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Why our tester thinks the KSGER T12 is a great value and useful piece of kit

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Our contributor explains how an unloaded three-band dipole resolved his conundrum

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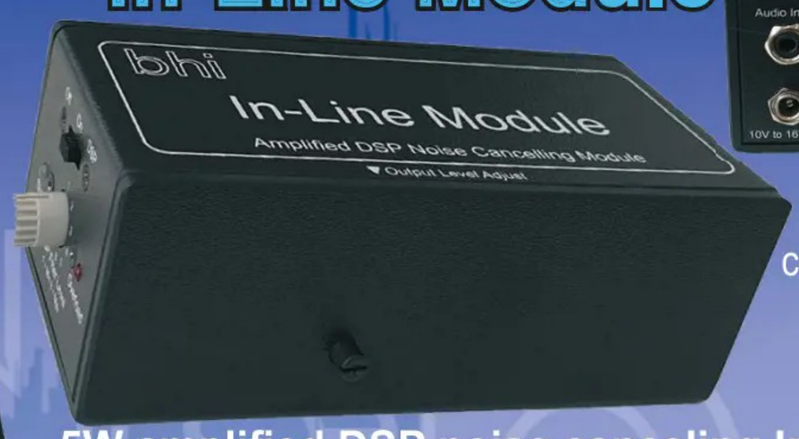
EQ20B-DSP *QST Dec 2019* review *"easy-to-use device that improves the audio clarity of amateur signals"*

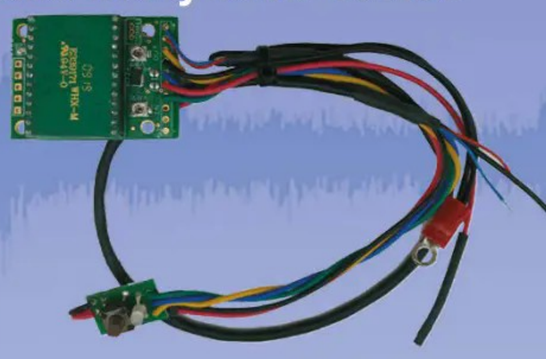
In-Line Module



In-Line Module connections

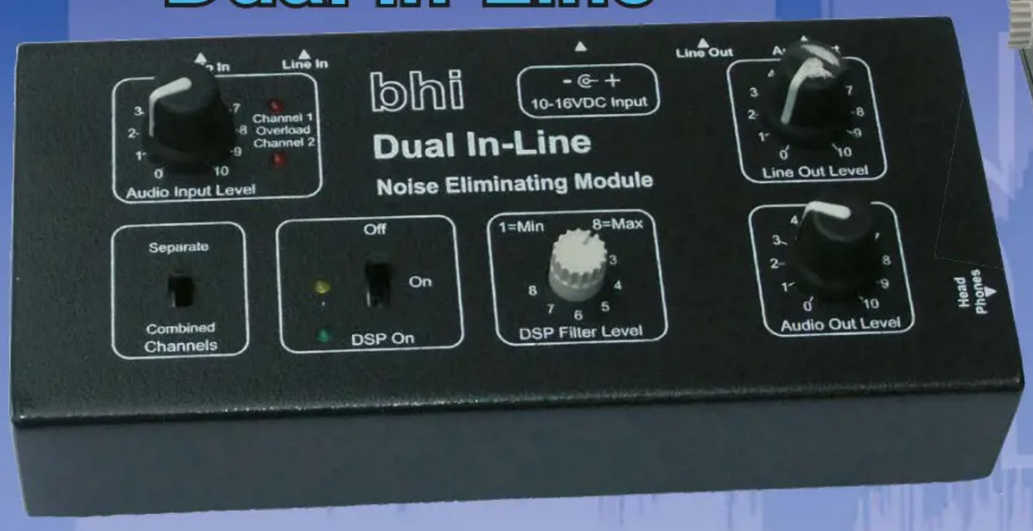
NEDP1901-KBD

Low level audio install module for Yaesu FT-817, FT-897, FRG-100, Icom 706 MKIIG, Kenwood TS-50, TS-440, Realistic dx-394, Alinco DX70, DX-77 and many other radios



5W amplified DSP noise canceling In-Line module - 8 filter levels 8 to 40dB - Use in-line with a loudspeaker - Audio bypass feature - 3.5mm mono inputs and outputs - Headphone socket - Audio input overload

Dual In-Line



Fully featured dual channel DSP noise cancelling in line module
- 8 Filter levels 9 to 40dB
- 3.5mm speaker level input
- Line level input for SDR radio and headphone output
- separate 7W mono speaker output, stereo headphone socket and line level output
- Easy to use controls

Compact In-Line

- Compact In-Line noise DSP cancelling Module
- Powerful audio processor
- Removes noise and interference
- Hear weak signals clearly
- Easy to use with "real time" audio adjustment
- Use with headphones or a loudspeaker
- 3.5mm line level or speaker level inputs
- Suitable for use with SDR radio

NES10-2MK4

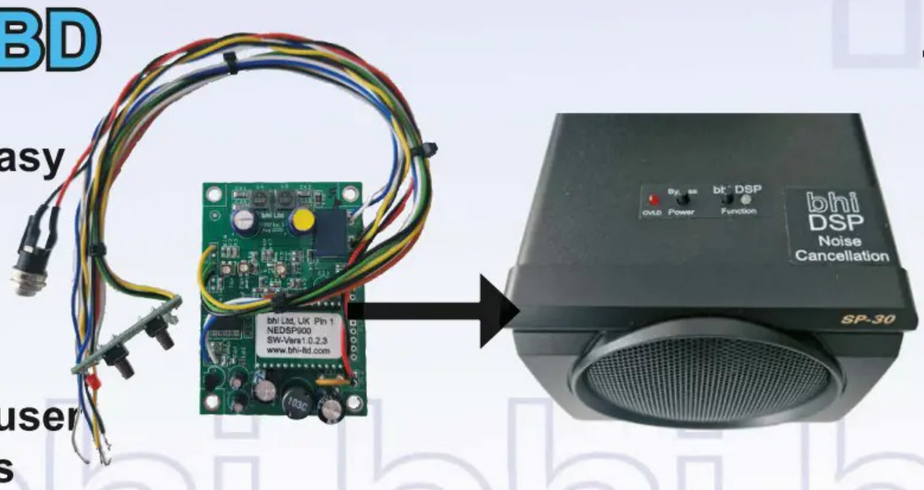
- 5W amplified DSP noise cancelling speaker
- 8 to 40dB noise cancelling
- Audio bypass feature
- Compact rugged speaker
- Use mobile or base station
- Supplied with integral 2M audio lead, fused DC power lead & manual

DESKTOP MKII

10W Amplified DSP noise cancelling base station speaker
- Easy to use controls
- 8 DSP filter levels
- "Real time" adjustment
- Suitable for all radios incl' SDR
- Headphone socket
- Loudspeaker and line level inputs

NEDSP1962-KBD

Amplified DSP noise cancelling pcb module - easy to install retrofit module
- Audio bypass feature
- Simple control with LED and audio indication
- Supplied with fitting kit, user manual and speaker labels



Check out the videos of our products on Youtube

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

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

Advertisement Manager
Kristina Green
01778 392096
kristina.green@warnersgroup.co.uk
Marketing Manager
Sophie Thornton
sophie.thornton@warnersgroup.co.uk
Marketing Executive
Charlotte Bamford
Charlotte.bamford@warnersgroup.co.uk
Production Manager
Kay Cotterill
01778 395065
k.cotterill@warnersgroup.co.uk
Publisher
Claire Ingram
claire.ingram@warnersgroup.co.uk

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Keylines

Here I am writing an editorial for the November issue of *PW* – it's starting to feel as though the year is drawing to a close although, in fairness, it's still only September. I've recently had a play in the Scandinavian Activity Contest (always a good one from the UK – the skip favours us on most of the HF bands and the Scandinavian amateurs tend to be excellent operators). I am also looking forward to some great expeditions coming up later in the autumn.

Of course, going on expeditions isn't always straightforward and news has just come out that the 6O3T (Somaliland) expeditioners have left in a hurry without getting active, having suffered what they describe as 'traumatic experiences' in the country. They have promised more information when they are safely back in Europe.

Thankfully not all overseas operations have to face such experiences – I plan to return to Uganda for the CQWW CW Contest at the end of November, this time with my own callsign (last time I shared **Alan G3XAQ's**). The problem with Uganda is that getting an amateur licence is a protracted process, something that seems to be common to most African countries. It's taken me since May. In contrast, when I visited Bermuda some years ago, on business but with a weekend free which happened to coincide with the RSGB's Commonwealth Contest, the licensing office took less than 20 minutes to issue my licence and apologised that it had taken so long (their computer system was playing up). It turned out that they were used to American cruise ship passengers coming ashore, getting a licence and 'working' each other on their handhelds, in order to say they had operated from Bermuda!

Mind you, that also reminds me of when my brother – an ardent birdwatcher – was on an Antarctic cruise. He commented to one of the guides that they must find birdwatchers rather odd, rushing ashore at every destination with their tick lists, to check off what birds they could see in the time available. The guide agreed but said they had an even stranger type of passenger sometimes, who wanted to rush ashore with a radio set and make contacts to say they had 'activated' a new country. My brother wisely didn't mention that he had one of those in the family!

Laurie Margolis G3UML

I have known **Laurie G3UML** for very many years – we have contested together, been on expeditions together, etc. So, I was pleased to see that his recent retirement from a lifetime at the BBC got a mention in several of the national newspapers. Laurie was licensed while still at school (his parents were both radio amateurs), went on to feature on the BBC when he worked **King Hussein JY1**, and later found notoriety when he was one of the first to gain knowledge of the Argentinian invasion of the Falklands, again through the medium of amateur radio – he had the information before even the Foreign Office!

Conventions

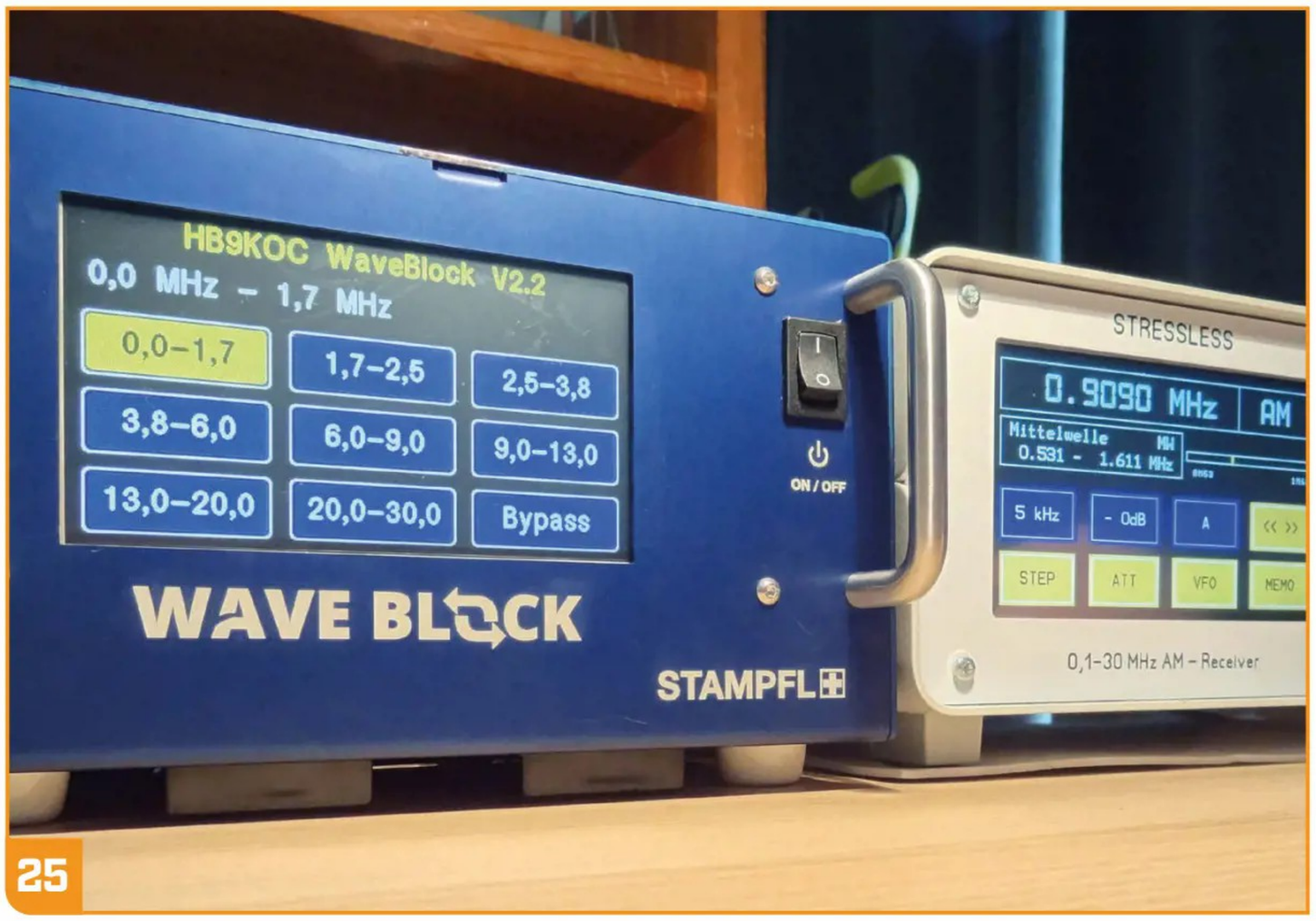
I decided for several reasons that I would have to give Newark a miss this year, but our intrepid Designer **Mike Edwards** was planning to be there to take some photos for our *News* pages. I will, though, as previously mentioned, be at the RSGB Convention in October and have had my arm twisted to give a talk entitled *'92 Years of PW and my 12 years at the Helm'*. So, that's one not to be missed!!

Apropos of which, in starting to prepare my presentation, I dropped a line to past editor **Rob Mannion G3XFD**, who many of you will remember. As well as helping me with material and ideas, Rob told me he has just been declared clear of cancer, which is very good news indeed. He is also due to be fitted with a new 'bionic' (!) arm, courtesy of the NHS. I'm sure we all wish him well.

Incidentally, Rob too has a King Hussein connection, which not all readers may be aware of, in that his wife, before they married, was Governess to two of the King's children, and therefore already knew about amateur radio.

Don Field G3XTT
Editor, *Practical Wireless* Magazine

Contents



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44

55

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New from Moonraker

The Moonraker Titan 10m Multimode is a 40W FM/SSB/CW and 12W AM Transceiver now in stock for just £149.95.

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- Output Power: Low 4W, Middle 8W, High 40W
- Step: 5Hz, 10Hz, 100Hz, 1kHz, 10kHz, 100kHz
- ASQ on/off • ECHO on/off
- Output power adjustable
- Hi-cut on/off • Beep on/off
- Dual Watch • Noise Blanker on/off
- ANL build-in • Scan • Roger Beep
- LCR (Last Channel Recall)
- Mic gain adjustable
- TalkBack • Scan list • TOT
- Digital RFG adjustable
- A-RFG (Auto RFG)

https://moonrakeronline.com

RSGB ANNOUNCES SPECIAL ISS CONTACT: The RSGB said: *"We are delighted to announce that the Radio Society of Great Britain and ARISS, in conjunction with Girlguiding Surrey West and Brooklands Museum including the Innovation Academy, have been collaborating on a special event due to take place on Saturday 5 October. Girlguiding President, **HRH The Duchess of Edinburgh**, will attend a planned contact with the International Space Station (ISS) as part of a visit to promote the engagement and involvement of girls and young women in science, technology, engineering and maths (STEM)".*

BYLARA 45TH CELEBRATION: BYLARA (British Young Ladies Amateur Radio Association) attained 45 years of age on 29 April 2024. To celebrate, a buffet lunch for 40 guests was held at the NARSA Rally in the Lancastria Suite of the Norbreck Hotel. There was more than ample delicious food for all, so the excess was shared with other rally attendees. Friends from WAB and RAIBC joined us as both groups were also celebrating anniversaries. WAB is 55 this year and RAIBC will be 70. Cake was graciously provided by **Pat Summers** SWL and her OM **Tim Summers M6SEC**, both BYLARA members. Chairperson **Sharon Lewis 2E0SHZ** insisted that this was cut by **Judith Brooks G4IAQ** and **Maureen Fellows G8GKR**, as some of the group's longest serving members. **Val Bates G6MML** was presented with a vase and flowers, as a thank you for years of service at NARSA rally, expeditions and committee member. **Helen Melhuish** was awarded the G3HCQ rose bowl for her work behind the scenes. She has ensured that the website was overhauled and renewed and designed beautiful new banners. Many thanks to **Dave Wilson** of RSGB for his assistance and support and to all those who came to celebrate with us. It was much appreciated.

Icom announces more products at Tokyo Hamfair 2024

Following the highly anticipated launch of the IC-7760 200W HF/50MHz amateur radio transceiver at the Tokyo Hamfair, Icom UK have shared more product news from the event. While the innovative IC-7760 has captured the imagination of amateur radio enthusiasts worldwide, Icom used the Tokyo Hamfair platform to showcase several additional new products:

- IC-2730A/E (Black Screen Edition): This take on the popular IC-2730A/E features a stylish black display, adding a touch of sophistication to your operating station.
- ID-52E PLUS: Building on the success of its predecessor, the ID-52E Plus retains all the acclaimed features of the ID-52E while offering even more functionality.
- IC-PW2: Take your signal strength to new heights with the all-new IC-PW2, a 1kW HF/50MHz Linear Amplifier.

Meanwhile, Icom have announced provisional pricing for the IC-7760. The press release says, *"The IC-7760 has generated significant excitement within the amateur radio community with its cutting-edge features, including:*

- *Innovative Shack Style: Separate control head and RF deck for flexible use and installation.*
- *200W High Output Power: Will deliver clear and strong communication on both HF and 50MHz bands.*
- *Advanced Features: Packed with innovative technology to enhance your operating experience.*

The IC-7760 will be available at a Recommended Retail Price (RRP) of £5,700.00, including VAT Please note: This is target pricing only and whilst we are confident it is fixed, it could be subject to change during the run-up to the initial production, although unlikely. Any orders placed will be subject to confirmed pricing at the time of manufacture and may differ slightly".

To keep up to date with updates, sign up for the Icom UK newsletter or their social media channels. Icom UK Sales

sales@icomuk.co.uk

WORLDDAB SHARES DETAILS OF NEW AUTOMATIC SAFETY ALERTS ON DAB+: New Automatic Safety Alerts (ASA) mean *"lives will be saved as a result"*, WorldDAB President **Jacqueline Bierhorst** said at the IBC Show in Amsterdam.

The new technology aims to protect the public during emergencies by delivering safety alerts without requiring an internet connection.

The first roll-out of the ASA system will be in Germany, where many partners, including public and private radio broadcasters such as ARD and Deutschlandradio, network providers, safety authorities and Fraunhofer IIS have come together.

WorldDAB's conference session at the annual content and technology show, which attracts over 45,000 delegates from 170 countries to the Netherlands, also heard from the Chair of its Technical Committee, **Lindsay Cornell**. He announced that the international ETSI specifications – the official standards underpinning the ASA system – have now been approved and published, marking the successful completion of the technical work. Cornell emphasised that ASA gives broadcasters editorial control over the area in which receivers will respond to alerts, a key differentiator from existing emergency warning provisions. Cornell also showed a development receiver from Frontier Smart Technologies which had been used in the 'Warntag' tests.

The importance of these innovations was underlined by **Matthieu Rawolle** from the EBU. *"The impact of natural disasters in Europe is increasing. Terrestrial distribution of radio including DAB+ has shown resilience in extreme situations. It's a key pillar in times of crisis,"* he said. Rawolle also highlighted that radio devices are ubiquitous, portable, easy to use, reliable and innovative.

"It's essential for radio to preserve its strengths while continuing to innovate," he added.

The global growth of DAB+ was also featured at the IBC event**. Xavi Redon Hernandez** of network provider Cellnex Telecom detailed the rollout of DAB+ in Spain in partnership with public broadcaster RTVE. 12 sites are already broadcasting DAB+ in Spain, with more to come by the end of the year. *"DAB+ is the best way to have good quality radio, a trusted public service, that is open to all, and fully digital radio,"* Hernandez said, adding *"DAB+ is the most efficient way to deliver linear digital radio, and it's ready."*

Meanwhile **Denis Nikola Kulišić** from Croatia's OIV explained the company started a trial of DAB+ in 2017 with four sites, and by 2022 had extended the network to 27 permanent locations. Kulišic announced it was further expanding DAB+ coverage.

Many of these topics will be explored in more detail at WorldDAB Summit 2024, to be held in Zagreb on 14 November.

TORBAY AMATEUR RADIO SOCIETY: (From the organisers) Once again we held a very successful annual Rally at Newton Abbot Racecourse with many traders. We would like to say a special thanks to our regular traders always willing to attend, and a very warm welcome to any new traders attending. Hope to see you next time.

We were very fortunate to have two speakers this year - **Steve G4JVG** and **Don G4MMP** - who both gave very entertaining and enlightening talks on subjects they were well informed on. Obviously, a Rally will be no good without the visitors and we hope you enjoyed our Rally and picked up the bargains that you were looking for.

AMATEUR RADIO PAPER EXAMS TO END: (From the RSGB) Currently 97% of amateur radio licence examinations are sat online using the TestReach platform, either at home under remote supervision, or in a club setting. Following the implementation of Syllabus v1.6 on 1 September 2024, the new examination question bank will only be maintained online. Generating paper exams will involve significant additional work for the RSGB Examinations Department, with the associated costs. Therefore, from 29 November 2024, we will stop taking routine bookings for paper exams. **https://tinyurl.com/yck44rvf**

UK AMATEUR IN ARDF CHAMPIONSHIP SUCCESS: The 24th IARU Region 1 ARDF Championships in Bulgaria saw a UK amateur on the podium. **David Williams M3WDD** took the silver medal position in the M60 category of the 144MHz Classic five-transmitter race at the Championships held at Primorsko, Bulgaria. David had come very close to winning being only 14 seconds behind the winner **Jozef Simecek** of Slovakia. There were four races altogether. The week of competition started with the Sprint race on 80m followed the next day by the 2m five-transmitter Classic race for the M60 category in which David did so well. A well-earned rest day followed and after that came the 80m five-transmitter race. The week ended with the Foxoring event, a combination of direction finding and orienteering, again using the 80m band. You can see the results in full, and read more about ARDF, on the RSGB

Hamfest 2024

The National Hamfest returned to the Newark showground after a gap of two years, and it was good to see so many of the 'usual culprits' in evidence. Here we feature several of the well-known traders who were displaying their wares - next month we will have a selection of other stands, general views and so on. Photos by *PW* Designer **Mike Edwards.**

Photo 1: ITregeneration. Photo 2: Telonic. Photo 3: bhi (and PW advertising Manager, Kristina Green). Photo 4: ML&S with the 'governor' himself, Martin showing how it's done. Photo 5: Yaesu UK promoting the latest products. Photo 6: Orlando Hamcation promoting their event. Photo 7: Mark Allgar and colleague from the RSGB. Photo 8: Moonraker, now incorporating Waters & Stanton, and Nevada.

Rallies & Events

All information published here reflects the situation up to and including **20th September 2024**. Readers are advised to always check with the organisers of any rally or event before setting out for a visit. To get your event on this list, email the full details, as early as possible, to: **practicalwireless@warnersgroup.co.uk**

13 October

DARTMOOR AUTUMN RADIO RALLY: The Yelverton War Memorial Hall, Meavy Lane, Yelverton. Devon, PL20 6AL. Free Parking. Bring and Buy, Trader Stands and Refreshments available. Doors open at 10:00hrs. Admission £2.50.

Tel: 07854 088882 Email: 2e0rph@gmail.com
www.dartmoorradioclub.uk

27 October

GALASHIELS RALLY AND OPEN DAY: Volunteer Hall, St John Street, Galashiels TD1 3JX. Admission will be £3 per person, with free entry for under 16s accompanied by an adult. CASH ONLY at the door. Change will be given but we appreciate having correct change for faster entry. A sticker will be provided for exit and re-entry.
Doors open for general admission at front doors at 11:00 BST. Disabled/accessible entry and early book-in of Bring and Buy items only at 10:45 BST at rear door. (Table traders entry at rear door from 08:00.). Bring & Buy Stall. Catering with hot and cold refreshments.

Traders: rallytraders@galaradioclub.co.uk
General: rallyqueries@galaradioclub.co.uk

3 November

HOLSWORTHY RADIO RALLY: Holsworthy Leisure Centre, Well Park,Western Road, Holsworthy, Devon EX22 6DH. There will be Traders, a Bring & Buy and Catering. The venue also has disabled access and free parking. Open to Traders from 8:00am.
Doors open to the public at 10am, entry £3 per person.

Traders booking: https://forms.gle/8h8aNNJZHHcGQSKw8
www.qsl.net/m0omc/holsrally24.htm
Enquiries: Chris Bolton M0KNF, boltonbicycles@gmail.com

23 November

THE ROCHDALE & DISTRICT AMATEUR RADIO WINTER RALLY: St. Vincent de Paul's Hall, Norden, Rochdale, OL12 7QR. Doors open at 10am, entry £3. Usual Traders and caterers. Plenty of free parking. Contact Martin Shore (Treasurer & Rally Organiser) on:

Mobile: 07587 709006, Email: rally.radars@hotmail.com

1 December

WILTSHIRE RADIO WINTER RALLY : Kington Langley Village Hall, Kington Langley, SN15 5NJ, just off Junction 17 of the M4. Opens 09:00 close 13:00. Admission £3.00. Indoor tables £10.00. Car Boot Car size Pitch £10.00 Van Size Pitch £15.00. Hot and Cold refreshments available on site.

Email: Chairman@Chippenhamradio.club

8 December

MID-DEVON AMATEUR RADIO & ELECTRONICS FAIR 2024: Winkleigh Sports & Recreation Centre, Mid-Devon EX19 8HZ, from 09:00 – 13:00. Entry £3 per person, no charge for partners & under 16s. Easy access from the A3124, free parking, free WiFi, 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 (tables supplied), pre-booking in advance recommended. Mains electricity available on request. Traders - please pre-book ASAP

Phil G6DLJ 07990 563147, email wrg2024@hotmail.com
What3Words ///focal.fountain.laminated

26 January

LINCOLN SHORT WAVE CLUB, WINTER RADIO RALLY: The Festival Hall, Caistor Road, Market Rasen, LN8 3HT. Doors open at 10.00, Admission £3.00, Indoor event ample free car parking, Hot refreshments including our famous bacon butties. Tables £10. Contact Steve Burke M5ZZZ:

Email: m5zzz@outlook.com Mobile: 07777699069

Michael Jones GW7BBY/GB2MOP
michael@gb2mop.org

1

KSGER T12 Soldering Iron

Michael Jones GW7BBY/GB2MOP enthuses about a reasonably priced soldering station.

While my trusty Weller TCP (Temperature Controlled Pencil), **Fig. 2**, soldering station continues to work well, after 40 years it is getting a bit long in the tooth. Replacement tips are not very expensive, about £5, but they do not last very long. If I am having a prolonged construction session, the iron is on continuously all day and quite possibly all night too if I forget to turn it off. Herein lies the problem: the iron is running at the set tip temperature continuously and while not actually soldering the tip coating oxidises exposing the base metal and then the tip will not tin properly, consequently it will not transfer heat efficiently to the workpiece. When the heating elements occasionally fail they are quite expensive and are tricky to fit.

I decided to take the plunge and see how a more modern soldering iron performs. I chose the KSGER T12 soldering station, **Fig. 1**, and I have to say I am very impressed. There are many good features, but the most significant two for me are:

•The tip saving strategy: Upon switching on it will heat to the set temperature, I use 350°C. If the iron is not used for five minutes, the temperature drops to 'idle' at 150°C. If you leave it a further 30 minutes the temperature drops to ambient. This strategy prevents the tip from running constantly at high temperature, greatly reducing oxidation and prolonging tip life. As soon as the iron is picked up, a motion sensor engages the heating element, bringing the tip from idle temperature to working temperature pretty much by the time the iron is brought to bear on the workpiece. It takes a bit longer from ambient, but is still very quick. All of these parameters are programmable to suit individual needs.

•The iron itself has a lightweight positive feel and is comfortable in the hand (**Fig 3** & **10**). Importantly, the tip is held securely in the handle by a sleeve and nut, similar to the Weller, so the tip can be directed accurately onto the joint to be soldered. This is not the case for many cheaper irons where the bit is secured by a set-screw that can become loose with thermal cycling and can even fall out.

The controller is in an extruded aluminium enclosure, 120 x 88 x 38mm. On the front panel, **Fig. 4**, a miniature 5-pin GX12 connector for the iron is on the left, blue OLED (Organic Light Emitting Diode) display in the middle and on the right a multifunction rotary encoder. The rear panel has an on/off switch and a fused three-pin IEC connector. The internal switch mode power supply accepts any voltage in the range 100 – 240VAC. The iron is rated at 70W and reaches the set temperature in 5 – 8 seconds. The target temperature range is from 150 to 480°C.

With the top cover removed it appears to be well made and neat, **Fig. 5**, on good quality circuit boards. The switch mode power supply takes up most of the space and the actual controller and display is on the right. The backup memory battery can be seen with its yellow insulation. If you decide to use an external 24V DC supply (see later), then it is a simple matter to connect it to the Molex connector at the bottom right.

Temperature control

Tip temperature is controlled by a three-term algorithm, commonly used in industrial process control applications and known as PID (Proportional, Integral and Derivative). A simple explanation, avoiding Calculus, follows (**Fig. 6** refers). When initially turned on, power is applied to the tip and the actual temperature is fed back via a control loop to the controller. The temperature will be allowed to rise until it reaches a certain percentage of the set point, say 85%. At this point control will pass to the Integral function: this calculates the accumulated error between the set point and the actual temperature and uses this to reduce the applied power as the set point is approached. At a further point, say 95%, control passes to the Derivative function. This component monitors the slope of the curve and adjusts the output based on the rate of change of the error.

Older traditional irons rely on simple proportional control alone, **Fig. 7**. Power to the tip is turned off only when the target temperature is achieved. The problem with this is that thermal inertia will allow the temperature to continue to rise to some point above the target. The tip will then cool and as it passes the set point on the downward curve power will be re-applied, but the temperature will continue to fall until thermal inertia is overcome, the temperature starts to rise again and the cycle repeats. This gives very poor control and continued thermal cycling reduces the life of tip coatings.

All the percentages and the control strategy for PID control have to be learned in detail by the controller for effective control to take place. The first time you use a particular tip, press and hold the encoder knob in while turning it clockwise.

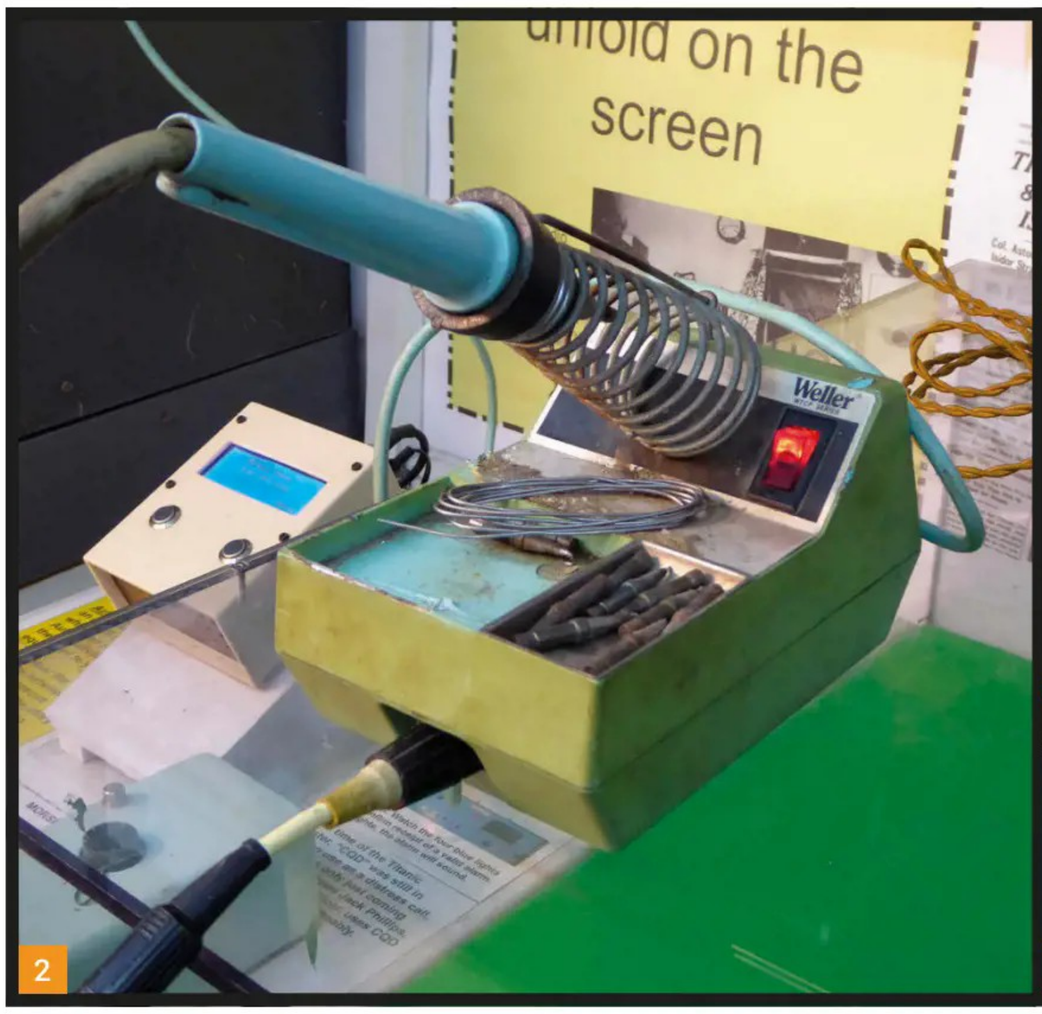


Fig. 1: The KSGER as supplied. Fig. 2: The popular Weller soldering station. Fig. 3: In the hand. Fig. 4: Front Panel showing Standby, Target Temperature of 150°C, Actual Temperature, Percentage power being applied, Fitted tip (D24), CPU Temperature and the time. Fig. 5: Internal view.

Release the knob when the tip selection screen appears. Rotate the encoder until the tip in use appears and select it with a further button press. Hold the button in for >3 seconds to exit the tip selection screen. The screen will show error while the controller learns the tip characteristics for 5 – 20 minutes. After this tip parameters will be stored against the tip type.

Menu options

Navigating the 21 menu options is fairly intuitive. A long press, three seconds, on the encoder will enter the menu system, **Fig. 8**. Rotating the encoder will bring up the menu options, then a short press on the encoder will enter the option. A further short press will select the required setting. A further three second press will exit each menu level. If no input is seen, the menu system will be exited automatically after a few minutes. Once set up with Standby Setup, Sleep Setup, Boost Setup and maybe date and time there is little need to venture back into the menus. However, there are options for a password, screen saver, Language System information and many others. There is a link at the end of this article to the user manual that gives more information on the menu options. Although it refers to the Quicko version, it does apply to the KSGER T12.

Boost

I generally run mine at 350°C, which is fine 90% of the time. Sometimes a bit more heat is required for a larger joint, having a greater thermal mass.

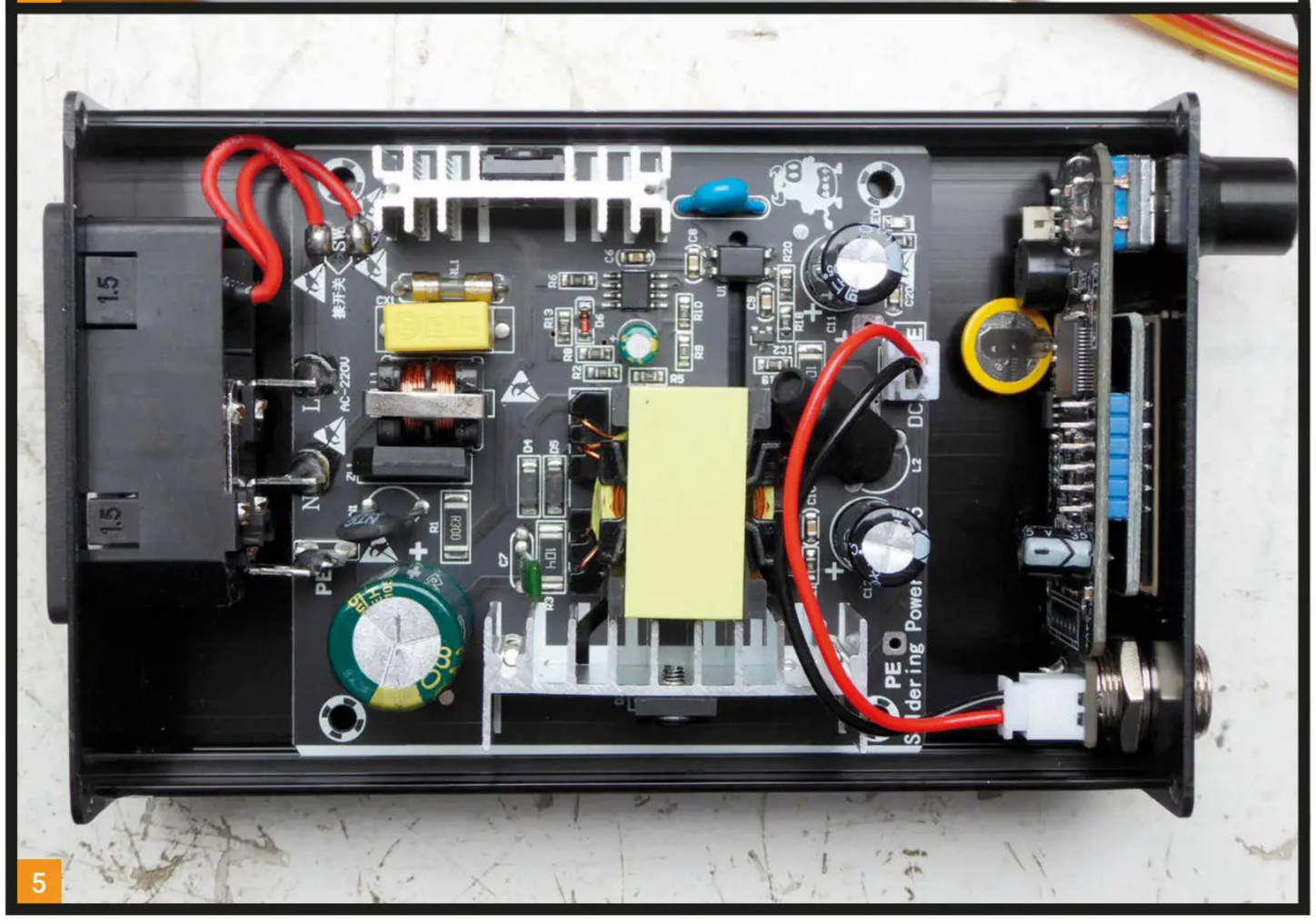
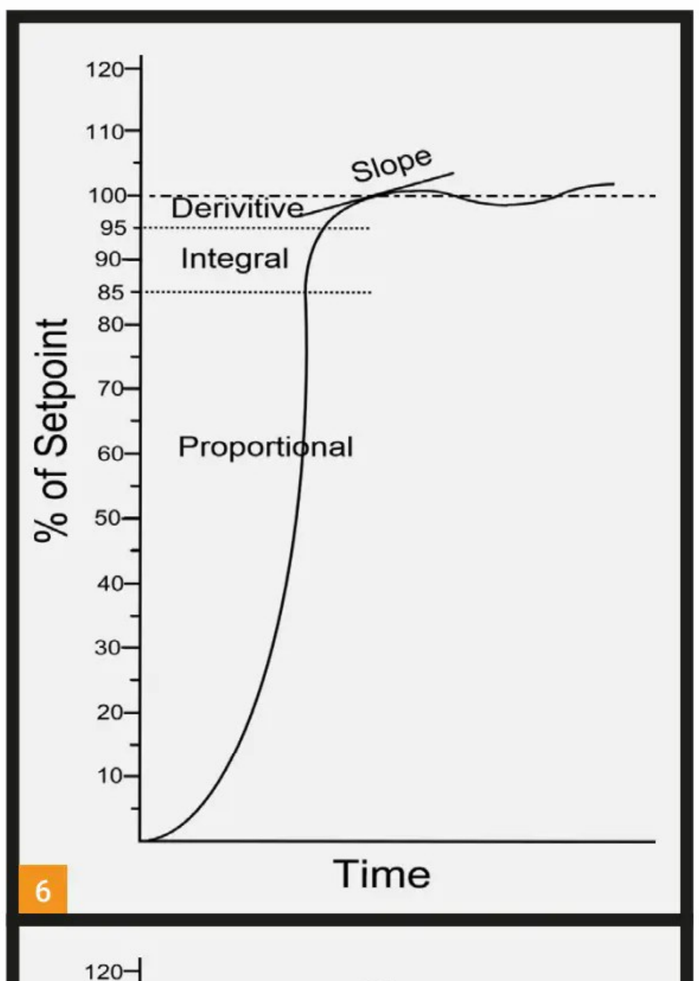


Fig. 6: Graph showing PID control.
Fig. 7: Heating using 'traditional' proportional control. Fig. 8: The menu.
Fig. 9: A suitable separately bought stand.
Fig. 10: Handle, tip and securing collar.
Fig. 11: The three supplied tips on the left and extra large tip on the right. Fig. 12: Through hole soldering. Fig. 13: Surface mount soldering.
Fig. 14: In use for a larger job



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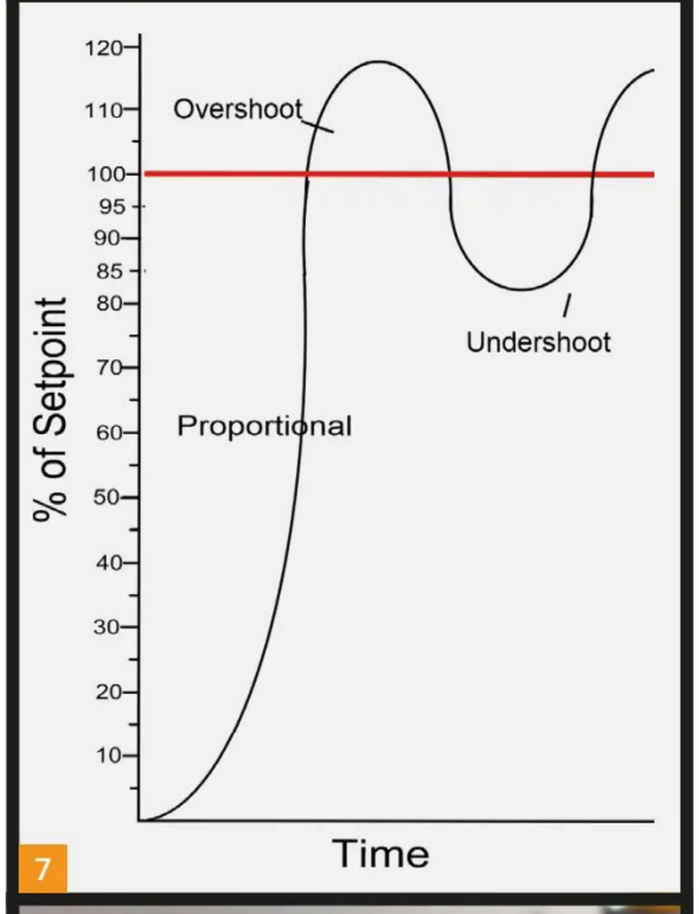

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I could change to a larger tip make the joint and change back to the smaller tip. It is quicker to just give the rotary encoder a quick clockwise twist and the temperature will raise to my preset boost setting of 400°C. If left, the temperature will return to 350°C after five minutes (or whatever you have set the boost timer to) and then to idle again after a further five minutes. Alternatively, an anti-clockwise twist of the knob returns the temperature directly to 350°C. A further anti-clockwise twist will return the temperature to idle.

Flexible heat resistant silicon cable

The iron comes with about a metre of heat-resistant flexible silicon cable and is connected to the base unit with a 5-pin GX12 aviation connector (some have a 4-pin connector).

Stand

A stand is not supplied, but there is a wide range of reasonably priced stands available on the internet. I would just recommend that you get a heavy one that won't get dragged around the work bench and won't topple over. Mine, **Fig. 9**, has provision for a tip cleaning sponge although I rarely use it as I prefer the brass wire wool.

Range of tips

'Tip' is a bit of a misnomer, especially if you are used to the Weller or ceramic element type, as the T12 tips are about 150mm (6in) long and each 'tip' comes with its inbuilt ceramic heating element and temperature sensor, thus changing a tip effectively replaces all the active elements of the soldering iron, **Fig. 10**.

A very wide range of tips are available. The three tips supplied are shown in **Fig. 11**. From the left: the chisel point (D24) is a good general-purpose tip for both through-hole and surface mount soldering (**Figs 12** & **13**). The very fine pointed tip (ILS) is useful for small precision work such as soldering multi-pin connectors where space is at a premium and for touching up surface mount devices. The third tip (K) is a knife blade used for soldering surface mount devices, clearing solder bridges, or drag soldering a number of pins in one operation. On the right is a larger tip I bought with greater thermal mass for soldering larger joints, **Fig. 14**, such as those found in valve radios.

The KSGER works on the same principle as the more expensive Hakko irons. Some people consider the Hakko tips to be superior, so if you are looking for replacement tips it might be worth trying a Hakko T12 tip, which will fit the KSGER iron. From my own experience, I've not had to replace any of the generic tips in the 18 months that I have owned the KSGER and they are a fraction of the price of the Hakko tips.

Handles

A wide range of handles in aluminium, stainless steel and plastic are available. I chose the plastic 907 handle with the soft yellow grip as this seemed to suit my hand (Figs 3 & 10). Take a look at the many sales sites to see the selection.

Kit

The KSGER T12 comes in two basic forms, either the full version that I have, that has an internal 100 – 240V AC power supply, or a shortened version without a mains power supply. For the latter, it is up to the purchaser to provide a 24V DC 5A supply. Both versions are available fully built or in kit form. Kit form basically comprises a number of complete modules, display/processor, PSU etc, requiring minimal soldering to assemble. In Kit form the basic unit without power supply can cost less than £20. The fully built-up version with PSU is usually between £55 - £70. As always it will pay to shop around.

Other brands

The T12 is sold under a number of brands, including Quicko. They all appear to be the same product although the KSGER is the most popular.

Oxidation: the enemy of good soldering

Solder tip oxidation occurs when the iron plating on the tip degrades into iron oxide. Oxidation does occur at room temperature, but at a much slower rate. The heat of soldering dramatically accelerates this process.

The biggest consequence of oxidation will be deterioration of tip wetting. Wetting occurs when the molten solder flows smoothly over the tip of the iron allowing the efficient transfer of heat from the tip to the workpiece. As oxidation builds up on the tip, it creates a thermal de-wetting barrier. When this happens, the solder will tend to ball-up on the tip instead of flowing smoothly, and heat transfer to the joint will be poor.

Preventing oxidation

- Keep the tip coated with solder during idling periods.
- Operate at the lowest possible temperature: <427°C. Operating at higher temperatures than this dramatically increases the formation of iron oxides.
- Avoid no-clean fluxes and low-residue fluxes.
- Use good quality solder with tin content (60/40% tin/lead).
- Dry brass wool is best for wiping the tip of your soldering iron. Sulphur-free pure cellulose sponges, damp to the touch, are OK but thermal cycling as the tip passes over the damp sponge can lead to de-lamination of the tip coating.

Cleaning

To clean your tips, use either brass or stainless-steel wool. Brass wool is softer and less abrasive, while the harder stainless-steel wool has a longer life.

Brass wool effectively removes dirt and other contaminants and avoids issues associated with using a damp sponge to clean soldering tips. Using a wet sponge reduces the temperature of the tip, resulting in repeated changes in temperature, causing the tip to expand and contract repeatedly. This thermal cycling causes metal fatigue, de-lamination of the coating, and eventually the failure of the tip. Cleaning wool does not reduce the temperature of the tip. To remove small amounts of contaminants from your tips using metal wool, gently dab them into the wool. For more stubborn residue, hold the iron more firmly and apply more pressure when rubbing it against the wool. Vary the strokes, so you remove contaminants from all sides and edges of the tip.

After cleaning, immediately wet the tip with fresh solder to prevent oxidation.

Awarning!

After completing some repairs to my BC348 (WWII airborne receiver), I turned it on and found an amazing level of noise. Thinking I had done something wrong I re-checked my work and found nothing wrong. Then a eureka moment: I turned off the KSGER soldering iron and all the noise disappeared. The switch mode power supply in the KSGER iron was to blame. I wouldn't consider this to be a deal breaker. You just need to be aware of the possibility and turn the iron off before making receiver adjustments. This might be a case for only buying the shortened enclosure and providing your own 24V DC 5A linear power supply.

Conclusion

You will gather that I am very enthusiastic about the KSGER T12. It is a very pleasant tool to use and has proved to be reliable for the last 18 months or so. For me the standby and sleep features are a real boon as the tip life is extended immeasurably. The menu system is easy to navigate and comprehensive. Temperature control is impressive. There are more expensive soldering stations available, but they do little more than the KSGER does for £50 - £70. The only negative point is the RFI from the switch mode supply mentioned above, not really a problem as long as you are aware of it. No manual or instructions are provided so you have to rely on the many YouTube videos and other online resources for more. **PW**


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References

- Prices are quoted were accurate as of April 2024.
- User Manual:
  https://tinyurl.com/4bhke4wa
- Review/Guides:
  https://tinyurl.com/yd74ujue
  https://tinyurl.com/srt7x438

Billy McFarland GM6DX
gm6dx@outlook.com


1

Triband Elevated Vertical

Billy McFarland GM6DX builds a simple portable multiband antenna.

As I was planning another trip to the Isle of Man, this time for the CQWW DX RTTY contest, I realised that we had to cut down the amount of equipment we were carrying. As we were operating beside the sea, verticals and dipoles are the usual antenna choice for our short visits. I got to thinking and decided I would build a triband, 10/15/20m vertical antenna with elevated radials. This would allow one run of coax and one pole (rather than three) and it would still offer us the ability to switch between the vertical and dipole antenna during the contest. I always like to recycle antenna projects where possible, so I dug out a dipole centre from an old antenna as seen in **Fig. 1**. I can never remember which bolt connects to the centre and which connects to the outer of the dipole connection, so I got the multimeter out and checked for continuity. Once I knew which bolt was the inner connection I marked the dipole centre.

Now onto the wires. Unlike a traditional ¼ wave vertical antenna using four radials, this antenna would only use two radials per band. Simple calculation of 300 divided by 14.1MHz = 21m, then divide this answer by 4 gives you 5.25m. So, I cut 3 x 5.25m lengths of wire, which would provide me with two radials and one radiating element. You can follow this calculation process for the 15m and 10m bands also. I measured back 100mm and made a loop at the end of the radials as seen in **Fig. 2**. Once the loops were made, I connected these two radials together via a ring connector. I also fitted a separate ring connector on the radiating element.

The ring connector is so that we can connect the wire to the dipole centre. I followed this process for the three bands, giving the end result of a radiating element for 20/15/10m with a ring connector fitted on each, as well as three pairs of radials for 20/15/10m connected together via a ring connector, as can be seen in **Fig. 3**. Once the wire sets are completed it is then time to connect these to the dipole centre.

You need to space out the elements when on the mast, so I went into my shed and pulled out some 40mm PVC pipe that I previously used for homebrew antenna traps. This stuff is perfect for creating a spacer. I cut two pieces at 500mm long and marked the centre at 250mm. I drilled a 35mm hole in the centre of one of the spacers and a 20mm hole in the second spacer (this was to fit over 10m fibreglass pole). I also drilled 3 x 5mm holes in each spacer to pull the wire radiating elements through. Drilling a hole at each end of the spacer and one just off centre. These spacers are now complete and can be seen in **Fig. 4**.

Assembly and tuning

This is all the main antenna work done. It is now time to assemble the antenna for tuning. Pull out the 10m mast and slide over the bottom spacer. Feed the three radiating elements through the spacer. I found it easier to have the 20m element going through the centre of the spacer with the 10m and 15m elements to the outside. Cable-tie the dipole centre onto the mast just below the spacer as can be seen in **Fig. 5**. Slide the top spacer onto the mast and pull the wire elements through it. Now you will realise that the 10m and 15m elements are too short, so tie a piece of cord to the end of the elements and then feed the cord through the spacer. Leave some extra cord for tuning as the wire element will need to be trimmed during tuning. Stand up your mast and pull out the radials. Like all of my elevated verticals, I tie cord on the end of the radial and peg that into the ground. Make sure you spread out the radials around the mast. It is worth noting that the radials alone are not sufficient to hold the mast, it will need guying further up between the two spacers. I put mine up in the front garden jammed between two garden seats, which was enough to hold it for tuning, keeping the radials off the ground as seen in **Figs 6** and **7**.

Hopefully you have never done what I did, which was to assemble the whole antenna with no coax connected, so make sure you attach some coax before you erect the mast. Now plug this coax into your analyser and give it a scan. One thing that affects SWR is if the radials are too close to each other, so make sure they are well spaced out. Once scanned simply trim the radiating element to raise the frequency of the antenna. From experience, scan all three bands and trim all three at once. Low SWR can easily be achieved as seen in **Fig. 8**.

That is the antenna complete ready for use and simple enough for you to give a try. Some additional info, only tape the fiberglass sections once the spacers have been slid over the mast. Don't pull the cords holding the wire element too tight as it bends the mast like Robin Hood's bow. Guy the mast around the 7m mark as it can feel top heavy with the spacers on the mast. As always, any questions drop me an email at the address at the top of this article. **PW**

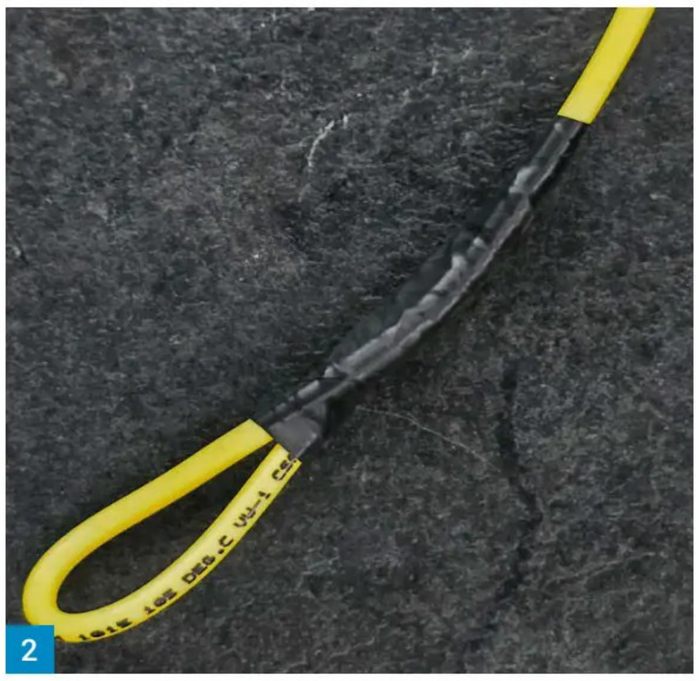

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Fig. 1: Dipole centre piece. Fig. 2: Loop at end of radials. Fig. 3: Three radials (one for each band) connected together by a ring connector. Fig. 4: Spacers. Fig. 5: Dipole centre cable-tied to mast just below the spacer. Figs 6 & 7: The antenna set up for testing. Fig. 8: A nice low SWR!

1

Roger Dowling G3NKH
practicalwireless@warnersgroup.co.uk

Bob McCreadie G0FGX

Roger Dowling G3NKH meets a presenter of amateur radio's own popular television show 'TX Factor' as it celebrates its tenth birthday.

Just over a decade ago, three former presenters/engineers at the commercial radio station *Orchard FM* got together for a reunion. They all were licensed amateurs and they decided, to their credit, that they would like to use their professional skills to promote their favourite hobby. The result: the highly regarded and professionally produced YouTube channel *TX Factor*, which celebrates its tenth birthday this year.

One of the three founders was broadcaster **Bob McCreadie G0FGX**, **Fig. 1**, and I was delighted to have the opportunity to learn more about Bob's radio activities, and how *TX Factor* has become such an enormous success since its launch in 2014.

It all started with the school radio society

Essex-born Bob was educated locally in Southend and was lucky in that his school had an amateur radio society. One day they had an Open Day, demonstrating amateur radio on 80m and topband. *"I was only about 12 then and learned to my dismay that one had to be at least 14 to take the RAE"*, said Bob. *"The thought of studying for exams was not very appealing at that age so I decided to leave it for a while."*

However, he remained as keen as ever on the idea of becoming a radio broadcaster one day, though there were very few broadcasting opportunities outside the BBC in the 1960s. Pirate offshore stations *Radio Caroline* and *Radio London* were quickly declared illegal but Bob's interest in radio was further stimulated when, in 1970, another pirate station *Radio North Sea* started up a few miles off the Essex coast, anchored in international waters a few miles from Clacton. By this time, he had commandeered his brother's Philips electronics kit and he managed to make his first little low power AM transmitter.

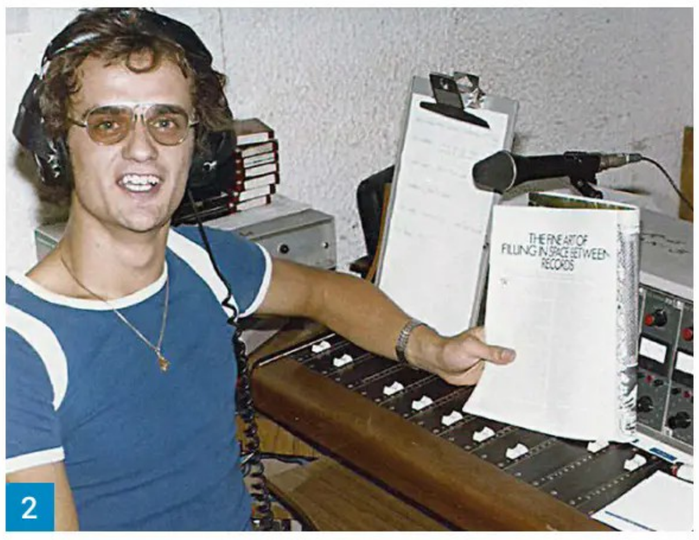
The broadcasting scene was about to change dramatically when the Conservative party won the General Election in June 1970. Unlike the Labour Party, the Tories were keen to end the BBC monopoly and bring in commercial local radio in the UK. *"I immediately wrote to **Christopher Chataway**, then Minister for Posts and Telecommunications, saying I would very much like a licence"*, said Bob with a smile. *"And I actually received a reply, letting me know 'in due course' how the process of obtaining licences would work"*.

Meanwhile, one of Bob's friends had converted a Panda Cub transmitter to work on the bottom end of the medium wave and Bob, unable to contain his impatience any longer, used the transmitter to broadcast happily for a few weeks before the authorities intervened and they had their equipment confiscated. *"The first thing my mum heard about this was the report on the front page of the local newspaper – she was pretty cross about that!"* said Bob.

But then an opportunity to broadcast more legitimately came about, thanks to Bob's brother who had been lucky enough to get a job with Gulf Air in Bahrain in the Middle East. The country – a former British protectorate – had a very large English-speaking population and the authorities had just decided to set up an English Language radio station. Scenting a big opportunity, Bob, then 20, quickly abandoned his vague thoughts of taking up a teaching career. *"I sold my car and bought myself a one-way ticket. My brother generously agreed to buy me a ticket home if it didn't work out."*

Luckily it did work out and Bob found himself happily installed as a presenter ('disc jockey' in those days!) in the studios of Radio Bahrain, broadcasting to a large audience on VHF/FM, **Fig. 2**. In addition to music, the station broadcast general interest programmes from the BBC transcription service. *"We had a Harris 2kW transmitter"*, said Bob. *"I remember that when I did the breakfast shift the first job was to switch the transmitter on for the day. That was REAL broadcasting!"*

Meanwhile, Bob retained his keen interest in am-



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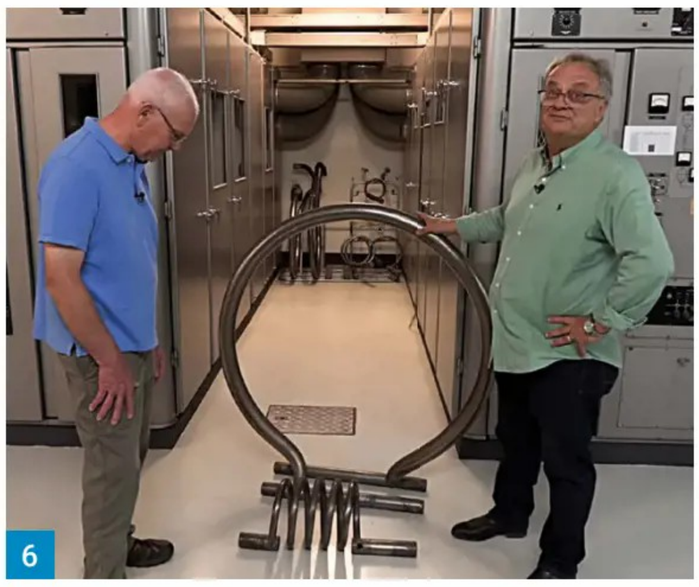
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Fig. 1: Bob McCreadie in his shack today. Fig. 2: 'The fine art of filling in space between records': Bob in a Radio Bahrain studio. Fig. 3: Presenting the breakfast show at the new 107.3 Eagle radio studios in Bristol. Fig. 4: TX Factor founders, l to r: Bob McCreadie, Nick Bennett, Mike Marsh. Fig. 5: On location: collector John Alexander, G7GCK demonstrates a very rare Enigma machine to Bob at a Friedrichshafen Ham Radio Convention (TX Factor episode 4). Fig. 6: Plug-in coils: Bob is taken on a tour of Woofferton transmitter site by former senior transmitting engineer Dave Porter G4OYX (TX Factor episode 29). Fig. 7: Quadrifilar antennas for 2m and 70cms with mast-head amplifier for 70cm for LEO satellites.

ateur radio. Luckily, in Bahrain there was the Gulf Technical College where he successfully took his City & Guilds RAE. He was also a member of the Amateur Radio Association of Bahrain (ARAB) and the authorities agreed that if ARAB would conduct the Morse test he could then be issued with a full licence. Bob's Bahrain callsign, issued in 1978, was A9XCX, and he was also allocated G8WJC for use when he was back in the UK. *"My first transmitter was a KW Vespa and I had a Collins 75S-3 receiver and a Mosely TA33 Junior triband beam, all bought in the UK and shipped over to Bahrain"*, recalled Bob. *"It was great – 10m was wide open at the time and it was a wonderful experience to be at the DX end of a pile-up."*

Back to the UK

Bob returned to the UK for family reasons in 1986, at which point he relinquished A9XCX and became G0FGX. His experience at *Radio Bahrain* made him keener than ever to get into broadcasting in the UK and he was successful in obtaining a position with *Plymouth Sound*, a successful independent local radio station that had been set up in 1975. In due course he presented an 'opt-out' breakfast show for *Radio in Tavistock*, a popular pioneering community station using a little 50W transmitter. *"We lived on Hay Tor on Dartmoor at that time"*, said Bob. *"It was a marvellous site for amateur radio."*

After a brief spell at *DevonAir Radio*, Bob moved to *Orchard FM* in Somerset where he worked for nine years and became presenter and programme controller. In 1999 he became launch Programme Controller and Breakfast Presenter at the new *107.3 The Eagle* station in Bristol, **Fig. 3**, before moving on to become Programme Director and Breakfast Presenter at *Pirate FM* in Cornwall, a station that won Sony Gold 'Station of The Year' awards in 2003 and 2006. Bob's final move was to *Radio Plymouth* (nowadays part of *Greatest Hits Radio South West*) where he stayed until semi-retirement in 2019.

"Looking back, It's amazing how the technology has changed over the years", said Bob. *"When I started, we used to play music from 45s, LPs or reel-to-reel tape machines. Ads/jingles and station idents were played in from NAB cartridges. We had to keep a paper record of everything that was played. All this as well as presenting the show, answering the phone and so on! Now, computers have transformed the whole operation – everything is played in from hard drives and all the broadcast details are on the computer screen. Nowadays, presenters don't even need to be in the studio – so long as you have a microphone and a mixer you can get on the air!"*

TX Factor

TX Factor (URL below) is produced by TX Films Ltd, a joint initiative of Bob, **Nick Bennett 2E0FGQ** and **Mike Marsh G1IAR**, **Fig. 4**, all of whom had previously worked at *Orchard FM*. Nick's company Media Concepts was responsible for all Orchard Group's radio stations and he had extensive experi-

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ence in broadcast radio and television, and Mike has his own mastering studios working with some of the biggest names in the music industry.

www.txfactor.co.uk

The first programme in the UK dedicated entirely to amateur radio, *TX Factor* – in the early years produced in association with Martin Lynch & Sons and Yaesu – made its successful debut on YouTube in February 2004. In 2017 the three founders were joined by **Pete Sipple M0PSX**, whose broadcasting career started in radio technical operations after which he became IT manager for a group of eight radio stations in the South-East.

The show – sponsored by the RSGB since 2020 – has covered the full range of amateur radio activities since its launch. It regularly reviews new equipment and also includes features and reports from events outside the UK, such as the Friedrichshafen ham radio convention, **Fig. 5**.

"We find that viewers particularly enjoy reports from locations which are normally inaccessible to the public," said Bob. *"We got tremendous viewing figures from a visit to Woofferton transmitting station in Shropshire* (**Fig. 6**)*, which has massive transmitters and antenna arrays about which most of us can only dream."*

Bob's radio shack today

The range of equipment at Bob's Cornwall QTH is testimony to his wide range of radio interests. His modern radios include an Icom IC-7300 to which he has added a large-screen panadapter display using a Radio Analog PTRX-7300 RF interface module, an external SDRPlay RSP1 and SDR Console software (all entertainingly demonstrated in *TX Factor* episode 26). He also has a Yaesu FT-991 for HF/2m/70cm and an Anytone AT-D578 for DMR, the latter making use of the new DMR repeater at the Marconi Centre in Poldhu.

A keen member of the Vintage and Military Radio Society (VMARS), Bob also has a fine range of vintage radios. He has had a KW Vanguard transmitter and still has his Collins 75-S3 receiver, supplemented by a Racal RA17 receiver, a Heathkit DX100U transceiver and a Codar AT5 topband/80m transmitter. He enjoys regular daily AM nets on 80m.

Bob also has a 'vintage' Yaesu FT-726R, still in excellent working order, which he uses for duplex operation with non-geostationary LEO satellites.

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Antennas include a G5RV, a Hustler vertical, 2m and 70cm collinears and 2m/70cm quadrifilar antennas, **Fig. 7**.

QO 100 satellite station

Bob's latest adventure, described at length in TX Factor episodes 30 and 31, has been to set up a duplex ground station for SSB QSOs via the geostationary QO 100 satellite, **Fig. 8**. So that he could use his existing transceivers, Bob opted for a simple approach using a DX-Patrol Groundstation 2 double transverter unit, **Fig. 9**. This converts a transmit IF of 144MHz from his Yaesu FT-857 to 2.4GHz, and converts the receive downlink from 10.4GHz to 432MHz for reception on an RSP1 using SDR Console software.

Bob uses a 1m offset dish with a DX Patrol 4-turn helical antenna for the 2.4GHz uplink and a DX Patrol LNB for reception, **Fig. 10**.

He has been delighted with the results so far. *"I have found that, for me, using the DX Patrol 2 Groundstation was a really easy way to get into operating on QO 100."*

Fred – the Fabulous Flamingo

From entertaining listeners on the radio to putting entertaining words on to paper is a relatively short step, so it was no surprise to me to learn that Bob also had a successful book to his credit. In 2012, his first book, *Fred – the Fabulous Flamingo*, was published, **Fig. 11**. *"It was a story I originally made up for our children when they were youngsters,"*

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Fig. 8: Bob demonstrates his new QO 100 installation (TX Factor episodes 30, 31). Fig. 9: Setting up a DX Patrol Groundstation 2 (TX Factor episodes 30, 31). Fig. 10: 1m offset Dish, DX Patrol 4-turn helical uplink antenna and DX Patrol downlink LNB (TX Factor episodes 30,31). Fig. 11: Fred –The Fabulous Flamingo.

said Bob. *"The book was published in association with Paignton Zoo who sold it in their bookshop."* Beautifully illustrated by **Debbie Bellaby**, it tells the heart-warming story of a flamingo who couldn't quite master the art of standing on one leg. *"Fortunately, he encounters a special friend and the story ends very happily,"* Bob reassured me.

Looking ahead

Following his success with QO 100 SSB, Bob is now keen to explore video transmission and reception using the satellite's wideband spectrum. Already active on DMR and D-STAR, he'd also like to set up his own C4FM and Wires X node, so both these topics may well be the subject of future *TX Factor* episodes.

Bob and the rest of the *TX Factor* team would also like to step up the production of new episodes, following the inevitable hiatus of the Covid years.

One ambition they have yet to realise is to be able to relay *TX Factor* via television repeaters around the country. *"One amateur TV repeater in Australia already does this,"* said Bob. *"It would be great if our regulators would give us this facility here in the UK."* **PW**

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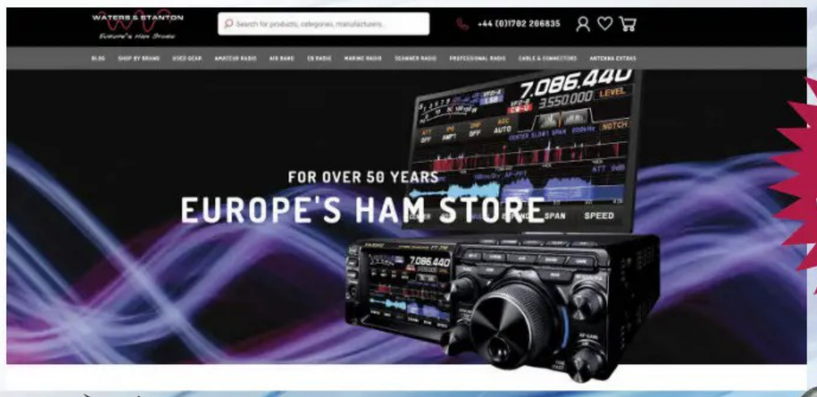

Check out our WEBSITE

When I look back over our fifty-one years, I realise how Ham Radio has progressed. I started with home-built gear and modified war surplus items. Most of us had to use separate receivers and transmitters. In many ways, radio communications itself was still developing and anything above 144MHz was the territory of 'radio explorers'. You could never hope to get on the air without a soldering iron - and a Morse Test!

Today we have transceivers, computers and levels of performance we once only dreamt of but here at Waters & Stanton I am still as passionate about the Hobby and the Company I created. I publish at least one video a week and an associated blog. I still enjoy bringing you the latest gear and encourage the staff to give you the best service and where possible, a great deal. So, to both new and old customers, a big thank you for your support.

73, Peter G3OJV

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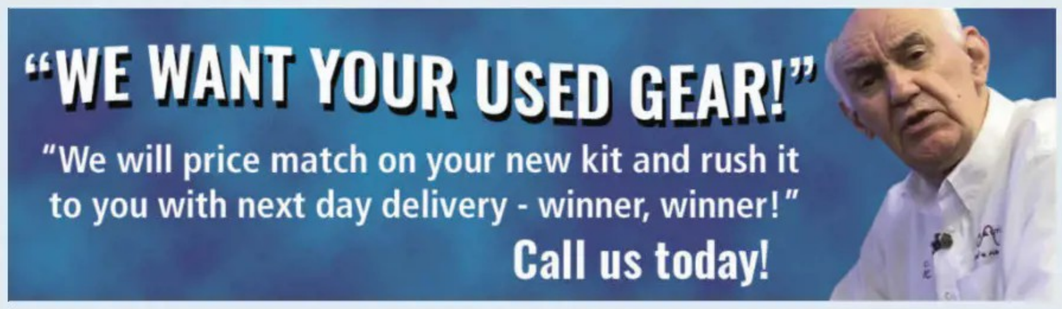

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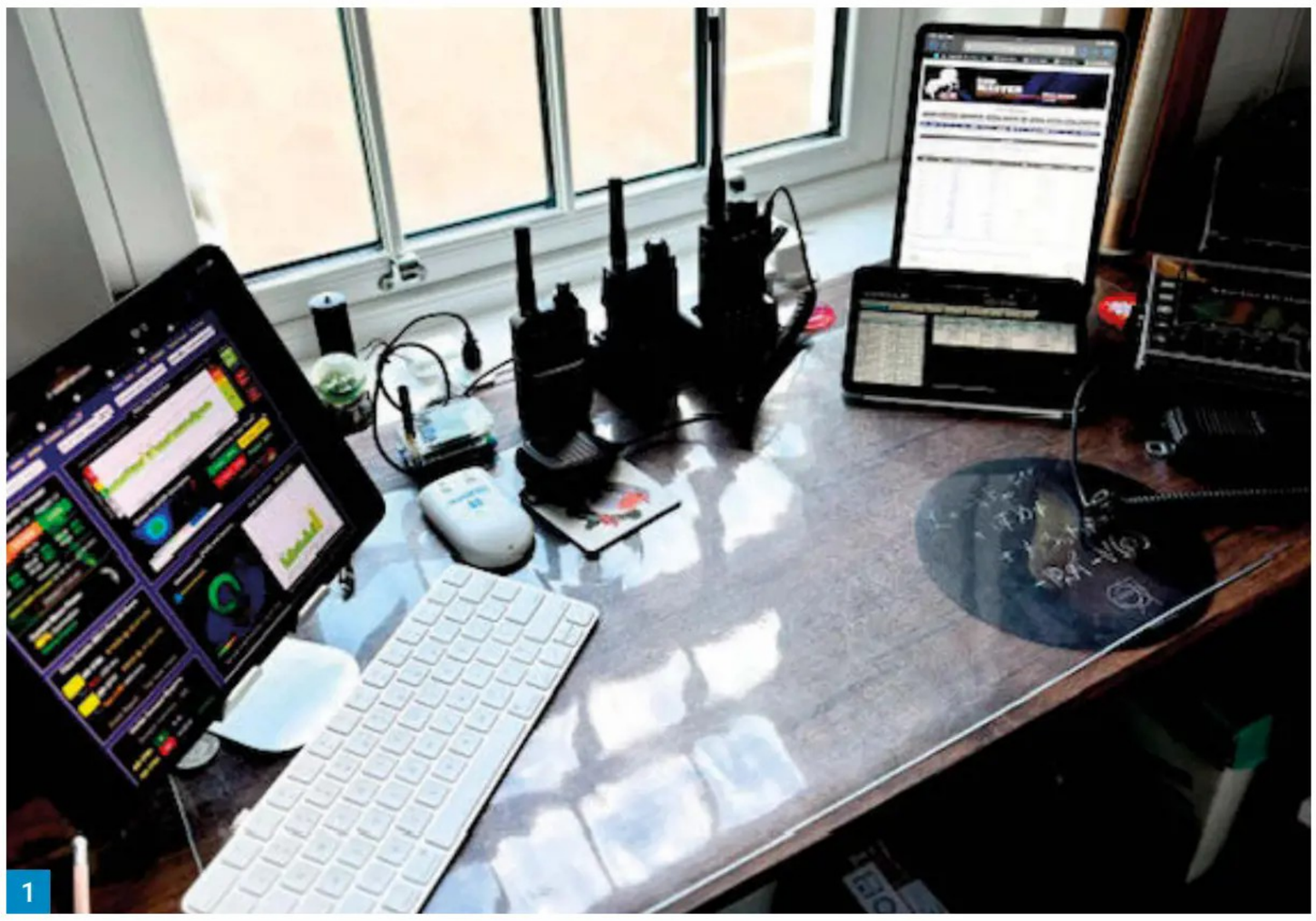
1

Protocol Wars

Joe Chester M1MWD shares some of the trials and tribulations but also benefits of digital voice systems.

Today, I have a simple proposition for you. I heard, 'through the grapevine'(♪), that you bought a digital handheld. I bought one too. So, I was hoping that perhaps we could use these transceivers to contact each other. Problem? Well, yes, I suppose. Are we close enough to work simplex, ie across the road from each other? Or will we need to use a repeater? Wait a minute, I said digital handheld. Which means?

At its simplest, it means it doesn't matter how far apart we are. Because, of course, we both have DVAPs, digital voice access points, or hotpots if you prefer. What the DVAP does is take the digital transmission from the handheld, converts it into packets, and ships it onto the internet. The internet is a wonderful collection of nodes and gateways and servers, and routers which, operating together, safely deliver your bitstream to my DVAP. Which of course turns it back into a radio transmission which my handheld receives. Magic? Not quite, just applied engineering.

But...

But when we actually try this, nothing happens. Of course, it would be easy to blame lots of pieces in this extended internet system. But the problem is more obvious than that. Because the two handsets use different protocols to encode the analogue voice signal. How daft is that? Stupid even? But that's commercial competition for you. Different companies choose different systems and, dare I say it, assumed that their system would be so good that it would be accepted by customers in preference to any other offering. Don't get me wrong, the OEMs are quite entitled to do whatever they want. They take the risk, and either reap the reward, or, like Betamax, fail to do so.

"But I really want to be able to talk with friends who have bought into one of these different systems", I hear. This is an old and well-known problem in systems engineering. Which leads to the invention of the gateway, or bridge. This takes in one protocol and outputs the other protocol. Simple. And in the digital world, even easier. One bitstream is encapsulated in a certain manner, and the gateway simply extracts the voice bits and re-encapsulates them in the other protocol. From an engineering point of view, it's a trivial problem.

The world of gateways

And guess what, the world of digital radio is full of gateways. So, no issue then to find a gateway between us, and talk away. I do this regularly. As an example, I did it the other day, with my friend **Nigel G4RWI**, known as the Guru(!) for his facility with software systems. We had a long QSO on our digital radios. He was in France using a DMR handset, and I was at home using my D-STAR handset. And more recently, my friend **John G4FZA** struggled through the effort of getting a cheap Baofeng handset up and running on DMR (well done John!), and we also chat using my FT-70D. Magic again? No, just good old-fashioned systems engineering, courtesy of a group who call themselves FreeStar (with thanks to **Bruce M0UKB**, **Shane M0VUB** and **Oscar 2E1HWE** who set up and maintain this system). They have installed gateways between the various digital radio protocols (or modes as they are called), so that operators with different manufacturer's equipment can have QSOs with each other.

How does it work? On the one hand it doesn't matter. But as we are amateur radio operators, I will try to satisfy your curiosity. In a word, it's all about servers. Each of the digital modes has a word to describe what happens when you talk with someone else who is using the same mode. D-STAR has Reflectors, YSF or Fusion has what they call Wires-X Rooms, and DMR has Talk Groups. All of these are just servers, running on PCs in someone's spare bedroom, probably running Linux rather than Windows. So, two D-STAR operators join a Reflector, means two D-STAR handsets access the same server - eg REF001C is designated as worldwide, and is quite popular, but there are others used by specific groups, eg REF009B is listed as emergency comms for Arizona. On DMR, users connect to a Talk Group (TG), which are also servers. TG23526 is quite popular, it's a server somewhere on the internet, it's worldwide and is usually called Hubnet. A popular room on Wires-X is CQ-UK, also a server, which is accessible worldwide as well. I should also say that all reflectors, rooms and TGs are essentially worldwide, but specific ones have more or less specific uses. However, this doesn't preclude you joining in.

Now there is lots of complexity underneath this simple viewpoint. But in the end it's all software running on computers called servers, which are connected together via the internet. And when you press the PTT to link to any of these systems, all you are really doing is connecting to a server somewhere in the world. We are radio amateurs. We love to tinker, to build, to implement new systems and then, like Olympic athletes, to stand by at the base of the podium hoping to collect a medal for our efforts. I'm being facetious, of course, or am I?

So, what's the problem?

What I have described is of course idyllic. Everyone can talk to everyone else. It's an ideal world, digital radio. Except it isn't quite. I hear calls over and over again from amateurs who have invested in digital handsets and cannot find anyone to call. *"Which TG do I join", "which reflector, which Wires-X group? Which one are you on?"* Confusion reigns. And this is a problem. At least to my way of thinking. In the HF world, people invest in the required technology, select a frequency in accordance with the terms of their licence, and call CQ. Someone, somewhere may answer. The important thing to note is that, within the agreed band plans, there are no restrictions. Anyone can call anyone. And we do. This was Marconi's real achievement.

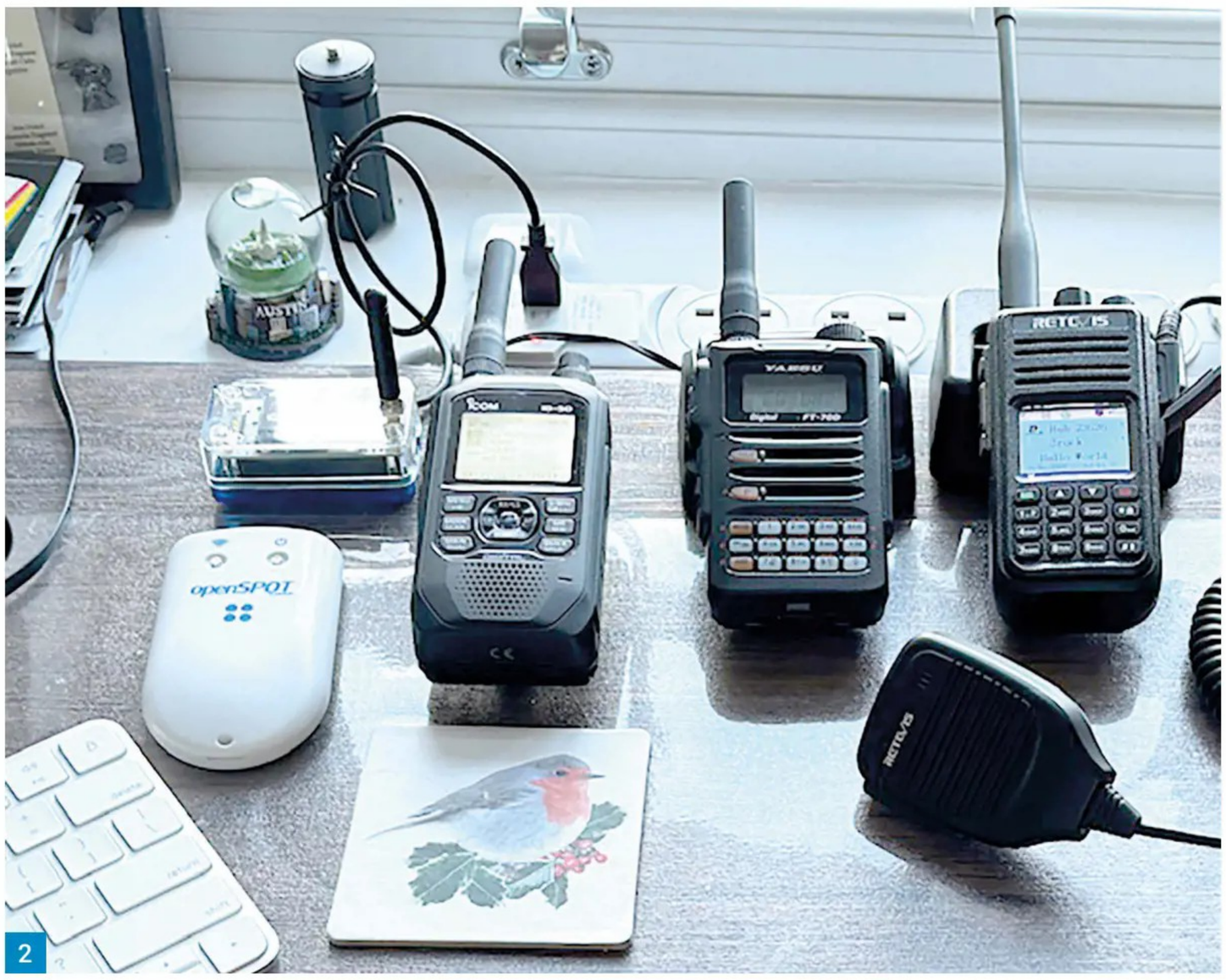

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Photo 1: The modern small radio station: KX3 HF radio on the right, two tablets with digital dashboards, 3 digital handhelds, two DVAPs (hotspots), and solarham, showing bottom right KP index over 5 indicating very poor propagation on HF - time for digital radios to come into their own.
Photo 2: Starting on the left: PiZero Hotspot on DMR and Fusion, Openspot 4 pro on D-STAR, Icom ID-50E D-STAR, Yaesu FT-70D Fusion, Retevis RT3S DMR.
Photo 3: This is the Dashboard for Reflector 001C, showing stations connected.

The digital radio world is not like the HF world. In the HF world you choose a frequency and call CQ. Potentially you can be heard by anyone anywhere in the world. In the digital radio world, somewhat reflecting its origins in the commercial two-way radio market, when you call CQ you will be answered only by those operators who are currently connected to the same server you have joined. So, on D-STAR, if you connect to REF001C, only other operators who are connected to 1C at the same time will hear you. Not much fun in that, I hear you say (!). But surprisingly, there is much fun to be had doing this. To again use REF001C as the example, you will hear stations from all over the world chatting on this server, or reflector to give it its proper name. The same works with DMR and Fusion. If you connect to the Fusion CQ-UK server, or Room to give it its official name, then you will find operators from all over the world there willing to have a chat with you. On the DMR+ system TG1 is also worldwide. So, there is no lack of people to talk with worldwide. And there are also servers running lots of TGs or Rooms or Reflectors for all sorts of local groups too.

So, in the digital radio world, why is it that operators are confused? Because, frankly, there is just too much to choose. There are thousands of Reflectors, Talk Groups, and Rooms to which you can connect. On HF you might get a message from a friend telling you that there is an opening on 6m, and jump in. There is no similar facility on digital radio. There are, however, dashboards. These are just web pages on the servers, which list the currently active stations on that server. Yes, there are hundreds of these too, but you will soon realise which ones your friends are using, and get to know who is on which server.

"But my friend is on TG23526, how do I talk with him with my D-STAR radio?" This is where the gateways enter the picture. It happens that Hubnet, which is also TG23526, is an open system, open to all and any protocol (or mode if you prefer). So, on your D-STAR handset, select DCS477, link to this reflector, and press the PTT. And there you are, both of you talking on Hubnet with radios which use different modes. If you have a Fusion radio, you can do exactly the same - light up Wires-X, enter 41461, press the AMS button, then the PTT, and you are on Hubnet. This is at the same time the power of gateways, and of the operators who run open systems, ie digital radio systems engineered to allow access to any mode. FreeStar, FreeDMR and TGIF are also open system.

As far as I know, this doesn't quite work the other way round. Using a DMR handset, I don't know how to get to REF0001C, for instance. But if you connect the DMR radio to a DMR TG, a server with a gateway, then the D-STAR station can connect to that gateway and you can talk to each other. Now not all DMR TGs have gateways. Many on Brandmeister (BM) don't. You can read their policy on gateways here:

https://tinyurl.com/5acbbjxr

Make what you will of that. It would seem to me to suggest that BM want to be a pure DMR system, with perhaps a few gateways to other systems, at the discretion of individual sysops running the servers. I suppose it's up to them, but it seems daft to me. In my view, the future of the worldwide digital radio system is an interconnected set of local or regional systems fully interconnected for the benefit of amateur radio operators worldwide. And there are DMR systems which support this viewpoint. Consequently, most, if not all of their DMR Talk Groups can be accessed by D-STAR and Fusion radios.

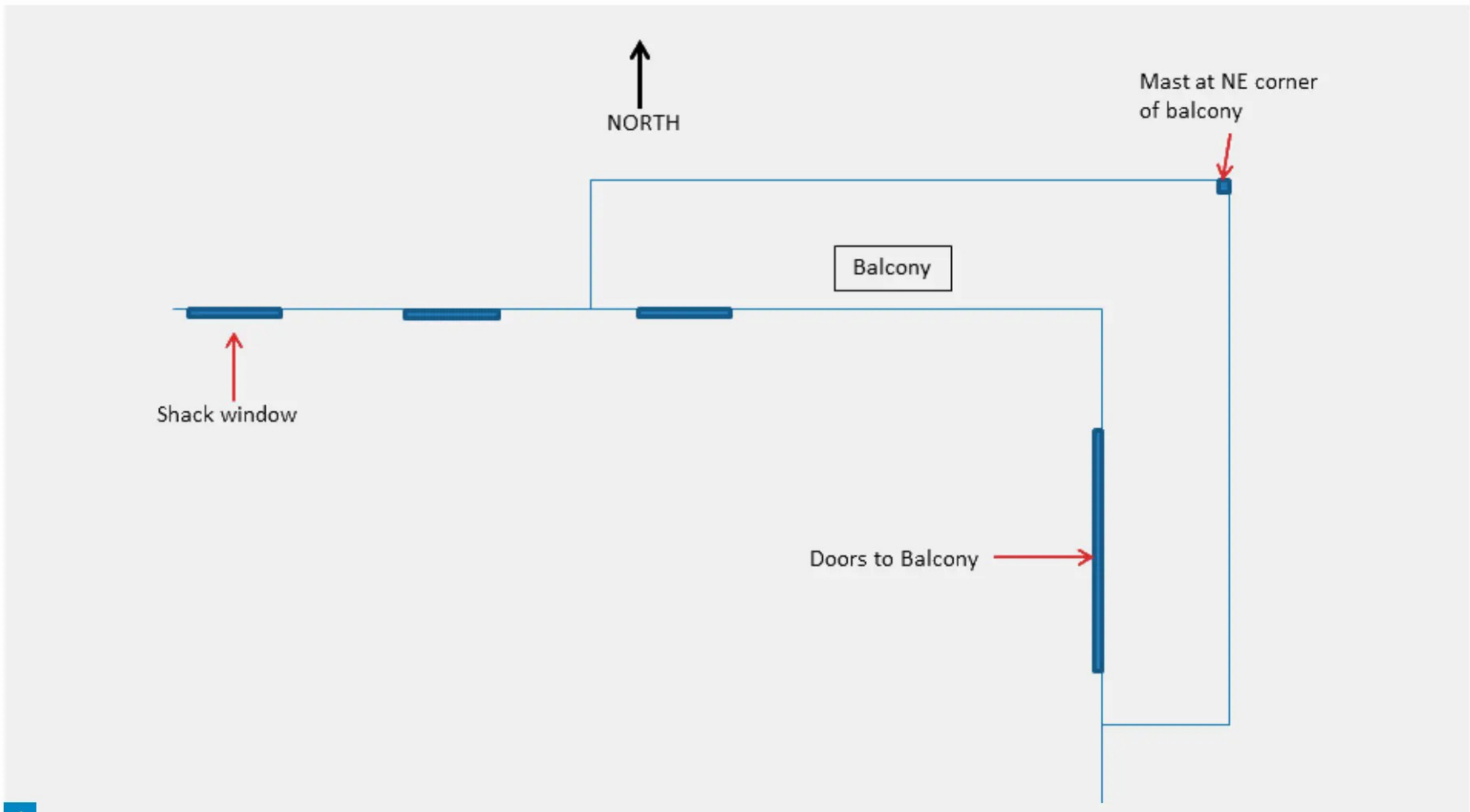
OK, enough for now. But one last thing. Make the overs short (certainly less than three minutes), or the system will time-out. And leave a sizable gap between the overs, to allow the timers to reset. If you don't follow this simple etiquette, then you will crash the system you are on - not the recommended, or indeed quickest way to make friends on the digital way. **PW**

18:24 Wed 28 Aug
Not Secure — ref001.dstargateway.org

Last Heard

Callsign	User Message	Last TX on	Time
VE7JBX		C	2024/08/28 17:24:26
G4TGB	Dave, G4TGB here .	C	2024/08/28 17:24:08
M1MWD		C	2024/08/28 17:23:58
DL4BBG	Michael NW Germany	C	2024/08/28 17:21:27
W1FJF	Fred Loudon TN	C	2024/08/28 17:08:36
N9APK		C	2024/08/28 17:04:33
G4JBI		C	2024/08/28 17:02:04
KE2DSQ		C	2024/08/28 16:47:18
M7HHD	Graham UK	C	2024/08/28 16:32:05
KA7PRR	Steve Crescent City	C	2024/08/28 16:30:03
K0ETR	Denver Colorado USA	C	2024/08/28 16:28:33
N4DJC	Jerry - Anderson, SC	C	2024/08/28 16:20:08
M0SVU	Tiago - Bristol - UK	C	2024/08/28 16:08:58
M0AUT		C	2024/08/28 15:53:19
VE6DZ	IC705 OS4 PRO	C	2024/08/28 15:49:55
EB1MM	Valdelafuente,Leon I	E	2024/08/28 15:49:12
AK6DP	IC-705	C	2024/08/28 15:21:39
N5LL	Larry San Antonio TX	C	2024/08/28 15:12:11
K9LTR	Thomas	C	2024/08/28 15:05:58
KA8E	Glenn / Dearborn, MI	A	2024/08/28 14:59:37
KJ4VO	T U D	A	2024/08/28 14:59:10
M7ATE		C	2024/08/28 14:43:47
K4YGD	TH-D74/ Savannah,GA	C	2024/08/28 14:31:45
MM3PTJ	KENNY ID50	C	2024/08/28 14:17:57
G0LGF	Terry Shipdham Norfo	C	2024/08/28 14:16:05
GM0CSN		C	2024/08/28 14:01:39
G0GMQ		C	2024/08/28 13:50:31

3



1

More bands than you expected

Ken Ruiz ZB2MD outlines ways of getting more out of limited antenna space.

Ken Ruiz ZB2MD
practicalwireless@warnersgroup.co.uk

All antennas are a compromise. We all want an antenna that is small (relative to wavelength), efficient, and with a large bandwidth. You can have any two of these, but you can't have all three. That's physics. Some compromises are imposed on us, others are self-imposed.

We each have a limit as to the space for our antenna farm, the finance available, planning considerations, what we're prepared to put up, and what others at home are prepared to put up with. So rise to the challenge, and squeeze the most possible from every situation. Let me tell you of my physical constraints, to help explain my choices.

I live on the 8th floor of a block of flats. There are several more floors above me. No attic, no roof access, no garden. My only outside is a balcony. Not so much an antenna farm, more of an antenna petri dish. I can immediately discard any delusions of a tower and stacked beams. See **Fig. 1**, showing the orientation and layout of my outdoors.

Each leg of the L-shaped balcony is 5m long and approximately 2m deep. I have marked where I place what passes for a mast. This must fit between the floor of my balcony and the underside of the balcony of the floor above (2.5m). The space for my antennas is the slot between the top of my balcony railings, and the underside of the balcony above (1.3m). There are smaller balconies, but still…

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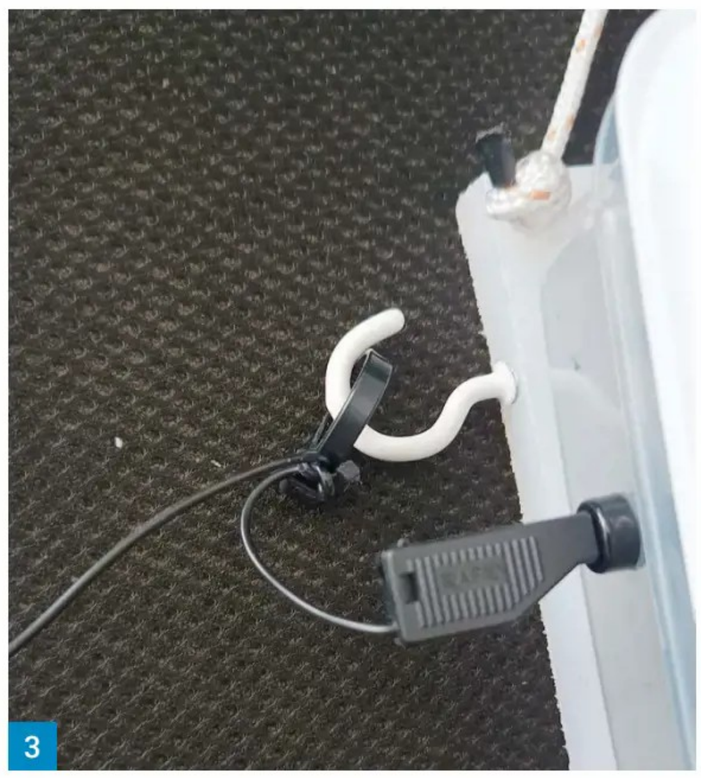


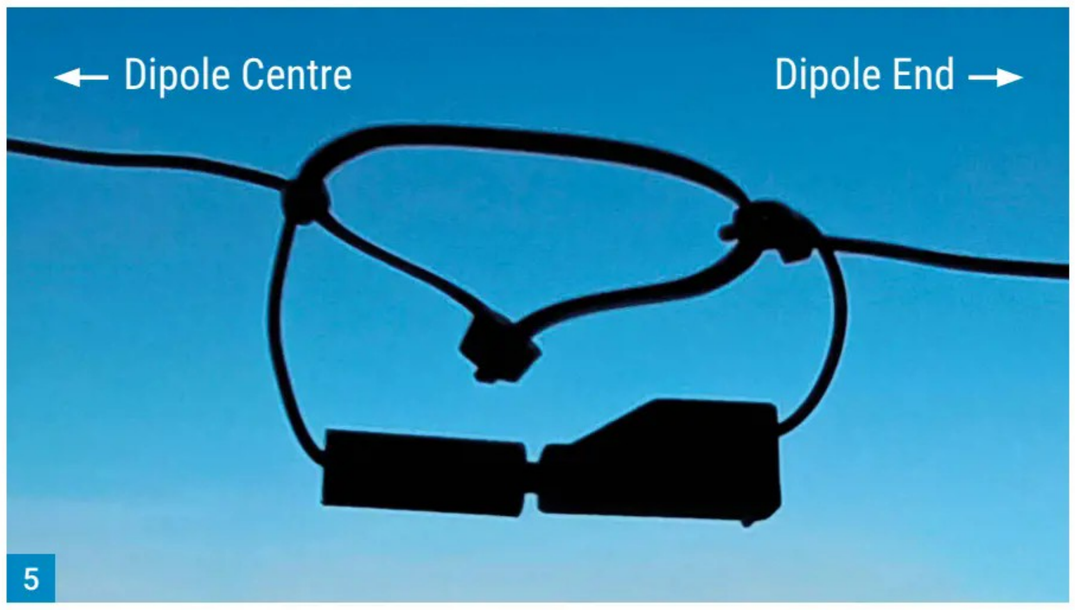
3

An unloaded three-band dipole

Noting the balcony legs are each just over 5m long, the obvious antenna that uses the space maximally is a dipole for 20m. If such a dipole fits, so does a 15m and 10m dipole. Classically, multi-banding uses traps (lossy) or employs a web design (heavy, and there are interactions between the wires). Instead I went for a linked dipole. The disadvantage of such a dipole is that band switching requires access to both the dipole arms. If your dipole is some metres above ground, this can be impractical at the very least. When your dipole is at eye level when you walk out onto your balcony, it's no effort at all. Instructions for making your own, and available kits, are found readily on the internet. Rather than waste space here, I would suggest you look there for construction ideas and choices.

A most important consideration in dipole design to my mind is the choke at the feedpoint. This has been pretty much dealt with comprehensively (Hunt, 2015, ref. 1) and I shall enter into no further discussion but merely state, nine turns of coax on three stacked FT240-52

4



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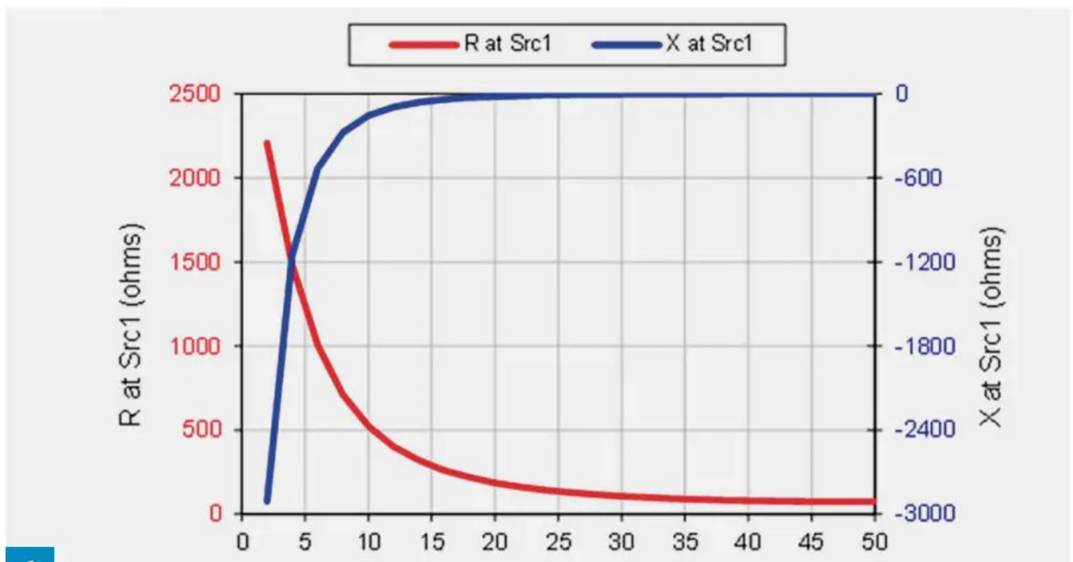

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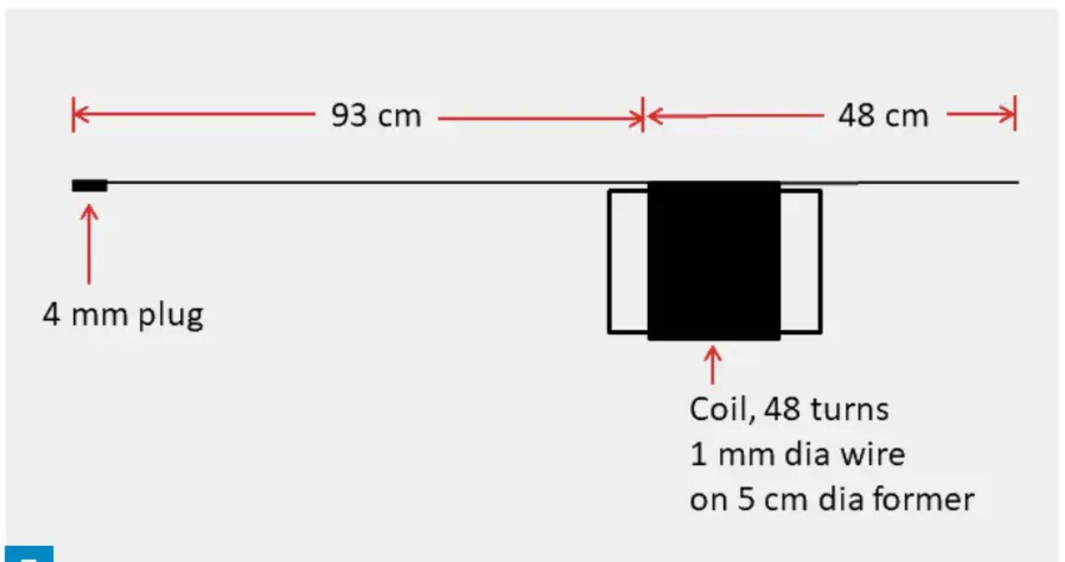

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Fig. 1: Available antenna space at the author's QTH. Fig. 2: Choke in a sandwich box. Other foods are available. Fig. 3: Detail of strain-relief. Fig. 4: Choke box in operating position. Fig. 5: Cable ties fulfil yet another function. Fig 6: Impedance along length (see URL in text). Fig 7. My 40m loading coil dimensions.

toroids. I recommend you read the article. Here's my choke in **Fig. 2**.

In use, the choke box is screwed to a piece of chopping board, and hung from the mast. Hooks screwed to the sides of the ex-chopping board take the strain off the dipole arms so that they do not pull out of the 4mm sockets they are connected to, on the sides of the choke box, as shown in the photographs, **Figs 3** and **4**. Constructed like this I can change dipoles entirely, as the arms come off easily. Multi-band antenna, multi-antenna choke.

Fig. 5 illustrates my chosen method for creating the links, using cable ties.

The cable tie 'insulator' takes the strain regardless of whether the link is open or closed. Only the parts of the dipole in electrical continuity with the choke/feeder form the dipole. Once open, the wire distal to the open link becomes a guy – typical of linked dipoles. Using suitable lengths of wire between such links, I made a loss-free inexpensive and easy to construct dipole for 10, 15 and 20m, full-sized on each band.

While many electrical connectors will do to form the links e.g. croc clips, I would recommend you do as I have done and use a covered arrangement, such as 4mm plug-and-socket, Power Pole connectors or similar. My covered 4mm socket is attached at the proximal side of the link. Dipole ends can develop high voltages even at modest power, and exposed conductive ends can result in a nasty experience given that, in my case at least, the dipole is very accessible.

Two more bands for free

It's not difficult to make an '*any-number-of-bands*' linked dipole if you want. Just more links are required, for whichever bands you want. It is not always necessary to do that, however. Consider the 12 and 17 m bands. No effort required. This three-band dipole is actually a five-band dipole; the hint was in the title. You just need to think laterally. Literally. It's difficult to imagine how you could do this with anything other than a linked dipole, whether bought or home-made.

You may recall that it is possible to feed a half-wavelength of wire anywhere along its length. Typically, we cut the half-wavelength into two equal halves (two quarter wavelengths) and feed them at this midpoint. In an asymmetrical dipole, we feed the dipole unequally, moving the cut and the feeder towards one end. The feedpoint impedance rises until, in the extreme, we feed it at one end to form an end-fed half wave, when the feedpoint impedance is in the region of 2500 to 3000Ω. When using such an antenna we use an unun (typically 49:1 or 64:1) to present a 50 to 60Ω impedance to the rest of our equipment.

With this dipole, thanks to the links, we can easily mix lengths to form an asymmetrical dipole. If you use one dipole arm cut for one frequency, and the other dipole arm is cut for another frequency, the working frequency of the resulting asymmetrical/offset dipole is the average of the two frequencies, corresponding to the overall length of the offset dipole.

		Arm A			
		10m	15m	20m	40m
Arm B	10m	10	12m	15	17m
	15m		15	17m	20
	20m			20	30m
	40m				40

Table 1: Resulting resonances when asymmetrical dipole arm lengths are employed.

Mixing dipole arms, as demonstrated in **Table 1**, can result in resonances close to or in a WARC band! No additional anything!

For 12m, depending on the precise frequencies the original dipole arms were trimmed for, it is possible the resulting resonant frequency may fall in the band. Mixing 15 and 20m arms to cover 17m probably gets you close enough to the band itself for your ATU to cope. Mine does easily.

On feeding the dipole asymmetrically however, its input impedance will vary. By how much, and what do we need to do about it? Consider the graph shown in **Fig. 6**. This graph was posted on the internet by **Brian Machesney K1LI**:

https://tinyurl.com/mryc8wm7

He explained: *"Using a NEC-2 model, here's how R and X of a free-space 20m dipole made from #14 copper wire vary with feedpoint position (50 = center fed; 0 = end fed)."*

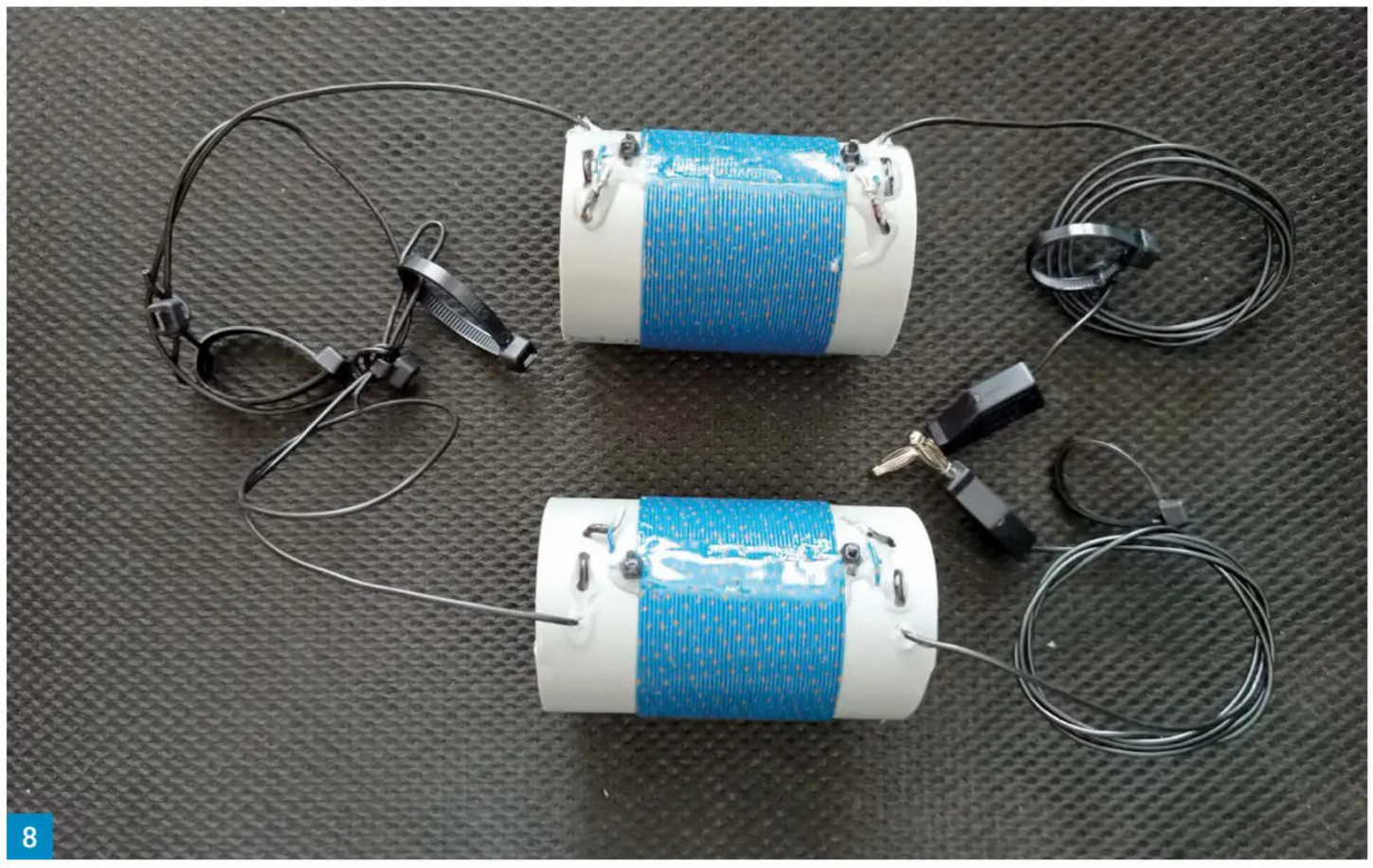


Fig. 8. Finished 40m loading coil, one needed for each leg of the dipole.
Fig. 9: Note this link can be taken apart.

For both 12m and 17m, the feedpoints lie approx. 38 – 45% along the length of the dipole – no real differences in impedance characteristics when compared to the standard symmetrical dipole. Nothing more needs to be done, all works as is. Nice unexpected bonus! Five bands, full size, no loading. Now I get greedy.

More bands?!

Adding 40 m comes with a compromise.

No additional space is available. To fit a 40m dipole into a space just big enough for a 20m dipole requires loading, typically done with coils. I refer you to the web pages of **Mike Meserve** [2] where full explanations are given, and loads of formulas and calculators are available to help you design and make whatever it is you need for your circumstances.

To add 40m handling to my dipole I needed to add a loading coil at each end, **Fig. 7**. These reduce antenna efficiency, but the efficiency reduction is less if the loading is at the dipole ends rather than at the centre.

Following the advice and instructions given in the web pages referred to, my calculations revealed I needed a 118µH coil, as in Fig. 6. This was wound on a commonly available diameter of plastic pipe, **Fig. 8**.

In use, these sections replace the outermost 20m sections of the dipole as constructed so far. Beware when trimming these 40m extensions to your desired frequency – a physically very small adjustment in wire length makes a relatively huge difference in your dipole's resonant frequency. This is a manifestation of the reduced bandwidth of a dipole, which is half as long as it ideally needs to be.

In order to fit this, the link between the 15 and 20m sections needs to be made a little different from the one shown in Fig. 5. A suggested arrangement is seen in **Fig. 9**. This photo shows the link between the 15 and 20m sections of each dipole arm. A Velcro strap holds these two sections together, looped through cable ties. Undoing the Velcro permits removal of the distal 20m sections, replacing them with the 40m coil sections.

Compromises, eh? A less than perfect antenna is better than no antenna at all. Without such a compromise, there might not be access to 40m. Of course, if you can fit a dipole for 40m (albeit loaded), there is room for a 30m dipole – now for the seventh band this dipole covers. There are two ways of doing this – and the easy way doesn't work as well as the difficult way. The easy not-so-good way first.

The closest to 30m comes when you work a 20m and 40m arm together. Even if you cut both your 20m and 40m arms to the lower band edges, the average frequency comes to 10.5MHz [(14.0 + 7.0)/2 = 10.5]. That may well be close enough for your ATU. Actually, if you use a nanoVNA to help trim your dipoles, you will find that it is very difficult to get an SWR dip near the 30m band.

The more difficult but far better way is to make a pair of coils specifically for 30m, just as for 40m, but with a different solution of course.

Of course you could add 60m, 80m, and longer – but with ever decreasing bandwidth and ever decreasing efficiency. At some point you may as well plug in a dummy load instead of an antenna!

Conclusions

I hope to have stimulated your interest, and it might be that you adapt some or other aspect touched on here for your particular needs, perhaps nothing to do with such an antenna at all. Not everyone will have need for a linked dipole, and I appreciate its impracticability if high up a mast or among trees. Kits tend to be marketed towards /P operation, where space and weight are a premium if you're walking some distance, and when access to the antennas is often easier than at home – but this arrangement works just as well in a permanent installation.

With a bit of lateral thinking, some problems have easy solutions. The application of constraints can be stimulating. If I'd had acres of space, I might never have explored a possibility such as this. The old adage 'necessity is the mother of invention' rings true. Certainly, I have not come across a relatively compact and unobtrusive antenna which covers so many bands so well, with so few lossy components.

References

1 Hunt, S. (2015). High performance common-mode chokes. RadCom Plus 2015, May p32 – 39. Also available at:
https://tinyurl.com/3jyesw9p
2 Meserve, M. (nd) Electrically shortened center-fed dipole:
https://k7mem.com/Ant_Short_Dipole.html

Georg Wiessala
wiessala@hotmail.com

The SDRplay RSPdx R2 Receiver and the Stampfl WAVEBLOCK Preselector

Georg Wiessala checks out an interesting wideband receiver and a specialist preselector.

The SDRplay RSPdx R2 (**Fig. 1**) follows hard on the heels of the earlier release of the RSP1B and has been planned, it appears, as the successor to the older – and popular – RSPdx variant. The RSPdx R2 provides up to 10MHz spectrum, anywhere from 1kHz to 2GHz, without gaps. According to the most recent SDRplay press releases and manuals, the new stand-out features and functionalities of the receiver are as follows.

- Improvements to the RSPdx for MF frequencies and below
- Better noise performance below 1MHz
- Enhanced dynamic range below 2MHz, in both tuner and HDR modes
- 3 software-selectable aerial inputs, including a BNC input for up to 200MHz
- A 500kHz LPF (Low-Pass Filter) for LF/VLF reception
- An HDR (High-Dynamic-Range) mode for enhanced performance below 2MHz
- Notch filters on all inputs, and a rugged steel case

Table 1 provides an overview of those reviews of previous SDRplay models of which I am aware at the time of writing. I have used most of SDRplay's models in my shack over the last five years or so and always found that new developments in the range marked a noticeable step-change in terms of reception quality, extension of functions and overall ease of use. This time, I was particularly keen to find out whether it would be worth 'upgrading' to this model if you were using its predecessor, the RSPdx.

From within the SDRplay range, every user – casual, hobbyist or semi-professional – may well have formed an individual preference for one of the other of the half a dozen or so different RSPs; many will select a model according to the specific purpose they wish to use it for. Or maybe you need them all! My own 'user profile', as it were, is that of a dedicated Short Wave DXer and HF broadcast stations listener, an occasional utility signals monitor and an experimenter in the nîche areas of Very Low Frequency (VLF) and L-Band signals.

The RSPdx R2 in use

While this has determined how I have put the RSPdx R2 to use, I was also mindful of the general aspects applicable to all HF receivers, such as sensitivity, selectivity, long-term signal stability, interference-rejection, ease of operation and ergonomics of both the hard- and software. In an era of ever more sophisticated SDRs with advanced DSP features and filters, performance gaps between individual receivers are shrinking overall. Nevertheless, it is possible, and necessary, to sort the wheat from the chaff, given the prevalence of so many cheap clones and imitations that are not worth your money.

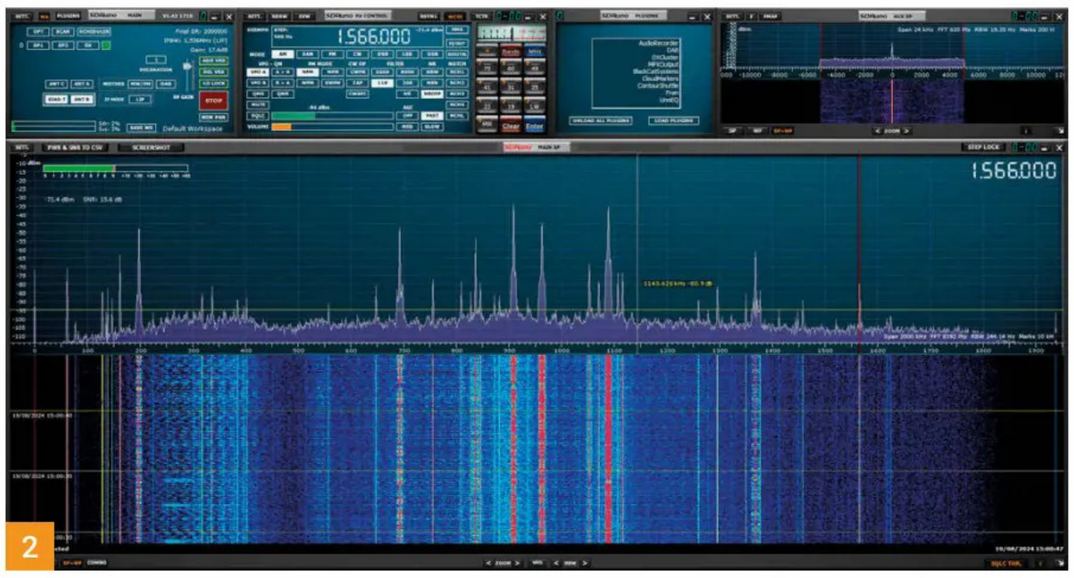
Given that there are three aerial input ports (A-C), I connected three antennas to the RSPdx R2. My mainstay Wellbrook ALA1530 loop for general HF, a Moonraker Scanking 25-1300MHz discone for VHF/UHF, and a custom-forged VLF magnetic bar (LFM/S1-N 15-70kHz) from *BAZ Spezialantennen*. I also used, as required, a standing wave barrier (MWS-1, 150kHz-30MHz from Stampfl HamElectronics; cf. below). Or you may prefer a Bonito GI 1000. If you are still on holiday, you can experiment with remote access to your RSPdx R2 at home. In the *YouTube* video below, **Jon Hudson** of SDRplay demonstrates how this can easily be done with a Raspberry Pi and an *SDRconnect* server-client software setup.

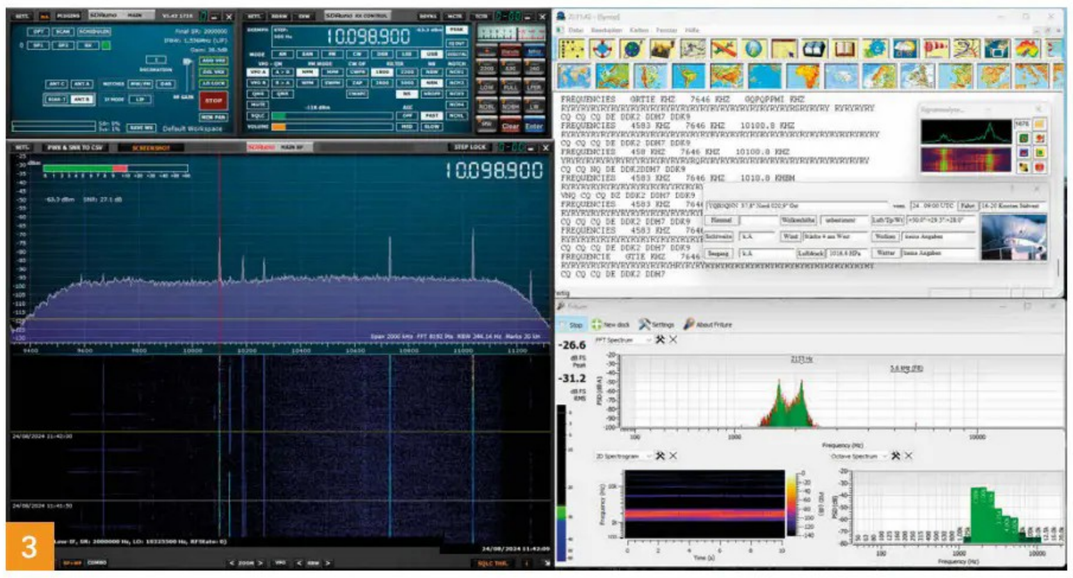
BAZ:
https://tinyurl.com/4pt7n6mj
Bonito:
https://tinyurl.com/29jsk7vd
SDRplay RSPdx R2 remote operation:
www.youtube.com/watch?v=FooYxhbhS9k
Stampfl Hamelektronik:
https://tinyurl.com/5n8dntcs

Bands and signals

In terms of HF broadcast reception, the RSPdx R2 consistently delivered above-average performance during the test period. There were some stand-out results. For instance, the 22m Broadcast Band during the daytime, and at the worst possible time of year for HF signals, was busy; not just with a strong transmission from CRI (China Radio International) but also resolving many weaker signals. From inside a full daytime MW section, I even managed to hear the very weak (0.06kW) local religious broadcaster Salaam BCR from Bury on 1566kHz (**Fig. 2**) – a first at my QTH.

Weather Fax (WEFAX, weather facsimile) and RTTY (ITA-2, Baudot, Radioteletype) signals presented no challenge to the RSPdx R2. The screenshot in **Fig. 3** shows the German Weather Service (DWD, Deutscher Wetterdienst) daytime frequency of (nominal) 10100.8 (10098.9kHz) USB being resolved with the aid of software. The top-right half of the screen is Zorns Lemma (ZL) 11.42, and the bottom-right half shows the Friture real-time audio analyser. RTTY reception remained stable over several hours, as evidenced by the





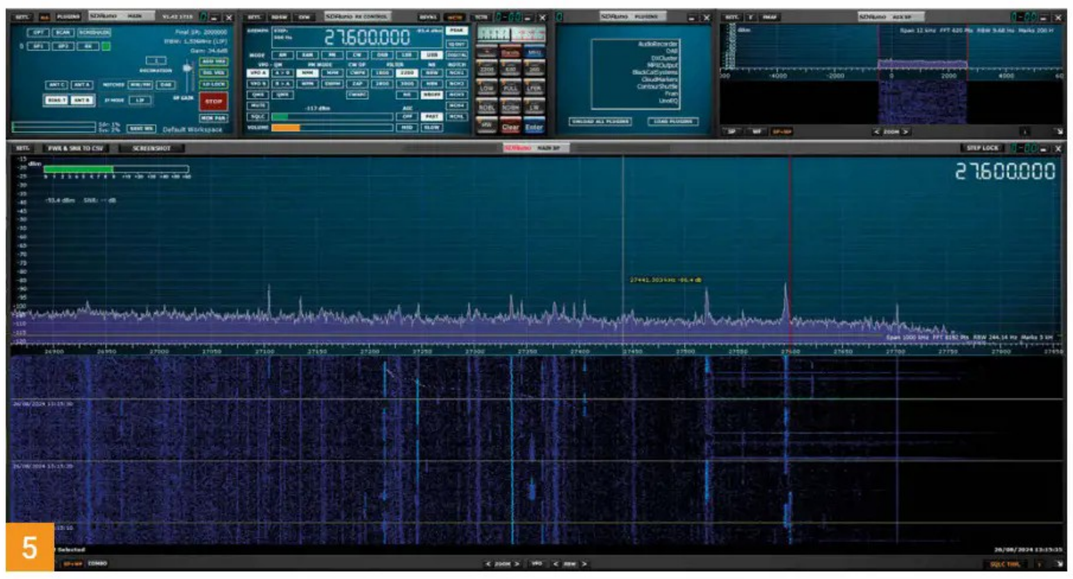


Fig.1: The new SDRplay RSPdx R2 (cables and adaptors are the author's). Fig. 2: The weaker station *Salaam BCR* from Bury on 1566kHz was a welcome reception success for me. Fig. 3: The RTTY signals from DWD on (nominal) 10100.8kHz USB were stable over long periods. Fig. 4: Not always a daily catch these days: DWD LW on 147.3kHz. Fig. 5: Some CB traffic from Europe at the weekend, around 27MHz.

pictures of the ships and buoys where the data originated – a feature unique to Zorns Lemma (centre-right).

The same applied when I switched to other software (SeaTTY). For WXFAX, you may wish to avail yourselves of the *Black Cat Fax Decoder* plugin of *SDRuno* (V. 1.42 1710). Moreover, **Fig. 4** illustrates the successful reception of the German-language-only DWD forecasts on Long Wave (147.3kHz), which the RSPdx R2 had no issues at all in settling on, at length and in the daytime. This was in contrast to plenty of other radios. Note the BBC LW 'spike' at 198kHz, on the right of the waterfall.

Finally, for this section, when skimming over the CB band at the weekend, I was very impressed to hear EU operators, especially from Germany and Luxembourg, at around 27600kHz coming in loud and clear here in the Northwest of the UK (**Fig. 5**). That was an unexpected pleasure.

Beyond shortwave

For Airband enthusiasts, there is much to enjoy here. Use the scanning feature in the background and just let the continuous stream of Airband comms wash over you, as I often do; or you could go back onto HF to check voice traffic or VOLMET transmissions. On the Non-Directional Beacon (NDB) front, the RSPdx R2 proved both sensitive and fun to work with, in both monitoring, recording and replaying signals.

L-Band reception (around 1.5GHz) is a fascinating subject. The wide coverage of the RSPdx R2 invites you to explore these upper realms further. Alternatively, you could reconnoitre other signals from space (cf. **Tim Kirby's** eponymous series in *RadioUser* magazine). Tim covered amateur satellites, cubesats, the ISS (International Space Station), L-Band (*RU* March 2020: 16), ACARS, weather satellites, meteor scatter, and much more, from 2020-2022 – and almost all of those signals are within range of the RSPdx R2.

I shall report back later on how I get on with this area. I am currently looking to get an RTL-SDR Blog Active Patch Antenna (V.2) for Inmarsat, Iridium and GPS, to use with the RSPdx R2. You can check out *In the Sky* or *Heavens Above* to acquire more information about what is up there; and, who knows, with its wide coverage, the RSPdx R2 might just open the doors to a completely new hobby to you.

Heavens Above:
www.heavens-above.com
In the Sky:
https://in-the-sky.org/satmap_radar.php
Radio Astronomy and SDRplay:
www.sdrplay.com/radio-astronomy-and-sdrplay
RTL SDR L-Band Patch Antenna (Tech Minds):
https://tinyurl.com/ms725zv9

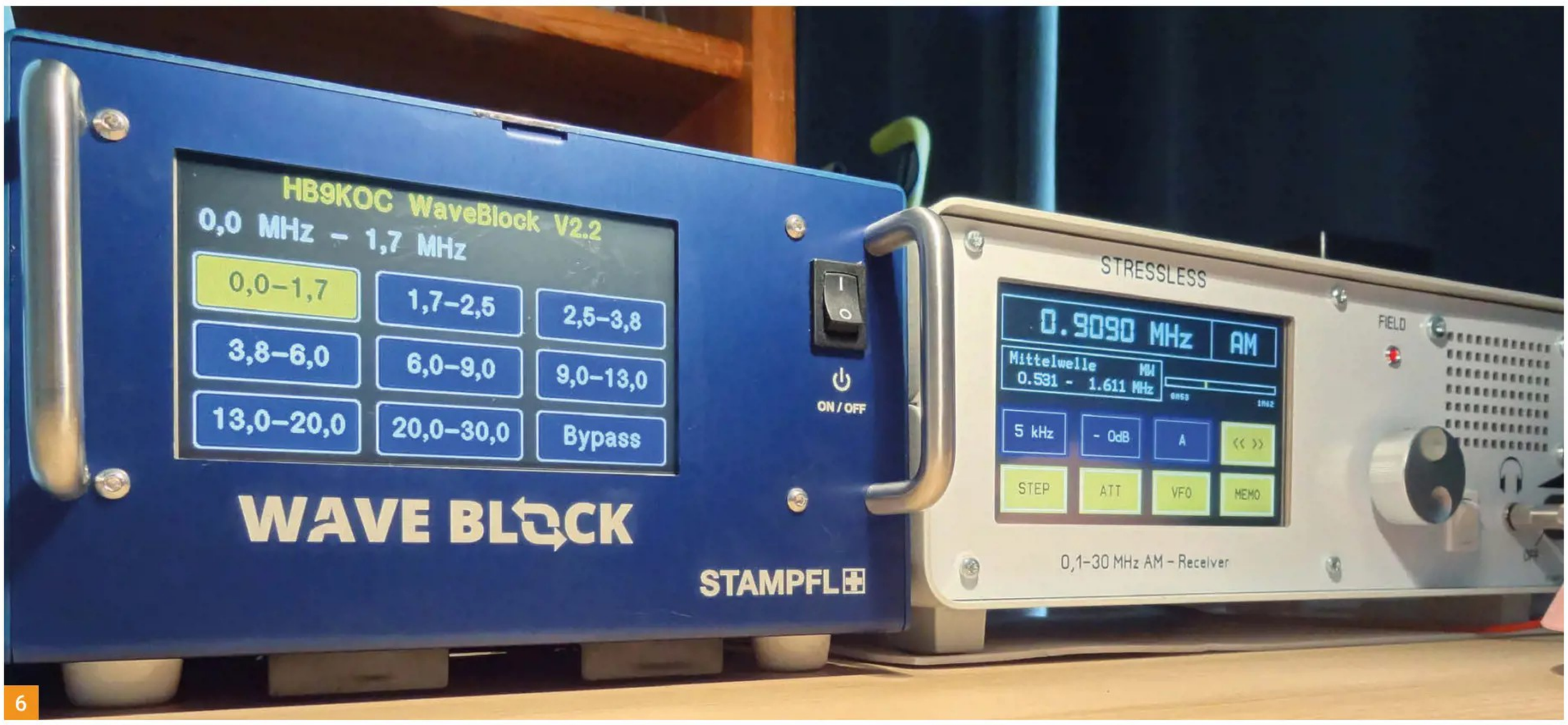
Do we still need preselectors?

Many radio enthusiasts nowadays are working with sophisticated gear and have dispensed with the need for a dedicated hardware preselector. Indeed, you might argue that a preselector is not, perhaps, as essential today as it used to be in former times. Many hardware radios and SDRs are now offering seamless, professional, HF engineering with excellent strong-signal handling and noise suppression and including a host of advanced features. The Stampfl STRESSLESS HF Receiver is a good example of this (cf. *The Spectrum Monitor*, April 2024: 24; Aug 2024: 20, *PW* June 2024:16).

In addition to the easier availability of modern technology, there are now fewer stations to listen to throughout the contemporary HF bands, when compared to the 'golden days' of SW radio. Despite this, preselectors are still in use, popular and widely available. My first one was the Lowe PR150, which came in a rack with the HF150 receiver and SP150 Speaker.

I achieved excellent DX using this combination. What is more, many dedicated DXers are still operating preselectors such as the Reuter RAP1-D, Palstar MW550P, RF Systems P-3, MFJ 1040B, Heros Technology SCR-CAT 2020, ELAD QSF-06, Cross Country Wireless HF Preselector, and Mizuho SX-3, to name but a few. And there are countless 'homebrew' models.

For me, a decent preselector remains a shack essential. It is one of those items I find worthwhile to work with – much like my propagation clock (MFJ) or low-noise PSU (SSE). Ironically, with the new breed of SDRs, you can now immediately appreciate the switching-in of a preselector and its effect on reception quality, by a simple observation of the waterfall display.



6

Enter the Stampfl WAVEBLOCK

Heinz Stampfl HB9KOC is well-known in the European radio scene for his modern, high-end kits and receivers – often with an educational bent and, laudably, aimed at a younger audience – and for the accessories and aerials he makes, for example the LW Converter (UC-1S), Preselectors (WAVE STAR, WAVEBLOK), Standing Wave Barrier (MWS-1), and Aerials (X-One).

Heinz's new preselector looks very much as though it could be a successor to the smaller WAVESTAR (*RadioUser*, August 2022), which is still being offered by Fenu Radio and *Funkamateur* in Germany. You can watch an instructional video on Fernando Duarte's blog. Here the Stampfl WAVEBLOCK is properly put through its paces with an ELAD FDM S2 receiver:
https://tinyurl.com/39jca4eh

The WAVEBLOCK (**Fig. 6**) is sold ready-assembled and fully tested. It comes with a DC (9-16V) power cable. This is a large and beautifully built device in dark blue aluminium; and yet it is lightweight, much like the STRESSLESS alongside which many users might use the WAVEBLOCK. These two devices look like 'cousins' – made for one another and with a strong family likeness. The WAVEBLOCK will work with any HF receiver – whether it be hardware or SDR. It may also be used with transceivers, having a PTT input, which the WAVE STAR did not offer. During my tests, I used the WAVEBLOCK with the brand-new SDRplay RSPdx R2 Software-Defined Receiver, the AOR AR7030 legacy radio, and my Stampfl STRESSLESS HF Receiver (Fig. 6 again), which has become my new 'top dog' for HF performance.

Technical details and operation

The WAVEBLOCK covers 0-30MHz. On the inside (**Fig. 7**), it shows Swiss *Aufgeräumtheit* (tidiness) itself. Heinz was responsible for hardware development, whereas filters and software were implemented by **Ernst Kirschbaum DL2EBV**. The published measurements of the preselector relate to selectivity, return-current suppression, and variable standing wave ratio VSWR (in bypass mode). They were undertaken by **Hans Zahnd HB9CBU**, using a Rohde & Schwarz ZNLE3.

It appears then, that we have here a serious device, built by dedicated HF engineers for equally dedicated radio amateurs, DXers and general listeners. Physically, the WAVEBLOCK measures 310 x 190 x 120mm (L-D-H). The device has a large, industry-standard, TFT display of 480 x 272 pixels, measuring 100 x 60mm. This proved to be very responsive, and it offers eight frequency ranges (0-1.7; 1.7-2.5; 2.5-3.8; 3.8-6; 6-9; 9-13; 13-20, and 20-30MHz). Naturally, there is also a bypass. These choices can be toggled easily and work with a satisfying click, audible from within the preselector.

Continued on page 30

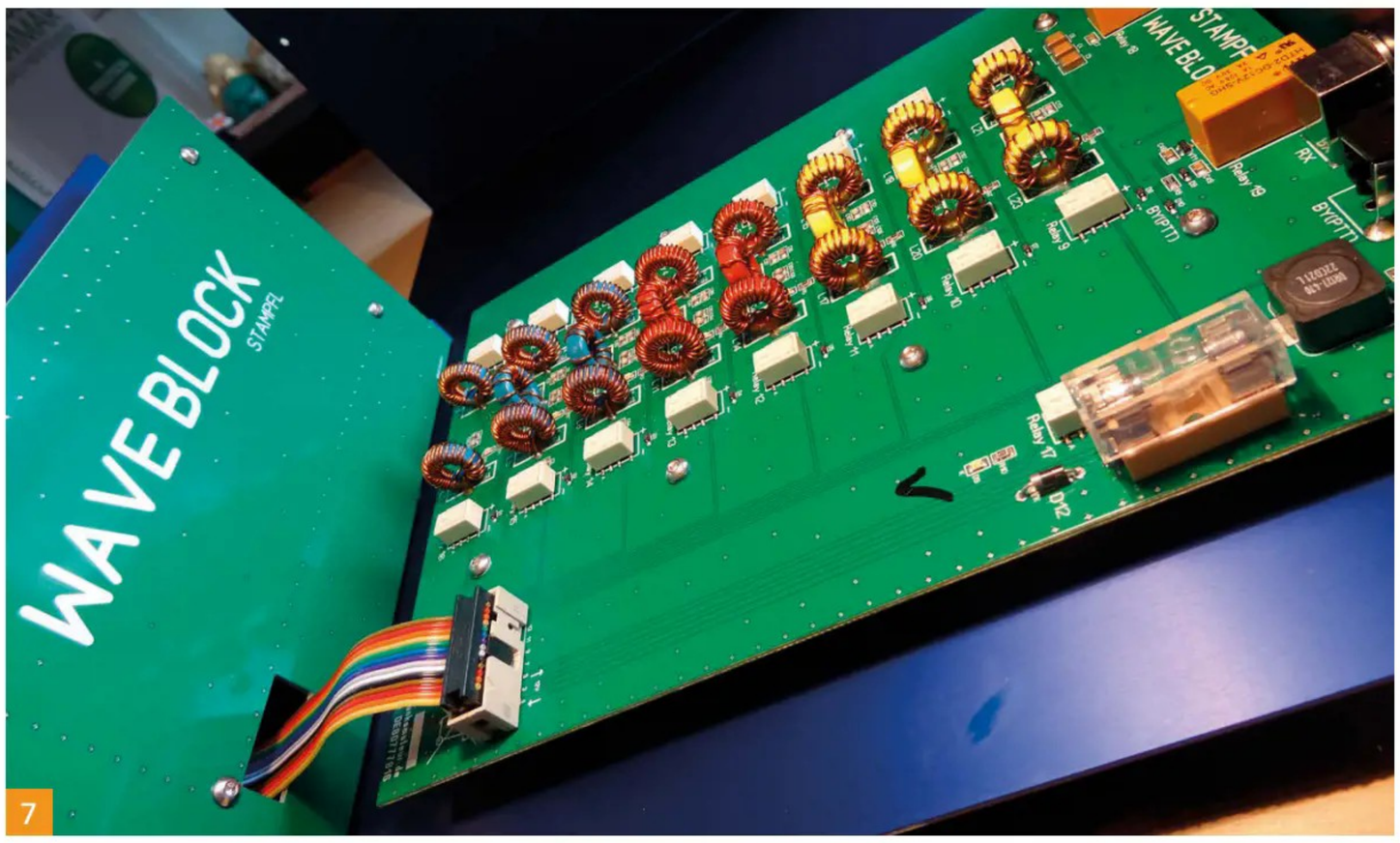


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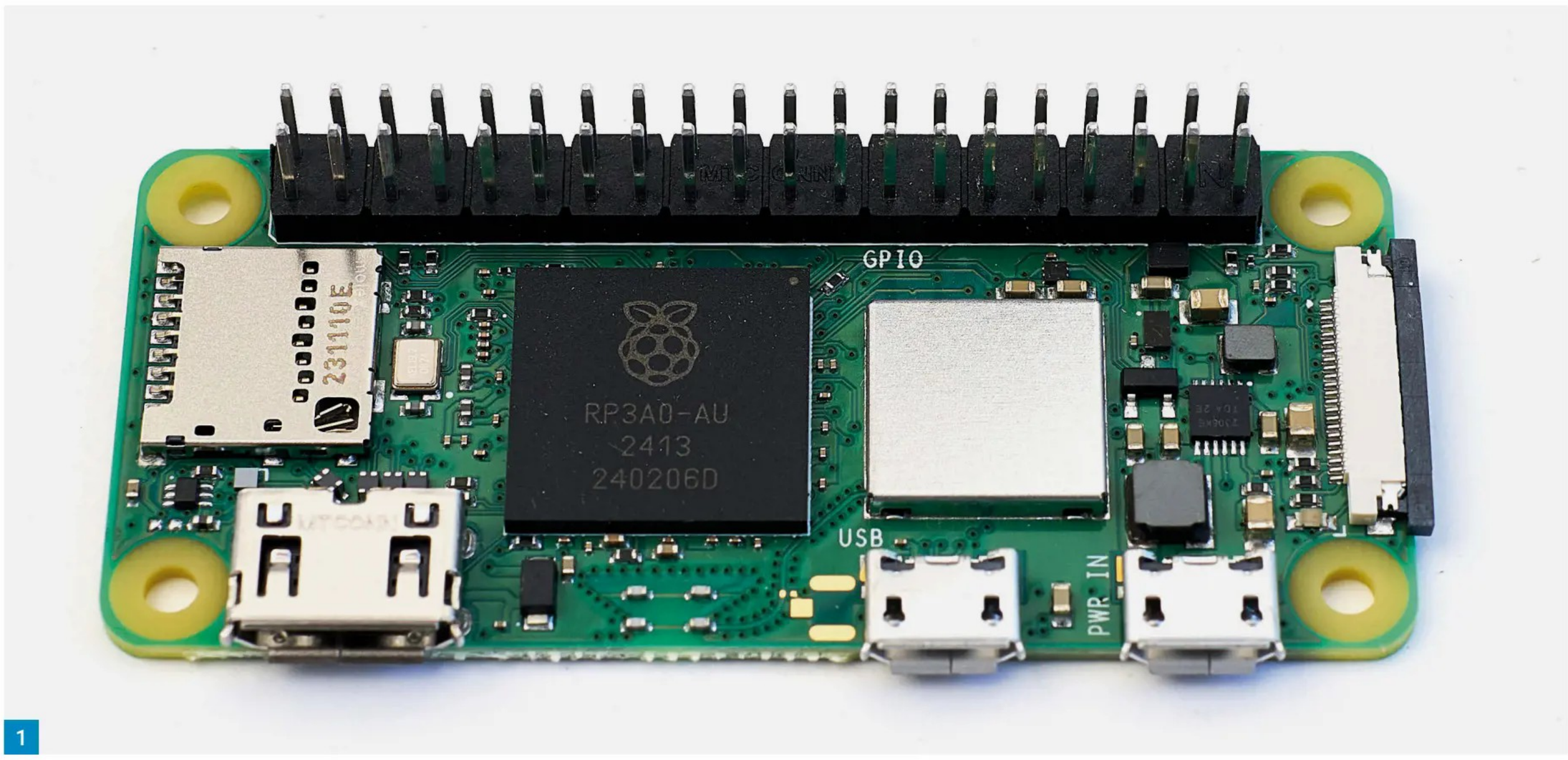
Fig. 6: The Stampfl WAVEBLOCK Preselector.
Fig. 7: The inside of the Stampfl WAVEBLOCK.

- SDRplay RSP2: *RadioUser*, April 2017: 8
- RSP1A: *RadioUser*, April 2018: 21
- SDRplay *RSPduo* (Software): *RadioUser*, August 2018: 14
- RSPdx: *RadioUser*, January 2020: 8/9; February 2020: 14
- SDRplay *SDRconnect* (Software): *Practical Wireless*, February 2024: 47
- RSP 1B: *Practical Wireless*, June 2024: 16 (*SWLing Post*, May 2024: **https://tinyurl.com/mwenkkwk**)
- RSPdx R2: *The Spectrum Monitor*, April 2024: 24; June 2024: 61
- RSP1A & RSP1B: *Radioworld*, 1 August 2024: 16-18 ('SDR: The next level of shortwave radio listening', by James Careless: **https://tinyurl.com/3tfbsx2u**

Table 1: Previous Reviews of SDRplay Receivers.



1

WSPR with a Pi

This month, **Mike Richards G4WNC** looks at a cheap but effective way of running a WSPR beacon using the latest software.

Mike Richards G4WNC
practicalwireless@warnersgroup.co.uk

One of the original amateur radio applications for the Raspberry Pi configured the PWM (pulse width modulation) output to produce a WSPR RF signal directly from a pin on the Pi. Although generated at the final RF frequency, the output was a square wave, so some filtering was essential before reaching the antenna. This was a simple task achieved using a basic low-pass filter. The original project underwent a few improvements as various amateurs contributed to the open-source software. However, interest in the original project has declined, and it's been seven years since the last update. As a result, that original software won't run with the later Pi models and Linux editions. This has frustrated some readers who tried using the WSPR example in my *Raspberry Pi Explained* book. Fortunately, **Bruce Raymond** from TAPR (Tucson Amateur Packet Radio Group) revived and advanced the project two or three years ago. That work culminated in the TARP WSPR Without Tears project. This project is still current, and you can see details here:

https://tapr.org/wspr-documentation-and-files

Thanks to **Lee C Bussy AA0NT**, the TAPR project has been further developed into an up-to-date application with many enhancements over the original program. Lee's work provides the foundation for creating a multiband WSPR beacon with internet time-based clock correction. This includes a web interface for configuring the Pi WSPR parameters.

Most of the original WSPR Pi projects were based on the Raspberry Pi Model B series (2, 3 & 4); these are full-size boards. However, the Pi Zero 2 released a couple of years ago brought a 1GHz quad-core processor with 512GB RAM to these smaller, cheaper boards, making them up to five times faster than the original Pi Zero. For this WSPR project, the Pi Zero 2 W is the ideal board, **Fig. 1**. It has sufficient processing power and includes the vital wireless connectivity we need to access the NTP (Network Time Protocol) servers to ensure accurate transmit frequency and WSPR timing. What's more, the Pi Zero 2 W costs just £15! When buying your Pi Zero 2 W, I suggest using the official Pi resellers such as PiHut, Pimoroni and Cool Components in the UK. Also, ensure you get version 2, not the previous Pi Zero W! Due to the high demand for the Pi Zero 2 W, a few suppliers have started selling them at a premium price. Some overseas copies are sold at very low prices, and you should avoid these.

Preparing the Pi

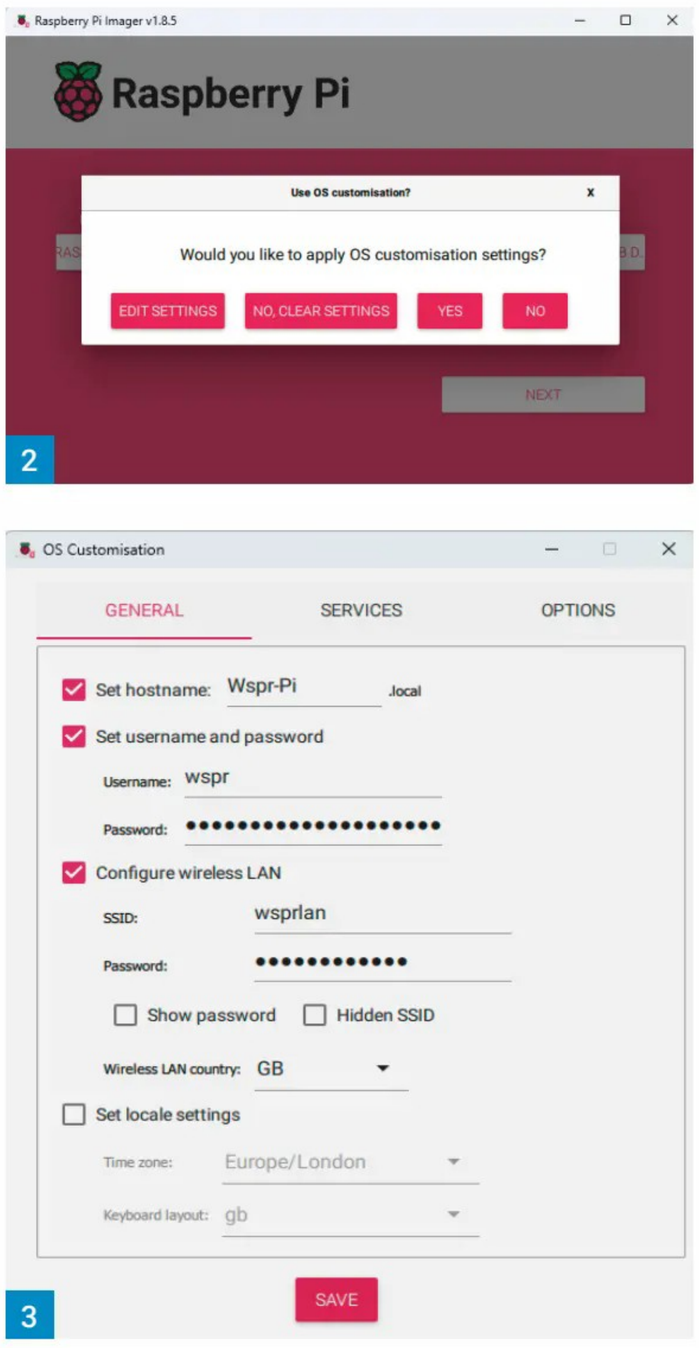
For the examples here, I will be using Lee Bussy's software, which is the latest available.

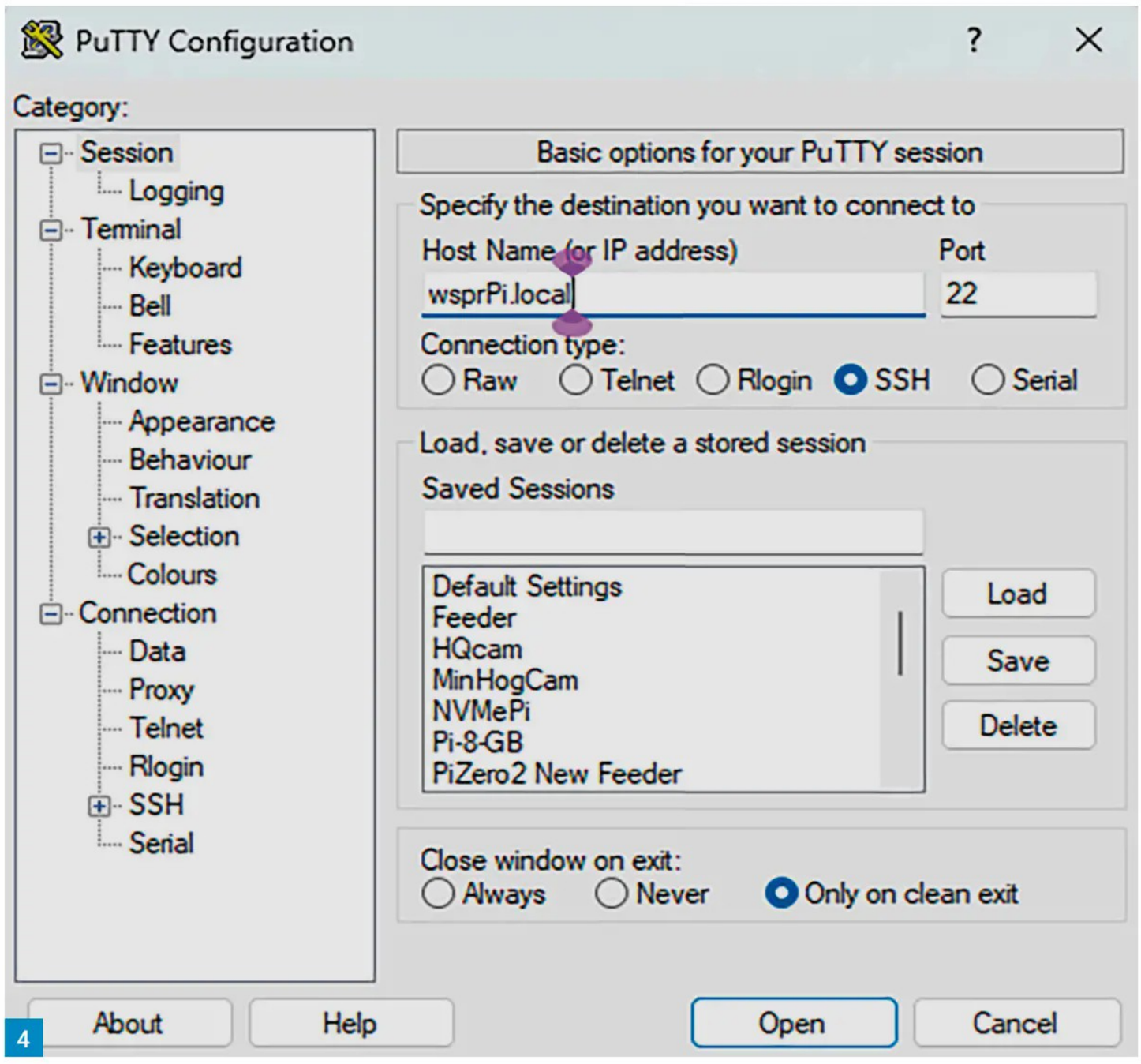
The first step is to prepare a microSD card with the Raspberry Pi Linux Operating system. You'll need a 16GB or larger microSD card and a card reader for your shack computer. The simplest way to program the microSD card is to use the Raspberry Pi Imager, which is a free download from here:

www.raspberrypi.com/software

The Pi Imager is available for Windows, Linux and Apple operating systems, so you can burn the microSD on any of these systems. With the Raspberry Pi Imager installed, insert your microSD card and run the program. The process is straightforward: You begin by selecting the board, then the operating system. I suggest using the recommended Raspberry Pi OS (32-bit). For more experienced Pi users, the 32-bit Pi OS Lite has everything we need to run the software and avoids the processing overhead of the GUI (Graphical User Interface). Please note that Lee's WSPR software only supports 32-bit operating systems. The final step is to choose the storage device. You need to take care here to ensure you select the microSD card and not one of your PC drives. You will be presented with the OS customisation screen when you click Next, as shown in **Fig. 2**. This very useful enhancement lets you set the username, password, Wi-Fi details and more. This saves lots of time and simplifies getting the Pi running. Click Edit settings to see the panel shown in **Fig. 3**. Here's a step-by-step guide to the settings:

1. In the General panel, set a unique hostname, i.e. wsprPi. Once the Pi is running, you can access it from any device on your local network using the URL wsprPi.local.
2. Next set a username and password of your choice.





3. Enter the SSID and Wi-Fi password for your local Wi-Fi. NB: Don't forget to set the Wireless LAN country to GB.
4. Set the locale to your timezone and keyboard.
5. Select the Services tab and tick Enable SSH and password authentication
6. Complete the configuration by clicking the red SAVE button at the bottom of the panel
7. Click Yes in the Use OS customisation panel to start burning the SD card.

The Imager will then transfer the OS to the microSD card and verify the file transfer to ensure all is well.

The next step is to fire up the Pi and ensure it works. This stage is easier if you can temporarily connect a keyboard, mouse and HDMI monitor. See the next section for direct SSH access to the Pi. Power up the Pi, and depending on your chosen OS, you will get either the GUI or the command line. Before installing the WSPR software, you must have a working internet connection. Those with GUIs can open a browser and access a website. However, The PiZero will be very slow, so you must be patient. The faster option is to use the command line and type the following command:

ping -4 8.8.8.8

This will send four data packets to the Google DNS (Domain Name Servers) and measure the response times. You know you have a working connection if you get 0% packet loss.

SSH access

If you preconfigured your Pi image using the Pi Imager software, you should have SSH access to the Pi from any device on your local network. You will need terminal software supporting the SSH protocol to do this. The free PuTTY (URL below) is the most popular application for Windows users. When you open PuTTY, you will see a panel similar to **Fig. 4**. Ensure SSH is selected and enter your Pi host name.local into the Host Name (or IP address) field. If you've followed my instructions, you'll enter wsprPi.local, then click Open. You will see a security warning you can accept the first time you do this. You can then access the command line using the Pi username and password.

https://putty.org

Installing WSPR software

In addition to providing valuable improvements to the Pi WSPR software, Lee has created a script that greatly simplifies the installation. This reduces the installation to a single line of text on the command line! Here's the line:

sudo curl -L installwspr.aa0nt.net | sudo bash

NB: This is a change to Lee's original command as I found that failed with a lock error unless I preceded the line with sudo. After downloading the install script you will see the WsprryPi start screen, **Fig. 5**. The next prompt will ask you to confirm the timezone. This will be followed by a prompt for the system shutdown

Fig. 1: Raspberry Pi Zero 2 W.
Fig. 2: Pi Imager customisation option.
Fig. 3: Pi Imager customisation settings.
Fig. 4: PuTTY configuration.

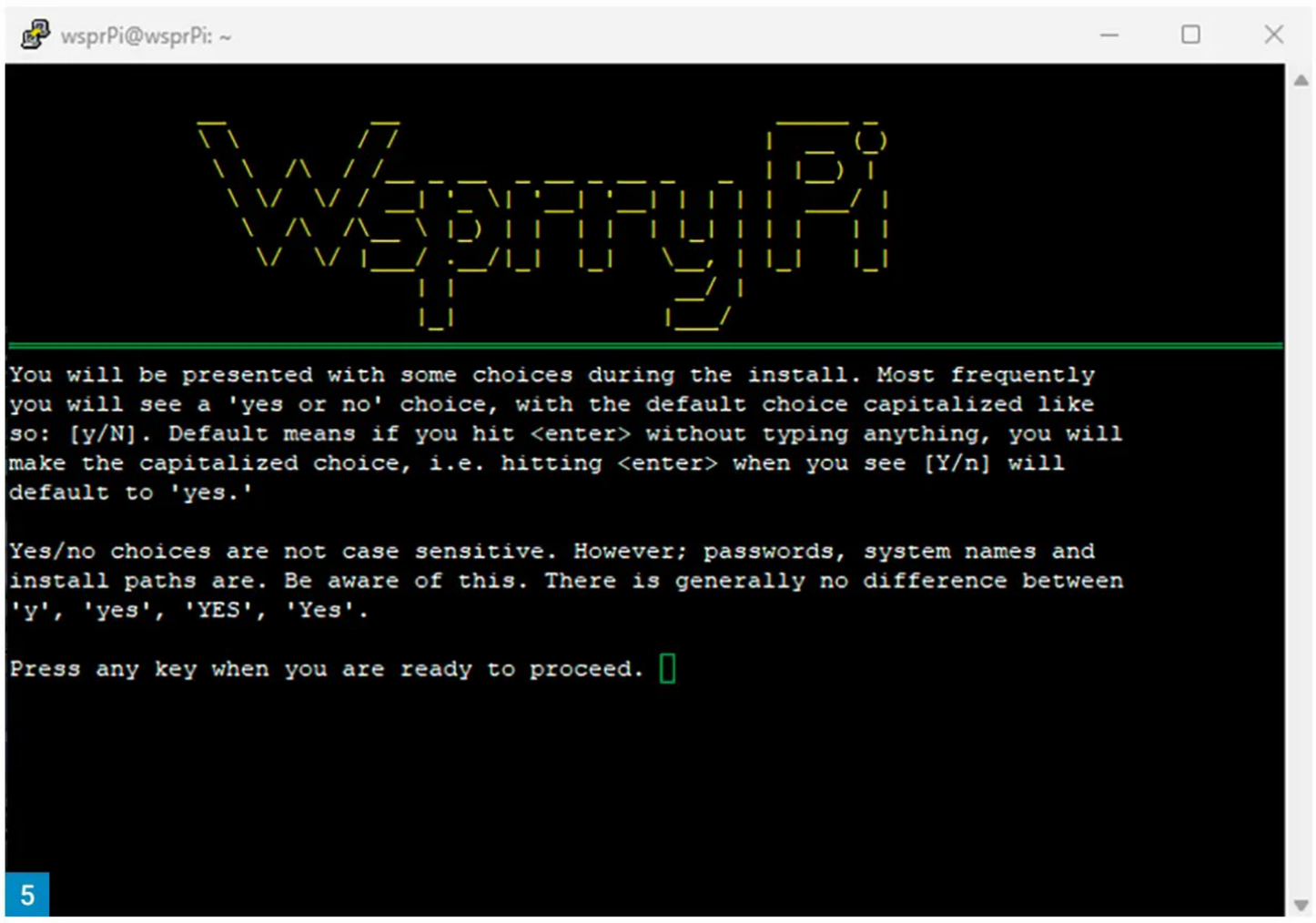
button; answer N to this. After this, the main install routine will run. This will take a while as it first updates the Pi and then downloads and installs all the packages required to run WSPR and its web server. I timed my installation on a Pi Zero 2 W at nine minutes. At the end of the installation, you will see a message that the internal soundcard has been disabled. This is to prevent any system sounds from interfering with the WSPR application. You can complete the installation by rebooting the Pi by entering: sudo reboot.

Configuring WSPR

One of the great benefits of this WSPR setup is that you can configure the operation via a simple web page. For those who set up their Pi Zero 2 W with the GUI, you can use the built-in web browser, but it is very slow. I recommend using another device on your local network. To access the WSPR Pi enter the Pi hostname followed by: .local/wspr. If you've followed my instructions, the address will be: http://wsprPi.local/wspr

If all is well, you will see the configuration screen shown in **Fig. 6**. Here's a quick run through the settings.

Control: Enable will start the WSPR transmissions, while Enable LED is only



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applicable to the TAPR WSPR board as this has an LED that shows when the board is transmitting. You could add your own LED and series resistor to Pin 12 on the Pi.

Operator Information: Enter your callsign and the first four characters of your locator.

Station Information: Enter the transmit power in dBm. You need to measure this on the antenna side of the low-pass filter. The frequency field can accept the precise frequency in Hz or the band name, i.e. 20m, 15m, etc. If you enter the band name, the transmission will be in the centre of the WSPR allocation. You can also enter multiple frequencies separated by a space, and it will cycle through these. If you add a 0 to the list, it will pause transmission for one cycle. Take a look at Lee's documentation for more details. The random offset does precisely that and offsets the transmission from the centre of the band.

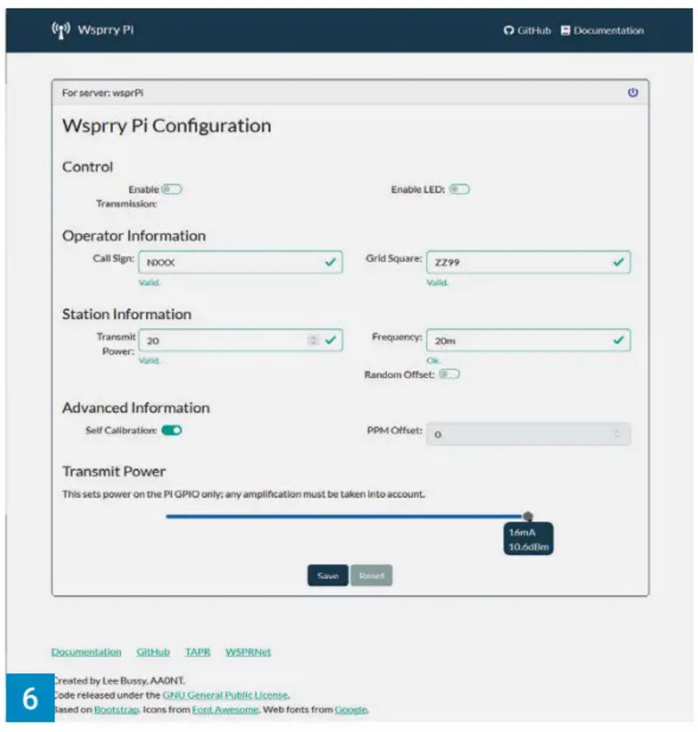
Advanced Information: Self-calibration uses the NTP time servers to calculate the clock correction for the Pi internal clock. You can switch this off and enter a specific PPM offset, but the NTP calibration works very well, so I recommend sticking with that.

Transmit Power: This slider controls the drive level in mA, which is available from the GPIO port of the Pi. However, you must use a low-pass filter that blocks DC between the Pi and the antenna. The slider adjusted the available power from -3.5dBm to +11dBm in my measurements.

When making changes to the Web interface, you must remember to hit the Save button and note that the changes will take effect from the next transmit cycle.

Antenna filtering

As the Pi output is a square wave, filtering is essential before the signal reaches the antenna.



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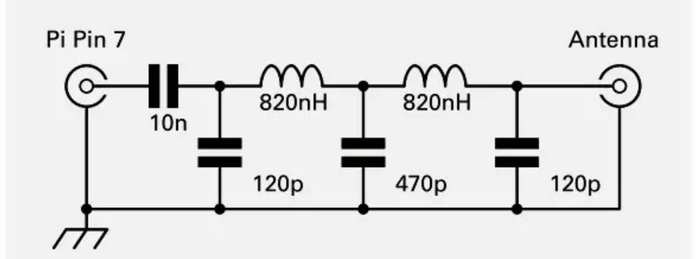

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Fig. 5: WSPR installation start screen.
Fig. 6: WSPR web configuration page.
Fig. 7: 20m low-pass filter.

However, filtering a square wave is relatively simple, and a 5-pole low-pass filter should be sufficient. These are easy to calculate and build from scratch, or you can use one of the many kits, such as the 3-band QPR filters from SOTA beams. **Fig. 7** shows a design for 20m calculated using QUCS.

That's about all I have room for this month. Next time, I'll show you some tools for processing WSPR data. **PW**

Continued from page 27

Did it work well? Yes, it did for me, the evidence was there: I was able to make some quick and easy performance comparisons of the reception quality by just looking at the waterfall diagram displayed in the software of my SDRplay RSPdx R2. This proved both revealing and useful: any improvements in reception quality can be quite small – too small, perhaps, to be heard with the naked ear. But they were significant enough to be seen on the screen of *SDR#*, *SDRuno* or indeed other relevant SDR software. I conclude, therefore, that the WAVEBLOCK can help lift performance noticeably. The device is versatile and of a very high quality; it represents an all-round solid investment in your shack.

Overall conclusions

The new SDRplay RSPdx R2 from this established and innovative UK firm was a joy to operate and represents a measurable improvement over previous models, such as the RSP dx. In my opinion, the receiver is more sensitive and offers more flexible handling and features. Coverage is very wide and particularly improved in the VLF-LF and MW sectors. The wide coverage, up to 2GHz, invites further experimentation and represents future-proof technology.

The Stampfl WAVEBLOCK is a modern professional-grade preselector, which will grace the shack of any broadcast signals DXer, radio amateur and utility monitor. It is flexible and represents quality made in Switzerland, at an affordable price. Performance with both legacy radios and modern SDRs was flawless. It may well help you dig that last ounce of signal out of the mush, and it looks great in the shack. If you enjoy working with preselectors, do consider getting this one. At the time of writing, in June 2024, the WAVEBLOCK was available in the online shop at Stampfl Ham Elektronik for 590 CHF (Swiss Francs; ca. £520/$660US).

My sincere thanks go to **Jon Hudson** at SDRplay UK, **Tony Wiltshire** at ML&S Martin Lynch & Sons, and **Heinz Stampfl**, at Stampfl HamElectronics for the extended loan of the review units, for furnishing answers to my questions, and for much-valued advice. **PW**

Resources

- Stampfl HAM Electronics: **www.heinzstampfl.ch**
- Stampfl WAVEBLOCK Preselector, 0-30MHz: **https://tinyurl.com/37kvyavk**
- Wiessala, G (2024): Stampfl STRESSLESS HF Receiver Reviews: *The Spectrum Monitor*, April 2024: 24; *Practical Wireless*, June 2024: 16; *Radio Kurier* 5/2024: 24; *RadCom*, July 2024: 70.
- Product page SDRplay RSPdx R2: **www.sdrplay.com/rspdxR2**

ML&S Web: www.HamRadio.co.uk Tel: 0345 2300 599

Trustpilot 4.9 — HamRadio Reviews
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YAESU

ML&S Officially the only Direct Factory Appointed Distributor & Repair Workshop for Yaesu Musen Products

This month's Featured Yaesu
Yaesu FTX-1F
ALL BAND ALL MODE PORTABLE

Another Dream Radio from Yaesu.
Taking over from where the best-selling FT-817 left off, the new FTX-1F is due into us early 2025.

- 6W/10W on any band
- 160-70cm incl 4m
- Twin RX with any mode on either receiver
- SDR Technology and 3DSS
- 5670mAh high-capacity Li-ion battery pack
- Dual Loudspeakers
- USB ports support CAT operation, audio input/output and TX control

Join our reserve list at HamRadio.co.uk/FTX1F

FT-710 AESS **£985.00**
HF/6/4m All Mode Compact Transceiver. Perfectly sized & simple to use. **Comes with a FREE SP-40 Speaker**
FT-710 Field (no speaker) **with FREE Yaesu hat** **£899.00**
Yaesu FTM-6000E
Dual Band 50W 2/70 FM Mobile Transceiver **£199.99**

Yaesu FTM-300DE 50W C4FM/FM 144/430MHz Dual Band Digital Mobile Transceiver **£375.00**

Yaesu FTM-200DE Single RX C4FM Mob **£295.00**

Yaesu FTM-500E Latest C3FM/FM 2/70 Transceiver. As reviewed in the video, **see: txfactor.co.uk**

ML&S Price only £499.00
Free carriage for UK mainland, use code FTM5RC in check out.

FTdx101D
with FREE SP-101
100W HF/6m Transceiver
.....**£3099.95**

FTdx101MP
with FREE M-70 Mic worth £129.99..... **£4099.99**
Yaesu FT-dx10 Narrow band SDR and Direct Sampling
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Yaesu FT-891 HF/6m Base/Mobile **£649.00**
20% discount off FC-50 when bought together
Yaesu FT-5DE IPX7 Dual C4FM RX Handie.....**£369.00**
Yaesu 70DE
C4FM/FM 144-430MHz Dual Band Handie **£167.95**
Yaesu DR-2XE C4FM Repeater. In stock **£1249.99**
Yaesu FT-65E VHF/UHF 2m/70cm Dual Band FM Handie **£84.95**

Yaesu FT-4XE 5W VHF/UHF FM Portable Transceiver **£59.95**
Yaesu M-70 Desktop Microphone **£129.95**
Yaesu M-90MS Microphone Stand Kit **£144.96**

Fancy moving to North Devon to a superb 5-Bed residence with breathtaking views & a fantastic DX Location?
See HamRadio.co.uk/G3TXF

KENWOOD

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New! Dual Band remote TM-DXXX First shown at Tokyo Ham Fair 2024. Release date 2025.

This month's Featured Kenwood
Kenwood TH-D75e
144/430MHz Handie

The new TH-D75E is the logical evolution of Kenwood's popular TH-D74E duo bander. 5W on 2/70. FM & D-Star, Built-in Digipeater, APRS, Wide-band all mode receive, IF Shift function, USB-C charging port & IP54/55 approved.

AUTUMN SPECIAL £778.99

Kenwood TS-890S
Probably the best HF/6m Transceiver Kenwood have ever made.
Peter Hart was astounded by the receiver performance & general build quality. This month's Summer deal includes a FREE MC-43S microphone & a Sangean MMR-88-DAB+ Portable receiver. **New version due for release in 2025.**

Kenwood TS-590SG
160-6m Base with ATU
..... **£1649.99**

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Wouxun KG-UV9K 2m + 70cm Handie ProPack..... **£139.99**
Wouxun KG-UV8G 2m + 4m Handie ProPack **£149.99**

The Wouxun KG-UV8G is our best selling 2m & 70cm Handie in the UK, so we persuaded the factory to offer the 2m+4m version as a 'ProPack' with all your favourite accessories and placed them inside a presentation box.

Wouxun KG-UV9D.....**£139.95**
Wouxun KG-UV980PL **£299.99**
Wouxun KG-Q336.....**£139.99**
Upgrade your communication experience with the Wouxun KG-Q336 Tri-Band 4/2/70cm Handheld Transceiver. Explore its impressive features and unlock a world of possibilities.

ICOM

ML&S Stock the Full Range of New Icom Products

This month's Featured Icom
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Transportable Masterpiece!
FREE LC-192 Icom Backpack Carry Case worth £156 AND 20% OFF selected accessories!

ALSO FREE! Radio Today's Guide to the IC-705 worth £15.95* Use code RC-RTGuide at check-out.
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NEW! Icom IC-7760 60th Anniversary Remote Head Transceiver. 200W HF/6m Full Remote head & control.
Available end 2024 ..RRP £5700
See HamRadio.co.uk/IC7760
NEW! Icom IC-PW2 1kW
Remote head HF/6m Linear Amplifier.
Price & Availability TBC.

Icom IC-905
VHF/UHF/SHF D-Star Transceiver
The IC-905 is a versatile all-mode transceiver that covers 144-5600MHz and includes a 10GHz trsnsverter option, providing access to VHF/UHF and SHF frequencies.
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Or buy together with IC-905. Call for package price!
The Icom CX-10G 10GHz Transverter is a high-performance radio frequency (RF) converter designed for amateur radio enthusiasts and radio experimenters.
Icom ID-52e Still Icom's best selling D-Star Handie
..... **Low Autumn Price: £518.95**
ID-52E Anniversary Identical to ID-52E including BluetoothR connectivity **£619.95**
Icom IC-7100 HF/6m/4m/2m/70cm Base & Mobile Transceiver including D-Star with remote control head unit
PRICE DROP RRP £1270.00 ML&S £1199.99
IC-R6E 0.100–1309.995MHz Handheld receiver
.....**AUTUMN PRICE DROP £220.00 ML&S £199.00**
Icom IC-7610 SDR HF/50MHz Transceiver with
FREE SPEAKER and Mic.....**£3299.99**
Icom ID-50E Compact VHF/UHF dual bander with both D-STAR and FM dual modes.**AUTUMN SPECIAL £349.99**
Icom IC-705 The worlds best selling All-Band All Mode Transportable 160m-70cm **£1349.99**
Icom AH-705 Random wire auto tuner for IC-705. ..... **£299.99**
Icom IC-7300 Best selling 100 Watt - HF/50/70MHz Transceiver with SSB / CW / RTTY / AM / FM
..... **with FREE SHIPPING £1199.00**
PTRX-7300 High quality RF interface module for the IC-7300 ..... **£199.95**
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Icom IC-9700 With FREE SP-38 speaker worth £156
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Icom IC-R8600 New 100kHz-3GHz Receiver with SDR technology from IC-7300 ..... **£2549.99**
Icom ID-5100
Latest 2/70 D-Star Touch Screen Transceiver **£639.95**
Deluxe Version also available for £799.95
NEW! Icom AH-730 100W Remote Auto-ATU..... **£550.00**

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- The CREDIT won't expire for a whole 12 months so you will have more than enough time to use it
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ELAD

Elad FDM-DUO

5W - Multi use SDR Transceiver for only £999.00

The FDM-DUO is a game-changer - a top-end SDR with dials and knobs! This transceiver has a 5W output that can operate as a stand-alone unit, without a PC! Connected to a PC, FDM-DUO is a very modern SDR receiver and transmitter with capabilities which are usually available in very large large radios only.

Elad TM-2

Console for SDR Radio for only £279.95

TMate2 allows the control of main functions of SDR software as FDM-SW2, PowerSDR and Perseus. Intended mainly to allow the use of SDR software without the need to watch the screen of the PC, or when the screen of the PC is crowded by various programs such as LOG or software for DIGITAL operations or CONTEST.

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Tiny new digital modes interface

- Combines audio codec, serial CAT interface and PTT switch
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Providing up to 10MHz Spectrum Display anywhere between 1kHz to 2GHz.**£225.60**

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With screen £5599.99
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Optional Auto ATU £399.99

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With screen £3599.99
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The FLEX-8400™ and FLEX-8400M™ offer the ultimate in high-performance direct sampling SDR technology for the most demanding HF/6m DXers and contesters. The FLEX-8600 is designed for operators who want to use the radio exclusively as a server from a PC, laptop, Maestro™, Mac®, or iOS® clients—whether local or remote.

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Vertical Antenna 40m-6m Package with Optimize Controller.

NEW SteppIR Stealth Antenna. £3999.99

The elegant solution for potential restrictions or neighborhood issues! Base antenna is 20m-6m with available 80m/60m/40m/30m or 40m/30m stepper motor controlled coil. Ground radial systems are also available.

SteppIR UrbanBeam. £4199.99

40m-6m Yagi Antenna Package 40-6m with Optimize Controller. It doesn't look like a traditional beam, but it sure works DX like a SteppIR!
The SteppIR UrbanBeam Yagi is a fantastic choice for those that are limited by lot size, regulations (HOA's) or even the critical eye of neighbors and spouses. The UrbanBeam has a unique appearance -some customers have remarked it looks like a bow-tie, or a butterfly! Regardless of its shape, the UrbanBeam delivers outstanding performance for an antenna that weighs only 45lb (20.5 kg) and has a wind load of a mere 4.4 sq ft (.41sq m). The overall physical length of the Yagi is 30.5ft (9.3m), which allows for a turning radius of just 15 feet (4.72m).

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ANAN-G2 Ultra

HF & 6M 100W Ultra High Performance SDR. £4395.00

Introducing the ANAN-G2 Ultra, the new generation ultra high performance SDR.
The G2 Display model has been upgraded to the G2 Ultra: Higher resolution 8 inch Display allows for much better visibility of the GUI. Front Panel with a wider array of control knobs/buttons and LED function indicators.Future capability of using these front panel controls with Thetis (whilst using Thetis on your PC/Laptop). Ergonomic layout of controls for ease of operation. CNC machined Aluminium Front panel for added isolation and shielding.
The G2 (Gen2 SDR) provides the same stellar receiver and transmitter performance as the earlier ANAN radios, however, it provides a huge leap forward in processing capability and flexibility in use case scenarios.

ANAN-G2 (without display)

This Version is without the front Panel LCD, Knobs and Buttons, more suited to those who like the PC interface for their SDR. Apart from this difference the Hardware and specifications are identical.....**£3899.00**

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1500W 1.8-54MHz SWR & Power Meter for HF Shortwave Radio with a 4.3inch LCD

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The mAT-S1500 features a 4.3" diagonal TFT colour display screen that displays the current RF power and SWR using bar and digital displays. This device is equipped with two high capacity 18650 lithium batteries, which can operate without the need for an additional power supply.
By using the TYPE-C charging socket, users can easily use their phone charger to charge it. Please note, the charger is not included as an accessory to this instrument, and the user needs to prepare it themselves. It only has one power switch and can automatically set the range based on the input RF signal.

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Auto ATU for Icom IC-705 with Internal Li-Ion battery **£169.96**
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A date for your diary: Saturday 30th of November Lynchy's Hog Roast without the HOG. Put it in your diary NOW!

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Digital Display SWR/Power Meter.This digital SWR & Watt meter is highly accurate for measuring Forward Power,Reflected Power, & VSWR **£149.99**
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The perfect world band radio to roam the globe with.. **£224.95**

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Philip Moss M0PBM
practicalwireless@warnersgroup.co.uk

AEW1 New Zealand entertainment receiver

Philip Moss M0PBM looks at a New Zealand receiver that appears to be closely related to the once-popular PCR series.

This set was donated to the British Vintage Wireless & Television Museum, Dulwich. Sadly, it was not in its original condition by quite a long way, but fortunately the receiver circuits were unmolested. The case should be green, but was over-painted in grey, and not very well, at that, the lid is missing, which would have had a compartment to hold the two quite thick battery leads, terminated in battery terminals for connection to 6V. Additionally, it should have handles on the ends, and a leather carrying strap. **Fig. 1** shows our set and **Fig. 2** as it should be. There appears to be a specific loudspeaker for it, a round and presumably metal one. **Fig. 3** shows the top of the chassis, **Fig. 4** the underside, and **Fig. 5** a close-up of the dial. The manufacturer is not known. The manual has been viewed and it does not state this. The website does not say either. All information on this set is from that, see acknowledgement below. The site is interesting, and covers quite a few sets, perusal is recommended.

Internally it should have a synchronous vibrator pack. **Fig. 6** shows it in its own box with the original transformer, but has a mains transformer only mounted with two screws, and an additional dual electrolytic capacitor across the one fitted originally. The rectifier is mounted horizontally on a bracket attached to the transformer. Originally it had a 500Ω output impedance to drive a line distribution system, allowing the speaker to be a long way away. This has been replaced by a normal transformer, of rather mean proportions. There is also an added smoothing choke. Both of these too had only one screw, despite lining up with holes for another. The wiring done was acceptable, but not very nice. Some screws were missing from the case. The chassis is mainly held by small screws in the front panel, but there are two larger ones in the bottom at the rear. They are American threads.

Investigating further

The set had a short mains lead of gold PVC covered 2-core, rather thin if it ran off batteries, for the current that it would draw. Two-core for an old metal-cased set is not my idea of safe.

I will speculate that AEW stands for Army Entertainment Wireless.

The set comprises a 6U7G RF amplifier, 6K8GT frequency changer, 6U7G IF amplifier, 6Q7GT AGC/AF detector and audio pre-amp stage, and a 6V6GT output. It is quite compact, much smaller than the Pye PCR- series, and is self-contained, not using an external PSU. Electrically all that is different in the receiver itself is only one IF amplifier and a fourth band. The four bands are: 550 – 1600kc/s, 6 - 12Mc/s, 12 - 17Mc/s and 16 - 24Mc/s.

Initially I did a check for correct mains voltage connection, and that the HT resistance seemed reasonable. Powering through a 60W lamp, I tried it. The heaters came on, no smoke, so I switched out the lamp-limiter. This also has two 150W lamps in parallel, in series with the 60W. For big appliances I can use them, or disconnect one by partly unscrewing it in its base. Both can be switched out. The progress of the glow in the lamps gives some indication of what is going on. If bright, there may be a short, a quick flash on turn-on is normal, and

Fig. 1: Front view of the museum set.
Fig. 2: The set as it should be.
Fig. 3: Top of chassis. Fig. 4: Underside of chassis. Fig. 5: Close-up of the dial.
Fig. 6: The vibrator power pack.

with a valve radio the 60W will then probably go off, or very dull, then lighting brighter as the rectifier begins to conduct.

There was no reception. All bands dead. Some HT hum, after re-affixing the speaker wires. All terminals had rusted and there was quite a high resistance at one of them. I hoped that at least the band it was left switched to would show some life. It is often the case that the others have oxidised connections, and initially are therefore open-circuit. Turning the switch many times usually brings some life back. I have found that mains switches often are open circuit too when a set has been off for a long time, so when one measures across the mains, it appears there is a fault but on applying the mains, the oxide is blown off instantly, and the set works. As a result, if one wants to check there is no leakage to chassis, one needs to connect to the mains transformer, if there is an open circuit across the mains lead. In this case though the switch worked fine. That it was not intended for mains operation, probably, is a matter I will pass over… It worked fine and appeared to have an adequate gap between contacts. Moving the aerial connection to the top cap of the RF amplifier did not improve things, and then to the frequency changer. This gave an 'airy' sound, that was not tunable. A clear sign the local oscillator was not running. The set was therefore receiving anything that came down the aerial within the bandwidth of the IF amplifier. This is not an unknown situation. The usual fault is the wave change switch. Cleaning the switch did work, but was intermittent. All sections needed doing before there was more gain from the aerial terminals than to top caps.

Some progress

The set then worked on all bands, but was intermittent. Further attention to the switches did not cure this. Something seemed very sensitive to touch around the coil-pack, but exactly what took considerable fathoming. Trouble was traced to the beehive-trimmers. I have encountered this before, when I replaced one, but I have learnt something new with this set. I always thought the concentric cylinders were aluminium, they look like it. They would therefore not be solderable, and the thing is held together by very small rivets. Taking one of the trimmers out, I thought it worth running a file across the rivets and cylinders. They are plated brass, which changes the situation entirely. So carefully filing and scraping the rivets and the ring of metal they fix to, and applying extra flux in the form of red-jelly rosin from a pot I bought from RS many years ago, I soldered the rivets to the ring,

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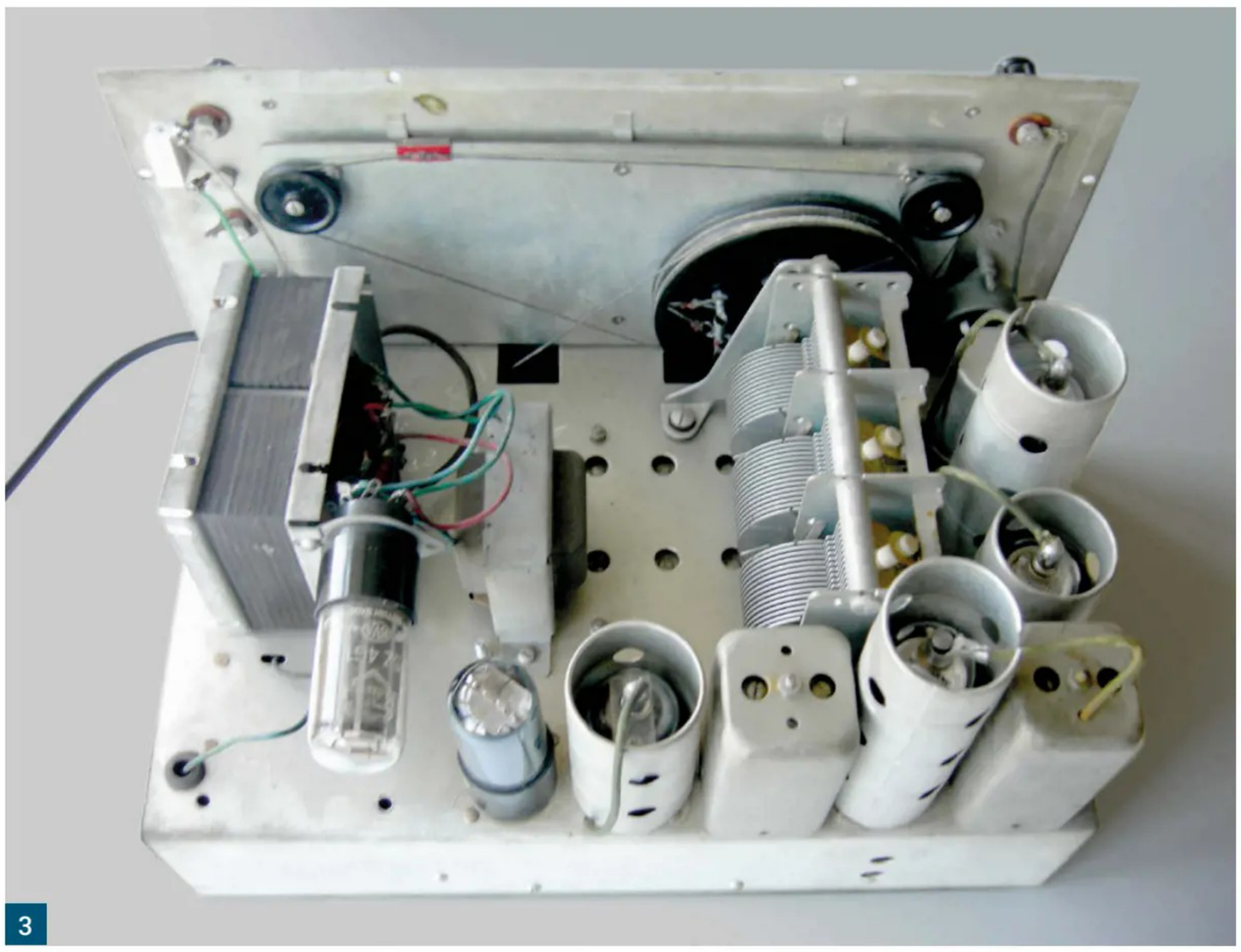
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and replaced the trimmer. It needed peaking, not surprisingly, at the HF end of the band. There are no slugs in any of the coils to adjust the LF end of bands. I restored the operation. Two trimmers needed doing on different bands.

The rest of the work was typical. Replace the coupling capacitor to the output valve grid, though the leakage was not bad in this case, and a couple of other waxed-paper capacitors. The ones on the AGC were inaccessible at the bottom of the coil pack, and would have required major work to get at and replace, nor could I get at them to cut off a connection and mount new ones elsewhere. As it happens, they leaked very little as evidenced by the fact that there was trivial volts drop across the series resistor. Resistors were reasonably close to the marked values.

The transformer and mains situation needed at-

tention. A new mains lead, three-core, was fitted and properly secured with a P-clip. A third screw was added to the mains transformer, requiring drilling another hole, which was done in-situ, due to my having the extra-length drill bit, allowing drilling from directly above the mains transformer. The choke and output transformer had the second screw added, the mains was run through the existing switch, and an in-line fuse holder was added. The set was PAT-tested at 3kV DC, no leakage, and earth continuity to chassis was checked.

The added reservoir capacitor failed and was replaced with another vintage one which was fine, and a wax capacitor across the HT started dripping wax and was cut out. The set worked fine without it and I didn't replace it. In some sets, this would cause them to go unstable.

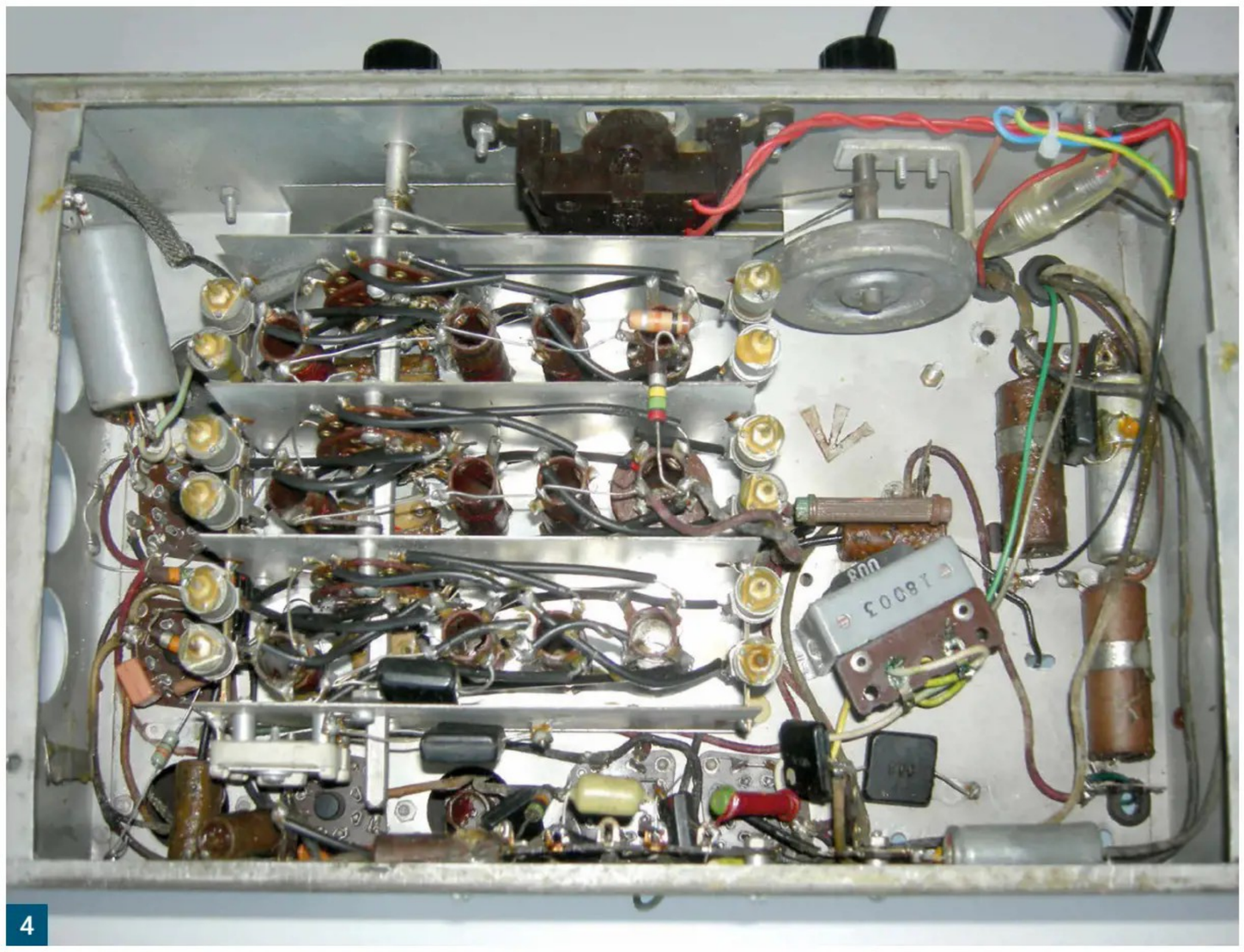
The volume control was very scratchy and of unusual construction. The spindle is a separate item, held in the pot by a screw, within a hollow tube where one would expect a spindle to be. What is more, the body of the pot gyrated when the pot was operated because said screw caught on the front panel, either because the hole wasn't big enough or the pot wasn't centred correctly. The pot was mounted on stand-offs, held to the front panel by two screws. In contrast the tone control was conventional. And also very stiff. Thin oil was applied and the shaft heated with a soldering iron, this repeated a couple of times to help work the oil into the grease. It helped a bit. As to the volume pot, the back was mainly open and switch cleaner did a great job of restoring it.

I initially had trouble with the valve top-caps. Trying to see what valves were fitted, I pulled the top cap off the RF amplifier. There was enough wire exposed to allow a repair, and I epoxyed it back on. The trick to getting the caps off safely was to use the leg of thin round-nosed pliers to force between the top of the top cap and the connector.

I lubricated the pulleys for the tuning cord, and washed the set's face. The tuning scale is plastic, so one has to be gentle. It was still in fairly good condition considering its age.

The performance was checked against specification and found very good. At the ends of the four bands, a signal of 2.5µV from a 50Ω source, 40% modulated, was more than adequate to give 50mW output with the volume up full. The signal-to-noise ratio was >17dB in all but one case. The set seems to be a considerably more practical one than the PCR series, being all in one smaller unit, with a protective lid. The lack of the second IF amplifier is no problem for a broadcast receiver, really.

In the Museum it is next to the PCR-2, and that next to what I call Hitler's radio – a German army entertainment set.



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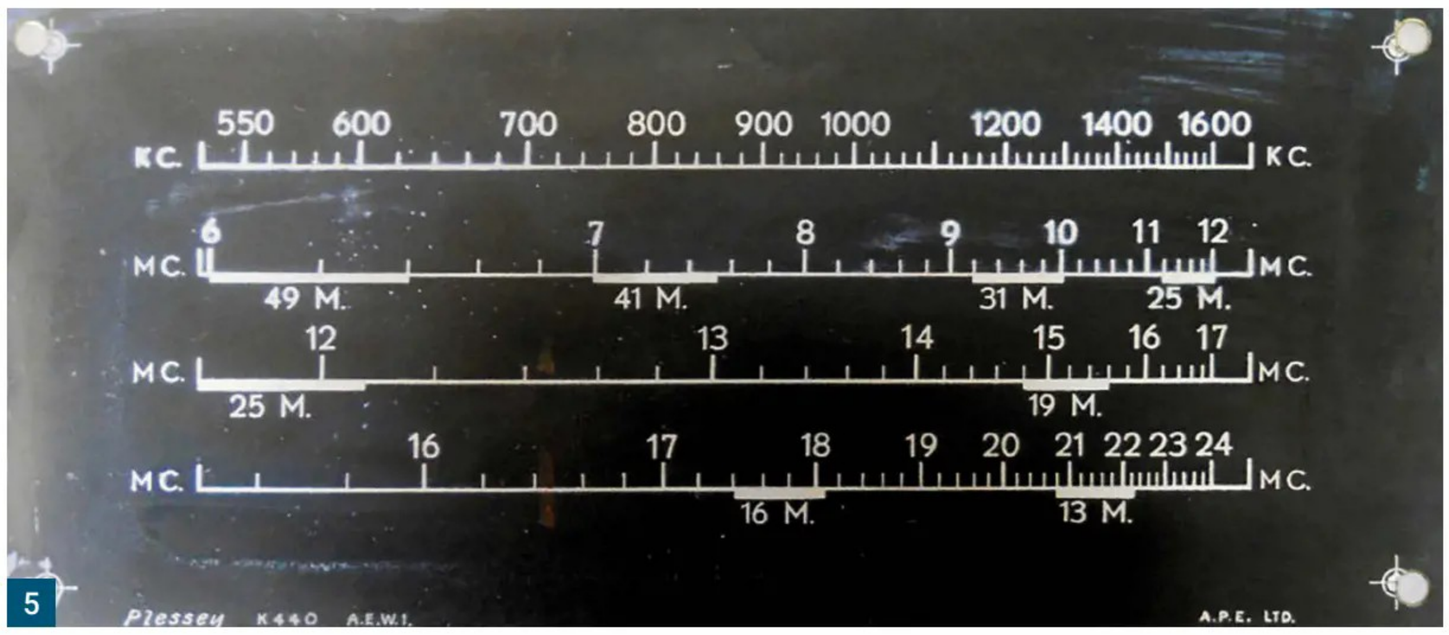

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Acknowledgement

The site used was Ray Robinson's via:
www.tuberadio.com/robinson/museum/AEW1
(Fig. 2 is taken from this site.) **PW**

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Steve Telenius-Lowe G4JVG
teleniuslowe@gmail.com


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Looking ahead

As well as news of recent activity, **Steve Telenius-Lowe G4JVG** looks forward to a busy couple of months ahead, with two major contests and plenty of DXpeditions to chase.

Having recently moved from Bonaire to Exmouth in Devon, I was invited to give a presentation at the Torbay Amateur Radio Society's annual rally, which took place on 25 August. I put together a PowerPoint presentation with photos illustrating amateur radio in Bonaire (PJ4), which was appreciated by a small (but select!) audience of Devon's HF operators, **Fig. 1**. Having lived overseas for nearly 20 years, this was the first UK amateur radio event I had been to for two decades and it was good to catch up with several old friends and make some new ones.

A few days later **Eva** and I spent a week in Kraków, Poland, a grand city with plenty to see and do. We made an excursion to Auschwitz, a sobering experience indeed, where we spotted a memorial to **Father Maximilian Kolbe**, **Fig. 2**, a Polish priest who was a prisoner in Auschwitz. He gave his own life to save a fellow inmate from execution, who survived and eventually passed away at the age of 93 in 1995. What has all this to do with amateur radio? Well, Kolbe was licensed as SP3RN and was active in the late 1930s from near Warsaw. 41 years after his death he was canonised by **Pope John Paul II** for his act of martyrdom, making him almost certainly the only saint who was also a radio amateur. For far more, see:

wikipedia.org/wiki/Maximilian_Kolbe

CQ World Wide

The CQ World Wide DX SSB contest takes place over the last weekend of October, this year on the 26th and 27th, while the CW leg is on 23 – 24 November. Last year was my final full year living in Bonaire and for the SSB event I decided to put in a single-band entry, on 21MHz, because there were two large multi-operator contest stations active that were using all the six HF contest bands. I ended up 3rd in the world and 2nd place in South America (**Fig. 3**), setting a new Bonaire 21MHz record in the process.

Because of the many high-powered stations with excellent antennas active in CQWW it is often easier to work rare DX then than it is outside the contest – so even if you don't think of yourself as a contester, give it a go! And, as we are close to the peak of Solar Cycle 25, propagation conditions should be excellent. Exchange a report ('59' or '599') and CQ Zone (the UK is Zone 14). The full rules are at:

https://cqww.com

The month on the air

The N5J DXpedition from Jarvis Island (see last month's *HF Highlights*) continued until 20 August, making a total of 106,000 QSOs.

From Vanuatu, four Australian operators were active as YJ0VK from 20 to 27 August.

The CY9C St Paul Island DXpedition was active from 25 August for 11 days, making over 113,000 contacts.

KH8T from American Samoa started operations on 4 September and after a week had made 28,000 contacts. They were due to continue until the 16th.

www.kh8t.net

What to look for in November

As usual during the autumn period, there are plenty of operations planned from some interesting locations. Here are just a few of them:

Oliver W6NV plans activity as ZD7W from St Helena in both legs of the CQWW DX contests (see above).

A German group led by **Sigi DL7DF** plans activity as 3DA0DL from eSwatini between 25 October and 9 November. See:

webufr.dl7ufr.selfhost.eu/3da

A mainly Norwegian group (along with **Philipp OE7PGI**, **Fig. 4**) will be active as V55LA from Namibia between 30 October and 11 November, on all HF bands using CW, SSB and digital modes, emphasising CW and SSB.

ardxpeditions.com/dxpeditions/v55la

Antonio I8KHC of the Mediterraneo DX Club has announced that an international team of 14 operators will be active as XT2MD (**Fig. 5**) from Ouagadougou, Burkina Faso, between 31 October and 11 November. Activity will be on all bands with an emphasis on the low bands and WARC bands.

A group mainly from the Slovak Republic plans activity as VK9CV from the Cocos (Keeling) Islands from 1 to 15 November using SSB, CW, FT8 and RTTY in the 1.8 to 28MHz bands. See:

vk9cv.com

The Dateline DX Association has announced a major DXpedition to Sao Tome and Principe between 11 and 20 November. 14 amateurs from USA, Hawaii, Portugal, Italy, Cyprus and Dominican Republic plan to operate as S9Z on SSB, CW and digi modes using amplifiers to beams and high verticals on all HF bands plus VHF / UHF.

www.s9z.org

Xenia ZL4YL will be active, mainly on CW, as ZL7YL from New Zealand's Chatham Islands between 19 and 26 November, including activity in the CQWW DX contest.

EA3NT, EI5GM, EI9FBB, MM0NDX and MM0OKG plan activity from 25 to 29 November as C5T from the mainland of Gambia, and possibly C5I from the Bijol islands, AF-060.

dx-world.net/c5t-c5i-the-gambia

Members of the Pacific Islands DXpedition Group (PIDXG) led by **Gregg W6IZT**, are planning activity from Rotuma (**Fig. 6**) from 15 November to 4 December. PIDXG announced a partnership with YOTA (Youth On The Air) in which two 'NexGenRiBs' on Rotuma will be used remotely by YOTA members to complement the six-man team physically on the island. Gregg said, *"It is our hope that 75% of the remote contacts made from 3D2Z will be made by the youth participants."*

Readers' news

We start this month with a lengthy report from **Reg Williams G0OOF**, who gave a good account of 'the thrill of the chase', tracking down and working

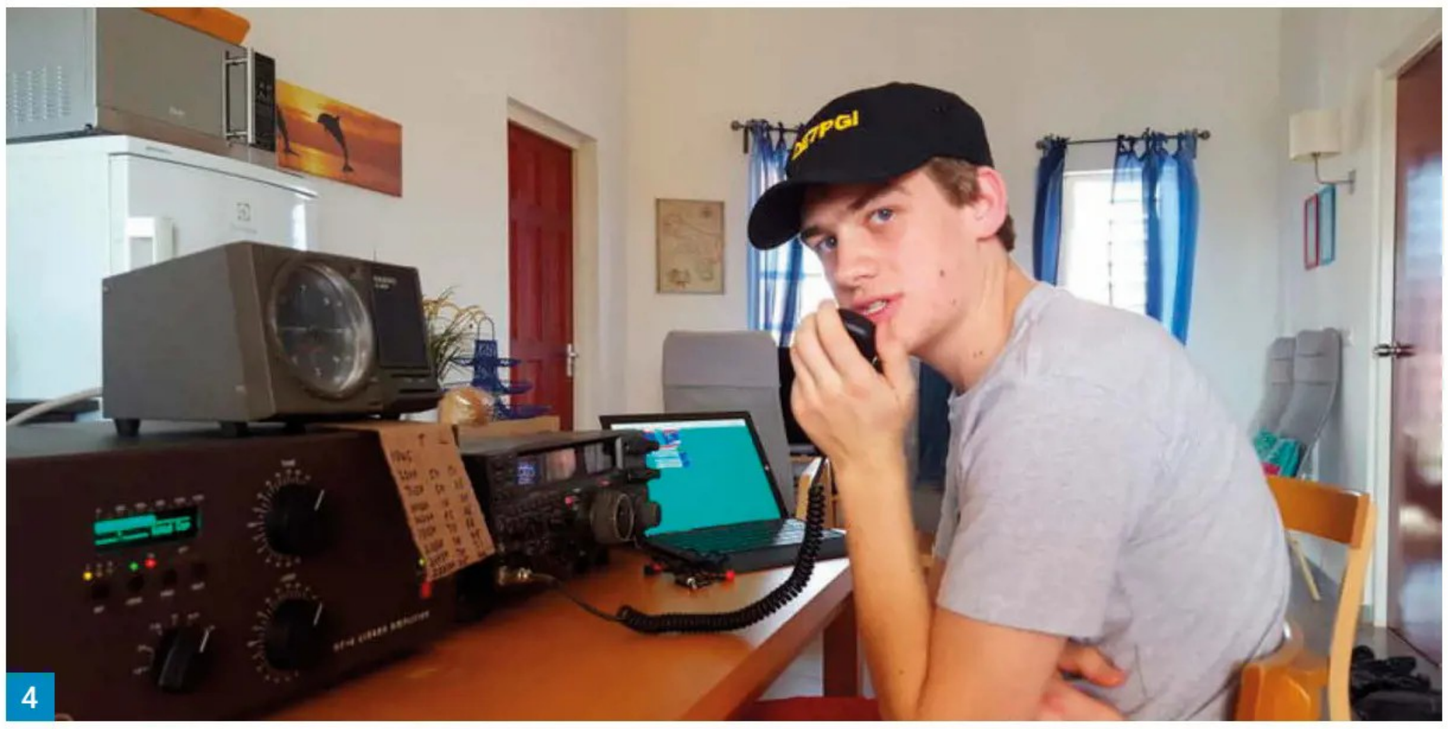

Fig. 1: Steve G4JVG – formerly PJ4DX – giving a presentation at the Torbay ARS rally. Fig. 2: Maximilian Kolbe SP3RN remembered at the Auschwitz museum in Poland. Fig. 3: PJ4DX CQWW DX SSB contest certificate. Fig. 4: Philipp OE7PGI, operating here as PJ4/OE7PGI back in 2015. Fig. 5: Look for the Mediterraneo DX Club operating as XT2MD from Burkina Faso. Fig. 6: A beach on Rotuma Island. Fig. 7: OS8D/P on 19 August. Fig. 8: The 2E0HPI/P station, a battery-operated Xiegu G90 transceiver and Notebook PC for logging and datamodes.

two DXpeditions to rare DXCC entities. Reg wrote: *"It has been an exciting and challenging month with two DXpeditions on the bands. Generally poor propagation and WSJT-X with revised versions of software with the new SuperFox mode provided the challenges.*

"The first DXpedition was N5J (Palmyra and Jarvis), who were using SuperFox. I must admit I struggled with this, trying to set up my TS-870 with Hamlib. Various Hamlib files were tried. One file I received from a friend which worked but the radio response was sluggish in operation. In any case I could not even see the DXpedition's signal on the FT8 waterfall on any of the bands. Propagation was pretty poor and even the well-equipped stations were struggling at times to work the DXpedition.

"Towards the end of the DXpedition the team used normal F/H [FT8 'Fox and Hounds' – ***Ed***] *mode and on their very last day I worked them on 30m at 0630BST. Surprisingly their signal was easily strong enough to work them. Just had to settle for that one contact.*

"The next DXpedition later in the month was CY9C, St Paul Island. Now you would think this one would be easy to work being fairly close to the UK and just the Atlantic between us. Poor propagation played its part. At this early stage the team were using FT8 SuperFox mode but I still did not have this mode working. Eventually later in the operation they changed to working normal F/H mode. What a relief for me, I could now join the challenge. Over a period of days I worked them on six bands on FT8, 7MHz to 28MHz, excluding 21MHz.

"I turned my attention to SSB towards the end of the DXpedition on their last full day on the island. Propagation was good on the 21 and 28MHz bands. 28MHz was particularly strong in the afternoon and early evening. The operators were working split over a very, very wide frequency span because of the number of callers on 28MHz. No luck for me, calling for two hours in the afternoon. Trying again in the evening I started with 21MHz. Good signals but a large split frequency range to cope with. On CDXC's Skype chat a club member indicated a spot frequency where he managed to work CY9C just a few minutes earlier. I tuned to that spot and was successful in working the operator. Back to 28MHz in the evening. The band was beginning to fade but I just managed to work the operator by staying on one spot frequency. A very efficient operation from the team.

"I was also very pleased to work RI1ANE and VK0DS, Antarctic stations, during the month."

Tim Kirby GW4VXE, operating on CW as **GW4MM**, said that he felt conditions made a marked improvement around the beginning of September. *"Suddenly there seemed to be just a bit more DX to work, even in the daytime, which had been quite poor over the summer, even if the mornings and evenings had still been good. The CY9C expedition to St Paul Island was good fun to chase. It was interesting that they gave up SFH ('SuperFox') operating after a few days. I'd successfully decoded and worked them on SFH mode on 17m, but one evening I listened to them on SFH mode on 20m and though their signals were strong, I couldn't decode them (and neither could anyone else) because their clock was just a bit too far out. As it turned out, I worked them on CW on 10, 12, 15, 17 and 30m with standard Fox/Hounds QSOs on 20 and 40m."*

Owen Williams G0PHY wrote that *"This month was much more interesting than last month with two new DXCCs worked in the space of eight days, a rare event nowadays at the G0PHY QTH. Conditions have been variable with the A Index frequently being in double figures. The first new one was D93H from IOTA AS-093 on 14MHz followed by XV9T on 21MHz. I've not heard many stations from South Korea and I think XV9T was the first Vietnamese station I'd heard. He has been very active of late on various bands and with good signals. I thought I'd worked him on 14MHz a few days before the 21MHz contact but the QSO was at 'ESP' levels. During the Lighthouse weekend I worked VO1GRC on 21MHz and TC7TR on 14MHz."*

Carl Mason GW0VSW wrote that *"although I am not too keen on FT4/8, I found it easier to operate these modes when my health was not so good. The purchase of an HF-360 vertical gave me another antenna option and it seems to be working well. It's interesting seeing / hearing the difference in signal strengths when you can swap antennas and surprisingly the indoor loop was hearing better DX than the G5RV or vertical... It was good to work V31MA for my 100th entity using digital modes and to get S01WS with just 5W."*

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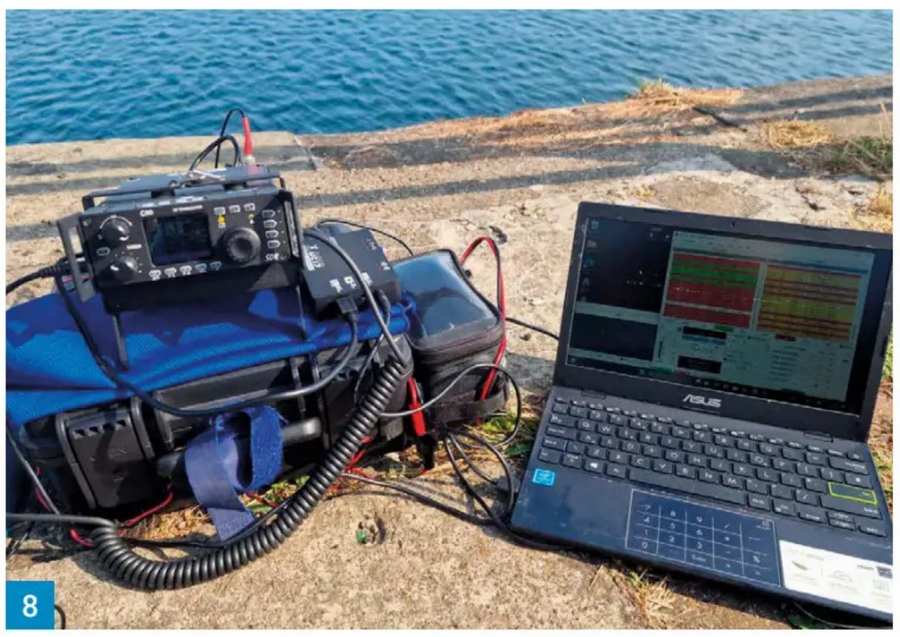

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"As with last month", **Jim Bovill PA3FDR** said, *"there was also generally poor reception this month in the higher frequencies with only one DX QSO in the 10m band. Fortunately, there was quite a lot of activity in the 17m and 15m bands to compensate. I did manage two new DXCC entities, the Maldives (8Q7PR) on 15m and Bangladesh (S21AF) on 17m. The latter finally completes my contacts with all the countries in the Indian sub-continent. Hopefully propagation will improve next month."*

Once again, **Etienne Vrebos OS8D** reckoned he had *"a poor month due to bad conditions. Only 820 QSOs as OS8D/P, with mainly castles of course, and 210 QSOs from home, giving a poor 1000 QSOs this month with the usual Icom IC-7610 and Acom 1500 from home and the Yaesu FT-710 when portable, always on 40m. Some days, when /P, [after driving] hundreds of kilometres to reach my castles and, suddenly, a black-out except from the east and UK: strange not being able to work your local people."* **Fig. 7** shows Etienne's portable location on 19 August. He said that it *"shows me near a mast of the GSM provider: I thought if they think it's a good location, it's OK for me too – and they didn't disturb me at all!"*

Carl Gorse 2E0HPI also admitted that he had *"not that much to report this month, but I did take part in the International Lighthouse and Lightship weekend and worked over 200 QSOs over the two days operating from the Hartlepool Marina, UK-0198 Seaton High Tower Lighthouse. My best QSO was with K8JSM/AM flying a Boeing 757 over the USA to Edinburgh in Scotland at 33,000ft on 20m SSB. I also recorded the QSO on my YouTube channel... It looks like the Sporadic E season is closing and the DX starting to appear again.* Carl was using a Xiegu G90 transceiver (**Fig. 8**) at 20W output to a 20.5m-long EFHW wire.

28MHz beacons

Neil Clarke G0CAS reports on the 28MHz beacons logged during the month. August continued, like the rest of the summer Sporadic E season, well down on the last few years. OY6BEC 28235 was logged on 14 days and was heard with auroral tones on the afternoon of the 4th. Last year IZ8RVA was heard for over 50 consecutive days during the summer but it was only logged on 13 days this month. Often this beacon is the most heard beacon in Europe via Sporadic E but IQ8BB 28260 takes the honour this month, being heard on 17 days. There was better news on the DX front, with long-distance beacons heard more regularly as the month progressed. On the world-wide beacon network frequency of 28200 VK6RBP was not heard until the 23rd but between then and the end of the month it was heard on five days. In South Africa ZS6DN was logged on 18 days. In South America, LU4AA, OA4B and YV5B was heard on 25, 7 and 10 days respectively. From North America 4U1UN was logged on the 27th, 28th and 30th. Away from 28200, HS0ZEA 28260 was logged on 5 days, but I am sure it would be heard more often with a shorter time of five minutes break before identifying itself. It runs 50W into a 3-element beam looking towards Europe.

Band highlights

Key: Q = <20W, M = 20 – 100W, H = >100W, S = Single-element antenna, B = Beam.

Reg Williams G0OOF (MS): 7MHz FT8: CD6SMT, CY9C, RK9UN. **10MHz FT8:** CY9C, N5J, VK4AFU. **14MHz FT8:** CE4FOQ, CX3VB, CY9C, JA7BXS. **18MHz SSB:** FP/DC8TM. **18MHz FT8:** A61QQ, CY9C, FP/DC8TM, VK7EA. **21MHz SSB:** CY9C. **24MHZ FT8:** CY9C, HC3RJ, KP2BH, LU1QAH, XE1GLL. **28MHz SSB:** CY9C. **28MHz FT8:** A41ZZ, CX1AA, CY9C, VK0DS.

Tim GW4VXE (MS): 18MHz FT8: A61BG, CY9C, RU0LL, VK1AX, VK3ACE. **21MHz FT8:** VK2FAB, VK3AUX, VK5COL, VK7ZBX, XE2JS. *And, operating as* **GW4MM (MS): 10MHz CW:** VK2BJ. **14MHz CW:** CX5FK, VK5GG. **18MHz CW:** R0AA. **21MHz CW:** CE2ML, CY9C, CX5FK, TI5/VA3RA, TO8FP. **28MHz CW:** CE2SV, CY9C, VK6NU, ZF1C, ZF2VE.

Owen Williams G0PHY (HS): 7MHz SSB: K0JGW. **14MHz SSB:** A41CK, D93H, YB5DDE. **21MHz SSB:** CN8YZ, VE6CQ, XV9T.

Carl GW0VSW (QS): 3.5MHz FT8: LB6FG. **7MHz SSB:** TM37JO. **7MHz FT8:** CO8LY. **10MHz CW:** EJ7NET. **10MHz FT8:** J88IH, KP2B, NP3DM, PZ5RA. **14MHz SSB:** SA7LKO. **14MHz CW:** DM50LOW. **14MHz FT8:** VK2BYF. **14MHz FT4:** J88IH, KP2B, V31MA. **21MHz SSB:** S01WS. **21MHz FT4:** PY7VI. **24MHz SSB:** EA8NF. **24MHz FT8:** 9K2MO, RM8W. **24MHz FT4:** A61DD. **28MHz SSB:** 9H4CM. **28MHz FT8:** KP4AH, PP5HR. **28MHz FT4:** PY2QT.

Jim PA3FDR (MS): 10MHz FT8: KP2B. **14MHz FT4:** JA9BFN. **14MHz FT8:** BG4UCZ, JF4VZT, UN2NC. **18MHz FT8:** 9K2YD, BD4UJ, BG8TFN, BV1EK, DS4AKP, JA6RCH, JA8DIV, JF3VAX, K0TC, PZ5RA, RA0ADQ, S21AF, VA7RY, XW4KV, YB3RPS. **21MHz FT4:** 4L4DX, JA1HOX, JG8LOL, KP4NZ, PY7VI, VP8LP. **21MHz FT8:** 8Q7PR, BA7LUI, BV400, JA9RRH, K0IEA, PY2ZZ, RA0FLP, VA2QA. **24MHz FT8:** A61BG, CO8LY, HS5NMF, JA4NIJ, PU1TFT. **28MHz FT8:** 7Z1IS.

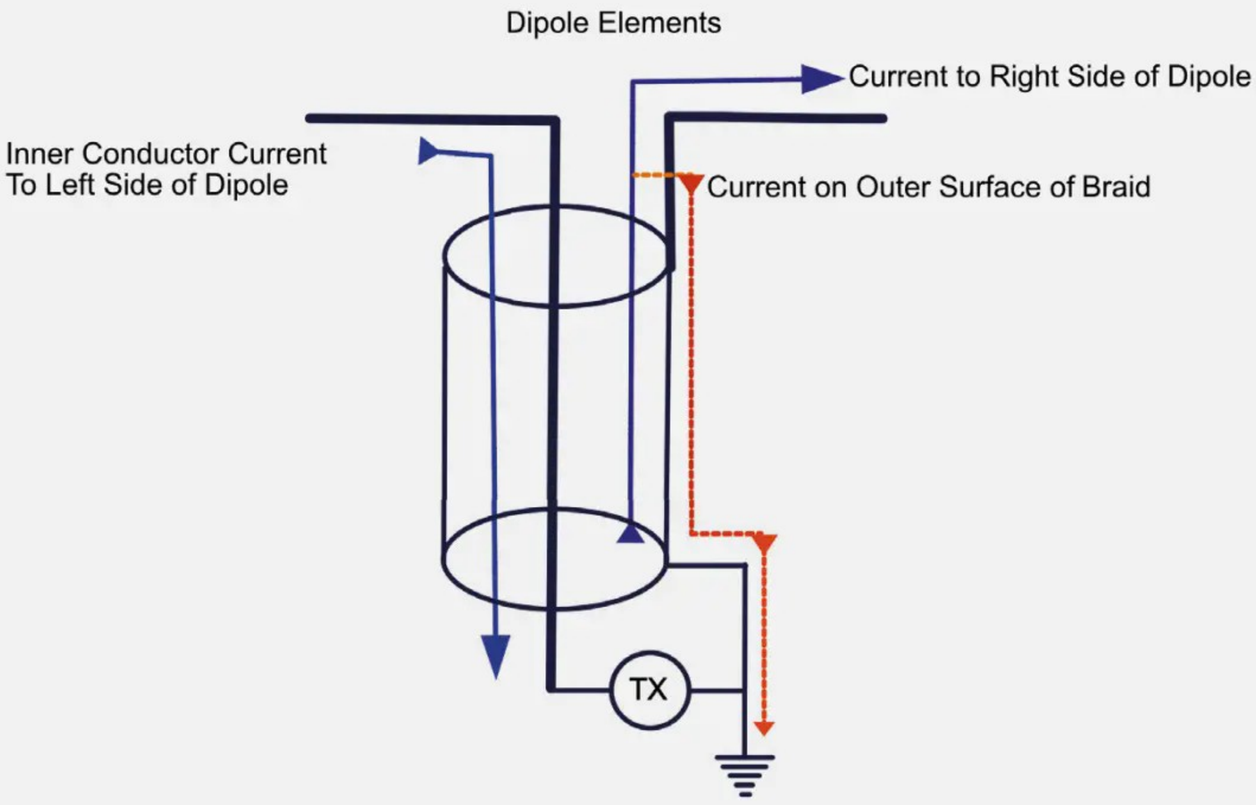
Etienne Vrebos OS8D (HB): 14MHz SSB: RI0KA. **18MHz SSB:** XV9T. **21MHz SSB:** 8H79I, 8I79A, BI8FRF, D93H, EK/AB1F, S79VU, VK3AWA/P, YC0IRH. **24MHz SSB:** CY9C. **28MHz SSB:** EK6OLS.

Carl 2E0HPI/P (QS): 14MHz SSB: K8JSM/AM. **21MHz SSB:** 4X5HL. **21MHz FT4:** RU0LL, W6M.

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 2025 issue the deadline is 11 November. Photos of your station, antennas or you in the shack are always welcome. 73, Steve G4JVG. **PW**

Keith Rawlings G4MIU
keith.g4miu@gmail.com



1

A Common Problem

This month **Keith Rawlings G4MIU** catches up on reader feedback, both of which have a 'common' (there is a pun there somewhere) theme.

Firstly, in a follow up message from last month about the presentation given to his radio club **Paul M1CNK** wrote: *"We did a similar presentation a few years earlier on where we investigated the performance of an active RX loop. I did a comparison between the loop and my OCFD. Although the levels were lower, the improvement in SNR (on the loop) was very noticeable since I get a lot of VSDL in my garden (there are four phone lines crossing it).*

"This ended up turning into a club project to make an active loop kit - we made a run of about 20 kits and a lot of them were installed. I still use the club loop as my main RX antenna for most of the bands below 21MHz.

"I haven't used MultiPSK (with regard to antenna testing) but will be interested to learn more. The main advantage with WSPR net is that there is a vast array of both TX and RX stations out there and the reports end up on a number of websites allowing for easy comparisons. The use of FT8 would be another option with more stations on air but I suspect it might be more problematic when using two TXs due to band occupancy- it could certainly work for RX comparisons though.

"If anyone wants to contact me directly, my email is on QRZ.com".

The loop used for the club project was the very popular and well regarded LZ1AQ Active Receiver Loop Amplifier and more details may be found here:

www.lz1aq.signacor.com

Readers of last moths *PW* will remember that Paul stopped using his OCFD due to common mode currents on the feeder, which became unacceptable after he increased his transmit power to 100W. I too had problems with the K1POO and the Vine OCFD's, both needing a common mode choke on the feedline. The K1POO required one at the feedpoint and the Vine was used successfully after one had been placed at the shack end of the feeder.

Common mode currents can be a nuisance as they can be a cause of TVI and audio system breakthrough. These 'gremlins' can cause RF to get back into the shack where they can cause havoc, such as breakthrough on PC speakers, even when switched off, and breakthrough on extension speakers connected to the radio being used. I have had a flickering fluorescent tube which was switched off. A rally-sourced 12V PSU module that was obviously once part of some rack-mounted equipment or other locking itself into current limit. Switching off and on again was the only way to 're-set' it. Incidentally, this only happened on 40m when using a G5RV fed by a run of coax connected to the 300Ω ribbon feeder. I found a cure for this thanks to my father complaining about the coax lying on the ground in the garden. I coiled the surplus up into a loop, keeping it out of the way, and unwittingly found out about a 'coaxial choke balun' although at the time I didn't have a clue that I had! Only eventually did I notice that the PSU was now behaving when I was using 40m!

Other signs of common mode problems I have noticed are the VSWR varying when touching the controls on a KW107 matching unit and I have also had the odd RF burn as well, but only when using older equipment such as my KW2000E and aforementioned KW107.

Common mode currents can also be the cause of interference pick up on antenna feeders, usually on coax when there is an imbalance, but this can also happen on open wire line if it too is imbalanced in some way. And, not forgetting that current flowing on the outside of a coaxial cable can distort the radiation pattern of an antenna. Which is most undesirable in the case of a Yagi.

W8JI has written a thorough description of the subject of common mode currents here:

https://tinyurl.com/mrjtewxv

In part he explains: *"Common mode currents effectively bring the radiating part of the antenna system down along the feed line or the antenna's metallic supporting structure. Common mode currents can extend all the way to the desk and station equipment, and even out through power line connections. Problems flow both ways."*

The diagram in **Fig. 1** demonstrates the path of RF currents on a coaxial cable when fed directly to a dipole. To overcome these problems a BALUN at the feedpoint may be used but be aware that if the feedline does not come directly away from the dipole, it is possible that current may still be found on the feeder as shown in **Fig. 2**.

Steve G3TXQ (SK) also has a lot of useful information on CMC and chokes here:

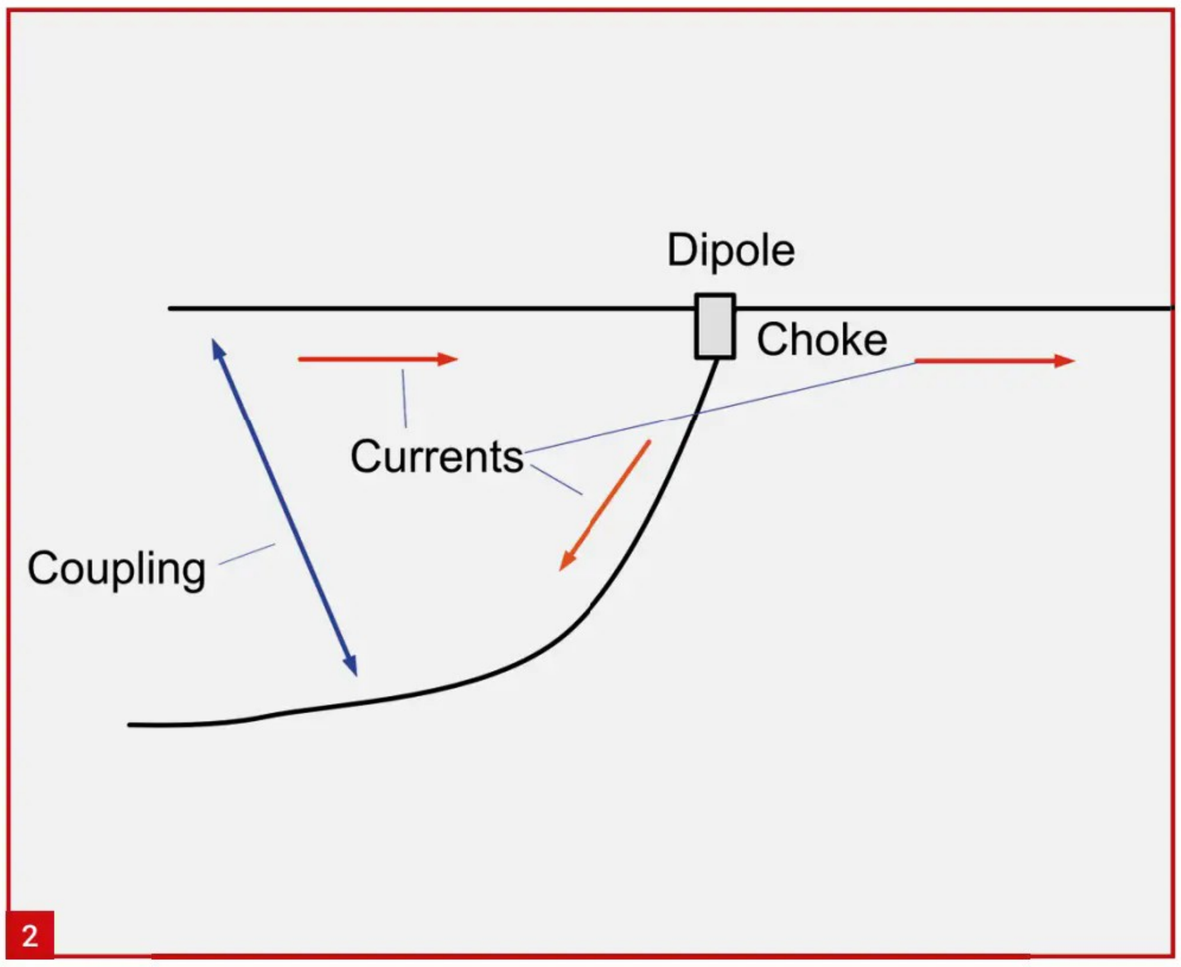
www.karinya.net/g3txq/chokes

So, common mode currents on an antenna system are a clearly a bad thing. Or are they?

End Fed Dipole, Coaxial Dipole, Resonant Feed-line Dipole, CFR Antenna or could it be a Flower Pot?

Well, **Bill Sykes G2HCG**, founder of J-Beam Antennas, didn't think so; he found they could be quite useful and presented his ideas on a Controlled Feeder Radiation antenna firstly in the May 1990 issue of *RadCom* and then later in the summer 1992 edition of *Communications Quarterly*, **Fig. 3**.

The story goes that while living in France he used the 40m band to keep in touch with friends back in the UK. The problem was that the way he had his dipole orientated meant that the UK was



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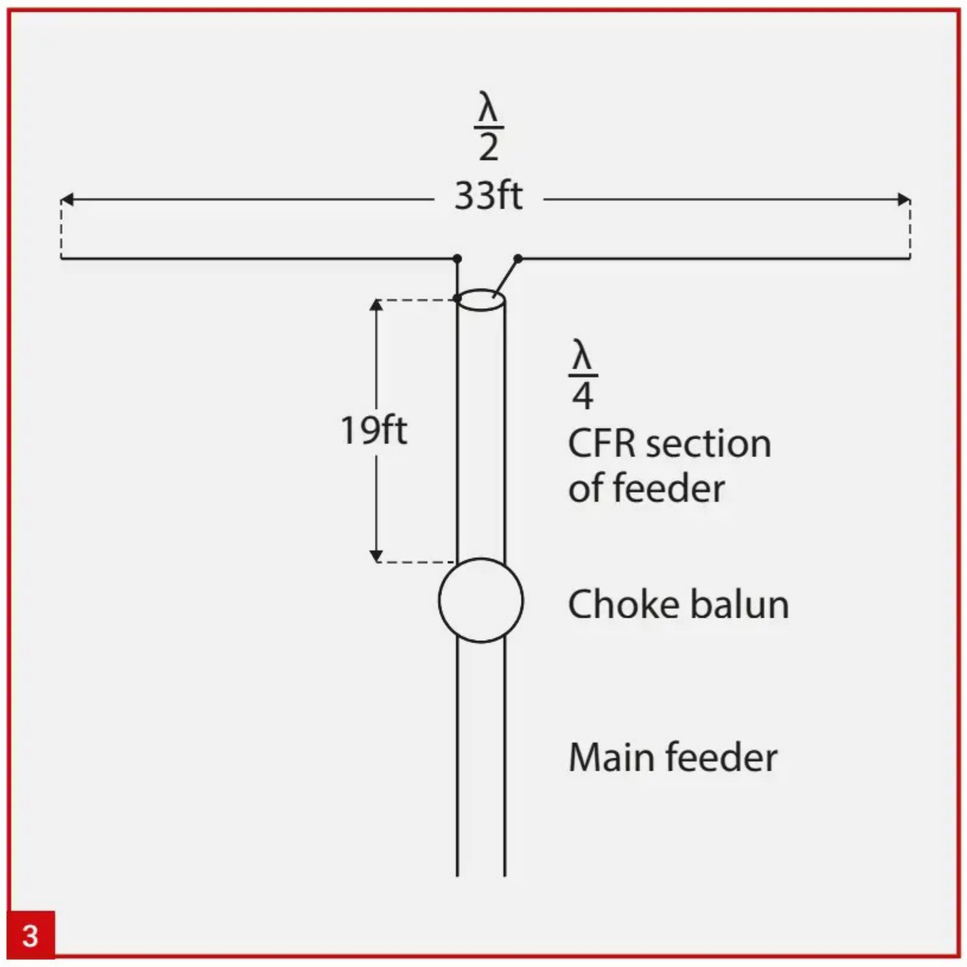

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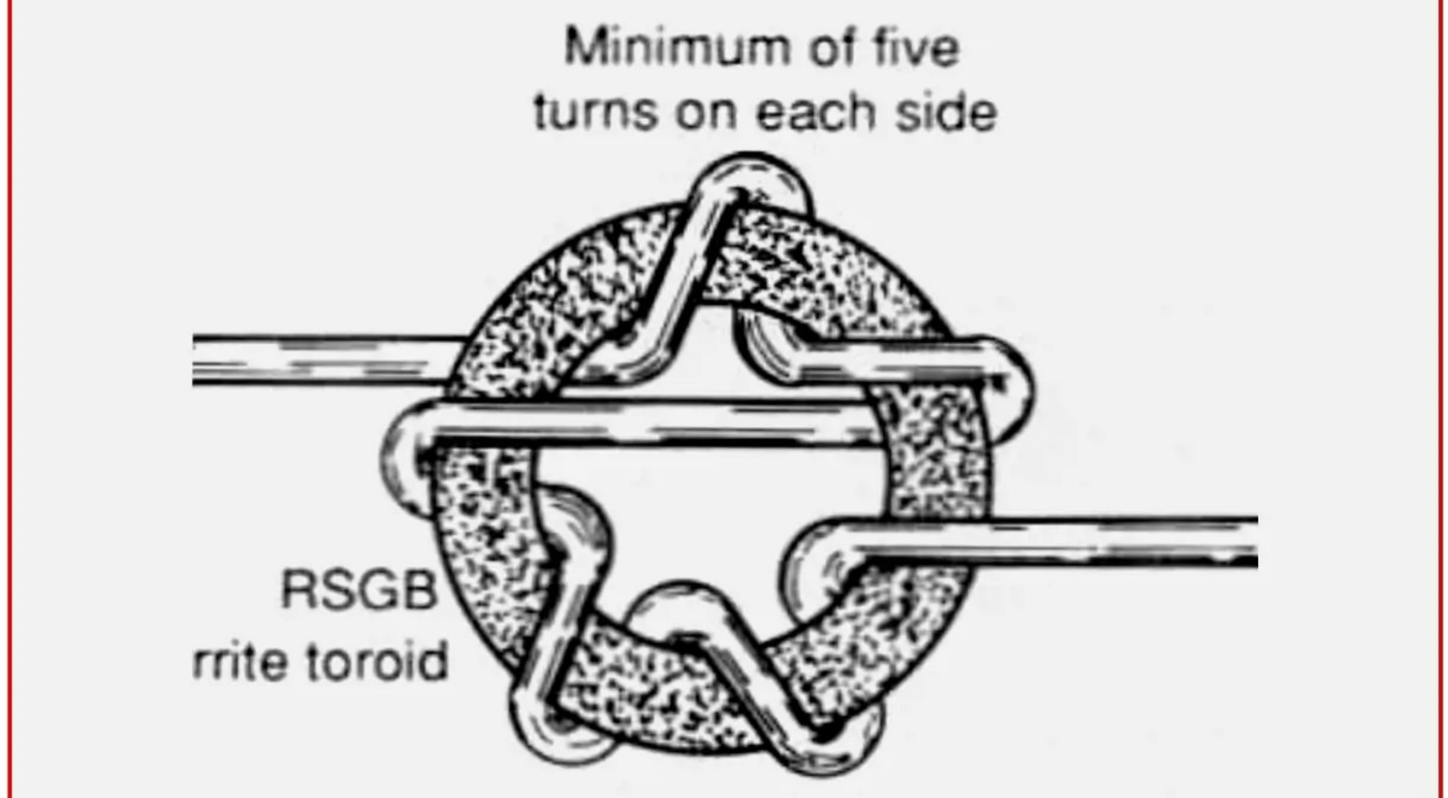

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Fig 1 Diagram of how CMC currents can flow on a coaxial line. Fig 2 Diagram of how a coaxial line may become imbalanced despite the use of a feedpoint choke. Fig 3 G2HCG Controlled Feeder Radiation dipole, original dimensions for 20m. Fig 4 Suggested method of choke construction. Fig 5 G2HCG 'Isotropic' antenna. Fig 6 The isotropic turned into a Flower Pot. Fig 7 AN-SOF RF Calculator page screen grab.

off the end in the direction of minimal radiation. Not wanting to move the antenna he came up with a plan. Knowing that a feed line will radiate if it is imbalanced he deliberately fed his dipole directly with coaxial cable, in this case, URM76. However, the twist to this is that he turned part of the feeder into a λ/4 radiating section by placing a choke λ/4 (actually he calculated λ.275) from the feedpoint. This isolated the current from the rest of the system while happily leaving the rest to radiate with both a horizontal and now vertical and therefore omnidirectional direction.

This choke was formed by winding around ten turns of the URM67 through an 'RSGB' ferrite ring, **Fig. 4**.

To prove this antenna configuration worked he went back to operating the dipole in a conventional manner for a few days where it was noted that his signals had now dropped back to the previous levels.

He called this technique Controlled Feeder Radiation or CFR and his thoughts on the matter did not end there as he suggested that a multiband version could be made with similar sections of λ/4 feeder but using traps in the main element and he also put forward some CFR 'Specials'

These specials consisted of an 'Isotropic', two types of Half Square and a Bobtail.

The first design, the Isotropic, is of interest as it is a λ/4 End Fed element, which when combined with the CFR section forms a right-angled dipole which has horizontal and vertical polarisation (or a mixture of both), **Fig. 5**.

It is acknowledged that if the antenna is 'straightened' out, it becomes a low impedance End Fed Dipole, **Fig. 6**.

It may not be lost on readers that this End Fed CFR dipole is now looking like another antenna which presently seems to be quite popular, mainly on the VHF and UHF bands.

Enter the flower pot

This brings me back to the second part of reader feedback, which also involves common mode currents radiating from an antenna, but like the CFR, in a way that is wanted. I received a message earlier in the year from ex-*RadioUser* reader now 'occasional' *PW* reader **Peter Jay** from Felixstowe.

Peter originally contacted me back in June 2020 asking about an antenna airband enthusiasts had been talking about called a Flower Pot Antenna. He asked if it would be a better antenna for airband than his discone and would I be describing one in my *RU Aerials Now!* column. At the time I replied that I would try and fit something in when I got space but in the meantime Peter and I went through a number of email exchanges about the process of building a Flower Pot for civil air band use. I also promised that when I did include this antenna as a subject in the column I would include a military airband version too. Unfortunately, I never got round to undertaking this!

So, come this May I got the email from Peter reminding me that I had been remiss by not keeping my word in *RadioUser* and asking if I

had written anything in *PW* about the Flower Pot?

Well, the answer is no but I'm sure that the subject was been covered although not probably ones to cover airband.

As *PW* now incorporates *RU* I guess there is room to move away from amateur radio for a moment and cover an antenna that may be of interest to airband listeners, bearing in mind that the techniques described will carry over to those designing a Flower Pot for any frequency.

The Flower Pot Peter built back in 2020 is still hanging in his attic and working well. He has since built another for Military airband use, which he claims to work well too, although I was sceptical due to the very wide bandwidth of this band, being some 150MHz wide.

So, what is a flower pot antenna?

The flower pot is a λ/2 dipole fed at the end, basically the same as G2HCG's idea in Fig. 6.

Most of the Flower Pots for the VHF and UHF bands I have seen seem to be closely based on the VK2ZOI construction method. Here the coaxial cable is housed within a length of 25mm PVC waste pipe, but at the end of the radiating section of coax it leaves the inner of the tube and is then wound around the outer of the tube for nine turns to form a choke before it is then fed back inside the tube. So, the Flower Pot, on V/UHF at least, does not use a ferrite ring as G2HCG's CFR does.

I believe the Flower Plot name is attributed to VK2ZOI after a presentation in 1993 where the antenna was disguised with a plant in a flower pot!

https://tinyurl.com/36ay8b4j

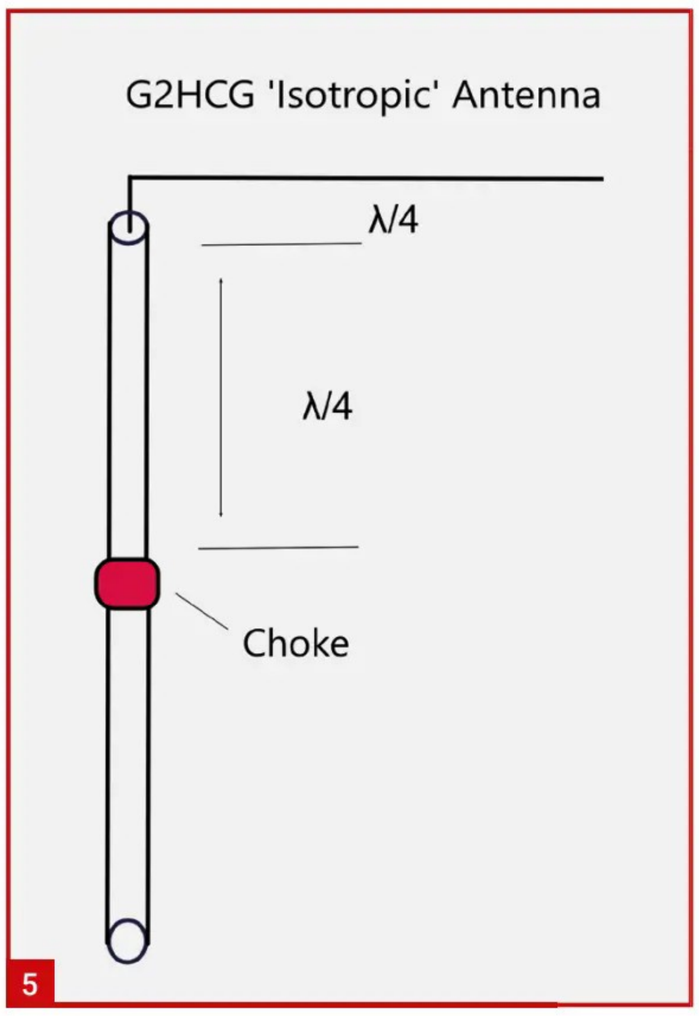
However, as we have seen, G2HCG had similar ideas before this and so did others.

An antenna very similar to the Flower Pot with a coiled coaxial cable choke was presented for a US patent in 1944 and another, more in the format used by G2HCG, had a λ/2 vertical radiator with the feeder wound through a toroidal core and was presented for a US patent in 1965.

More recently **Mike Parkin G0JMI** has described a 20m band CFR dipole in the February 2019 *RadCom* with a follow up 6m version the next month. Mike went into detail on how to design the dipole and also how to calculate the choke needed.

It was Mike's design method that was used in Peter's first antenna but we did not enclose it in a PVC tube in the way of VK2ZOI as it was to be attic mounted.

Since then I have found an online Flower Pot calculator, which not only calculates the length of the 'dipole' but also the length of coaxial cable needed to form the choke which is not reliant on the diameter of the tube.



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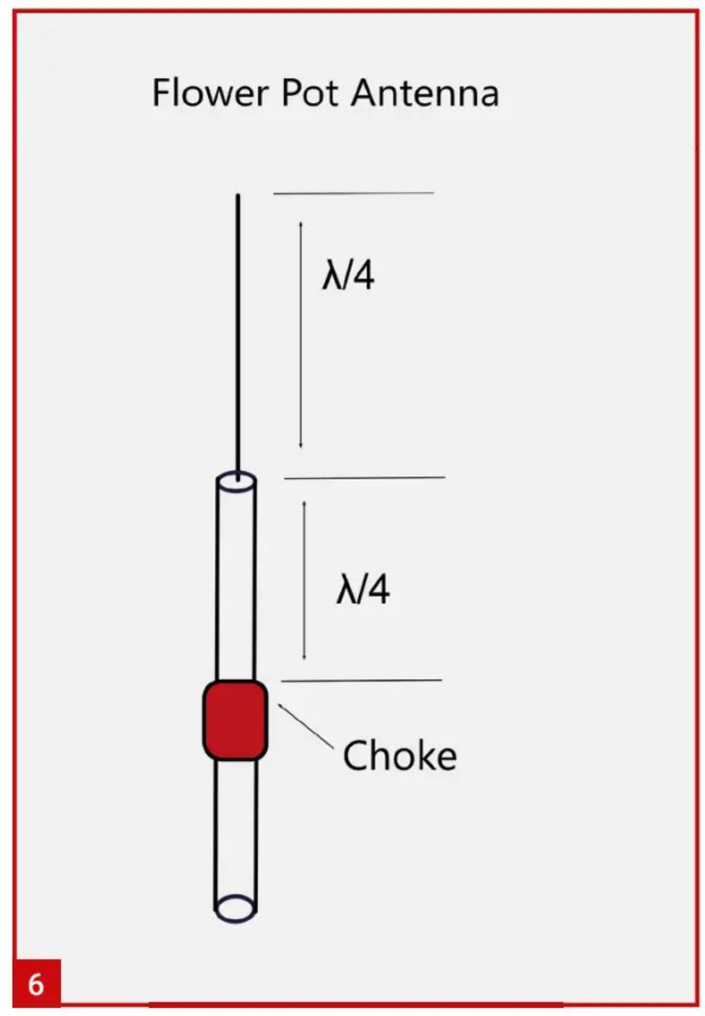

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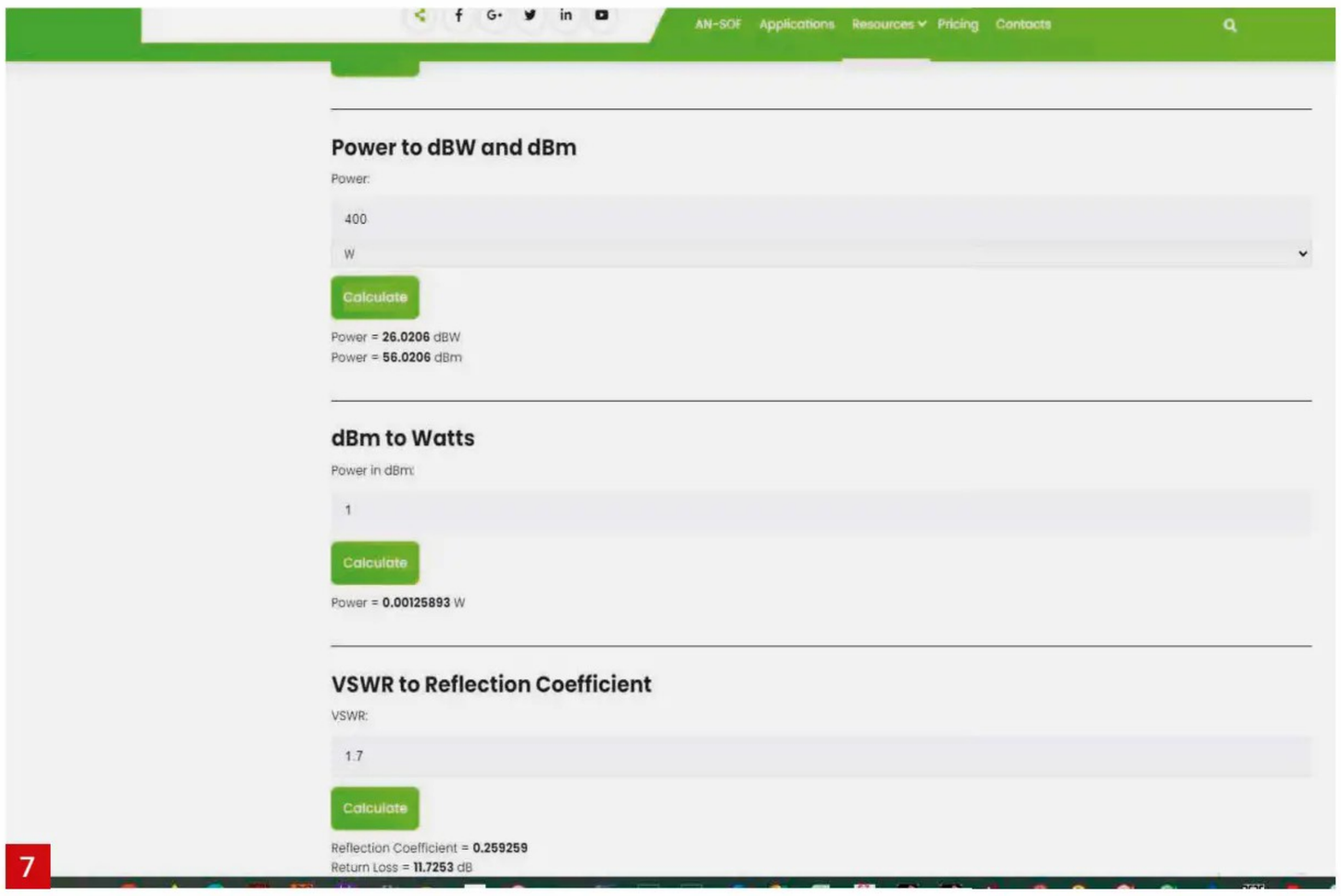

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https://tinyurl.com/yz9r2czr

More on the Flower Pot next month!

New online RF calculators

AN-SOF have recently added a series of online RF calculators to their website. These free to use 'apps' are intended to work alongside the AN-SOF simulator but they can be used standalone by anyone.

Tony from AN-SOF writes: *"I often find myself using tools I've programmed over time in C++ to convert electrical parameters and perform various propagation calculations. To make these tools more accessible, I've converted them to JavaScript and added them to a new page on our website, RF Calculators, which is under the Knowledge Base section. These online calculators assist with conversions such as frequency to wavelength, Watts to dBm, VSWR to reflection coefficient, etc. and offer easy calculations for antenna power density, near-far field boundary, line of sight, radio horizon, and more.*

"The calculators are organized into two categories: Conversion Calculators and Antenna Propagation Calculators. Just fill in the fields, hit Calculate, and you'll get your results instantly.

"I hope users will find these tools useful as a complement to AN-SOF. If you use or need any specific formulas that aren't included, feel free to reach out—I'd be happy to hear your suggestions."

Fig. 7 is a screen grab of just three of the calculators: Power to dBw and dBm, dBm to Watts and VSWR to Reflection Coefficient.

https://tinyurl.com/3xv3y42c

See you all next month. **PW**

BBC coronations Pt XIX

Keith Hamer and **Garry Smith** continue the special series looking back at the BBC's coverage of Coronations since 1937, focusing on the important role of sound broadcasting. There is also a vintage Coronation advertisement from the archives for television cabinets. There are more unique details about Roland Pièce, the pioneer of Swiss radio broadcasts, from family archives supplied by his Grand-Nephew, and PW reader, Pierre-Yves Pièce. The series charting the rise and fall of BBC 198kHz transmissions focuses on the two long-wave stations in Scotland. Coverage detailing 60 years of BBC-2 looks at how the new service was distributed. We also continue our series about the development of Swiss Radio and Television since 1922, with the closure of short-wave radio and the start of digital television.

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

Without doubt, the Coronation Day broadcasts on 2 June 1953 were a complete triumph for the BBC. All those who watched, or listened to, the various historic programmes were amazed at the excellent way in which this great occasion had been covered. In particular, it was a triumph for the special techniques required for the complicated Outside Broadcasts. It was the best demonstration of radio's power to convey all the excitement and actuality of a great event at the very moment of it happening. The immediate reaction of most people was the artistic presentation of the programmes. However, those who were in any way associated with radio techniques probably thought more about the huge complexity of the technical arrangements that made it all possible.

Although television was undoubtedly the star performer on this occasion, it could be argued that sound broadcasting had, in reality, a much larger role to play. The programme heard by listeners in the United Kingdom was only one of many that were broadcast to all parts of the world. Altogether, facilities had to be provided for some 90 commentators along the route of the procession and in Westminster Abbey. In addition, there were all the microphones used for sound effects, of which some 40 were installed in Westminster Abbey alone.

Not only were there all the BBC's home and overseas transmitters to be served, but also a number of foreign broadcasting organisations. At the same time, arrangements had to be made for supplying several newsreel film companies, the television sound control room, the audio reinforcement system in the Abbey, and public address loudspeakers along the processional route.

Engineers at the *General Post Office* worked hard to provide and maintain all the lines necessary for this complicated link-up, and a share of the credit duly went to them for the vital part they played in the whole operation.

Vintage coronation television equipment

This month's wander through vintage copies of tattered newspapers and magazines has elicited part of an advertisement by *Electronic Precision Equipment Limited* for their television cabinets, **Fig. 1**. The advertisement dates from June 1953.

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 Coronation Console*, *The Regina* and *The Ensemble* television cabinets, plus the inclusive *Parcel Of Metalwork*.

The advertisement was placed in June 1953 by *Electronic Precision Equipment Limited*, based at 42-46 Windmill Hill, Ruislip, Middlesex and 152-153 Fleet Street, London E.C.4.

Roland Pièce archives: Part XIII

The following information has been sent from Bex in Switzerland by **Pierre-Yves Pièce,** Grand-Nephew **of Roland Pièce**, the pioneer of radio broadcasts in Switzerland.

Roland was entrusted with the management of the future national transmitter in Sottens. He left his home city of Lausanne and moved to Prangins on the shore of Lac Léman where he learned how to operate the new high-power transmitter.

Roland then married **Germaine Antenen** and the newlyweds settled in Sottens, at the foot of the transmitter. At a New Year family gathering in 1960, Roland's brother, **Georges Pièce**, photographed Germaine and Roland in Bex, together with a very young Pierre-Yves Pièce, **Fig. 2**. On 21 May 1933, Roland wrote to his cousin, **Fontannaz**: *"We are right in the countryside. At this time of year the weather is very nice, but the winter is very long and sad."*

Today, there is virtually no reminder of Roland Pièce's existence in his home village, although the authorities granted him the title of *Honorary Bourgeoisie of the Commune of Bex* shortly before his death on 7 October 1972, in Sottens, almost exactly 50 years after the first Champ-de-l'Air broadcast.

1

TV. CABINETS
THE CORONATION CONSOLE

This very handsome cabinet will put your TV. into the £200 class.

The Tube cut-out is for the standard 15in. Tube, but can be easily modified for other sizes.

The storage space at the top if desired can be used for an auto-changer or tape recorder, and the sloping panel can be used as a control panel or for a pre-set radio.

The cabinet is 47in. wide 31in. deep, to the corner, and 50in. high. it is already polished and supplied flat for you to screw together ; price is £18, plus 10 - carriage and insurance, or you can buy it on Hire Purchase if you wish, the deposit is £6, then 12 monthly payments of 25 -.

THE REGINA

TV. Console Cabinet, undrilled, but cut for 12in. tube, with adjustable platform. This cabinet looks really superior and is ideal for all popular sets— Viewmaster, Tele-King, etc. Price £7 17 6. Carriage 10 - extra.

THE ENSEMBLE

A 12-in. Table Model complete with armour-plate glass and surround as illustrated £3 17 6, plus 7/6 carriage and insurance.

PARCEL OF METAL WORK, for Table Model : Punched and prepared metal chassis, punched out-rigger, valve plate, spacers, Tube clamping ring, tube rear support, brackets, etc., etc. Price 25 -, plus 2/6 post. Included free with this parcel is circuit diagram of 5-Channel 12in. TV to use with this chassis.

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His grave, which can still be seen in the Bex cemetery, is in danger of disappearing in the near future, with total indifference on the part of the current authorities.

The rise and fall of 198kHz: Part XII

In addition to the well-known BBC long-wave transmitter at Droitwich, two other stations were opened in the Thirties at Westerglen and Burghead in Scotland. The transmitters will remain in service until the BBC eventually decides when long-wave broadcasts are to be finally switched off.

The medium-wave and long-wave *BBC Regional Station* at Westerglen opened on 2 May 1932, **Fig. 3**. The transmitter, located a few miles south-west of Falkirk, served the population of central Scotland. It was originally the site of the BBC's third 'twin-wave' system which, for the first time, allowed two wireless services to be radiated in Scotland simultaneously and over a much larger area than before. It currently transmits *BBC Radio Scotland* (810kHz), *BBC Radio 5 live* (909kHz), *Absolute Radio* (1215kHz) and *talkSPORT* (1089kHz) on medium-wave, as well as being one of only three stations in the UK to broadcast *BBC Radio 4* on long-wave (198kHz).

Following an international agreement drawn up between broadcasters in the late 1920's, the BBC were given a total of ten wavelengths. In an effort to extend wireless services to new areas and provide listeners with a choice of programmes, it was decided to establish five 'twin-wave' stations at strategic locations throughout the country.

60 years of BBC-2: Part VIII

The distribution of BBC-2 to the transmitters (initially only to Crystal Palace in 1964, but later to hundreds of new outlets throughout the country) called for a duplicate network of vision and sound circuits to be provided by the *General Post Office*. The vision circuits, mostly achieved by radio links with the 'new' *Post Office Tower* playing a part, were constructed to the much more stringent wideband requirements necessary for the 625-line standard and, eventually, colour.

In April 1964, the Vision frequency of the BBC-2 Crystal Palace transmitter was 567.25MHz. The Sound frequency was 573.25MHz. The first four 'fill-in' stations were planned to be brought into service during the summer of 1965 with a further 17 transmitters to be opened a little later.

Over some routes (for example, between Folkestone and London in respect of Eurovision), the BBC temporarily installed their own point-to-point links because sufficient GPO circuits were not available for the start of BBC-2.

2

Fig. 1: An advertisement by *Electronic Precision Equipment Limited* in June 1953 for their Coronation television cabinets. Fig. 2: Roland Pièce and wife, Germaine, in 1960 with a very young Pierre-Yves Pièce. Fig. 3: The *BBC Scottish Regional Station* at Westerglen opened on 2 May 1932.

Service information, Switzerland: Part XXI

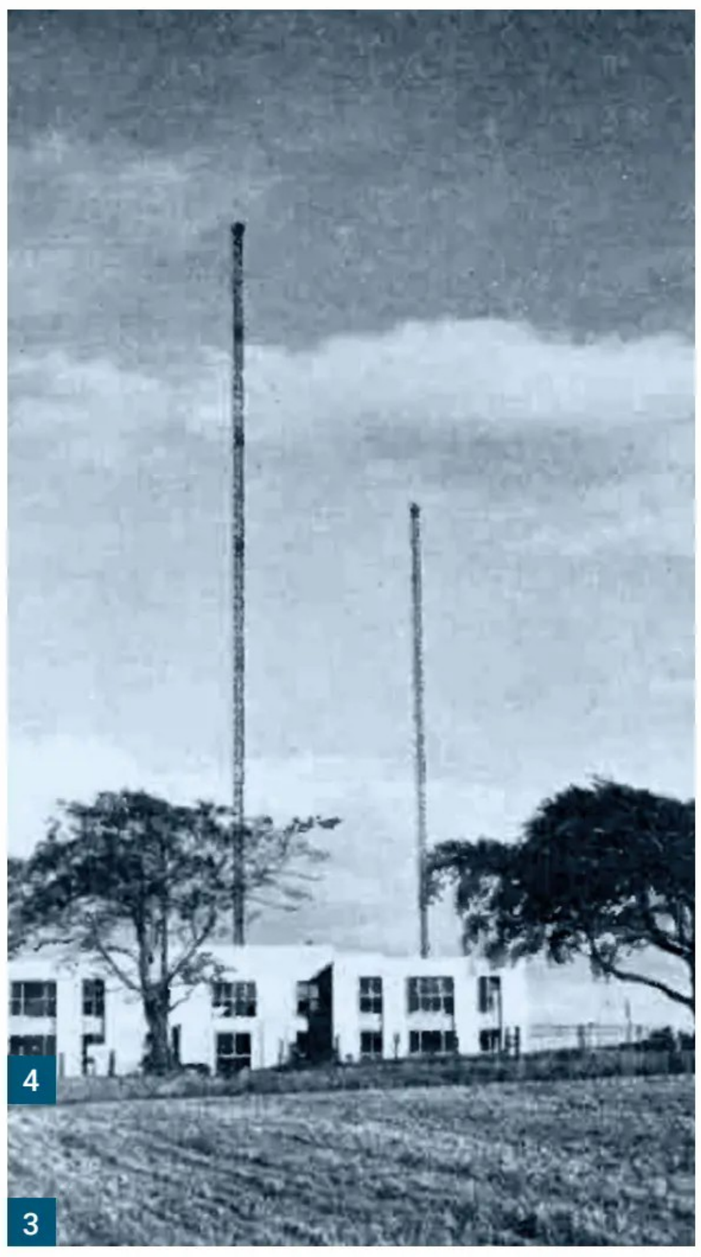
In 1999, working in collaboration with *Presse TV* in the district around Zürich, *SF DRS* produced the first test transmissions for a new channel showing repeats of SF's news and factual programmes.

In 2001, *Swiss Radio International* transformed itself into a multi-media company and continued to expand their online platform at *www.swissinfo.org*. At the same time, they began closing down their short-wave service. In the same year, Swiss Radio International was officially renamed *Swissinfo*.

In 2003, *SRG-SSR idée suisse* began digital terrestrial TV broadcasts (*Digital Video Broadcasting*, DVB-T). The new system made its début in the Engadin and the Ticino.

Stay tuned!

The first and third photos this month are from Keith and Garry's archive collection. The second is courtesy Georges Pièce, Bex, Switzerland. Please send archive photographs, information or suggestions for future topics via the email addresses shown at the top of this column. **PW**



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Martin Evans GW4TPG
practicalwireless@warnersgroup.co.uk

Refurbishing an SB200 Amplifier

Martin Evans GW4TPG describes the challenge of refurbishing a classic Heathkit amplifier to make it suitable for use in a modern shack.

I have had my Heath SB200 a very long time. I got it through a friend in work who had bought it and did not really have need of a linear amplifier. Many years ago I went to a local rally and spotted a SB200 for sale, I wanted the amplifier but I had a fit of the shall I or shall I nots all day and did not buy it in the end. I have always wondered if my SB200 is the one that was left for sale that day when I decided to keep my wallet in my jacket. My main amplifier is an Ameritron when QRO is needed, so the SB200 does not get used much but it's still handy to have as spare amplifier. Despite being an 'old timer' amp from the 70s it can still get me through the pileups when the going gets tough!

Using an HF bands linear amplifier helps no end when trying to crack a large pileup, contesting on a busy band or trying to bag a QSO with a DXpedition when conditions might be tough. Trying to bag a new DXCC entity when signals are weak and fading, propagation when weak sometimes results in not being able to hear the pileup and just have to 'guestimate' where to call. Having a linear and a bit of power behind you helps, a pileup can be cracked in minutes instead of hours or even days. A linear is of no use when taking part in a local net and a linear is definitely not needed when having a QSO when there is no pileup present, propagation is good and the band concerned is quiet. The old adage, only use enough power to make the contact is still a good one. Talking to 'Harry' three miles away on 80m SSB on a Sunday morning using 10 to 100 watts is fine, a linear can safely be left in standby, however talking to a DXpedition on a tiny island on the other side of the world while they are already being called by stations with lots of power, my linear amp will most certainly be warmed up and switched on.

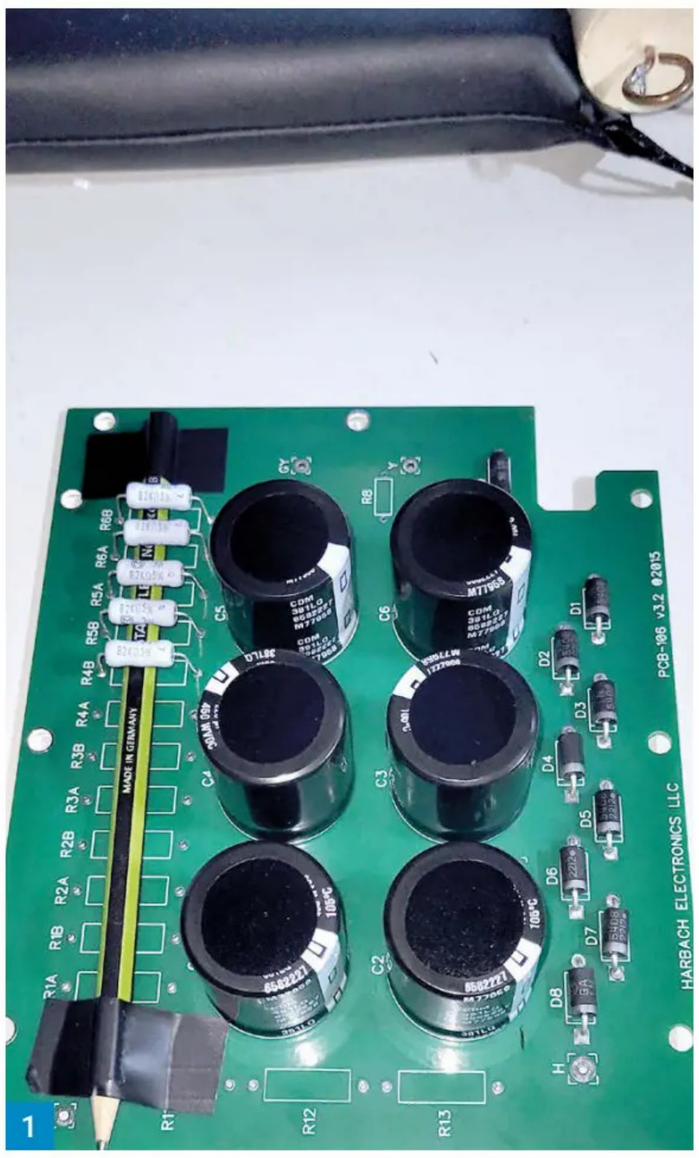
About the SB200

The SB200 uses two 572b valves in parallel grounded-grid configuration, with around 2400V on the anodes. It can deliver the old UK limit of 400 watts with ease and can be pushed to around 800 watts maximum output SSB or about 500 watts CW. It's not designed for 100% duty cycle so don't push it to run data modes at QRO power levels. I would not expect more than about 150 watts on data. Snappy tuning is a must, 10 seconds key down and 10 seconds cooling is a good habit to get into. The SB200 is basic compared to a modern amplifier. It has no alarms to tell you when it's being over-driven or getting hot, etc like most modern linear amps, but it is a lot of fun to operate a classic era valve linear on the air with a modern transceiver and it's certainly far cheaper to buy than today's big linear amps so won't leave a big dent in the bank account. One bugbear with the SB200 is the lack of a standby switch, but as my Ampkeyer switch box has a standby switch, this is not an issue. There are replacement SWR sensitivity pots available, which incorporate a 'push/pull' type switch contact, which can be used to switch the SB200 into standby, but I have not installed one.

Judging by the internal construction quality of soldering my SB200 is a Heath built one rather than a kit built one. I am guessing from the serial number it's probably around 1975 vintage, so nearly 50 years old. When I have had the covers open it's fairly obvious it's had no mods or work done.

Getting the project underway

Last summer I thought it high time to get my SB200 down off the shelf and look at what I needed to do in the way of replacing parts to make it reliable for years to come, so I started to look online to see what work other amateurs had done. The Heathkit products were very popular not just in the US where they were manufactured but worldwide so they have quite a high online following, useful for reading up on problem solving or researching mods and upgrades. I discovered a small company in the US called Harbach Electronics who make lots of upgrade and replacement modules for lots of valve-based linear amplifiers of a certain age, among them the Heath SB200. A quick scan of their website showed Harbach had three modules for the SB200, namely a new power supply with nice new electrolytic smoothing capacitors, new silicon high voltage diode rectifiers and new resistors, including a new shunt for the HV metering circuit. Also available is a soft-start module to limit inrush current when powering the SB200 up and a very useful softkey circuit to enable modern transceivers to safely key the SB200 with low voltage and current instead of the amplifier's unmodified keying voltage of -135V/30mA,



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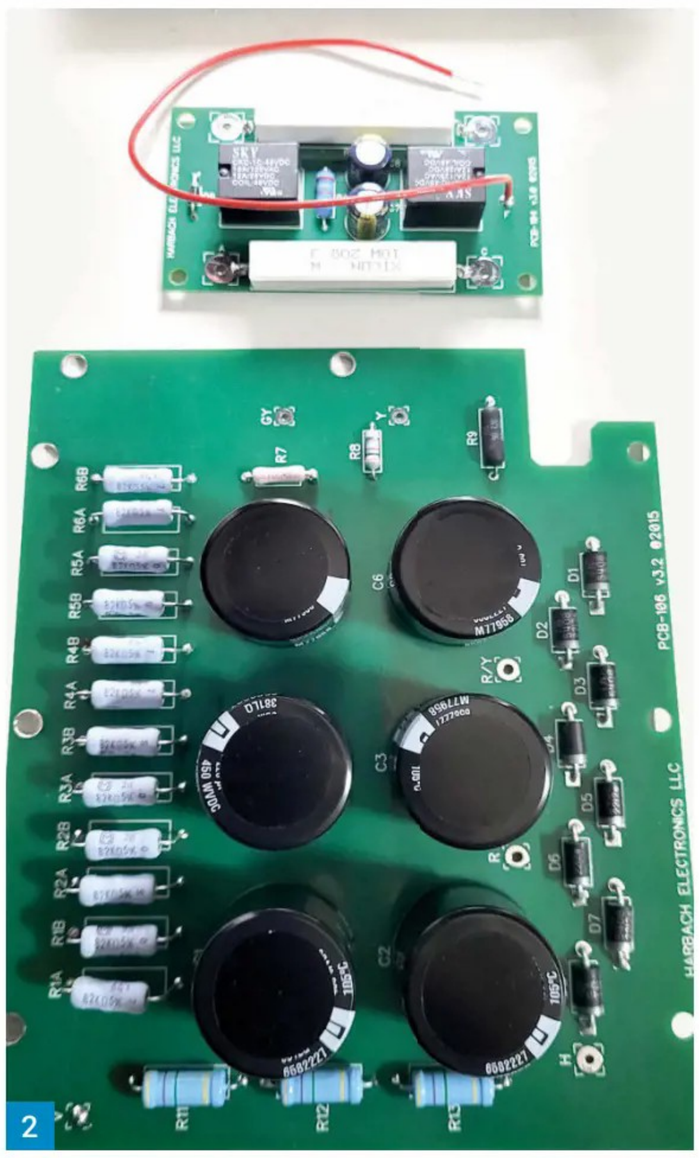

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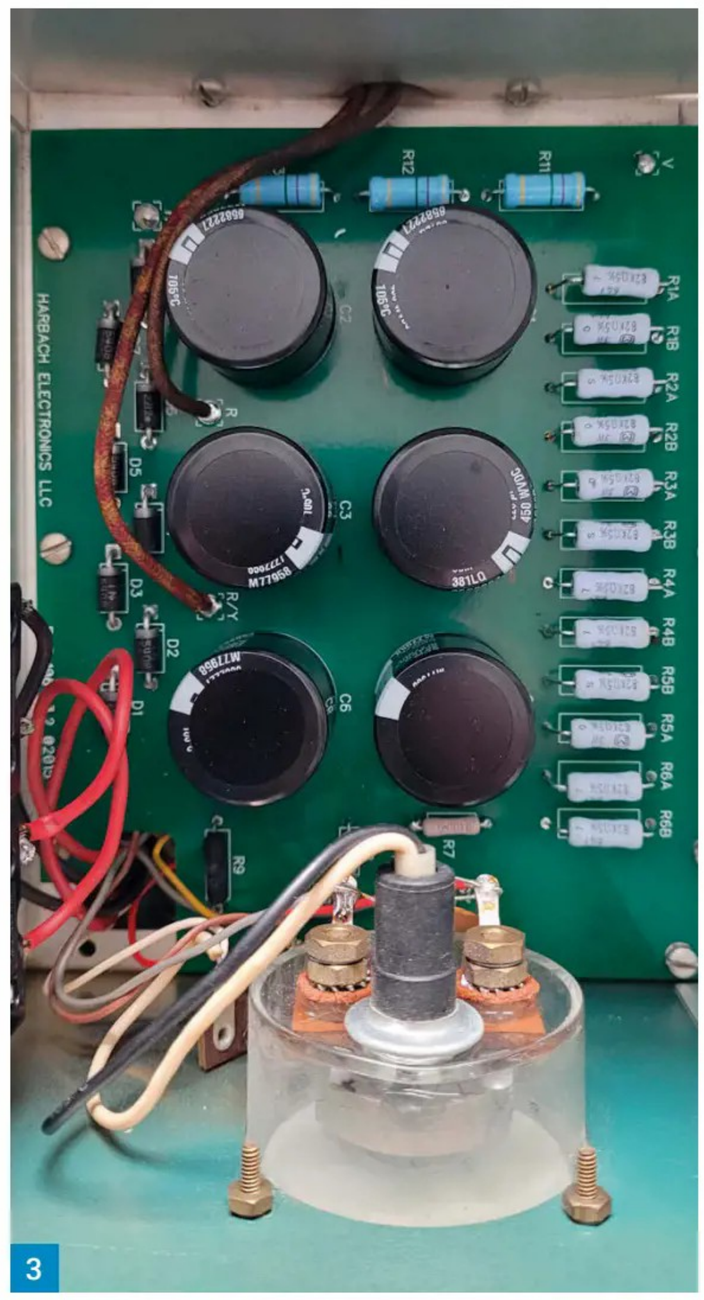

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Photo 1: PSU under construction. Photo 2: PSU and soft start ready for install.
Photo 3: New power supply installed. Photo 4: Soft start installed.

which would make mincemeat of most modern transceiver keying circuitry (don't be tempted to try it, it could be very expensive).

A quick courtesy email was sent to **Jeff Weinberg** to confirm he could ship modules to the UK. He confirmed within hours that shipping to the UK was OK, then I placed an order online for all three modules. One thing to watch is when ordering the soft-start module online the correct kit is ordered to suit UK mains voltage. Two ballast resistors have to be supplied with the correct values to suit 240V AC. Harbach also offer a nice discount on both the power supply module and the soft start module if ordered together.

I thought fitting an internal Harbach soft-key would be a good idea and would make the amplifier a bit easier to sell should I ever look at selling the SB200. I also downloaded both the construction manual and the installation and operation manual from the internet and printed both out. Heath construction manuals are legendary for their thoroughness and ease of reading and the SB200 manuals are no exception.

The kits arrived a lot quicker than I anticipated, I had this project in mind as an autumn project so anticipated a long lead time on the kits. I got back home from summer hols to find a package from Harbach already arrived in the post. Delivery had only taken a few weeks, even when using the cheapest standard US mail option. Try as I might, I could not resist the excitement of opening the box and the project was on!

Harbach had packed the three module kits really well and all three came with very extensive instructions. Jeff at Harbach is available via email in case of issues building or installing the kits.

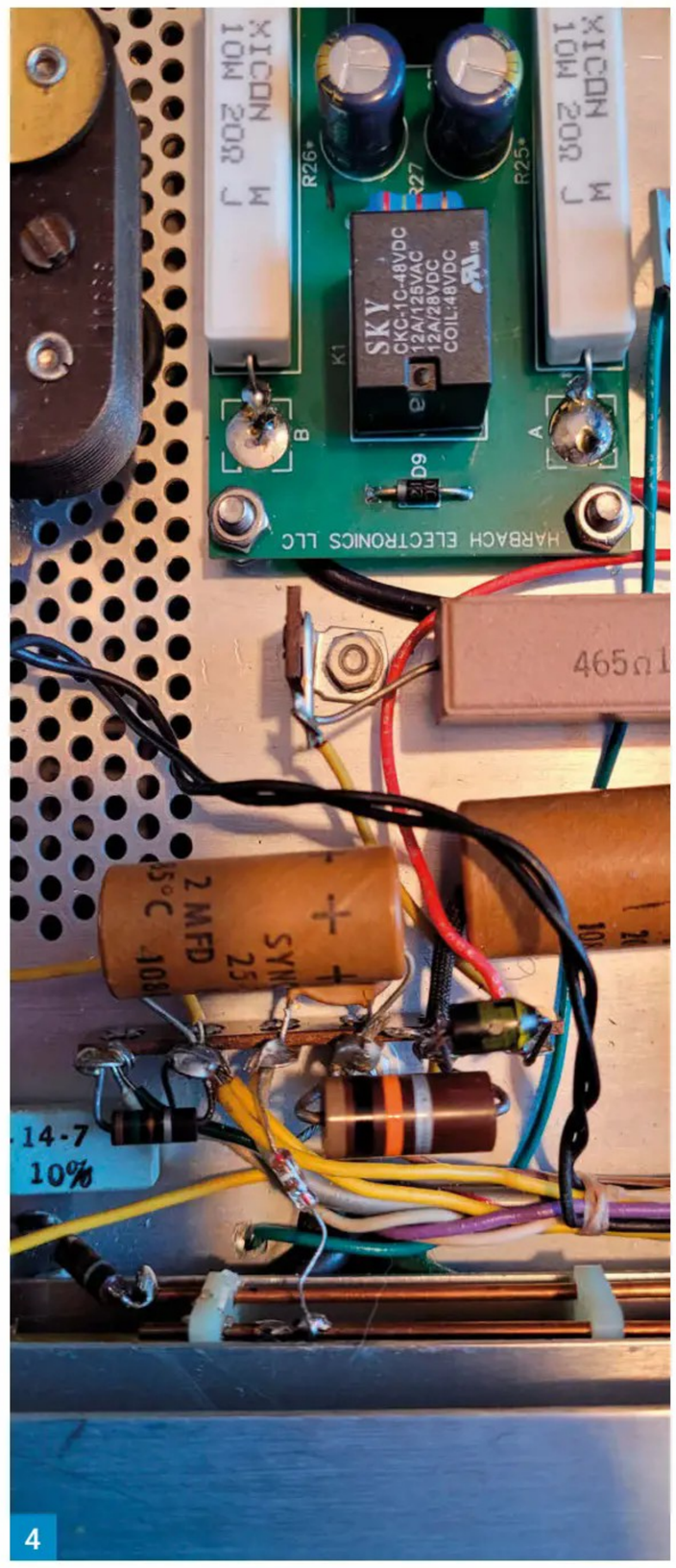
Preparing for the modification

First phase was to get the soldering iron and tools out and build up the modules prior to installation inside the SB200. Building did not take more than a couple of evenings. I was careful to double check every component before and after fitting and double checking my soldering with a jeweller's eye glass. When the build was complete another double check of everything was a good idea and all was OK. A couple of points worth mentioning are, the equalising/bleed resistors on the power supply board need standing off the PCB in order to dissipate heat, the stand-off required in the instructions was ¼ inch, handily I found a pencil that had a ¼ inch width so this was used as a temporary spacer during construction. Once construction was complete the pencil spacer was removed and chucked back in the toolbox! The soft key PCB is very small and needed a helping hands device to aid construction. I was very careful to get this soldered up right and spent a long time afterwards double-checking parts and soldering with my eye glass.

All three modules, power supply, soft start and soft key were now ready for installation and it was time to delve inside the SB200 but not before giving safety ample consideration.

Delving inside

The SB200, in common with all valve-based linear amps and valve-based equipment in general has



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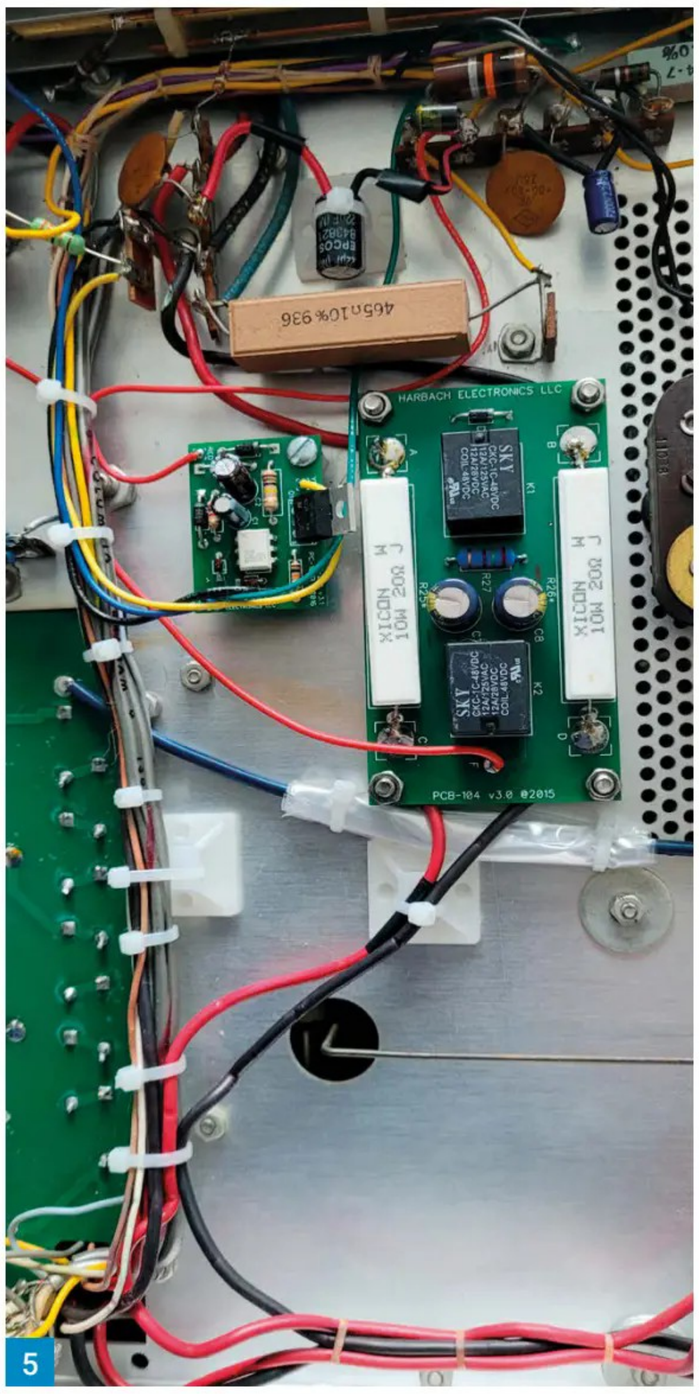

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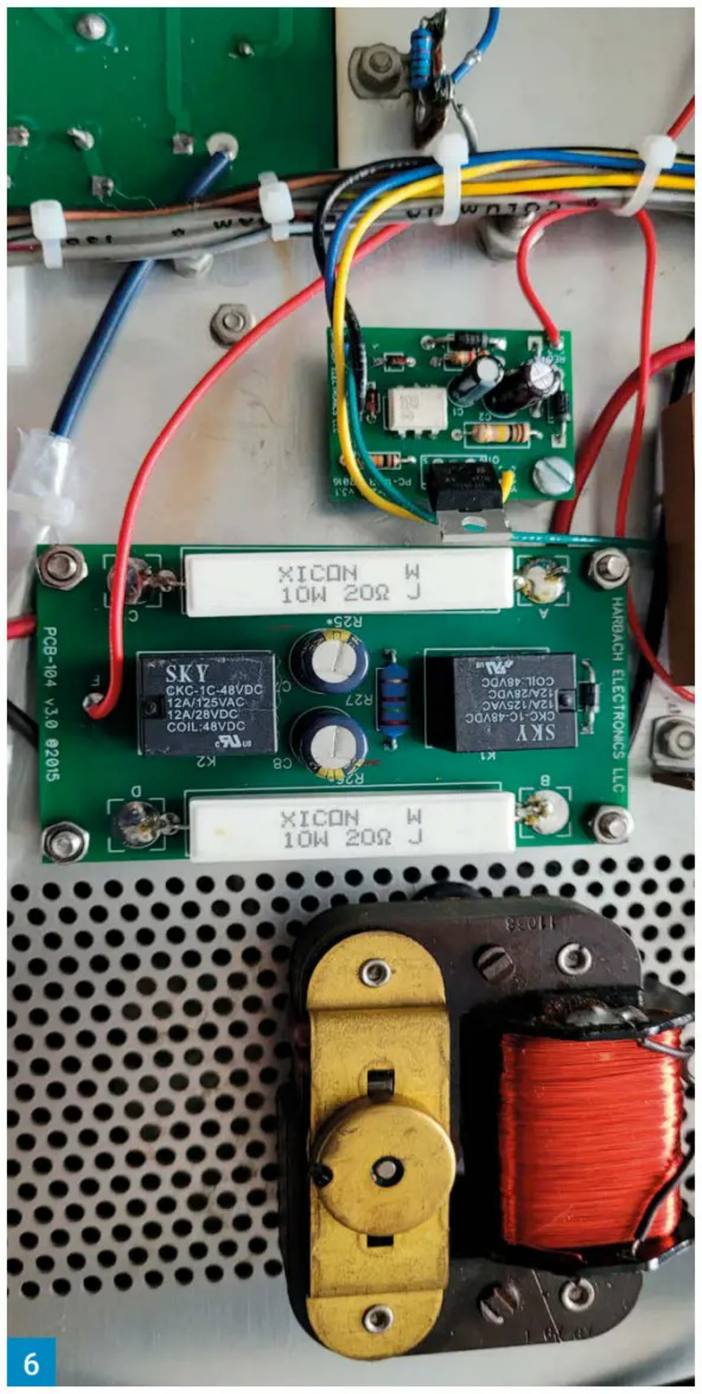

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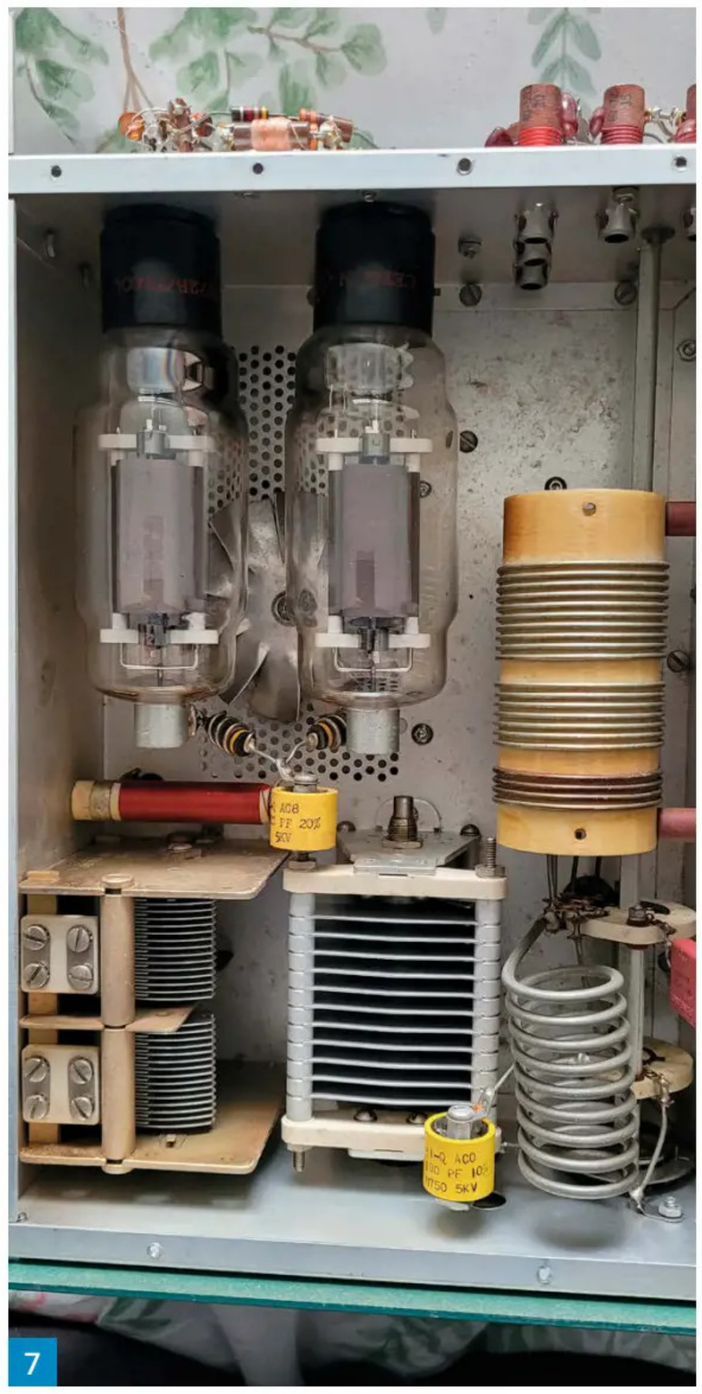
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some very hefty voltages inside. The SB200 has 2400V DC on the valve anodes. This voltage is LETHAL and requires extreme care to be taken before the amp is opened up and worked on. Note, removing the mains power supply is not enough to ensure the voltages are removed as the big power supply electrolytic capacitors can retain charge for a very long time after the mains has been switched off.

The easiest way to ensure the anode supply line has fully discharged is to switch off the power using the front panel switch with the front panel meter set to HV (ie monitoring the anode voltage), and observe the anode voltage slowly falling to zero. One other thing I always do once the amp covers are removed, is to make sure each individual electrolytic smoothing capacitor in the power supply has been fully discharged in case of faults in the capacitor bleeder chain. Being careful not to touch any components inside the amp I carefully place a multimeter with fully insulated probes and preset to high voltage DC across the terminals of each of the large smoothing electrolytic caps and make sure they are all well and truly discharged just in case one or more of the bleeder/equalising resistors have gone high value or open circuit.

Then both the 572b valves were carefully removed and wrapped with some spare bubble wrap to prevent damage and put away safely until later. After all that had been done it was time to install the modules. Rather than install all three, I installed each one at a time, then tested the amp before moving on, that way I can deal with issues as they arise. I took my time and gave the whole amplifier a good dusting out with a clean dry paintbrush and used the mini-Hoover to remove all the loose dust.

Photo 5: Soft key (left) and soft start (right). Photo 6: Soft start (large) and soft key (small) installed. Photo 7: RF deck after dust removed. Photo 8: Amplifier rear with new connectors. Photo 9: All the old parts removed.

The power supply was the most difficult to replace as it required the amp front panel to be removed and carefully lowered with controls still attached to gain access to the power supply board. The old Heathkit board has a hole that is used for some wiring to pass through between the underside of the chassis and the top of the amp. It needed a pair of side cutters to carefully remove part of the old power supply board so that it could be removed without having to remove all the cables in the wiring loom first. All the old board securing nuts and bolts were removed and carefully stowed, before fully removing the old board with a bit of manoeuvring and muttering. Installing the new board was easy. Instead of a hole for the cable loom it has a slot so it's a simple install. After installing the power supply, double checking all connections had been re-soldered, both of the 572b valves and the amp's covers were temporarily replaced for my safety before the amp was powered up to test the new board, anode supply was checked on the front panel meter and noted at 2400V which was correct. Time for a cup of tea!

Next it was time to install the soft start and soft key modules under the chassis after once again making sure the HV supply was zero, the new power supply board capacitors were checked with the multimeter for 0V, both of the valves put back into safe storage once again. Both the soft-start and soft-key were installed this time under the chassis. These are much easier to install as no parts within the amp needed removal and there is plenty of space available under the chassis for the new modules. The chassis was very carefully drilled for the new module mounting screws, I used a blob of Blu Tack on the opposite side of the chassis to drill into, in order to catch the swarf from the drilling process.

After three modules were fully installed and wiring double checked, the valves and covers were again replaced for my safety before the amp was powered up yet again to test. This time a healthy relay click was heard from the soft start a few seconds after powering up and anode voltage rechecked again at 2400V. Checking the amp keying connector with a multimeter read a nice low 1.5V DC so a temporary test cable with a phono plug one end and a toggle switch the other was made up from junk box parts and used to check the amp would key into transmit when the keying line is shorted to ground. The amp keyed up with

8

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no issues so installing all three Harbach modules was now completed and it was time for yet another cuppa and a Welsh cake this time!

Now it's time to look at replacing rear panel connectors, the t/r relay and a couple of internal electrolytic capacitors before cleaning the bandswitch and meter switch contacts.

Safety first! Please ensure the HV anode line is fully discharged before removing the chassis from the covers and then check each smoothing electrolytic capacitor on the new Harbach power supply module to ensure each is fully discharged using a multimeter set to high voltage DC with insulated probes.

Completing the rebuild

In my amplifier, I needed to replace the t/r relay because of intermittent receive and SWR issues, which I put down to pitted relay contacts. Cleaning the contacts did not resolve the problem so the relay needed changing out. As the relay coil forms part of the 572b's bias circuit the resistance of the coil is critical, so a replacement relay has to be a specific type. Unfortunately, Harbach no longer supplies new relays for the SB200 but I was lucky to source a brand new original SB200 relay from another online source, which amazingly arrived from the US within days of ordering!

Replacing the t/r relay was straightforward. It is mounted to the amplifier chassis by a single machine screw through a rubber grommet to deaden the relay activating thumping noise. I replaced the grommet with a new one from my junk box as the old one had worn and gone hard over the years. After the old t/r relay was desoldered and removed, I took the opportunity to replace the RF input connector, which was the original Heath fitted phono! I replaced this with a flange-type BNC socket, which fitted the hole vacated by the phono perfectly so no chassis bashing required. I just needed to drill four holes for the mounting machine screws and nuts. Consulting my junk box I found a BNC male to SO239 adapter so I could use a new PL259-to-PL259 coax patch cable to connect my transceiver to the amplifier RF input.

The RF output SO239 needed replacing as the old one looked very tired and worn. I had a pleasant surprise when I looked at the replacement flange-mounted SO239 I had ordered from Mouser Electronics and found it was exactly the same one with the same part number stamped on it that Heath had originally used for the SB200 way back in the 70s!

Fitting the new SO239 was a bit difficult as the directional coupler for the SWR and relative power meter needed dismantling to get the old SO239 out. This is located across the rear of the lower chassis and under a chassis lip. Doing this needed a steady hand and the original assembly manual steps had to be followed in reverse order to get the old socket out. Once the coupler was out, I was able at long last to be able to tighten the mounting nut on the amplifier's earth binding post connector, which had been loose for many years! Once the new SO239 was installed the assembly manual was followed once again. This time the steps were repeated in the right order, to reinstall the directional coupler correctly. As usual all was double checked before moving on to the next stage.

The next step was to clean the contacts on the bandswitch and meter switch. This is a fairly straightforward operation as both the switch contact wafers are easy to get at. To clean the contacts both switches are left in situ, the contacts on the wafers are sprayed with contact cleaner and 'worked in' by operating the switch several times.

While I was at it, I also visually checked then cleaned the contacts in the two valve bases even though both looked fine in my case. The anode valve clips were also cleaned with contact cleaner and squeezed slightly to ensure a tight fit on the valve anode caps after reinstalling the valves.

My amp contained two paper tube type electrolytic capacitors, which are now nearly 50 years old and probably getting to the stage of shifting values and getting leaky because of their age. The two replaced are C3 20mfd, 150V and C19 2mfd, 150V. Both were obtained from Mouser UK, C19 was replaced by a 2.2mfd 150V type. Be careful when ordering to make sure the working voltage is 150V or higher and when installing them make sure the polarity is correct – I took a photo and double checked against the circuit diagram in the manual. It was amazing to see how much smaller the replacements are compared to the original. Installation is relatively straightforward as the amp has point-to-point tag strip style wiring. One slight snag I had was one electrolytic cap obtained from Mouser had to be a radial type as the value needed was not available as an axial type as originally fitted inside the amp. I used a self-adhesive pad and cable tie to mount the radial electrolytic onto the chassis before soldering the connections on the tag strips.

While the amplifier was open I also applied a few drops of light oil onto the bearing of the fan motor.

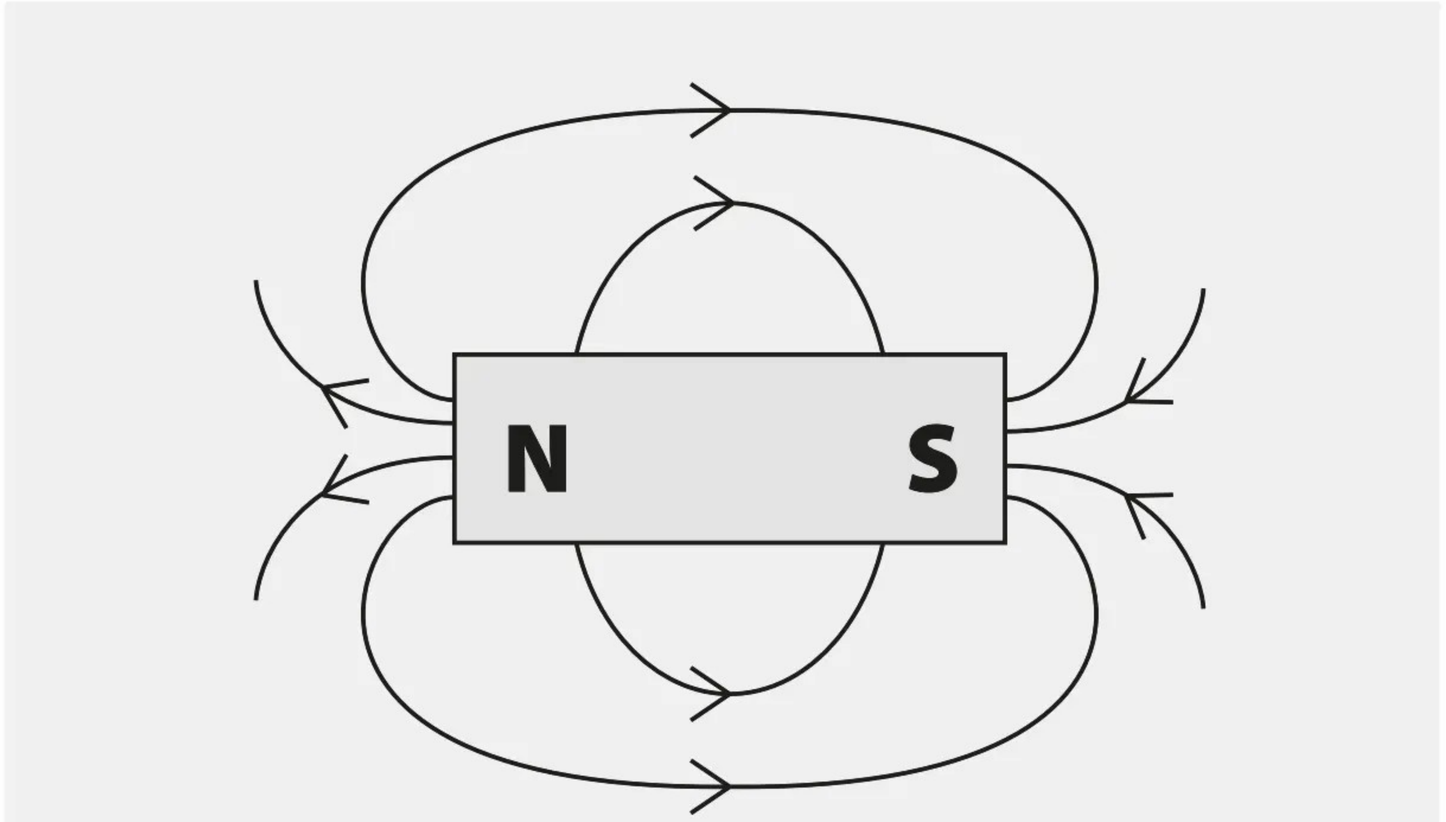
The final thing I did was to replace the 'tx ground' and 'alc' phono sockets on the rear of the amp. Both of the original phono sockets were looking worn out and tired. This was a fairly easy job.

Finalising the job

A visual check was made of the whole amp was made before reinserting both of the 572b's. The anode top caps were reconnected, covers replaced, mains power reapplied and HV checked on the front panel meter again before replacing the amp back into the station.

All proved well and the amp was tuned up and slowly run up to full power output with no issues; the power output was exactly the same as before the upgrades. So, I now have an excellent Heath SB200, modernised for use with a modern transceiver and capable of 800 watts, not that I will be using it at 800 watts out anytime soon! **PW**

Chris Murphy M0HLS
practicalwireless@warnersgroup.co.uk



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A Lab Tutorial: Electromagnetism

Jeff takes Natalie through the basics of electromagnetism.

Jeff was sat in the lab office with his feet up on a spare chair, reading last night's football results in his paper with his usual large mug of tea on his desk. His solitude was broken when Natalie breezed into the office full of beans as usual.

"Morning Jeff", she shouted before sitting down at her desk. *"Morning"*, Jeff replied, *"I suppose that I'd better ask what you did at college yesterday so that I can prepare for lunchtime". "Archie took us through the relationship between magnetism and electricity in preparation for talking about inductors"*, said Natalie, *"A lot of it was about magnetism, or rather electromagnetism though". "I see"*, said Jeff. *"Well, it is something that you need to have a grip on to understand things like inductance. You do really need to understand the basics at least behind electromagnetism". "Archie said something like that"*, Natalie replied. *"OK, we'll talk at lunchtime"*, said Jeff.

Lunchtime arrived and after both Jeff and Natalie had eaten their lunches and Jeff had brewed himself another mug of tea, Natalie went over to his desk and sat down. *"Right"*, said Jeff, *"If you remember than when we talked about capacitors we started with a look at the physics behind electric fields". "Yes, I remember"*, Natalie replied. *"OK"*, Jeff continued. *"Well, we now need to have a look at magnetic fields. The relationship between electricity and magnetism is quite important"*, Jeff explained. *"A lot of electrical and electronic devices rely upon magnetic fields for their operation".*

"Such as", asked Natalie. *"Well, inductors for a start, and there are such things as motors, generators, relays, loudspeakers and a lot of sensors used for measurements, for example. And you may remember from your radio studies that antennas produce a magnetic field as well as an electrical field. In fact, some receiving antennas are designed to work using the magnetic field as the noise is lower". "Yes, I think I've seen those advertised as magnetic loops"*, said Natalie. *"Correct"*, said Jeff with a smile. *"I use one myself".*

"Anyway", said Jeff, *"Let's go back to school and have a look at basic magnets. If you remember a magnet always has two poles, a North pole and a South pole. This always applies no matter what the shape of the magnet or how strong it is". "Yes, we did experiments with different kinds of magnets at school"*, said Natalie. *"Bar magnets and horseshoe magnets for example".*

"Right", Jeff continued, *"You may remember then that lines of magnetic force are set up between the two poles like this"* (**Fig. 1**).

"The lines are most concentrated at the poles and diminish the further they get away from the magnet." "Yes, I remember that", Natalie replied, *"And a few other things like that the lines never cross each other and we use arrows to show them moving from North to South. Also, that like poles repel each other and unlike poles attract each other". "Anything else?"* Jeff asked. *"Only that you can make a magnet by introducing a piece of steel for example to a magnetic field but that you can't destroy a magnet". "OK"*, said Jeff, *"As you say, it is possible to create a magnet, but you're not quite correct in saying that you can't destroy one. A magnet can be destroyed by heating it up for example, but you can't destroy one by chopping it up into pieces".*

"OK", said Jeff, *"Going back to the lines of force, these will be confined to a certain area around the magnet, the area of which depends upon the strength of the magnet. We call the magnetic field within this area Magnetic Flux, and we give it the symbol Greek letter Phi (Φ). It has the units Webers after the scientist* ***Wilhelm Weber****". "Yes, we've done that in Engineering Science with Arthur"*, said Natalie, *"How do we know how many lines of magnetic force there are?"*

"Well", said Jeff, *"We know that the magnetic field is present in an area extending up to a certain distance from the magnet. So, if we divide the amount of magnetic flux by the area, we get what is called the Magnetic Flux Density which has the symbol capital B and is measured in Tesla's after the scientist* ***Nikola Tesla****".*

Magnetic Flux Density,
B = Magnetic Flux (Webers) / Area (m^2)

"Can we do an example?" asked Natalie. *"Yes, OK"*, said Jeff. *"Let's say that we have a magnet. To make the area calculation easier we'll assume that it's in the form of a round bar and the magnetic field has an area of one point five square centimetres. We'll also say that the magnetic flux is fifty micro Webers. Then"*

$$B = \Phi / A \quad B = 5 \times 10^{-5} / 1.5 \times 10^{-4}$$
So, B = 0.33 Teslas

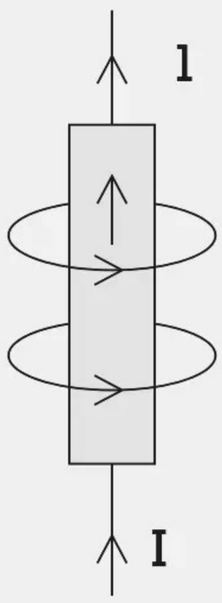
"Note, that the above only applies if the lines of flux pass through the area at an angle of ninety degrees. Otherwise, we have to use a bit of trigonometry and the equation becomes"

$$B = \Phi / A \cos\theta$$

"Anyway, now that we've done a bit of revision about magnets, let's have a look at magnetic fields produced by an electrical current. To start with, let's consider a simple piece of wire with an electrical current flowing through it like this" (**Fig. 2**).

"As you can see, I've drawn lines to represent the magnetic field, the direction of which depends upon which direction the current is flowing in." "How do we know the direction?" asked Natalie. *"Two easy ways"*, Jeff replied. *"The first is using the corkscrew rule. If you can imagine driving a right-handed corkscrew into the end of the conductor in the direction that the current is flowing in, then the direction in which you turn the corkscrew is also the direction of the magnetic field. Like this"* (**Fig. 3**).

"Oh, OK", said Natalie thoughtfully. *"But why have you drawn a cross at one end of the conductor and a dot at the other end?" "That is the convention for indicating the direction of current flow in a*



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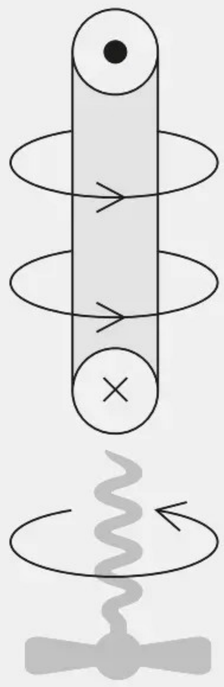

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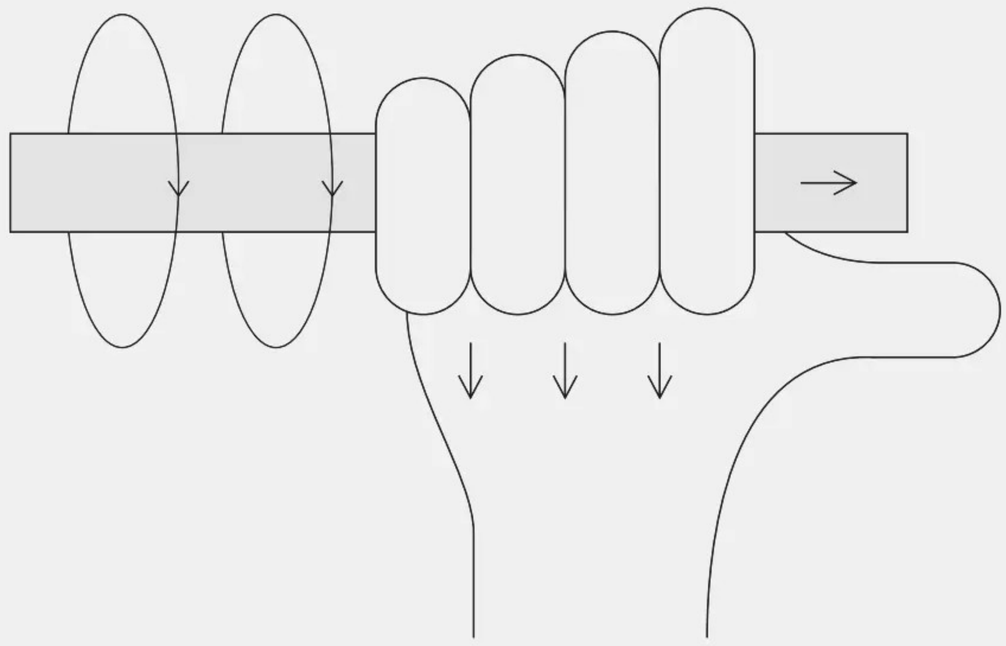

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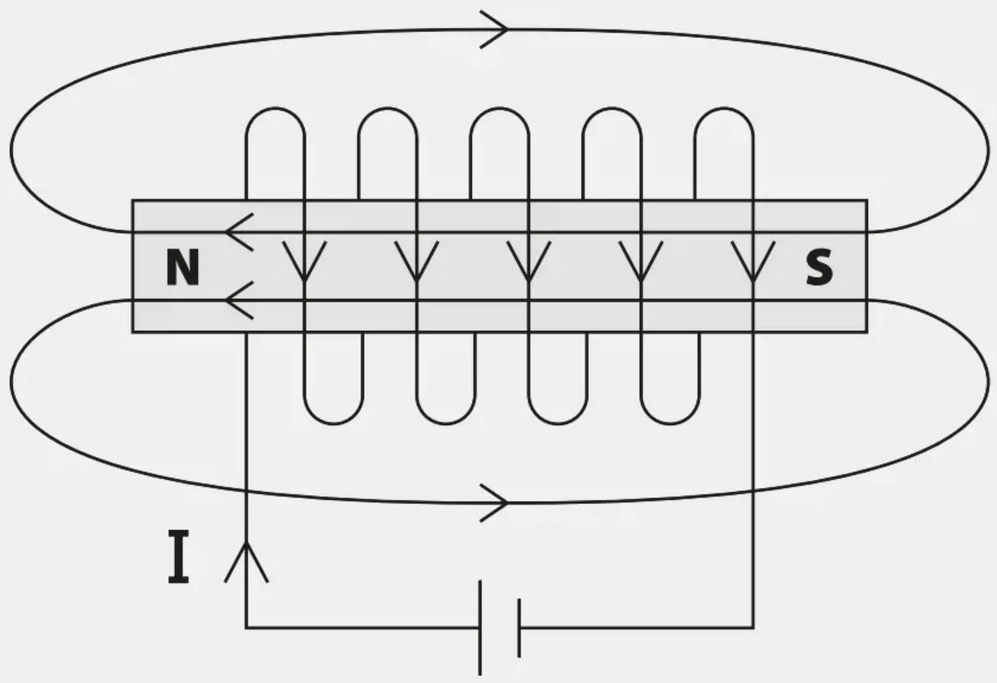
Fig. 1: Lines of force of a magnet.
Fig. 2: Magnetic field round a conductor.
Fig. 3: The corkscrew rule.
Fig. 4: The right-hand rule.
Fig. 5: Conductor wound around magnetic material.



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conductor based on an arrow", Jeff explained. *"The dot represents the tip of the arrow approaching us and the cross the feathered other end travelling away from us". "Oh, that's clever"*, said Natalie. *"I'll show Poppy and Isla that. By the way, our self-study group is growing. A guy called Tommy has joined us now". "Good to see that you're taking an interest out of class"*, said Jeff laughing.

"You said that there are two ways of finding the direction of the magnetic field", said Natalie. *"Yes, the other method is called the right-hand rule. If you were to grip the conductor with your right hand and point your thumb in the direction of the current, then your fingers will be pointing in the direction of the magnetic field. Like this"*. Jeff drew the arrangement (**Fig. 4**). *"By the way, the right-hand rule only works for conventional current flow. In other words, from positive to negative. For electron flow, which is in the opposite direction, you have to use your left hand"*, Jeff explained.

"This phenomenon whereby a magnetic field is created by an electrical current is called electromagnetism and is very useful with many practical applications". "Such as?" asked Natalie.

"Well, if you consider that the magnetic field is only there while a current is flowing, we can use this to make a temporary magnet. Old door chimes used an electromagnet. And if you've ever been to a scrap metal yard you might have seen one hanging from a crane. What they do, is to drop the electromagnet into a pile of metal, switch the current on, lift the metal out, and move it to somewhere else. They then switch the current off and the metal drops off." "Oh yes. I see what you mean", said Natalie.

"Anyway, so far, we've only talked about a current flowing through a single conductor and the magnetic field will be quite weak and get weaker with distance away from the conductor. How can we make it stronger?" Natalie asked.

"Well, for a start", Jeff explained, *"We can take the conductor and wind it into a coil. Coils come in many forms from a single turn air cored coil to coils with many turns wound on to materials with special magnetic properties as we'll see." "Oh, OK"*, Natalie replied. *"Anyway"*, said Jeff, *"Let's have a look at what happens when we wind a conductor around a piece of material that's magnetic – such as iron or steel and allow a current to flow through the conductor"*. Jeff drew the circuit, **Fig. 5**.

"When a current flows in the conductor, the core will become a magnet but as soon as the current stops the core will cease to act as a magnet – although a small amount of residual magnetism may remain. The magnet will have a North and a South pole and as with traditional magnets, the magnetic field will be strongest close to the core". "OK, what determines how strong the magnetic field will be?" Natalie asked.

"Basically", Jeff replied, *"The amount of current flowing and the number of turns. Which brings us to something called magnetomotive force. As you can see from what I've drawn, the lines of flux complete a complete circuit. This is called a magnetic circuit and as with an electrical circuit it has to be complete and unbroken". "Seems reasonable"*, said Natalie. *"Well, as we know in an electrical circuit, an electrical current will flow. In a magnetic circuit, as we discussed earlier a magnetic flux (Φ) will be present. As we also discussed, the flux density, depends upon not only upon the amount of magnetic flux but also upon the area that is dissipated across. So, we can say that flux density, B is":*

$$B = \Phi / A$$

"Now, in an electrical circuit", Jeff continued, *"In order to make a current flow we need a voltage, or more accurately an electromotive force applied to the circuit". "Yes, understand that, but what's the equivalent for a magnetic circuit?"* Natalie asked. *"Well"*, Jeff replied, *"When a current flows through a coil, each turn will produce what is known as a magnetomotive force or mmf. This can be considered as being the equivalent of an emf in an electrical circuit". "How do we know what the magnetomotive force is?"* Natalie asked, *"I think that we covered it in engineering science with Arthur, but I can't remember".*

"Well", said Jeff, *"we said that each turn will produce a mmf so the amount of mmf obviously*

Material	Relative Permeability
Iron (99.95% pure)	200,000
Electrical Steel	4,000
Carbon Steel	100
Permalloy	8,000
Ferrites	650
Air	1.00
Aluminium	1.00
Copper	0.99
Platinum	1.00
Wood	1.00
Plastics	1.00

Table 1: Relative permeabilities.

depends upon the number of turns in the coil, and the other thing that determines the mmf is the current flowing. So, we find the total mmf by multiplying the number of turns by the current. We give it the symbol capital F, not to be confused with Farads and the units Amperes". "Wait a minute", Natalie interjected, *"shouldn't the units be Ampere Turns?" "I see where you're coming from",* said Jeff, *"And yes, some people do quote mmf in Ampere Turns. But the number of turns doesn't have any units, just a numerical value, so sticking to the principles of SI units we just state mmf in Amperes". "Oh, OK, fair enough",* Natalie replied.

F = NI Amperes

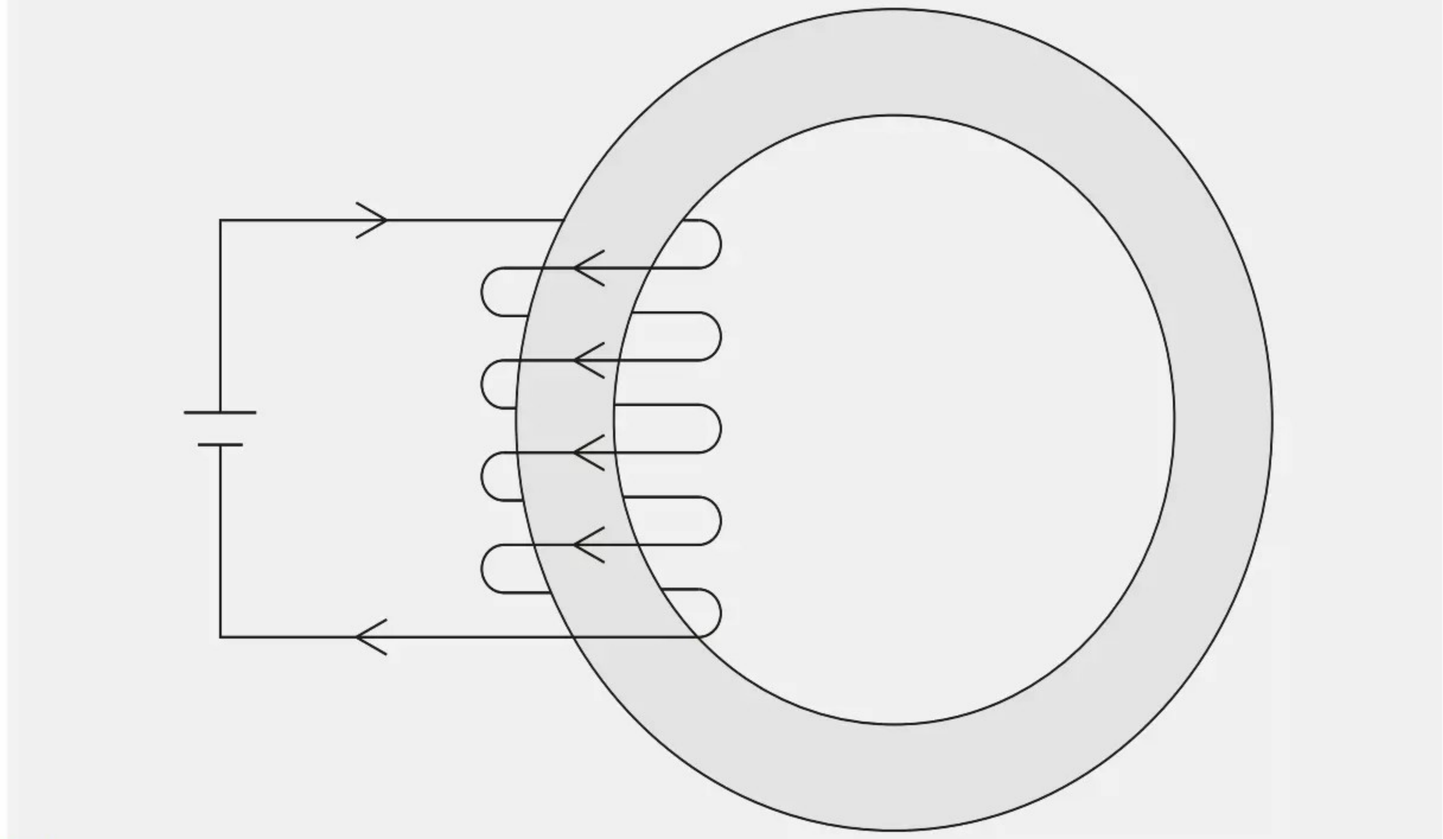
"Can we do an example please?" "Yes, OK. Let's say that we have a coil consisting of one thousand turns and that a current of two milliamps flows through it. Then"

F = NI Amperes so, F = 1000 x 0.002
F = 2 Amperes

"Mmm, I see. Does the mmf affect the strength of the magnet then?" "Yes, but there are other things that have to be taken into consideration as well. The strength of the magnetic field also depends upon the length of the magnetic circuit, and what the core is made of". "Oh, so two coils with the same mmf could have different field strengths then?" Natalie asked. *"Yes",* said Jeff. *"Perhaps the best way to show this is by doing a couple of examples. Let's say that we have a coil wound on a toroid. A toroid is a circular ring-shaped core which, for radio use, come in various sizes and made of various materials. They're used quite a lot in radio as we'll discuss later". "Ah yes, I've seen those advertised in radio magazines",* said Natalie. *"Yes, and if you look at photographs of circuit boards for radio kits you will see a fair few of them",* Jeff replied.

"Anyway, we've digressed. Let's wind a coil on a toroid like this". Jeff made a sketch, **Fig. 6**.

"Now if you remember back to our very first session when we talked about resistance and resistivity, we said that the resistance of a conductor depends upon amongst other things the length of the conductor, which in turn goes towards determining the current". "Yes, remember that", Natalie replied. *"OK, likewise",* Jeff continued, *"In a magnetic circuit, the field strength is dependent upon the length of the magnetic circuit. The magnetic field strength is defined as being the total mmf divided by the length of the magnetic circuit. This is provided that the cross-sectional area of the core is constant. We give it the symbol capital H, not to be confused with Henrys and the units Amperes per metre."*



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Magnetic circuit		Electrical Circuit	
Magnetomotive Force	Amperes	**Electromotive Force**	Volts
Magnetic Flux	Weber	**Current**	Amperes
Reluctance	Amperes/weber	**Resistance**	Ohms

Table 2: Units used in magnetic and electrical circuits.

H = mmf/L Amperes per metre
"From which we can say that"
H = IN/L Amperes per metre

"Let's do some examples. Say, we have a coil of two hundred turns wound on a toroid with a mean circumference of one hundred millimetres and a current of fifty milliamps flows in it. Then"

H = 0.05 x 200 / 0.1 = 100 Amperes per metre

"Now let's wind the same coil on a toroid with a mean circumference of three hundred millimetres. Now,"

H = 0.05 x 200 / 0.3 = 33.33 Amperes per metre

"Anyway", said Jeff, *"We've talked about quite a few terms and formula's so let's do an example that uses most of them. But before I do, there's another term that you need to be aware of and we'll talk about it more later. It's called the permeability of free space. We give it the symbol lower case Mu followed by the subscript 'o' and has the value of four times Pi times ten to the minus seven".* Jeff wrote down the value.

$\mu_o = 4\pi x\ 10^{-7}$

"And for a nonmagnetic material we can say that the magnetic field strength is given by the magnetic flux density divided by the permeability of free space"

$H = B / \mu_o$

"So, let's do an example. Say we have a coil of 300 turns wound on a plastic toroid with a mean radius of 80 millimetres, a cross-sectional area of four hundred square millimetres and the current flowing is two Amps. Let's find:
1. The magnetic field strength
2. The flux density
3. The total flux.
"First, the magnetic field strength is found by:

H = IN/l

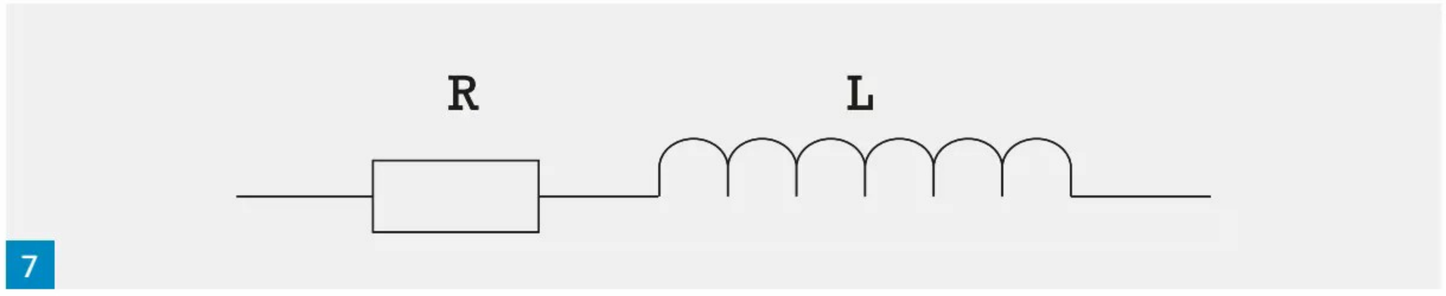
"The length of the magnetic circuit, l is the mean circumference of the toroid:

$l = 2\pi r \quad l = 2\pi \times 0.08 = 0.5m$
$H = 2 \times 300 / 0.5 \quad H = 1200A/m$
Flux density $B = \mu_o \times H$
$B = 4\pi x\ 10^{-7} \times 1200 = 1.5mT$
Total Flux = Flux Density x CSA
$= 1.5 \times 10^{-3} \times 4.0 \times 10^{-4} = 0.6\mu Wb$

"OK, I see", said Natalie. *"When we talked about capacitors, we said that the capacitance was dependent upon the area of the plates and the distance between them. I suppose for inductance that equates to the number of turns and the length of the magnetic circuit. We also talked about the relative permittivity of the dielectric. Is there a similar thing for inductors?"*

"Yes", said Jeff, *"There is, and it has a similar name so don't get confused. We call it the relative*

Fig. 6: Conductor wound around a toroid.
Fig. 7: Equivalent circuit of an inductor.



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permeability. If you remember, for capacitors, we started with a reference point – the permittivity of a vacuum which we gave the value of one. As I've already mentioned, for permeability we give the value for a vacuum the numerical value four Pi times ten to the minus seven and the symbol Greek letter lower case mu (μ) with the subscript 'o' to make μ_o. We give it the units Henrys per metre. H/m".

$$\mu_o = 4\pi \times 10^{-7}\ H/m$$

"Now, as with permittivity, we give different materials different values of permeability, called relative permeability, with the symbol lower case mu again followed by an 'r', μ_r. Basically we can say that the permeability is a measure of how dense the flux in the material will be compared to a vacuum". "Do you have some examples", Natalie asked. *"Yes, in a minute, but first there's a third term that we need to consider which is Absolute permeability. Absolute permeability, which we again give the symbol mu but with no subscript, is the product of the permeability of free space and relative permeability. Let's do an example. Let's say that a material has a relative permeability of twenty thousand, then the absolute permeability will be"*

$$\mu = \mu_o \times \mu_r \text{ so}$$
$$\mu = 4\pi \times 10^{-7} \times 20\,000 = 25 mH/m$$

"Why do we have three terms?" "Well", Jeff explained. *"Look at what we've just worked out. What makes more sense to you? If I told you that a material has a relative permeability of twenty thousand or an absolute permeability of twenty-five milli Henry's per metre compared to an air cored coil? We can of course do the sums in reverse to find the relative permeability"*

$$\mu = \mu_o \times \mu_r \text{ so } \mu_r = \mu / \mu_o$$
$$\mu_r = 0.025/4\pi \times 10^{-7} = 20\,000$$

"Anyway, I said I'd give some relative permeabilities didn't I, so here you are" (see **Table 1**).

"OK, thanks", said Natalie, *"I'll share these with the others". "Just one thing to be aware of",* Jeff replied. *"These are typical figures. If you're dealing with some specific material, it's best to have a look at a data sheet for that material to get a more exact figure, and note that the figures for non-metallic materials are one or thereabouts".*

"You mentioned the resistance of an electrical circuit", said Natalie. *"Does a magnetic circuit have something similar?" "Yes, it does",* Jeff replied. *"It's called reluctance. Think back to the toroid that we used in our example earlier. As well as having a mean circumference, it will also have a cross-sectional area, A. If you think back to our first session again, we said that the resistance of a conductor is given by its resistivity times its length all divided by the cross-sectional area. Well, for reluctance, we divide the length by the permeability of free space times relative permeability times the cross-sectional area. I'll write them down for you and also a comparison between electrical and magnetic circuits We give reluctance the symbol capital S and it is measured in amperes per weber."*

$$R = \rho l/A \text{ Ohms} \quad S = l/\mu_o \mu_r A \text{ Amperes/Weber}$$
(See also **Table 2**)

"Can we do an example please?" Natalie asked. *"Yes, OK",* Jeff replied. *"Let's say that we have a toroid with a mean circumference of three hundred millimetres, cross-sectional area of four hundred square millimetres and a relative permeability of 800. Then"*

$$S = l/\mu_o \mu_r A$$
$$\mu_o \mu_r A = 4 \times \pi \times 10^{-7} \times 800 \times 4.0 \times 10^{-4} = 4.02 \times 10^{-7}$$
$$So, S = 0.3/4.02 \times 10^{-7} = 7.46 \times 10^{5}\ A/Wb$$

"OK, thanks", said Natalie taking the list of permeabilities. *"Before we talk about inductance",* said Jeff, *"There are a few other terms to do with magnetism that you should be aware of but don't have time to discuss now". "Such as?"* Natalie asked. *"Well things like B/H curves and hysteresis",* said Jeff. *"You can find them in any engineering science textbook or on the internet".*

"Anyway, let's have a quick look at inductance," said Jeff. *"We won't have time to look at any depth into the different types of inductors, we'll do that another time. But we'll have a quick look at how they behave in DC circuits." "OK",* said Natalie.

"An inductor is a passive component along with resistors and capacitors. Although there are many different kinds of inductor, as we'll see later, they nearly all consist of one or more turns of wire in the form of a coil. They may be air cored or wound on some form of former". "Does the former have to be a magnetic material?" Natalie asked. *"Not necessarily",* Jeff replied. *"They could be plastic or any other non-metallic material. The symbol for inductance is a capital L and has the units Henrys."*

"You said that inductors are usually coils. What sort aren't?" "Well, if you think back to our session about capacitors, and we drew the equivalent circuit, we said that the component leads can possess a small amount of inductance. There are many examples where stray inductance may be present. It's not usually a problem, but it can be – especially at high frequencies".

"Right, let's have a quick look at what inductance is. There's a bit of maths involved, not too dissimilar to what we came across with capacitors, but there's one term for want of a better word that crops up quite a lot, and it's this". Jeff wrote an equation.

$$di/dt$$

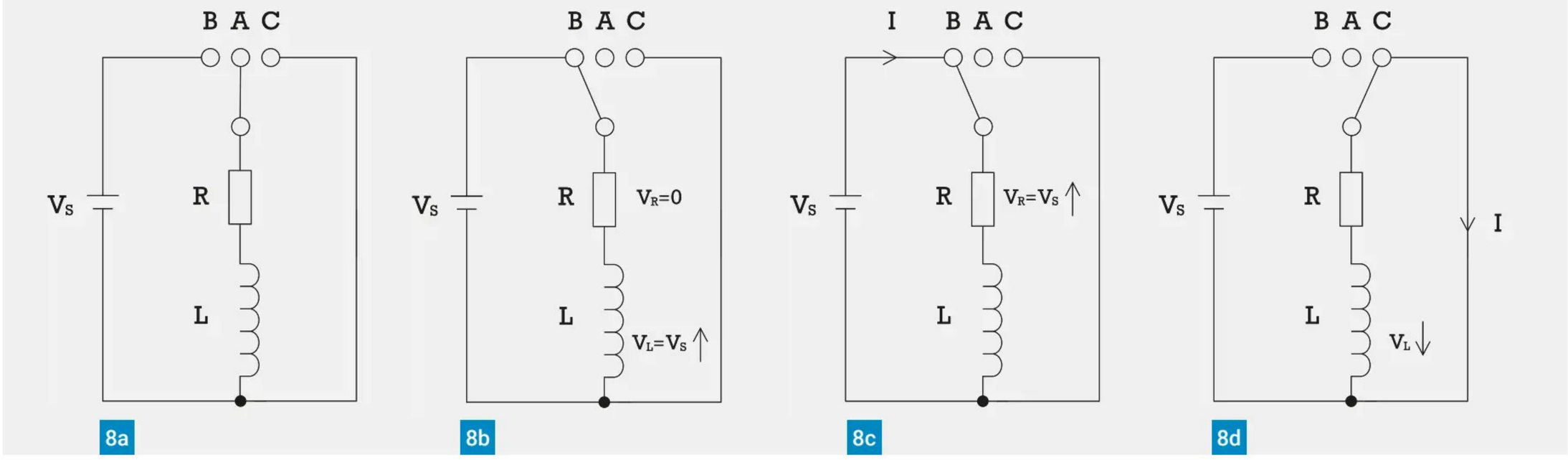
"Here, the letter 'd' means a change in", Jeff explained. *"So, di means a change in current and dt a change in time." "Ah yes, we've done that in maths with Reggie", said Natalie, "But can we do an example?" "OK",* said Jeff. *"Let's say that the current in an inductor changes from zero to two Amps in half a second. Then"*

$$di/dt = 2\text{-}0/0.5\text{-}0. \text{ So } di/dt = 2/0.5$$
$$\textit{and } di/dt = 4A \text{ per second.}$$

"Right, let's have a look at what happens when we connect an inductor in a DC circuit like what we did for capacitors. We said that capacitors store energy in the form of an electric field. Well, inductors also store energy but as a magnetic field. Hence the revision on magnetism. We've already said that most inductors are some sort of coil made from a conducting material and so they will also possess a small amount of resistance." "Yes, understand that", said Natalie. *"So",* said Jeff, *"We can draw the equivalent circuit for an inductor like this",* **Fig. 7**.

"Let's consider a circuit consisting of a voltage source, a switch, an inductor, and a resistor, like this", **Fig. 8a**. *"Now obviously when the switch is open, no current can flow and the inductor can't generate any magnetic flux." "Yes, see that",* said Natalie. *"Now, let's set the switch to position B. Even though the switch is closed, the current cannot change instantaneously. So, for a very short time, no current will flow and by Ohms law the voltage across the resistor will be zero. But, if you remember back to our tutorial about Kirchoff's laws, the sum of the voltages around the circuit must equal zero. So that means that the whole of Vs must appear across the inductor."* (**Fig. 8b**) *"Ah yes, remember Kirchoff",* said Natalie. *"But after a very short time, a current will start to flow through the resistor and inductor but instead of being a step change, the current will grow exponentially. I'll draw a graph to help you understand"* (**Fig. 9**). *"OK, thanks, that will help",* said Natalie. *"The current now flowing means that a magnetic flux will start to build up. Now because the magnetic flux is building up, in other words changing, it will cause a voltage across the inductor to be induced. We call this an induced electromotive force."*

"OK, what effect does this induced voltage have?" Natalie asked. *"Right",* Jeff replied. *"This induced electromotive force is due to what we call self-induction and by Lenz's law it will be in the opposite direction to the supply voltage, and as such it will*



work to limit the amount of current flowing. Because it's in the opposite direction we call it a Back emf. How high the voltage gets depends upon the rate of change of current". "So, for a faster rate of change of current, a higher voltage will be induced?" Natalie asked.

"Yes", Jeff replied. *"Have a look at Faraday's laws if you're interested. We have said that the unit of inductance is the Henry and an inductor will have a value of one Henry when a current that is changing at the rate of one Ampere per second causes an electromotive force of one volt to be induced in it. From that, it should be clear that the induced electromotive force is determined by the value of the inductor and how fast the current is changing. Or to put it mathematically, and I've already explained what the di/dt means you can work it out using"*

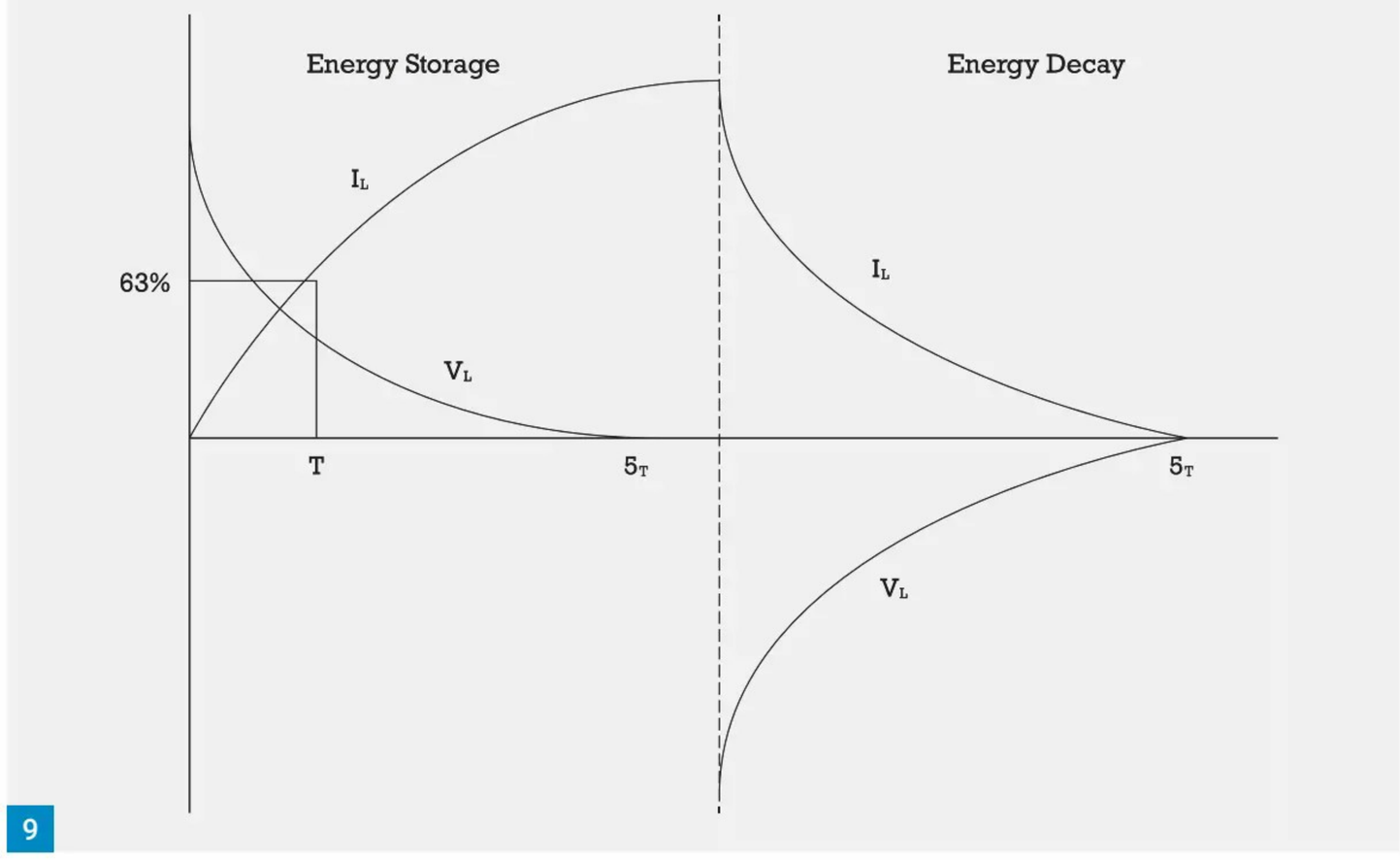
$$e = -L \times di/dt$$

"As we've said, the current will slowly build up to a maximum value, the time taken depending upon the values of the resistor and inductor. Eventually the current will reach its maximum value and the whole of the supply voltage will be present across the resistor (**Fig. 8c**). *Remember, the inductor is assumed to have very little resistance compared to the resistor. At this point the current is in a steady state and the magnetic flux remains constant." "I see"*, said Natalie looking at the graphs.

"This is similar to what we drew for capacitors", *said Natalie. "Can we also work out time constants?" "Yes"*, Jeff replied. *"For inductors the time constant is found by dividing the inductance in Henrys by the resistance in Ohms. As you can see from the graph, after one time constant the current will have reached about sixty three percent of its maximum value which it reaches after five time constants"*

$$\tau = L/R$$

"Now let's move the switch to position C. The supply will be disconnected, and the current will cease to flow. The magnetic flux will now start to collapse." "But you said that the magnetic flux contains energy. Where does it go?" Natalie asked. *"Whoa, hold your horses for a minute and let me finish"*, said Jeff. *"As with when we first applied the current, when we remove it, it cannot change instantaneously but will start to fall exponentially. Because the current, and hence the magnetic flux is changing again, this time diminishing, an induced voltage will be set up again, but now its polarity will have changed."* (**Fig. 8d**). *"Eventually both the current and voltage will fall to zero." "I see"*, Natalie replied. *"Just one final point to be aware of here"*, said Jeff, *"The induced back emf can be quite large and can destroy things like semiconductor devices. I'll explain how we avoid this later"*.

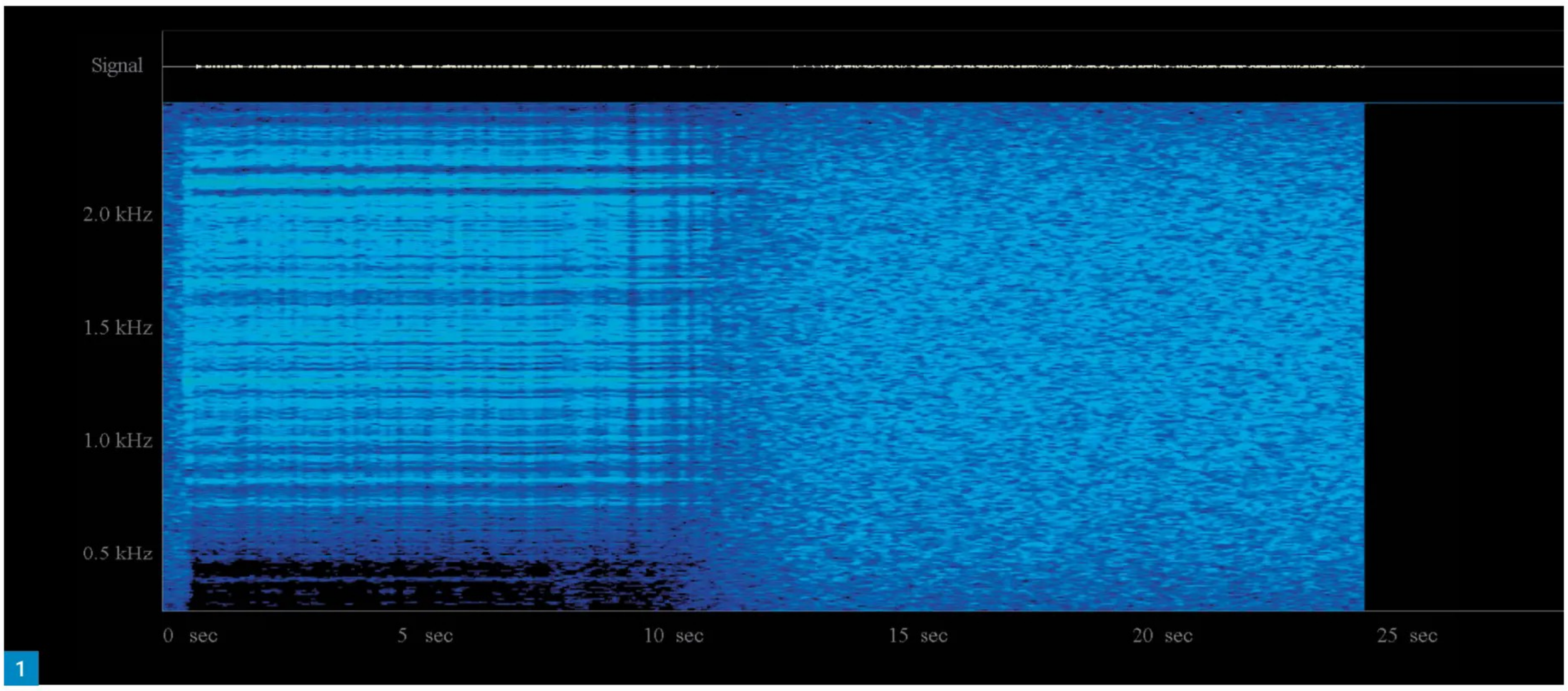


"Anyway, we're out of time", said Jeff looking at the clock on the wall. *"We've done a bit of revision about electromagnetism and how inductors work in DC circuits so we'll have a look at inductors in more detail another day. And I suppose that you want me to give you some practice exercises?" "Yes please"*, said Natalie.

Fig. 8: Applying voltage to and then discharging an inductor. Fig. 9: Energy build-up and decay in an inductor.

Jeff's questions.

1. If a material has an absolute permeability of 30mH/m, calculate the relative permeability (23,873)
2. Calculate the magnetic flux density if the magnetic flux is 40μW and the area 0.5cm^2 (0.8T)
3. Calculate the mmf of a coil consisting of 800 turns with a current of 2.5mA flowing in it (2A)
4. Calculate the voltage created in a coil with an inductance of 12mH when the current through it changes from zero to 3A in 20mS. (-1.8V)
5. Calculate the reluctance of a magnetic circuit with a mean length of 250mm, cross sectional area of 280mm^2, and a relative permeability of 1200. (5.92 x 10^3 A/Wb)
6. Find the time constant of a 20mH inductor in series with a 2Ω resistor. How long will it take for the current to reach its maximum value? (0.01s and 0.05s)
7. What magnetic flux will produce a magnetic flux density of 0.25T over an area of 1.5cm^2 (37.5μW)
8. What value of resistor is required to be used in conjunction with a 500mH inductor to produce a time constant of 25ms? (20Ω)
9. How many turns will a coil require to produce a mmf of 1.5A if a current of 6mA flows through it? (250)
10. Calculate the reluctance of a magnetic circuit of mean length 320mm, CSA of 180mm^2 and relative permeability of 8000. (1.7 x 10^5 A/Wb) **PW**



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More on 432MHz meteor scatter

Tim Kirby GW4VXE starts this month's column with a fascinating account of GM0ICF's meteor scatter QSO on 70cm.

Tim Kirby GW4VXE
gw4vxe@icloud.com

In the last column, I included a brief piece about **Bill Ward GM0ICF** who had worked **Ingolf SM6DHZ** on 70cm during the Perseids meteor shower in August. Meteor scatter contacts on 70cm are very rare indeed and, as I said in the last column, I suspect that one or two that have been claimed in the past have actually been completed by aircraft scatter (which, of course, does not devalue them in terms of being an interesting and exceptional contact).

Bill very kindly wrote with a few more details about the contact: *"The 432MHz QSO had been in the planning for a year. Ingolf SM6FHZ was concerned that the radiant wasn't in an ideal position and had suggested some time slots. We settled on 1100 to 1300UTC. This also was the predicted peak time of the meteor shower.*

"As expected, there were not a lot of pings or bursts and then we experienced some quite remarkable bursts! From what I've read about the subject such bursts are extremely rare. There are reports spread over the decades on the 70cm MS pages of OK1TEH. These have lots of useful information if you're thinking about having a go at one of the most difficult modes:

http://ok1teh.nagano.cz/ms_70cmlog_text.htm

"To get several such bursts seems almost unbelievable. Even with these remarkable bursts the QSO still took 1 hour and 42 minutes to complete with reports 36/26 at 1039km. SM6FHZ was running 800W to a 5.5m dish and I was running 4 x 9 homebrew Yagis, I originally built these to work through the Greencube satellite! TX power was about 750W. Gotta love that new power limit!

"It's interesting to consider that if one sums up the total of all the bursts, it comes to about 49 seconds. The total QSO time was around 6120 secs. That's about a 0.8% time efficiency and it must be remembered these long bursts are extremely rare, it could have taken a lot longer! Patience is essential for 432MHz MS! The recordings have a lot of other information about the possible mechanisms involved, they need further study. As a meteor astronomer, this is a total bonus let alone a super QSO".

I was intrigued about the arrays that were being used to make the QSO, because with a 5.5m dish at SM6FHZ and 4 x 9 Yagis at Bill's end, the beamwidth is quite narrow, so you're only 'illuminating' a fairly small portion of the sky, therefore, you'll only 'collect' reflections from that part of the sky. Having a small Yagi can sometimes be beneficial on meteor scatter, as it has a much greater coverage of the sky. **Colin G0CUZ** proved this admirably back in the 1980/90s making hundreds of 2m meteor scatter QSOs with a simple 5-element Yagi. Anyway, I asked Bill about that and he replied: *"I completely agree that as wide a beamwidth as possible is the best option. As long as the signal is above the noise floor and can be decoded it's still a QSO. I regularly use a 4-element (+200 to 300W) on 2m and can get +2000km with patience. But that's the problem, nobody seems to have any patience anymore, I'm NOT an expert in radio communications but some of the comments that one sees on KST Chat for example are exasperating! Large stations complaining that it's taking 15mins to make a QSO. Then even the smaller stations start complaining that they've not had any 'stones' for 30 minutes! I think the Digi modes are fantastic but they seem to have made people expect miracles!*

"If I had the capacity to get antennas up to a reasonable height, I'd re-configure my 9 elements into a vertical stack, to give as broad a horizontal pattern as possible and a compressed vertical pattern. Due the distance between myself and SM6FHZ, some elevation is needed for optimum positioning. This is just as well, since my array was put up for satellite operations, its centre is only 2.5m off the ground. I needed about 8 to 10 degrees just to clear the houses across the road.

"Apart from the QSO, the recordings might contain something quite unique. I've no idea if this has been recorded before and simply ignored as it doesn't really contribute to the QSO. If you look at the audio spectrograms I made (**Fig. 1**)*, there is a distinct burst of noise 3 to 4 seconds before my signal in Ingolf's recording of me. In contrast in stretched images there is a Doppler 'hook' connecting the decoded signal to the noise burst. What this might be showing is the signal from the actual 'meteor head' echo, which will be travelling at the speed of the meteor, the signals hugely Doppler shifted.*

"As the column of ionisation spreads at right angles and starts reflecting the signal, since there is now no relative motion between it and the receiver there is no Doppler. This change in Doppler is what I believe these hooks are showing. Why it takes a few seconds in these cases I have no idea, it could

just be the coincidence of the meteor motion and path geometry. There are very high-speed winds in the mesosphere. Perhaps the trail is stretched out by the winds by blowing in just the right direction. It did happen twice. If this is correct, it might be the very first time it has been recorded. Although, there are no such bursts on the shorter and weaker reflections, so it's just speculation at the moment.

"The theory of scatter at UHF gets a bit iffy due to the losses involved and a huge number of variables. Nonetheless it makes Ingolf's recordings extremely rare. I'm looking forward to the Geminids immensely now!"

Lots of really interesting thoughts from Bill here and it will be fascinating to see what happens with further experimentation. Bill's point about 'expecting miracles' is a good one. Back in the 1980s, the majority of meteor scatter QSOs were made in the defined meteor showers. Some 'sporadic meteor' contacts were made, generally in the early mornings, but this took a while to catch on. With digital modes such as FSK441 and MSK144 came in, people started to try meteor scatter at pretty much any time! Perhaps it should come as no surprise that sometimes you need a little more time.

Why does aircraft scatter seem to work better on 2m than 70cm?

I was interested too, in Bill's comments about the theory of scatter at UHF. I had been talking to **John G8CQX** about this earlier in the month. John monitors the GB3VHF and GB3UHF beacons in Kent from his home in Cheltenham. He sees far more aircraft reflections from the GB3VHF (2m) beacon than the GB3UHF (70cm) beacon. Assuming that antennas and EIRP are roughly equal between the bands, I think I would have expected to see more reflections on 70cm. Why? Because there is a larger reflecting area, in terms of wavelength, from say an A380 on 70cm compared to 2m. But my sense, based on observations is that it doesn't seem to work like that and that the reflections are much better on 2m. I've also seen this when experimenting with aircraft scatter contacts on FT8 on 2m and 70cm. With the higher frequencies, does Doppler play a part in this? If any readers have any thoughts to help me, it would be great to hear from you. There are some talks on Aircraft Scatter coming up at the RSGB Convention – that might help too!

DroidStar rides again

Digital voice modes enthusiasts may well be familiar with the DroidStar app, **Fig. 2**, which runs on smartphones, allowing licensed amateurs to connect to D-STAR, DMR, Fusion, M17, NXDN etc networks from their phone. Development was started by **Doug McLain AD8DP** but then seemed to stall. It's been taken up again by **Rohith VU3LVO** who has created Beta versions for both Android and iOS. The Android version is freely available

Fig. 1: A screenshot of the spectrogram of a meteor burst of SM6DHZ's 70cm signal, received by GM0ICF – the noise burst before the reflection is interesting to study. Fig. 2: A screenshot of Droidstar, now being developed once again. Fig. 3: Stations received by G3XBM during the September 70cm FT8 Activity period.

to try, but iOS is a little more restricted. However, if you want to try the iOS version, you can email Rohith and he will give you information on how to access the Beta.

Certainly, initial impressions are positive and I was able to connect to a Brandmeister DMR network and have a contact from my iPhone. I don't use DroidStar often, but it can be useful when testing and debugging digital radio issues.

The 8m band

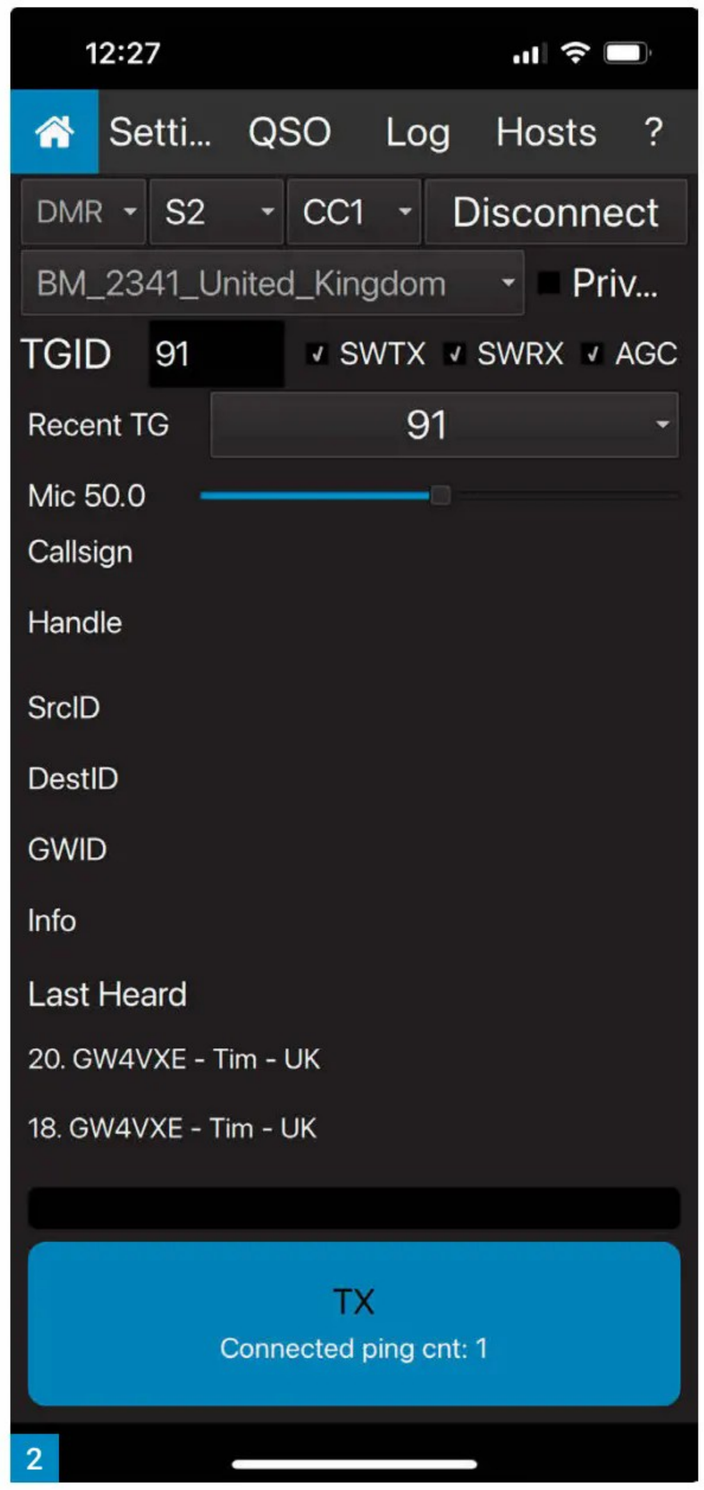
Paul Farley G7PUV (Sussex) operating on 8m as **G9PUV** writes to say that Italian amateurs have been granted experimental access to the 40MHz ISM band until 31 December. Paul says that they wasted no time at all in getting active on the band. On 1 September, Paul worked IS0YFG, I0LYO, IK0FTA and IS0IYE. On 2 September, IW4BET was worked and then on 3 September IW5BHU, I0VHL, IK4RSR, I0KJX, IK5JRZ, IU8MHG and IW0REF. Paul says that on the 3rd it was interesting to note that the Es, which were noted on 28MHz, reached 40MHz but not 50MHz. IK8YTA was worked on 4 September. He says that Italy is pretty much optimum Es range and direction and that it's very encouraging to see so much activity within a few days of the release of the band.

Paul reports a busy time on the band over the next few days too: 05/9/24 ZS6OB, 06/9/24 IK3BNO, ZS3/V51PJ, 8/9/24 IK6FWJ, 9/9/24 IK5YJY, 11/9/24 IW4EGP, CT7BIZ, 12/9/24 IK4MTK, IS0AWZ, 13/9/24 IK2OFO, IW0RGN, EA9IB, EA9E, EI7HBB, CT1FSG, CT2GQA, EA4EQ, EA3BMU, EA8DS, 14/9/24 IS0YFG, S59F, IZ8EOB, IZ8DVD, IK8VRH, IK0OKY, SP5NOF, S51WX, IZ6FLS, IK7FPV, I3VWK, HA6AN, S52O, IK5ZUL, HA6ZB.

It's good to see some F2 contacts in there – ZS6OB and ZS3/V51PJ. Paul says he's been heard by ZF1EJ too, so he's hoping for good things through the autumn.

Paul also writes, *"**Norbert HA6AN** who I worked earlier today (Saturday 14th) has been getting excellent results operating licence-free using the ISM band specification of just 10mW ERP using an inverted-V dipole, he's worked ZS and EA8 as well as most active countries in Europe. Although it's not strictly amateur radio, much like my Trial and Innovation licence it's a good way to experiment on a new band for free and with no licence application necessary, maybe some UK stations might like to try? All activity is centred on 40.680MHz so unless you're checking for beacons this is the frequency to sit on monitoring FT8."*

Roger Lapthorn G3XBM (Cambridge) spotted



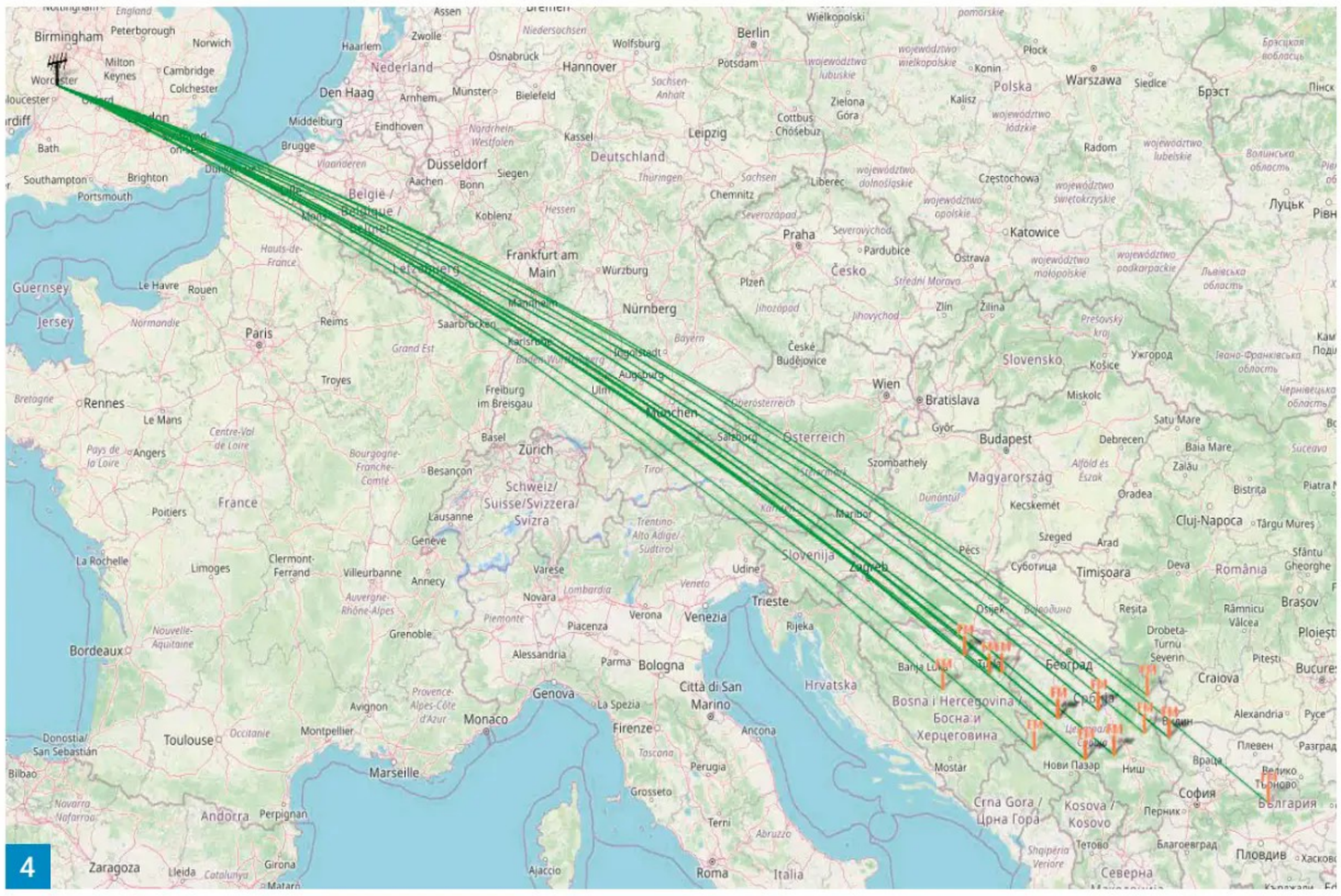
ZS3/V51PJ on FT8 (which is an interesting callsign, combining the old South West Africa prefix, now used for Northern Cape Province, and the Namibian callsign). Roger says that no-one has spotted his 2.5W FT8, using an end-fed antenna which has a very high SWR on 8m. Roger hopes that he will be able to get his 8m dipole back up again shortly.

The 6 and 4m bands

On 6m, **Jef VanRaepenbusch ON8NT** (Aalter) worked RA7A (KN94) on 4 August and CT3IQ (IM12) and EA8DIR (IL28) on 17 August. Jef runs 10W from an IC-7300 to a V-2000 vertical.

Chatting with **Dave Edwards G7RAU** (Cornwall), he feels that when there is a good tropo opening to the south west, both 4 and 6m are affected too, with EA8BPX always being a good signal on both bands and he says that in the past he has worked D4 on both 4 and 6m – a 4000km tropo contact is

Fig. 4: Simon Evans caught an Es opening on the Broadcast FM band on 14th September, receiving these stations.



quite something on any band.

Although I have certainly been aware of tropo on both 4 and 6m, I think I would have tended towards the view that openings would be over fairly short distances, because the duct to support such an opening would have to be very large. However, I suppose if the duct is almost entirely over the sea, being a relatively stable mass in calm conditions, maybe this becomes more likely. Something else interesting to think about!

Don G3XTT (Wells) reports that DX has been few and far between on 6m but towards the end of our reporting period XT2AW was in three days in a row late afternoon, often with very strong signals. V5 and PY were also copied again and Don notes that in the last day or so G stations had also been working into LU and CE. The big question is whether the propagation will allow TEP QSOs with Lance ZD9GJ (W7GJ), currently active on 6m from Tristan da Cunha.

Like many others in the UK, I suspect, here at **GW4VXE** (Pembrokeshire) I pointed my 6m beam out to the west when the CY9C expedition was taking place. I didn't hear them, but it was quite interesting to note that I heard at least a couple of US and Canadian stations briefly, who were presumably also beaming towards CY9C. It made me wonder whether fleeting propagation, even across the Atlantic is more common than we expect on 6m. Although I didn't work CY9C on 50MHz, I understand that at least one UK station did so.

The 2m band

It's great to hear from **Gary Sangwell 2E0IHS** (Berkshire) for the first time. Gary worked CT9/OM3RG on 26 August on FT8. Gary used an FT-991, 35W and a Diamond A144S10R 10-element Yagi. Gary was particularly pleased with the contact as his antenna is only 5m above ground.

Jef ON8NT had a good month on the band. Towards the beginning of the month, there was some tropo when he worked GW3ATZ (IO83), G7RAU (IN79), M0DSR (IO82), F4EVV (JN08), F6CIS (IN94), F6GNR (IN97), F1MLN (IN99) and F1GTU (JN05). There was some Es on 6 August and Jef worked YO7FWS (KN24). More tropo from 12 to 20 August when he worked DK1FG (JN59), F4EVV (JN08), G7DCT (IO93), F6CTT (IN97), F4BKV (IN95), EC2BBS (IN93), F6CIS (IN94), F5DYD (JN03), F6GRA (JN04), EA2AGZ (IN91), F1NZC (JN15) and F5GHP (IN96).

Ian Bontoft G4ELW (Somerset) says that he has been away for much of the month, but worked EA2XR (IN83) on 26 August using 15W of FT8 to a low 5 element. Ian also writes, *"Interestingly I had a report of drifting on FT8 using my (just switched on) FT-991A. As the rig has a TCXO, I had never given much thought to the possibility of this, but I do tend to work split on FT8 and it prompted me to check the radio settings in WSJT-X. Sure enough, split operation was set to 'Fake It' and Googling around it would appear that even with a TCXO the (single) VFO does not always return to exactly the same frequency when switching between TX & RX. I have now changed the setting to 'Rig' (so now using both VFOs) for split and have had no further reports of issues. It did however prompt me to look at other stations' frequencies and very few are 'rock solid'."*

I've tended to use (and recommend) people to use 'Fake It' because WSJT-X will then always transmit an audio frequency above 1500Hz, avoiding the possibility of harmonics being transmitted and causing interference. It's interesting that Ian has observed this effect with the FT-991 though.

Dave G7RAU worked CT9/OM3RG on 14 August at 1855 – wait for it – using a budget Quansheng UV5K with a whip attached to the handheld. Dave says that his Quansheng is using the IJV firmware, which allows the handheld to transmit DSB. Dave says that **Stevo CT9/OM3RG** was S9+50dB on the 16-element Yagi – so he thought it would be fun to try the Quansheng! Dave says that tropo has been poor this year, with few openings to the south west (EA8/CT3/D4) compared to usual.

The 70cm band

Bill GM0ICF says that on 12 August, following his MS QSO with SM6FHZ, he started to notice auroral signals on 6m and 2m and wondered if he might be able to make his first auroral QSO on 70cm. He could hear some signals in and out of the noise, but nothing consistent until he heard GM4BYF (IO85) who he was able to work very easily, swapping 55A/57A reports.

Jef ON8NT worked EC2BBS (IN93) and F6CIS (IN94) on 19 August.

Roger G3XBM is always amazed at what he receives on 70cm FT8 during the Activity sessions, using his 2m big wheel antenna, **Fig. 3**.

Satellites

Unfortunately, no report from **Patrick WD9EWK** this month – the AMSAT email address seem to have a problem currently, so our lines of communication are broken! However, there is bad news for Greencube users. It's starting to look as though this excellent satellite may be inoperative. Efforts to revive the satellite continue, but so far they have failed. It's a great shame; Greencube made all sorts of satellite contacts possible, allowing many satellite operators to complete DXCC, WAS and even Worked All JA awards. Greencube's unique capability was that it was in a Mid Earth Orbit and thus able to have a much greater footprint of the Earth. Sadly, a replacement seems unlikely, with the main difficulty being getting a satellite to such an orbit.

Thank goodness for RS-44! Jef ON8NT used FT4 to work PD5JOS (JO21), PA3GAN (JO21), N2YZH (FN22), EB3SA (JN11), G1YEF (IO83), EA3EA (JN01) and HB9FVL (JN36).

Broadcast FM and DAB

Simon Evans (Gloucestershire) says that, as you would expect, Es openings have diminished somewhat as we move towards the end of summer and into autumn. There has been some tropo into northern Spain as well on 14 September an Es opening from around 1000 to 1200 local time to the southeast, with Simon's best DX being BNR Hristo Botev in Bulgaria on 92.2MHz, at a distance of 2268km, **Fig. 4**.

Final

That's it for this month. Hopefully by next month, we shall have a few more 50MHz F2 openings to report on. Thanks to everyone for their news and please keep it coming. **PW**

More from RSGB

Don checks out some more books from the RSGB.

Don Field G3XTT
practicalwireless@warnersgroup.co.uk

The RSGB and the ARRL are the two primary publishers of amateur radio books in English. So, it's always worth keeping an eye on what they have to offer. Yes, many of us rely on the internet when we want to know something but, personally, I still like to have a bookshelf of amateur radio reference books for instant access.

RSGB Handbook of Radio Communication

I bought my first *RSGB Handbook* back in about 1967, a year or so before I was licensed. Indeed, I wish I had hung on to it – it would have been fascinating to look back at it (although, as it happens, I have subsequently been gifted a Second Edition from 1941, price three shillings and sixpence at the time!).

The current edition is the fifteenth and it has grown substantially over the years! This one has been edited by **Ed Durrant G8GLM/DD5LP** and quite a task it must have been. Of course, the individual chapters (25 in all) have been written by a wide range of contributors, many of them well known to *PW* readers – **Steve Hartley G0FUW**, who authored our recent QRP transceiver series, **Roger Cooke G3LDI** who writes our bi-monthly *Morse Mode* column and **Andrew Barron ZL3DW** who featured in my recent (September) book reviews.

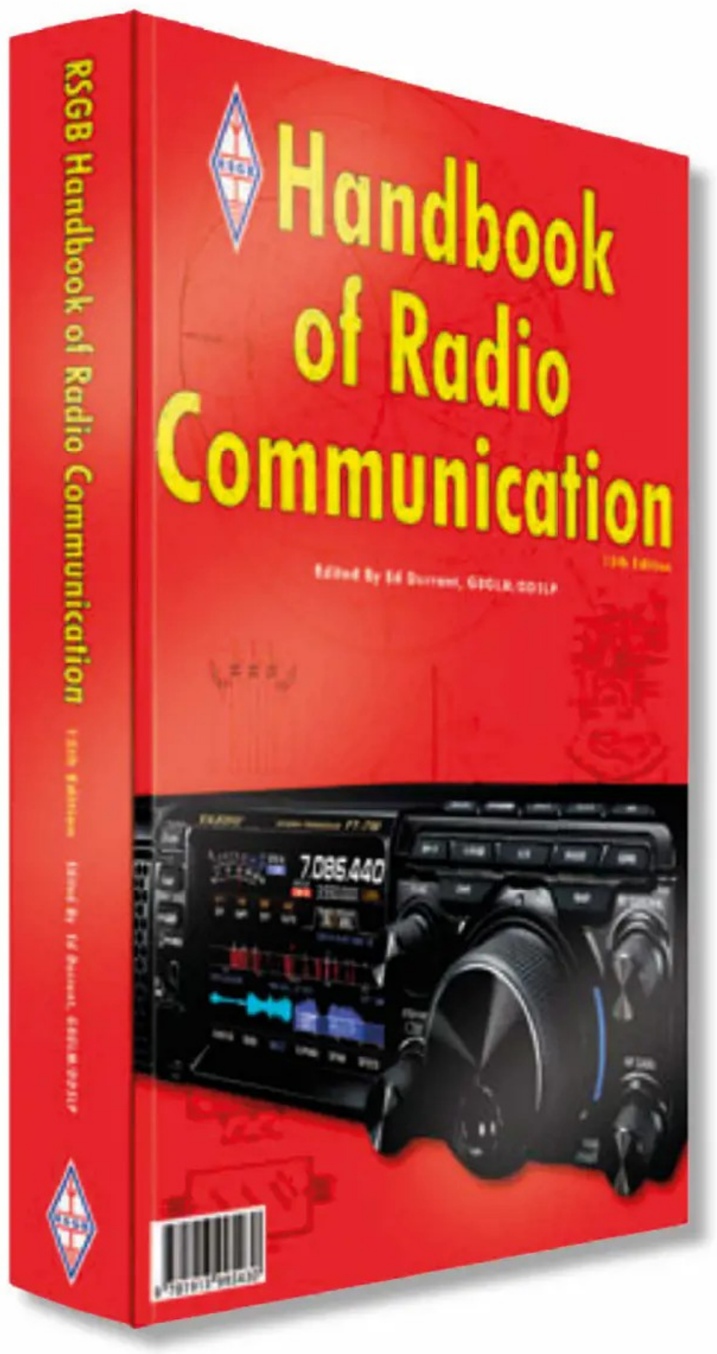
The book is largely a technical one – operating amateur radio is left to a separate publication, *The Amateur Radio Operating Manual*, also edited by Ed Durrant.

The Handbook follows a logical sequence, starting with a chapter on basic principles, moving on to passive components and semiconductors, then to the use of these in oscillators, amplifiers, mixers, etc, before putting the elements together to discuss receivers, transmitters and transceivers.

Subsequent chapters cover specialist areas such as low frequencies (below 1MHz) and QRP operation, before moving on to propagation and antennas (divided between HF, VHF/UHF and microwave). There is a chapter on 'the great outdoors' before looking at Morse and data communications. The book then moves on to computers in the shack (an essential for most amateurs nowadays), electromagnetic compatibility, power supplies, measurement and test equipment and, finally, a chapter on construction and workshop practice. There are two appendices – the first containing lots of useful data from basic formulae to various filter design calculations, the second having printed circuit artwork for many of the projects appearing earlier in the book,

As the pages are numbered by chapter, I have no idea how many there are in total but it's a lot! The book is well illustrated with drawings, circuit diagrams and photos – more than enough to keep the home constructor happy for years! But there is plenty to occupy others too – if you want to know about the equipment in your shack, rather than simply operate it, there should be plenty in here to inform you. And as you'd expect, there's a good index.

"The Handbook follows a logical sequence, starting with a chapter on basic principles, moving on to passive components and semiconductors, then to the use of these in oscillators, amplifiers, mixers, etc."



What I didn't find was anything about checking out safe distances from your antennas to meet Ofcom rules – an odd omission in my view.

All in all though, a comprehensive tome which, although pricey, should probably find a place on most amateurs' bookshelves and, although new editions will no doubt appear in due course, I'm sure there will be no need to replace it each time!

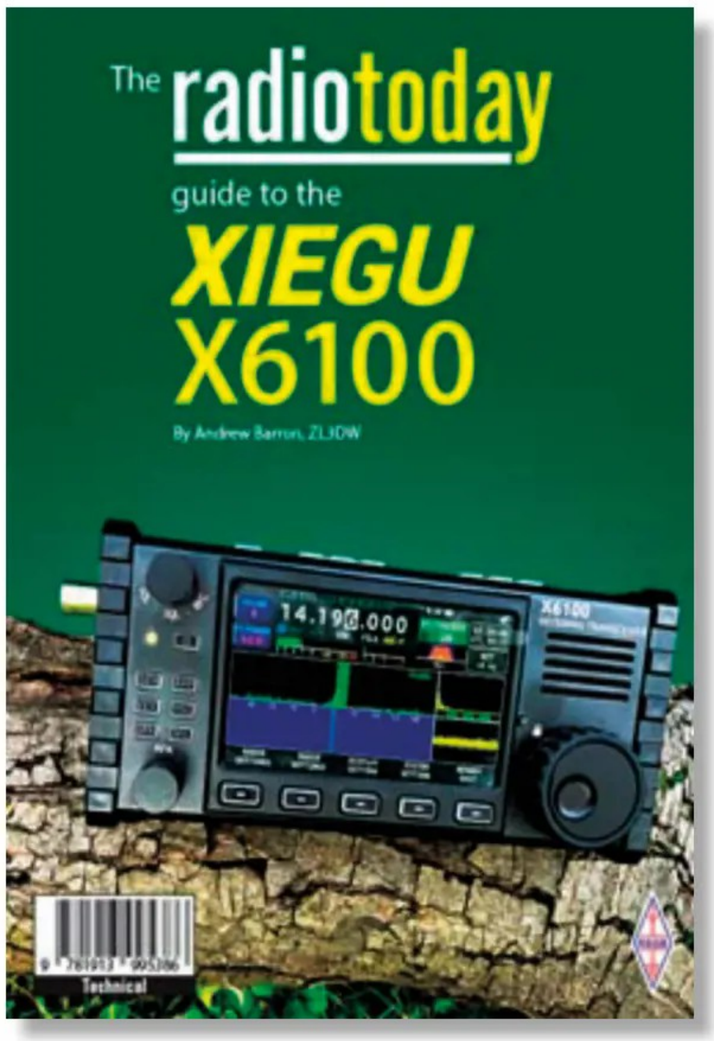
The *RSGB Handbook of Radio Communication* is available in hardback at £49.99 (£39.99 for RSGB members), in paperback at £39.99 (£33.99 for members) and individual chapters can also be bought as PDFs – see the RSGB online shop for details.

HF Amateur Radio for Everyone

This 114-page book is written by regular *PW* author and reviewer **Daimon Tilley G4USI**, and serves as an introduction for HF mainly for those coming to HF operation for the first time, either because their amateur radio journey started on VHF or perhaps, they are entirely new to the hobby.

The book, therefore, starts with a chapter 'What is HF?' and then goes on to discuss how signals travel on HF (via the ionosphere for the most part, unlike VHF and above), before looking at the HF bands available and the modes used. It then goes on to choosing a suitable rig, planning your station and, of course, antennas. All this is at the level of the beginner – I didn't spot anything about big towers and large Yagis! A chapter on operating is followed by one specifically about QRP operation. This is followed by a short chapter on awards (there are a huge number of operating awards available to amateurs – only a few are covered here) and one on operating activities – again, the author covers just an indicative selection, nowadays there is a plethora of '….on the Air' programmes as well as special event stations and much else. He moves on to 'HF on holiday' before finishing with a chapter entitled 'Weekend Projects and Activities' with suggestions, for example, of trying new modes, playing at different power levels, putting together a simple antenna for portable operations and so on.

All in all, this book does no more than scratch the surface of HF amateur radio. As one who started on HF and has been active on HF ever since, albeit with occasional forays onto VHF and UHF, I am acutely conscious that there is much more to be said about HF operating and, in fairness, the author includes a list of websites at the end of each chapter for further exploration. If you are new to HF, this book will almost



certainly prove handy. If you are already active on the HF bands, you probably won't learn much that is new.

HF Amateur Radio for Everyone is (at the time of writing) available on special offer from the RSGB for £9.99. A Kindle version is also available.

The Radio Today Guides to the Xiegu X6100 and the Icom IC-705

These two books are by **Andrew Barron ZL3DW**, author of the 'Work the World with …' books I reviewed two months ago and of several other radio-specific guides. He is certainly prolific!

The *Guide to the Xiegu X6100* runs to 106 pages and is intended to complement rather than duplicate the handbook that comes with the radio. The radio has been around for a while now – **Daimon Tilley G4USI** (yes, he of *HF Amateur Radio for Everyone*!) reviewed it in these pages for our June 2022 issue. It is a QRP rig covering the 160 through 6m bands.

The author states at the outset *"The aim is not to replace the manual but to more fully explain how to configure and operate the radio to take advantage of its many great features. For example, when I cover the front panel controls, I explain not only what the control does, but how and when to use it. Along the way, I offer a few 'tips' on how I configured my radio"*.

Which is all good stuff insofar as modern SDR rigs, which this is, offer a vast number of configurable options, and it's necessary to find your way around them, at least initially, especially if, for example, you want to play with the modern digital modes. Yes, we have come a long way from those earlier HF radios that simply had jacks for microphone, Morse key and headphones, and a handful of controls!

I won't try to cover all the contents but the author, logically, starts with an overview of the radio, initial setup and operation, along with programming the voice keyer, Morse memories and memory channels. There is a discussion of using Wi-Fi and Bluetooth with the radio (the latter apparently is not too well implemented), which leads on to how to update the firmware – one of the benefits of SDR radios is that as enhancements and 'fixes' come along, they can easily be added. Indeed, in his *PW* review, Daimon stated, *"In my experience it takes Xiegu quite a little while to get to the point where the user can be satisfied that all functions perform well"*. The good news is that, as this rig has been around for a while, most features are now pretty much sorted.

Further sections of the book deal with the various controls and interfaces. Yes, although it's a QRP radio, it really does have lots of features and also has a very nice, clear screen, albeit not a touchscreen.

The *Guide to the Icom IC-705* is, not unsurprisingly, somewhat more meaty, just over twice as long in fact, at 220 pages. This rig was reviewed by **Richard Constantine G3UGF** in the December 2020 issue of *PW*, so is probably about at the middle of its life, but has proved extremely popular, perhaps because Yaesu have only in the last couple of months announced a rig that could reasonably be described as a direct competitor. The IC-705 is another QRP radio, but more sophisticated than the Xiegu (and costing rather more!), covering 160m through 70cm. The radio has an excellent touchscreen, built-in Wi-Fi and even GPS, which is handy if, as it is intended, you are out portable with it. There is D-STAR built in, and the rig receives on a wide range of frequencies outside the amateur bands too. So

"It's perhaps worth mentioning that these Radio Today Guides are being added to all the time."

quite a lot for the author to cover, again in a way intended to complement rather than duplicate the Icom manual.

So, this one, as you might expect, and as the page count suggests, has a lot of information (although, thanks to Icom, the interface is very much the same as the IC-7300, IC-7610 and IC-9700). The book starts with an overview of the transceiver, then moves on to the menus and functions, showing you how to set up the radio for your operating preferences. The front panel and touchscreen controls are explained, leading into actually operating the radio. There are chapters on D-STAR, the CS-705 software, the side panel connectors and more. The book finishes with a comprehensive index, a list of online resources and a Quick Reference Guide.

Again, both books are available from the RSGB Bookshop. The *Guide to the Xiegu X6100* costs £14.99 (members' price £12.74) and the *Guide to the Icom IC-705* is £16.99 (RSGB members £14.44).

www.rsgbshop.org

It's perhaps worth mentioning that these Radio Today Guides are being added to all the time and now include, for example, guides to the Icom IC-905 and the Icom IC-R8600 receiver, as well as to the Yaesu FT-710 and FT-991A. As the owner of an IC-7300 and IC-7610, I have both those guides and find them very handy. **PW**

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Various

Dear Don,

Many thanks for *PW*, which I think is great as its content has something for almost everyone. I find the range of articles excellent and the recent series by **Steve G0FUW** made me want to have a go at constructing a QRP set. Now you've published the article by **Richard G3UGF** on building the Kanga Rooster, I don't know which to build. The article by **Tim Bolt** took me back to my days repairing televisions in the early 1970's. We had a wobbulator in the workshop and if I remember correctly, it was used for alignment purposes to ensure a sufficient bandwidth was obtained. This makes me think that the problem Tim has encountered with his receiver relates to the IF frequency. If it should be 10.7MHz, then why is it resonant at 10.5MHz? I know this is only a small difference but we come back to the bandwidth and gain of the stage.

Moving onto VHF and especially 2m activity, I can look back to the days of calling CQ and announcing *"tuning high to low"*, then we moved onto the 25kHz channel spacing and then 12.5kHz spacing to try and fit everyone in. I have to ask why are amateurs asking for the likes of the 8m band? There is a danger that we lose what we don't use so why ask for more? To the argument about serious experimentation on 8m, I have to say it's a band that will work like one between 10m and 6m so no real surprises there. I have invested money in my VHF equipment as have many amateurs, it would be a serious financial blow if we were to lose 2m due to inactivity. How we reverse this is a very difficult question and has many causes to be addressed. Do we need as many repeaters now, do we need 12.5kHz channel spacing? I feel that the main manufacturers are reducing the number of dedicated VHF/UHF sets they offer, do they think the band plans will change and they don't want to be left with a lot of redundant equipment?

I'm looking forward to the next edition and to see what **Joe Chester** has to say. I wonder if the various digital speech modes are having an impact on apparent VHF activity? Back in those halcyon days when it was difficult to find a spare channel, we used FM mainly. There was some SSB and CW activity but the main mode was FM with 25kHz spacing. Is there now lots of activity but on D-STAR, C4FM and soon to be joined by M17 Protocol? Another thought, I always believed that we were supposed to communicate in 'plain language'. Using FM, SSB or CW is plain language that communications or Ham Band receivers are designed to receive. The digital audio modes can only be decoded by appropriate devices and I feel this is not plain language. This is like the VHS versus Betamax issue of the 80's, why create different systems that are not compatible? One will always prove more popular to the detriment of the others.

Tom Brady GW8HEB
Welshpool, Powys

Reciprocal Mixing and Classic Rigs

Dear Don,

I was delighted to see that **William Blankley G8CMK** is still going strong. I recall we worked on many occasions in the good old days and I send him my best wishes.

He mentions reciprocal mixing and it is something that dogged most receivers until about ten years ago when oscillator design took a massive step forward. It dramatically reduced receiver noise and what was often thought to be splatter from stations on nearby frequencies. Take a look at Sherwood's listings and compare the top 10 with the bottom 10. The difference is huge.

On the subject of modifying old radios, I think it is a mistake to try to upgrade the circuitry with modern components or improved design. It is like having a vintage car and putting a modern engine in it. These radios can be repaired and obviously some modern components may be the only answer. But I think they should be as close to the original as possible, warts and all!

On that subject, can I congratulate **Daimon Tilley G4USI** on restoring his HW-9 Heathkit. What pleasure he must get from knowing that he has changed a radio that had been butchered to a pristine transceiver looking and working as good as new.

Graham Lindsay G8BZL
Hove

Lack of 2m Activity

Dear Don,

I took this snapshot (see photo) from my SDR Play receiver a few moments ago. The span runs from 144.000 to 148.500MHz and the only meaningful trace is a SCADA/Telemetry transmission on

147.800. Granted it's a horizontal Halo for the 2m band, but it does recover the Airband very well and I suspect the SCADA antenna is vertical.

I really enjoy amateur radio but I think this reinforces what I said to you last time regarding lack of use on 2m. If nothing else it's made up my mind to concentrate on HF instead of VHF. All the best and enjoy HF!

Richard White G6NFE
Shrewsbury

QRP & VHF Handhelds

Dear Don,

In the October *PW*, **Andy G0FTN** expressed his 'gripe' about the absence of any articles on VHF handheld operating in QRP Journals or newsletters, and the obsession with two-transistor transmitters for 40/20m. As the Chairman of the G-QRP Club, I feel I must respond to both agree and disagree with him.

Andy is 100% correct in that there have not been any articles on handheld operating in our Journal (*SPRAT*) for some time. I wrote a piece (many moons ago) about using my 2m FT-290 from a Scottish hilltop. That may not have been a handheld, but it was portable QRP VHF and jolly good fun; I recall best DX was Norway, with 2.5W out. However, we can only publish what members write, and if no one writes an article, it cannot be published.

Coincidentally, the latest *SPRAT* (#200) dropped on my doormat a day after *PW* and it includes articles on homebrew test equipment, experiments on the 600m band, an Arduino-based digital VFO, a book review of the T41-EP Software Defined Transceiver, as well as the 'obligatory' two-transistor transmitter, but that uses surface mount devices, so not exactly the same old, same old. Yes, there is some

'nostalgic' content with a number of valve projects being outlined. Amateur radio is a broad church and QRP is no different; lots of members enjoying lots of different aspects of our wonderful hobby.

Whilst Andy's perception about QRP being all about 2W two-transistor CW rigs is inaccurate, I am with him on encouraging more VHF QRP activity. For example, the G-QRP Club's construction competition for 2025 is focusing on 50MHz, to chime with its 50th anniversary year. That will, no doubt prompt a few VHF articles, and maybe some hilltop portable activity.

Steve Hartley G0FUW
Bath

Ramblings from Ray!

Dear Don,

G4USI's restoration of a Heathkit HW-9 in the October 2024 issue, stirred the embers of remembrance for me. I owned one of these rigs back in the 1990's. I recall buying it at a Longleat radio rally, partially built. It was previously the property of a Silent Key. Sadly, he only managed to complete half of the build or so.

The stall holder informed me that although there had been some interest, the fact that you couldn't apply volts and operate it immediately *"had put the mockers on it"*. *"Maybe the wrong people were here"*, I explained. Anyway, after I'd expressed an interest in buying it, but at the right price, I told the seller I would return later in the day. Come 3pm, I was back at the stall and into protracted negotiations. Twenty minutes later, I was the proud owner of a partially built HW-9. £95.00 (I was so eager, I would have signed my own death warrant to walk away with it). I had it up and running in a couple of weeks. I didn't have many of the problems that had beset Daimon. My HW-9 was to all intents and purposes like brand new.

So, enamoured with my new toy, I operated it frequently. Conversations via CW came and went. I sold it to a fellow Heathkit devotee about three years later to a Glaswegian bloke. He waxed lyrical about it, told me he was *"as pleased as punch"*. Maybe he still has it? There again, he was in his late sixties, so maybe not.

Yep, as G4APD notes, one of the things that partially sounded the death knell for 2m operations was the ban on the use of handheld microphones. Let's face it, it was a dangerous thing to do. I had a few close shaves. But I never had anyone confuse me with a taxi driver. Nor someone banging on my car window asking me to follow that red car in front. And yes, back in the 1980's, most repeaters were chock-a-block with tongue wagging. It was difficult to get a word in edge-wise. That was then, before the advent of a multitude of data modes and all the other technological shenanigans that pervade ham radio now. However, that fact still doesn't really address the question as to why so many handheld and mobile VHF/UHF rigs are bought each year. And why some people change their handheld rigs as often as my partner buys another pair of new shoes. When, like my partner's shoes, it seems they rarely get an outing. It can't just be the temptation of the new, or more money than sense, can it?

I trot off to Devon regularly. For my sins, I have a property in Sidmouth which I visit often (luckily, the next door neighbour has lots of time on his hands, so he keeps an eye on it for me), and as is the case with G4APB's excursions to Devon, I also find that 2m FM repeater activity is not exactly brimming over with people looking for contacts in that neck of the woods. Or for that matter, many other parts of our Sceptred Isle. It never used to be like that of course. Those of a certain age that can remember how ham radio used to be, the 1960's or the 1980's for example, will know that ham radio nowadays is as different as, well, chalk and cheese. In my humble opinion, there is far too much chalk and not enough cheese, if you see what I mean?

I have to confess though, that I did at one point become concerned, even anxious, about where ham radio was headed. Because one momentous day when our hobby would finally set off on its journey to embrace the inevitability of technological advancement that would transform ham radio, anxiety set in. To me, past ham type happenings had been comforting. The new was an unknown and a touch frightening. But I found that acceptance is the key here. Going with the flow. When I did this, my irrational anxiety disappeared and never reappeared. But I still do wonder why so many handhelds are being sold. I'm not anxious about it. Just curious.

Ray Howes G4OWY/G6AUW
Weymouth, Dorset

Next Month

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MALAHIT DSP 2 REVIEWED: Daimon Tilley G4USI checks out this interesting SDR-based receiver.
THE EIFFEL TOWER IN THE EARLY HISTORY OF RADIO: Georg Wiessala looks at how the Eiffel Tower has been used for various radio purposes over the years.
PORTABLE 80m AM CLASS E TRANSMITTER: Eric Edwards GW8LJJ returns with a design for something a little different.
PW 144MHz QRP CONTEST RESULTS: Colin Redwood G6MXL has the results of this year's event.
ARGONAUT RESTORATION: Mike Dunstan G8GYW tackles the restoration of a classic Ten-Tec Argonaut 509.

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

The publishers reserve the right to change content according to circumstances.

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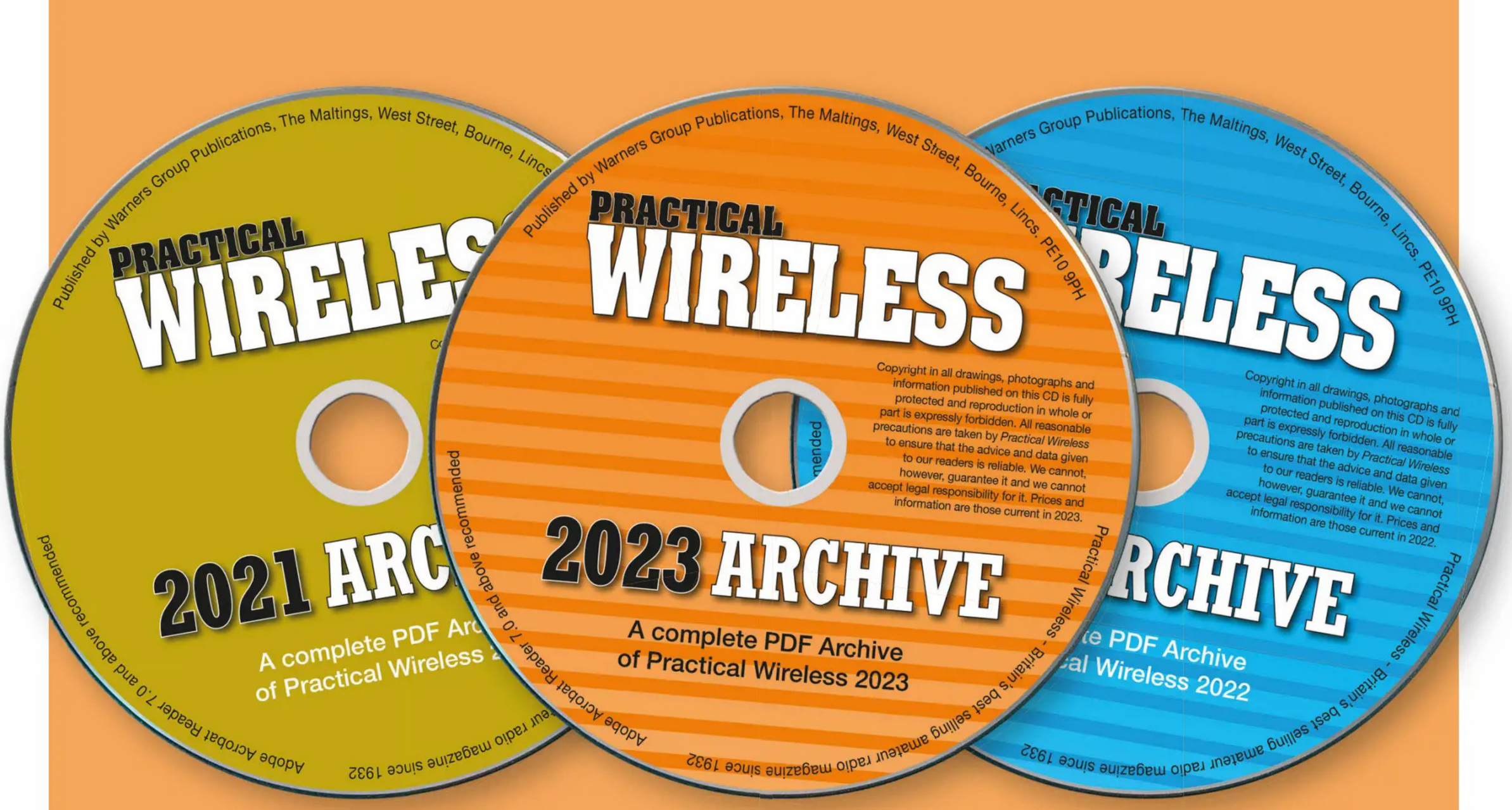

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* Photo shows the FT-710 AESS

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YAESU UK Ltd
Unit 4, Concorde Park, Concorde Way, Segensworth North,
Fareham, Hampshire PO15 5FG

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