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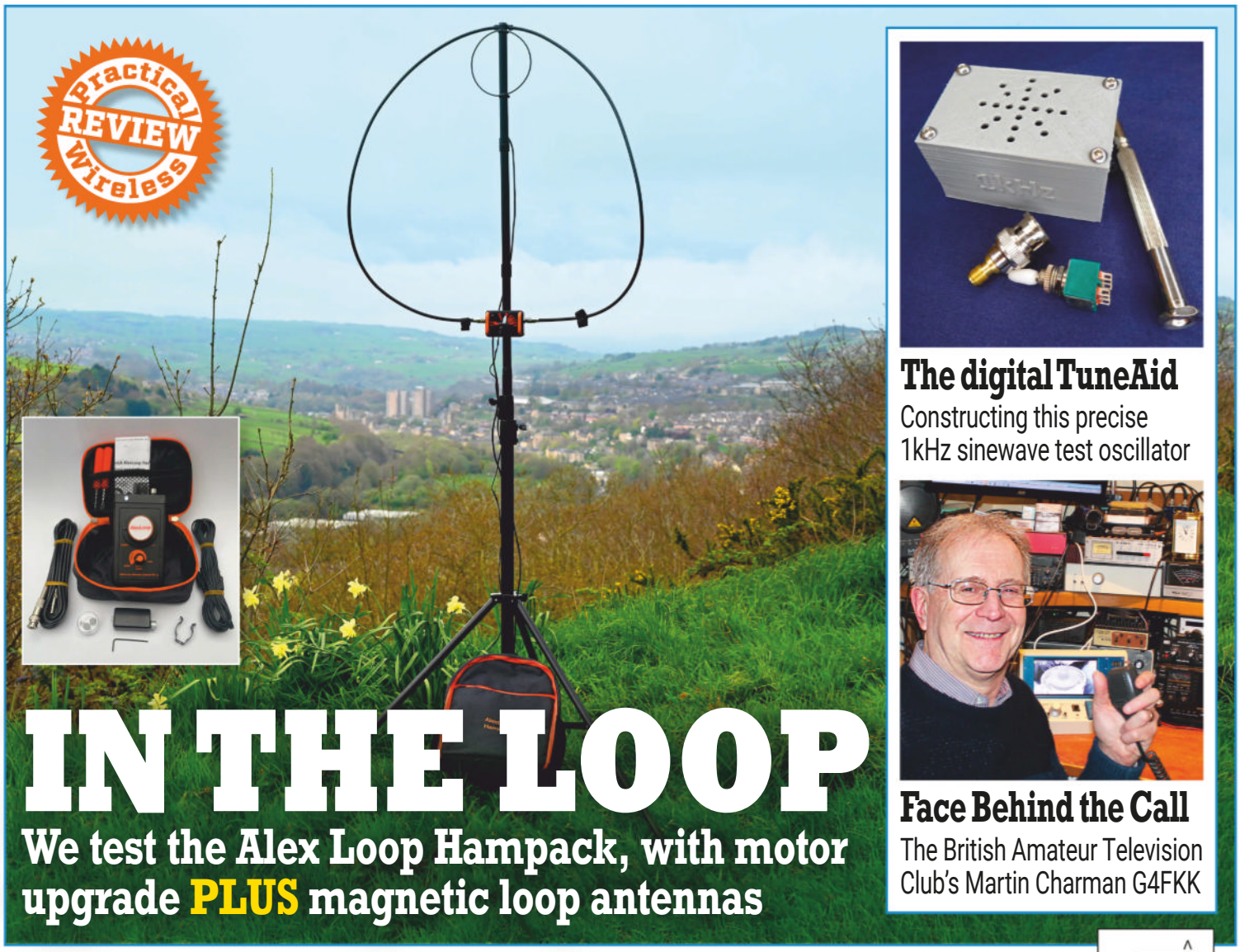

IN THE LOOP

We test the Alex Loop Hampack, with motor upgrade PLUS magnetic loop antennas

The digital TuneAid

Constructing this precise 1kHz sinewave test oscillator

Face Behind the Call

The British Amateur Television Club's Martin Charman G4FKK

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Keylines

Another month and we are almost halfway through the year! Where does the time go? I am already thinking about the August issue of *PW*, publishing being what it is. HF band conditions have, for the most part, been good with some exceptional propagation on the 10m band, albeit a total blackout when that aurora struck! (I am gutted that I failed to look out for it – apparently even here in Somerset the views were spectacular – I have seen some amazing photographs taken at Glastonbury Tor, just a few miles from here.)

The aurora brought some excellent VHF propagation for a couple of days, as **Tim Kirby GW4VXE** covers in his column. And we are at the time of year when Sporadic E propagation has started and TEP (transequatorial propagation) is still around, giving us some interesting north-south opportunities on 6m in particular.

And if construction rather than just operating is your thing, we have some great articles for you again this month.

Magnetic loops

On the subject of which, we have two articles on magnetic loops, one a constructional article and one a review. I also have two other magnetic loop articles in the pipeline. I need first to apologise to the authors for sitting on these for so long, but I have a (good) problem in that I have quite a backlog of great articles to use at the moment, as well, of course, as finding space for our regular columns.

Anyway, I know there is a lot of interest in magnetic loops and these articles will hopefully give some useful ideas. An American acquaintance of mine, who lives on a small 'lot', has quite a lot of experience of loops and has written extensively about them. He believes a lot of misinformation exists about them on the internet and elsewhere. His advice includes, *"Do not rush out and sell your beam, the loop still has zero gain over a dipole. In fact, a dipole that is a half wavelength above ground will beat the magnetic loop, but this antenna is vertically polarized, with much less noise than any Marconi or Ground Plane antenna. It is so narrow banded that it acts as a bandpass filter, virtually eliminating TVI and greatly reducing RFI"*.

He goes on to say, *"The efficiency of any antenna is the ratio of radiation resistance to ohmic resitstance. Since the radiation resistance of a magnetic loop is very low, any ohmic resistance is intolerable. This mandates using copper as a construction material and soldering all of the joints. In addition, the largest diameter material available should be cleaned thoroughly. Copper tubing is available and can eliminate soldered joints but can be rather expensive.*

"The efficiency drops as the requirements for a tuning capacitor grow. A multiband magnetic loop is a proper antenna at the highest frequency. Adding capacitance lowers the resonant frequency but at the cost of reduced efficiency at the lower frequency. There is no 'free lunch'.

"The tuning capacitor is at a high voltage point. For a power of 2kW, over 17,000V are present at the capacitor. A plate spacing of 1in or better is required to prevent arcing.

"The design of the loop is very easy if you understand the rules. The optimum efficiency is when the circumference is about one third of the wavelength. Just think 'metres' and 'feet'. So an antenna for the 20m band should be about 20ft in circumference. Building loops for a single waveband is preferable to trying to build a compromise antenna for several bands".

News pages

We have a bumper crop of *News* pages this month, largely as a result of a last-minute flurry of News from the Dayton Hamvention which I thought worth including – in particular a couple of interesting new product announcements. Incidentally, reports suggest that the attendance at Dayton this year was at a record level, which is good to hear.

Don Field G3XTT
Editor, *Practical Wireless* Magazine

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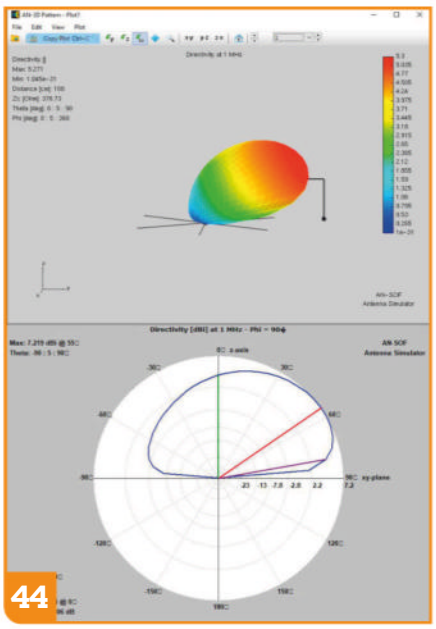

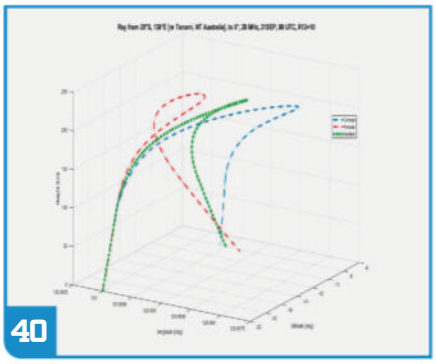

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Newsdesk

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

Latest news from Icom

Icom report over 100,000 sales worldwide for their acclaimed IC-7300 HF transceiver since its launch in January 2016.

The press release states, *"From Day one, the 7300 etched a significant place in Icom's amateur radio lineup boasting our 'first-ever' model with RF direct sampling system. This technology converts RF signals directly into digital data, which is then processed within the FPGA (Field-Programmable Gate Array). Using this clever approach the 7300 offers the perfect blend of high performance whilst using a simplified circuit design, all housed in an attractive, compact, and user-friendly end product.*

"Previously the domain of high-end models, the 7300 also boasts an integrated real-time spectrum scope and waterfall function, which considerably enhances receiver performance and maximises QSO opportunities. These features, coupled with its competitive price, have firmly established the 7300 as a true benchmark, enjoyed by a broad spectrum of HF enthusiasts – as evidenced by the phenomenal sales results.

"'We are delighted that the 7300 has found strong support from our customers worldwide', said an Icom engineer from the original design team. 'The RF direct sampling transceiver was a significant challenge to us, but our relentless efforts and results allowed us to balance both compactness and high performance into this incredible radio. The 7300 continues to be groundbreaking in amateur radio technology.'

"The International Sales Department's General Manager added, 'The 7300's popularity has been a resounding success across the globe. It has been well received and chosen by a broad range of Amateur Radio users, from beginners to experienced operators, this is all thanks to its reasonable price, its superior performance, and its extensive features. A best-seller in our lineup, we will continue to promote the 7300 to meet ongoing demand.'"

ICOM 60th Anniversary Concept Model 'X60'

At the Dayton Hamvention Icom released a snippet of what is around the corner from them. Referred to internally as the 'X60' all lips are very tightly and firmly sealed about this project and the exciting concept model behind the secrecy. Only a carefully selected handful of Icom's very top development gurus and members of the absolute senior management in Osaka know the complete and full details about this very special project.

Icom UK said, *"Along with the rest of the global HAM community, ICOM UK will have to wait until later in the year for the full reveal to learn more about the X60, but we can assure you that all of us here in Herne Bay are very excited about what is coming next from ICOM."*

The full reveal will be at the Tokyo Ham Fair, which will be held over the weekend of 24/25 August.

Latest Icom Firmware

Meanwhile Icom have released new firmware for several of their current models: Latest Icom IC-7851 (Version 1.41), IC-7610 (Version 1.41), IC-7300 (Version) 1.42 and RS-BA1 (Version 2.60) Firmware Updates: **https://tinyurl.com/y8794hsr**

FLEX-8000 announced at Dayton

The FLEX-8000 Series next-generation SDRs build on the success and original idea of the FLEX-6000 series. Like the FLEX-6000 before it, the 8000 series contains ground-breaking new hardware capabilities and performance to enable next generation capabilities that are simply not possible on earlier hardware. Broad increases in CPU, FPGA, attached memory, and other capabilities have been included in the FLEX-8000 to lay the groundwork for innovations now in development.

Chief among the early capabilities is Adaptive Pre-Distortion (APD), bringing the cleanest signal possible from an Amateur Radio platform. The FLEX-8000 series will be FlexRadio's native APD platform with all FLEX-8000 radios having this capability.
Also included in all FLEX-8000 models is an integrated, standard Global Navigation Satellite System (GNSS) capability and future integrated NTP time server. This capability will ensure that all FLEX-8000 radios always remain on frequency. Without any view of the sky, the FLEX-8000 can continue to run on the internal TCXO.
The FLEX-8000 Series line will consist of four models: the FLEX-8400, the FLEX-8400M, the FLEX-8600 and the FLEX-8600M. All models incorporate the latest in FPGA, ADC, and CPU technology offering 4x the CPU power of the 6000 series and twice the performance in the FPGA over the FLEX-6000 series allowing for exciting new features and capabilities over time. The Flex-8000 series will be available from August 2024.

MFJ to cease manufacturing

The following was released on 25 April: *"Dear Fellow Hams and Friends, It is with a sad heart as I write this letter. As many of you have heard by now, MFJ is ceasing its on-site production in Starkville, Mississippi on 17 May 2024. This is also the same for our sister companies Ameritron, Hygain, Cushcraft, Mirage and Vectronics.*
"Times have changed since I started this business 52 years ago. Our product line grew and grew and prospered. Covid changed everything in businesses including ours. It was the hardest hit that we have ever had and we never fully recovered.
"I turned 80 this year. I had never really considered retirement but life is so short and my time with my family is so precious. I want to thank all of our employees who have helped build this company with me over the years. We have many employees who have made MFJ their career for 10, 20, 30, 40 and more years.
"We are going to continue to sell MFJ products. We have a lot of stock on hand. We will continue to offer repair service work for out-of-warranty and in-warranty units for the foreseeable future.
"Finally, a special thanks to all of our customers and our dealers who have made MFJ a worldwide name and a profitable business for so many years. You all are so much appreciated.
"Sincerely Yours, 73s, ***Martin F Jue K5FLU****"*

NEW MAXIMUM TRANSMITTER POWER CALCULATOR FOR RADIO BEACONS, GATEWAYS, DATA STATIONS AND REPEATERS: From **Alan Messenger G0TLK**:
The Ofcom 2024 amateur radio licence includes Effective Radiated Power (ERP) limits of 5 Watts and 25 Watts for these uses.
For example, according to the RSGB EMF calculator a full size G5RV antenna has a gain of 4.7dBi or 2.55dBd on the 10m band. With a feeder loss of, say, 0.55dB the ERP with a transmitter having a minimum 5W power setting would therefore be 7.9W, or about one and a half times the 5W ERP licence limit.
This calculator is designed to make finding the likely maximum transmitter power for these ERP limits a bit easier by using the antenna and feeder characteristics from an EMF Assessment using the RSGB EMF calculator. It also includes the additional dB attenuation that then needs to be used with the popular WSJT-X software audio drive.
It is now released via my new web tools page at: **www.g0tlk.me.uk/web-tools**

DICK RUTAN KB6LQS SK: **Dick Rutan KB6LQS**, record-setting pilot, has become a Silent Key. He passed away at the age of 85 on 3 May. In 1986, Rutan made international headlines for his flight in *Voyager* with copilot **Jeana Yeager**. The pair flew around the world (nonstop and unrefuelled) in 9 days, 3 minutes, and 44 seconds. Rutan was a highly decorated United States Air Force combat pilot in Vietnam. His civilian test pilot career had him flying everything from military jets to rocket-powered airplanes, in which he set speed records. In 2022, Mojave Air & Space Port in Mojave, California, was renamed Mojave Air & Space Port at Rutan Field in honour of the contributions he and his brother **Burt** had made to aviation.

DXPEDITION AWARDS: Many times, the Southwest Ohio DX Association has used the Dayton DX Dinner as the vehicle to honour those who have gone above and beyond the norm to positively affect the DX community. These are the 2024 awards:
The 2024 DXpeditioner of the Year award goes to **Thierry F6CUK**, who operated FT8WW on Crozet Island. Thierry single-handedly worked over 50,000 QSOs on HF and about 1,300 on satellite from this overall #3 most wanted entity. A well-organised and executed DXpedition in a very challenging environment.
The SWODXA 2024 DXpedition of the Year award goes to W8S, Swains Island

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CQ MAGAZINE HALLS OF FAME: As every year at the Dayton Hamvention, *CQ Magazine* announces the new inductees into its Halls of Fame. Here are the 2024 recipients:

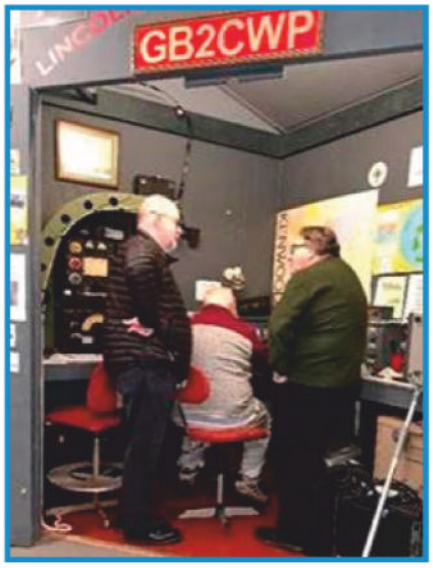
CQ DX Hall of Fame
Cezar Trifu VE3LYC was born and raised in Romania, and holds a PhD degree in physics. A second-generation amateur radio operator, he has held VE3LYC since 1995. He serves as the Islands on the Air (IOTA) Operations Manager and Deputy General Manager, and is a member of the Board of Directors of IOTA Ltd.
Bernie McClenny W3UR has impressive on-the-air bona fides. He has operated from two all-time new DXCC entities: E44DX in Gaza, Palestine and 4W/W3UR in Baucau, East Timor. Other DXpeditions in which he has participated include A61AJ, AH3D, OH0/W3UR, VU4AN, YU8/OH2R, 8P9UR, J77A and V47UR. He has also been a guest operator multiple times at the United Nations Amateur Radio Club, 4U1UN. Bernie enjoys the DXCC Challenge, and has published his *Daily DX* since 1997 and *Weekly DX* since 2001. He has also served as editor of the *How's DX* column in the ARRL journal *QST* since 1987.
Richard A. Ross K2MGA, who passed away on 27 April at age 84, was president of CQ Publishing. He was editor, then publisher of *CQ Magazine*, and at one time, published 11 magazine titles as well as books, calendars, and an extensive video library. Dick was also a huge supporter of DXing and contesting, and believed in recognising his fellow amateurs for their exemplary achievements in these endeavours.
CQ Amateur Radio Hall of Fame
Joachim Kraft DL8HCZ/CT1HZE has been an enthusiastic amateur radio operator since 1980 and has been committed to the technical development of amateur radio and research into propagation phenomena in the VHF/UHF and microwave bands since 1989 by publishing the English-language amateur radio magazine *DUBUS* with a team of specialist authors from all over the world working on a voluntary basis. The magazine is read in over 50 countries.
Tim Duffy K3LR, already a member of the CQ Contest Hall of Fame, is being inducted into the CQ Amateur Radio Hall of Fame because of his lifetime achievements that far transcend his contesting accomplishments. As a contester, Tim has hosted over 160 different amateur radio operators from around the world to his superstation since 1992. He has been the moderator of the Hamvention Antenna forum for 36 years, and has served as chairman of Contest University (15 years), the Dayton Contest Dinner (29 years), and the Top Band Dinner. He also co-coordinates the Contest Super Suite (37 years) in Dayton during the Dayton Hamvention. He founded the popular RFI reflector and has moderated it since 1999. Tim serves on the board of directors of the World Wide Radio Operators Foundation (WWROF) as Chairman and is President Emeritus of the Radio Club of America (RCA). Tim is multi-year President of the Mercer County Amateur Radio Club (W3LIF/W3JTV). He received the RCA Barry Goldwater Amateur Radio service award in 2010, Hamvention Amateur of the Year in 2015, and the YASME Excellence award in 2016. Professionally, Tim is the Chief Executive Officer of DX Engineering.
Richard Ross K2MGA – see above – has now been inducted into all three of the CQ Halls of Fame – Amateur Radio, Contest, and DX – in recognition of his lifelong dedication to the amateur radio service and to his fellow amateurs.
CQ Contest Hall of Fame
Sergio Lima de Almeida PP5JR is a cardiovascular surgeon in Florianopolis, Brazil. First licensed in 1979, he has held PP5JR since 1985. He has also operated as PR0R. PQ0MM, PT5A, ZZ5JR, PX5E, ZX5J and PT5J. Sergio is a member of the Araucária DX Group. In 1996, he began construction of a station in Serra da Boa Vista, which is incorporated to the Araucária DX Group. Over the years, he has mentored many people to become contest operators. A perennial WRTC participant, Sergio has also been involved in several DXpeditions, including to Bhutan as A52JR in 2014. His spouse and three children are all licensed amateur radio operators, and often operate together in contests.
Steven (Steve) London N2IC has been at or near the top of the leaderboard in virtually every contest he has entered for decades. He most often enters contests in the single-operator category, and challenges himself sometimes with single-band, low power, and QRP entries. Steve travels extensively to operate at multi-operator-multi-transmitter stations, notably K3LR, and has been involved in the World Radiosport Team Championship six times with two Top Five finishes. A member of the N1MM contesting software development team since 2008, Steve created a customised version of N1MM to support rig-in-a-box (RIB) operations. A retired engineer, Steve lives on a mountaintop in southwestern New Mexico. He is a devoted communications technician with a volunteer fire department, providing essential communication in forested areas.
Richard Ross K2MGA – see above. Dick was keenly aware of the legacy of *CQ's* contest program, beginning with the very first CQ World Wide contest in 1948. The contest program was his pride and joy as he witnessed its growth into a collection of the world's largest competitions that we enjoy to this day. The quintessential behind-the-scenes visionary, Dick ensured that *CQ Magazine* gave extensive coverage to the contesting world, providing for a time a dedicated publication called *CQ Contest*, a regular contesting column in *CQ Magazine*, video content, and full narrative reports and line scores in the magazine long after other entities moved this information online.

LINCOLN SHORT WAVE CLUB: From **Mary G6SWZ**, LSWC Activities Officer: Lincoln Short Wave Club have been busy over Easter and April.

We had a club BBQ on 30 March in memory of the late club member **Dave Davy G6EWP**. We were lucky that the sun shone down on us allowing us to sit outside.

There was also an Easter Quiz arranged by **Pam G4STO** with Easter Eggs as prizes. **Marc M7DEU** cooked the food which was enjoyed by all.

Then on 2 April **Steve M5ZZZ**, **Shaun G7ORH**, **Steve Birchall G7JHU** and **Mary G6SWZ** opened the radio room at Lincolnshire Aviation Centre, East Kirkby and worked some airfields on the air and also activated the WAB Square. This is a WWII airfield turned museum built as a memorial to Bomber Command by the Panton Brothers primarily as a tribute to their eldest brother **Christopher Witton Panton**; who was shot down and killed on a bombing raid over Nuremberg on 30/31 March 1944. The museum has the Lancaster *Just Jane* and the LSWC run the radio room with equipment including T1154/R1155 and using the callsign GB2CWP. The radio room is open on the first Tuesday and third Thursday of the month.



THE ISWL: From **Dick King M5DIK**, ISWL President: *"The International Shortwave League is one of the world's oldest shortwave clubs. During lockdown I took the opportunity to go through our archives and discovered a register of members starting in October 1946 with our very first recruit **Dr Arthur Gee G1**. Since that time over 20,000 other people from all around the world have joined the ISWL.*

"Currently our register holds about 7,000 names and I thought it would be interesting for the sake of historical reference to add as many of the missing past members as possible. I am sure that many past members are readers of PW *and I would ask them if they would like to e mail me at **richardvking@ntlworld.com** with their name, ISWL Number (if they can remember it) and the year they joined we can add them to the list. Conversely if someone would like to know when they joined and what their ISWL number , I should be able to let them have that information."*

We plan to run a feature on the ISWL and its history in next month's issue of *PW*.

UPDATED SPECTRUM ANALYSER SOFTWARE FOR SDRPLAY RSPS: **Steve Andrew** has released Version 1.2 of his popular Windows Spectrum Analyser Software – it has new features and is updated to be compatible with the RSP1B.

Check out his new website with links to his new Facebook group and his latest tracking generator software:

www.spectrumanalyser.co.uk

CAISTER MARCONI STATION: Norfolk radio hams at Caister Lifeboat managed to contact nearly 100 other radio amateurs in 29 countries on Saturday 27 April when they took part in the International Marconi Day (IMD) event to mark the inventor's 150th birthday, using the call GB0CMS. Notable contacts were with Marconi stations GB2IMD (Gwynedd, Wales), GB8MD (Waunfawr Wales), EI150IMD (Rosslare, Ireland), IY0GM (Sardinia), IY4FGM (Villa Griffone, Bologna), IY5PIS (Pisa), II1GM (Genoa), IQ4AX (Moderna) and II4CLM (Bologna).
The Norfolk Amateur Radio Club (NARC) ran the all-day special event station at Caister Lifeboat to commemorate the village's original Marconi Wireless Station, which was established at Caister in 1900. The station was in a house in the High Street known as Pretoria Villa and its original purpose was to communicate with ships in the North Sea and the Cross Sands lightship.
On Saturday, the closest to Guglielmo Marconi's birthday, stations around the world are set up at sites with historical links to the inventor's work. These include Poldhu in England; Cape Cod Massachusetts; Glace Bay, Nova Scotia and many others.
The photo shows *PW Morse Mode* columnist **Roger Cooke G3LDI** operating GB0CMS.

DISTANCE LEARNING FOR THE FULL LICENCE EXAM: The Bath Based Distance Learning team (BBDL) have been running courses since 2011. In that time they have helped over 1,000 students to obtain their Full Licences. Student feedback is always very positive and the pass rate continues to be well over 80%, compared with a national average of around 65%.
The BBDL team are now planning another Full Licence level course. The course will run from the end of August to December, with exams in January.
Students receive weekly work packages via an online classroom and have access to weekly online tutorials. Each student is allocated to one of the remote tutors who provide feedback and additional guidance. There are weekly quizzes to check on progress and at the end of the course there are a number of mock exams.
There is no charge for the training but applicants must work through some pre-course material and complete a quiz to be eligible for a place. This focuses on the 'new' Intermediate topics that were introduced to the syllabus in 2019. The aims of the pre-course classroom are to make sure applicants can use the BBDL systems, and to ensure that they are ready for the current Full training syllabus.
Each student will need to provide their own *RSGB Full Licence* textbook and arrange their own exam at the end of the course. Advice will be provided as part of the course.
The deadline for course applications is Tuesday 23 July. To request full details and an application form, please email BBDL Team Leader, **Steve G0FUW**, via **g0fuw@bbdl.co.uk**

GB2DWM - NATIONAL MILLS ON THE AIR -2024: Over the weekend of 12/13 May a group of radio amateurs from the Huntingdonshire Amateur Radio Society (HARS) set up and activated a Special Event Radio Station for Duloe Tower Mill in Eaton Socon, Cambridgeshire with the callsign Golf Bravo Two Duloe Wind Mill (GB2DWM). The station was put on for the annual National Mills on the Air weekend which is set up by the S.P.A.B. Mills section (Society for the Protection of Ancient Buildings) with Denby Dale Radio Society doing all the information collation of Mills that would be taking part.
This year was the 13th year of operating from the grounds at the Mill, this is by kind permission of the current owners **Steve** and **Sandra**.
A total of 60 QSOs was achieved during the event, including 17 Mill QSOs plus one other special event callsign and even a /AM Aeronautical Mobile!
http://hunts-hams.weebly.com

GX4LMR July sees the centenary of the first two-way communication between an amateur radio on a train and fixed (i.e. 'ordinary') amateur radio stations. This was on 5 July 1924. The station on the train was 6ZZ, which operated on a journey from King's Cross to Newcastle-on-Tyne. BRARS members will be celebrating and commemorating this centenary by putting the club call sign GX4LMR on the air from 5 to 14 July inclusive.

NEWS EXTRA

MOONRAKER NEWS: The SDRplay RSPdx-R2 is an enhanced version of the popular RSPdx and is a wideband full-featured 14-bit SDR which covers the entire RF spectrum from 1kHz to 2GHz.
Combined with the power of readily available SDR receiver software (including 'SDRuno' for Windows and Multi-Platform 'SDRconnect' supplied by SDRplay) you can monitor up to 10MHz of spectrum at a time.
The RSPdx provides three software selectable antenna inputs, and an external clock input.
All it needs is a computer and an antenna to provide excellent communications receiver functionality.
£225 from Moonraker.

The XIEGU X6200 HF/50MHz SSB/CW/AM/FM/WFM/Airband Portable Transceiver is a new generation of ultra-portable shortwave transceiver. It adopts advanced RF direct sampling architecture and is equipped with powerful baseband and RF units. It integrates rich functions of major models and has built-in

popular remote network control function. bringing you a new amateur radio experience.
£849.95 from Moonraker.
https://moonrakeronline.com

STEAM ON THE LEVELS: Taunton and District Amateur Radio Club provided an exhibition station at 'Steam on the Levels', a popular annual exhibition of steam powered vehicles, pumps, classic cars, vintage tractors etc held over the weekend of 18/19 May near Westonzoyland in Somerset.
The station consisted of a Kenwood TS590SG c/w RSP1A used as a panadaptor for SSB & CW – large 32in monitor connected for waterfall, along with a Yaesu FT991A for FT8 – additional 32in monitor connected for showing spots on PSK reporter.
There was also an exhibition of home brewed equipment and completed kits (Kanga etc), plus a hands-on demonstrations of Doppler radar using a HB100 module feeding an oscilloscope and a short range CW radio link using two BBC Micro:bit computers (Microsoft MakeCode block code). Additionally, a traditional Morse key with audio oscillator and, on the second day, a demonstration of QO-100 reception displayed on a laptop
Visitors to the station included several 'lapsed' amateurs (we hope that we re-kindled their interest!), people familiar with CB but not amateur radio and members of the public who were just curious (possibly attracted by the monitors and audio). At times we were very busy.
It was also interesting to note the interest in CW from people of all ages
Thanks to the team from TDARC – M0CIE, M7UTX, G1BED, M0LHC, G4ELW, G7BEH, G8PLL, G4USI & M0AOD.

1

Antenna switches: why pay more?

Richard Constantine G3UGF considers the pros & cons of spending more (or less) on antenna switches.

Richard Constantine G3UGF
richard@norcomm.co.uk

Having experienced damage to one of my favourite QRP radios some time ago and for which there isn't a viable cure, I was anxious to find out how to avoid a potential repeat at some time in the future. The most likely culprit seemed to be a faulty antenna switch that had allowed RF from one radio to pass directly into the antenna socket of another… could I prove it?

I say antenna switch as I hesitate to call such things coaxial switches. I prefer to think of them as 'switches for coax'. A genuine coaxial switch is a slightly different animal that provides a constant impedance. That said, for most practical amateur radio use, unless you're talking GHz bands a commonly available switch unit normally does the job …. that is if it's reliable and can be trusted…Hmm?

Trying to locate the author of my misfortune sent me on quite a journey with some surprising and unexpected findings.

When I was a teenager the prime purpose of an antenna switch was, as the name suggests, to connect a single radio to more than one antenna. For that reason, switches didn't always need to short circuit to ground the unused ports, as can be seen in one of the most popular switches from the 1960-70's. Today, rather than in use with a single radio, it's fairly commonplace to see one or more antennas connected to multiple radios. As in my case, far too many radios (don't ask!).

In theory it's safe to do such things. As a precaution most radio manufacturers incorporate overload protection into the design of their radios. Manufacturers need to avoid unsuspecting amateurs destroying equipment and claiming repair under warranty – not uncommon I'm reliably informed and second only to reverse polarity.

I have the nostalgic impression but no real data, that valve radios in my classic collection were much more tolerant of my teenage misdemeanors but then again, I could only afford one radio. Anxious to know if modern solid-state is the same or better than the good-old-days of youth, I referred to the guru of all things radio, **Rob Sherwood NC0B**. Rob most definitely knows a thing or two and can definitely be relied upon for sage advice. In general, I'm not a fan of those far self-promoting online YouTubers, preferring to make my own judgements when reviewing new equipment. However, I can recommend W2AEW's excellent online video on this particular topic.

I learned from Mr. Sherwood that commercially made radios can typically withstand RF leakage inputs of around 93dB over S9, impressive. This indicated the amount of isolation required when using a typical 100W radio would be around 50dBm or better. Incidentally, the amount of isolation required for 1.5kW from your newly acquired linear is around 62dBm…. Of course, you'll not be running that much power even under the new licence scheme, will you?

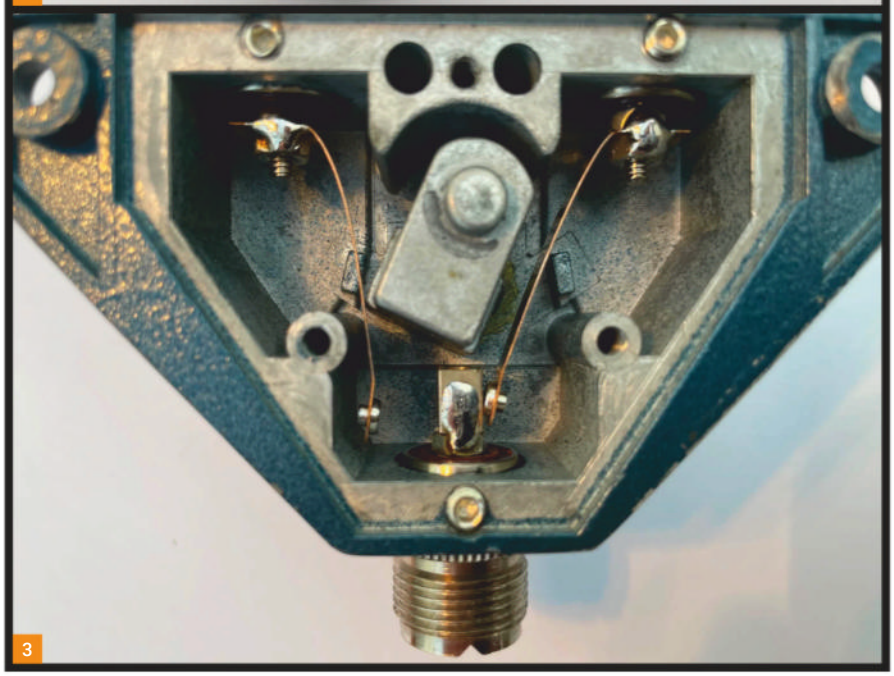
Once bitten, my safest way forward in the very short term seemed to be to do away with switches altogether. That is, to manually connect each radio in turn as and when needed to my antenna farm. No great issue in my case as I only currently have two HF antennas but sadly time consuming. I really needed to know more about switches.

Why pay more?

If indeed the culprit for my disaster was the antenna switch, it begged the question how do I avoid a repeat? First solution appeared to be to build a patch panel with manual coupling links as used by many commercial operators. This would require additional coax, more connectors and with it some losses. Alternatively, I could try to discover why some switches cost more than others.

Photo 1: The AD 4- and 2-way switches. Photo 2: Internal view of the AD 4 way showing the switch mechanism. Photo 3: A FE switch making poor contact. Photo 4: Some typical FE and classic switches as used by amateurs. Photo 5: Internal views of the switches shown in Photo 4. Photo 6: The HADARS Club switch workshop.


2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Being somewhat lazy construction-wise these days, I took the latter option. I decided to investigate why US made Alpha-Delta (AD) switches apparently cost three times more in the UK than the mountain of readily available Far-Eastern (FE) made products. These devices appear in many guises and styles at many different prices, typically ranging from £25-£50 for a two-position version.

Clearly the first and most obvious difference is that AD switches are physically bigger and heavier. Currently the latest model 2B version with SO239 sockets costs £119.99 and the 4B, £134.99. N type sockets as used here cost a little more.

All AD switches have the addition of an extra, central switch position that connects all ports to ground (case earth) via a replaceable surge/static protector when not in use.

Unlike oriental versions that have a completely open internal design, each AD unit has its own separate internal cavity from input to output for each port in order to prevent flash over. It presumably also helps to maintain a constant impedance. The contact area of each phosphor bronze, silver plated flat connector strip is larger than that of FE designs, both when in use or when at case potential. The case casting has a dedicated bare metal bolt hole to which an earthing strip or wire can be attached.

The internal switch mechanism itself is radically different and quite clever. While non-used radio or antenna ports are always short circuited, the required port contact is lifted. It is supported under tension by an ingeniously clever spring tensioned mechanism that securely connects over its whole surface area to the common port's radius bar. In 'park' mode the common port remains floating.

ISO9001

To the average user, ISO9001 may not mean much. To someone with personal experience like me it shouts quality. In a former life I spent 18 months and many man hours certifying my comms company from scratch to this industry standard. BSI/ISO is universally recognised worldwide. It encompasses every aspect of a company's policies, procedures and in this case manufacturing, documenting and recording everything the company does. Not only does it significantly cost time and money to reach the required standard, it's subject to regular external inspection.

My guess from both the design, construction and colour of AD switches that the company has gone through this significant process to qualify as an approved military and civilian supplier.

End result

The outcome of all this design, manufacturing and quality control results in quoted losses of 0.1dB at 30MHz and stated isolation values of greater than 60dB minimum (significantly better in practice). Switches with SO239 sockets are good for use up to 500MHz and my much-preferred N type sockets, 1.3GHz. Losses at 450MHz are quoted as 0.5dB.

So far, so good

By this time and notwithstanding fluctuating dollar exchange rates I was beginning to understand where the end user price was coming from. Now it was time to investigate the oriental alternatives and what may possibly have happened to damage my QRP radio's receiver.

Opening up two switches (no brand names) it became instantly clear that they were suffering from age and constant usage issues. The case housing was solid enough but both central moving cam mechanisms were showing their age. At times one of them if not fully pushed to the right or left, could be parked, not fully engaged with the desired spring metal port contact.

A closer inspection revealed a difference in the quality of the contacts between two similar looking units. In particular, one was quite worn and neither engaged flush over the whole surface area of the studs. Now less than half of the hardened contact tip was making an acceptable connection with the common port thereby limiting the power handling. It was also possible to leave

all ports open circuit.

One of the common port blocks appeared to have been silver plated, while the other was not. Both were discoloured and on closer inspection the silver-plated version had almost lost its silver at the contact points. All of which highlighted potential insertion losses and so it proved.

Was it possible that while using one of these switches I had found myself in a position where there was an arc-over or one contact engaged before another? I guess I'll never really know but there was enough doubt to make me think of the possibility.

To be fair, there was also the rare possibility that as these switches have no facility to ground all input and output ports that perhaps a static burst was the culprit, something I'll never know.

Having separately made my own measurements at home and whatever the cause, I thought that this might be a subject of interest for a hands-on workshop at my local club and an excellent opportunity to compare notes. There was indeed great interest and with the aid of friends I took a back seat while the club's network analyser was deployed making for a very revealing evening that certainly made some members think. Naturally the 1960's switch with no internal shorting mechanism wasn't a fair comparison, suited only for multiple antenna connection to a single radio and giving no protection. Similar to my own findings, one of the FE switches gave better results than the other while the two AD switches shared almost identical results. Both were well above the makers' quoted specification.

Averaging all test results together the most suspect FE switch gave only 40dB of isolation if not fully switched hard over. Isolation for the AD switches was greater than 85dB with almost negligible losses at 30MHz.

What have I learned?

Of course, there must be thousands of Chinese and Japanese made switches in daily use the world over that perform quite adequately, so maybe I was unlucky.

Here's some of what I've learned:

Not all switches are made to the same standards of quality and performance.

To be wary of worn switches.

That someone else's cast-off is perhaps not always the best choice.

A switch with a ground-all position and static leakage provision has practical benefits.

It takes 3 x 2-way switches plus cables and connectors to make one 4-way switch.

Thoughts

Having delved deeper, I think I've answered some of my own questions concerning the cost and quality of switches. The differences across a range of £25-£55 brands are mainly cosmetic. The construction is reasonable but not ideal, with opportunities for failure, long term.

At the higher end of the cost scale namely the Alpha Delta switches, you're buying a radically different animal, built to a known traceable standard. It has the prospect of better power handling, lower losses, less leakage and a longer working life, with a potential cost saving.

When it comes to the AD four-way comparison the price gap closes to almost the same as the use of multiple FE switches and extra patch leads. You also get the added benefit of the earth-all position and replaceable 'ARC-PLUG' static fuse.

After taking a quick and frightening inventory of the investment on my shack table the FE switches went to the recycle bin. I bit the bullet and purchased both a two-way AD switch for VHF/UHF use and a four-way AD version for my HF gear. Now I either need another switch for more radios or more antennas for the switches I have.

Acknowledgements

My thanks to HADARS members for their input and to Martin Lynch & Sons for Alpha Delta switches for review. **PW**

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1

Loops big and small

Richard Constantine G3UGF checks out the Amazing Alex Loop Hampack … plus the all-new RC-2 motor upgrade.

Loop antennas are nothing new and have been around almost as long as radio itself.

There's no doubt that a single-band full-wave loop is an efficient antenna. Most practically, a horizontal wire loop is usually fed either with a Z-match ATU or a balanced-to-unbalanced device of some kind.

The radiation and reception from a small magnetic loop are interesting and complex. If it's too low to the ground in relation to the wavelength in use, the ground acts as a reflective medium. The maximum field is leaving and arriving at higher angles. That's good if you are designing for an NVIS (Near Vertical Incident System) with relatively short hop contacts. Of course, a short hop means different things according to the wavelength.

There is much to recommend loop designs both large and small. In the real world of amateur radio, loops work quite well even at modest heights and are well known for being 'quiet' antennas in terms of electrical noise.

Use the same installation at shorter wavelengths/higher frequencies and it becomes more effective as the ground effect lessens. You can mount a small magnetic loop in a horizontal plane but vertical is more popular. It largely overcomes water ingress or standing water on the antenna. Vertical mounting, for vertical polarisation occurs in line with the loop. There will be some horizontal polarisation broadside to the loop at an angle of around 10° elevation.

Single square or multi-element Quad antennas work well even at relatively low heights. Is there such a thing as a low height? I'm sure you know what I mean.

If you are curious to know more about loop designs both large and small I can recommend the RSGB's 15th and latest edition of the *Handbook of Radiocommunications*.

Like all antennas that are less than full size, smaller loops are less efficient but much more manageable while remaining usable. Ideally you looking to maximise the radiating surface area while minimising resistance.

Over many years professionals and experimenters have been playing with loop designs to get the best out of them. Loops are quite common for receiving, both for military, commercial and amateur use. Anyone remember those old set-top TV antennas? Now I think that perhaps they weren't just random loops of bent wire.

Alexandre Grimberg PY1AHD has been perfecting his AlexLoop design for around 25 years and certainly knows a thing or two about the design and performance of portable loop antennas. That's why I was delighted when I was offered on behalf of *PW* readers the chance to take a look at the latest upgrade; an optional, portable remote tuning system add-on.

The Main Loop antenna

The current manual version of the loop arrived in a very distinctive black and orange Cordura style quality made backpack, tailor made for the job. It was followed sometime later by the remote-control unit, in its own matching bag. My immediate reaction… anyone seen wearing the distinctive backpack in a park or up a hill has definitely got to be a radio amateur.

The body of the bag houses the three-part support tube that slots together, tuning box, 20cm/8in diameter coupling loop with approximately 3m/10ft of coax. It's all secured by Velcro for easy transit. The pack also contains two additional snug fitting, contoured zip bags. The bags likewise have bright orange piping, harder to lose in fog or low light on a SOTA hill.

Photo 1: What's in the pack.
Photo 2: Loop on tripod.

The bags are clearly marked for a QRP transceiver and for accessories. In fact, everything you need for a complete outing fits neatly into the pack.

The large loop of semi-rigid coax that coils into three turns has its own compartment at the rear. Both the back of the pack and the shoulder straps are padded and have breathable mesh.

There's no manual supplied as such, only an A4 assembly sheet. In reality you only need to read it once as assembly proves easy and almost self-explanatory.

I had expected the 25mm/1in insulated support tube to contain a threaded stud at the bottom to permit attachment to a photo-tripod. Somewhat disappointingly for a premium product, no such luck. However, it was easy to slot it into the top of a photographic lighting tripod that was to hand. Alex has left the mounting up to individual choice.

The semi-rigid coax makes up into a sort of fat egg shape to create a 1m/39in diameter loop. It's made from DLC-213 coax (Data Light), less weighty and more rigid than conventional RG-213 yet flexible. It has both a copper weave outer plus a foil liner and the normal inner conductor. Both inner and outer of the coax is short-circuited so as to maximise the skin effect of all the radiating surfaces.

The efficiency of a small single loop depends on a number of practical factors. The radiation resistance is proportional to the square of its area. Double the loop circumference and the loop area effectively increases around four times.

It's well understood that high voltages exist at the tuning capacitor and builders go to quite some length to mitigate this. Vacuum or wide-spaced variable capacitors are required if you want to run high power and they don't come cheap. Vacuums can suffer from heating effect; even wide spaced variables can experience arcing in damp air. For example, 100 watts of RF can according to the frequency in use, generate between 3kV and 7kV at the capacitor plates.

No such problem for the two-gang capacitor in the AlexLoop as the power handing is designed for 25 watts maximum and ideal for portable QRP. My recommendation is don't push it as you have to increase the power significantly even to gain an S-point at the remote end of the contact.

Once assembled I was pleasantly surprised that the loop worked straight away and thanks to the gearing system the band markings proved quite accurate. Many DIY builders of loops experience detuning when the operator approaches the loop while some describe hand capacity effects when turning the dial. Not this one.

The instructions suggest that the operator sits alongside the mast and rotates it as and when required, for maximum signal strength. It certainly does make a difference. If you raise the height of the loop to improve the take-off and make the most of your QRP, there comes a point where you can no longer reach the tuning control to adjust the band and VSWR. This is where the new upgrade comes in. Raising the loop may not increase received signal strength by much but is most likely to give improved take off. Placing it more remote from objects, such as caravans, wet trees and people makes a real difference. No such issues on an open hillside, unless you're in a vehicle.

Upgrade kit, the RC-2

In essence the upgrade kit consists of an incredibly compact reversible motor unit that fits onto the tuning capacitor spindle, secured by a 3mm grub screw, Allen key provided.

Once the manual control knob is removed with the aid of yes, one of two bright orange screwdrivers, the instructions detail how to simply and easily fit a support bracket for the motor. All that's required is to remove the lower capacitor securing screw. Slip the bracket over the screw and re-fit using the larger flat blade screwdriver. A two-minute job that's easily reversed at any time.

Photo 3: RC-2 motor pack.
Photo 4: Motorised conversion.

Not recommended in the field even though there are spare fiddly bits in the pack.

A BNC extension cable is provided together with a twin-core power/control cable, extending the total length from antenna feedpoint to controller to almost 5.8m/19ft.

As mentioned, there's a nice little addition to the pack. A transparent pill box containing spare grub screw, securing screw plus spare feet for the controller. The controller is powered by the included alkaline PP3/9V battery.

The smaller of the two front-mounted knobs on the controller acts as on/off and motor speed adjustment. The idea being that you can quickly change bands then reduce speed to allow the larger knob to fine tune.

The miniature motor is very precise and responsive thanks to its mini gearing system that resembles the workings of a Swiss watch. There's no over-run. You simply wind the large knob and listen for maximum noise on the receiver's band of choice and you're almost there. Transmit a carrier and finally adjust for minimum VSWR. As an added bonus and guide the mast-mounted tuning box has a white LED that illuminates at acceptable reflected VSWR.

Matching is very sharp on 7MHz as you would expect with small adjustment being necessary every time you change frequency for transmit purposes, hence the need for very precise and easy adjustment.

Just for devilment I tracked the time to get from maximum to minimum value of the tuning capacitor. Just 15 seconds end-to-end on the fastest speed. 1 minute 52 seconds for the slowest speed. More than enough time to reach minimum reflected power on any band.

Manually turning the loop through 90° proved most fascinating. I found myself smiling every time I returned to a new band. Having the added benefit of the motor was a fun experience.

The only other things you really need for an adventure is a support of your choice for the antenna… oh yes, and sandwiches and flask in the backpack.

Out and about

Everything goes together quickly and is simple to use. Contacts around Europe on 14 -28MHz with 10W PEP SSB and 5W CW were no trouble. It may be just coincidence but the odd 40m daytime contact in the UK worked better than I would have predicted for such a small antenna.

Impressions…

There is no getting away from the fact that this latest incarnation of the Alex-Loop, now with its optional RC-2 motorised tuning is a premium product. Shipping, import duty and VAT from Brazil are all unavoidable.

3

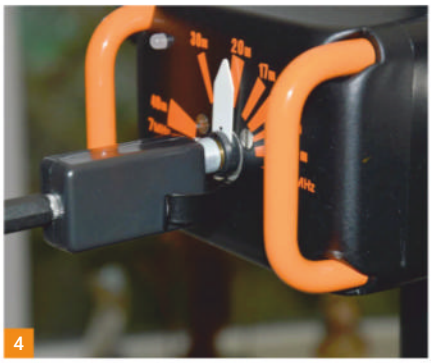
The components, of which a number appear to be unique and custom made, are of excellent quality. If you want something quick, easy, effective and ready to match to your QRP radio or indeed your 100-watt transceiver operating at lower power, it's a good choice.

For those with limited space or those that just like to get out and about it's easy to deploy, use and pack up. I wouldn't describe it as weatherproof but a light shower won't hurt. Using this type of antenna avoids the requirement for an earth connection, messy radials or counterpoise wires. A big plus in an area of footfall other than your own. If you're already a user, the RC-2 upgrade is a worthwhile addition.

Here's a thought… If you own a loop or any other antenna with a tuning capacitor and have read this far, the motor kit fits a standard shaft. I would suggest that it's worth considering it as a stand-alone item in its own right. I just love the tiny motor!

I've found the whole thing fascinating. For me a very different and most pleasant experience.

I've never had to end an equipment review on a more poignant note than this one. I was reading through the proofs when I learned that sadly Alex PY1AHD recently passed away. He will be missed by his many friends around the world.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The Alex-Loop stands as a great tribute to his 25 years of enthusiasm, work and development. I am however pleased to report that his legacy lives on, as his son **Alan** will continue the business.

I must admit *PW* readers that with summer on its way and the sunspot cycle on the up I'm extremely tempted to let my credit card see daylight.

My thank to ML&S for the extended loan of the Alex-Loop and RC-2. Prices are: Alex Loop Hampack, £599.95, RC-2 Motor Pack, £449.99, Hampack+RC-2, £899.99. **PW**

1

Bernard Nock G4BXD
military1944@aol.com

A National Treasure

Bernard Nock G4BXD introduces readers to a little-known variant of the popular HRO receiver.

Many readers will know the HRO range of receivers built by the US firm National. They produced many variations of the famous receiver with the rather odd looking main tuning control, which gave you numbers as you rotated it. You then had to look at a chart on the plug-in coil pack front, which had a graph of frequency verses numbers. This looks rather dated now with modern digital and SDR readouts but at the time, it was a rather clever way of doing things.

With plug-in coil packs for each band they eliminated the need for complex band switching, which would have had a myriad of wires and contacts for the RF, mixer and oscillator coils, all prone to fail under constant use, not a good idea for a military radio.

A very good website which details the history of National and the HRO set can be found at the URL below and is a very interesting read indeed.

https://radioblvd.com/national_hro_part1.htm

Many of us, myself included, had an HRO back in the day. I had a very nice example and along with a 2m converter it served me well for a number of years. I even added an FM discriminator to it as FM was becoming the thing on VHF, sacrilege of course and not something I'd do today.

This National though is what was called an RBJ receiver. The RBJ series of receivers were built by the National Radio Company for the US Navy [**1**]. The RBJ was designed for use at Naval shore stations or aboard naval vessels. The sets were supplied with mounting racks suitable for table mounting, usually several to a room.

The RBJ is a nine-valve superheterodyne, receiving AM and CW/SSB with a BFO, using nine plug-in coil sets to cover the range from 50 to 400kHz and from 480 to 30,000kHz with an intermediate frequency of 456kHz.

The U.S. Navy designation for the receiver was CNA-46081, optional power supply CNA-20125, optional coil rack CNA-10075 and optional mounting rack CNA-10036. Net weight of the fully loaded rack was 66kg or 145lb.

Circuit design

There are two stages of RF amplification, mixer, HF oscillator, two stages of IF amplification at 456kHz, a bias type triode detector and a resistance-coupled audio output stage. A triode is used for amplified and delayed automatic volume control and a BFO is provided for CW reception. Unlike some of the HRO versions there is no crystal filter on the RBJ.

Audio output is either through headphones, RBJ has its headphone jack where the HRO has its meter, 10mW at 600Ω with a chassis mounted transformer, or via a loudspeaker output circuit providing 2W at 5000Ω. Restorers or users should note though that an external audio output transformer will need to be provided to match 5000Ω to any loudspeaker impedance. In commercial use there might be several receivers in one room so headphones were the standard option.

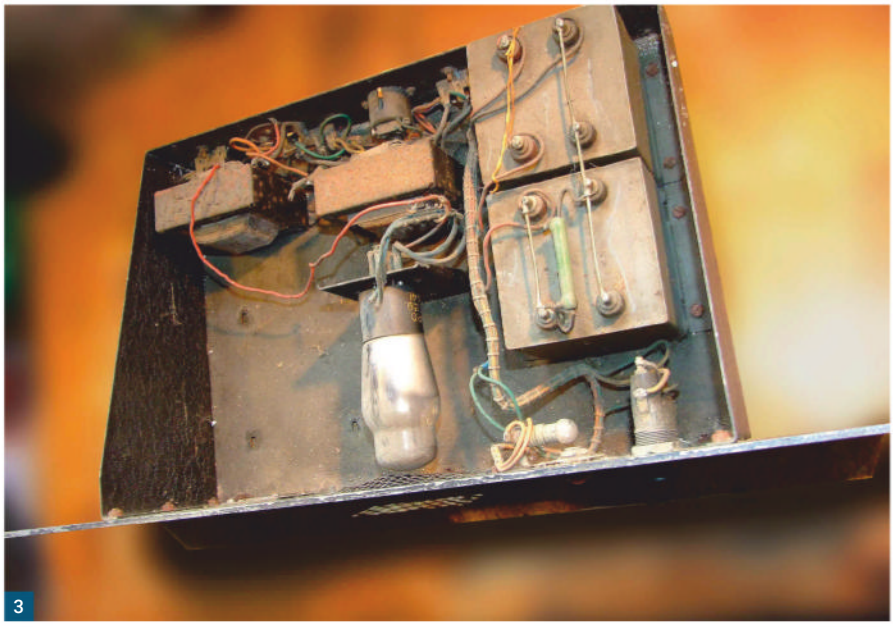
The rear panel connections go to the audio output valve anode when the phones are removed with the other connection going to the HT line. The antenna feed can be configured for either single wire, by grounding the one terminal, or a balanced feedline. The antenna connections are on the left side of the receiver.

Power Requirements: The RBJ, RBJ-3 and RBJ-4 were supplied with a 230V AC power supply CNA-20125, while the RBJ-1 and RBJ-2 were supplied with 117V AC supply type CNA-20090. Both supplies were rated at 50/60Hz single phase. The HT voltage required is 240V at 70mA while the LT is 6.3V at 3.4A.

The valves used are: 6D6 1st and 2nd RF amplifier, 6C6 as oscillator and 1st mixer, 6D6 as 1st and 2nd IF amplifiers, 6C6 as BFO, 6F8 as audio detector/AVC and a 6V6 as the audio output stage.

Restoration begins

While sitting and thinking what to do next it crossed my mind that my RBJ could do with looking at. I had all the components but they were spread around the museum. I gathered up the various parts, receiver, PSU, coil box and rack and spent a while looking at them. The receiver had already been restored in that I had already replaced all the old paper capacitors and a few resistors had been changed but I gave it the once-over, gingerly applied some voltages and the thing seemed to work OK. All the valves seemed fine but I do have numerous sets of the types used.



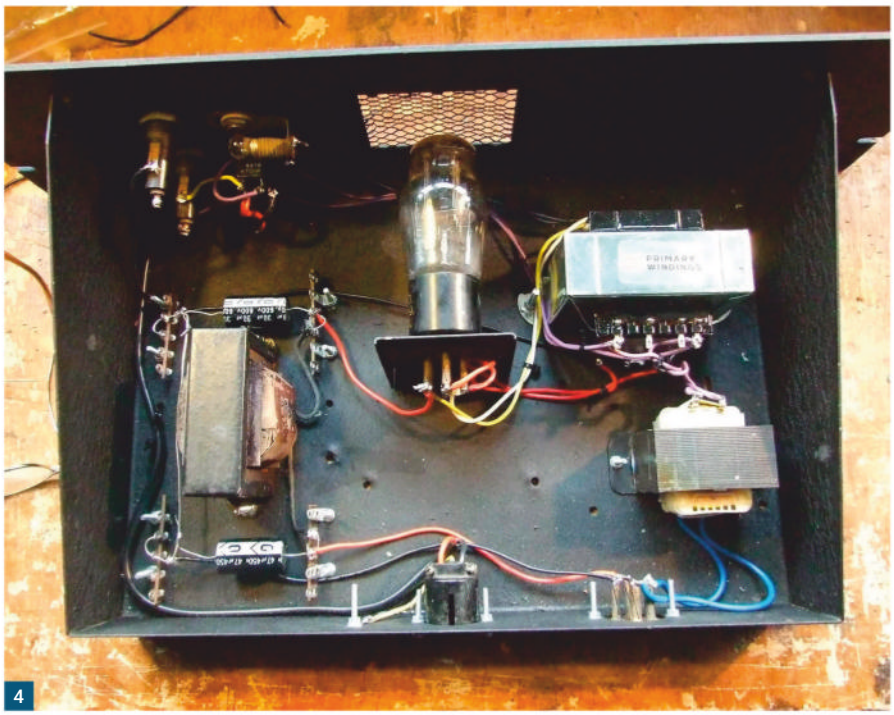


Photo 1: The RBJ receiver. Photo 2: The 19in rack unit. Photo 3: The PSU as I found it. Photo 4: The re-built PSU with valved rectifier. Photo 5: The coil packs as found. Photo 6: The re-lettered coil packs. Photo 7: The completed receiver, PSU and coils rack mounted.

The only modification I did to the receiver was to fit an audio output transformer internally to the underside of the chassis. I felt it was a little too much of a risk trying to insert banana plugs into a high voltage socket at the rear. Now, the two connections on the rear chassis wall are for a low impedance speaker along with no risk of a shock.

The PSU on the other hand had seen somewhat better days. The main transformer was missing. Presumably it had gone shorted turns at some point, but the two smoothing chokes and large filter capacitors were still there along with the bracket holding the rectifier valve. The mains connector was broken and the supply socket to the receiver was also missing. The power lead on the receiver was also fitted with the wrong plug.

Everything was removed from the PSU chassis and it was resprayed black. The chokes were fine but I felt the paper smoothing caps were long past their best. A replacement transformer was found as was the correct four-pin plug and socket to feed the receiver. With all the parts refitted the PSU was now ready for use, the warm glow of the rectifier valve being far better than the cold nothingness of a silicon slab.

The coil box, which houses the nine coils needed for the set, had a slightly bent edge down one side. A large piece of wood and some clamps and muscles soon put that back in alignment. Other than a quick flash with the spray can there was only the matter of tweaking the catch which held the access door open. After years of use it was prone to slip, dropping a fair weight of steel down on the head or hand of the operator.

The rack again was in very good condition, a spray of black brought it back to life and all looked well. I was thinking about the bolt holes which hold all the bits to it and found a 4mm bolt was loose so I was about to tap each hole for 5mm when luckily I thought to check the manual. The manual states the holes are tapped for 10-32 UNF. I had thought that at this age they would be unavailable but was surprised when I looked online to find I could still buy the correct fixings.

Coil-packs

The plug-in coil packs are basically the same as the HRO ones but there are slight differences. Full details of the various coil packs can be found here:

https://radioblvd.com/National_HRO_Part2.htm

The RBJ packs have a plate fitted to the centre of the unit stating its number and frequency range. On the edge of the coils is also lettered the range, which is visible to the operator when they open the coil box, but after all these years some of the lettering had worn off. I found that Impact font at size 40 was a good match for the original lettering so printed a complete set onto to a sliding transfer sheet.

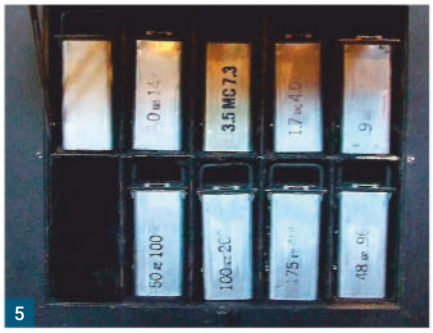
The sheet instructions said to print your design then leave the sheet to dry for several days. I did this by going off to Dubai for several days and when I got back the sheet was indeed really dry. It said to spray the printed sheet with a clear varnish and again leave to really dry. I had thought of another trip but I had other things to do so after a few days the now really dry lacquered sheet was cut into the various labels.

With the strips immersed in water they soon

slide easily and made a good job of re-lettering the coil-packs making selection from the coil box very easy indeed while really improving the look of the whole unit.

With the new PSU, the re-lettered coil-packs and the fully working receiver the whole rack unit was assembled in one of the museum's rooms. With the set switched on it's a pleasure to tune across the bands. The short-wave commercial bands still resound with multinational stations, Chinese, Arabic, American, north and south, and numerous European stations with their mix of music and talking, some stations even had English language programmes. I think many radio amateurs today are missing the joy of short-wave listening, using their Japanese plastic boxes for amateur-bands only listening.

It's odd but a valved receiver has a different sound to it compared to a modern SDR or transistorised set. I would recommend anyone to acquire such a set, any valved set of some age, and give listening a real chance. I think a lot of the more recent converts to the hobby are missing a very enjoyable part of the hobby, digital and whisper, marathon or whatever it's called does not compare to the full rich sound emanating from a valved radio. Happy twiddling.



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Reference

[1]
www.kurrajongradiomuseum.com.au/rbj4.htm


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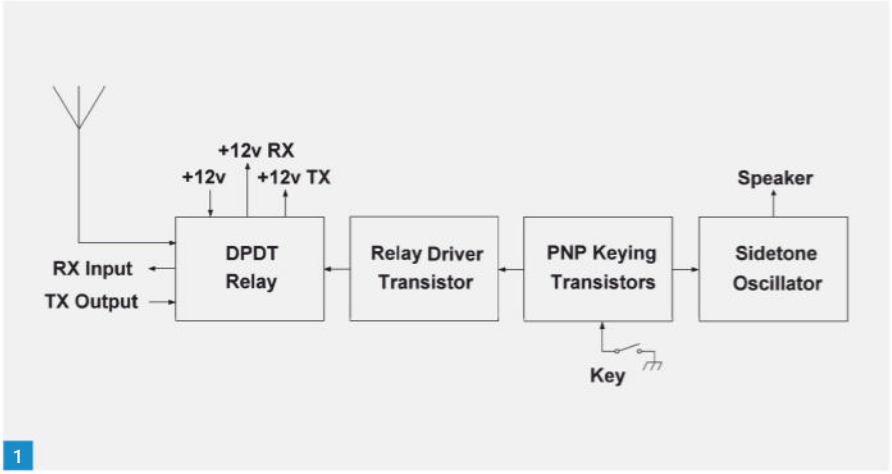

1

The G3RJV SCD QRP Transceiver Revisited (Pt IV)

Steve Hartley G0FUW continues the build, with circuits to enable your transmitter and receiver to interwork.

Just as a quick recap, part 1 of this series provided the basic project overview and some advice on construction methods, PCBs, etc. Part 2 covered the construction details for the Variable Frequency Oscillator, or VFO. Part 3 covered the receiver side of the project.

This part is only required if you are going to add the transmitter to your project; the circuit switches the antenna and 12V power from the receiver section to the transmitter section and back again. It also provides Receiver Independent Tuning (RIT) and sidetone so you can hear your own Morse Code when sending.

Changeover module circuit description

This module, block diagram in **Fig. 1** and circuit diagram in **Fig. 2**, includes a sidetone circuit that means you can hear what you send. I find this a great help to be sure my hand (fist?) sends what my brain intended. The original sidetone circuit used a unijunction transistor that I was unable to find when I searched for it. The circuit used here uses common NPN transistors in a very simple configuration found in *SPRAT*, the journal of the G-QRP Club. It is pretty foolproof and includes a pre-set output adjustment so you can set the level to your own liking.

The original SCD used a crude, but effective, manual switch to change between receive and transmit. Later projects by G3RJV often included a semi-break-in circuit to operate a relay; an electromechanical device that includes an electromagnet that operates the switch when a direct current flows through its coil. This approach is included here.

The relay is a Double Pole Double Throw (DPDT) type, in other words there are two switches (poles) which each have two positions, normally closed (NC) and normally open (NO). One of the poles switches the antenna socket from receiver board input to transmitter board output and the other provides 12V DC to either the receive or transmit circuits. The relay NC position is used for the receiver side of the project, and the NO side for transmitter circuits.

When you press the Morse key two PNP transistors operate as switches. Transistor T5 triggers the relay and T4 keys the transmitter and the sidetone oscillator.

When the relay is activated, Q8, another transistor switch, starts to conduct and an electrolytic capacitor holds it in transmit mode until you stop keying for about a second. This prevents the relay 'chattering' between transmit and receive every time you close the key contacts. The relay hold delay is adjustable with a pre-set resistor, which acts with the electrolytic so you can set it to suit your own keying style.

Finally, there is a diode across the relay coil terminals to prevent the energy stored in its magnetic field from giving the DC circuit an unhelpful extra jolt when the relay coil releases. This is sometimes referred to as a 'snub diode'.

With this semi-break-in arrangement you cannot listen between your Morse characters, but it is a big improvement over a simple manual switch.

Building instructions

The parts list appears at **Table 1**. During the prototype builds, three different DPDT relays were used; one by Goodsky, one by Rayex and one by Bestar. All worked well. The only difference was the current drawn by the relay coil.

Most parts are available from G-QRP Club Sales. Non-members should be able to purchase from the likes of Rapid Electronics, CPC Farnell, Bowood Electronics, JAB electronics and/or Spectrum Communications.

Let's melt some solder!

As I said in part 1, I am a great advocate of building a bit and testing it before building some more. That way you can narrow down any issues to the section you built since the last successful test. This board is another good example of using that technique.

First build the relay circuit and test it, then the sidetone circuit, and test it, then finally the RIT circuit and test that.

Work your way through the parts list and tick them off as you go. It is worth pausing after each stage, to compare your board with the photo of the finished board and correct any misplaced parts before moving on.

I cannot stress enough the need to check, check and check again, that you have the right part in the right place before you solder it; it is so much easier to make changes before soldering!

A wee reminder that all parts should sit on, or just above the surface of the printed circuit board.

Semi-break-in relay circuit

Fit those parts now. The components list for this circuit appears as **Table 2** while **Fig. 3**, shows the parts in place on the PCB.

At this stage it is worth taking a break and then coming back to cast an eye over the parts to make sure they are in the right places, and to check the soldering for any leads you may have missed, or any unintended solder bridges. If all is well, move on to the testing.

Testing

First of all, connect a temporary lead between the ground of the PCB to the negative terminal of your battery or power supply. A 'clip lead' with a crocodile clip at both ends is useful but you can simply solder a length of spare wire to the board and grip the other end in the power supply terminal if you prefer.

With your multimeter set to read DC Amps (most meters require you to change the red lead

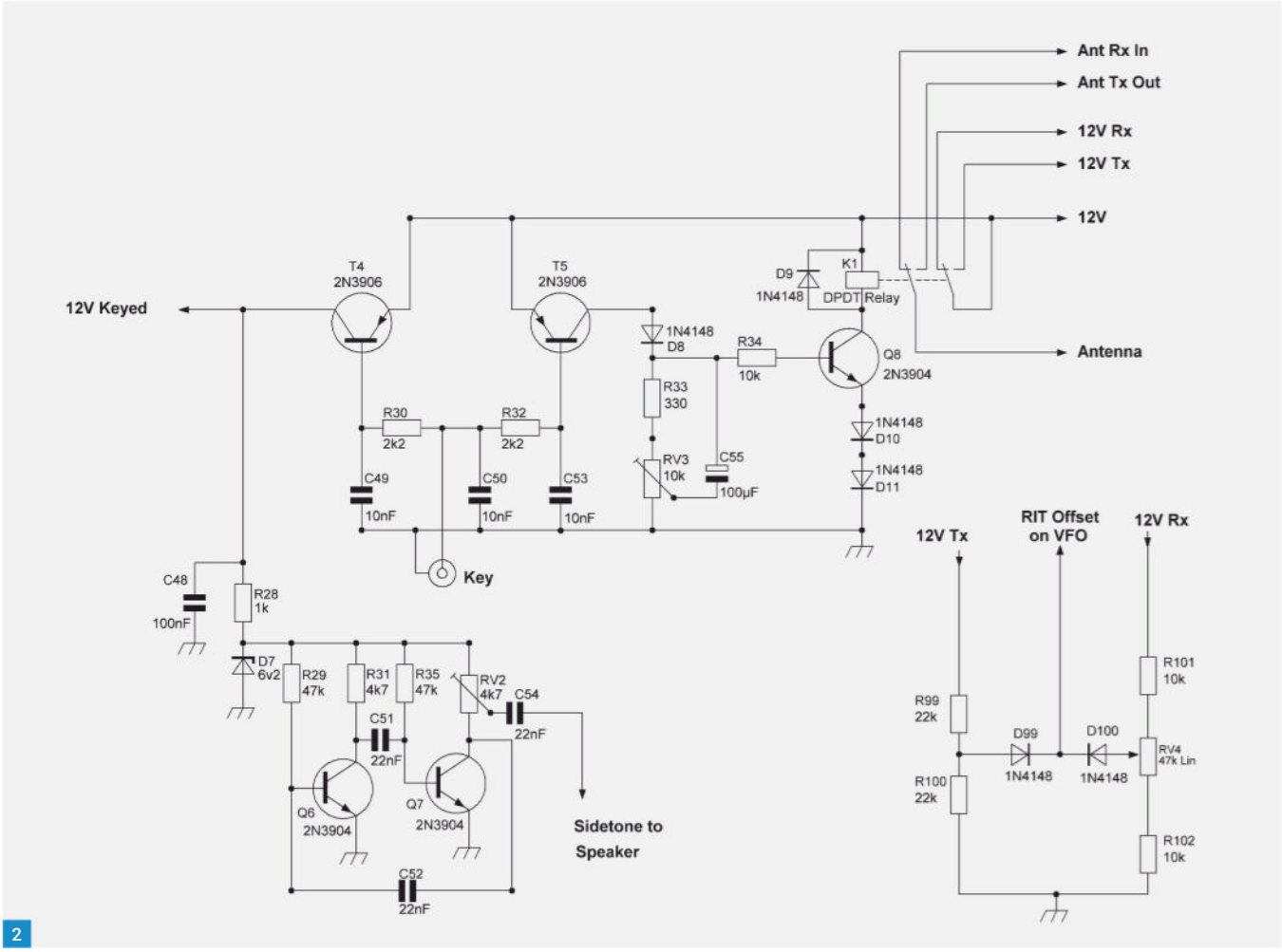

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Fig. 1: Block diagram of the SCD changeover section. Fig. 2: Changeover and sidetone circuit diagram.

over to a separate socket) connect the red lead to the positive terminal of your battery or power supply and the black lead to the V+ point on the PCB.

If you get any current reading, you probably have a solder bridge or a faulty component. Re-check your soldering before continuing.

Assuming your reading is zero, you can short the Key terminal to Ground using a clip lead or short length of hook-up wire. The relay should activate and the current should rise to be in the region of 30-60mA, depending on the relay you are using.

Assuming all is well, remove the grounded wire from the Key terminal and the relay should return to its original position with an audible click, maybe after a short delay.

If there is no delay, adjust RV3 and ground the Key terminal again. After a few seconds remove the ground connection again. Repeat this until you have about a one second delay between removing the ground wire and the relay returning to its original position. You can adjust the delay to suit your keying style when the transceiver is completed.

If all is well, replace the meter with another supply lead and prepare to measure some voltages. To prevent confusion, I would recommend sticking to the 'red is positive, black is negative' convention. Set your meter to read at least 13V DC (typically a 20V max range).

Switch on the power supply and connect the black meter lead to ground. Now touch the red meter lead on each of the points in Table 3, taking care not to short out two or more connections.

Note: there are two sets of measurements, one with the Key terminal open (Key Up) and one with the Key terminal grounded (Key Down).

Table 3 shows the expected results – you can tick off each measurement as it is completed.

Knowing the voltages are correct is always very reassuring. If the results are very different to those in Table 3 (more than 10%), it is worth re-checking all the parts are the correct values and in the right places and that there are no solder bridges or unsoldered joints.

Assuming the relay is operating as it should and the voltages are correct, you can now move on to add the sidetone components.

Sidetone circuit

The component list for the sidetone circuit appears as **Table 4** while **Fig. 4**, shows the component placement on the PCB. Fit those parts now.

At this stage, once again it is worth taking a break and then coming back to cast an eye over the parts to make sure they are in the right places, and to check the soldering for any leads you may have missed, or any unintended solder bridges. If all is well, move on to the testing.

Testing

Before carrying out any current or voltage measurements, connect temporarily the Sidetone AF Amp terminal and ground, to a speaker, or pair of headphones. This will allow you to hear the sidetone when it is activated.

Next, repeat the current checks you did earlier.

If you get any current reading, you probably have a solder bridge or a faulty component. Re-check your soldering before continuing.

Assuming your reading is zero, you can short the Key terminal to Ground using a clip lead or short length of hook-up wire. The relay should activate and the current should rise to be in the

PARTS LIST:	QTY	PART NUMBERS
Resistors (0.25W)		
330Ω	1	R33
1kΩ	1	R28
2.2kΩ, sometimes shown as 2k2	2	R30, R32
4.7kΩ, sometimes shown as 4k7	1	R31
10kΩ	3	R34, R101, R102
22kΩ	2	R99, R100
47kΩ	2	R29, R35
4.7kΩ pre-set resistor	1	RV2
10kΩ pre-set resistor	1	RV3
47kΩ Linear potentiometer	1	RV4
Capacitors		
10nF	3	C49, C50, C53
22nF	3	C51, C52, C54
100nF	1	C48
100µF 25V electrolytic	1	C55
Semi-conductors		
1N4148 diode	6	D8, D9, D10, D11, D99, D100
6.2V Zener diode	1	D7
2N3904 NPN	3	Q6, Q7, Q8
2N3906 PNP	2	T4, T5
Miscellaneous		
PCB	1	
Double Pole Double Throw (DPDT) Relay 12V coil, 5A switching	1	K1
Hook-up wire (4 different colours, e.g. red, black, blue, yellow)	20-30cm each	
3.5mm mono key socket	1	

Table 1: Components list for changeover module.

COMPONENT & VALUE	NOTES	DONE
R33 330Ω		
R30 2.2kΩ	sometimes shown as 2k2	
R32 2.2kΩ	sometimes shown as 2k2	
R34 10kΩ		
RV3 10kΩ pre-set resistor		
C49 10nF	Sometimes marked 0.01uF	
C50 10nF	Sometimes marked 0.01uF	
C53 10nF	Sometimes marked 0.01uF	
C55 100µF 25V	Electrolytic - note orientation; usually a stripe on same side as negative lead	
D8 1N4148 diode	Note orientation; the diode has a black band at the cathode end of the body	
D9 1N4148 diode	Note orientation; the diode has a black band at the cathode end of the body	
D10 1N4148 diode	Note orientation; the diode has a black band at the cathode end of the body	
D11 1N4148 diode	Note orientation; the diode has a black band at the cathode end of the body	
Q8 2N3904 NPN	Check pin configuration	
T4 2N3906 PNP	Check pin configuration	
T5 2N3906 PNP	Check pin configuration	
DPDT Relay		
Hook-up wire	(4 different colours, e.g. red, black, blue, yellow) for 12V, ground and key, 12V Tx, 12V Rx	
3.5mm mono key socket	For the key or keyer	
Check against photo before carrying on		

Table 2: Components list for semi-break-in relay circuit.

region of 30-60mA, depending on the relay you are using.

You should also hear an audio tone from your speaker/headphones; it may be quite faint, so listen carefully. If there is no tone, try adjusting RV2 until you can hear a tone.

If you still cannot hear a tone, it is worth re-checking all the parts are the correct values and in the right places and that there are no solder bridges or unsoldered joints. Carrying out the voltage checks in Table 5 may help track down any issues.

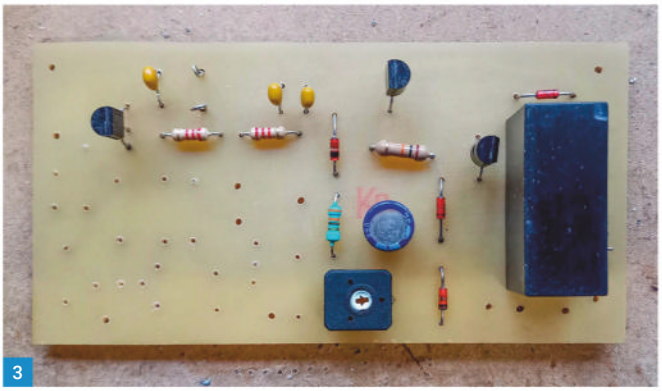
If all is well, replace the meter with another supply lead and prepare to measure some voltages. To prevent confusion, I would recommend sticking to the 'red is positive, black is negative' convention. Set your meter to read at least 13V DC (typically a 20V max range).

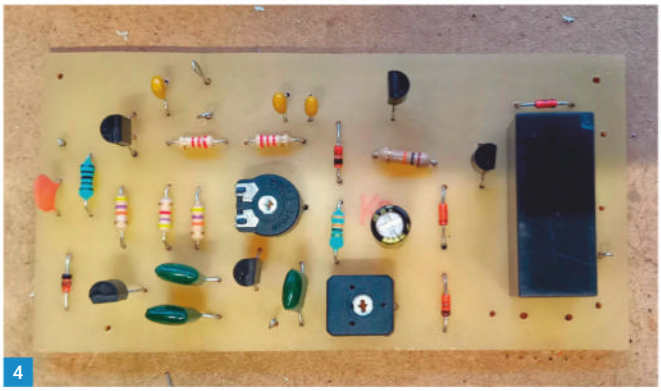
Switch on the power supply and connect the black meter lead to ground. Also short the Key terminal to ground.

Now touch the red meter lead on each of the diode/transistor pins, taking care not to short out two or more.

The expected test results appear in **Table 5**.

The small negative values may seem odd, but all three units built gave the same value. Popping an oscilloscope probe on these points confirmed that the negative reading on the DC multimeter is due to the audio oscillator going negative at this point. If you don't have a scope, getting a negative





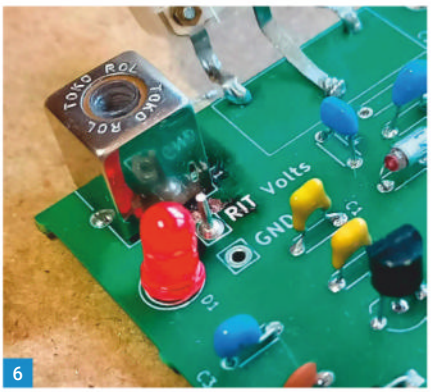


Fig. 3: Changeover board with Semi-break-in parts fitted. Fig. 4: Completed Changeover & Sidetone Board. Fig. 5: The completed RIT pot. Fig. 6: Part of VFO circuit with RIT parts C1 & D1 fitted.

multimeter reading, and hearing a sidetone in your speaker/headphones, should be sufficient to know things are as they should be.

Knowing the voltages are correct is always very reassuring. If the results are very different to the above (more than 10%), it is worth re-checking all the parts are the correct values and in the right places and that there are no solder bridges or unsoldered joints.

Assuming the voltages are correct, remove the ground wire from the Key terminal. The audio tone should stop and relay should return to its original position with an audible click after about a one second delay.

Try grounding the Key terminal to activate the relay and then tapping the ground connection on and off to see if it generates Morse Code while keeping the relay in the 'transmit' position.

If all is well, move on to the Receiver Independent Tuning (RIT) parts.

RIT circuit

The component list for the receiver incremental tuning (RIT) circuit appears at **Table 6**.

The parts listed in the table are not on the PCB; they are soldered directly on the back of RV4 (see **Fig. 5**). This little circuit determines the voltage that is applied to the VFO RIT terminal in both receive and transmit modes.

It is advisable to rub the side of the pot body with a file or some emery paper to ensure there is a clean bright surface to solder to. Tinning the body where R100 and R102 are grounded makes the job of soldering them in place much easier too.

There are also a few more parts to be added to the VFO PCB, but it is worth building and checking the RIT voltage control components first.

At this stage it is worth taking a break and then coming back to cast an eye over the parts to make sure they are in the right places, and to check the soldering for any leads you may have missed, or any unintended solder bridges. If all is well, move on to the testing.

Testing

First of all, connect a temporary lead between the ground of the pot (where R100 and R102 are soldered) to the negative terminal of your battery or power supply. A 'clip lead' with a crocodile clip at both ends is useful but you can simply solder a length of spare wire to the pot and grip the other end in the power supply terminal if you prefer.

With your multimeter set to read DC Amps (most meters require you to change the red lead over to a separate socket) connect the red lead to the positive terminal of your battery or power supply and the black lead to the 12V TX point at the top of R99.

If you get a reading more than 1mA, you probably have a solder bridge or a faulty component. Re-check your soldering before continuing.

Repeat the test with the meter's black lead connected to the 12V RX point at the top of R101. Again, the current should be less than 1mA.

If all is well, replace the meter with another supply lead connected to the top of R99 and prepare to measure some voltages. To prevent confusion, I would recommend sticking to the 'red is positive, black is negative' convention.

Set your meter to read at least 13V DC (typically a 20V max range).

Switch on the power supply and connect the black meter lead to ground. Now touch the red meter lead on each of the points shown in **Table 7**, which lists the expected test results.

Knowing the voltages are correct is always very reassuring. If the results are very different to those in Table 7 (more than 10%), it is worth re-checking all the parts are the correct values and in the right places and that there are no solder bridges or unsoldered joints.

Now, swap the red lead to the top of R101. Switch on the power supply and connect the black meter lead to ground. Now touch the red meter lead on each of the points listed in **Table 8**.

Knowing the voltages are correct is always very reassuring. If the results are very different to those in Table 8 (more than 10%) it is worth re-checking all the parts are the correct values and in the right places and that there are no solder bridges or unsoldered joints.

VFO modification

You can now add the RIT parts (D1 and C1) to the VFO PCB. These were covered in Part 2. Just

OPERATION / TEST	EXPECTED RESULT (Assuming 13.8V DC supply)		DONE
	Key Up	Key Down	
D9 cathode	13.8V	13.8V	
D9 anode / Q8 collector	13.8V	1.9V (depending on relay)	
T4 emitter	13.8V	13.8V	
T5 emitter	13.8V	13.8V	
T4 collector	0.6V	13.8V	
T5 collector	0V	13.8V	
T4 base	13.2V	13.0V	
T5 base	13.2V	13.0V	
Q8 base	0V	2.5V	
Q8 emitter	0V	1.7V	
Key terminal / junction R30 & R32	13.2V	0V	
12v Rx terminal	13.8V	0V	
12v Tx terminal	0V	13.8V	

Table 3: Expected measurement results for semi-break-in relay circuit.

COMPONENT & VALUE	NOTES	DONE
R28 1kΩ		
R31 4.7kΩ		
R29 47kΩ		
R35 47kΩ		
RV2 4.7kΩ	pre-set resistor, set to half travel	
C51 22nF		
C52 22nF		
C54 22nF		
C48 100nF		
D7 6.2V Zener diode	Note orientation; the diode has a black band at the cathode end of the body	
Q6 2N3904 NPN	Check pin configuration	
Q7 2N3904 NPN	Check pin configuration	

Table 4: Component list for sidetone circuit.

OPERATION / TEST	EXPECTED RESULT (Assuming 13.8V DC supply)	DONE
Top of R99	13.8V	
Junction R99, R100 & D99	6.9V	
Junction D99 & D100	6.2V	

Table 7: Expected results from initial testing of RIT circuit.

OPERATION / TEST	EXPECTED RESULT (Assuming 13.8V DC supply)	DONE
Top of R101	13.8V	
Junction R101 & RV4	11.5V	
Junction RV4 & R102	2.0V	
Junction D99 & D100	Variable: turning the pot control should swing the voltage from about 1.5V to about 11V with 6.9V when it is set to the centre of its travel	

Table 8: Further testing of RIT circuit.

OPERATION / TEST	EXPECTED RESULT (Assuming 13.8V DC supply)	DONE
D7 Cathode	6.2V	
Q6 collector	2.5V	
Q7 collector	2.5V	
Q6 Base	-0.6V	
Q7 Base	-0.6V	

Table 5: Expected test results for sidetone circuit.

COMPONENT & VALUE	NOTES	DONE
RV4 47kΩ		
R101 10kΩ		
R102 10kΩ		
R99 22kΩ		
R100 22kΩ		
D99 1N4148	Note orientation: black band is cathode	
D100 1N4148	Note orientation: black band is cathode	
Check against photo before carrying on		

Table 6: Component list for RIT circuit.

Part	3.5MHz	5MHz	7MHz	10MHz	14MHz
TR2	4 + 30 turns T-68-2	4+30 turns T-68-2	4 + 30 turns T-68-2	3 + 21 turns T-50-6	3 + 19 turns T-50-6
C31	330pF	150pF	56pF	120pF	47pF

CORRECTION: Unfortunately, Table 2, Band specific parts, in last month's issue, became corrupted. Here is the correct version. Our apologies.

as a reminder, the LED (D1) is used in reverse bias mode, so the anode (round side and long leg) goes to ground and the cathode (flat side and short leg) connects to the capacitor, C1 (47pF).

If you have the means to measure the frequency of the VFO (frequency counter or a separate receiver), you can check that the RIT does its job. If you don't have a means of checking the frequency, you can simply check that the RIT acts as a 'fine tune' control when receiving signals off air.

First, connect the RIT control to the VFO and the 12V connections on the Changeover Board. Do not forget to ground the body of the RIT pot; a failure to do that can result in many minutes of head scratching when things do not work properly (blush).

Next, connect the VFO and Changeover Board to a 12V supply. Now set the RIT pot to the centre of its travel and measure or monitor the frequency of the VFO.

Check that rotating the RIT pot changes the VFO frequency. There should be a few kilohertz shift either side of the centre position. If you find it shifts more than 10kHz either way, try replacing C1 with a smaller value. If it doesn't shift enough, try a larger value. Tests on VFOs from 3.5 to 10MHz worked as expected with 47pF.

Reset the RIT control to its centre position and note the VFO frequency. Then activate the changeover relay by grounding the Key Terminal. If all is well, the VFO should be on the same frequency in TX mode as it was in RX mode. If there is a small difference, it may be that the RIT pot was not exactly in the middle of its range. You can sort that when the final assembly is completed. If it is wildly different, something is not right and it is worth re-checking all the parts are the correct values and in the right places and that there are no solder bridges or unsoldered joints.

Assuming all is well, disconnect the Key Terminal from ground and switch everything off; your work is done for this part of the series.

Fig. 6, shows part of the VFO circuit with RIT parts C1 & D1 fitted.

What next?

The next part of the project will be along soon and it will cover the transmitter board, boxing it all up and calibrating the VFO and receiver independent tuning (RIT) circuit. **PW**

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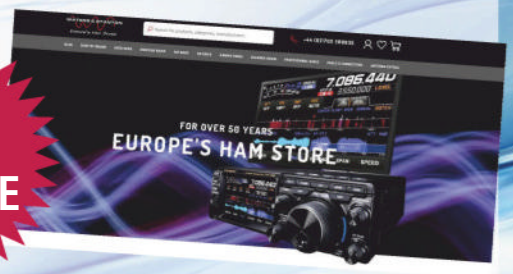

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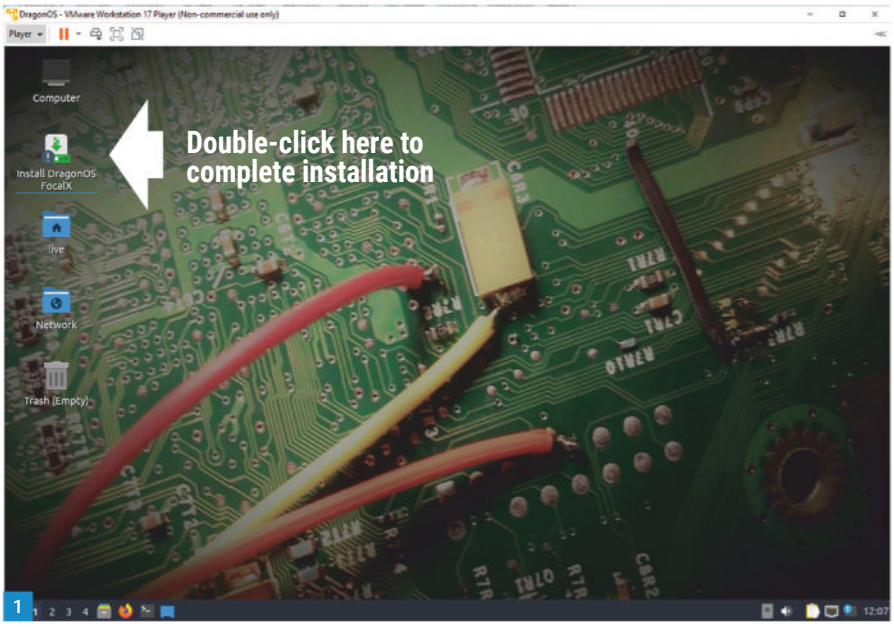


DragonOS

Mike Richards G4WNC has a significant new release of VarAC and a look at a dedicated operating system for SDRs.

If you enjoy experimenting with the many types of SDR and supporting software, you will soon discover that much of the software uses Linux as the preferred operating system. This can be a major deterrent as most radio amateurs use Windows-based computers for their main stations. The other problem with a changeover to Linux is the relatively steep learning curve to get to a point where you can confidently compile and configure the software. However, a great solution was devised during the Covid pandemic. Known as DragonOS, the author (@cemaxecuter) has utilised the portability, security and power of the Lubuntu Linux distribution to create a suite of pre-installed SDR software and utilities. Close to 180 applications are pre-installed, so they should keep you interested for a while! This makes DragonOS a great timesaver. DragonOS is available as an x86/64 version for desktop and laptop PCs and a Raspberry Pi version for 64-bit hardware. I'll cover installation on a virtual PC and a Raspberry Pi in this article.

Virtual Dragons

While there are several SDR applications for the PC, installing and removing lots of new software on your PC carries the risk of destabilising the computer. One of the best ways to avoid this is to use virtualisation software. This effectively creates a separate operating system installation isolated from your primary PC. You can then install software freely on the virtualised operating system without risk to your main PC. I provided detailed guidance on this topic in the April 2024 issue of *PW*.

When you install software using a VM, it remains isolated from your main operating system, and the entire VM can be deleted later with no impact on your computer other than freeing up space. The software for running a VM is free for personal use, and I usually recommend using the VMware Workstation Player, as this has always worked particularly well for me. If you need help installing the VMware Workstation, check that April 2024 *Data Modes* column, or you'll find plenty of tutorials on YouTube. Once the VM software is in place, you can install multiple operating systems on your host PC; all you need is an installation DVD or, more commonly, a downloaded ISO file. DragonOS is one such operating system, and installation is straightforward, as described here:

Open a browser and navigate to the DragonOS site at:

https://sourceforge.net/projects/dragonos-focal

Then use the Download button to start the download.

The download will probably take a while as it's a 4GB file and the link speed is quite low.

Once the download is complete, open VMware Workstation Player and select Create a New Virtual Machine.

Select Installer disc image file (iso), browse to the DragonOS downloaded iso file and click Open followed by Next

In the 'Select a Guest Operating System' panel, select Linux and Ubuntu 64-bit and click Next

You can change the VM name in the following panel, and I suggest using DragonOS. The location box also shows where VMware will store the files for the VM. Select a location on a NVMe or SSD storage device for best performance. **NB**: You will need at least 40GB of free space. Click Next

You can control the Disk space allocated to your new VM in the following panel. DragonOS needs around 35GB, so enter at least that amount.

The next panel provides a summary of the new VM, and you can click Finish to start the installation

Those steps install the downloaded ISO, but you must run the new VM to complete the installation, so hit the 'Play virtual machine' button. On the following screen, select DragonOS, and the installation will commence. Once finished, you should see the screen in **Fig. 1**. You are running DragonOS as a live CD at this point, meaning any changes won't be saved. For the best performance, you should complete the installation by double-clicking the 'Install DragonOS FocalFX' icon. Don't worry; this will only install the OS on your virtual machine and won't affect your host PC. During the installation, follow the prompts to select language, etc. When you reach the Install panel, it will ask if you want to Erase disk and Install DragonOS. Don't worry, it will only erase the 35GB of disk space we set aside for the OS! When this second stage installation is complete, reboot the VM.

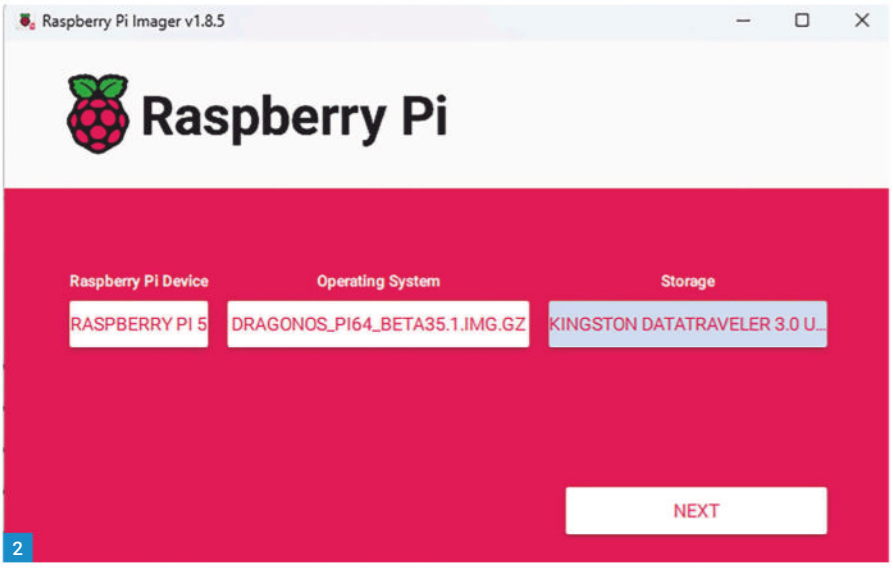
VM Tip: To switch your mouse between your main PC and the VM, press Ctl + Alt.

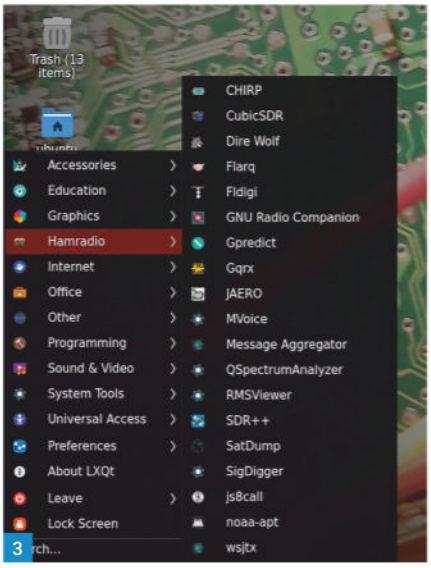
When you have DragonOS installed and running, you can use the Dragon button at the screen's bottom-left corner to open the main menu. Before using one of the many SDR packages, you must connect your SDR hardware to the computer's USB port. A popup will appear when you do this. As we run two operating systems on the same computing hardware, we must tell the computer which system will have access to any newly connected USB device. This popup provides that control. In this example, we want to connect our USB device to the virtual machine, so choose that option.

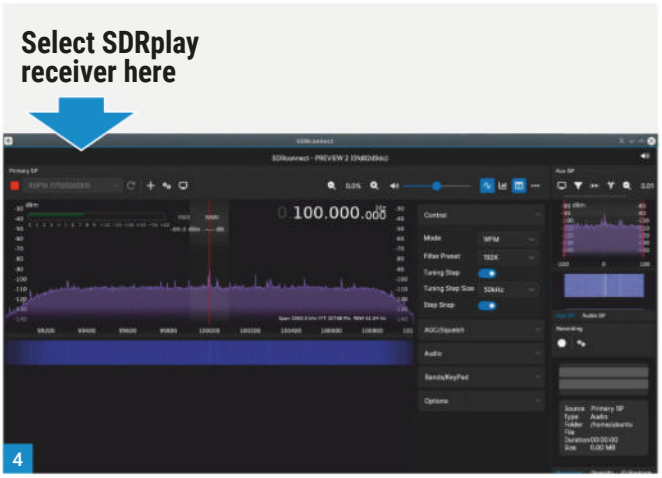
At this point, you should have the new OS working, and you can start playing with the installed applications. I'll provide guidance on these later, so let's move on to Raspberry Pi installation.

Dragon Pi

For complete isolation from your main PC, a Raspberry Pi is an excellent option for running DragonOS. The Pi version of DragonOS is only intended for use with the 64-bit Raspberry Pi, and I strongly recommend using a Pi 5 as it is by far







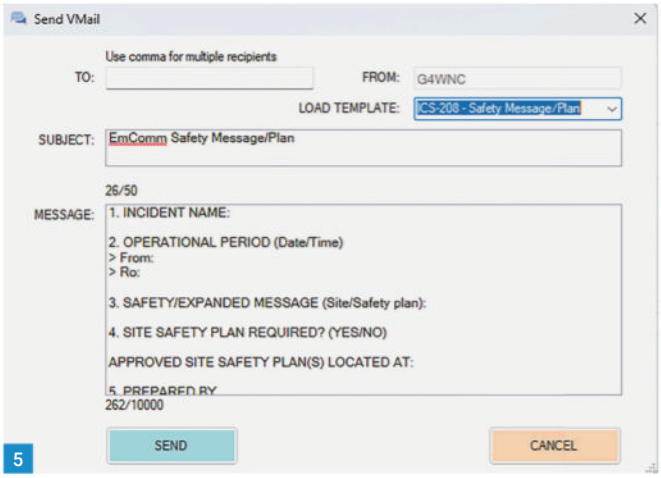


Fig. 1: DragonOS start screen with Install icon highlighted. Fig. 2: Raspberry Pi Imager set up to burn DragonOS. Fig. 3: DragonOS Hamradio menu. Fig. 4: SDRplay Connect on Raspberry Pi and DragonOS. Fig. 5: VarAC ICS style EmComm Vmail templates. Fig. 6: GNU Radio Companion running a FFT display on Raspberry Pi. Fig. 7: Qspectrum Analyser running on DragonOS with a Raspberry Pi. Fig. 8: SDR++ on DragonOS powered by a Pi 5.

the most powerful and works well with all the SDR applications. However, the Pi 4 also does a respectable job. The Pi version of DragonOS uses aarch64 Linux, an ARM port of ArchLinux (v20.04). Installation is simple as follows:

Open a browser and download the operating system from here:

https://sourceforge.net/projects/dragonos-pi64

Once downloaded, the 5.4GB img.gz file can be burnt to a 32GB or larger microSD card using the free Raspberry Pi Imager software:

https://www.raspberrypi.com/software

Open Raspberry Pi Imager, select your device, and then click Operating System, **Fig. 2**.

Scroll down to the bottom of the OS list and choose Use custom.

Navigate to the downloaded file (NB: there is no need to expand it first).

Next, click the Storage option and CAREFULLY choose your microSD card.

Finally, click WRITE to start the process.

Raspberry Pi Imager will burn the image and verify it.

Once complete, you can move the microSD card to your Raspberry Pi and boot the Pi.

NB: The default username/password for the Pi is: ubuntu/dragon.

As with the VM version, once installation is complete, you can access the applications via the Dragon button in the screen's bottom left corner.

Using DragonOS

Most interesting applications live under the Hamradio submenu, where the SDRs, GNU Radio, and other key applications are found. I've shown the display from my system in **Fig. 3**. As you can see, there are plenty of apps to keep you occupied. I successfully tried the SDR receiver software with AirSpy, Airspy HF+ Discovery, SDRplay, Pluto, LimeMini, LimeSDR, and a few RTLSDR dongles. However, SDRplay users have an additional installation step to complete before using this range of receivers. The SDRplay drivers and software require the user to agree to the terms of use separately. Because of this, the drivers and SDRconnect software are included in the DragonOS package but not installed. The author has made installation simple, and here's a guide:

Open a Terminal session and enter: cd /usr/src followed by ls

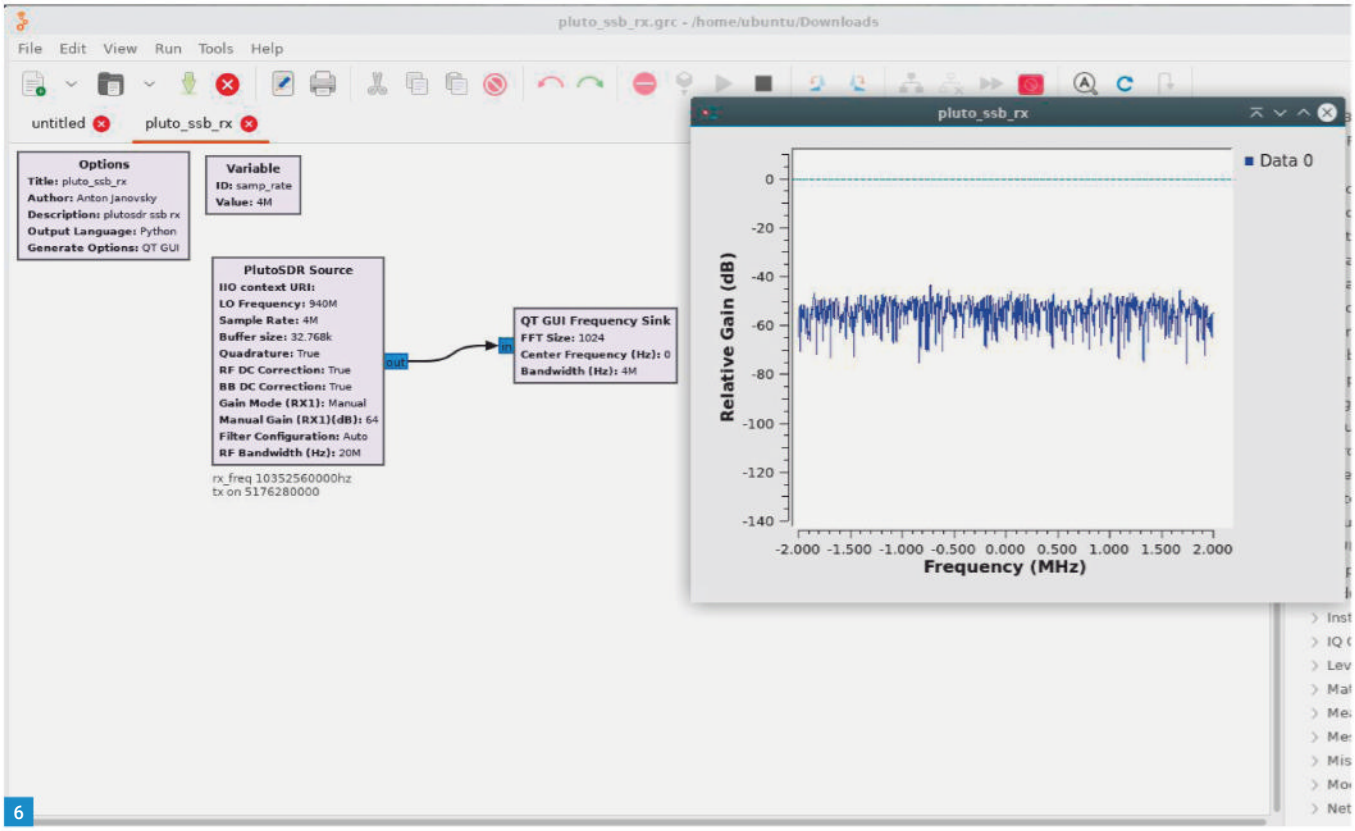
This will show a list of all the files where you should see a few entries coloured green. The two we need begin with SDRplay_RSP_API and SDRconnect_linux-arm64…

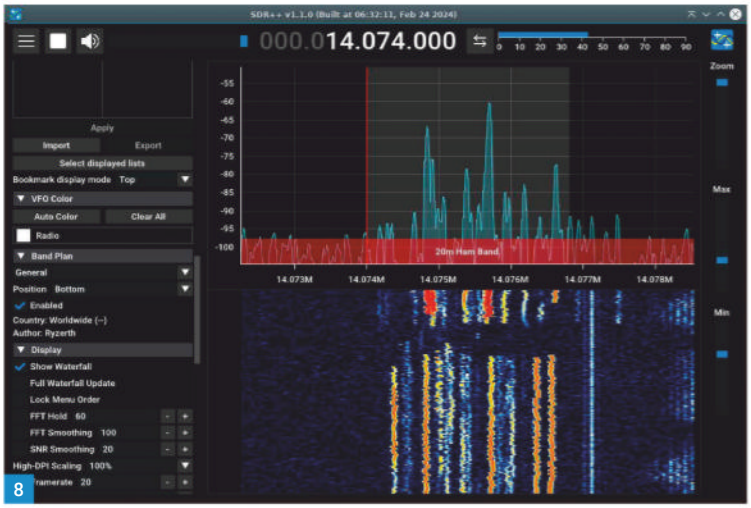
Begin by installing SDRplay drivers by entering ./SDRplay_RSP followed by the tab key. That should auto-complete the filename; you can finish it by pressing Enter.

Follow the prompts and default options to complete the installation.

Now you can install the new SDRconnect software as follows:

With the Terminal session still open, enter ./





SDRconnect followed by the Tab key to complete the filename and Enter to start the installation.

Follow the prompts and default options to complete the installation.

You can test the installation by connecting an SDRplay receiver and using the Dragon menu button then 'Other' to open the SDRconnect software. Ensure your receiver is selected in the Source box, **Fig. 4**, and press the Start button at the top left. You should also find that your SDRplay receiver is available to the other SDR software.

SoapySDR

DragonOS relies heavily on the Soapy SDR project, so I should credit them. Soapy SDR is a brilliant project that provides a standard interface between SDR software and a wide range of popular SDR hardware devices. Without Soapy SDR, projects like DragonOS would be untenably challenging to implement. You can find out more about Soapy SDR here:

https://github.com/pothosware/SoapySDR/wiki

VarACversion9.1.0

The development of this new data mode system continues at pace. I don't have enough space this month to do it justice, so I'll cover a few highlights. The significant change is the inclusion of Emergency Messages with the new EmComm mode. This is selected via the Mode selection drop-down at the top-right of the main screen. When in EmComm mode, the interface layout changes, removing items that are not relevant to emergency communications. You will also find that the new VMail panel includes an option to load standard, ICS style, EmComm message templates, **Fig. 5**. The EmComm mode also features a special beacon where the beacon interval can be reduced to five minutes.

Other highlights include automatic callsign lookup with Log4OM when you connect. Rig control now supports Hamlib-Rigctld, which opens up TCP connections. The 2m and 70cm SSB and FM calling frequencies are fully integrated. **PW**

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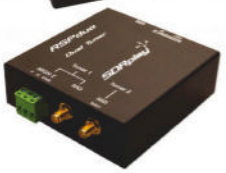

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BBC coronations Pt XV

Keith Hamer and **Garry Smith** continue looking back at the BBC's coverage of Coronations since 1937. Also featured are reminiscences from a PW reader who worked at Ekco, a Coronation vintage television advertisement, more about the Swiss radio pioneer Roland Pièce, the rise and fall of BBC 198kHz, the series marking 60 years of BBC-2, and the development of Swiss Radio and Television since 1922.

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The main commentary for the *Coronation Service* on 2 June 1953, was provided by doyen television broadcaster, **Richard Dimbleby**, from a position high-up in the Triforium, **Fig. 2**. After the service, the unit outside the Abbey covered the departure of the various international Prime Ministers, the Colonial Rulers, **Queen Elizabeth The Queen Mother**, and **Her Majesty The Queen** together with **HRH The Duke of Edinburgh**.

Viewers then saw the procession in all its splendour, initially from a high vantage point in Hyde Park where the commentators were **Bernard Braden** and **Brian Johnston**. Coverage concluded with the RAF fly-past and salute at the *Victoria Memorial*.

Vintage coronation television equipment

This month's trip through vintage copies of uncared for newspapers and magazines has gleaned an advertisement by *Ferranti* for their Coronation 12in television, **Fig. 1**. The advertisement dates from 24 April 1953. The text has been left in its original format to reflect the spelling, grammar and punctuation of the time.

The full description of the *Ferranti 12" Table Model T1325* appears below Fig. 1.

The Ferranti T1325 was a 5-channel (Band I-only, Band III wasn't utilised until 1955), AC/DC (200-250V) superhet table model fitted with the company's 12in T12/72U CRT. It had a total of 14 valves: EF80 (7), EB91 (2), PL81 (1), EY51 (1), ECL80 (2) and one PZ30.

Introduced in 1950, the *EF80* was an internally-screened pentode valve. *Mullard* described it as a high-slope RF pentode and not a variable-μ type. The variable-μ counterpart to the EF80 was the EF85.

The *EB91* first appeared in 1949 and was a double-signal diode. Mullard differentiated between their *rectifier diodes* and *signal diodes* by denoting full-wave rectifiers with the letter 'Z', and twin-diodes being designated 'B'. Mullard designed these diodes for vision and sound detection.

The *PL81* was a line-output valve, which first appeared in 1951. Mullard designed it for universal mains sets, not employing a mains transformer, with the heaters in a series chain.

Introduced in 1948, the *EY51* was Mullard's first EHT rectifier for AC/DC equipment. It had a 6.3V 90mA heater, and was normally fed from a well-insulated winding on the television's line-output transformer.

The *ECL80* was a triode, output pentode for audio use. Mullard designed it primarily for use in VHF 405-line receivers with the triode acting as a frame-blocking oscillator and the pentode being a frame-output valve.

The *PZ30* consisted of a pair of half-wave rectifiers in a single glass envelope. They could be used for full-wave rectification in certain applications. Some set manufacturers used one half as an HT rectifier and the other section as an efficiency diode in the line-output stage.

Ekco feedback

We recently began an in-depth feature about the founder of the Ekco radio and television company, **Eric Kirkham Cole**.

This prompted **Sid Smith** of St. Neots in Cambridgeshire to write the following: "*I loved the information on Ekco radio in the March edition of* Practical Wireless*. I felt compelled to write to you.*

"I worked at the Ekco factory in Southend-on-Sea as a lad of sixteen, assembling televisions. It was a great place to work. I well remember having a little accident on the assembly-line in 1961 when wheeling a truck down a gangway. I knocked over a row of cathode-ray tubes that had been left unsecured. There were a few rather loud bangs as they crashed onto the floor.

"I always remember the lovely social club and the snooker tables. I also remember someone called Ken who worked on a repair and fault-finding bench. He chain-smoked Capstan full-strength cigarettes, one after the other. Those were very happy days - until Pye took over and everything started to go haywire. Pye sold the buildings which covered a huge area, nearly down to Southend airport. The site was later used by the 'Access' credit card company.

"I hope this is of interest to you and your readers."

Thanks for your very interesting memories, Sid. The second instalment of *The Ekco Story* will continue as soon as space permits.

1

Ferranti 12" Table Model 58 GNS.
Take a look. The Ferranti 12" Table Model T1325. Its large flat screen and front controls will give you a front-line view for the big events of the year. At 58 gns. it's too good to miss.
POST THIS COUPON TODAY!
FERRANTI LTD., RADIO SALES OFFICE, MOSTON MANCHESTER 10
Please send details of Model T1325
Clearly FERRANTI for sight and sound

2

Roland Pièce archives: Part IX

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.

The financial means to operate the *Champ-de-l'Air* transmitter were very modest. Roland Pièce was responsible for all engineering activities, including the creation of a small studio next to the transmitter.

In November 1925, the Lausanne town council awarded a grant of SFr. 32,500 for the modernisation of the installation and the purchase of a new Marconi transmitter. In addition, *Kanton Vaud* allocated an equivalent amount, and the *Société romande de radiophonie* contributed SFr. 10,000.

Roland Pièce was asked to make all the

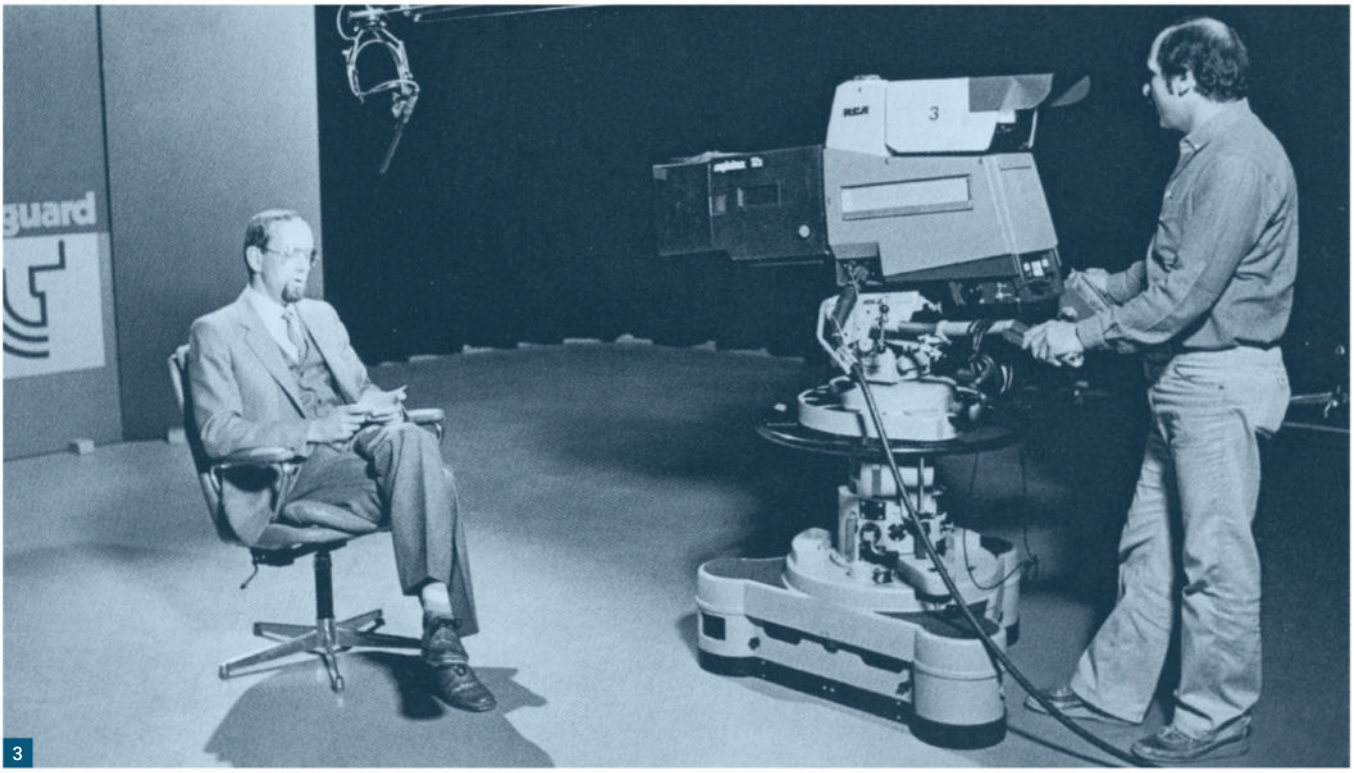

Fig. 1: An advertisement dating from 24 April 1953, for the Ferranti 12" Table Model T1325 television receiver. Fig. 2: Richard Dimbleby describing the Coronation Service on 2 June 1953, from his position high-up in the Triforium at Westminster Abbey. Fig. 3: Telesguard, hosted by Chasper Stupan, was the first current affairs programme to be broadcast in the Latin-based Rumantsch language, which is mainly spoken in Kanton Graubünden, Switzerland.

arrangements with the Marconi company in London. He visited the BBC studios several times and met **Guglielmo Marconi** in person at *Marconi House*. He also supervised the installation of the new station, which was inaugurated in March 1926.

The rise and fall of 198kHz: Part VIII

Following the June column and the BBC's confusing information about the closure of *Radio 4 LW*, **Godfrey Manning G4GLM** has written from Edgware with several observations. Godfrey writes: *"Dear Garry and Keith, BBC Radio 4 - will it or won't it close? Suggestions I've seen are that the Shipping Forecast will cease on Long-Wave, but Droitwich transmissions (inclusive of slow-data) could continue until 2025. My 'Radio Teleswitch' still changes the electricity tariff to 'Economy-7'.*

"The data stream is binary phase-shift keyed at 25bits/sec and contains a time reference, as well as other data, in addition to controlling meters. My nearby Crystal Palace MW relay (720kHz, 240W) is no longer carrying programmes. Instead, there is an endless-loop announcement which I have attached for your interest.

"As always, I look forward to reading your articles in PW. *Regards, Godfrey G4GLM."*

Thanks for the information, Godfrey. The announcement states: *"This BBC Radio 4 transmission has now closed. Please retune to FM, digital radio, digital TV, BBC Sounds, or smart-speakers to continue listening to BBC Radio 4."*

Perhaps the BBC will eventually issue a definitive statement regarding the future of their LW transmissions!

60 years of BBC-2: Part IV

The technical complexities that faced BBC engineers in 1964 during test transmissions for BBC-2 cannot be over emphasised. However, in essence, a very simplistic account is as follows: some electric current flowed through 480 metal rods around the summit of the Crystal Palace transmitting tower in London – and not a great deal of current at that, perhaps enough to warm a single home on a winter's night. However, the current, reversing its direction some 1,134-million times every second, was the vital end-product of many months of planning, preparation, technical ingenuity, hard work, and not a little anxiety, for BBC engineers and programme makers alike.

The launch of BBC-2 presented a number of problems. The huge expansion was something which had never been attempted before. In effect, the existing BBC-TV output was increased by almost 50% within only 21 months from the publication of the government's *White Paper,* which was the starting signal for BBC-2.

Service information, Switzerland: Part XVII

On 1 April 1981, the Swiss *Federal Council* officially adopted a single national anthem which the radio station, *SRF Musikwelle*, plays every night at closedown. Previously, there had been two vying for official recognition. There was the German-language patriotic song, *Rufst du, mein Vaterland* (French title: *Ô monts indépendants*; Italian: *Ci chiami o patria*; Rumantsch: *E clomas, tger paeis*) composed in 1811 by **Johann Rudolf Wyss**, in competition with *Schweizerpsalm* (French: *Cantique Suisse*; Italian: *Salmo svizzero*; Rumantsch: *Psalm Svizzer*; English: *Swiss Psalm*), composed in 1841 by **Alberich Zwyssig**, based on a poem by **Leonhard Widmer** in 1840. Unfortunately, the former was set to the same melody as the British national anthem, which caused confusing situations at events when both countries' anthems were played.

Radio- und Fernsehgesellschaft der deutschen und rätoromanischen Schweiz (*DRS*) television continued to expand their range of programmes in the Rumantsch language. *Telesguard*, hosted by **Chasper Stupan**, was the first current affairs programme to be broadcast in the Latin-based language, **Fig. 3**.

Stay tuned!

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

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1

Goodbye MFJ

Steve Telenius-Lowe G4JVG has all the month's HF news but starts with news of the closing down on MFJ (and see also our News pages).

Welcome to the July *HF Highlights*. I was a little saddened to read the open letter issued on 25 April by **Martin Jue K5FLU**, the founder of well-known amateur radio manufacturer MFJ. In it Martin stated that after 52 years in the business he would be retiring and with effect from 17 May MFJ, along with its sister companies Ameritron, Hygain, Cushcraft, Mirage and Vectronics, would be closing its manufacturing facility in Mississippi.

There can't be many HF operators who haven't used an MFJ product or perhaps a Hygain or Cushcraft antenna over the years. My first experience was with an MFJ ATU, which I bought from the then fledgling company nearly half a century ago. In those early days MFJ had a reputation for perhaps not the highest quality and indeed I succeeded in destroying the switches in the 300W-rated ATU while using only 100W. Fortunately that negative reputation was short-lived and I became a very satisfied user of the MFJ-259 antenna analyser for many years. This device became so ubiquitous among DXpeditioners that, at least on the FSDXA operations that I was involved with in the 1990s and 2000s, it became known simply as *"the MFJ"* (in the same way that vacuum cleaners are known as 'Hoovers').

Meanwhile, the Ameritron AL-1200 linear amplifier, **Fig. 1**, became the go-to amplifier for many of the big US and Caribbean contest stations because of its reliability and ability to put out the (there!) legal limit of 1500W for 48 hours non-stop.

Martin's open letter confirmed that MFJ products will continue to be sold after 17 May and that the company would continue to offer repair work for the foreseeable future. It is probable that some products are manufactured in the Far East – it is only the USA facility that is closing, so MFJ products may well still be around for quite a while yet.

Aurora!

We are edging closer to the peak of solar cycle 25 and with it comes an increase in the likelihood of solar flares, geomagnetic disturbances and auroras. On 10 May an X3.9 flare occurred, causing the solar flux to rise to 233 units, followed by a series of Coronal Mass Ejections (CMEs) and, in the early hours of the 11th, an even larger flare at X5.9 units. According to the US National Oceanic and Atmospheric Administration (NOAA), the following geomagnetic storm was a G5 event (the highest level) and the strongest recorded for two decades. There was a widespread blackout on all the HF bands on the 11th when the Ap index rose to 400 with the Kp at 9, some of the highest levels recorded in decades.

On the plus side, there were numerous sightings of spectacular visual auroras on the night of 10/11 May as far south as Cornwall, the Channel Islands and even the Algarve in Portugal. **Pete Walker G4RRM** in Crewe, Cheshire, shared the photo of the aurora with his XR5C beam (**Fig. 2a**) that he took at around 2230UTC on 10 May using his iPhone, while **Vince Lear G3TKN** sent in **Fig. 2b**, taken at Portsdown Hill near Portsmouth, also on the evening of the 10th.

Following the 'summer doldrums', conditions should improve though, and this autumn should see some spectacularly good propagation on the higher HF bands such as 21, 24 and 28MHz.

A significant centenary

Don Beattie G3BJ writes: *"We sometimes forget that amateur radio operators have made great contributions to the development of radio communications over the years. Perhaps we don't see quite as much of that pioneering spirit nowadays, but back 100 years it was quite different.*

*"Having been 'set free' to explore the 'useless' short waves, amateurs found that, far from being useless, they held the promise of easy long-distance communications. Distances increased until, in October 1924, the ultimate DX – fully trans-global communications – took place. That was a contact between **Cecil Goyder**, operating **2SZ** in Mill Hill School* (**Fig. 3**)*, London, and **Frank Bell** on a sheep farm on the South Island of New Zealand. You can hear a description of the contact here:* **https://rb.gy/ypod01**

"18 October will be the centenary of this momentous event and there are plans to celebrate with on-air activity jointly with New Zealand, using very special callsigns, including operations from Mill Hill School itself and the sheep farm in Shag Valley, New Zealand. More details nearer the time, but this is something to watch out for."

The month on the air

As mentioned last month, the Czech DXpedition Group operated as A80K from Liberia (normal prefix EL), starting on 5 April. They continued operations until the 18th, ending up with over 122,000 QSOs.

The Italian DXpedition Team was active from Chad from 17 to 30 April, signing TT8RR on SSB, CW and RTTY, and TT8XX on FT8.

Four Norwegian operators went to Market Reef and operated as OJ0T on CW and SSB as well as OJ0/ own calls on those modes plus FT8, using four stations.

The Rebel DX Group's activity as 3D2CCC from remote Conway Reef was hampered by high seas and bad weather. They were on the air from 28 April to 4 May, mainly using FT8 with some CW and SSB.

Dave G4WXJ operated as ZC4RH from the UK Sovereign Base Areas on Cyprus from 28 April to 9 May using SSB, CW and FT8 / FT4.

Three German operators were on the air as

Fig. 1: An Ameritron AL-1200 amp at the PJ4G station; Rick K5UR operating. Fig. 2: Visual auroras on 10 May, (a) above Pete's G4RRM XR5C beam in Cheshire, and (b) at Portsdown Hill near Portsmouth, as seen by Vince G3TKN. Fig. 3: Mill Hill School, London (photo credit: Plumpdj via Wikipedia Creative Commons). Fig. 4: The island of St Eustatius, PJ5, as seen from St Kitts, V4. Fig. 5: GW4VXE's 'new' old FT-77 sees action again. Fig. 6: G0PHY received this QSL from French Polynesia.


2a


2b


3


4

3G0YA from Easter Island between 18 April and 6 May. By all accounts this was a really excellent operation, worked by most of our reporters, and the group made 140,000 contacts.

Janusz SP9FIH was active from January to March as PJ5/SP9FIH from St Eustatius in the Caribbean (**Fig. 4**) and had only just returned to Poland when he was off again, this time joined by **Leszek SP6CIK** for an operation from Bhutan as A52P and A52CI respectively. They were active between 19 April and 6 May.

What to look for in July

Poland joined NATO, the North Atlantic Treaty Organisation, in 1999 and, to celebrate the 25th anniversary, special event station HF25NATO is on the air from 1 May until 31 August. An award is available, see:

https://hf25nato.spaward.pl

Two operators from New Zealand will be active on CW and SSB as E51KEE and E51CZZ from Rarotonga (IOTA OC-013) in the South Cook Islands between 20 July and 2 August. After that they move on to Aitutaki (OC-083) for four days from 3 August.

The RSGB's biggest contest of the year, the IOTA Contest, takes place from 1200UTC on 27 July for 24 hours. Activity is on the five HF contest bands using CW or SSB (or both modes). Send an RS(T) report followed by a serial number starting from 001 and then your IOTA reference. The mainland of Great Britain is EU-005, with separate references for islands off the coast of the UK, while the island of Ireland is EU-115. The full rules can be found at:

rsgbcc.org/hf/rules/2024/riota.shtml

Readers' news

First on parade this month is **Reg Williams G0OOF** who had been away on holiday last month, so it seems he was making up for lost time this month with a bumper log! *"First off was the pursuit of working VP6G, a one-man DXpedition to Pitcairn Island. Not easy with the band conditions but worked on 7 and 18MHz FT8 mode, two days apart between 0700 and 0800UTC. The next DXpedition was 3G0YA, Easter Island, a first-class operation from the team. Fairly easy to work, with them operating on multiple bands at a time, night and day. I managed six bands FT8 worked early morning and three bands SSB worked during the evening, the most contacts I have had from any DXpedition. The next DXpedition to appear later during the month was 3D2CCC, a two-man operation from Conway Reef. I had no luck working this DXpedition, I tried for many hours and days but did not spot them on any band. Again they had been working multi-band FT8 mode on regular frequencies, rather than on DXpedition frequencies. I was not sure what antennas or power they were using. My vertical antenna does not seem to be up to the task on this one! Another contact was a special event station running for 30 days from Nadi, Fiji: 3D2AJT in memory of his friend* ***Zorro JH1AJT*** *who passed away some time ago. Two QSOs were made here on 14 and 21MHz FT8. It has been a good month working FT8/4 with plenty of DX contacts which have filled in the gaps between the DXpeditions."*

Jim Bovill PA3FDR says that this month he noticed *"a notable reduction in both DX and local activity on 10 and 12 m, especially during morning sessions during the second half of the month, when on these bands I usually see much more activity at that time. Among my interesting contacts were new DX entities Honduras (K6VHF/HR9) and Peru (OA1F) and QSOs with some rarer but not new countries including New Caledonia (FK8HM), Kyrgyzstan (EX8BT) and the Philippines (DV1K). I have had only a few QSOs with the latter country in past years, in contrast with my success with contacts with Indonesia even though they both are in the same part of the world."*

Tim Kirby GW4VXE has noticed a real change towards summertime conditions, with daytime absorption being very obvious on 14 and 18MHz. When Tim was operating the station remotely on FT8, 10MHz came up with some goodies, including A5 (Bhutan) and BY (China). Closer to home 3A2MW (Monaco) was also a new country for him. For a week or two, long-path conditions to Australia were very good in the evenings. It was a nice surprise to call CQ on 21MHz CW expecting, perhaps, a reply from North America to be called by VK3CWB at good strength. Tim writes, *"it's been nice to put an old Yaesu FT-77* (**Fig. 5**) *back into service.* ***John G8CQX*** *worked some magic to get it running again. I've been using it in the shack as a spare receiver, connected up to an active loop antenna. Although it's a very simple rig, it has a nice feel and sound to it. I was interested to read that* ***Daimon G4USI*** *had solved the problem of disintegrating rubber on the tuning knob, with a 3D printed cover – such a great idea. The FT-77 I have doesn't have the optional FM board with it. I was intrigued to read recently that there was also an optional AM board for the FT-77, although I don't ever remember seeing one! That would be really good fun for 10m AM."*

Owen Williams G0PHY reckoned that *"Band conditions were good at the start of the month but seemed to go downhill from about mid-month. Further contacts were made with A80K on 18, 21 and 28MHz. The highlight of the month was a 28MHz QSO with 3G0YA. From memory, this was the first time I had heard anybody from Easter Island... One afternoon I saw that they had been spotted on the DX Cluster on 28MHz but when I fired the rig up I could hear nothing. Shortly afterwards I could hear something and the signal started to build. I made a couple of calls and was just contemplating turning the amplifier on when*

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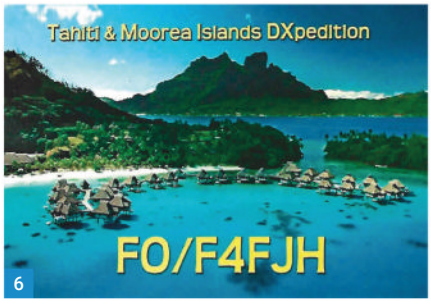

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Fig. 7: Etienne OS8D/P has now activated 350 Belgian castles. This one was on 26 April. Fig. 8: URE 75th anniversary award issued to Etienne OS8D.

he came back to my call and he was in the log in the space of about five minutes. I note from Club Log that Easter Island is number 83 in the most-wanted list, so I was more than happy to get it." Owen was also pleased to have just received a QSL from FO/F4FJH (**Fig. 6**), confirming a QSO he made in August last year.

Etienne Vrebos OS8D has now reached a total of 350 Belgian castles activated (**Fig. 7**) but says *"still 2400 to go, and it's becoming a bit more popular now. I hope I did give some ideas to others, and hope they go over from chaser to activator. It's for sure nice to sit at home with a coffee or a beer and chase for DX or others specials, as I did now the last four days. I chased 100 Russian stations for the commemoration of the Great War, starting all with RP79... Another award from Spain* (**Fig. 8**) *– AO stations, reached Silver: of course SSB only doesn't allow you to reach the top. But, I repeat, being at the active side of the pile-up is a never-ending joy."*

28MHz beacons

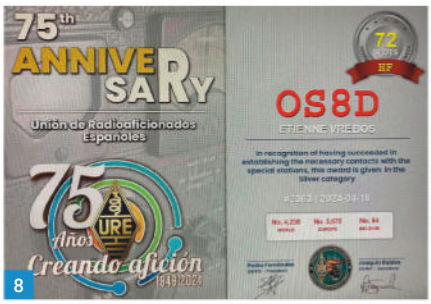
Neil Clarke G0CAS reports on the 28MHz beacons logged during the month of April. The transition from winter-time propagation to summer Sporadic E conditions took place during the month. A few localised and small Sporadic E openings took place on the 5th, 18th and 20th. However, from the 27th larger and stronger openings took place and occurred every day until the end of the month. Beacons such as OE3XAC 28188, DK0TEN 28257, DL0IGI 28205, ED4YBA 28263, OZ7IGH 28271 and SK7GH 28298 were all logged. 28MHz beacons from Italy form a distinct pattern with several like IT9EJW 28225, IQ8CZ 28230 and IQ8BB 28260 [in southern Italy - *Ed*] heard almost every day during the winter months but then only occasionally through the summer months. Conversely beacons IZ0EGC 28180, IW4EIR 28194, IZ8RVA 28240 and IZ0CWW 28295 [further north in Italy – *Ed*] are generally only heard during the Sporadic E season. All DX paths from Europe, except that to South Africa, were less reliable than in previous months. ZS6DN 28200 was heard on 26 days during April. Paths to North America were the hardest hit, with 4U1UN 28200 logged on 13 days and W6WX 28200 logged just the once on the 18th.

Band highlights

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

Reg Williams G0OOF (MS): 7MHz FT8: 3G0YA, HI6M, KL7J, VP6G. **10MHz FT8:** 3G0YA, BD4WN, KH6U, RI0POL. **14MHz FT8:** 3G0YA, BG2DVL, RI0POL, VK2AMT. **14MHz FT4:** KH6TU, TR8CA, V31MA, VK3BD, XE1DEZ, ZL4AS. **18MHz SSB:** 3G0YA. **18MHz FT8:** 3G0YA, A8OK, AH6T, J79WTA, JR6EZE, NL8F, PJ2MAN, RI0POL, VK3AUX, VP6G, ZL4KYH. **18MHz FT4:** HI6M, HZ1TL, PJ2MAN, V31MA, VK3BOB. **21MHz SSB:** 3G0YA. **21MHz FT8:** 3D2AJT, 3G0YA, VK5LO, XP3A. **28MHz SSB:** 3G0YA.

Jim PA3FDR (MS): 10MHz FT4: CO2AV. **10MHz FT8:** K6VNF/HR9, VK3GK, ZL4AS. **14MHz FT4:** PP6EOJ, UN8PC, V31MA. **14MHz FT8:** OA1F, UN7CBY, VE3KZT. **18MHz FT4:** DV1K, JE3EDJ, JG4AKL, KF9UG, PY5EJ, RU0LL, VE5SF. **18MHz FT8:** 4L7T, 9K2HQ, A71XX, BD4WN, BG0CAB, CR3GPDX, DS5TUK, JN1RFB, JR5JEU, JT1BV, K7GQ, PZ5RA, UA0SM, V26K, VE7SA, VK2FZR, VK3BAC, VK5LO, VR2CO, VU3FGJ. **21MHz FT4:** 4K6FO, 5W1SA, JA4BRS, JH1WFS, W7CT. **21MHz FT8:** 3D2AJT, 7L4VYK, 7Q6M, BA5CW, BI4JJO, EX8BT, JA4MOK, JH1XUM, KP4AH, LU3AAK, PY2GIG, RN9AZ, VP2ETE, YF4SDF. **24MHz FT8:** A61QQ, CE8EIO, FK8HM, HI0AUT, JA0JWQ, JE1LFX, JT1CO, KI8JP, PY2ZA, PY7ZC, RW0CR,



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VE3XN, YB1HR. **28M Hz FT4:** PU5FLP, ZS4JAN, ZS6PD. **28MHz FT8:** 4L4DX, BH7PUE, EK/RX3DPK, HI6AV, KP3J, PP5CF, WB2UBW.

Tim GW4VXE (HS): 10MHz FT8: 3A2MW, 3G0YA, A52CI, B9CRA, FM4LV, UN7QAT, V31DL, VK3AFW, WL7SJ. **18MHz FT8:** 3G0YA, BX4AQ, ZA5G. **24MHz FT8:** 7Q6M, TT8XX, ZF2OO. **28MHz FT8:** A52P, TT8XX, YC1ERV.

And, operating as **GW4MM (HS): 14MHz CW:** 5Z4VJ, 9N7AA, VK2GR, VK5GG. **18MHz CW:** 4K6FO, A8OK, RI0POL, ZL2AGY. **21MHz CW:** 3G0YA, HZ1TT, PJ2ND, RI0POL, V44KAI, VK3CWB, YE1BON. **28MHz CW:** A71WW, CX1AA, FY5KE, JT1CO.

Owen G0PHY (HS): 14MHz SSB: KH6ML, TO60CSG (FY), TT8RR. **18MHz SSB:** A8OK. **21MHz SSB:** A8OK. **28MHz SSB:** 3G0YA, A8OK.

Etienne OS8D (HB): 7MHz SSB: HV1GP. **14MHz SSB:** EX/OH7O/P, JW8EKA, KL7WG, OJ0T, OX3LX, UO79P. **18MHz SSB:** JR7TKG, OJ0T, TT8RR. **21MHz SSB:** 3G0YA, A8OK, TT8RR, YI1YY, YJ0CA. **24MHz SSB:** 3G0YA, 7Q6M, A52CI, A8O, HL5KY, PY6HD, TT8RR. **28MHz SSB:** 3G0YA, A8OK, CA3VAK, CX4RT, CE5DSQ, PY5NT, TT8RR, ZS6/PB5X.

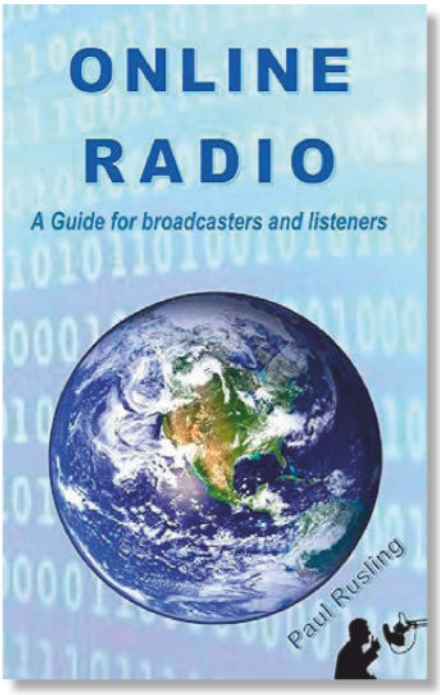
Signing off

Thanks to all contributors. Please send all input for this column to teleniuslowe@gmail.com by the 11th of each month. For the September issue the deadline is 11 July. Photos of your station, antennas or you in the shack are always welcome. 73, Steve G4JVG. **PW**

David Harris
mydogisfinn@gmail.com

Online Radio

David Harris reviews a book that looks at the development of online (internet) radio.



Online Radio. A Guide for Broadcasters and Listeners by Paul Rusling.
World of Radio, 2023. 192 pp. Pbk. £18.95. ISBN 9781900401425
www.onlineradiobook.com

Paul Rusling is one of Britain's most prolific writers on radio. Since 2016 he has published books on Radio Caroline, Laser Radio, Radio Formats and DAB, all of which I reviewed for *RadioUser*. Paul is much more than just a radio historian for he has spent most of his working life as a broadcast consultant advising radio stations in many countries. His hands-on knowledge of how to set up a radio station is distilled into this very informative publication.

Internet radio began back in 1993 and slowly took off with most terrestrial radio stations now having an online streaming service. Rusling estimates that there are around 100,000 online radio stations in the world today. Many will also be terrestrial stations but there are also many small-scale stations that are purely online. This book is aimed at those who might aspire to set up their own station or simply want to learn more about how online stations operate. Online has many benefits, including that it is interference free and not subjected to the kind of control that OFCOM exercises over mainstream broadcasters. Many online stations are free of adverts as they have different business models and might be funded through subscriptions, donations or simply run as a hobby station.

Paul provides a short but useful chapter on the history of broadcast radio from its origins in the 1920s on AM to the development of FM in the 1950s and DAB/DAB+ in the early years of C21. He also looks at modern developments such as DRM, which has been around since 2003 but has had limited take up. Satellite radio began in 1999 but has only really been successful in the USA with Sirius satellite radio receivers being fitted in many cars.

In order to set up an online radio station one does not need to apply to OFCOM and go through an expensive, bureaucratic process. However, if an online station plays music, then fees need to be paid to the appropriate performance and song writing copyright agencies. In the UK these are managed by Phonographic Performance Ltd (PPL) and the Performing Rights Society (PRS). The fee structures are complex and these costs would need to be factored into the business plan of even the most modest online station.

There is a whole chapter on sourcing the right equipment for an online radio station studio. Rusling makes the point that many years ago it would have cost tens of thousands of pounds to equip a studio. Today there is a wide range of equipment on the market that won't break the bank. He gives a lot of practical advice on microphones with a good explanation of how they have evolved from carbon to moving coil to ribbon, condenser and dynamic. The leading manufacturers of studio mikes are Røde, Shure, AKG and Neumann. Paul recommends the Shure SM58, which retails for around £100 in the UK. He also looks at headphones, recommending the Beyer Dynamics DT770 for £125.

If one is setting up an online music station, then format is extremely important. He suggests that stations need to stand out in order to attract any listeners. The key points are: Music Style – that is the type of music played; Music period – oldies or contemporary music; Music activity – hard or soft, easy listening or challenging content; Sophistication – simple pop or complex jazz. Paul has also written a book which goes into great depth exploring over 100 distinct radio formats used in the USA and UK. *Radio Formats, 2020 £9.99. World of Radio.*

The ways to finance a radio station are discussed in detail in chapter 7. The owner of an online station needs to be able to have the funds to purchase the capital equipment, promote the station and pay recurring costs such as licence fees, server hosting and energy bills. Sponsorship and advertising are obvious methods but online stations may struggle to attract worthwhile audience numbers that might attract advertisers.

"In order to set up an online radio station one does not need to apply to OFCOM and go through an expensive, bureaucratic process."

There is a lot of technical information on how to soundproof a studio with advice on choosing acoustic tiles. He also looks at various software products that have been designed for radio stations, such as RadioStation Pro, Audio hijack, IceCast and Listen2MyRadio. Once a station has been set up it needs to be accessible and most online stations can be found through various aggregators' directories or online station directories. A few examples are InternetRadio, which lists 50,000 stations as does MyTuner. A quick look at MyTuner reveals that there are 20 smooth jazz stations in the UK, 14 folk music stations and 68 world music stations. Clearly even in these minority areas there is a lot of competition and to attract any significant number of listeners the station really has to stand out.

Paul gives us a chapter on online radio receivers, which never really took off as online stations can be received on any PC using a browser or on any of the seven billion smartphones around the world. If you do want a dedicated internet radio Paul recommends the Lemega IR1, which can be found for £55 on Amazon. If you prefer a radio by a more established manufacturer, then the Pure Elan Connect can be picked up for around the same price. *Radio Listener's Guide 2024*, a publication which Paul recommends, lists 11 portable internet radios available in the UK from mainstream manufacturers with prices from £55 up to £300 for a Ruark R1S.

The book concludes with a useful glossary, list of suppliers and biographies of some of the key players in the radio industry. In conclusion Paul distils a lifetime knowledge of radio into a relatively slim book but one which is surely the definitive guide to setting up an online radio station. **PW**

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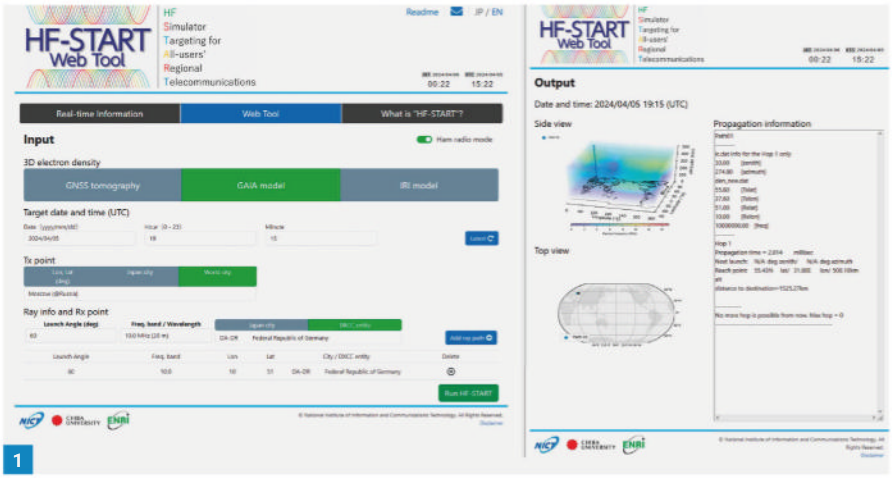

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PHaRLAP - HF laboratory between heaven & earth

HF forecasts from Australia enjoy an excellent reputation, as shortwave still plays a major role there - in communications as well as in their over-the-horizon radar JINDALEE. Mostly developed on behalf of the government and the military, corresponding software offers reliable, state-of-the-art results and is often made available free of charge and without discrimination. PHarLAP is the HF laboratory among all programs.

Worldwide shortwave contacts are based on diffraction (more precisely refraction and diffraction) of radio waves in the ionosphere. This is an area of the upper atmosphere in which solar energy in particular splits the gases into positive ions and free electrons. This 'cold plasma' then becomes conductive for radio waves. The mechanisms are already well researched. Since the 1940s, this has led to increasingly refined models that can be used to predict propagation for certain frequencies, over certain distances and at certain times and boundary conditions such as sunspot and geomagnetic activity. Since the advent of PCs and the release of models initially developed for the military, radio amateurs and shortwave listeners have also benefited from this science [**1**]. These are always so-called climatological forecasts, which, as with the weather, can predict radio conditions over the course of the year and month, but not always precisely for a specific day. If you are planning a garden party in September, you can 'in principle' expect warm, sunny weather, but no one can reliably predict whether it will hail on 9 September two weeks in advance. Regarding the propagation forecast, only real-time models corrected by ionosonde measurements, i.e. based on actual and current observations, can help here. These are now also available free of charge and without discrimination [**2**].

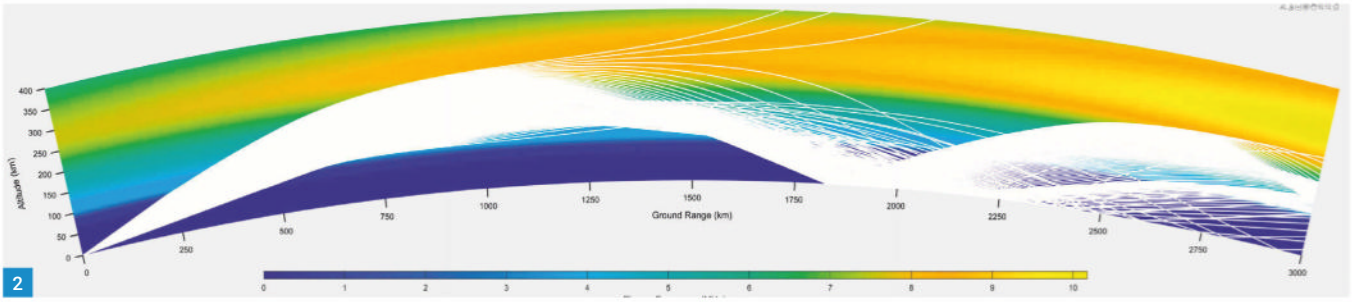
More and more research, more powerful PCs and better modelling have resulted in 'ray tracing' models that are also good at tracing complicated propagation paths. With Proplab 2.0, **Cary Oler** brought such software onto the market in 1994 for the emerging home PCs for $150 (US), with which it was finally possible to simulate the beam path of a signal through the ionosphere in three dimensions and considering the magnetic field, i.e. the splitting into ordinary (o) and extraordinary (x) rays with their respective different paths. I still remember well how I first laboriously programmed the initial conditions in DOS on a 386 and then the computer was busy with the 3D calculations, sometimes overnight. Today's version 3.2 is not only much faster and easier to use, but also offers far more possibilities [**3**]. Any radio amateur seriously interested in the intricacies of wave propagation will find it indispensable. Speaking of computing speed: all these projects, including VOACAP, are rooted in mainframe computer technology, and academic institutions are often no longer able to attract third-party funding to rewrite in new programming languages or process matrices more efficiently. Fortunately, however, this was achieved by porting the IRI model to Python, which means that a calculation of the worldwide distribution of electron density over 24 hours in a 3D-grid of 1°x1° no longer takes 934 hours or a full 39 days 24/7, but only eight minutes (see below)!

IRI model is the basis

Proplab bases its calculations on the International Reference Ionosphere (IRI), which was initiated by the German physicist **Karl Rawer** in the late 1960s and is now available in its latest version as IRI-2022 [**4**]. This modelling is based on detailed measurements below and above the ionosphere, which is divided into seven layers, under various conditions. In its latest versions, the FIRI model [**5**], which was first proposed in 2001, also considers the layers E and D in the lower storeys, which are important for propagation. Ionospheric research has received a further boost through the evaluation (occultation) of GPS data, among other things, so that more and more irregularities [**6**] (geographical, temporal) are now being discovered in the previous model ionosphere, which may or may not be included in the IRI after careful examination.

In addition to Proplab, there is now other software that makes use of ray tracing according to various models. AREPS [**7**], was one of the first, freely available and military stand-alone programs, while IONORT [**8**], was based on Matlab and is no longer readily available in its latest version 2023.10 [**9**]. The web tool 'HF-Start', on the other hand, is a free and non-discriminatory service from a Japanese authority that also offers ray tracing according to three different models - GNSS, GAIA and IRI - see **Fig. 1** [**10**]. With the 'Ham radio mode', it even offers an extra input option for radio amateurs. However, this welcome approach still seems to have some development ahead of it.

The empirical IRI model has been the internationally recognised world standard for the ionosphere since 1999 and was even certified as ISO standard ISO 16457 ten years ago. However, if you want to use it on your own, you will only get numbers, even if there are visualisation options such as PyIRI under Python [**11**]. This is why **Dr Manuel Cervera**, among others, developed PHaRLAP, a convenient application for the Australian Ministry of Defence back in 2008, which uses IRI-2020 but also provides simple inputs and giving meaningful results. On request, Manuel will make the latest version of this software (here: 4.5.3 from 2023 with IRI-2020) available to anyone free of charge and without discrimination [**12**]. A small drawback of this 'provision of a high-frequency ray tracing laboratory for propagation studies': it does not



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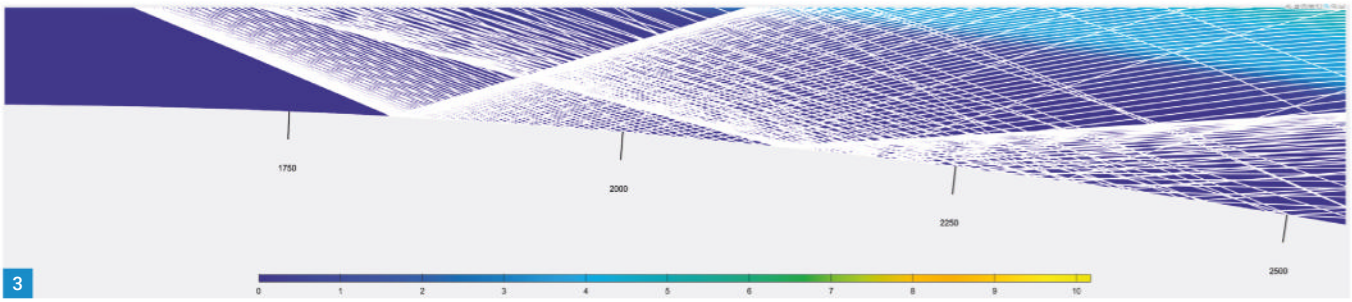

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run solo ('standalone'), but only under Matlab [**13**] or, since 2022, as PyLAP [**14**] under Python.

PHaRLAP makes complex models clear

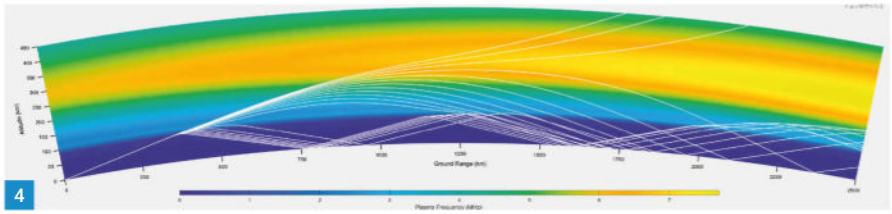
As a raytracing laboratory, PHaRLAP offers the following possibilities:

- 2D and 3D ray tracing engines and supporting routines (geomagnetic, ionospheric, etc.) for modelling RF propagation through the ionosphere,
- Geometric focusing, ionospheric absorption (SiMIAN according to George and Bradley and deviations from this) [**15**]
- Forward and backscatter losses on the ground
- Detection of backscatter losses (forward and backscatter) due to irregularities in the field alignment (FAI)
- Detection of rays escaping from the ionosphere
- Splitting the beam into ordinary (o) and extraordinary path (x)
- Polarisation, Doppler shift and Doppler scattering are taken into account.
- E_s fields are not considered in ray tracing, but there is a way of modelling sporadic-E.

Let's put theory into practice!

All in all, this results in a realistic and clear modelling of the simple as well as the complex course of the rays according to the latest scientific and internationally recognised methods, whereby the basis is almost always formed by first spanning the three-dimensional IRI model grid over the region of interest - after entering the desired locations, monthly R-number and possibly other data. Many included examples in the 'Examples' folder make it easier to get started with the 30 or so core routines, and here, as everywhere else, you should move from the familiar to the new to get a feel for this comprehensive view of the behaviour of electromagnetic waves in the ionosphere.

In the following, I would like to give a few examples to encourage radio amateurs and shortwave listeners to take a closer look at the fascinating phenomenon of radio wave propagation as an essential basis of our hobby and, on the other hand, to do this in line with



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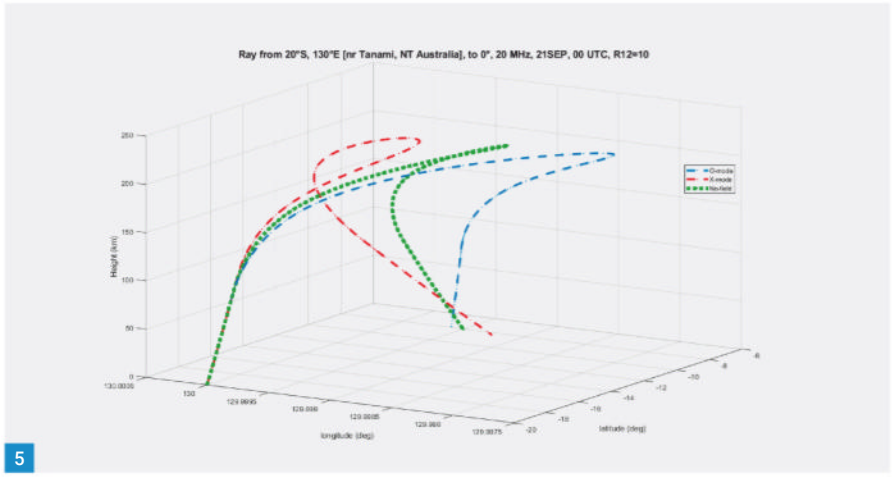

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Fig. 1: With 'HF-Start', the Japanese National Institute of Information and Communications Technology offers a web tool for the 3D simulation of shortwave routes according to various models - also, as here, for radio amateurs. The route DK8OK->Moscow was simulated. Fig. 2: Simulation of the ray tracing with PHaRLAP. In mid-July DK8OK points his antenna towards Ankara (119.5°) on 18MHz at 11UTC. For further information see text. Fig. 3: The enlarged section of Fig. 1 shows the effects of focusing on the ground. Fig. 4: Mid-July, again DK8OK towards Ankara, but on frequencies from 3 ... 21MHz at 1MHz spacing with a vertical beam angle of 12°. R12 number 100, time 0500UTC. Fig. 5: A signal radiates with an elevation angle of 20° from the Northern Territories of Australia in a northerly direction at 20MHz, 21 September, 0000UTC, R12=100. Due to the restriction to only one elevation, the different paths that result when the earth's magnetic field is considered can be clearly seen as 'o' and 'x'. They also differ from the simpler simulation without taking the earth's magnetic field into account ('no-field').

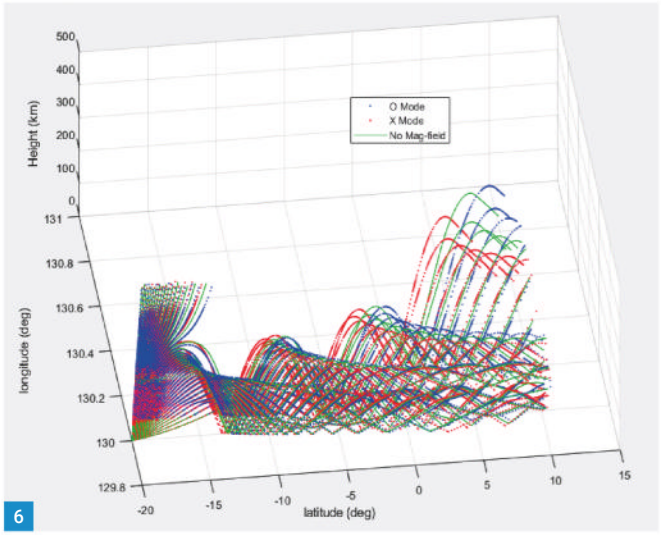

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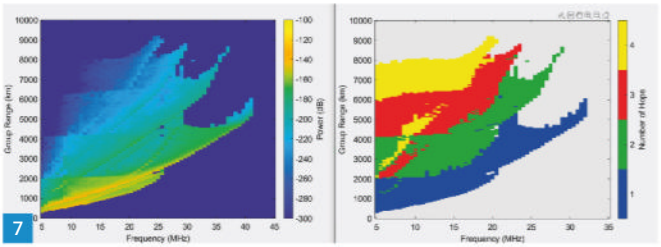
Fig. 6: Similar to Fig. 5, but at different elevation angles. In the original, the 3D representation can be rotated and tilted. Fig. 7: Backscatter when DK8OK is transmitting towards Ankara. Mid-June, 0930UTC, R12 = 130. Power left, number of hops at the right. Fig. 8: While contacts between DK8OK and Madrid are still possible beyond the 15m band in December around 4p.m. UTC, these possibilities are reduced ... Fig. 9: ... in June to the range below about 16MHz. In practice, however, this does not rule out contacts over Sporadic-E and thus far above 30MHz, especially in summer. Fig. 10: Effect of the earth's magnetic field (top) - and below the simulation without geomagnetic influence.



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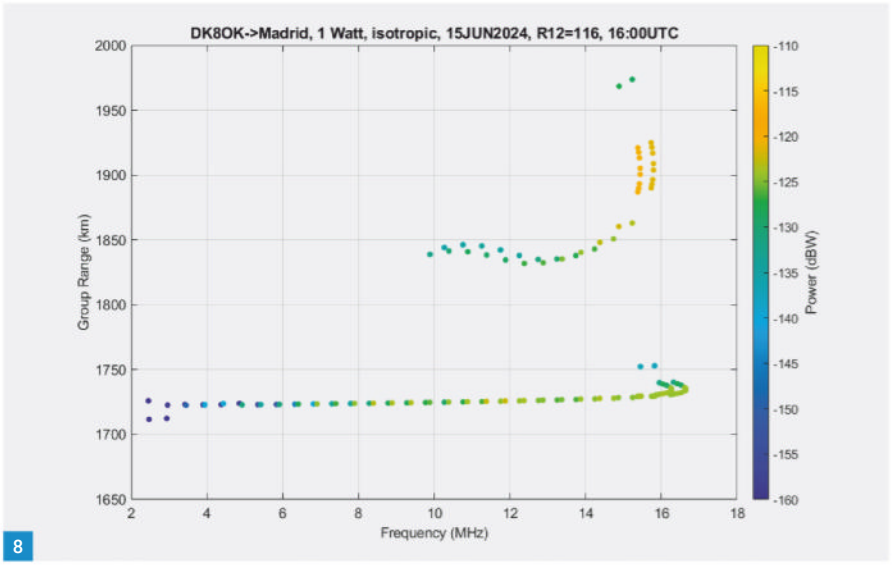

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the current state of science, as is not only appropriate for our technical and scientific leisure activity, but from which we also benefit.

Fig. 2 shows something seemingly familiar: In mid-July at around 1100UTC, I point my antenna near Hannover/Northern Germany towards Ankara/Turkey and call CQ on 18MHz. With an R12 number of 120, a vertical radiation angle between 3° and 23° is modelled in steps of 0.1°. We are now moving away from the often grossly simplified representations in the hobby literature and can see where these are unnecessarily simplified. The ionosphere does not span the earth as a mirror, but as an area that is characterised in all three dimensions by different ion concentrations with different diffraction capacities for different frequencies (colour-coded: the MUF, the highest frequency that is still diffracted back as 'plasma frequency' at a vertical angle) and angles of incidence. Above a certain angle of elevation, the waves are no longer diffracted but escape into space. Between about 1800 and 2300km, however, the first contact with the ground occurs, which is of course not point-like but by and large two-dimensional. However, this area has a structure that can be clearly seen when enlarged, **Fig. 3**. There are areas of strong and less strong occupancy by the rays. This also makes it clear that even small changes up in the ionosphere can cause major shifts in signal strength on the ground - the lever is an analogy from mechanics.

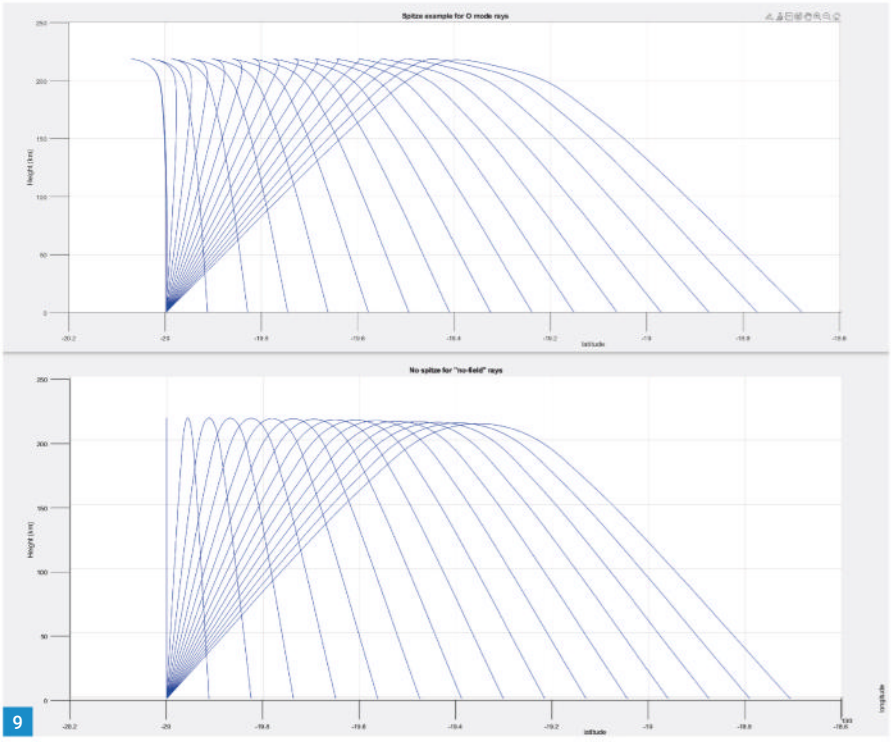
Fig. 4 shows a similar situation. However, here it is not *one* frequency that has been simulated, but *frequencies* from 3 to 21MHz at MHz spacing with a constant elevation angle of 12°. If the lower frequencies reach a receiver at 750 to 800km, waves up to around 18MHz still penetrate almost 2500km, but are no longer diffracted at even higher frequencies.

Figs 5 and **6** demonstrate the influence of the earth's magnetic field, which a) leads to a splitting of the beam, whereby b) these deviate from the great circle according to the earth's magnetic field. Such deviations can be up to several tens of degrees from the great circle azimuth and can often be observed during passages from Europe across the equator towards South America. In PHarLAP, this 3D representation can be rotated as desired for better visualisation. Processing only takes a few seconds here, whereas Proplab has to work several times a minute on the same computer.

Fig. 7 shows how strongly irregularities in the ionosphere reflect the transmitted signal back towards the receiver (left) and up to how many ionospheric jumps this 'backscatter' extends.

The synthetic ionograms between two locations are particularly interesting. Here the software examines which connection possibilities develop at which frequencies via which ionospheric layers, considering the earth's magnetic field at specified times and R-numbers. I tried this out for the DK8OK [near Hannover]->Madrid route for 1600UTC in mid-December (**Fig. 8**) and mid-June (**Fig. 9**). In practice, it is particularly interesting that the most stable connection with the strongest signal always occurs slightly below the highest usable frequency MUF. Why? Because beyond that, multipath propagation occurs with its disadvantageous properties. Staying below the MUF by a factor of 0.85 is always a good recommendation for a good connection. The plasma MUFs for perpendicular frequencies are not shown here, but the actual communication frequencies (oblique ionogram).

Finally, let's look at a special phenomenon, the 'Spitze' [peak] [**16**], which is actually also called this in English. This brief turn of the (ordinary) beam perpendicular to the earth's magnetic field occurs near the critical frequency. The angle itself depends not only on the frequency but also on the intensity and inclination of the earth's magnetic field. **Fig. 10** (top) shows how this 'peak' occurs in the simulation taking the earth's magnetic field into account, while the simulation in Fig. 10 (bottom) does not take the earth's magnetic field into account and the peak



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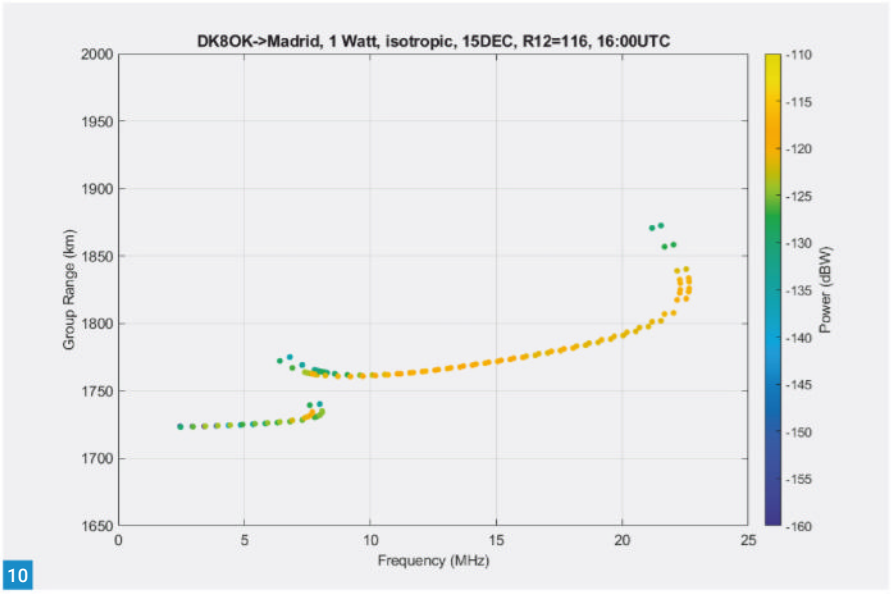

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is therefore absent.

Unfortunately, I was only able to give a brief insight here. The word 'laboratory' is really justified for PHaRLAP. It allows extensive comparisons to be made between different models. However, it cannot and will not replace the various other advanced options that professionals - even in Australia! **[17]** - as well as active radio amateurs use for route calculation. This is not always possible because, for example, propagation over the 'long path' cannot be simulated. There is also a lack of 'footprint' maps plus those fork-ready conveniences that programs specially prepared for radio amateurs offer. But if you want to get to the bottom of some interesting phenomena between heaven and earth and get a realistic view of these processes, this Australian software is just the thing for you.

References

VOACAP is the best known of these programs, PC version free of charge and non-discriminatory:
https://t1p.de/dxuju
A web version can be found at
https://t1p.de/jh47x
For example at
https://t1p.de/jjr1u, https://t1p.de/3aztu
and a map of the world's highest usable frequency MUF:
https://t1p.de/85t0t
https://t1p.de/5ufjk
$240 (US)
For more details: **https://t1p.de/2a2ci** . The data itself is available free of charge and non-discriminatory here:
https://irimodel.org/
2018 revised:
https://t1p.de/owjko
Also available as pyFIRI 2.0 in Python, see:
https://t1p.de/un1qq
For the influence of anomalies on the IRI model, see https://t1p.de/76b7g. For an example of satellite-based research ("Midlatitude summer nighttime anomaly ...") see: https://t1p.de/g0dce. The irregularity over Mongolia is one of the more recent discoveries (https://t1p.de/fec0q), while the anomaly over the Wedell Sea is already well established through satellite measurements:
https://t1p.de/kx095
This ingenious software from the US Navy was available for a short time around 2008 free of charge and without discrimination with homing in the HF ray tracing part, until first this and then the free availability of the entire software was discontinued.
https://t1p.de/fk8np
Personal communication from Marco Pietrella to the author, 2.4.204
https://t1p.de/k2ha4
As the GNSS model only uses the Japanese GPS stations, the geographical range is limited accordingly. The GAIA model developed in Japan (see: **https://t1p.de/ykhd5**) is quite slow, and I have not been able to get the IRI model to work.
Paper:
https://t1p.de/f9c43
Python Files:
https://t1p.de/gaswz
https://t1p.de/jf49a
PHaRLAP stands for 'Provision of High-frequency Raytracing Laboratory for Propagation studies'. It is possible that this astonishing abbreviation was created in reference to Phar Lap, an Australian wonder horse born in 1926. The software is also the best horse in the stable .
https://de.mathworks.com
from 900 euros for one year or 69 euros for students. There maybe always a student member of your local radio club … The calculations and illustrations for this article were created using Matlab R2022b.
https://t1p.de/0v7zy
Python and PyLAP are free of charge
https://t1p.de/k4t8i
https://t1p.de/xbody
See also the excellent free and non-discriminatory services of the Australian Space Weather Forecast Centre for radio amateurs:
https://t1p.de/mpmr3

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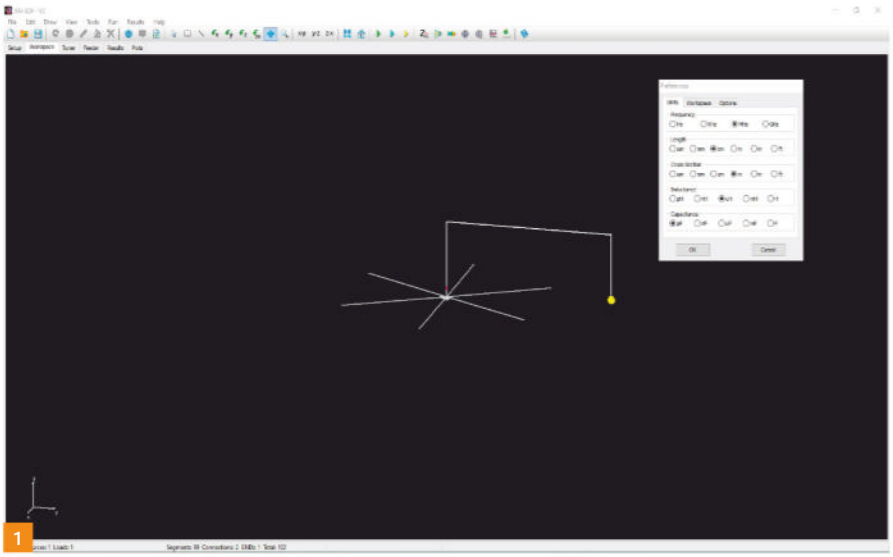


AN-SOF DX Antenna Simulator

Keith Rawlings G4MIU gets his hands on the latest version of AN-SOF and puts it thought its paces.

In the June issue of *PW,* I announced news of the release of the latest version of AN-SOF antenna simulator, namely AN-SOF DX. **Tony** at AN-SOF has kindly made available to me a fully working version of AN-SOF DX so I can bring a full review to *PW* readers; consequently, I have carried over my intended subject for this month to next month.

AN-SOF DX is a fully featured electromagnetic antenna modelling simulator for Windows operating systems. This special version has been aimed specifically for use by radio amateurs, for non-commercial use, and offers a more affordable lower-tiered alternative to the Professional edition of the software with a 500/50/5 combination that is: Up to 500 Segments + Connections, up to 50 frequencies in a linear sweep and 5 degrees of 3D radiation pattern resolution.

AN-SOF was released for the first time in July 2012 but the original engine was developed from 2002. It took Tony ten years to add features that now surpass NEC. Unlike NEC, which was a project involving several people and funded by a laboratory, AN-SOF was developed and funded only by Tony and is being continually updated.

Presently 80% of AN-SOF users are commercial entities.

The software is capable of providing accurate calculations of many different antenna parameters.

Using a comprehensive GUI (Graphical User Interface) the software allows a user to easily draw the geometry of a structure using the mouse, menus and dialog windows. All wires are placed on the screen in a 3D environment and the design may be moved rotated and zoomed while under construction by use of the mouse.

Once the model is built and the simulation run, the results may be visualised using any of the tools provided within the software.

Unlike the commonly used NEC calculating engine, which is based on the 'Method of Moments', AN-SOF is based on the 'Conformal Method of Moments', with an exact Kernel, which is the most accurate method to date for modelling wire structures. A full explanation of CMoM is beyond the scope of this review but an explanation may be found here:

https://tinyurl.com/4n4a952j

AN-SOF has a comprehensive 293-page colour PDF user manual, accessed via the dropdown 'Help' menu; it may also be downloaded from the main website. The Help menu also provides access to the online 'Knowledgebase', email and 'Chat' support and also the AN-SOF home page, which is packed with information on using and getting the best out of AN-SOF. It also provides a lot of interesting material that relate to antenna modelling in general.

Just some of the type of antenna that may be modelled are wire antennas (including dipoles, monopoles etc), Yagis, log-periodic arrays, helices, spirals, loops, horns, fractals, and many other antenna types. It is also possible to run simulations on single-layer microstrip patch antennas and printed circuit boards. In addition, and taking a line from the documentation: *"AN-SOF can be effectively utilized for Electromagnetic Compatibility (EMC) Applications. The software accommodates passive circuits with lumped impedances and non-radiated networks, enabling a comprehensive analysis of antenna systems."*

It will be impossible for me to describe all of the capabilities of this software here but a full overview in PDF may be found here:

https://tinyurl.com/tdmatumy

Installation

Once purchased the installation file is downloaded from a link that will be provided. When run the installation file will place its files in a folder, which can be selected by the user if required. On running the AN-SOF application an 'Activation Key' application will open where the user will be prompted to send off for an activation key by email. This typically is returned within a very short time, the activation app is run again (from the help menu) and the key entered. The software should now be fully activated (on a single PC only).

In use

AN-SOF is made up of a series of applications. AN.SOF.exe is the main program GUI where all the work is undertaken, such as the setting up of your project, entering the antenna's dimensions, running the simulation and viewing the results, see **Fig. 1**.

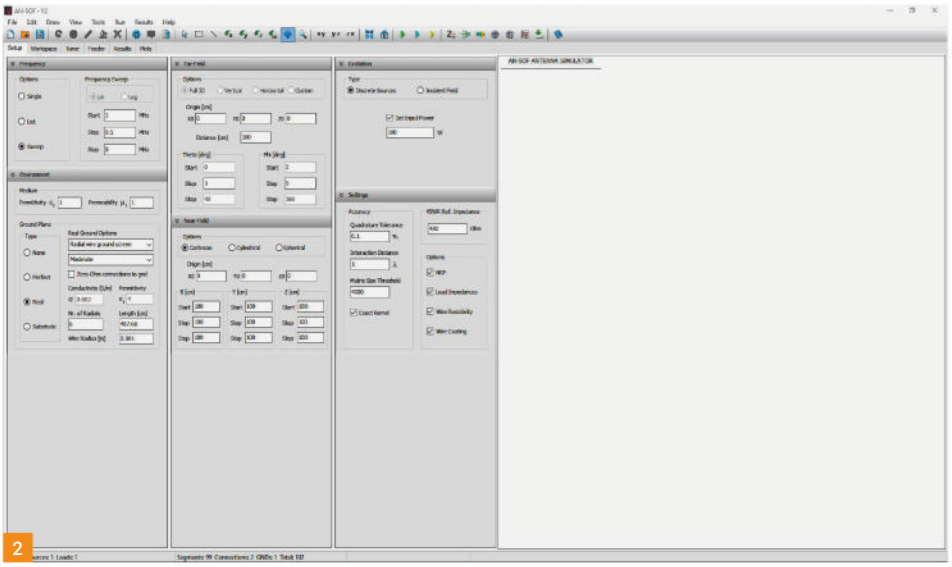
When viewing results AN-SOF can call the following integrated applications to present the data.

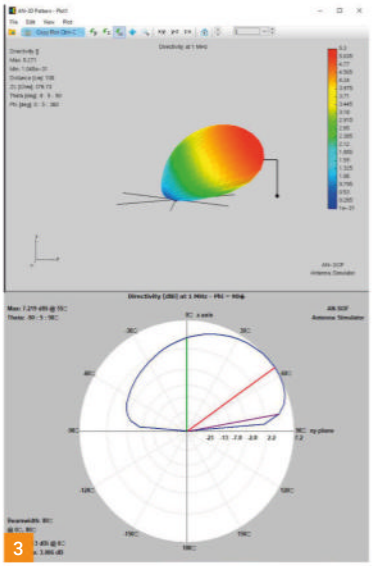
AN-Polar will plot results as a polar diagram with the **radiation pattern** as either the azimuth (horizontal) or zenith (vertical) angles. The maximum, -3dB and minimum radiation levels are shown on the chart in addition to the **beamwidth** and **front-to-back ratio**. Results may be displayed as power density, directivity, gain, normalised radiation pattern, total electric field, linearly and circularly polarised components, and radar cross section (RCS).

AN-3D Pattern will plot a complete view of the radiation properties of an antenna by plotting a 3D radiation pattern. It implements a coloured mesh and surface to present a full 3D implementation of the radiated lobes. This includes a colour bar-scale which indicates the field intensities over the lobes.

Results can be displayed as power density, normalised radiation pattern, directivity, gain, total field, linearly and circularly polarised components, and radar cross section (RCS). Linear or decibel scales can be chosen and near fields may be displayed as colour maps in the proximity of antennas as: Cartesian, cylindrical and spherical plots. Current distribution of the antenna may be displayed as coloured intensity on a map.

AN-XYCHART is used for plotting two related quantities in the X/Y dimension. It will plot parameters that depend on frequency, such as currents, voltages, impedances, reflection coefficient, VSWR, radiated power, consumed power, directivity, gain, radiation efficiency, radar cross section, and many more. It will also plot the current distribution along wires as a function of position, 2D





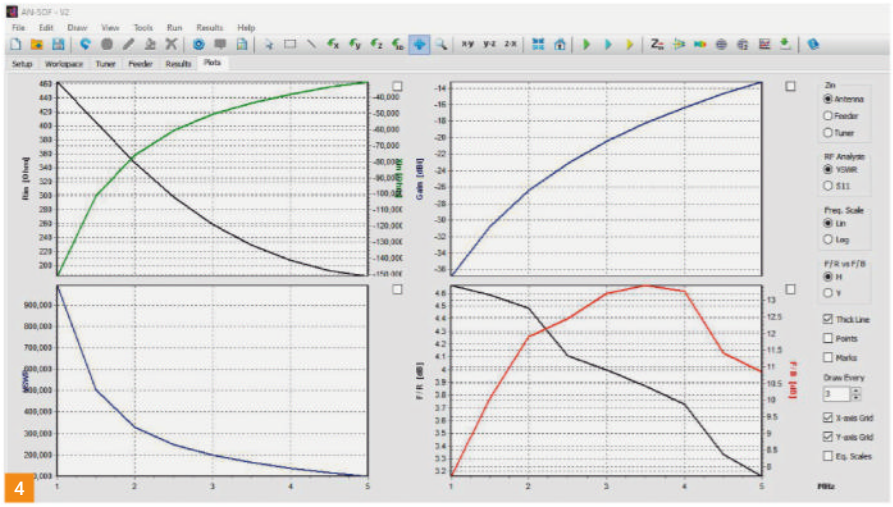


Fig. 1: Workspace screen. Fig. 2: Setup screen. Fig. 3: EWE 3D plot top, 2D plot below. Fig. 4: Plots screen charting Rin, VSWR, Gain, F/B Ratio.

slices of radiation lobes and near fields as a function of distance from an antenna. Different units may be chosen to display results and the mouse can be used to easily zoom and scroll graphs.

AN-Smith application is used to Plot **impedance** or **admittance** curves on the **Smith chart**. The graph may be clicked to get the frequency, impedance, reflection coefficient, and VSWR that correspond to each point on the curve.

Plots from the above applications can be stored as files independent from the AN-SOF program and as they are separate applications they may be run on their own, detached from the main program, to display stored results for later analysis. Any number may be open at one time and plots may be copied to the clipboard and pasted/opened in other applications such as an image viewer or PowerPoint, so it is easy to make presentations if needed.

Starting a model

Fig. 1 shows a simple model of an EWE antenna with a ground radial system as a simple example.

The first thing to do when starting a 'Project' is go to 'Tools' and 'Preferences' to set up the workplace parameters such as frequency, units of measurement and so on.

Next, an looking on the main page, there are a selection of tabs at the top. By selecting 'Setup', **Fig. 2**, the Frequencies of interest are entered, either as a fixed frequency, a swept range of frequencies or a list of frequencies of interest to the user, next the models Ground parameters have to be set, these can be 'None' i.e. Free space, Perfect, Real, or Substrate. When Real is selected the user is presented with a number of pre-set ground options or custom values may be entered.

It is also possible to set-up a Real Ground option that includes a Ground Radial Screen. See Fig. 1 again.

When substrate is selected a number of different substrate parameters are available to choose from.

Also, Set-up allows the selection of parameters for measurement in the Far and Near Field, the accuracy of the model, Input Impedance, input power and also if the model will be driven by an Incident Field, project notes may be added here too.

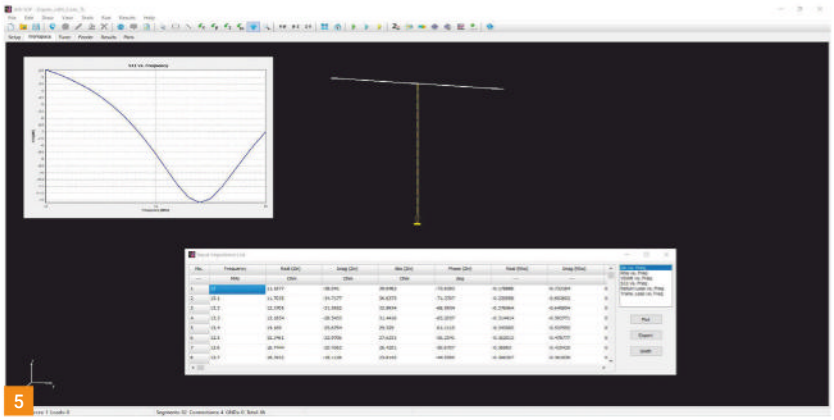
The 'Workspace' Tab is where the model is constructed. To make life easier AN-SOF has a multitude of tools to draw objects for you such as Line, Arc, Circle, Helix, Archimedean and Logarithmic Spiral, Wire Grids and Solid Surfaces, Tapered wires and more.

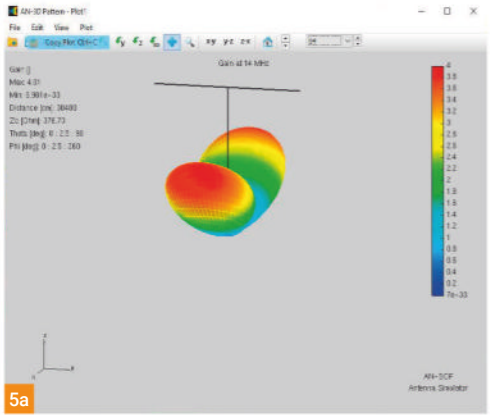
A model's parameters may be entered in a Tabular format, somewhat but not exactly like that used in MMANA-GAL/EZNEC or by selecting a function such as 'Line' directly, either from the Draw/Line menu or by Right clicking on the workspace and selecting Line. This will open the 'Draw' dialogue box and the wires details are added, including Co-ordinates, the cross section of the wire which may be round, square flat etc, the type of material used for a particular wire and importantly the wires segmentation. Here AN-SOF recommend *"To ensure accurate results, the line should be divided into segments that are relatively short compared to the wavelength. Generally, a segment length equal to or less than one-tenth of a wavelength is considered short. AN-SOF suggests a minimum number of segments to achieve reliable results automatically. If you require higher resolution, you can manually increase the number of segments"*.

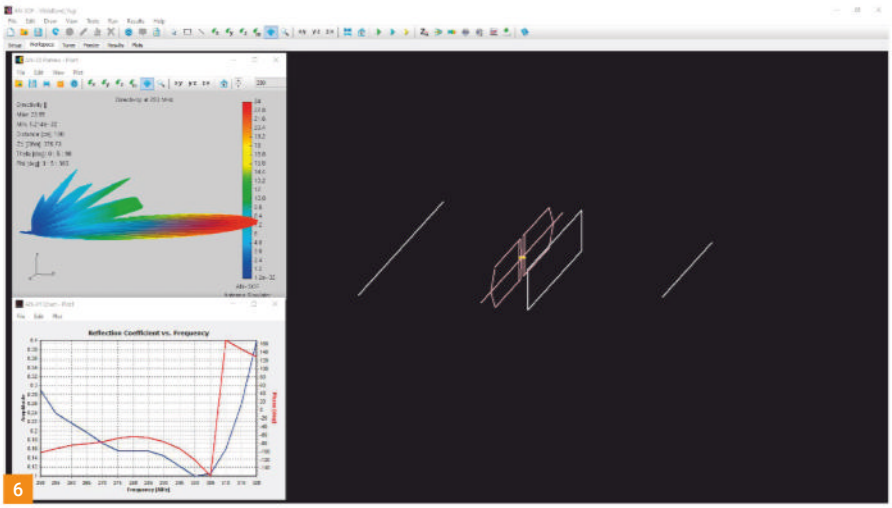
By setting Segments to 0 each wire will be automatically divided into segments, with the calculation based on a default value of 10 segments per wavelength.

Incidentally, I tend to use the Draw dialogue box for data entry and the Tabular format for editing.

Once drawn the model will need to have at least one 'Source', the point where the antenna is driven. This is achieved by right clicking on the wire to select it. A menu with various options appears.







Select source and a toolbar with a slider will be displayed at the bottom of the screen. Move the slider to the position on the wire where you want the segment located then, click the Add Source button then add 'voltage source' with an amplitude of 1 Volt and a 'phase' of zero. Selecting the Red 'X' box exits from the menu.

Now Save the Project!

The model is then Run from either the Run Dropdown Menu or from buttons along the toolbar at the top of the workspace. There are various options for this but 'Run All' will run all of the parameters of the model within the simulation.

Now we come to the interesting part. I have counted 25 different ways to display results and this is where AN-SOF demonstrates its strength, the ability to present data in a large number of easily understood formats. These can be selected from the 'Results' dropdown menu or from buttons along the top of the workspace and, I'll be honest, I can't describe them all here so I'll go for the main ones.

3D Plot. Fig. 3 demonstrates a couple of the different ways data may be presented. Top shows the 3D Directivity colour plot of the EWE antenna at 1MHz and below, the 2D plot.

Plots Tab, Fig. 4. By selecting this tab, plots of the antenna's Resistance, Gain, VSWR and F/B ratio are quickly displayed and each may be made full screen by selecting the check box next to each graph.

The EWE model did not include a feeder but these may be simulated in AN-SOF.

Fig. 5 is one of the many example antennas included with the software. It is a simple horizontal half-wave 14MHz dipole fed though a 50Ω coaxial transmission line.

So, this time we will click the '**Zin**' button and a table displaying a list of the Input Impedances for the model appears Fig. 5, also from here it is possible to display charts such as VSWR, S11, Return Loss, Smith Chart and so on. The VSWR plot for the dipole model may be seen in the window upper left of Fig. 5 and Fig. 5A 3D Gain Plot.

Other features are Tabs for the embedded transmission line calculator, which simplifies the design of feedlines for antennas. Actual cable part numbers can be selected from a wide range of manufacturers.

A brand-new feature, added to all versions of AN-SOF, and which I have yet to fully explore is the Tuner Calculator. With this new and powerful feature it is possible to model BALUNS and Tuners within the model.

Once the user has run the simulation AN-SOF remembers the details so the user can run things such as different 3D Plots, Impedance results etc. over and over without having to re-run the model. Only if the model is altered is it necessary to re-run it.

Also, when the model is saved the parameters of each run are saved with it too, so each model does not have to be run again unless it is altered. This is useful as it avoids repeat runs and speeds up the simulation process.

There are no limits on how many integrated windows may be open at any one time meaning that any number may be compared side by side.

Projects may be merged, NEC, DXF, MM files may be imported and AN-SOF files may be exported as an NEC file.

Fig. 5: Workspace screen of a 14MHz dipole with feeder, including VSWR plot and input impedance list. Fig. 5A: 14MHz dipole 3D gain plot. Fig. 6: Depicts a more advanced model of a wideband 4-element Yagi incorporating plots of directivity and also reflection coefficient.

Verdict

I have barely scratched the surface of AN-SOF's capabilities in this review. The software is a very sophisticated and powerful modelling tool.

I have used two very basic models here but it is capable of simulating so much more. See **Fig. 6** for example.

The 500/50/5 combination seems to work well and should be good enough for even the most demanding amateur radio applications. Consider too that, because of its engine; it is capable of accurate modelling of wires near ground.

Features are being added all the time and I think AN-SOF DX would be a good choice for any serious amateur antenna modeller. I have used AN-SOF for a number of years and have found it very good.

My sincere thanks to Tony for supplying a copy of AN-SOF DX for the review.

The current price is US$300/year for individuals, US$249/year for licensed radio amateurs worldwide. For details:

https://antennasimulator.com/index.php/pricing

PC requirements

Windows Vista/7/8/10/11. 2GHz CPU, 2GB RAM, 1GB free disk space. **PW**

Maurice Webb GW0UGQ
gw0ugq@yahoo.com

My new magnetic loop approach

Maurice Webb GW0UGQ continues his experiments with magnetic loop antennas.

First I must say thanks for all the emails, tips and QSL replies from experimenters who have followed my journey to try and improve their radiated signal and enable them to still enjoy the wonderful world of amateur radio. It's not been easy and I have had great obstacles in my way and other problematic things that I have had to try and master, like living in a Faraday Cage! So I have had to try and re-adapt myself and antenna design to overcome these obstacles that I have inherited. I have been amazed at the prices that some companies and other sellers are asking for their magnetic loop antennas. Somehow I feel that I am in the wrong business (hi)!

Seriously though, I was never very good at skin effect theory of an antenna, so I have been studying some excellent videos on YouTube with reference to that same topic. I am not sure if they cover this topic in the modern-day radio amateur's examination. I have a wonderful friend who keeps trying to encourage me to try a different approach in my constructional practices of magnetic loop building, hence this final article. But in the back of my mind I keep thinking that if the difference is (or can be) so noticeable, then why is there an absence of this in the topics of magnetic loop designs? Please also understand that as the late great **Ken Dodd** once said, *"I'm not as young as I used to was!"* I just hope that I have the time and especially the patience to complete my final mission. My course of action is to try and build an antenna using aluminium flat plate. You will see on the internet and of course YouTube, where some radio amateurs and companies have used a similar idea, using an experimental width of around 2in or so. I propose to build my test experimental antenna with a larger width of 4in. I hear you asking *"Why?"*

Roger G4ROJ used this same principle quite a few years ago, albeit using aluminium foil, though he used a slightly larger circumference, and different configuration than I will be using. His design was for use within the 40m (7MHz) amateur band. His results, I have been told, were very promising as compared against a 40m dipole at 40ft above ground, **Fig. 1**. As I cannot have an outside antenna as a comparison, I have to use my results that were obtained using my copper tubing loop experiments. Also before I go into my theoretical construction, again please understand that I cannot compete with an experimental antenna similar in size to the one shown in Fig. 1.

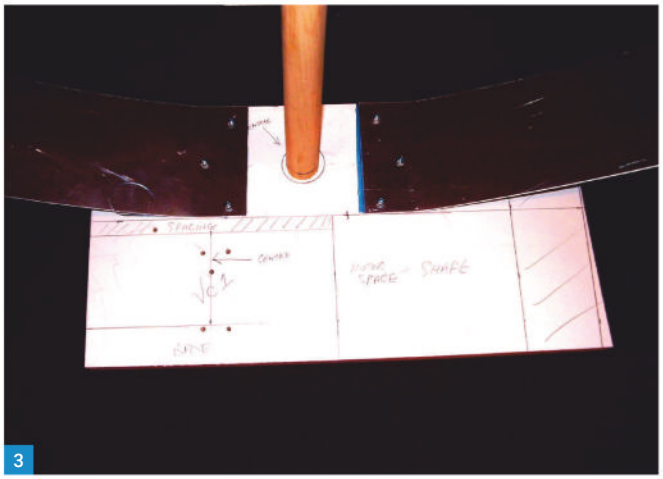
In my magnetic loop experiment I obtained my flat aluminium plate from S.G.S. Metals Ltd, at a cost of around £44, which included delivery, **Fig. 2**. My order was for 1 x 1m flat plate with a thickness of 0.9mm. Some people may find 0.9mm quite flimsy to play with, but with patience, three hands, and a few 'G' clamps, you can succeed (hi). I will again be using a broadcast type triple-gang variable capacitor (VC1). Its value per gang is approximately 117pF. I will be using all three gangs (351pF) as a general starting point, which then may enable tuning on the 5 and 7MHz bands; albeit with a loss of efficiency on these lower bands.

Construction

I have designed a base template for my loop antenna, **Fig. 3**. `This will again be a table-top idea. You can see the different sections that I have allocated for any future additional inclusions, such as a slow-motion motor. I may change the template sections as and if I locate any problems in my design, which I think I may encounter.

The picture, Fig. 2 again, shows delivery of my flat plate sheet. Please note, that this will have to be cut into 4in strips. Each strip will be one metre in length and you will need a total of three strips. These will be joined to produce a 3m total circumference circular loop. The joined small sections will then be welded by a friend of mine to try and keep any resistance losses down. The strips were cut for me using a scribing jig machine, with a short blade. You will have to arrange your own method of cutting these strips safely. Please follow all common-sense cutting techniques to save any possible accidents, to yourself or others helping you! The picture in Fig. 3 shows my base plate template with markings of my operation needs and shows the start and finish of my 4in flat plate aluminium magnetic loop design. You may use the above antenna measurements and design for experimentation or your own measurements depending on what band coverage you require. The Faraday loop was made by using an offcut of mini 8 coax, with braid and centre connected together. This also gives some insulation of RF currents when positioned close to the main loop. The formula for the inner Faraday is 1/5th, of the total circumference of the main loop, and terminated in a chocolate block.

The photo, Fig. 3 again, shows my rough base template for my 4in flat plate magnetic loop design. Sorry about the poor picture but it should give you an idea. The wooden upright pole forms the main support structure of my magnetic loop, and is also useful as a carrying handle. Again a wooden support is fine for me as I will only be using this



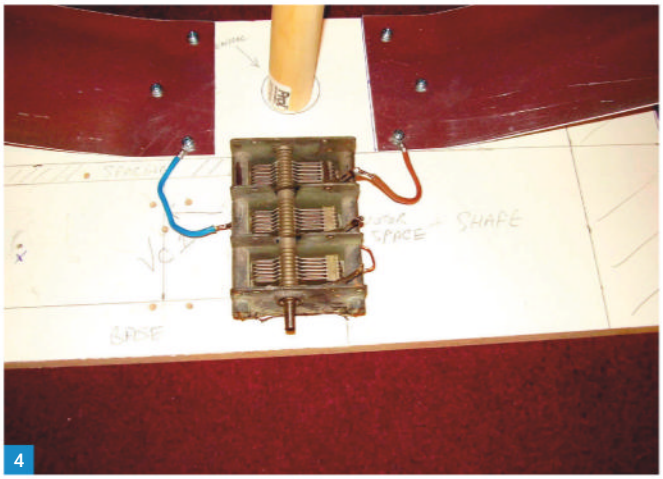


Fig. 1: Experimental aluminium foil loop used by Roger G4ROJ. Fig. 2: Aluminium flat plate sheet supplied by SGS Metals Ltd. Fig. 3: Base template design of magnetic loop mounting idea. Fig. 4: Showing the triple gang variable capacitor in position. Fig. 5: Assembled HF magnetic loop on bench ready for testing. Fig. 6: Close up view of my adjustable Faraday loop assembly.

antenna in my apartment or for a brief spell of portable activity. A better support method will be needed if your use is to be outdoors. My support was a simple brush handle shaft, available from any local hardware store. Using the capacitor mentioned as VC1 should allow coverage from 18MHz down to 5MHz. I will again be using my loop for data modes but will experiment with phone on occasionally.

The next photo, **Fig. 4**, shows my variable capacitor in position and connected to the loop. Those two terminals will be welded after tests. All gangs are used. The connecting wires are about 3mm copper due to only running QRP for the tests. The photo is missing the link connection to the top gang, from the blue wire. That will be added later before testing. The aluminium flat plate is just screwed to the wooden base plate. The brown wire is connected to the rotor vanes or chassis, as it is termed. Both the blue and brown wires (after final testing) will be welded to the plate, as mentioned before, to help with any losses. The picture does not show the insulated shaft and control knob for tuning. The insulated shaft will be around 4 or 5 inch, with a large control knob to help in tuning. This can be seen in **Fig. 5**.

This photo (Fig. 5) shows my assembled magnetic loop, after adjustments, ready for testing. In this design I have made adjustment of the Faraday slightly easier. The holding unit of the Faraday loop actually moves up or down, to obtain better coupling. The two black lines are insulating tape to keep the coax down-lead secure, after adjustments. The above produced an SWR of 1.1:1 on all bands from 18MHz to 10MHz. SWR on the lower bands (5 and 7MHz) was 1.2:1. The tests were done with just 5 watts RF output. The antenna bandwidth will be more noticeable on the LF bands, with mine producing around 4kHz before retuning was needed. The Faraday looks a little elliptical but don't worry too much about that as long as RF power transfer to the main loop occurs. Please be aware, DO NOT TOUCH the main loop when transmitting. Even at QRP power levels the voltage generated across the variable capacitor can be in excess of 1000V. So be warned!

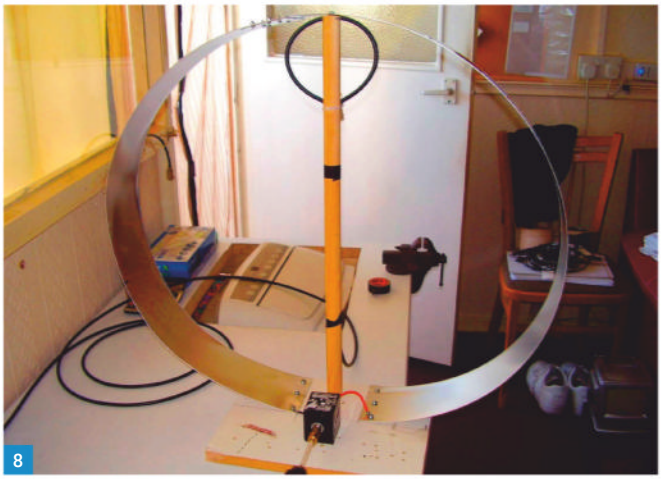
Fig. 6 shows my very crude idea for an adjustable Faraday loop assembly. The cable tie adds friction, although not too tight. Then it can be moved up or down to obtain final wanted low SWR results. The cable tie can then be pulled tighter, and insulating tape is added to make the coax downlead more pleasing to the eye. Please note that the edges of the aluminium flat plate can be quite rough and sharp, so be careful. You can add some simple car door rubber trim if you prefer, but I never bothered.

In use

I have not yet run major tests on all bands, but I am extremely impressed with this magnetic loop response. This loop is more susceptible to nearby metallic objects including, of course any electrical strip sockets, like I have. You can re-position your loop to an area which is less congested with objects that will/may affect its performance or SWR.

The screenshot, **Fig. 7**, shows my signals, using 2.5W of FT8, as received across Europe and further afield, and displayed on the PSKreporter website. I don't recall the band or the time but the results are encouraging.

In this loop design I have tried to obtain as many



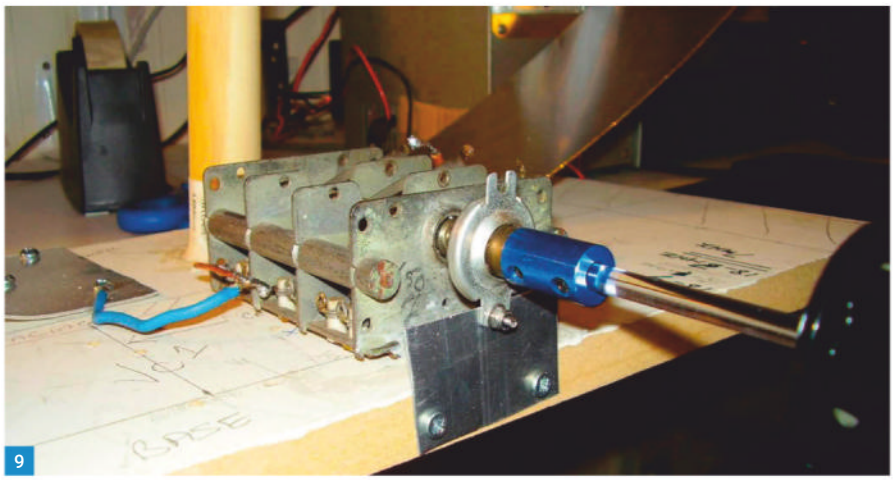


Fig. 7: Displayed results of my test transmission reports. Fig. 8: Baby mag- loop for playing with the higher frequencies. Fig. 9: Simple use of a Jackson 4511 reduction drive.

usable bands as I could given the physical size of my magnetic loop. Don't expect it to be good on all bands covered – because it won't be. Also don't expect it to perform great every single day, as there are far more things to be taken into account! Please also be aware that not everyone uses 2 watts as I do. I don't expect to work YB or JA every day. That is the nature of our hobby, and the limitations of the antenna that have to be taken into account, so as I have said repeatedly, *"Don't get disappointed"*.

Nevertheless, the results I have found in using the above new design magnetic loop are very rewarding. The main difference that I have noticed is that I am receiving a lot more weaker signals. That is, as said before, in comparing it against my same size copper tube loop. I have used the dB scale on the WSJT-X software as a comparison. Using the copper loop when bands are slightly folding, when almost no signals were visible, and then changing over to the aluminium loop it was still displaying signals. These included the US, PY and Canada. This was on the 20m band, which is not really fair as it is a summer band, but my results were very good, and encouraging.

It must be taken into an account that I live in a Faraday cage so for me to obtain those types of results proves that there is a noticeable difference between the two different antenna tests that I was able to perform. I would also expect that if this loop was outside, in the fresh air, and outside my apartment, that results would be somewhat better.

The baby loop

As another small experiment I decided to construct a baby version of my new loop construction, mentioned above, and seen in **Fig. 8**.

This baby version has only been added as a slightly easier way of covering the higher frequencies, with any leftovers from the aluminium flat plate. This version, all being well, should cover from 18MHz to 29.7MHz, and will allow reception of the 10m repeaters. The total length of this baby magnetic loop is 72in (6ft). It is constructed using the same construction techniques as for the larger one.

I have done short tests on 10m, albeit WSJT-X, on 28.074MHz and there has been activity on most mornings with very good signal reception reports. This was using an output of only 2 watts. My best and furthest contact to date was NF3R in FN20 square at a distance of 5410km on FT8 while using only 2 watts RF output (FT8). I also received a SWL reception report from Australia, at a distance of 16,339km. My FT8 report was -10. The variable capacitor used for the baby loop tests is 110pF (BC), C804 type.

I had to slightly increase the Faraday loop length by 1/2in or so to get it right. It now displays a SWR of 1.1:1 on most bands with about 1.2:1 on the 10m band.

As a last minute decision I decided to add a small reduction drive, to assist in fine tuning of the loop. The reduction drives are available on eBay and are priced at around £15. The one I used in the photo, **Fig. 9**, was donated to me by a YL SWL, with her wish that I put it to good use. The pictured Jackson 4511 reduction drives are usually of a 6:1 ratio. I used just a very crude mounting plate. Please note that when tightening the reduction drive to get it as near square as possible and check it via its rotation many times before it becomes permanent. This is a must as you may get some tight spots during its rotation. I know I did. It's a bit time consuming, but it will be of benefit in the long run; especially if you decide to add a motor, at a later date.

So basically I am very happy and quite surprised at the overall performance of these two magnetic loop antennas. The variable capacitor used in both my mag-loop ideas can be any general-purpose broadcast receiver type, which will also keep costs down. So with an initial layout of £44 excluding my time in constructing them, I can now cover from 5MHz to 30MHz amateur bands. It is well worth the effort, and being homemade, it adds that little thrill to it, which can only be achieved through home-made experimental ideas.

Thanks to Roger G4ROJ for his kind permission to use the picture in Fig 1. And also to Andy G3PKW for his encouragement in my pursuit to reach my personal 'Holy Grail'. And to both for letting me use other related items or comments of theirs, in my article. **PW**

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1

The best aurora in years

Tim Kirby GW4VXE reports that the recent aurora brought some great propagation to the VHF bands.

The best aurora in years was the considered opinion of many VHF operators who were able to take part in the aurora which occurred on the evening of Friday 10 May. Solar forecasts predicted that it was going to be a 'big one' but you never know until it arrives. Most parts of the country could see the aurora – for me it was a mesmerising sight! Auroral contacts were made on 40, 50, 70, 144 and 432MHz – I'm happy to be able to include details in some of the band reports this month. The majority of contacts appear to have been on CW with one or two stations trying out Q65C which seems to cope with auroral distortion. On 50MHz, where doppler shift is less than on 144MHz, some stations were using FT8 without any problems. Intriguingly, some transatlantic contacts were made, which is, to my recollection, a first for Auroral propagation, with K1TOL having been worked from Europe.

145 Alive again

Another of the popular 145 Alive events, originally created by **Tim Hughes G5TM** and now organised by **Mark Savage M0XIC** and **John Alexander M0XJA** took place on the afternoon of Saturday 11 May. A full analysis of the event will hopefully follow at a later date, but there is no doubt that, once again, the event generated a lot of activity and interest in 2m FM. Some 51 nets were running simultaneously and Mark estimates that over 1000 contacts by over 250 different operators were made in the two-hour period of the event. Mark says that 145 Alive is an event that people can take part in at little cost and that access is simple.

First QO-100 contact from North America

AMSAT-UK report that on Saturday 11 May **Gopan VO1/M0XUU** (VU3HPF) succeeded in making the first contact from North America through the QO-100 satellite. Gopan was in Newfoundland, which is just outside the coverage area of QO-100, the elevation at Signal Hill at St. Johns is below the horizon at -0.9°.

He used FT8 to have a transatlantic contact with **David G0MRF** in south-west London. Gopan reported that QO-100's signals were too weak to support SSB communication.

Quansheng UV-5K on 10GHz?

Not quite of course, but I did see an interesting video demonstration of someone using a UV-5K with updated (IJV) firmware as an IF, in conjunction with an LNB and a bias-T, receiving a beacon on 10GHz. Because the modified firmware allows SSB reception, this worked quite well. I did wonder whether this same setup might work as a QO-100 receiver, but unless you modify the LNB, the IF frequency will be in the coverage gap on the UV-5K. It's a shame – it would be a very portable little system!

The 8m band

Dave Thorpe G4FKI (Ampthill) is now on the band using 10W from an Icom IC-7300, a filter and a vertical dipole. The best DX that Dave has received was PJ4MM but he worked ZR1ADI and V51PJ. In May, Dave has worked a good number of stations from Spain and the Balearic Islands, who now have an 8m allocation.

Paul Farley G7PUV (Sussex) who uses the G9PUV call on 40MHz worked two EI stations by Aurora on 11 May; EI4GNB and EI2IP were both worked on Q65C before switching to USB. **Tim EI4GNB** told Paul that his signals were much less distorted on 8m, compared to similar signals on 6m. Paul also reports that Spanish stations have access to the band and that he has worked a good few via Es. CT1DIZ also has an 8m permit and Paul worked him for the first time on the morning of Sunday 12 May, on FT8.

The 6m band

Tony Collett G4NBS (Cambridge) took part in the auroras on 10 and 11 May and experimented with the Q65C-15 and Q65C-30 modes, working GM4FVM (IO85), GM4UYE (IO86), G8BCG (IO70), LA3EQ (JO28), SP6CPH (JO81), G4BRK (IO91) and PA0RDY (JO22). Worked on a mix of CW and SSB were GM0OQV IO85), LA3EQ (JO28), EI4DQ (IO51), PC0A (JO32), S57TW (JN75), F4VPC (IN87), G4FJK (IO80), GE1SDX (IO80), DM4IM (JN49), DM2PR (JO30), OM5KM (JN98) and S51ZO (JN86).

Tony said of the Q65 QSOs that it was interesting trying Q65, but although it works with very weak signals, Tony is not convinced that it's an improvement on CW (even if the CW is rusty!). For those people who don't understand CW it might be an alternative. It will be interesting to see if it gains traction in Auroras.

Roger Lapthorn G3XBM (Cambridge) is planning to try his 10mW WSPR experiment on the band and see where he is received. It should work well in the Es season.

Phil Oakley G0BVD (Great Torrington) is pleased to have been working some DX on the band. On 30 April, Phil worked PZ5RA (GJ25) along with a good selection of European stations worked by single hop Es – including I, YO, HA, LY, OZ, OM, LA and SM. Phil says that unfortunately, 3B8FA got away!

Ian Bontoft G4ELW (Bridgwater) runs around 20W of FT8 to a loft mounted HB9CV beaming west. He's seen a few openings around Europe and one or two decodes from South America and is looking forward to more openings over the summer period.

Roger Greengrass EI8KN (Co Waterford) was pleased to work 7Q6M for DXCC #129 on 7 May. During the Aurora on 11 May, Roger tried out Q65C-30 and found it worked very well.

Don G3XTT was pleased to work PZ5RA on 30 April. Don worked FR4PJ and 7Q6M during an extended opening on 7 May, but things got really good on 13 May when he worked FH4VVK for a new one at 1615UTC and then, another new one,

Fig. 1: Allan GM4ZUK's portable station during the recent 70MHz CW contest.
Fig. 2: 2m contacts made by Andy G4PIQ during the auroras on 10/11 May. Fig. 3: Nick G7IZR operated maritime mobile off the coast of Plymouth during the 145 Alive event.
Fig. 4: The Chesham club operated their 145 Alive station from Brill Windmill.
Fig. 5: David G4DHF's 2m array with the aurora in the background. Fig. 6: Members of the Stockport Amateur Radio Society operating during the recent 145 Alive event.

5Z4VJ at around 2043UTC. Don says that 5Z4VJ was audible for some time and that 7Q6M was coming in again at the same sort of time.

Here at **GW4VXE** the Es season seemed to be very late in getting started, compared to previous years. I'm assuming that a combination of the unsettled Spring weather and the active solar conditions have had a lot to do with this. The first reasonable Es opening noted here was on 28 April. In an opening on 30 April into Central Europe, there was clearly another hop to the East, as I was surprised to work UA4HBW (LO53). In an opening to the south on 12 May, I was pleased to work C37AC along with the more usual EA stations.

The 4m band

Allan Duncan GM4ZUK (Aberdeen) took part in the RSGB 70MHz CW contest on 12 May from the Cairn O'Mount (IO86RW), **Fig. 1**. Allan's best DX was GU3TUX (IN89) at a distance of 802km.

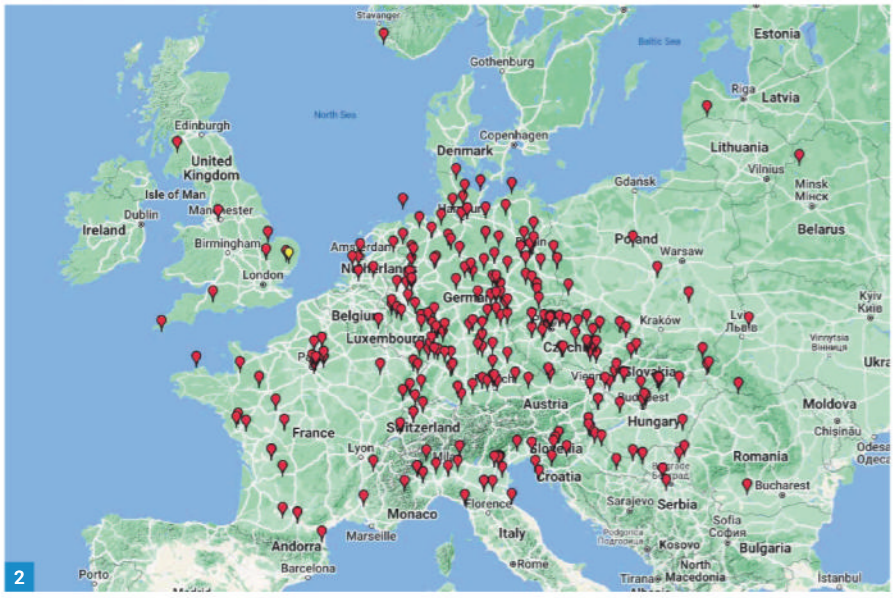
Roger EI8KN used Q65C-30 during the aurora on 11 May, working EI4GNB (IO63) and GM4CXM (IO75).

The 2m band

Andy Cook G4PIQ (Suffolk) operated on the evening of Friday 10 May and the afternoon of 11 May using a single 17-element Yagi. Andy made over 300 QSOs, **Fig. 2**, and feels that the numbers of DX stations worked were greater than in the big auroras back in 1989 and 1991. A summary of the stations that Andy worked is 9 9A, 109 DL, 29 F, 14 HA, 4 HB9, 23 I, 4 IE, 37 OK, 9 OM, 5 S5, 4 SP, 4 UR, 4 YO and 4 YU. Andy's best DX was YO7FWS (KN24) at a distance of 1903km.

Andy said that he noticed the variability and size of the doppler shift and says that you could have signals on one path calling quite close to the transmit frequency and those from another area quite some hertz away. At times, Andy thought that things had gone quiet, only to swing the RIT a little more and find another set of callers – the maximum doppler shift seemed to be around 1200Hz.

Tony G4NBS also enjoyed the aurora on 2m, with the highlights of his 25 QSOs being IV3GTH (JN65), 9A2AE (JN86), SP7EXY (KO00), 9A5R, 9A1CAL (JN86), IV3NDC (JN65), OE3JPC (JN87) and S51ZO (JN86). SP7EXY was Tony's 300th locator worked on the band.



Roger EI8KN's best DX during the aurora was S50C (JN76) on SSB along with a good handful of G, GM, EI and F stations.

Simon Evans G6AHX (Twyning) took part in the 145 Alive event on 11 May and was pleased to work fellow FM and DAB DXer, **Dan M0MST**. **Ian Bevan G0YAP** was on holiday in Yorkshire during the event and made contacts into the Peak District and Blackpool and was heard in Wales. Ian used his standard mobile setup, 30W and a Diamond 770 antenna. Rather than heading for the hills, **Nick G7IZR** operated maritime mobile off the coast of Plymouth, **Fig. 3**. Nick was able to work several stations taking part in the net run by **Keiron M0RTQ** from Caradon Hill. Nick says that he enjoyed it, but for the next event, he'll be back in the hills! **Colin Evans MW7ABS** operated from Foel Cwmcerwyn in the Preseli Hills and made 53 QSOs in total, running an FT-8800 at 20W to a collinear on a 5.5m mast.

Malcolm Appleby G3ZNU wrote, *"as the 145 Alive event coincided with Mills on the Air weekend, we (Chesham & District Amateur Radio Society) decided to operate a net in the 145 Alive event from Brill Windmill (IO91LT)* **[Fig. 4]** *using the call GB0BWM. We were assigned 145.550MHz for our station. We set up in good time, and the fair weekend weather helped a lot. The net was run by* ***Roger M7RMF*** *and we recorded 21 calls in our log, the best DX was M0KZO/P in the Malvern Hills. It turned out to be quite a busy event, testament to the publicity that the organisers achieved".*

Ian G4ELW has found 2m FT8 quiet of late, but was pleased to work F6ASP (JO00) on the evening of 11 May.

The 70cm band

David Johnson G4DHF (Spalding) enjoyed the aurora, **Fig. 3**, and spent most of the afternoon of Saturday 11th calling CQ on 70cm, using his

little 19-element Yagi, rather than his larger array, owing to the poor weather that we have been experiencing. David says that his beam was quite wide and most contacts were made on a heading of around 70°. David's log includes DJ8MS (JO54), PC0A (JO32), PA3CWN (JO33), PA2V (JO22), PA0JOZ (JO22), DK5QN (JO42), I2FHW (JN44), OK1TEH (JO70), DF2ET (JO31), OZ8ZS (JO55), 9A2SB (JN95), 9A1CAL (JN86), OE3JPC (JN87), DL1YAW (JO41), F5DQK (JN18), DK9TF (JO31), PA3GDY (JO21), S51ZO (JN86). David also heard, but lost, 9A1UN and IK4PMB.

Jef VanRaepenbusch ON8NT (Aalter) says that his activity has been lower than usual because of bad weather; wind, thunder and lightning, so his antennas have been down. During the FT8 Activity Contest on 10 April, Jef worked G4CBW (IO83) and GW4HDF (IO81).

4


5

Satellites

Jef ON8NT monitored the Schools Contact from the ISS on 10 April and also made a couple of FT4 QSOs on the RS-44 satellite, N2YZH (FN22) and EA3TA (JN11).

Patrick Stoddard WD9EWK (Phoenix) writes, *"The big news for satellite operators came in late April, when the ownership of the GreenCube (IO-117) satellite was passed from the Italian space agency to AMSAT-Italia. After three months of uncertainty following the original plan to shut the satellite off, things are looking better for hams around the world hoping for a way to work intercontinental DX via satellite".*

Endaf Buckley MW1BQO/N6UTC writes, *"This past April, I travelled from southern California to the UK, planning on making stops in the Northwest of England and my hometown in North Wales. First stop was Blackpool where I was meeting up with the Wales Digital Radio Group who would have a stand at the NARSA Rally held at the Norbreck Castle Hotel. On previous trips to the UK, I have activated grids IO72, IO73 & IO94. With Blackpool in IO83, it was an opportunity I could not pass. Another first for me was the use of the new Regional Secondary Locator of 'E' for England, which I had decided I was going to use on this trip.*

*"After arriving in Blackpool on the Friday before the rally, I prepared for the first pass from IO83. I used a combination of my Yaesu FT2D & FT5D radios for this trip, and **Christian M7EMH** was kind enough to lend me his Arrow antenna. On Friday, I worked **Andy DL6AP** via SO-50 and GB3RS via the ISS. Andy and I have worked before from previous UK trips, and I also have worked him while he was travelling the US in the summer of 2023. The following Saturday, I visited the RNLI station near Blackpool Tower, and worked a couple of TEVEL passes with **Pete 2M0SQL** in IO87 and **Steve M0SKM** in IO91 - both of whom I have worked before via IO-117 from southern California. The highlight was working **Steve KC1MMC** in FN34 (Vermont) via SO-50. We had planned to try and work each other, and to my surprise we had a successful QSO covering a distance of 4969km from IO83lu to FN34mp.*

*"I spent the rest of the week in Penrhyndeudraeth, my hometown in IO72ww where I worked several SO-50, TEVEL and ISS passes. I also took a drive to IO82, as I needed to activate it for my VUCC reverse rover award. The final pass was SO-50 again with **Steve KC1MMC** and surprisingly again another successful QSO, this time from IO72xw to FN34mp. I will be back, later in 2024. A special thanks to **David G0IIQ** for our QSOs during my trip".*


6

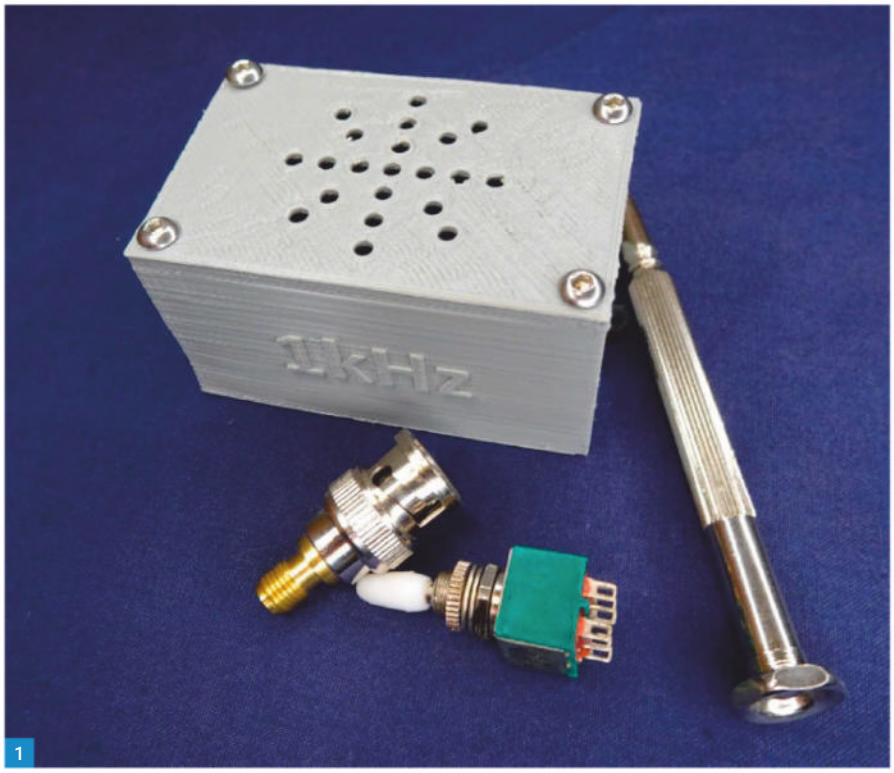
FM and DAB

Simon Evans had a half hour Es opening on 8 May enhancing FM propagation in the early evening to Sweden and Finland. Simon says this is the first Es opening that he caught in 2024. Simon wasn't able to detect any FM DX during the recent auroras. He notes that there has been an update to the QIRX program which is used for decoding DAB DX – the current version is now 4.2.2.

Paul Farley has put his Band II FM Yagi back on the mast, awaiting the Es season proper, but heard a brief opening to Algeria and Tunisia on 12 May.

That's it for this month! Thanks to everyone who has contributed to a very varied column. Please keep your news and photos coming. **PW**

Andrew Woodfield ZL2PD
practicalwireless@warnersgroup.co.uk



1

The Digital TuneAid

Andrew Woodfield ZL2PD describes a precise 1kHz sinewave test oscillator.

Some years ago, I developed a 'TuneAid', an audio oscillator with a 20 second timer driving a tiny speaker (see URL below). I placed this little box near my SSB transceiver's microphone to help me tune my antenna tuner.
www.zl2pd.com/tuneaid.html

I used to adjust the controls on my antenna tuner while whistling briefly into the microphone to generate a suitable signal for tuning, after delivering the essential voice station identification, of course! But one day, a really bad cold left me with a decided lack of 'whistle-power'. Those who suffer from asthma can probably appreciate this problem all too well. The original TuneAid solved the problem. Rather than whistle, I just pressed the button on the TuneAid. It generated a loud and far from sinusoidal (!) tone around 700Hz for about 20 seconds.

Recently, I have been restoring several compact legacy SSB HF handheld and manpack transceivers previously used for search and rescue. These now operate on 80m and 40m with variants of my SugarCube VFO (see links below). I used my TuneAid quite a lot during alignment and testing.
https://www.zl2pd.com/Condor_SC+C_VFO.html
https://www.zl2pd.com/TR-105_Conversion.html

Keith ZL4JA also modified and tested a second handheld HF transceiver to check my conversion instructions. He also made extensive use of my TuneAid. During the process, Keith asked another local radio amateur to double-check the frequency of his transceiver over the air with the help of the TuneAid. It wasn't a great success. The TuneAid was an analogue oscillator of highly dubious accuracy and even more doubtful audio quality!

So Keith asked me if I happened to have an accurate digital 1kHz sinewave TuneAid sitting in my toolbox for these over-the-air frequency checks. Well, that sounded like an excellent idea. A few days later, this digital version of the TuneAid emerged from my workbench, **Fig. 1**.

The design

The digital TuneAid (DiTA) is an ultra-simple very accurate 1kHz direct digital synthesis (DDS) oscillator. The Atmel/Microchip ATtiny85 uses an 8MHz crystal and 24-bit internal calculations to generate a precise 1kHz sinusoidal pulse width modulated (PWM) tone. The frequency accuracy is better than 0.005%. The circuit is shown in **Fig. 2**.

The PWM output drives a low cost 32mm diameter 8Ω speaker via a 100Ω resistor. I originally tried numerous discrete and IC-based audio amplifiers in the search for good volume and an undistorted sinewave from the speaker. However, everything I tried required considerably more parts, and some distorted the sinewave quite badly. In the end, the simple approach surprisingly yielded the best result.

Many audio distortion products are clearly audible by ear but the DiTA's output sounds very clean. Human hearing (especially mine!) does not extend up to the 32kHz PWM carrier frequencies. The speaker output is therefore a very nice sounding sinewave ideal for bench tests of the legacy transceivers via their microphones.

Measurements showed in-band audio harmonics and spurious products were at least 30dB below the 1kHz tone. If you require a sinewave for other purposes than this, a low pass filter using a series 10kΩ and shunt 10nF capacitor provides adequate filtering. They can be fitted to the PCB, too, along with a trimmer resistor to vary the level for such tests.

A jumper on pin 7 of IC1 allows selection of an alternate 400Hz tone. I used this to quickly check USB/LSB selection and BFO carrier attenuation. A glance at the spectrum analyser showed instantly if I'd got the correct sideband selected. One of the restored transceivers used the phasing SSB method and sideband selection during conversion and upgrading to 80/40m LSB operation could get a little confusing for me on the very compact radio.

The circuit is powered from a small 4.2V Li-Ion cell. It is recharged via a readily available low cost TP4056 charge module. The module I used also featured a low voltage disconnect circuit. This protects the battery from being discharged to voltages likely to damage the Li-Ion cell.

Features of the internal logic of IC1 meant a timeout timer could not be provided. I simply turn off the slide switch when testing is complete. I can rely on the battery disconnect feature of the TP4056 module if I forget. But honestly, it's very hard to forget a penetrating 1kHz tone in the workshop!

Building the DiTA

The circuit was constructed on a PCB I designed for an earlier CTCSS oscillator. **Figs. 3a** and **3b** show the PCB and component layout. A scrap of prototyping board could also be used. This board layout is used for several different projects and a number of components are not fitted for this design. That's why some parts labels do not match those in the circuit.

Because I could not locate a suitable ready-made enclosure, I also designed the 3D-printed box shown in the photos. It measures 60 x 40 x 35 mm and was printed using PLA filament. The

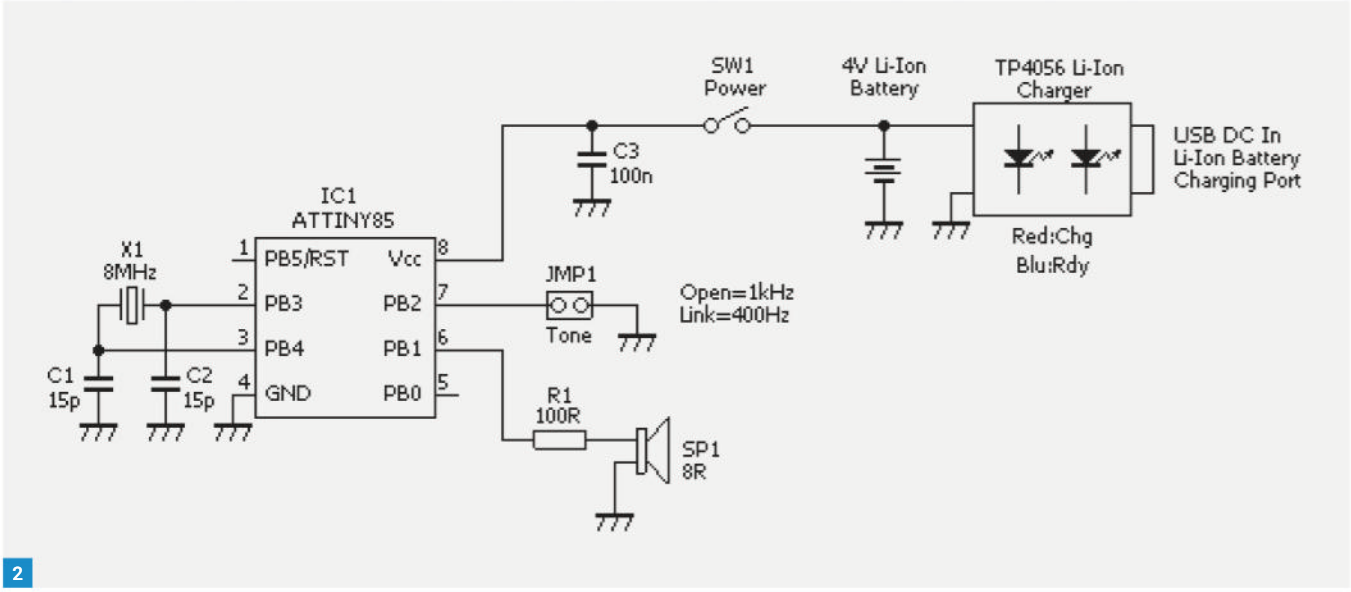


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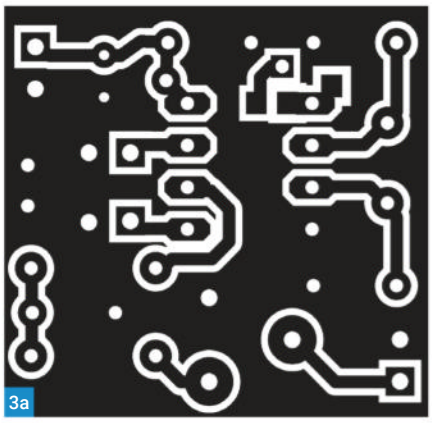
Fig. 1: Designed to test compact transceivers, this little box digitally generates a very accurate 1kHz tone into a low cost 8Ω speaker.
Fig. 2: The precise 1kHz tone is generated by just seven key components (ignoring the supporting switch, battery and charger module). IC1 may be an ATtiny25, ATtiny45 or ATtiny85.
Fig. 3: The single-sided PCB (viewed from copper side) and component layout. It measures 25 x 25mm.
Fig. 4: A typical TP4056 charger module available from the usual online sources. The Li-Ion battery connects to the B+ and B- tabs and the OUT+ and OUT- go to the TuneAid via the slide switch. Any low-cost charger can be plugged into the USB connector.
Fig. 5: Inside the digital 1kHz test oscillator. The small Li-Ion battery is under the PCB.
Fig. 6: The oscillator in use with the equally tiny modified 80m/40m Condor handheld 1W phasing HF SSB transceiver.



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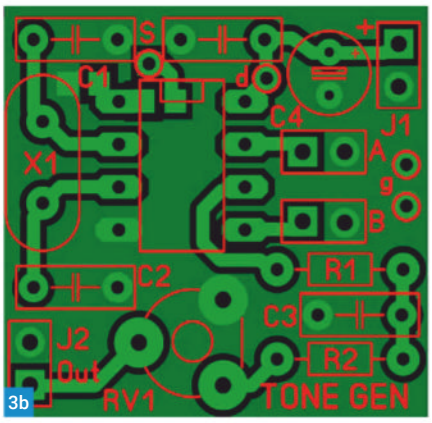
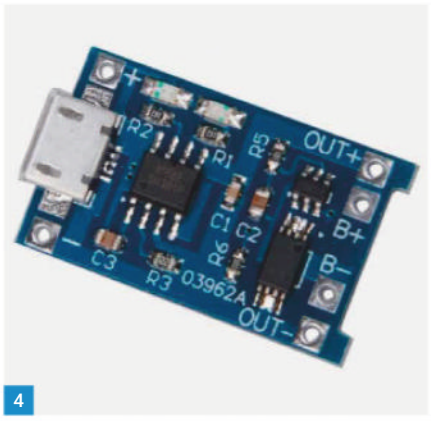


3b



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industry-standard STL format files for box and lid are available for downloading from my website (URL below). 3D printing services are widely available now in a number of places for those without 3D printers. For example, our local public library offers a 3D printing service in a variety of filament types at very low cost.

www.zl2pd.com

All the parts mount in the box. However, wire the entire assembly prior to mounting the parts into the enclosure. This allows it to be tested before final assembly.

IC1 can be programmed at this stage. I use the inexpensive USBasp programmer (It costs less than a cup of coffee) and the Extreme Burner PC software to load the program HEX file into the chip. The fuses are then programmed to &0dfh (High) and &0ffh (Low) to complete the task. These configure the ATtiny for the external crystal. If necessary, detailed step-by-step programming instructions can be found on my website.

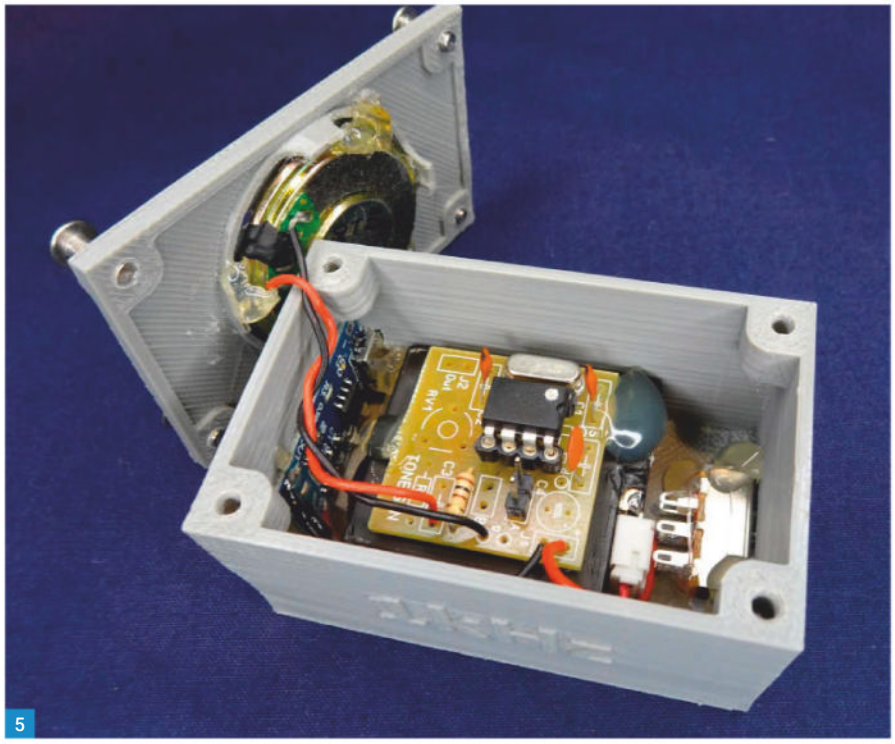
Glue the TP4056 module, **Fig. 4**, into place. Check the module's charger socket is aligned with the hole in the enclosure. Then mount the slide switch with hot glue. Make sure no glue gets into the switch mechanism. Some suitable slide switches come with panel mounting tabs. Just trim these off.

Place the Li-Ion battery in the bottom of the box and hot-glue it in place if necessary. The circuit draws 20mA and normal periodic bench use is fairly brief so batteries with capacities anywhere from 150mAh to 1200mAh are suitable. Then add a drop of hot glue to hold the assembled PCB on top.

A 'light pipe' is used to allow the red and blue charging LEDs on the TP3056 module to be seen during charging. This is made from a 20mm length of clear 1.75mm diameter PLA filament. Similar clear plastics can also be used. Push it through the hole by the charger socket and adjust the 'tail' inside the box so it's close to the module's LEDs. Add a further drop of hot glue to hold it all in place.

Use hot glue to mount the speaker to the lid. The lid is designed to suit a low cost 30 - 34mm diameter thin 8Ω speaker. Check that the speaker cone is not touching the lid during use. It may rattle if this occurs.

Screw the top of the enclosure onto the base. I ran a 3mm tap through each hole to add a thread to suit four 10mm long M3 dome head screws. Alternatively, you can use four M3 self-tapping screws.



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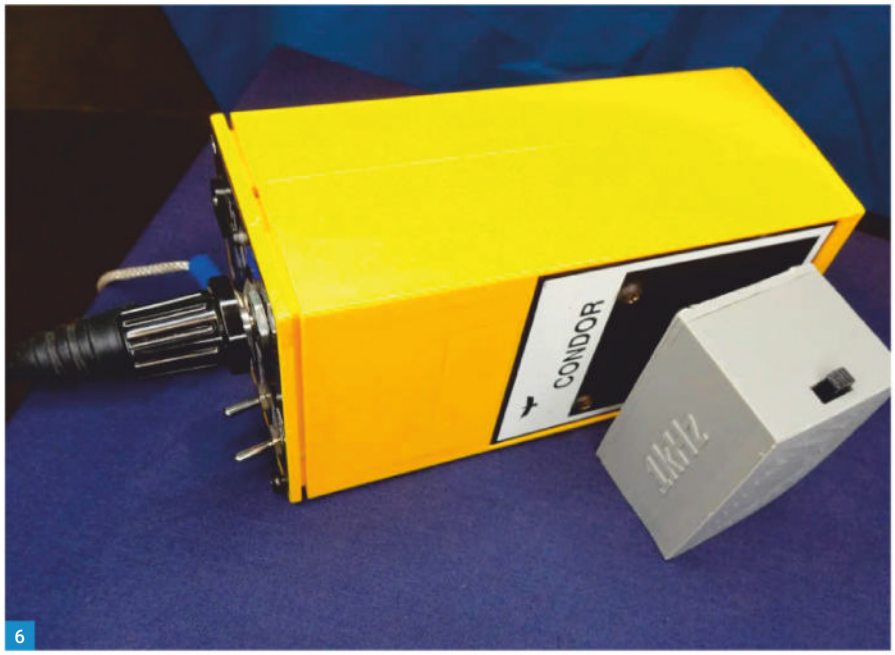

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Fig. 5 shows an internal view of the oscillator while the final photo, **Fig. 6**, shows the unit in use with my handheld transceiver.

Operation

Turn the power switch on and place your microphone on or near the box. The volume was such that it successfully fully modulated all the transmitters tested.

On-air frequency testing is easy, too. The remote operator can either zero-beat with the transmitted signal (The reported frequency will, of course, be 1kHz above or below the actual frequency depending on whether you are using USB or LSB) or the operator can tune for a 1kHz audio tone and report back the actual transceiver's frequency.

I hope you find it a useful addition to your toolbox!

Downloadable Files

- ATtiny25/45/85 program software
- Gerber files for the PCB
- STL files for oscillator 3D-printed enclosure
- These are available at no cost at:

www.zl2pd.com

13 COLONIES SPECIAL EVENT 2024: Durham and District Amateur Radio Society (DADARS) is privileged to be participating again as one of the bonus stations in the hugely popular 13 Colonies Special Event. The NoV special callsign GB13COL has been issued and will run from the club station 1 July 1300UTC to 8 July 0400UTC. The primary focus of the event will be the HF bands, including VHF, UHF & Satellite for QSOs using SSB, CW, FM, and various Digital Modes.

2024 QSL cards have been kindly sponsored by Canny Components. A warm thank you to **Amanda** & **Davey** for this.

For further information regarding the 13 Colonies Special Event, please visit the website:

www.13colonies.us

CDXC CONVENTION: CDXC: The UK DX Foundation is holding its annual DX Convention and dinner on 20 July this year. The event has a new venue: The Littlebury Hotel, Bicester, OX26 6DR.

The CDXC AGM will be held at 11am and in the afternoon there will be talks by **Mark M0DXR** on WRTC 2026, **Mike G4WNC** covering all things SDR, **Nigel G3TXF** discussing the impact of FT8 on DXpeditions and **Gregg W6IZT** describing the build and operation of his 'Rig in a Box' for DXpeditions.

Non-members of CDXC are most welcome to come for the day and the evening dinner. Full details and booking information can be found by following the link on the CDXC Homepage:

www.cdxc.org.uk

1

Roger Dowling G3NKH
practicalwireless@warnersgroup.co.uk

Martin Charman G4FKK

Roger Dowling G3NKH meets the current chair of the British Amateur Television Club (BATC).

When I joined the BBC straight from college in 1963 my first posting was to the television outside broadcast base at the Palace of Arts in Wembley, opposite the old Wembley Stadium. No, it was not normal practice for BBC engineers to be offered palatial workshops – the building was actually a left-over from the 1924 exhibition, which had become surplus to the nation's requirements.

I soon learned on the grapevine that the BBC was putting out experimental colour TV transmissions after close-down from the nearby Lime Grove studios. With the self-confidence that comes from youth, I thought this merited further investigation and decided to see for myself. In those halcyon days, a BBC pass would get you into premises anywhere in the country, probably even with a little salute from the commissionaire on duty.

As expected, when I presented myself at Lime Grove at 10.30 pm (close-down was quite early in those days), I was not only welcomed but immediately led through the rabbit warren to Studio H, Lime Grove's tiniest studio. I have never forgotten the sight that awaited me. There were two massive experimental Marconi colour cameras (I believe they were BD948s), which seemed to take up half the studio. They each used three 3in image orthicon camera tubes, which apparently took hours to register accurately, not helped by the brilliant hot studio lighting that was necessary to produce adequate pictures. But I remember being hugely impressed, even though the pictures were in 405 lines using the unreliable American NTSC ('Never Twice the Same Colour') system that was later rightly discarded in favour of PAL.

These thoughts went through my mind recently when I was reflecting on the huge advances in broadcasting technology over the years. It is nothing less than astonishing that even basic modern smartphones produce high-definition video of a quality that we could only dream of back in the 1960s, and voice communication all over the world has become commonplace. Radio amateurs are also still at the forefront of technological developments, with such techniques as SSB, Fusion, D-STAR, FT8 and even, thanks to the geostationary QO100 amateur radio satellite, high quality television communication all over the world.

Which being us neatly to the subject of this month's feature: **Martin Charman G4FKK**, **Fig. 1**, chair of the British Amateur Television Club (BATC) that does so much to encourage the development of the latest techniques in amateur television reception and transmission. Based in Carshalton, Surrey, Martin is also a long-time member of the Coulsdon Amateur Transmitting Society (CATS) and Surrey Radio Contact Club (SRCC).

Born in Selsdon, Surrey. Martin was interested in radio from an early age. *"I annoyed my father by dismantling his brand-new valve FM tuner at the age of 3 – and couldn't put it back together again!"* he told me. *"Radio has always fascinated me – it was like magic to me as a youngster"*, said Martin. His father was a watchmaker (an activity Martin continues as a hobby today), but he thinks he may have inherited the interest in radio from his grandfather, who was a Marconi radio operator in the Merchant Navy and later worked for the radio manufacturer Kolster Brandes. If

Fig. 1: Martin Charman G4FKK in his shack. using his home-brew 200W SDR transceiver.
Fig. 2: Martin's transceiver covers all bands from 160m down to 6m. Fig. 3: A home-assembled 'Langstone-Portsdown' VHF/UHF/Microwave transceiver, receiving DATV pictures from GW7BZY.

the interest was inherited, the magic may have worked again as Martin's son **Alan**, based in Cardiff, is now **MW3ZMA**.

For his 11th birthday Martin was given a Philips electronics kit and remembers making a radio when, to his delight and surprise, *The Archers* theme tune suddenly came through loud and clear. Further fiddling around with different coils in the hope of receiving short wave signals produced a local amateur on top band – amazing! *"I always remember the Hancock 'radio ham' sketch in which he claimed that his gear was 'the best £300-worth he'd ever spent!'"* said Martin. *"That's exactly how I felt".*

When he was 16, Martin started evening classes to take his Radio Amateur Examination but then suffered the misfortune of being knocked off his moped, resulting in a three-month spell in hospital. But all was not lost. *"A very kind radio amateur **Nick Moyes G8KMJ** came into hospital with all the RAE course notes and saved the day!"* said Martin.

The next hurdle in those days was the Morse test. Martin taught himself in about three weeks using the G3HSC 'Rhythm Method' CW records that he dubbed on to cassettes and practised during a holiday in Devon in the long, hot summer of 1976. A musician (Martin plays guitar and piano), Martin thinks that certainly helped greatly. He took his Morse test at the Post Office headquarters in St Martins Le Grand in London, passing with the help of a 'sympathetic' examiner, and the new call G4FKK soon followed.

Martin admits that he really never enjoyed his schooldays, so after gaining his 'A' levels he took up an apprenticeship with Marconi Communication Systems in Chelmsford, leading up to a Higher National Certificate. In due course the company also sponsored him for a degree course and he became a development engineer at the Marconi Specialised Components division in Hackbridge near Mitcham.

From there he joined the BBC's research department at Kingswood Warren, Surrey, which led to an attachment to *BBC Radio London*. *"These were the **Tony Blackburn** days and it was the best job I ever had!"* said Martin, who soon found himself on air as a presenter in addition to working as an engineer and producer. From Radio London he moved to the brand-new commercial radio station *Jazz FM* where he also helped to develop a sister station in Manchester. Then, after spells at the *BBC World Service* at Bush House and a few years at an embryo satellite broadcast company in Madrid, he worked for the BBC at MediaCity, Salford on a very big project updating over 600 audio editing and playout systems at Broadcasting House, Manchester, Scotland and Wales. Then followed a major BBC project 'Virtual Local Radio' (ViLoR) to centralise playout and storage for local radio stations around the UK.

After a spell in Cardiff where Martin was involved in a project to move the broadcasting centre from Llandaff to Central Square, Martin retired in 2020.

Martin's shack

It is unusual these days to see a shack that does not include examples of the latest transceivers from Yaesu, Icom or Kenwood, but the equipment on display in Martin's shack reveals an ongoing affection for older rigs together with an enthusiasm for home construction. Among his proud possessions I was pleased to spot a Codar AT5 AM/CW transmitter from the 1960s, an elderly HRO receiver (still in regular use, Martin assured me) and a couple of Labgear 160 TWIN transmitters.

But my eye was particularly draw to a handsome home-built transceiver, **Fig. 2**, which Martin revealed to be his home-built SDR-based variable-bandwidth rig that will run at up to 200W in all modes from Top Band down to 6m. It is based around the 'Red Pitaya', a large programmable FPGA (field programmable gate array) that can be used with various interfaces to build receivers, transmitters, filters and so on. *"**John Melton G0ORX** has written a clever piece of software for the ubiquitous Raspberry Pi computer called piHPSDR,"* said Martin. *"All I did was to put John's brilliant work into a box"* said Martin modestly. The 200W PA was his own design, using a pair of MOSFETs that were being sold cheap on eBay. The rig uses a 7in touchscreen, and the small

Fig. 4: A 1.1m dish and low noise block receive and transmit DATV to the geostationary QO100 satellite. Fig. 5: A 30ft crank-up mast carries a range of antennas for use on 4m, 2m and 70cm. Fig. 6: Martin (right) in his first band 'Group 36' in 1977. Fig. 7: Flying days – on route to the Channel Islands. Martin is on the right. Fig. 8: An 'extra' (left) in the feature film Cockneys vs Zombies released in 2012.

screen to its left uses Arduino software that Martin wrote for changing filters and similar requirements.

The other home-built unit that caught my eye in his shack was his 'Langstone/Portsdown' VHF/UHF/Microwave transceiver, **Fig. 3**, which can be used in all modes from 70MHz up to nearly 6GHz. At its heart is the Langstone/Portsdown SDR transceiver developed by **Colin Durbridge G4EML** and **Dave Crump G8GKQ** to produce a simple SSB, CW, FM and DATV VHF/UHF/Microwave SDR transceiver, which provides an easy way to 'get on air' at a relatively low cost. The unit also provides for a range of test equipment, including spectrum analyser, band viewer, noise measurement and meteor 'ping' detection; a truly versatile piece of kit to have in the shack.

To originate pictures, Martin mainly uses an old high-definition video camera, which uses free video mixing software OBS Studio (which can accept other video and audio sources) and DATV-EASY software, which produces a suitably configured transport stream.

QO100 operation

For VHF/UHF narrow band DATV, Martin can use his Langstone/Portsdown transceiver direct, but for QO100 transmission, he uses a relatively inexpensive Adalm Pluto SDR, which contains a fully professional chipset to take the transport stream from the Langstone/Portsdown and turn it into RF at 2.4GHz. This is then amplified and fed via a 30ft length of low-loss coax to a home-made dual-feed 'patch' antenna (designed by **Mike Willis G0MJW**), which uses a 1.1m offset satellite dish to transmit circular polarisation on 2.4GHz up to QO100, **Fig. 4**.

For reception, a length of 22mm copper pipe at the centre of the patch acts as a 10GHz waveguide and feeds an Octagon low noise block. The signals are then fed to a domestic distribution amplifier, which feeds a number of different receivers including two 'Minitiouners' (developed by **Jean-Pierre Courjaud F6DZP** and available in kit form from BATC). One is connected to a 'Ryde' receiver (also available for self-assembly from BATC) and the other to the Langstone/Portsdown transceiver.

HF antennas

Martin's range of antennas, **Fig. 5**, reflects his wide range of amateur radio interests. A 30ft

crank-up lattice tower with a rotator cage and stub mast carries a home-made 5-element Yagi and a vertical Slim Jim for 4m, a Tonna beam for 2m, and a home-made LFA for 70 cm. The tower also carries one end of a half-wave long wire for top band, Martin's favourite band.

Getting started in amateur television

"Dave Crump from BATC gave some excellent advice on simple ways of receiving and transmitting DATV in an article in the April 2023 issue of PW*"*, said Martin. *"Also, I would STRONGLY recommend joining BATC"*, he said. *"We actively promote every aspect of amateur television and online membership costs only £8 a year"*.

BATC produce a regular colour magazine *CQ-TV*, and have an excellent online shop stocking hard-to-get components for projects published in the magazine. There is a weekly net on QO100 on Thursday evenings (8.00 pm), which is streamed live at:

https://batc.org.uk/live/oscar100net

Beyond amateur radio

Martin continues to play guitar semi-professionally, with fond memories of his first band 'Group 36' many years ago, **Fig. 6**. Martin also holds a private pilot licence and formerly

enjoyed flying a Piper PA28 and a Piper Cub aircraft, **Fig. 7**.

A more unusual claim to fame is that he was an 'extra' in several films, including *Cockneys vs Zombies* that was being filmed locally in 2012, **Fig. 8**.

The future

Martin sees a bright future for amateur radio and for DATV in particular. *"There are particularly exciting developments in narrow-band DATV"*, he told me. *"It's now possible to produce really excellent pictures with miniscule bandwidths, which at one time would have been thought quite impossible. It's amateurs that have made all this work and I think the broadcasters will be watching with great interest!*

"Another reason I enjoy DATV is that there is still much scope for home construction and assembly, which is much more satisfying than buying off-the-shelf equipment.

"I think it's probably one of the last bastions of pioneering amateur radio." **PW**

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Rallies & Events

All information published here reflects the situation up to and including **16th May 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**

23 June

NEWBURY RADIO RALLY: Newbury Showground, next to junction 13 of M4 motorway in Berkshire, RG18 9QZ This is the 35th year of The Newbury Radio Rally and is the ideal event for anyone interested in radio communications, computing and electronics. There will be a display area with an amateur radio station, exhibits, special interest groups, clubs and societies. Open to sellers at 08.00hr and visitors at 09.00hr. Massive Free parking. On-site catering. Disabled facilities. Entry is £3 visitor, £15 sellers pitch. ADVANCE BOOKINGS (with discount) can be made via:
www.nadars.org.uk/rally.asp
Email: NewburyRally@nadars.org.uk
www.nadars.org.uk

28-30 June

HAMRADIO FRIEDRICHSHAFEN
www.hamradio-friedrichshafen.com

30 June

DUNSTABLE DOWNS ANNUAL CAR BOOT SALE: The Dunstable Downs Radio Club are holding their Annual National Amateur Radio Car Boot Sale at the usual venue, Stockwood Park in Luton on Sunday 30 June. This is the 39th year without a break (bar COVID) that this event has been run. For this year only our event has been forced to make way for the Radio 1 big weekend at Stockwood Park in May.
All the usual facilities will be there, further details on:
www.ddrcbootsale.org

7 July

BARFORD NORFOLK RADIO RALLY: The venue is Barford Village Hall and Green, Barford, Norwich, NR9 4AB and doors open at 9am for visitors. The event features trade stands, car boot sales, bring and buy, charity raffle, repeater groups, catering and free car parking. Entry £2.50 per person - under 16s free of charge. Traders only may arrive from 0800 - Outside pitches £8 no need to prebook / Inside hall tables £10 must be prebooked.
David G7URP radio@dcpmicro.com
www.norfolkamateurradio.org or

14 July

LINCOLN SHORT WAVE CLUB, SUMMER RADIO RALLY: The Festival Hall, Caistor Road, Market Rasen, LN8 3HT. Doors open at 10.00am, Indoor Event Admission £3, Hot refreshments including our now famous bacon butties. Ample free car parking, Tables £10
Steve M5ZZZ, 07777699069
Email: m5zzz@outlook.com

14 July

CAMBRIDGESHIRE REPEATER GROUP RALLY: Unfortunately, the April event had to be cancelled due to the wet weather. It is hoped to hold the rally on 14 July, subject to final confirmation from the venue (Foxton Village Hall). Please check the website for updates:
https://cambridgerepeaters.net

14 July

MCMICHAEL RADIO & ELECTRONICS RALLY AND CAR BOOT SALE: Reading Rugby Club, Holme Park, Sonning Lane, Reading, Berkshire, RG4 6ST. 09:00 entry (08:00 for Trader Set-up). Entrance Fees: Visitors - £4 per person, Traders - £10 per Table (includes entry for two people).
Berkshire Lowland Search and Rescue will be providing a First Response service. No Dogs other than Assistance Dogs are allowed on the events field.
Follow us on Social Media for the latest McMichael Rally News:
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General Enquiries: rally@radarc.org
Traders: traders@radarc.org
Tel: Colin Ashley 07706 512505
https://mcmichaelrally.org.uk/

28 July

WILTSHIRE RADIO SUMMER 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

4 August

KING'S LYNN ARC 34TH GREAT EASTERN RADIO RALLY: Gaywood Community Centre, Gayton Road, King's Lynn, Norfolk. PE30 4EL. NGR TF638203 Doors open at 9am. Admission £2.50. Traders from 7am, outdoor pitch £8, indoor £10 per table. Car parking is free. There will be trade stands and a Bring & Buy. Onsite Catering. Further information and reservations:
Email: rally.klarc@gmail.com
www.klarc.org.uk

9 August

29TH ANNUAL MINI-RALLY NIGHT: Community Centre, Main Hall, Port Seton. Bring along your own 'junk' and sell it yourself. Tables on First Come First Served basis. Entrance fee £2 for everyone. Time 18:00 to 21:00

18 August

WEST MANCHESTER RADIO CLUB RED ROSE SUMMER RALLY : St Josephs Hall, Mather Lane, Leigh WN7 2PJ. Doors open 10am. For further info and bookings:
Email: rally@wmrc.co.uk or

25 August

TORBAY ANNUAL COMMUNICATIONS FAIR: Newton Abbot Racecourse, TQ12 3AF. Doors open at 10am. Indoor event with free parking, bring and buy, RSGB book stall and catering on site.
Pete, G4VTO on 01803 3864528
Mike, G1TUU on 01803 557941
Email: rally@tars.org.uk

8 September

CAISTER LIFEBOAT RADIO RALLY: Caister Lifeboat station, Caister on Sea, NR30 5DJ. Entrance via carpark on Beach Rd. Raffle, onsite cafe, gift shop, museum. Free entry, open 9am-2pm (8am for sellers). Inside tables £10 each, outside £5 each.
Zane M1BFI, Email. m1bfi@outlook.com
Tel: 07711 214790

22 September

9TH RADIO & ELECTRONICS RALLY: The Campus Community Centre, Worle, Weston super Mare BS24 7DX For further information and to book a table please contact:
westonradiosociety@gmail.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

GENERAL RALLIES INFORMATION
http://www.arrl.org/hamfests-and-conventions-calendar
http://www.g4rga.org.uk/All.html
https://hfdxarc.com/calendar-3/radio-rally-calender
https://rsgb.org/main/news/rallies

Your Letters

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

New Licence Conditions

Dear Don,
I am writing in support of the recent easing of licensing restrictions for third parties under supervision.

My two grandchildren (8 and 11) were staying recently and were keen to have a go on the radio. My first CQ was responded to by **Chris 2E0UCB/P** who was working on his allotment but kindly stopped for a quick QSO with both girls, which they enjoyed. It then got better as **Rob M7JCN** called and his daughter then had a QSO with **Grace** about their secondary schools although they didn't know each other. Both practised correct procedure and Rob and I agreed that it was a good demonstration of the benefits of the change.

You cannot beat 'try before you buy' and one or both may go on to become licensed having had a taste of what the hobby can offer.

John Sones M0AAO
Ipswich

SEMARC construction club, PW and SCD

Dear Don,
I felt I owed you an update on the SE constructors. As I said when we met at the Convention, your support and column space in *PW* generated more interest than *RadCom* did.

Surrey Electronic Maker And Radio Club (SEMARC) is approaching the end of our second year and our second AGM and we have had a varied programme of construction, testing, project support and many other practical activities.

Eric M0REQ my fellow co-founder and I wanted to progress with some special interest groups. One has been a return to APRS and older digimodes and I have been trying to encourage a group 'scratch-build'. There was a lack of confidence in the group about a scratch build and so we have decided to follow the *PW* SCD series and have monthly buildathons to progress the different modules. We have a group of about nine constructors including: G4NMD, M7SMN, M7GET, G4CTP, G8YKM, G8ZAX, G0ACE and G3ZBU. And we have some mentors from within the SEMARC club too.

The project is not just about the build as the intention is to build for 40m and then to operate a CW learning/practice/improvers net and for those who are not so keen on regular CW we intend to get them to be able to send a callsign and test so that we can see them on the RBN and maybe issue a prize for the 'best DX'.

Thanks again for supporting the set up of SEMARC and also thanks for publishing the SCD style of article.

Graham Smith G4NMD
Co-founder SEMARC
Club call G8KVU

***Editor's comment**: Many thanks for the feedback Graham – good to know. **Steve G0FUW**, who authors the SCD series, and I have been very pleasantly surprised at the level of interest in the project. Steve tells me he is even getting enquiries from the USA and elsewhere, from electronic subscribers to* PW. *It's good to know that construction is by no means dead!*

Whatever happened to all those German radios of WWII? Our readers have various thoughts on the subject but will we ever know?

Where did those German radios go?

Dear Don,
I wish to respond to **Roger Wheeler's** letter on page 61 of May *PW*, regarding my recent series on portable military equipment of WWII. Roger asked *"Where did all the German WW2 equipment go?"* and *"If down the scrapyard (after WWII), then that seems a shame"*. After the end of the Second World War, with the integration of the Federal Republic of Germany into NATO, most of the existing Wehrmacht equipment was taken over by the Bundeswehr, until it became obsolete, at which time it was disposed of without recourse to sell-off into the civilian market. The current market particularly values portable German field equipment. A common radio, like the Torn.E.b, can be found in Germany in non-original or incomplete state for a couple of hundred

Euros, while a good quality original example, complete with battery box and accessories, will top €2.5k and rising. But none have been seen on the market for years in a complete mint condition with antenna, battery box etc, except in museums. The more rare and desirable sets have all but disappeared, what's left are the more common sets in poor condition.

Remo Caspers of **Funksammlermilitaria.com** tells me that: *"There are so many different German ex-WWII radio sets in different condition, that accessories like antennas, battery boxes etc, are often more expensive than the radio itself, so it depends a lot on how complete the equipment is. Also, the market is in constant flux with the older, specialised radio collectors, slowly disappearing, being replaced with Reenactors who want to run around with something strapped to their back; whereas the classic collectors are usually radio amateurs who were looking for high quality equipment like the E52 Köln".*

Martin Bösch of the Radio Museum in Switzerland at **www.radiomuseum.org** explained to me that: *"We are quite happy in this country, where there are only few collectors and prices are still okay, as long as it is not about German equipment, because they sell like crazy in Germany! Here in Switzerland, German equipment is rare, but we have a lot of American sets, because they were sold cheap as surplus in Germany just after the war and Swiss collectors went there to buy piles of these US sets, which had to be paid for with hard cash!"*

Graham Caldwell
Melbourne, Australia

Dear Don,

Oh, more revelations then (June 2024), regarding the Allies and their activities at the end of WWII from **Paul G7VAK**.

Reading through Paul's letter, it was interesting to note that *"**Peter Matthew's** did not mention radio equipment"*. So, the question of where the German radio equipment went, remains unresolved. As G7VAK also notes, as his friend Peter was reticent in revealing information of a sensitive kind, maybe this person held back information that might have spread some light on what became of the German WWII radio equipment? Was it destroyed? Or was it reverse engineered? I mention this, because not unlike G7VAK's friend Peter, I once met a very well-spoken elderly gentleman at a dinner party who, after the usual pre-drinks malarkey, told me that he'd been *"employed during WWII as a senior supervisor involved with intelligence operatives and signals reconnaissance"*. Maybe as a result of the 'Official Secrets Act' and that sort of thing, many of my questions fell on stony ground, But strangely - perhaps because I'd mentioned my interest in radio, he did reveal that *"the Germans were in possession of an advanced radio technology (developed in the latter part of the war) that America and Britain were keen to get their hands on"*.

Putting aside the fact, that some German WWII radio equipment is extant, the possible existence of 'advanced German radio technology' could be the reason why much German radio equipment apparently disappeared? In a puff of smoke? Sank in deep water?

In passing, I should mention, that not unlike the WWII German radio technology, there was also an American, British and Russian headlong rush to discover where the advanced German aviation/rocket technology was hidden too.

As for the fate of those *"Enigma" machines being given to governments not thought to be over friendly to Great Britain"*, well, why wouldn't they be, as G7VAK points out, they *"could be routinely read"*. The Russians in particular, were a specific target for such covert chicanery.

On another subject, the new licence regulations, having ploughed through the CEPT recommendations, a bit like GD0NFN, these recommendations are open to interpretation. And no doubt there will be many disagreements as to what they actually mean in practice. Another consequence of new technology muddling the waters?

Ray Howes G4OWY/G6AUW
Weymouth

***Editor's comment**: Thanks Graham and Ray. I guess we will never know the full details of what happened. Maybe, as in the UK, many sets were simply buried and forgotten - such a shame!*

Next Month

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

END-FIRE ARRAY FOR THE 10m BAND: Jonathan Hare G1EXG describes an easy-to build two-element array.

ADVENTURES WITH THE QUANSHENG UV-5K(8): Tim Kirby GW4VXE revisits this popular (and cheap) handheld.

A PC-CONTROLLED WOBBULATOR: Tim Bolt has a design for a useful piece of test equipment.

THE EDDYSTONE 1990R: Dr Bruce Taylor HB9ANY describes a versatile classic communications receiver covering 25-500MHz.

AN INCONSPICUOUS ANTENNA for VHF FM WORKING: Rod Angel G4ZUP describes a simple whip antenna suitable for use on the 4m band.

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.

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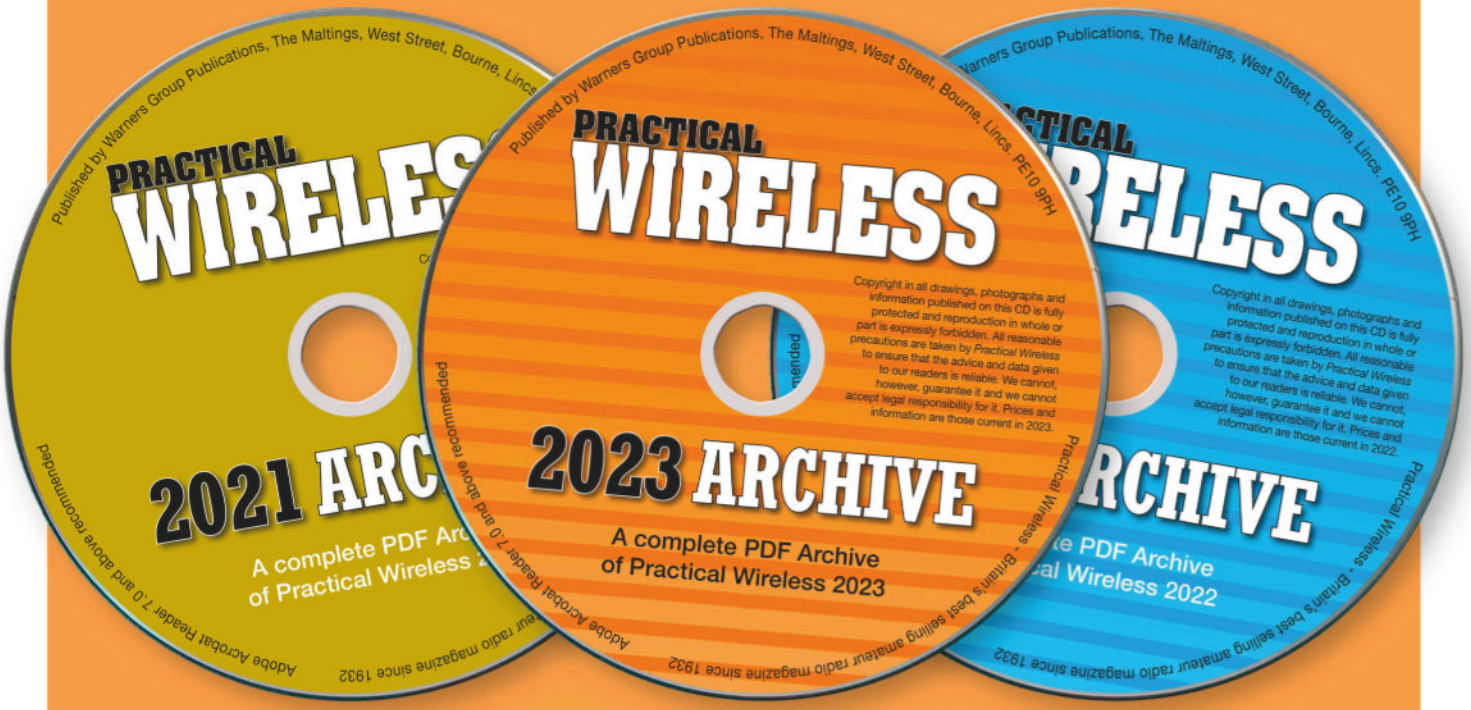

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