 MHz	Receive Only	N/A	N/A	--	--	--	07/09/2023 08:33:17
WB4TVK	em79	FreeDV 1.9.0	14.2360 MHz	Receiving	700D	--	--	--	--	07/09/2023 08:33:16
K9STL	EM58bk	FreeDV 1.9.1	14.2360 MHz	Receiving	700E	--	--	--	--	09/09/2023 10:42:04
JK2QQB	PM85KF80	FreeDV 1.9.1	7.2000 MHz	Receiving	700E	--	--	--	--	09/09/2023 10:42:07
N4YKU	EM79	FreeDV 1.9.1	14.2360 MHz	Receiving	700D	09/09/2023 02:28:33	--	--	--	09/09/2023 03:01:55
VK2ZIW	QF56HG	FreeDV 1.9.1	18.1170 MHz	Receiving	700D	--	--	--	--	09/09/2023 06:08:12
JA3JHG	PM85ac	FreeDV 1.9.1	7.1950 MHz	Receiving	2020	09/09/2023 08:32:04	--	--	--	09/09/2023 09:55:34
KN4RCX	EM86	FreeDV 1.9.1	14.2360 MHz	Receiving	700D	--	--	--	--	09/09/2023 09:20:05
SQ2DL	JO94BN	FreeDV 1.9.1	14.2360 MHz	Receiving	700D	09/09/2023 09:26:11	--	--	--	09/09/2023 09:26:44
4X1SK	KM72jb	FreeDV 1.9.1	14.2360 MHz	Receiving	700D	--	--	--	--	09/09/2023 10:42:07

★Star Letter★

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

The 'death of Amateur Radio as we know it'

Dear Don,

On 8 March this year (2023) I had held an amateur radio licence for 40 years.

Over those 40 years I've often heard, or read, about 'the death of amateur radio as we know it', usually said or written by someone who objects to some proposal or innovation within the hobby.

Before I obtained my two passes in the Radio Amateurs Examinations (RAE) it was the change from a written to a multiple-choice exam. Then it was when the Amateur Licence B holders were allowed to use Morse code on the VHF bands without having to pass a Morse test. I have my NoV and notes of guidance for doing this, dated 1 April 1985 (probably an apt date for the doom mongers), in front of me.

Then there was the use of AX.25/Packet Radio (disparagingly called 'Racket Radio' at the time).

Next was the proposed abolition of the Morse test for allowing access to the HF bands, but Morse code is still alive and well and even being used by people who are quite proficient but objected to being forced to pass a test to use it. I passed my 12wpm test, eventually, after the third attempt and I use the mode quite often.

Then we got onto the abolition of the RAE as a City & Guilds Exam in favour of a structured, three-part system. Not to mention the hand wringing when novice licence holders were proposed to be given access to the 10GHz band with a significant RF output allowance.

As someone who was trained as a heavy current electrical engineer, I learned a lot about how a radio works by making a Wide Band FM 10GHz set. I had lots of help from people like **Glenn Ross G8MWR** and went on to build a similar set-up for 24GHz. I did have a 10GHz Narrow Band set-up for a while as well and still have one for 24GHz. People who disparage newcomers as not being capable of such bands seem to forget that the self-training element of our hobby has a long history and there are lots of people who will help newcomers to get onto the more exotic bands. Just because you can use a particular power output doesn't mean that you will use it. If you do, you will probably know what you are doing. It's not like you are buying a kitchen microwave oven and just plugging it in. (Microwave ovens work on a frequency of about 2.45GHz, near to the 13cm amateur band anyway and not 10 or 24GHz. So much for the jokes about frying pigeons...)

Recently, it seems, the common scapegoat is using computers to generate signals, back to the 'Packet Racket' arguments maybe? Disparaging comments are made about modes like FT8, but the evidence on the air is that they are very popular with many people. I still use Morse code, FM, etc, but not SSB or AM much. I do use FT8, JS8Call, Olivia and other data modes at times. That's not to say that SSB and/or AM should be banned, quite the opposite. If that's what interests you, carry on. Then there are modes such as SSTV, FSTV, Hellscriber, slow speed Morse and other very slow speed transmissions, satellites, repeaters, the use of internet chat rooms and reflectors, DX Clusters, RF hot spots, HubNet, D-Star/DMR and on and on with modes I've probably missed out.

The thing is, the hobby changes and evolves, it doesn't end, as some people seem to fear.

Nobody is being forced to use modes or bands that they don't want to but there should be the opportunity for people to experiment and self-train on all sorts of different bands and modes.

Over my 40 years of being licensed I have come to the view that we, as radio amateurs, are a group of people who are separated by a common interest...

Dave Ackrill G0DJA
Bolsover

*(**Editor's comment**: Thanks David for the reminder that amateur radio has such a breadth of interests. I go back even further than you and recall SSB, for example, being the death of amateur radio as we know it. But, in reality, the reason amateur radio is still alive and kicking is exactly because it has moved with the times and that's also why I believe the hobby has a bright future, albeit it would be nice if we had more youngsters joining our ranks but I suspect that's more to do with young people having too many pressures on their time – other hobbies are finding the same thing.)*

MW interference

Dear Don,

I live in Clevedon about one mile from the medium wave transmitter. The strong MW signal bleeds through all over the short-wave bands making it very difficult to listen to World Band stations. Is there anything I can do to rectify this problem?

Richard Felton
Clevedon

*(**Editor's comment**: I have suggested to Richard that a band-stop filter tuned to the frequency of the offending station should help, but are there any other suggestions?)*

Simple 2m/70cm Vertical Antenna

Dear Don,

It is over 50 years since the UK began its glacial journey towards metrication and now most hardware and DIY stores no longer sell their materials in Imperial measurements. I was therefore surprised to see a mixture of millimetres and inches used in *An adaption of a simple 2m/70cm vertical for temporary use* (*PW*, October 2023). I appreciate that the original design came from ARRL and the USA is the only major country that still uses Imperial measurements but I suggest *PW* adopts metric measurements as standard practice.

The author also suggests using SO239 connectors – these are a poor choice for 70cm and not great at 2m. There are much better alternatives, such as N type, for use above 100MHz.

David Howard M0BGR
London

*(**Editor's comment**: Thanks David. The subject of measurements is always a tricky one especially, as you note, because there is still a strong US influence in our hobby. I well recall helping a South African friend assemble a Force 12 antenna from the USA – the sale of Imperial tools is actually illegal in South Africa, so it proved a challenge! And here in the UK road distances and speeds, for example, continue to be non-metric. I try to achieve consistency here at* PW *but it isn't always easy!)*

Thankyou!

Dear Don,

I have just been reading the October 2023 issue, a wonderful selection of radio topics! Thanks to all your staff and authors!

Dave Newman WB1EVP
Kingston, Massachusetts USA

*(**Editor's comment**: Many thanks for this Dave. We do have some excellent authors for which we are very grateful. But thanks also to our dedicated readers, without whom there would be no need for this magazine!)*

Read more radio news and reviews at www.radioenthusiast.co.uk/news

About Valves

Dear Don,

Last month there was an assertion that Murphy made valves important to the War effort. That was a surprise to me as I have not heard or come across any Murphy valves. That could be my omission obviously. However, **Joan Long**, **Frank Murphy's** daughter makes no reference to Murphy valves, in her biography of Frank, *A first-Class Job* (ISBN 0 9511208 0 8). The book, by the way, is a very good read, it is not a technical one. There is actually very little mention of the war.

Murphy radios and TVs almost always used Mazda valves, including their infamous short-lived CRTs.

This month it was stated that Mullard made the KT88. They didn't, they made the EL range of power-pentodes, such as EL34 and 37. MOV (Marconi-Osram Valves) made the KT range of valves. KT being Kinkless tetrode, which are more correctly known as beamed-pentodes, as the suppressor grid is replaced by beam-plates, which it appears were an RCA development. The two companies had close ties. This was a way around the Philips/Mullard patent on the suppressor grid, and the trade name of Pentode. Many RCA valves are beamed-tetrodes, the 6V6 being perhaps the most well-known. Actually, I am sure I did see a very old KT66 datasheet that called it a beamed-pentode. I assume there were solicitors' letters...

There was a genuine beamed-tetrode, with the beam effect achieved by the design of the screen-grid, and critical spacing, resulting in the electrons being 'bunched' as they flew to the anode, and this dense area repelling secondary-electron emission from the anode. For some reason it didn't catch on. Beam-plates do the same, and the pentode simply repels them without bunching, by being relatively negative.

Philip Moss M0PBM
Surbiton

Baked bean tin radio project

Dear Don,

Last month's topic *'Build your own gear'* by **Tim Walford** in the September 2023 issue: I have been building projects for some years and as Tim Walford is only 10 miles down the road I frequently build his kits. This was a fun project to build and not wanting to buy any new components I scavenged what components I needed from other projects and the only cost was a tin of baked beans. It was the main topic of the local Yeovil amateur radio club 2m net on how I was going to find a suitable box or container. Wanting to keep it a fun project and the approval of my 12-year-old great grandson, I wanted something unusual and the idea of a baked bean tin was perfect. It all fitted nicely up from the bottom of the baked bean tin leaving the top un-opened. The next stage will be the speaker and again the smaller size baked bean tin with the speaker in the top covered with a tea strainer for the grill, now for beans on toast and a cuppa tea, enjoy 73.

Derek Bowden M0WOB
Yeovil

Next Month

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

ATU-100 AUTO TUNER ON A BUDGET: Richard Constantine G3UGF looks at the ATU-100 plus the new and latest version, the AT-100M.

VINTAGE TELEVISION & RADIO: Keith Hamer and Garry Smith continue the special series looking back at the BBC's coverage of Coronations since 1937 along with many other topics.

TURN THE KNOB: Billy McFarland GM6DX creates a remote tuning knob for SDR radios.

VALVE & VINTAGE: In Part 1 of a two-part feature, Tony Smith G4FAI describes the early days of Morse sending.

LAB TUTORIAL: Jeff is back, this time teaching Natalie about capacitors.

There are all your other regular columns too, including HF Highlights, World of VHF, Antennas, Book Reviews, What Next, The Morse Mode, Airband News, Amateur Radio on a Budget and Data Modes as well as your Letters, the latest News and more. And, yes, we will have some previously promised articles that have had to be held over due to space constraints.

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* Photo shows the FT-710 AESS

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