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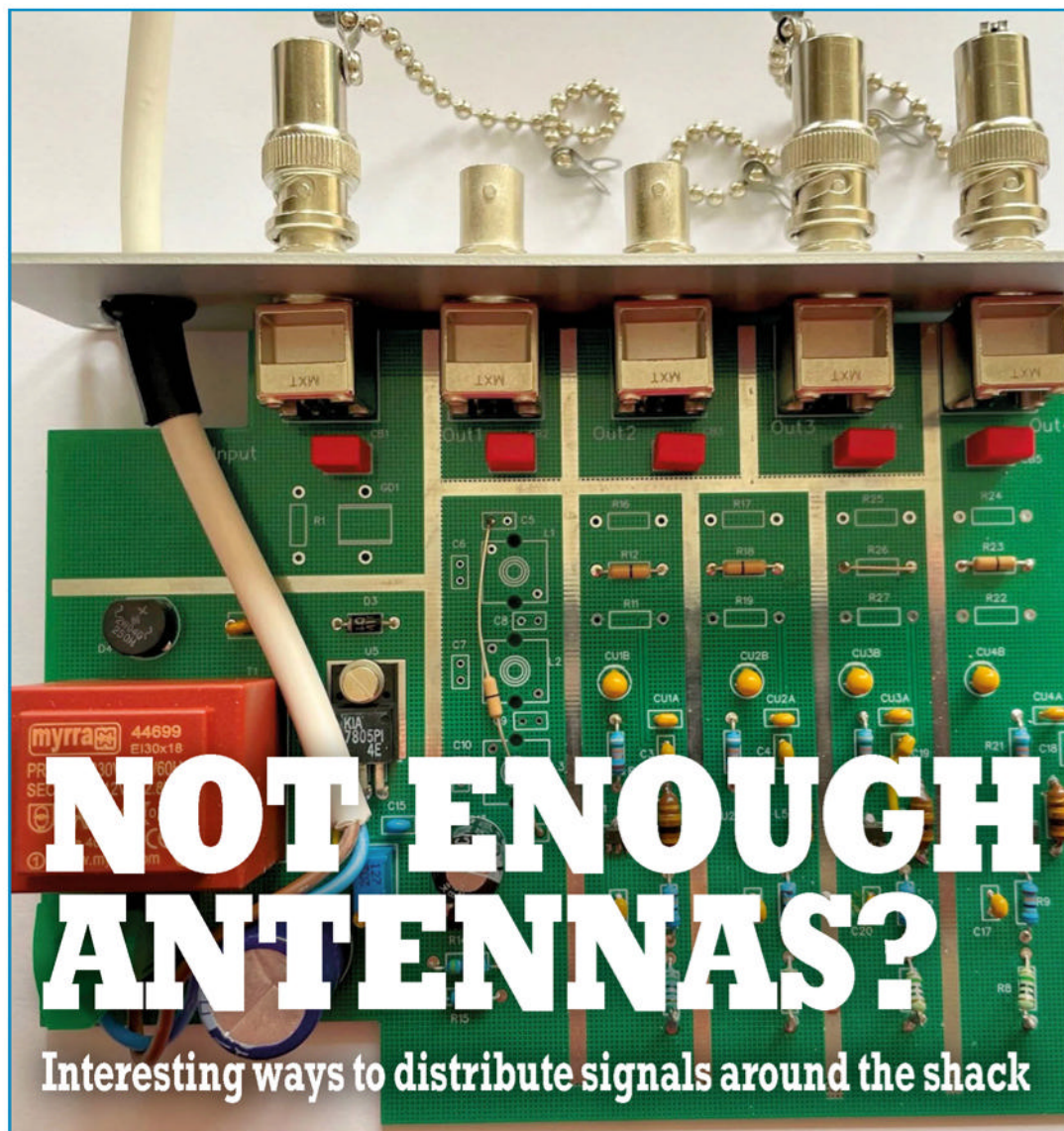
WIRELESS

JUNE 2025

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An in-depth look at Uniden's UB CD160DN Digital Scanner



California streaming

All the news from this year's International DX Convention

BUDGET Build your own simple 80m CW transmitter

Damon Tilley presents an easy-to-build project, guaranteed to give hours of fun



EVENT Announcing the 144MHz QRP contest

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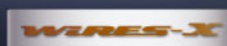
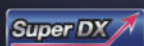
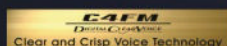
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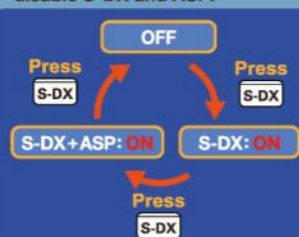
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Practical Wireless

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Keylines

I'm just back from California where I attended the so-called International DX Convention in Visalia (see my report in this issue). I say so-called because international participation seems to have dropped off significantly in recent years. The good news, literally hot off the press, is that there will indeed be an event next year, from 10 to 12 April, but in Santa Maria, California and organised by the Southern California Contest Club (SCCC) as against the Southern California DX Club who have been organisers in the past. For me Visalia was a great opportunity to catch up with a number of US friends who I haven't seen for several years. And, even more hot off the press, the Northern California DX Club have announced that they will indeed organise a further event in Visalia, in April 2027.

New RSGB President

Bob Beebe GU4YOX is the new RSGB President and will serve for two years. I have known Bob for over 25 years. We have watched each other's children grow up, stayed at each other's houses and DXpeditioned together. I am sure he will do a great job in the Presidential role and wish him well. The hobby needs a strong national society. I have been an RSGB member for not far short of 60 years, served on various Committees and for five years as a Board member, along with writing for *RadCom* for something like 13 years, and having two books published by the Society. They don't always get it right and, since becoming editor of *PW*, I have tried to stay independent and feel free to criticise if appropriate, but I wouldn't be without the RSGB and while there was an attempt many years ago to start a rival organisation, it failed very quickly indeed.

What is Amateur Radio?

Our hobby has changed in many ways during the time I have been licensed. New modes have come along, equipment has advanced in leaps and bounds, and our understanding of antenna design, propagation and more has also progressed significantly. Not surprising I guess – I have been a radio amateur for about half of the time that humans have been aware of radio!

Perhaps the greatest 'divide' nowadays, though, is the role of the internet. On the one hand, many amateurs are using radio to communicate just a few yards to their nearest digital voice node. On the other hand, amateurs are using the internet to remotely control their mega HF station. I have friends who would



contend that neither scenario is actually amateur radio, although many, especially of the younger generation, don't have any such concerns.

At the same time, mobile phone Apps such as WhatsApp have made global communication (including video!) totally ubiquitous. I travel to Africa quite frequently and every African seems to have a mobile phone, even if they don't know where their next meal is coming from.

As a result, lines have become blurred. I still feel amateur radio has a bright future. It continues to offer the prospect of learning about the science of radio. When you go on the air, it isn't necessarily to speak with another known person as on WhatsApp, but offers scope for making new friends around the world. And, like fishing, you never know what will surface – when contesting, for example, you can never predict propagation for an event and have to be ready to adjust your operating according to how the ether cooperates, or not.

My personal take on the hobby is that if there is an RF link anywhere in the system that uses an amateur radio band (for which an amateur licence is required), then it is amateur radio. At the same time, though, there is a lot to be said for not relying on non-amateur means as part of the overall link. If we are to be available as communicators when commercial systems fail (as happened in New York after 9/11, for example – there are quite a few other examples, too), then we need to be independent.

So, perhaps, a healthy mix of the two?

Don Field G3XTT

Editor, *Practical Wireless Magazine*

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40th Anniversary of CARS

2025 is the 40th anniversary of the Christchurch Amateur Radio Society. This friendly club is located in the seaside village of Mudeford (part of Christchurch) in south east Dorset. To celebrate, the club will be operating the special event call sign GB4MUD from the club house during 1-28 June.

At the club meeting on 5 June Duncan Layne GOAHK will be giving a talk on the history of the club which was originally founded as a company club, the Plessey-Christchurch ARS. Over the past year the club ran a successful series of construction evenings, led by Chris Wood G4CWS, teaching different construction

techniques, soldering and fault-finding skills. Members built a number of projects, including simple test equipment which could then be used to fault-find their other projects. The club meets every Thursday evening at 7:30pm and visitors are most welcome. Further details at: <https://christchurchars.org.uk>

LATE BREAKING DX NEWS

After several repeated unsuccessful attempts since 2018 to obtain the necessary permits to visit Marion Island and operate from there, Yuris YL2GM finally has got it! Yuris was due to operate from Marion Island as ZS8W between 21 April and 16 May. Prince Edward & Marion Islands is listed as #11 in Clublog's DXCC Most Wanted List as of April 2025. Yuris was to be on Marion Island as radio engineer and member of SANAP

station communication equipment maintenance team and stay there for the above-mentioned period of time, when this year's annual supply replenishment and exchange of overwintering personnel of the SANAP station is taking place. <https://www.lral.lv/zs8w/>

THE SECRET GENIUS OF MODERN LIFE: Have you ever wondered about the origins of the smart doorbell?

Although a modern phenomenon, it has a history dating back over 100 years. Watch Hannah Fry in *The Secret Genius of Modern Life*, as she explores its history, including a re-creation of Leon Theremin's device by Neil Smith G4DBN. Many radio amateurs will know Neil from Season 1 of the series when he re-created the Great Seal Bug (S1, E1) www.bbc.co.uk/programmes/m0029ktf

LIVINGSTON AND DISTRICT ARS: Livingston and District ARS are celebrating their Golden Anniversary this year. They are also moving to a

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new clubhouse hosted by 6th West Lothian (Broxburn & Uphall) Scouts. To mark these events the society is holding an Open Day on 21 June in the grounds of the Scout Hall on Station Road, Broxburn. Further details in this month's *Rallies* listing.

RSGB PUBLISHES TWO FORMS FOR EXAM QUESTION QUERIES AND CHALLENGES:

As part of its modernisation of the exams systems, the RSGB has introduced online forms for reporting possible errors found in exam questions. These forms replace the current procedure of writing to the Exam Department. RSGB Examinations Standards Chair Tony Kent G8PBH explained that there are two forms. The first can only be submitted by exam candidates and is to formally challenge questions in actual exams, where the outcome of a challenge may affect a candidate's result. The second form can be submitted by anyone, and is for informal queries of published exam questions, for example in mock exams. A separate form is needed for each question that you challenge. Please check carefully that you are using the correct form otherwise it may delay the process. Your query will be considered by the RSGB Examinations and Syllabus Review Group, who will let you know the outcome. For more information and to find the forms, go to:

rsgb.org/exam-challenges

SOUTH AFRICAN RADIO LEAGUE COMMITS TO HELPING CONTINENT'S LESS-DEVELOPED NATIONS:

As it prepares to mark its centenary in May, the South African Radio League has decided that it would be an especially wise move to nurture amateur radio's growth throughout sub-Saharan Africa. SARL president **Nico van Rensburg ZS6QL** told the website TechCentral that amateur radio is almost non-existent outside of Egypt and Nigeria in the northern part of the continent and Namibia and South Africa in the south.

"You have this middle part of Africa where there is nothing, absolutely nothing", he said. Finding a foothold for amateur radio in less-developed parts of the continent will be an ambitious agenda and SARL acknowledges that this kind of expansion will need political and financial support. SARL's **Chris Turner ZS6GM**, who has been active in amateur radio instruction and mentoring, has already had success with efforts in Mozambique.

In that nation, ham radio operators are seen as an asset, especially when floods or other natural disasters require emergency communications. SARL has already kicked off its next 100 years with a Centenary Marathon QSO Party that

Join the HamSCI Meteor Scatter QSO Party 2025

The Ham Radio Science Citizen Investigation is preparing for a series of meteor scatter (MS) experiments later this year. The target storms are in August (Perseids) and December (Geminids). Preparation and testing are underway now. This is a combination 'special event' and a contest to generate contact data during meteor scatter events using 10m and 6m. Contest rules will be released shortly.

10m has not been used much for meteor scatter study due to past symbol rate limits. But with recent changes in FCC rules in the USA, WSJT-X/MSK144 can now be used on the HF bands. The HamSCI meteor scatter event will collect contact data from both 10m and 6m as part of the scheduled events in August and December. Data will be analysed offline, comparing data from both bands, using both PSK Reporter raw data and operator contact logs from WSJT-X. User data, including both logged contact and received reports, are necessary for valid experimental analysis. The latter can be provided by any receive system reporting on MSK144 through PSK Reporter. Currently, we need operators to be active (i.e. CQing) on MSK144; or passive, if possible, reporting via PSK Reporter as 'monitors'. The best times are early morning hours prior to 10m opening to F2 propagation. Meteor scatter propagation occurs well below F2 and is supported in or near the E layer where the meteor ionisation tracks occur. Saturday mornings are being used regularly to

announce and coordinate 10m contacts using Ping Jockey Central. Announcements are also made on the Front Range Six Meter groups. io due to the substantial number of meteor scatter operators in that group.

To be successful, this effort needs operators, both active and passive. If you do not have the time to be active, at least set up passive reporting. PSK Reporter currently has scarce 10m MSK144 monitors; so we need to increase those numbers during the early morning hours.

Specific information for the August and December special events will be published as it becomes available, and as the planning matures. You can find the description of the HamSCI Meteor Shower QSO Party - 2025 here:

hamsci.org/msqp-poster

HamSCI serves as a means for fostering collaboration between professional researchers and amateur radio operators. It assists in developing and maintaining standards and agreements between all people and organisations involved. Its goals are to advance scientific research and understanding through amateur radio activities, encourage the development of modern technologies to support this research and provide educational opportunities for the amateur community and the public. For more information about HamSCI and to join our mailing list, please visit our website: www.hamsci.org

began on 1 January and will continue through to 31 December. Special event callsigns will include ZS100SARL.

CORRECTION: Godfrey G4GLM writes to say that D2 (Figs 5 and 6 of the Kramer Amplifier article, May PW) is shown the wrong way round. The author confirms that he must have had a 'brain glitch' when generating the schematic. However, as the diodes are preinstalled on the PCB, there shouldn't be any reason for concern.

SD CALLSIGN STANDS: Your editor was pleased to receive a customised callsign stand and drinks mat from Siggi G5ECO who has taken up 3D printing as a hobby. He says, "I started designing the callsign stand, initially for myself, but thought that other radio



amateurs would like them as well, which is why I now have a Facebook page with the items I have created for other people. Basically, if I can design it, then I can 3D print it. It's an interesting hobby as you need to learn how to design things using a CAD program, then slicing the items into the various layers, as well as setting up the printer and then finally sending the item to the printer".

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Georg Wiessala
wiessala@hotmail.com

VHF and UHF radio have always been an enjoyable part of the radio hobby for me. In my student days, I proudly owned one of the *Realistic PRO2006* scanners; later on, I acquired a *Yupiteru MVT 7100*. Both of these are still going strong on the second-hand market, I am happy to say. The *Yupiteru* was a milestone in its time, as was my long-term firm favourite, the *ICOM IC-R20*, mainly on account of its recording facilities and wide coverage.

More recently, I have used several Uniden scanners, above all the Uniden UBC125XLT, because of its great ease of use and versatility. I belong to some scanner-related Facebook groups and other fora, and I try to keep up with the latest developments in VHF/UHF and scanner technology. Therefore, I was more than happy to accept when **Justin Godefroy** at UK radio trader Moonraker offered me a review unit of the new Uniden UBCD160DN handheld scanning receiver, **Fig. 1**.

Technical details

The Uniden UBCD160DN works with digital and analogue frequencies alike and covers a frequency range of 25 to 520 and 758 to 960MHz, **Fig. 2**. It offers the following key features:

- A total of 1,000 memory channels (10 memory banks at 100 frequencies).
- Modes are Broadcast FM, **Fig. 3**, AM, and general FM (NFM, WFM)
- There is a basic band scope mode feature.
- The scanner receives digital modes (DMR, NXDN, dPMR).
- It decodes CTCSS (Continuous Tone Code Squelch) and DCS (Digitally Coded Squelch) systems.
- There are three assignable search ranges, 22 service searches and 10 custom searches.
- Easy PC control is via the ARC 260 software, e.g. from the Dutch firm Butel (€39.95)

<https://tinyurl.com/ms5tyszd>

You can also download the manual:

<https://tinyurl.com/yantkpnw>

There are a number of options useful for customising this scanner, including band default borders, band scanning and searching, memory banks, editing banks and channels, modulation, priorities and delays, alerts, and much more. This makes the unit very flexible and suitable for all users, from the casual 'scannerist' (is that a word?) to the more methodical frequency-collector and monitor of interesting (and legal-to-listen-to) local communications. The manual is clear and offers extensive detail on how to manage this radio to the best effect. I particularly liked the



The Uniden UBCD160DN Digital Scanner

Georg Wiessala gets his hands on a new scanner from Uniden, courtesy of PW advertiser Moonraker.

quick search and custom-naming facilities, which enable you to get started straight away when on the road, at a race, airshow or other event and when you have a reasonable idea of where the action should be found.

The UBCD160DN can be charged via its USB port, using the supplied USB data and charging cable. The radio has a charge-timer function. However, the default charge time is a whopping 14 hours. The scanner gets its power from two 2,300mAh (milli-Ampère-hour) Ni-MH (Nickel-Metal Hydride) batteries,

which are included. You can, of course, use other, suitable rechargeable ones. I find the *Panasonic Eneloop Pro* most useful for many of my radios and portable devices. You may also use alkaline batteries.

In terms of form factor, the UBCD160DN is identical to the UBC125XLT. It measures 67 (W) x 32.7 (D) x 115mm (H) without the BNC antenna, knob, clip and any other outside projections. It is lightweight at ca. 175g (261g with belt clip and BNC 'rubber-duckie' aerial attached, and with rechargeable batteries

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FREQUENCY RANGE		
25.0000 - 29.9950	FM	5
30.0000 - 79.9875	FM	12.5
80.0000 - 82.9900	FM	10
83.0000 - 87.2875	FM	12.5
87.3000 - 107.9500	FMB	50
108.0000 - 136.9916	AM	8.33
137.0000 - 137.9950	FM	5
138.0000 - 157.9875	FM	12.5
158.0000 - 160.9900	FM	10
160.9900 - 162.5875	FM	12.5
162.6000 - 173.9900	FM	10
174.0000 - 215.9500	WFM	50
216.0000 - 224.9950	FM	5
225.0000 - 399.9750	AM	25
400.0000 - 405.9875	FM	12.5
406.0000 - 439.9937	FM	6.25
440.0000 - 465.9950	FM	5
466.0000 - 469.9900	FM	10
470.0000 - 520.0000	FM	6.25
758.0000 - 960.0000	FM	12.5

Note: When you select AUTO for a channel or mode's modulation or step, these values are used UNLESS you have edited the Band Defaults. The scanner does not decode digital TV audio.

2

Fig. 1: The Uniden Bearcat UBCD160DN will appeal to many Airband enthusiasts. Fig. 2: These are the listed frequency ranges the scanner covers.

Fig. 3: If you want to listen to FM radio, an external speaker will improve overall audio quality (Sony SRS-XB12).

inside). The LCD display is of the 64 x 128 full dot-matrix variety, with a pleasant orange backlight. The backlight colour scheme cannot be changed, but there are some options as to when the backlight turns on, including on squelch opening, and how its contrast can be adjusted.

The tone-out option allows the radio to silently watch up to ten different channels for catching paging tones, which is very handy indeed if you wish to use this as a kind of silent pager-alert receiver. You'll eventually hear the comms when the initial tones have been decoded. The screen is not a touchscreen, which works for me. The 'rubberized' keys are both hard-wearing and sensitive to the touch and offer a reasonable haptic click and audible beep (when selected) feedback when pressed. Their arrangement is slightly different to the Uniden UBC125XLT.

The small internal speaker, at the bottom end of the radio case front, is of the 24Ω resistance variety at 0.8W (max) power. See the next section for some tips on external speakers. Please remember that the Uniden UBCD160DN scanner is classed as a 'conventional' model. This means *single-channel operation*. Yes, DMR and NSDN are included, but the scanner will not support the monitoring of the *trunking formats* of these two systems.

This makes it less complicated, but it may not suit some users. The UBCD160DN also



3

does not offer a close-call facility. This seems a shame, as it significantly restricts the scanner's useability when taken out and about, as compared, for example, with the UBC125XLT model.

Antennas & accessories

I began with a little light music on the FM broadcast band, Fig. 3. Good to have this: Apart from the older ICOM IC-R20, I have rarely had a scanner that could receive FM radio, so this was a nice surprise. The FMB band runs from 87.3 to 107.95MHz (European version). For those times when you need a break from listening to exhausting voice comms, you may quickly program in a few of your favourite FM stations. The sound of music on the built-in speaker is quite acceptable for portable use.

If you want more, you can always hook up a good (passive or active) speaker to the scanner's headphones output or use quality headphones. I connected my Sony SRS-XB12 active speaker and achieved a nice room-filling sound, Fig. 3 again. Or you could use your bhi

speakers and noise suppression devices; 'less snap, crackle and pop' definitely makes for a more relaxing monitoring experience:

<https://bhi-ltd.com>

If you prefer the imperturbable security-guard look, you could try one of those 'over-the-ear' earphones. Of course, you can use an active or passive speaker for voice communications too. Many scanner enthusiasts would not be without one. Or you can switch in an equalizer such as the *bhi ParaPro EQ20B-DSP*, the *Xiegu GNR1*, *MFJ-616* or the *Heil PRAS*. The *ELAD SP-1* looks stylish in the shack and offers excellent DSP functionality, which can be useful on some bands. In any case, my Sony yielded a substantial audio clarity improvement and worked very well with this radio.

Talking about accessories, the scanner did come with a USB charging and data cable and hand strap, but an actual charging plug was not included; maybe we can assume that everyone has one of these at home already. I certainly have a drawer full of them.



Fig. 4: The Diamond RHS1000 flexible component antenna is my go-to wave-catcher for all portable scanners.

On the bands

I used this scanner mainly for Airband listening and found it to be very sensitive with the right antenna. For many, the supplied BNC set-top aerial will be more than enough. My main VHF and UHF antenna for the outdoors is the Moonraker Scanking Discone (25-1300MHz); <https://tinyurl.com/ynvu8j35>

I also deployed various 'rubber-duck-style' set-top antennas – next to the included BNC one – and my all-time favourite, the multi-purpose Diamond RHS1000, **Fig. 4**. It is very hard to come by these days, and it works wonders. Moreover, I often use a rubber-headed stylus for key presses with scanners.

I live near Warton BAE Systems and both their civil and military communications were booming in. I would say that, on Airband, the UBCD160DN is about on par with the UBC125XLT. However, the UBCD160DN also brought in many aeronautical communications from a little further afield, signals such as automated ATIS services. On dPMR, I was very pleased to receive a regular stream of voice communications, there are many hillwalkers

and hikers here, and local businesses use 446 and local CB radio transmissions I caught with the radio but shocked by the use of foul language here.

In general, this scanner delivered very good results with PMR/dPMR 433 LPD and PMR 446 LPDs (short-range low-powered devices), allowing me to keep abreast with local events and incidents. The relevant frequencies, which logically relate to one another, are grouped and labelled in the pre-installed, advanced, service-search function; for example, if you search for 'Ham Radio', you will see five pre-programmed search banks, covering the 10m, 6m, 2m, and 70cm amateur radio sections. This kind of feature makes managing and logging any catches much more convenient. You might use a website such as *Radio Reference UK* as a basis for populating this scanner with frequencies.

Receiving non-voice signals

Then there are, of course, several other (non-voice) signals that the UBCD160DN can resolve within its wide area of coverage. I tried some ACARS first, the Aircraft Communications Addressing and Reporting System, **Figs 5** and **6**. I can just cover VHF ACARS here since HF

ACARS is outside of this radio's range. The principal ACARS frequencies (in Europe) are 131.525, 131.725, 131.825 and 136.750MHz. Please check the relevant ACARS frequency allocations in your region.

I set the UBCD160DN to one of the main European ACARS channels (**Fig. 5** again) and soon the messages came flooding in. I used the *Zorns Lemma 11.42* decoder to decode them. The right-hand side of the screen grab is the *Friture* audio analyser application (**Fig. 6**). I live in quite a privileged QTH here, below one of the main 'aerial crossroads' of the UK, in the Northwest of the country. Plenty of aeronautical traffic across the Irish Sea and the Atlantic passes over here, and Liverpool and Manchester Airports are not too far away either.

The scanner proved to be very sensitive to data signals. To get the best results, I would recommend that you invest in a good outdoor antenna, such as a discone (see above) or a customised VHF Airband aerial. However, bear in mind that the Uniden UBCD160DN does not *decode* ACARS transmissions (unlike, for example, the new Alinco DJ-X100). I deployed the *Zorns-Lemma 11.42* software to decode the ACARS signals, but there are other popular programs available in this area. I quite like the new *Black Cat* ACARS decoder, for example.

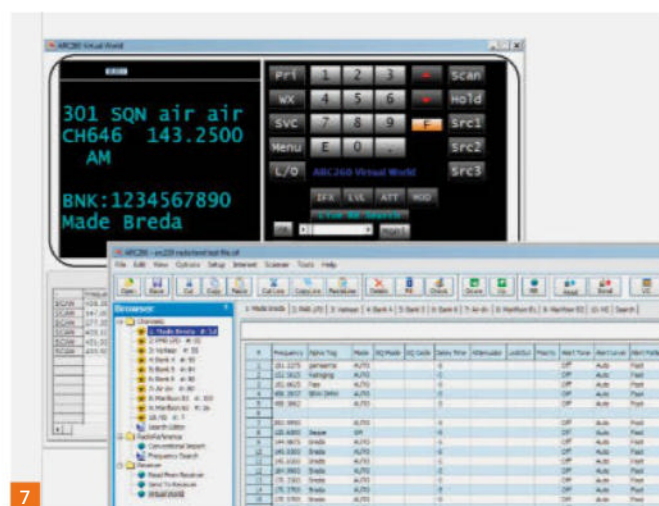
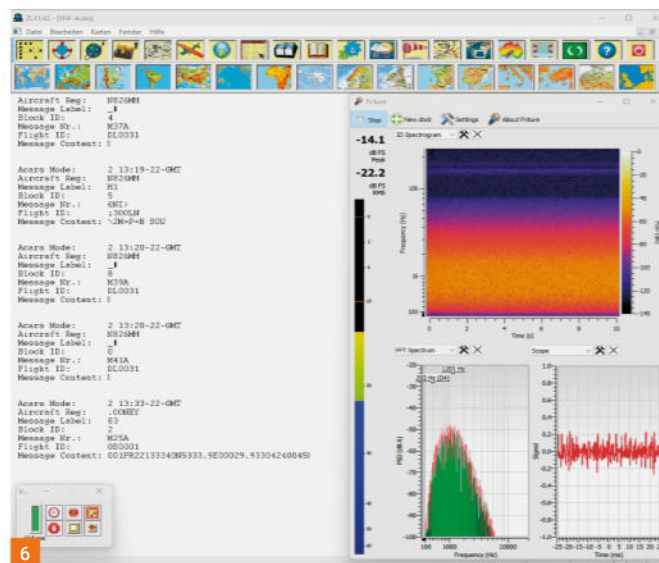


Fig. 5: The UBCD160DN was receiving one of the principal European ACARS frequencies without any problems. Fig. 6: With some auxiliary software (Zorns Lemma 11.42) the ACARS messages from the UBCD160DN could be resolved. The programme on the right of the screenshot is *Friture*. Fig. 7: You can use the ARC program to manage the scanner's memories and other functions.

Conclusion

In conclusion, the Uniden UBCD160DN offers many more features and functionalities that I do not have the room to go into detail about here. Overall, I found this scanner very easy and intuitive to use, especially if you add the Butel software, Fig. 7. The scanner is a conventional one, and it is easy to program. My favourite features are the quick-search and service search options, which cover most scanner enthusiasts' main areas of interest and include three customizable banks.

If you select the section on amateur (ham) radio, the 10m, 6m, 4m, 2m and 70cm bands are all here already, and you see straight away what's happening in your area. In the Airband service search, there are two search sections, one for 8.33kHz steps and one for the 25kHz variety – very convenient, indeed. It's nice to

have FM radio too, I have always missed that on the Uniden UBC125XLT. The custom-search functionality allows you to check all channels.

On the debit side, this scanner has no trunking, no close-call feature, and it does not allow unattended (non-PC-assisted) recording operation, which has been around since the time of the venerable ICOM IC-R 20. So, if you are using this radio semi-professionally on frequency-watch, weather and long-time monitoring services, or in a similar maritime capacity, look elsewhere.

The pre-programmed, service-search weather channels here are those of the USA. Nor is there an SD card slot; in my view, this ought to really be standard on just about any mid-range scanner by now. If you can make do without these things, you'll be very happy with the Uniden UBCD160DN. **PW**

Further reading and other resources

- King, R. (2025) United Kingdom Airband Frequency Guide (UKAFG) 2025
- Radio Reference UK:
<https://tinyurl.com/ydk66h8t>
- RTL SDR.com: Monitoring Airband Comms (Part 1)
- Uniden (USA):
<https://uniden.com/collections/scanners>
- Uniden ARC 260 software (Butel, €39.95):
<https://tinyurl.com/ms5tyszd>
- Uniden UBCD160DN User's Manual:
<https://tinyurl.com/53ktpc47>

Other reviews

(As always on YouTube, apply a large pinch of salt and a nerd filter!)

- www.youtube.com/watch?v=mHhZ_ZEtvrl
- The Scanner Guys:
www.youtube.com/watch?v=ktZmJPuvVSM
- Comparison UBC125XLT and UBCD160DN:
www.youtube.com/watch?v=c0dthxBLj-g

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Dr Samuel Ritchie EI9FZB

practicalwireless@warnersgroup.co.uk

This final instalment of switching between antennas and receivers concerns rolling your own distribution amplifier. In the August 2024 issue I wrote about using antenna switches. Last month I wrote about converting a professional distribution amplifier made for the audio-visual industry for amateur use. This month, I want to demonstrate how I rolled my own distribution amplifier, which is useful all the way to 500MHz.

The circuit

This distribution amplifier connects one antenna simultaneously to four receivers. The limit on the number of receivers that can be connected is that only five BNC connectors fit on the back panel of my enclosure – one for the input, and four outputs. The block diagram of the distribution amplifier is shown in Fig. 1 and I will explain each of the blocks.

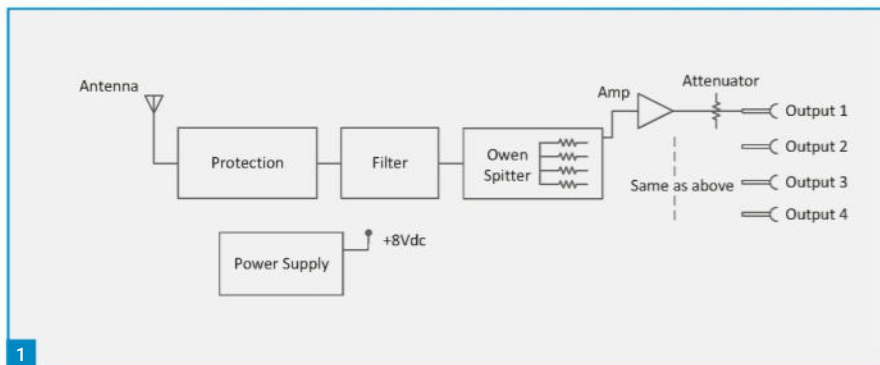
This design allows you to decide whether you want to include some protection on the front end of this unit or to ignore it if you already provide for it at some other point in your shack (the schematic of the protection circuitry is shown in Fig. 2). The antenna is connected to CN1 (a BNC connector) and following AC coupling (CB1) consists of a large value resistor (R1) to bleed off any static voltage. A gas discharge tube (GD1) handles any large voltage transients on the input. If you wish to bypass this part of the circuit, then do not mount R1 and GD1.

You will need to decide whether you want to include a filter, operate the unit in a wide band mode by not including a filter, or if you would rather use an external filter. I have included component values to construct a 7th order elliptic low pass filter that has a 3dB cut-off around 30MHz – to cover all the HF bands. The filter schematic is shown in Fig. 3.

For L1, L2 & L3 I used variable inductors made by Coilcraft, model 142-08J08SL, which are available from Mouser. In small quantities they cost approximately €3.56 each, but they are nicely shielded and well made. If you do use the Coilcraft inductors, then buy the tuning tool to make sure you do not crack the tuning slug. Of course, you could use fixed inductors or wind your own. If you choose not to include a filter, then do not install any of the components shown in Fig. 3. Instead, place a link from the top of C5 to the top of C12.

After mounting these components on the PCB I adjusted the filter and measured the filter characteristic with a VNA. The filter characteristics (the S21 parameter) is shown in Fig. 4.

The loss in this filter is 0.5dB at 14MHz and 1.3dB at 25MHz, but with the amplifiers there is still a positive gain over most of the band. I have



One Antenna and many Receivers?

Samuel Ritchie EI9FZB completes his look at ways of distributing signals around the shack.

built other filters (low pass and band pass) using the same mounting holes in some cases, as well as mounting a daughter board onto the PCB in others. You may prefer to use an external filter on the input and not include a filter in the enclosure.

The final part of this circuit is the amplifier, the schematic of which is shown in Fig. 5. Here I show one of the four identical channels. R2 and R3 together with the two resistors on each of the other three channels (R4 to R9) form part of an Owen resistive splitter. If you look at the review of the Cross Country Wireless Multicoupler in *RadioUser* magazine of January 2013 there are more details.

In essence, the Owen splitter design provides the highest isolation between ports of any of the resistive splitter systems. It can handle any number of output ports and maintains a 50Ω impedance match at all its ports. Exclusively using resistors makes it easier to obtain wide operating bandwidths. Going to this website (URL below) will reveal the mathematics. At the bottom of the webpage there is a table of resistor values if you want to change the number of channels, for those who do not want to work through the mathematics.

<https://tinyurl.com/235sya6d>

The purpose of the amplifier is twofold. First, to restore the level of the input signal as there is a loss of 16dB in the Owen splitter, and secondly to improve the isolation between output ports. The need for isolation between channels is explained in my article in the August 2024 issue of *PW* where I demonstrate that each receiver is also a transmitter.

I selected a Mini-Circuits GALI-52+ amplifier for the design for the following reasons: it has 50Ω input and output impedances, is good for DC to

2GHz, is a low noise device (which is important as we will be adding this noise to our signal), provides amplification that is around 20dB depending on the frequency, and costs around €2.10 in single quantities.

The GALI-52+ is a microwave monolithic integrated circuit (MMIC) and is a Darlington amplifier. It has, in our favour, a patented circuit which provides protection against damage caused by power supply turn-on transients. This MMIC is current-controlled rather than voltage-controlled, and a constant-current DC source is required to provide a stable operating point. This is provided by an external series resistor (R10) between the amplifier and a DC voltage supply to approximate a constant-current source. If you use a voltage other than +8V DC, then this value of resistor needs to be modified. L4 is provided to keep RF out of the power supply and becomes important as you go higher in frequency.

I provide for a pi attenuator on the output if you wanted to accurately set the output of the amplifier, and I have shown values for a 6dB attenuator. You can find a calculator online (URL below) to work out the values of the resistors required for other attenuation values. If attenuators are not required, then do not mount R11, R12 or R16 and place a short across R12 – this is what I did as I found I did not need the attenuators.

https://leleivre.com/rf_pipad.html

The schematic of the power supply is shown in Fig. 6. You need to be careful, as the power transformer is mounted on the PCB and there is a risk of coming into contact with the 220V AC that is on the primary. The transformer (T1) is a 12V, 2.8VA, encapsulated transformer with a resettable fuse (F1) on the secondary. The adjustable

Fig. 1: Block diagram of distribution amplifier.**Fig. 2: Front end protection.****Fig. 3: 7th order elliptic low pass filter.****Fig. 4: HF filter characteristic.**

voltage reference TL431 (U6) in the ground leg of the voltage regulator (U5) allows the output voltage to be accurately set via R13. I have set the voltage to +8V DC and measured the total current required by the all the circuitry at 160 mA.

Not shown in these schematics are the decoupling capacitors used for the amplifiers – these can be found on the complete schematic on my website.

The PCB

I designed a printed circuit board for this circuit which is shown populated but without the HF filter (bypassed by a zero-ohm resistor) and without shielding (more on this later) in **Fig. 7**. To encourage the building of these type of projects I try and use through-hole components as much as possible. However, some devices, such as the Gali-52+, are only available as a surface mount device (SMD). Fortunately, in this instance there are only four pins on each amplifier and two of them are connected (together) to ground.

The BNC coax connectors are good quality Molex connectors, available from Mouser under part number 538-73138-5033. These PCB-mounted connectors are made to be fitted to a panel and are specified up to 2GHz.

An enclosure

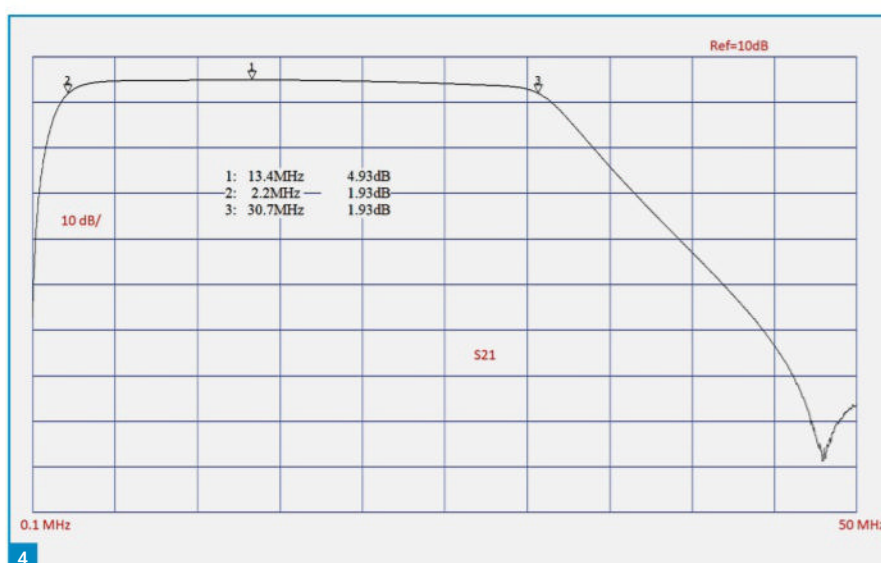
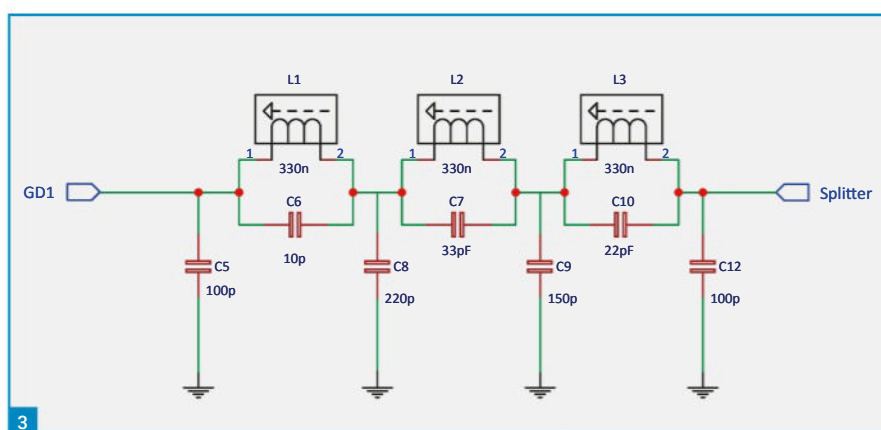
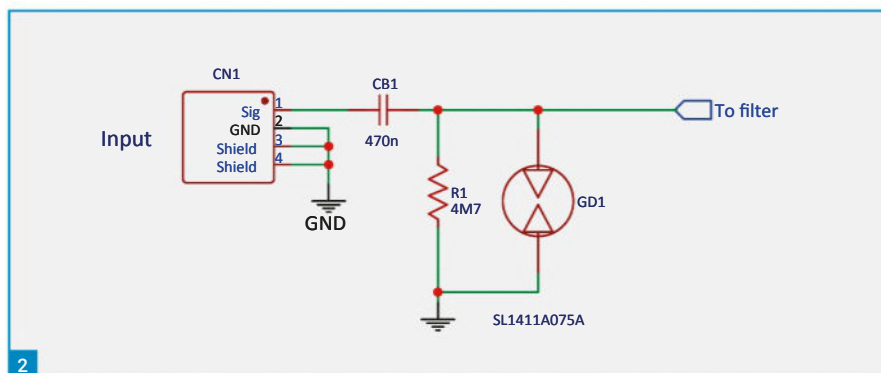
A front and rear view of the final product is shown in **Fig. 8**. Here I used a Hammond enclosure (model 1455T1201). This enclosure is made to mount the PCB horizontally by sliding it into internal slots which are extruded into the enclosure. In addition, the 1.5mm thick front and back panels are easy to machine with hand tools.

I designed and had the decal manufacturer as described in the July 2022 edition of *PW* and **Fig. 9** shows the decal before being cut up and stuck onto the panels. You can see I made an HF version and a wide band version of the decal.

Testing

Testing was carried out using a vector network analyser, where all unused inputs and outputs were terminated with 50Ω and the PCB was placed in the enclosure with the end panels in place. Please note that all measurements from this point forward were done on the wideband version of the coupler, which does not have the HF filter included.

Fig. 10 shows the transmission coefficient, S21, which is the ratio of the output on each channel to the drive signal going into the input. This tells me how much signal I lose (attenuation) as the signal passes through the device and how this loss varies as the frequency



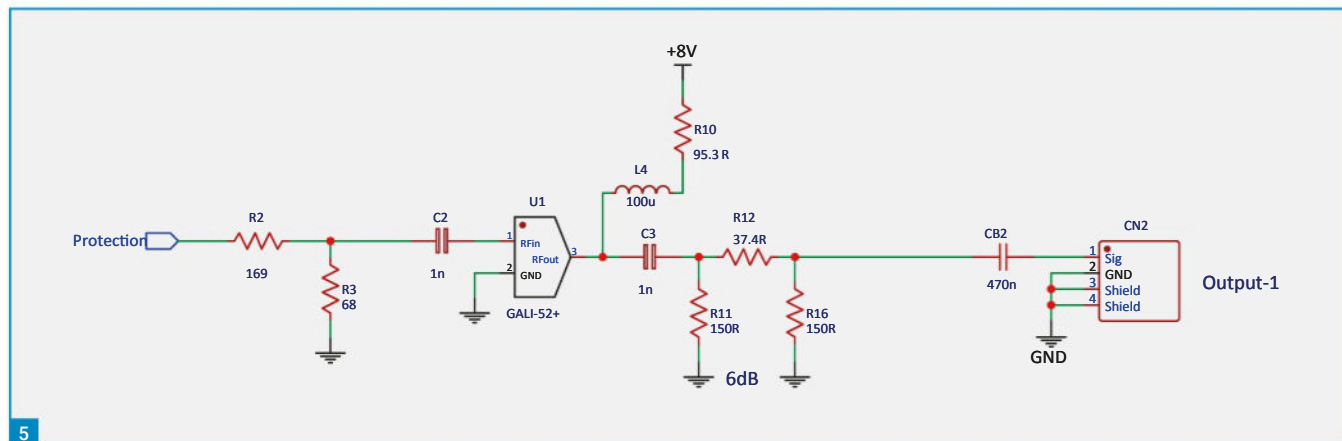
changes. Channel 1 measurements are given in blue, channel 2 in red, channel 3 in cyan, and channel 4 in pink.

The GALI-52+ amplifiers only have a minimum guaranteed gain that is given at 2GHz of 16dB. For all other frequency ranges the gain is only specified as 'typical' values with repeatable performance from lot to lot. These four amplifiers are close in gain up to 200MHz with some deviation up to 500MHz of 4.5dB between channels at 500MHz. I checked that each amplifier had the same power on the input, the voltage drops across R10, R20, R28 & R21 were

within 0.01 volt of 4.36V, and the power on the output of each amplifier was delivered without attenuation to that channel's BNC connector. The variation of gain appears to be in the GALI-52+ amplifiers.

The second test was to determine the isolation between outputs and the result is shown in **Fig. 11**. For this measurement I input a known signal into the one output port and measure what is coming out of the adjacent output ports. The isolation is around -40dB across the whole range.

The third test was to test the isolation between outputs and the input, and this is shown in **Fig. 12**.



For this measurement I input a known signal into the one output port and measure what is coming out of the input port. The isolation is around -43dB across the whole range.

Adding shielding

If you look closely at Fig. 7 you will see that I made provision to be able to shield each part of the RF circuitry to see if this radically improved the transmission coefficient and the isolation between ports. I also had suitable lengths of PCB designed to make this shielding, and the PCB with shielding added is shown in **Fig. 13**. In this version the HF filter and the front-end protection components are included and the PCB is being wired into the enclosure. The two cut-outs on the PCB make sure the cable grommet on the back panel and the switch on the front panel do not butt into the PCB.

I repeated the transmission and isolation measurements with this shielding in place, the PCB installed once again in the enclosure and the end plates attached. I discovered that it makes very little difference and is not worth the trouble of adding the shielding.

One last measurement of interest is the low frequency performance of the coupler – this is shown in **Fig. 14**. Zero gain is at 1.77MHz with a considerable loss below this frequency.

End note

The wideband version is permanently attached to my rotatable log periodic antenna, and the HF version services one of my HF loop antennas. Both are useful additions to my shack.

Have a look at my website (below) where there is a link to access the complete schematic and PCB design on EasyEDA if you want to modify what I have done or just have some identical boards made. There is also the Visio® file if you want to copy or modify the decal I used.

www.samuelritchie.com

As usual there are higher resolution pictures and details on some of the components. I have no financial interest in Coilcraft, Mouser, or Mini-Circuits. **PW**

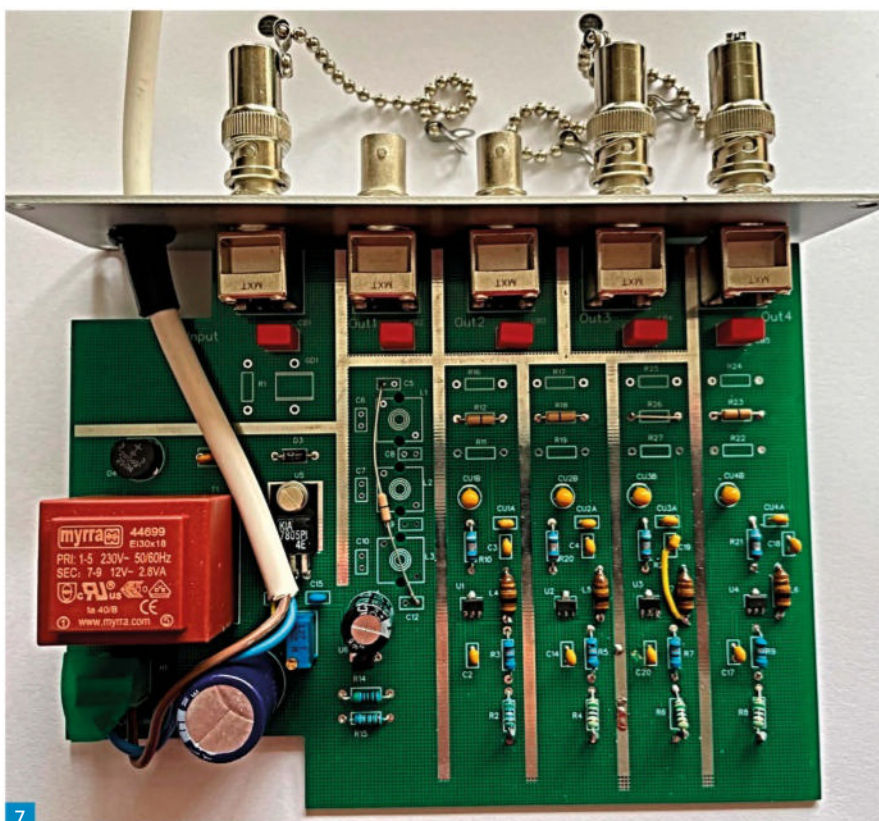
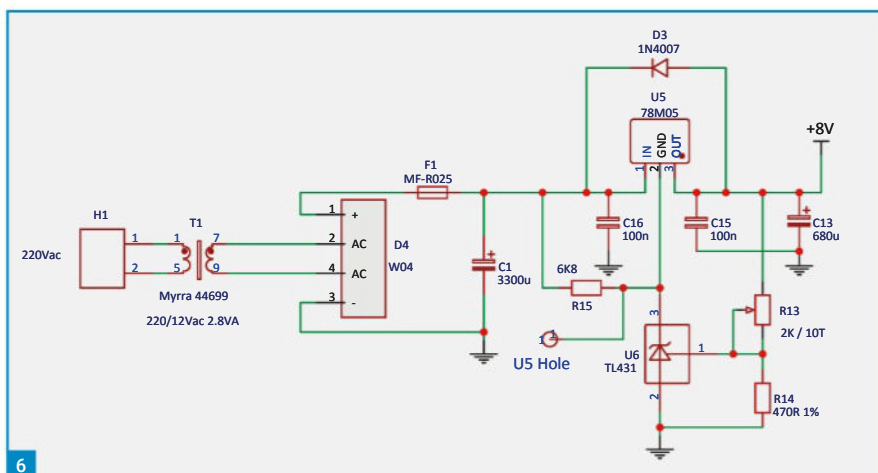


Fig. 5: Amplifier and attenuator. Fig. 6: Power supply schematic. Fig. 7: Top view of mostly populated PCB.

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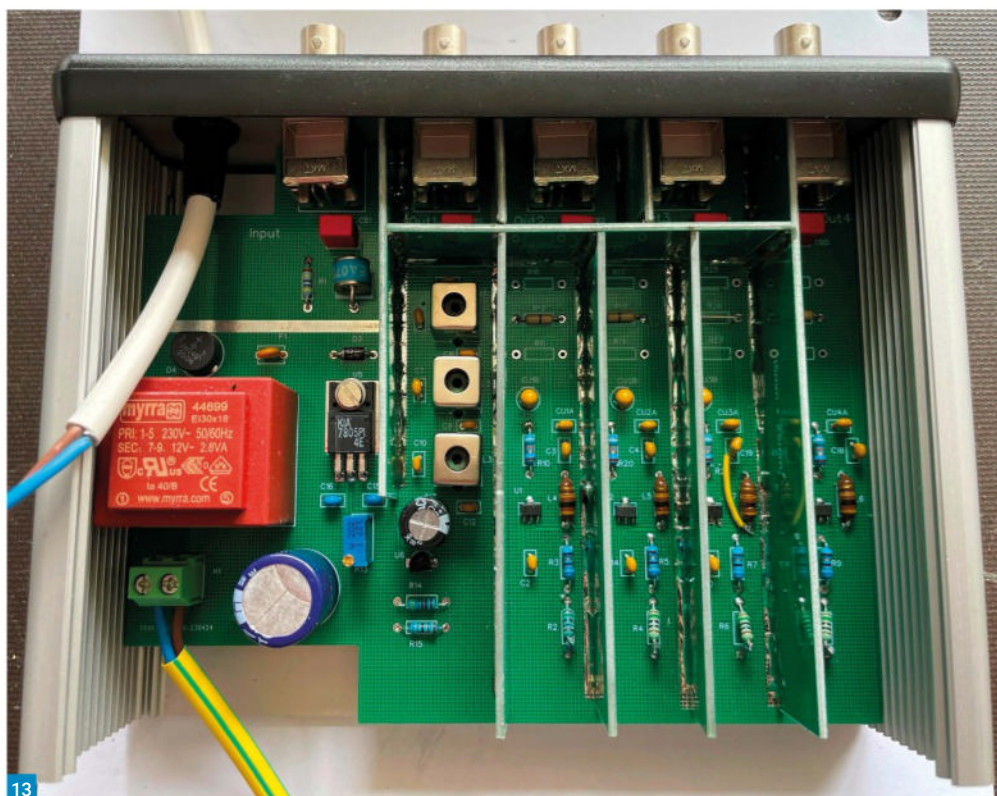
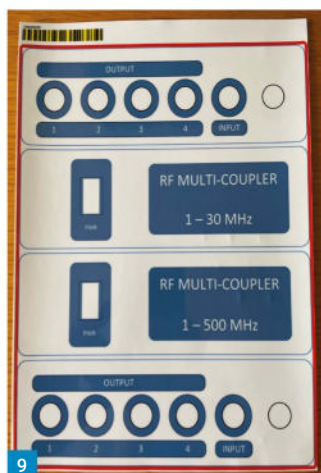
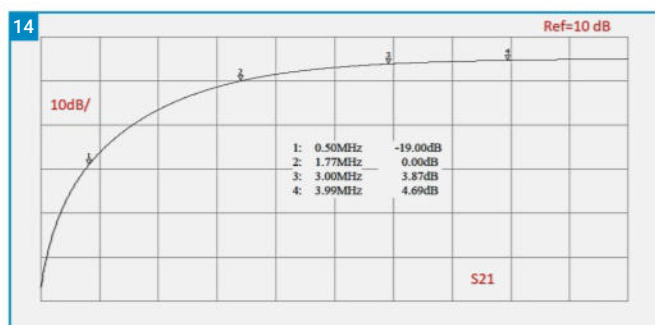
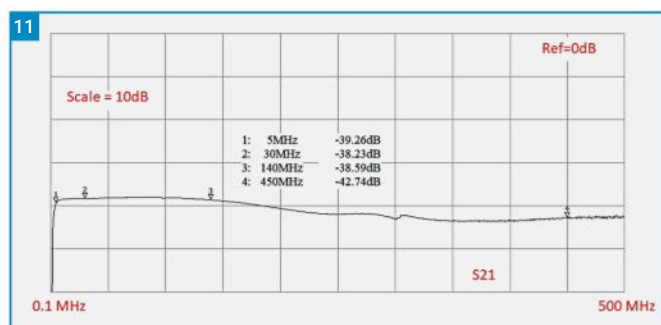
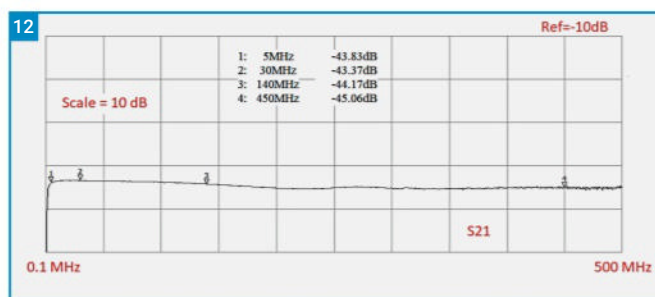
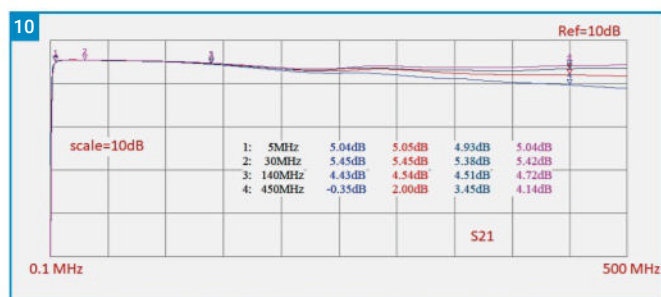


Fig. 8: Front and back view of the enclosure. Fig. 9: Decals before cutting up. Fig. 10: Transmission coefficient - S21.

Fig. 11: Isolation between output ports. Fig. 12: Isolation between output and input ports.

Fig. 13: PCB with shielding added. Fig. 14: Low Frequency Performance.



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Steve Telenius-Lowe G4JVG
teleniuslowe@gmail.com

In the April *HF Highlights* we reported on the SV1GA/A operation from Mount Athos, which was cut short after only two days following allegations that the correct authorisation to allow amateur radio operation from the Holy Mountain, **Fig. 1**, had not been granted. However, on 4 April, the ARRL DXCC Desk issued a statement saying that it “has determined that the operation by a DXpedition team from Mount Athos meets the DXCC award program’s accreditation criteria. Contacts with the team, which operated in January 2025 using the call sign SV1GA/A, will therefore count toward DXCC. Additionally, due to actions taken by local authorities that resulted in the early termination of the operation, any future operations by this team from Mt Athos will require additional documentation for securing accreditation for DXCC credit...”

Friedrichshafen 2025

The 48th annual International Amateur Radio Exhibition takes place in Friedrichshafen in southern Germany on 27, 28 and 29 June. This year’s motto is ‘Remote Radio – Connecting the World’, which “demonstrates in a unique way that amateur radio is on the pulse of the times”, say the organisers.

I had hoped to go to Friedrichshafen both last year and this year, but events conspired against it on both occasions. Nevertheless, there will be plenty of HF operators from the UK, Europe and indeed from all over the world attending – every HF operator has to go at least once!

www.hamradio-friedrichshafen.com

The beer garden within the Friedrichshafen exhibition centre is a popular place to meet friends old and new for a drink and a bite to eat, **Fig. 2**. Unfortunately, the wooden food and drink hut in the beer garden caught fire on 31 March, requiring 50 firefighters to bring it under control. However, I’m sure the facility will be up and running again by June!

<https://tinyurl.com/5c85xw3b>

QSL from Yesteryear

My G4JVG DXCC counter from Liechtenstein is a QSL from HB0/AI5P (**Fig. 3**), which I worked on 14MHz SSB on 19 May 1988. Nine years later, the operator, **Rick Harris AI5P**, visited the RSGB HF Convention at the Beaumont Conference Centre in Old Windsor, where I met him for the first time. Then, in August 2015 – more than 37 years after our first QSO – I was pleased to meet Rick again when he operated as PJ4/AI5P, **Fig. 4**, from Bonaire, one of more than 100 DXCC entities from where he has been active. He has also been incredibly active from the USA: while many amateurs around



SV1GA/A and more

Steve Telenius-Lowe G4JVG has a full column, starting with news of the recent operation from Mt Athos.

the world have achieved the CQ Worked All Counties award, Rick was the first to *transmit* from all 3077 of them! He has also worked all US counties five times over. Having achieved so much, a few years ago Rick started a new challenge and is now very active in the Parks On The Air (POTA) programme.

Professionally, Rick is a US Army Signal Corps veteran, having risen to the rank of Colonel.

PJ4DX reissued

I lived in Bonaire from 2013 to 2024 and was very active as PJ4DX during that time, making over 135,000 QSOs. I closed down on 5 March last year and exactly one year later I was informed that the callsign had been reissued. The new holder is **Paul Veldkamp Waalen**, who also holds **PJ4SON**, **Fig. 5**. Paul has said that he will continue to use PJ4SON for regular operating and will use PJ4DX for special activities and contests. The ‘new’ PJ4DX was active for the first time in the CQ WPX SSB contest over the weekend of 29/30 March.

IARU special event stations

The International Amateur Radio Union (IARU) was founded in Paris on 18 April 1925 and to celebrate its centenary (**Fig. 6**), numerous special event stations with ‘IARU’ callsigns were operating from around the world in April. GB0IARU was active from various locations around the UK, while just a few of the others

were: 8A100IARU (Indonesia), OQ0IARU and OR0IARU (Belgium), YP100IARU (Romania), HS100IARU (Thailand), SZ100IARU (Greece), LZ100IARU (Bulgaria), E7100IARU (Bosnia-Herzegovina), HG100IARU (Hungary) and 7Z100IARU and HZ100IARU (Saudi Arabia).

The month on the air

The Belgian-led VU4AX DXpedition to the Andaman Islands was active between 11 and 20 March, making over 65,000 contacts.

The EI DX Group 6Y7EI DXpedition to Jamaica was QRV between 13 and 24 March, closing down with around 101,000 contacts in their log.

C5YX was a one-man operation from the Gambia by **Gert PA2LO** from 16 to 25 March. He was active on SSB and FT8 and made around 8500 QSOs.

A group of operators from Czechia was active as 3B9DJ from Rodrigues Island from 24 March to 5 April on all bands using SSB, CW and FT8. The team made over 79,000 contacts.

8P9EI was holiday-style operation from Barbados by **Dave G4OSY** between 24 March and 5 April, using 100W to vertical antennas on CW and SSB.

ZA/IZ2DPX and ZA/IZ1CTE were active from Saranda, **Fig. 7**, in Albania on all bands from 8 April and were expected to stay until the 13th.

A group of four German amateurs started their activity from the island of Anegada in the British Virgin Islands on 10 April. They used



AI5P Fürstentum Liechtenstein
Principality of Liechtenstein
AISP OPERATING AS
HB0/AI5P

CONFIRMING QSO/SWL REPORT ☐ MOBILE ☒ PORTABLE

QSO WITH	DATE	GMT	MHZ	PK	RST	TKS	QSL
G4JVB	19 May	1734	14	558	S9		PSB

QSL VIA AISP or W3HNK

73 ES DX
RICK HARRIS



Fig. 1: Welcome to Mt Athos: the three things that are entirely forbidden. Fig. 2: Some well-known faces in the beer garden at Friedrichshafen. The food and drink hut in the background burned down in March but should be up and running again by June. Fig. 3: 1988 QSL from HB0/AI5P.

Fig. 4: Rick Harris operating as PJ4/AI5P. Fig. 5: The new PJ4DX, Paul PJ4SON, with his favourite beverage to hand. Fig. 6: The IARU celebrated its 100th anniversary in April.

the callsign VP2VI, making around 30,000 contacts in their first two days. (The callsign was originally held by **Bob Denniston W0DX (SK)**. Bob lived at Smuggler's Bay on the main island of Tortola for many years until he passed away in May 2002. I happened to be on holiday in the BVI when Bob died: he was a well-known character in the community and the local newspaper carried a lengthy obituary, highlighting his amateur radio activity.)

What to look for in May-June

Members of the '7163 Group' led by **Jim WB2REM** plan to operate as OY6A and OY6FRA from the Faroe Islands from 1 to 10 June using FT8. FT4, SSB and CW on all bands from 1.8 to 50MHz. Some of the team members may also operate as OY/own calls.

<https://faroeis.com>

Nobby Styles G0VJG wrote to say "I will be active as FO/G0VJG from Bora Bora in French Polynesia for 16 days from 11/12 June. I will operate QRO SSB, CW and data. QSL via M00X0. I will pack my G ears" (meaning he will listen specifically for UK stations in the pile-ups).

Six members of the Italian DXpedition Team plan activity from the Republic of Kosovo as Z68TT on SSB, CW and RTTY, and as Z68XX on FT8. They will use all bands from 3.5 to 50MHz



between 26 June and 10 July.

www.i2ysb.com/idx

Readers' news

It has been several months since we heard from **Martin Burch VK4CG** from near Brisbane in Queensland, so it was good to get an update from him once again. He says his working pattern has changed and he is now working from 6.00pm until 2.00am, "which means no early wake-ups for morning QSOs. I have managed to get on the air this weekend, about the first time properly for about five months, getting a lot of contacts using the Any Tone 5555N2 (Fig. 8) which puts out 60W of SSB on 10 metres. Really good monoband radio which I would recommend to anyone out there that enjoys using the 10m band." Martin says he still



uses a "1983 vintage Icom IC-730, but have just ordered an Icom IC-7300 which is en route to me now."

Jim Bovill PA3FDR wrote that "This month the number of DX QSOs on 10m and 12m was lower than usual, probably because most of my sessions were in the evening, not the best time for those bands. Most of my reports from these bands were from morning or early afternoon sessions, including a new DXCC entity from the Caribbean, Jamaica (6Y7EI). The other new catch was from the Comoros Islands (D68Z), a small group of islands in the Indian Ocean.

"Two other contacts I must mention were from Malawi, Fig. 9 (7Q6UJ and 7Q8AC). My first QSO with this country was in January 2023, with 7Q7EMH located at the Embangweni Mission Hospital, hence the suffix EMH. Since then I

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Fig. 8: Any Tone 5555N2 28MHz SSB transceiver used by Martin VK4CG. Fig. 9: On the Shire River in Malawi. Fig. 10: This explains the big signals from OS8D/P!

have had several QSOs with this station and also with several other amateurs from Malawi. What struck me was that most of them were young and only recently licensed as amateur radio operators. One (7Q5BM) is only 16 years old while 7Q6UJ mentioned above and 7Q2MM are only one year older. While one often hears about the problem of the ageing population of hams in the UK and elsewhere in Europe (there was an article on this topic in the recent edition of the magazine of VERON, the Dutch amateur radio society), this is unlikely to be a problem in Malawi, although it is worth noting that there are at present fewer than 10 licensed amateurs in the country."

Etienne Vrebos OS8D (Fig. 10) works exclusively SSB, saying "I really love the voices that cannot hide their local accents, a delicious travel world-wide... Scots or Ulster guys / ladies can never hide their '8'. I love their pronunciation of the number 8, and I'm lucky I've an 8 in my callsign..."

"My chase of Russian RDAs continues slowly, as long as their roads are difficult to drive on at this time of the season: they are the real activators /P or /M in very harsh conditions in Far Eastern Asia, driving to points where nobody ever goes on earth. I'm always thinking about those conditions where they activate RDAs: when I activate castles or parks or flora / fauna at the end I have a good restaurant or a beer somewhere, a few minutes driving from my activation point..."

"Since last week I do suffer from very bad conditions / propagation on all bands. As I never give up when I'm outside, sometimes it takes me 2h 30min to get my 50 QSOs to validate my castle activity and most QSOs in the morning come from the east. I'll have to live with it I presume."

Owen Williams G0PHY reported that "The activity this month was mainly centred on working 6Y7EI and the CQ WPX contest. I thought conditions were reasonable for the 6Y7EI operation, with the exception of 24MHz where I only heard them briefly. Conditions were also not at their best for the CQ WPX contest,



with few signals from the Caribbean, although one of the highlights was hearing both HC8M on the Galapagos Islands and ZM4T on 7MHz in the morning...

"It's certainly a pleasure to see the sun... however, the sun is not playing ball, with the A index being quite high. This may have had an impact on the signals from VP6RD. He was loud here last Friday morning but inaudible on Saturday and Sunday mornings. From memory, this is the first time I've heard Pitcairn since being active on the air. Looking back in my SWL log I did hear VP6JR in January 1990 on 14MHz and I may have used a Howes Direct Conversion Receiver kit although I'm not certain."

Ken Churms EA5/G4VZV wrote from his holiday home on the Costa Blanca coast of south-east Spain saying he had been there "about a month and had lots of fabulous DX contacts. Unfortunately Ken did not specify which band(s) or mode(s) he used, but some of his best DX was: 7Z1WW, 8P6NW, E51JD, FK4QX, HZ1LR, J60Z, JA, JY4CI, KP2AD, PJ4KY, VK7VZ/M, VP6RD, XQ6CF plus many Ws, VKs and ZLs. Ken operates either with his home-built radio trolley (**Fig. 11**) or while parked up in the salt lagoons in his motor car. "All stations worked using the FT-857D at 65W to an extendable telescopic whip and just 2 or 3 feet away from the shallow salt water of Salinas Santa Pola or Bonmati", he added.

Tim Kirby GW4VXE, operating on CW as **GW4MM**, feels that propagation seems to have been changing towards summer conditions, with only the higher bands (18MHz upwards) being 'useful' during the daytime. Tim writes, "having said that, 10m has been surprisingly poor over the last week or two, with comparatively little 10m FT8 traffic monitored on my SDR and indoor loop. Three expeditions caught my attention this month. **Red DL1BUG** travelled to Benin and operated as **TY5FR** using



100W to a 22m long wire. I was very pleased to work Red on 12, 15 and 17m. I heard him on 30m but didn't manage to make a contact. The Czech group operating as 3B9DJ put on a good show from Rodrigues, a place dear to my heart, having visited back in 2004 as part of the 3B9C trip. I didn't hear them much on CW but was pleased to work them on FT8 on 15, 17 and 30m, which was welcome as I had only previously worked **Robert 3B9FR** on 10 and 12m. Hopefully, we will be hearing Robert on the air a bit more now as the Czech group kindly repaired Robert's station for him. Finally, the EI expedition to Jamaica were very active as 6Y7EI and it was a pleasure to work them on 10m CW. At times, they had some very serious pile-ups going on!"

A brief note was received from **Carl Gorse 2E0HPI** to say that, although he had been operating portable a few times, **Fig. 12**, with all the solar disturbances he had only made a few QSOs on 7MHz but nothing on the higher bands. Carl said that he would be visiting the Norbreck Rally in Blackpool on 13 April, the largest amateur radio get-together in the north of England.

28MHz beacons

Neil Clarke G0CAS brings us his 28MHz beacon report for the month of March. Despite the elevated level of geomagnetic activity during March, which saw the daily planetary A Index



Fig. 11: The home-built radio trolley used by Ken EA5/G4VZV from the salt lagoons near Alicante.
Fig. 12: Carl 2E0HP/P location at POTA GB-1611, Durham Coast Route, on 27 March which unfortunately resulted in very few QSOs.



in double figures on 23 days, it seemed to have little effect on propagation most of the time. VK6RBP 28200 was heard on 24 days, compared to only 16 days in March 2024. Also, all of the W call areas were heard around the same amount or slightly more frequently, compared with March last year. As expected, paths crossing the equator to South Africa and South America suffered the least, with ZS6DN and 5Z4B 28200 heard on 27 and 25 days respectively, while LU2DT 28193 and PY4MAB 28270 were logged on 31 and 24 days respectively. Back on 28200, LU4AA and OA4B were heard on 30 and 26 days respectively. It would appear that YV5B is off the air and was not heard at all. April is normally considered to be the month for the start of the summer Sporadic E season, but small, short-lived, localised openings can take place in March, which was the case this year. On the 8th, both OE3XAC 28188 and DL0IGI 28205 were logged. Moving on to the 16th, SQ4HWI 28193 and SR5TDM 28216 were logged. SQ4HWI 28193 was logged again on the 20th, and finally ZB2TEN 28149 (previously on 28170) was logged on the 26th. All these beacons were logged at good signal strengths.

Over the last several months new beacons have come on the air; these are HZ1HSM 28150, 7Z1CQ 28164, G4AHG 28243 located in the

Bristol area and V31HQ 28258, operating from the club station of Belize.

Band highlights

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

Martin VK4CG (MS): 14MHz SSB: YE9XAJ.

21MHz SSB: FK8IK, JJ0PKS. **28MHz SSB:** 9M6A, CN3A, JJ1MBU, VA7KK, WB2ZAB, YJ0CA, ZM3A, ZM4T.

Jim PA3FDR (MS): 14MHz FT8: 4L1FL, UA9SHH. **18MHz FT4:** JG3LGD. **18MHz FT8:** BI4JJO, BV2NF, JA7ZF, JH5AVM, NE9U, VA7XU, VK2LAW, VK4AWB, YB8TDK, ZS6OB. **21MHz FT4:** A61SD, D68Z, EA8IK, N7XU, TF1A, VA2UT. **21MHz FT8:** 7Q6UJ, 7Q8AC, BG0HP, BG5FZU, CO6QK, UA0LBF, UN3P, VE2TBQ, VU2ZMK, W7CT. **24MHz FT4:** CX6TU, EA9E, JA0DAI, NG7M. **24MHz FT8:** 6Y7EI, JA7FKF, JF0CSK, KC0FGX, PU4TNT, ZD7CTO. **28MHz FT4:** KF9UG, VE3XN. **28MHz FT8:** 7Q5BM, PT7PT, W5XO, VE2CKW.

Etienne OS8D (HB): 7MHz SSB: 6Y7EI. 14MHz SSB: VP2ETE. 18MHz SSB: 8P9CB, VU4AX.

21MHz SSB: 4K3ZX, 6Y7EI, UN7QBX. **24MHz SSB:** FK4QX. **28MHz SSB:** 8P9CB, CA3PHX, CE2WK, CX/PY2TIC, FG5GP, HI5ATA, KP4PK, LU1DX, LW2DAF, PJ7EE, PP2CC, SU1SK, TO1P, VP5/WW1X, VU2XO, YE3BYE, YN9H, ZF2CI, ZY2B.

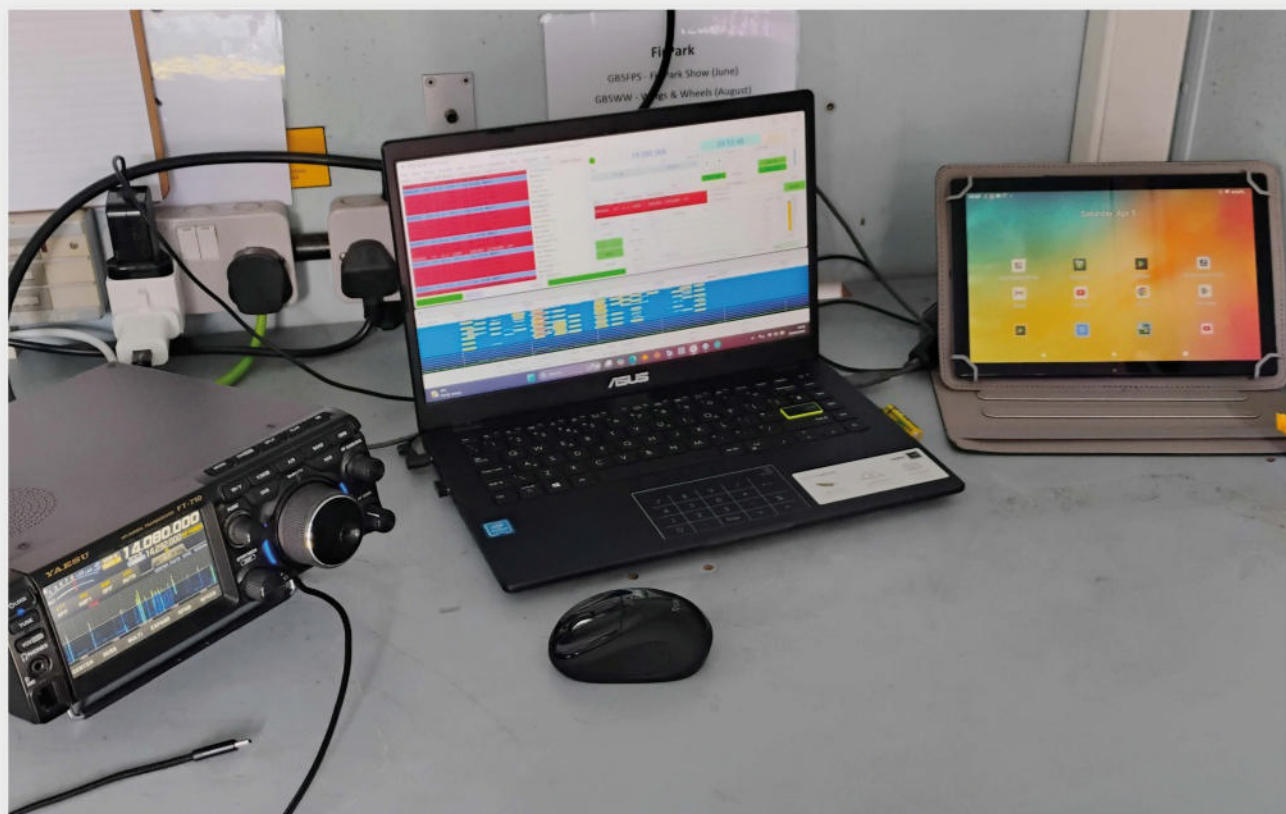
Owen G0PHY (MS / HS): 7MHz SSB: 6Y7EI, CN3A, CQ9A, D4DX, K3LR. **14MHz SSB:** 6Y7EI, D4DX, ND7K, NR6Q, V26K. **18MHz SSB:** 6Y7EI. **21MHz SSB:** 4X6TT, 6Y7EI, CQ35MD, J62K, PP4T, V26K, WJ0W. **24MHz SSB:** CQ35MD.

28MHz SSB: 6Y7EI, CQ9A, CW5W, FY5KE, TO1P.

Tim GW4MM (HS): 14MHz CW: 5Z4VJ, 9K2MU, 9N7AA, ZL4TT. **21MHz CW:** 5Z4VJ, TY5FR, V26K, V5/DL5XL. **24MHz CW:** E29TGW, TY5FR, XQ6CF. **28MHz CW:** 6Y7EI, CE2ML, V26K.

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



News from Lincoln Short Wave Club

Lincoln Short Wave Club members participated in the FT4 activity day at Fir Park Farm. We operated from the club's NATO trailer, led by Les G1LQB, Marc M7DEU, Ian M7BKF and David M6OYN.

Despite challenging conditions, we persevered for the full 24 hours. We used a simple setup, a vertical multi-band antenna and one of the members' Yaesu 710 radio. We managed to make 311 contacts, and the

weather was surprisingly pleasant. It was a great way to start the club's 2025 SES calendar. We managed to come 4th in our group.

Report from Marc M7DEU



THE LATEST FROM RAOTA: The spring 2025 edition of our quarterly magazine (*OTNews*) has been sent to our printer for a proof, prior to distribution, and to John G7OXX who records an audio version for members with limited vision. The magazine opens with reports from the President, the Editor, and Membership Secretary, followed by the members Opinions, News, and comments, section. There is quite a discussion by various members about the moon landings, in response to a letter by Ray G4OWY. We then have the third part of a series by Tim VK3BYP describing his 'Life in Amateur Radio'.

An obituary for Adrian M0ABY is followed by Ian G4EAN describing his visit to the Martin Lynch open day. Ian had intended to represent us at the RSGB HF Convention but had to cancel at short notice because of illness. Robin G8VVY outlines his introduction to our hobby, with detailed descriptions and

photographs that cover a wide range of equipment and operating. That is followed by Francis G4ALD going into great detail about 'the ultimate made-to-measure suit'. The Apollo lunar mission space suit is a lot more complex than most people imagine. Not radio, but fascinating nevertheless. Prompted by G3ZPF's description of an acoustic CW filter in our previous issue, Geoff G4TQM describes an audio filter he has used for many years, based on a pair of LM124 in cascade. The final submission in this issue is by Pat M1BNH who describes his life as a 'water rat' in the Land Drainage Division of Leeds City Council. He clearly enjoyed being 'up to his waders in becks, culverts & sewers' and his story is far more interesting than you might expect. To find out more about our magazine and our organisation, visit:

www.raota.org

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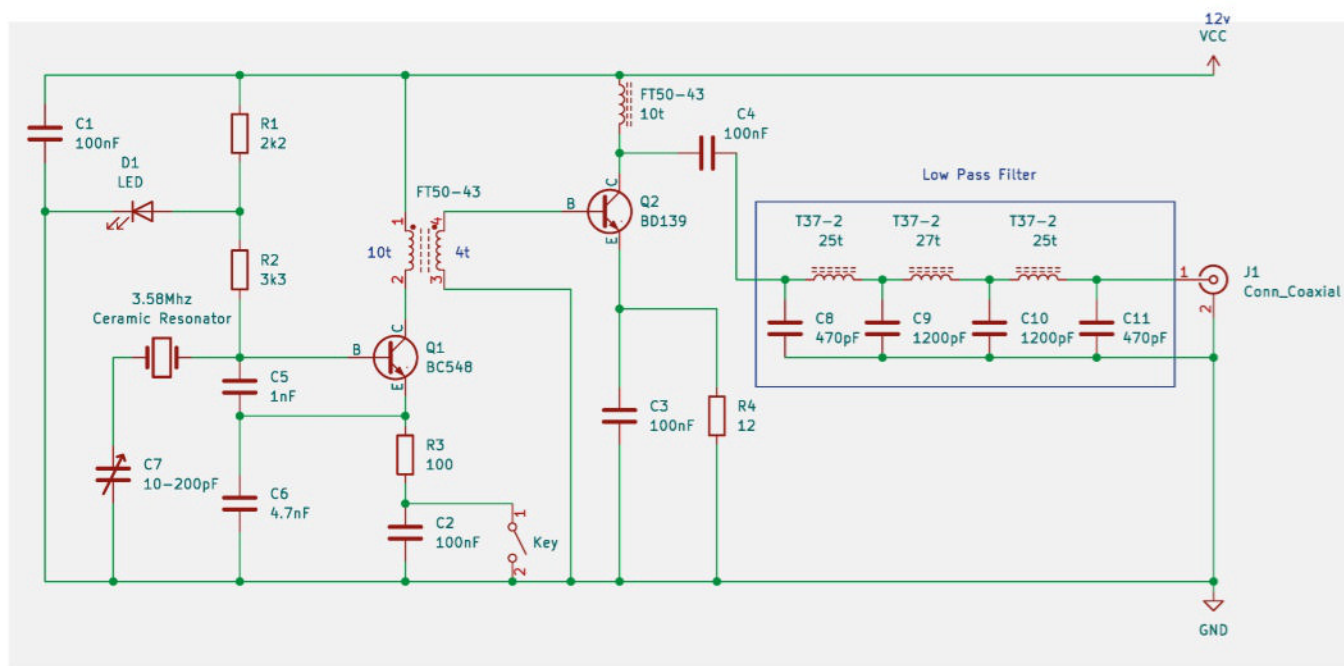
Compact In-Line

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DESKTOP MKII

DSP Noise Cancelling base station speaker, featuring powerful 10W sound with up to 40dB of adaptive noise reduction.



practicalwireless@warnersgroup.co.uk

In this month's *On a Budget* we are going to build a simple, yet excellent little CW transmitter, which can cover the entire CW portion of the 80m band and fits in an Altoids (or similar) mint tin. **Figs 1, 2 and 3.**

First of all, let me say this is not my design, but that of **Peter Parker VK3YE**, that denizen of simple homebrew construction down-under. All I have done is build it and drawn a proper circuit diagram that you can easily follow (Peter merely holds up a hand-drawn circuit during the course of a video – not ideal for reproducing here!)

There are only 17 active components, plus another seven for the Low Pass Filter (LPF), and the whole thing can easily be built by anyone in a couple of hours. Putting out a mighty two watts on the 80m band, I have made literally dozens of QSOs with mine over the last couple of years. All you need to do is add a CW key, and 12 volts (or thereabouts!) of power. Then connect to an antenna and use a separate receiver, with some way of switching the antenna between the two, and you have a complete QRP station! Why not give it a go?

Let's start at the beginning, as if you have never built a rig before, and work through what is required. Once the rig is working, I will help you to examine options for connecting and switching a receiver.

Partsrequired

Here is a components list. It is in two parts, the transmitter itself, and the LPF. An LPF is essential to reduce harmonics and interference. You have two options here – either build it yourself from scratch and hard-wire it in the tin, or build it from a

A simple 80m CW transmitter

Daimon Tilley G4USI offers an easy-to-build CW transmitter that will give hours of fun.

kit from QRP Labs (URL below) and plug it in when in use – this allows you to be frugal and use the same LPF in other transmitters. In my pictures I used the plug-in option, but as the lid of the tin will not close when this is used, I plan to hard wire one in from scratch soon.

www.grp-labs.com/lpokit.html

The transmitter

- Ceramic Resonator – 3.58MHz
- Variable capacitor – 10 – 200pF (or greater – not too critical) A poly-varicon type is ideal
- LED – colour of your choice and a bulkhead holder to fix it to the tin
- Capacitors – 4 x 100nF, 1 x 1nF, 1 x 4.7nF
- Resistors – 1 x 12Ω, 1 x 100Ω, 1 x 2.2kΩ, 1 x 3.3kΩ
- Ferrite cores – 2 x FT50-43
- Wire for winding the cores – thin gauge, e.g. 28 SWG but not critical
- Transistors – 1 x BC548, 1 x BD139
- Power connector of your choice (I used a 2.1mm coaxial socket – my QRP standard)
- Antenna connector of your choice (I used BNC, but phono sockets are a cheap alternative)
- 3.5mm mono or stereo headphone socket (for the CW key, if using an external one – see below)

OPTIONAL – a push-to-make momentary switch as an inbuilt key, either instead of, or additional to, the headphone socket above.

A 'mint tin' proto-board from Kanga:

<https://tinyurl.com/3kvucabp>

Where to buy? Well, for the ceramic resonator, toroids and poly-varicon capacitor, the large major suppliers will often stock these, but I get mine from G-QRP Club sales. For all other components I highly recommend Bitsbox ([URL below](#)), which is a UK family run business with good stock and cheap yet quick delivery. If you are just beginning in construction, then their starter component packs of resistors and capacitors can be great value too.

www.bitsboxuk.com

The lowpass filter

The kit from QRP Labs will come with all the components and instructions. If using this, you will require some standard 4-pin 'header sockets' into which you can plug the LPF. Or you may choose just to use the components in the kit and hard wire them into the transmitter.

To make your own:

- 3 x T37-2 ferrite cores
- Thin wire for winding (e.g. 28 SWG but not critical)

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Fig. 1: The 80m CW transmitter. Tuning wheel and push switch CW key on lid. Fig. 2: 3.5mm audio socket for external key and BNC antenna socket. Fig. 3: 2.1mm coaxial power socket (or socket of your choice) and red Power LED. Fig. 4: The Kanga Mint Tin proto-board, small square side. Fig. 5: Kanga board, large square side.

- 2 x 470pF capacitors (NPO or COG types)
- 2 x 1200pF capacitors (NPO or COG types)

Note – the type of capacitors in the filter are important for best efficiency and power output, and it can be difficult to source these in small quantities. If that is the case, just buy the LPF kit from QRP Labs and use that. You may want to order some for other bands at the same time to make best use of the shipping cost – I invested in two for each HF band.

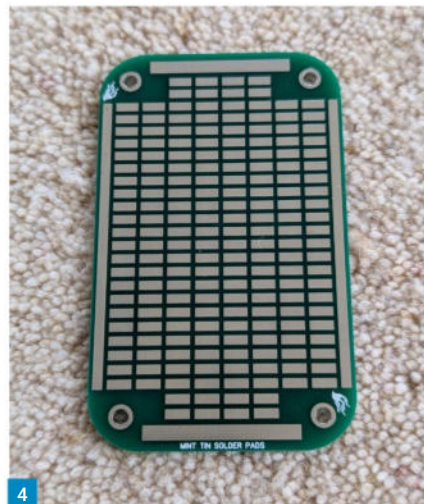
The circuit

I don't propose to go into detail as to how the circuit works for two reasons. First, I don't want to confuse beginners, and second, the videos by the designer (link at the end) explain this in some detail. For now, suffice to say that, from left to right, the components up to the Morse key are concerned with the oscillator. That is to say, they are generating the signal that you will transmit at the chosen frequency. This frequency is determined by the 3.58MHz ceramic resonator and the variable capacitor, C7. Adjusting the capacitor will vary the frequency. Note that it is possible to transmit below the 3.5MHz starting frequency of the amateur band, so care must be taken, and we will deal with this later when we come to set up and test. In my example it is possible to generate a frequency from 3.471 – 3.601MHz, but this may vary a little depending on your components and the precise value of C7 you use. Bear in mind the CW section of the band is from 3.5 – 3.57MHz. The oscillator is only on when the Morse key is depressed (that is pressed, not fed-up!) and this is helpful when monitoring your signal on a separate receiver, as it means you only hear the signal as you are keying, and this is your sidetone! A slight downside is that it can lead to a little 'chirp' on your signal, but it is nothing to be concerned with, and adds character!

From the right-hand side of the Morse key is Q2, the BD139 transistor and associated components. This is the power amplifier (PA) stage and will provide up to 2 watts out. That is plenty, but if you want a little more, then feel free to try other PA transistors in its place and experiment.

The section in the blue box is the LPF. You will either use a kit of parts or roll your own. The LPF is essential to reduce the risk of transmitting out of band on harmonic frequencies. Without it you run the risk of transmitting on 3.5 and 7MHz at the same time!

So, it really is very simple.



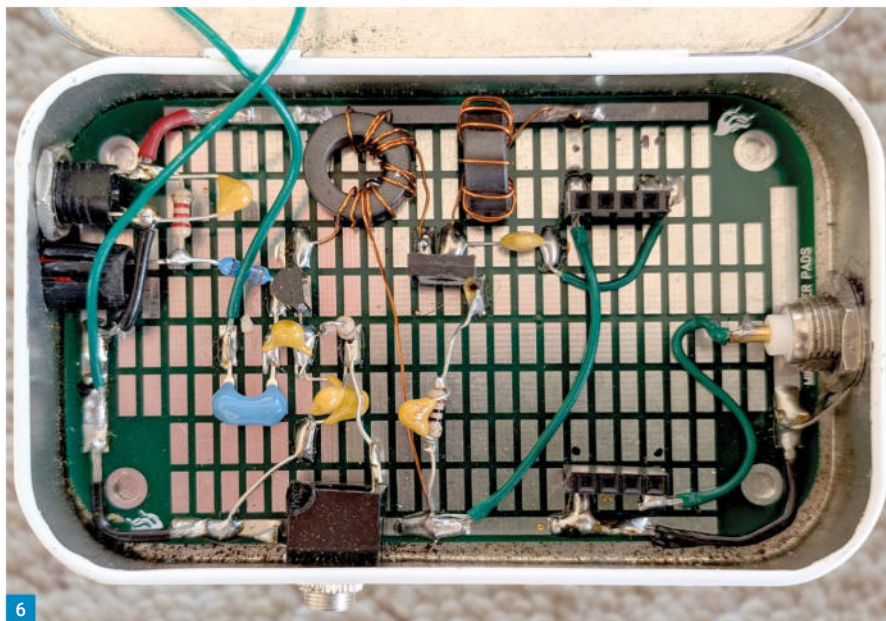
Construction

There are a number of options here, including 'dead-bug' and 'Manhattan'. I am going to use a proto-board. A proto-board is basically PCB board material with many 'islands' of silver-plated copper onto which you can solder component legs or leads. I use the ones from Kanga Products (see earlier link), which are double sided, with both large and small pads, as desired. A blank one of mine is shown in Figs 4 and 5.

The construction of mine is shown in Fig. 6 (with the sockets for the LPF on the right) and

Fig. 7 (with the LPF plugged in). You can see that I used the small pads and that there is plenty of space. I will just describe the location of the main components and hopefully, with the help of the circuit diagram you will be able to figure out the rest. Note that it is not important that you use exactly the same squares as I have, just that the right components are connected together as per the circuit.

On the top left of the tin is the 2.1mm coaxial power socket. Note the red wire going to the long metal pad on the top of the board. This is the



12V 'bus' and is the very top horizontal line in the circuit diagram. C1 is connected across the 12V centre and the Ground pin of the socket, with a black wire connecting this ground from the PSU to the left-hand side vertical long pad, and then onto the bottom long horizontal pad. These, together, form the Ground 'bus' represented by the very bottom horizontal line of the circuit diagram.

Beneath the power connector is the LED and holder. The blue item which is mid left and looks a bit like a capacitor is the ceramic resonator. They can be connected either way around – there is no polarity. Some have three pins. If yours does, you can safely snip the centre pin off.

Just above the right-hand leg of the ceramic resonator is transistor Q and associated components.

On the bottom side of the tin is the 3.5mm audio

socket for the external key.

Top centre are the two transmitter toroids. On the left is the inductor with two windings. Merely wind ten turns and then using a separate length of wire wind four turns over the top of the first ten. **Do not confuse the windings** and make sure they connect to the correct places as per the diagram. Use a multimeter to make sure you have not mixed the windings up.

The toroid to the right is the one associated with Q2 and this acts as the 'load' for the amplifier transistor Q2, which is visible just underneath and between the two toroids. Note the small metal tab around the hole in this transistor. This denotes the rear of the transistor. A heatsink is not required. If you look closely, you will see that two left most transistor legs are bent and soldered to the front (top) of the transistor, while the third, the Emitter,

is bent behind (bottom) and connected with C3 and R4, in parallel, to Ground.

The number of turns needed on the toroids is shown on the circuit diagram.

Note the connections for the LPF. In this case, header sockets were fitted for the QRP Labs plug in LPF module, with the top header for the INPUT and the bottom for the OUTPUT, which is routed to a BNC connector in the tin.

You may wonder where the poly-varicon tuning capacitor is. Well follow the two green wires on the LHS of the board up to the tin lid, where this is mounted along with a momentary push switch to act as an inbuilt key (but not yet wired across the 3.5mm audio socket (will I ever get around to that?!), **Fig. 8**. Note that you will need some sort of tuning knob for this capacitor. The ones from G-QRP Sales come with a small plastic shaft extender to which you can apply a normal knob. However, for fine tuning, a bigger diameter control is easier and less fiddly to use accurately. I fit my poly-varicon directly to the tin lid, allowing the small shaft to just protrude. I then 3D-printed my yellow control and fitted that. You could make one with a plastic lid and a little ingenuity.

I will leave the reader to determine how best to drill and adjust the mint tin, but one isn't really required, you could operate without an enclosure, or use a plastic or wooden one.

Testing

First of all, check, check and check again your construction and physical connections against the circuit diagram! Make sure all the connections are correct and that there are no unwanted ones! Time is NEVER wasted at this point! Spend yet more time making sure that you have the power connections and LED polarity correct, that the transistor connections are correct and that the two-winding ferrite transformer associated with Q1 is wired correctly (use a multimeter).

Now, connect a dummy load to your antenna socket and a Morse key to the transmitter. **Before applying power**, check that the two connection points of the 3.5mm key socket to the PCB are shorted when the key is down. If not, then check connections. You can get into all sorts of a muddle mixing stereo and mono plugs as a result, compounded by the fact I have noticed some variations in the dimensions of different plugs.

Fig. 9 shows a stereo (Tip, Ring, Sleeve – TRS) plug. A mono plug has the Ring and Sleeve as one piece, giving just Tip and Sleeve connections. Bottom line, the sure-fire way, with a straight key, is to use a **mono plug and a mono socket**, with the key connected to these two connectors (Tip and Sleeve.) **If you have a straight key, with a stereo plug on the end**, make sure the key shorts out tip and sleeve when depressed, and then make sure you use a **stereo socket on the transmitter, connecting the tip and sleeve connections to your transmitter board**. Leave the Ring connection

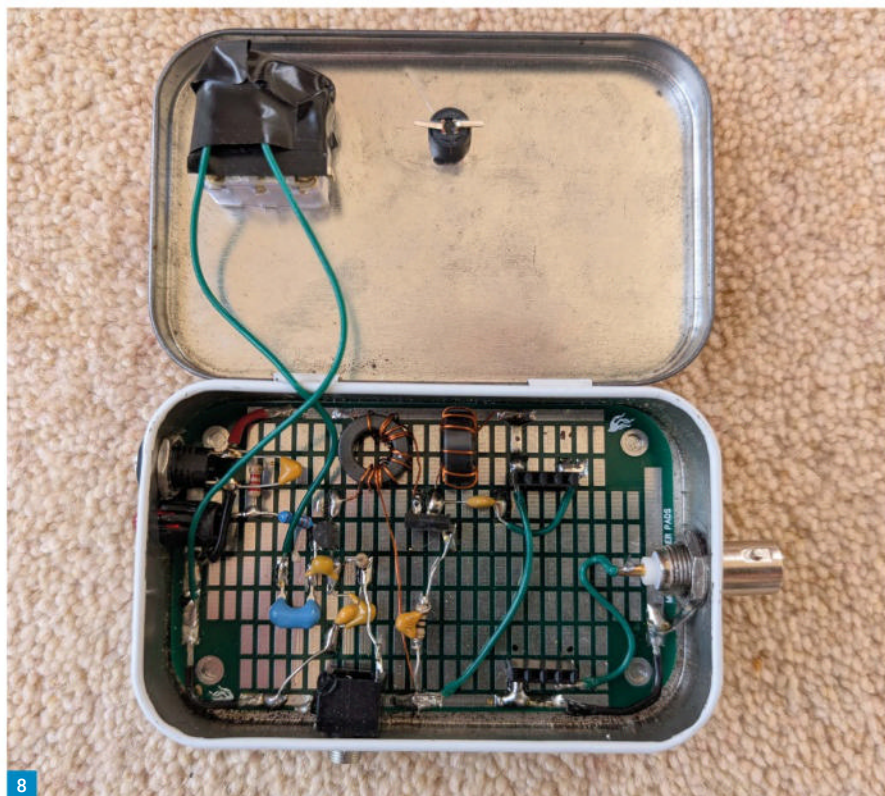


Fig. 6: Completed construction without LPF. Fig. 7: Completed with LPF in situ. Fig. 8: The whole arrangement. Note the unconnected switch terminals to the right of the capacitor on the lid - for an internal Morse key. Fig. 9: A stereo TRS Jack Plug Connection. Fig. 10: Switching arrangements.

unconnected on both key and transmitter. Phew!

Now switch on a receiver, tuned to the CW portion of 80m. If you have an SDR receiver, that is even better, as you will see where your signal is in the band. If not, you will just have to tune the band for it, or use a frequency counter if you have one.

Apply power to the rig (noting there is no on/off switch) and WITHOUT pressing the key, ensure your LED lights (polarity!). Assuming no magic smoke has been released, now press the key and hope that there is still no smoke! If not, you should be transmitting a healthy 2 watts or so of power into your dummy load. You can check this if you have a QRP power meter, oscilloscope or RF probe.

Now you need to find your signal, which is likely in the 3.4 to 3.6MHz range, but could easily fall either side of this. With an SDR or frequency counter, momentarily key down and find your signal.

Once you have, I suggest you tune to just above 3.5MHz (to ensure you are in band by 1 or 2kHz) and make a mark where the control lies on the tin lid. Do the same at about 3.6MHz and also at 3.56MHz (the QRP centre of activity).

You should now be able to tune all (or most) of the CW section of 80m and have many enjoyable QSOs. Does it sound a bit chirpy? Yes, but not to the point of being horrid! Does it drift a little? Yes, but not to make QSO's difficult. Is it satisfying to

build and use? Yes! Are people surprised when you tell them your TX is home-brew with two transistors and two watts? Absolutely!

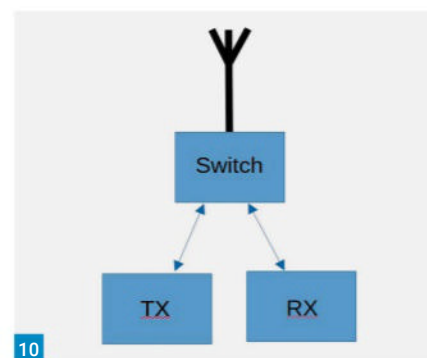
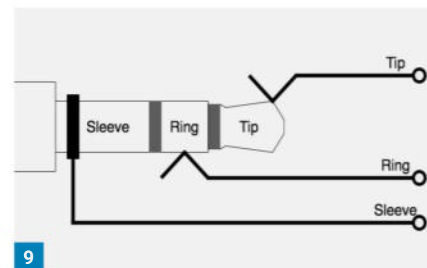
But, on a practical note, what about sharing the antenna with your receiver?

Connecting it as a working station

In order to make a functional station, we will use our receiver, both as a receiver of the other station, and of our own station. This allows us to monitor our signal and provides a sidetone without any separate circuitry. In order to do this we need to share our antenna between the receiver and transmitter as shown in **Fig. 10**.

This is simple and effective. We could get fancy and automate this switching from our transmitter, perhaps using a relay, but that adds complexity to this simple beginner's project – we need another way.

There are three main options. First, just use an ordinary coax switch, like you would to switch a rig between antennas. You use it in reverse - connecting the single socket side (that normally goes to the transceiver) to the antenna, and the other two sockets to the transmitter and receiver respectively. Or you could use a homemade switch. Simply find a box (another Altoids tin?) and fit three coax connectors with a simple toggle switch to do the switching, centre pin to antenna, the other pins to RX and TX respectively, ensuring



all grounds are connected.

If you have not wired a toggle switch before, it is a little counter intuitive. If mounted vertically and in the 'up' position, then it is the centre and bottom contact that is connected. If in the down position, it is the centre and top pin that are connected. Finally, if you are using an SDR receiver (I often use an SDRPlay RSP1a), then an automatic SDR switch can be purchased for around £30 from Chinese sites. These sense RF from your transmitter and automatically switch the antenna between the transmitter and receiver, and are a good investment.

As to receivers, almost any CW or SSB capable receiver will do, valve, vintage, etc. I have successfully used homebrew transmitters with valve ex-military receivers (Larkspur R210), old general coverage receivers such as the Heathkit Mohican, Kenwood R1000, portable receivers like the Malahit and Belka, and many others. I do prefer the SDR with homebrew transmitter though as it is easy to align your transmitter frequency to that of the station you wish to call, merely by tuning while keying to 'net' the frequency. What if you don't have a separate station receiver at all? Then merely use your commercial transceiver as the receiver. Above all, have fun building and using this little gem.

Well, that is all for this month. I hope you are encouraged to have a go and build this little simple rig. If you do, please drop our Editor a line and let him know how you got on.

Here is the link to the website of Peter Parker VK3YE and videos on this transmitter. There are two videos, entitled '3.5MHz frequency agile' with one and two transistors respectively.

<https://vk3ye.com/projects/projchirpy.htm>

While there, it is well worth checking out the rest of his extensive site for your next project. **PW**

Don Field G3XTT

practicalwireless@warnersgroup.co.uk

I first went to the International DX Convention in Visalia in the early 80s and have been several times since, and indeed wrote up my experiences there for the June 2014 issue of *PW*. However, for a number of reasons that was the last time I attended so it was high time I returned. Back in 2014 I reported that there were some 40 international attendees, including ten from the UK. This time though, the overall numbers seemed to be well down on what I remember and international participation was well down – two of us from the UK, one from Kenya (5Z4VJ, G3AB), one from Switzerland and a couple from Sweden and Denmark. There seems to be some question as to whether the event will run again – the organization has alternated between the Southern and Northern California DX Clubs but the Southern California DX Club seems to be pretty much moribund nowadays, which is a shame. No doubt COVID played a part in affecting events such as this, with a struggle to get numbers back up again.

Friday

All that said, there was an interesting programme of talks, as usual and, for me, an opportunity to meet up with a number of old friends – over the years I have got to know many of the active amateurs from the western states of the USA. As well as running a DX Academy on Friday morning and Contest Academy in the afternoon, there was an all-day stream dedicated to the 'Next Generation DX Program'. This was very much about the development of RiB operations (Radio in a Box) to help overcome constraints imposed by bodies such as the US Fish and Wildlife organisation, who are responsible for the management of a number of islands in the Pacific that count for the popular DXCC awards. I found the first slide of particular interest:

- 19 of the top 20 needed DXCC are islands with restricted access
- 16 are environmentally protected nature reserves
- 3 are military outposts
- COVID 19 encouraged/demanded 'virtualized' social events
- Internet available everywhere with Starlink
- Costs for DXpeditions and competitive contest stations rising
- DX and Contest participants desperately need an infusion of youth

The solution proposed by **Don Greenbaum N1DG**, **George Wallner AA7JV** and others is to build a RiB, which can be driven onto an island, antennas erected and then the whole operation run remotely. This can be from a boat offshore (where the principal team is based, so



Visalia 2025

Your editor was at this year's International DX Convention at Visalia, California, and brings this report.

they can refuel generators, sort out technical problems with the station, etc) but the capacity for remote operation also offers the opportunity for operators around the world to be part of the DXpedition, operating the station from the comfort of their home shacks and with much reduced expense.

This concept has been refined and led to the Jarvis Island (N5J) operation last year. Also, the Northern California DX Foundation has sponsored the development of small, hand-carried radios in a box that can be taken on DXpeditions, allowing fast setup and, again, allowing remote operators to dial in to supplement the efforts of the local team. This approach has already proved effective, as **Gregg Marco W6IZT** explained in a presentation the following day. A principally youth team operated from Rotuma Island (part of Fiji) late last year, with many other youth operators joining in from around the world. Next time, it is intended that some of those remote operators actually travel to the DX location, while other youngsters join the off-island team (the next such operation will be from Saba in the Caribbean). About half the young operators are from the successful

European Youth on the Air programmes.

The Friday programme covered a number of aspects that go towards making a successful DXpedition operation, including Mission Planning, Distributed Team Building, Data Networks, Radio Systems Design, Managing Operator Experience, Station Integration and Test, and Scheduling and Execution.

Saturday

Saturday saw two tracks of DX and Technical presentations, which made for some challenging decisions as to which to follow! (although all were being recorded and will, as far as I am aware, be uploaded to the internet in due course). Topics included The DXpedition Funding Conundrum, the XT2MD DXpedition, DXpeditions: Turning Ambitions into Realities, SV1GA/A and How to Organise DXpeditions to the Hard and Remote entities. But I particularly enjoyed a talk by **Don Miller W9WNV** who related his early days as a DX operator in the 1950s and 60s. Many older *PW* readers will remember Don as an excellent operator who put many rare ones on the air, albeit there was controversy around some of them after the event (as to whether

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Photo 1: The new K4/0 remote control head for the Elecraft K4. Photo 2: The FlexRadio stand. Photo 3: Glenn W0GJ of the Northern California DX Foundation, with one of the Radios in a Box that NCDXF have sponsored.

he had actually been where he claimed to have been). Don is 90 now but gave an entertaining presentation.

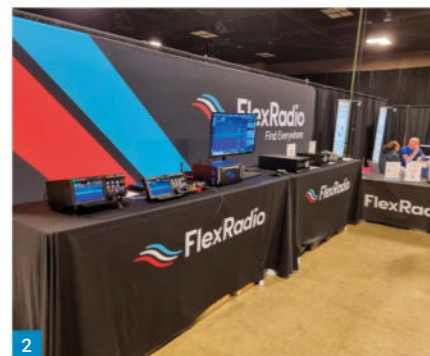
Vendor Displays

In parallel with the presentations (on both days) there was a hall with various manufacturer and vendor exhibits and displays. The Elecraft stand was especially popular, particularly as they had announced the K4/0, a remote head for their flagship K4 transceiver. One US amateur I spoke to had just ordered the combination to replace his existing setup of K3 and K3/0, which allows him to run his remote station, given that he lives in a high-rise apartment with no possibility of antennas.

The FlexRadio stand was also popular, with their latest radio (the 8800 series) offering some serious capabilities as well as the promise of spare processing power, allowing for firmware upgrades in due course.



1



Other
I passed on the Convention Banquet (with a talk about the VU4A Andaman Islands operation), the IOTA Dinner and the Contest Dinner, as well as the Sunday morning breakfast with a talk about the Jarvis Island operation. I would normally have attended some of these but was in California with my son for a week's holiday and we had other priorities!

All in all, I was glad to have been back at Visalia after an absence of 11 years but it will probably be my last time, if only because there is a real question as to whether the event will continue in its present form in the years to come. **PW**

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Mike Richards G4WNC

practicalwireless@warnersgroup.co.uk

I'll begin with an apology. I've had to postpone my promised feature on SATSAGEN because I had an issue with my PC. There's also a new feature that I'd like to include, so all being well, I'll conclude SATSAGEN next month. This month, I encourage you to upgrade to the latest WSJT-X release. Plus, the new v11 release of VarAC is out, and we'll look at the enhancements.

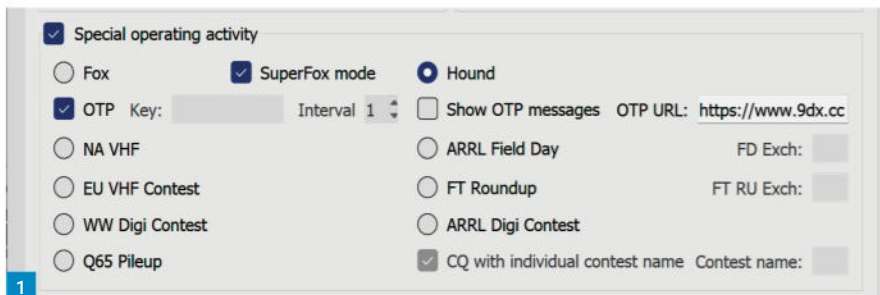
WSJT-X

Now that the latest WSJT-X 2.7.0 has been fully released and settled, I thought it might be interesting to see how well it's being adopted. A good way to identify the take-up is to use the Stats page on PSKReporter. Towards the bottom of the Stats page, you'll see an entry titled 'Software in use'. This lists all the software used by stations reporting to PSK Reporter. When contact reports are sent to PSK Reporter, they include details of the software used at each station. In addition to the program name, the report contains the full version number, allowing for a detailed analysis. The 'Software in Use' table displays a count of software used over the past seven days, making it a handy data source. When viewing the listing, you will notice that each entry includes a hyperlink; by following this hyperlink, you can access more detailed information. When I checked the data on 3 April 2025, it showed that 25,645 stations were using WSJT-X, making it the dominant software for Data Modes. The nearest rival was JTDx, which had 10,454 users. The next closest was MSHV, which had 2,050 users.

Looking deeper into the data, I wanted to see how many operators had upgraded to the current 2.7.0 release. I've shown the results in **Table 1**. Only 18.7% of operators have upgraded to the release version. However, some are still using recent pre-release versions, so they will at least have access to all the new features of WSJT-X 2.7.0. You will also note that 33% of operators have stuck with 2.6.1, so they will be missing out on the latest features that come with 2.7.0.

Here's a run through the most significant improvements with v2.7.0 to encourage operators to upgrade.

SuperFox mode: As a reminder, the Fox & Hounds mode enables DXpedition stations to increase their QSO rate when dealing with heavy traffic. SuperFox is a variation of the existing FT8 Fox and Hounds mode that adds a new transmission mode for the Fox station. Whereas the original Fox system would send up to five separate, concurrent 50Hz-wide FT8 signals, the new system employs a full power constant envelope waveform 1512Hz wide, conveying signal reports or RR73s for up to nine Hounds simultaneously. The new system also includes a One Time Password (OTP) used to



WSJT-X and VarAC

Mike Richards G4WNC updates readers on the latest enhancements to two popular data modes packages.

verify the station and eliminate malicious pirate transmissions.

Working a SuperFox DXpedition station: Begin by selecting the SuperFox mode. Go to File – Settings – Advanced. Tick the following boxes: Special operating activity, SuperFox mode, Hound and OTP, See **Fig. 1**. Next, access the wide spectrum display and set the green marker to 750Hz. Once a SuperFox station has been received, you can call by double-clicking on the callsign as usual. Your transmit frequency can be anywhere from 200Hz to 3kHz unless otherwise requested by the DX station.

As most DXpeditions will be using the new SuperFox mode for FT8 contacts, you must upgrade to WSJT-X 2.7.0; otherwise, you will be unable to work them!

WSJT-X Message System: One of the downsides of FT8 has been the lack of any form of messaging other than that required to confirm a contact. V2.7.0 introduces a new message system designed to address this issue. One situation where messaging would be helpful is to ask a station to QSY, either within the band or to a different band. This facility is now available in version 2.7.0. To generate the message, select Message Creator from the View menu. This will open the Message Creator window, where four tabs are visible, **Fig. 2**. The first three are for sending QSY messages, where you can specify both the frequency and mode. In the General tab, **Fig. 3**, you will find a selection of fourteen general messages that can be selected and sent. All message types are encoded for transmission over the link. At the receiving end, the decoded message appears as a popup window in WSJT-X. While a long way from a free-form messaging system, this does provide a helpful enhancement that could be very useful under contest conditions.

Q65 enhancements: I suspect serious EME operators will have already adopted v2.7.0, but here's a summary of the changes. QMAP is a new Windows-only tool that provides wideband decoding of Q65 signals in any one of the

60-second sub-modes. The QMAP decodes are automatically transferred to WSJT-X, enabling easy calling on the correct frequency. Also added for v2.7.0 is Q65 Pileup mode. This simplifies exchanges when working a Q65 pileup. For those wishing to know more, there is an excellent Quick-Start guide available here:

https://wsjt.sourceforge.io/Q65_Quick_Start.pdf

VarACV11

Just as I was preparing this column, the latest major release, v11, of VarAC arrived, packed full of goodies. The main headline is the new HF/VHF email gateway facility, which links standard VarAC Vmail and global internet-based email systems. The broadcast system has also been enhanced with locator and email gateway announcements. QSL button to create your QSLs in real-time, and a QSO log to quickly review all your previous QSOs. There is also a new link speed indicator, a one-time beacon option, and a few additional features I'll cover later.

Installing or upgrading to the new release is very straightforward. Download the installer from the website below and run it!

www.varac-hamradio.com/download

The email gateway is a significant development transforming VarAC's email capabilities. The original system relied on either both stations being online or an intermediary station being online through which both parties could relay. With the new system, you can potentially email anyone using a VarAC email gateway station. While this makes the system extremely powerful, not all countries permit that level of third-party traffic. To help limit access and remain within licensing constraints, the gateway station can restrict access to a specific list of callsigns. I'm sure emergency communications operators will find the email gateway extremely useful, as they can use a VarAC radio link to reach the nearest VarAC Vmail gateway to pass their messages to aid agencies.

Getting Started: When setting up an email gateway, creating a new email account is the first

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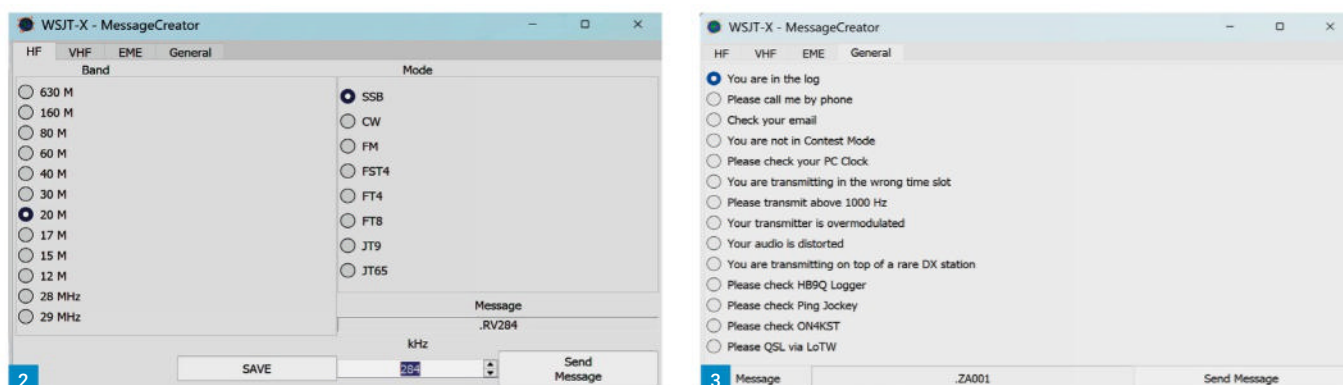


Fig. 1: WSJT-X Hound configuration.

Fig. 2: WSJT-X QSY message tabs.

Fig. 3: WSJT-X General message tab.

Fig. 4: VarAC email gateway settings.

Fig. 5: VarAC the new QSL button.

Fig. 6: VarAC QSL card created during a QSO.

Fig. 7: VarAC link speed indicator.

step. While you could use an existing account, a dedicated account helps to keep the gateway traffic separate and easier to manage. I used a free Gmail account with the address **g4wnc.varac@gmail.com** for my testing. I suggest using a similar format as your callsign, which should work nicely as a unique name. Once the account setup is complete, you need to go to the account's security settings and enable two-step verification. If you don't do this, the next step won't work!

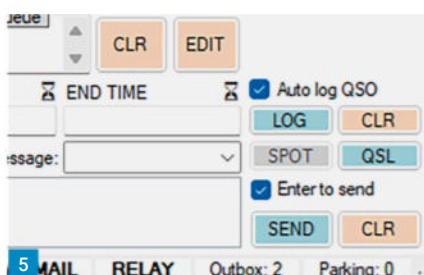
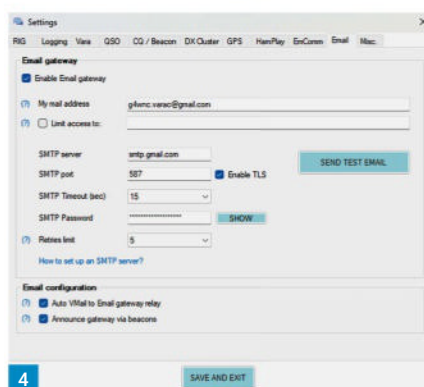
To access your Gmail account from VarAC, you must set up a dedicated App Password. To do this, follow this link:

<https://myaccount.google.com/apppasswords>

Give the password a simple name, such as VarAC, and Google will generate a dedicated 16-character password that consists of four groups, each containing four characters. Please note this password; you'll need it to configure the VarAC email gateway.

With the Gmail account in place, we can open VarAC, select Settings – Rig Control & VARA configurations and open the email tab, **Fig. 4**. Here, you should tick the email gateway box and enter your Gmail account details. However, in the password field, don't enter your standard email password; instead, use the 16-character App Password you created earlier. When the fields are complete, click the TEST button to check that VarAC can access your Gmail account and send emails. You can announce the service in your beacon message to help make other users aware that you're running an email gateway. Before enabling this in the email tab, switch to the CQ/Beacon tab and change the beacon type to Advanced. Then, switch back to the email tab and tick the 'Announce gateway via beacons' box.

I did have the opportunity to briefly test the gateway before completing this column. In a link-up with **Paul HB9AVK** in Zurich, I could send an



email via his gateway, and he could send via mine. The process worked seamlessly, and the emails arrived at their destinations within seconds. While there are still licensing issues, the service has great potential to help communications in isolated areas and disaster zones.

The VarAC broadcast mode has been upgraded to include more information, such as email gateway and locator. To help keep track of received data, VarAC stores all received files and images in a single location. This can be viewed via: Tools – Received files. With v11, you can generate a QSL during or immediately after completing a call by clicking the QSL button on the lower right of the main screen, **Fig. 5**. Most fields of the QSL auto-populate plus you have options to save to disk, copy to clipboard or switch to email and send the QSL via the email account you set up in VarAC, **Fig. 6**. This makes the QSL process very slick.

Another convenient addition is reporting the link speed and mode in the status bar at the lower left, **Fig. 7**. This provides a helpful indication of link quality and reassurance of the speed achieved.



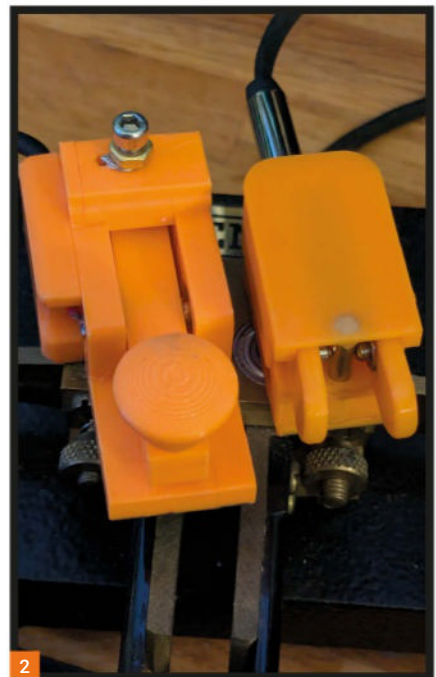
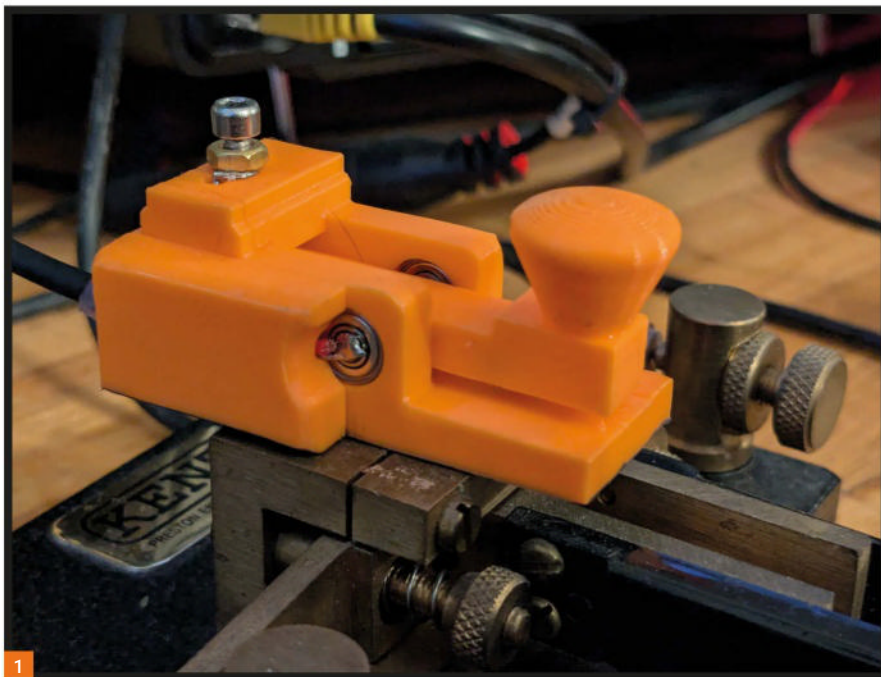
VarAC also includes a new Frequency Scheduler. This will automatically QSY to the selected frequencies at the specified times. The Beacon enhancement enables sending a one-off beacon instead of sending beacons every 15 minutes. To use this, right-click on the Beacon button!

It looks like this latest release of VarAC has transformed VarAC into a compelling data communications mode and is well worth a try. You can download for free from:

www.varac-hamradio.com/download

Software	Number	Per Cent
WSJT-X v2.6.1 6b6d74	8442	33.01%
WSJT-X v2.7.0 b4f9a4	4783	18.70%
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Table 1: WSJT-X version in use



Daimon Tilley G4USI

practicalwireless@warnersgroup.co.uk

In August 2023 I reviewed the UMPP (Ultra Miniature Portable Paddle) from GM0EUL keys (website below) and was so pleased with it that I now have two!

www.umpp-cw.com

Recently, through an online chat in the G-QRP Club forum, I spotted that **Peter GM0EUL** had produced a new miniature CW key – this time a straight key and called the UMPP-ASK (for Activators' Straight Key.) A quick email later and Peter agreed to send me one for review, which is the subject of this piece.

Description

Following his usual methodology of 3D printing, using high quality components, bearings and magnets, Peter has designed and produced yet another magnificent key that far out-performs its diminutive size. Measuring just 55mm long, 25mm wide and 35mm high, this straight key is slightly bigger than its close relative the paddle, but is a delight to use.

The key retains the magnetic base of its brethren and is easily adjusted for gap space by means of the Allen key fitting on top. I have the gap really quite small, out of preference, and it has shown no signs of this spacing varying in use. It is pictured in **Fig. 1**, stuck to one of the bearings on the top of my Kent Keys paddle. **Fig. 2** shows the ASK next to the UMPP paddle.

Peter has since modified the key slightly and the keying gap can now be adjusted without tools, using the wheel nut shown on the blue key in **Fig. 3**.

UMPP-ASK CW key review

Daimon Tilley G4USI gets excited by a new miniature straight Morse key from GM0EUL.

In the case of the ASK, instead of a stereo socket on the rear for users to add their own connecting cable, there is a hardwired cable of about 50cm, terminated in a stereo jack plug. This should be of no difficulty using the vast majority of modern or vintage rigs however, as the key is wired to the plug tip and sleeve of the connector, the ring being left unconnected. Indeed, I have a plethora of (for this read 'too many!') vintage and modern transceivers, and the key worked perfectly with them all. However, it would be simple enough to change the plug to a mono one if required, or Peter is willing to fit a mono plug, if you wish, at the time of order.

The magnetic base is really very powerful and it stuck strongly to my Kent bearing, otherwise surrounded by non-magnetic brass parts. Putting the key on air over the course of a couple of weeks was a dream, and yesterday I had a flurry of QSOs around Europe from 40 – 10 metres using my old Shimizu SS105S and the key performed flawlessly. In practice I have found it as good and as pleasant to use as any of the other straight commercial keys in the

shack, and not at all tiring in use.

The key will retail at £60 and will be just as much at home in the shack as it will be on top of a mountain, where its small size and weight will be ideal. **PW**



Fig. 1: The review key.

Fig. 2: The UMPP-ASK next to the UMPP paddle.

Fig. 3: The updated UMPP-ASK with thumbwheel adjustment.

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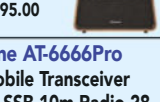
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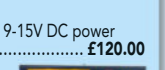
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Chris Murphy MOHLS

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Jeff had been in the lab since the crack of dawn as usual enjoying his usual early morning cup, or rather huge mug of tea. On his desk lay a copy of the latest PW that had arrived in the post the previous day. Jeff was just about to liberate it from its envelope when Natalie walked in looking rather down in the dumps.

"Morning Natalie", Jeff called out. "What's making you look so glum this morning?" "College", Natalie replied. "Or rather Archie's electronics class". "Why, what's wrong with it?" Jeff asked. "Well, it's turning out to be more of a maths class than electronics. Yesterday for example we spent the whole lesson learning about phasors. We've already covered them with Reggie in Maths and Arthur in engineering science. The only good thing was that the worked examples that Archie used were to do with electronics".

Jeff gave a chuckle and said, "Well I'm afraid that you'll find that most engineering, not just electronics, is about maths. Since you've been learning about capacitors and inductors as well, I have an idea what this is leading up to. But I won't spoil the surprise for you." "Oh, OK, makes sense", said Natalie. "Can we discuss at lunchtime?" "I suppose so", Jeff replied.

Lunchtime arrived and after Jeff had read a bit more of his PW and Natalie had listened to some music on her phone, Jeff asked her to come over to his desk.

"If", Jeff started, "you remember back to when we discussed alternating current waveforms, we said that we normally call the number of cycles that occur in one second the frequency. But there is another way of expressing this called angular velocity, which we denote by lower case Omega (ω). "Yes, remember that. We've covered that with Reggie and Arthur as well". "OK", Jeff continued, "we went on to say that if we were to draw a circle with a line from the centre to the three o'clock position, and then rotate the line with a constant velocity in an anti-clockwise direction, the end of the line will draw out a sine wave", Fig. 1.

"One full circle, or three hundred and sixty degrees would map out a complete sine wave with the maximum positive peak occurring at ninety degrees, the maximum negative peak at two hundred and seventy degrees and passing through zero at one hundred and eighty degrees and three hundred and sixty degrees which will take us back to where we started". "Yes, understand that", Natalie said.

"Now as well as degrees, we can also express an angle in radians, where one full cycle, or three hundred and sixty degrees equals two Pi (2π) radians, and one radian equals fifty-seven point three degrees. We can convert between degrees and radians like this"

Phasors

Natalie struggles with phasors until Jeff carefully explains them.

$$\text{Radians} = \text{degrees} \times \pi/180$$

$$\text{Degrees} = \text{radians} \times 180/\pi$$

"Can we do an example please?" Natalie asked. "Yes, OK", Jeff replied. "By the way, most calculators have functions that allow you to convert between degrees and radians and vice versa. Let's convert sixty degrees to radians. Then"

$$\text{Radians} = 60 \times \pi/180 = 1.047 \text{ Rad,} \\ \text{and } 0.5 \text{ radians is}$$

$$\text{Degrees} = 0.5 \times 180/\pi = 28.65 \text{ Deg}$$

"Now so far", Jeff continued, "we've only looked at what happens when the sine wave is at its maximum and minimum peaks and at zero. We now need to take this a little bit further and look at what happens at any point on the waveform." "We've already done this three times with Archie, Reggie, and Arthur", Natalie interjected. "Personally, I think that it's more of a maths lesson and none of us in class see what it's got to do with electronics".

"Oh, you don't do you. You soon will when you start looking at alternating current circuits containing capacitance and inductance", Jeff retorted. "OK, carry on", Natalie replied. "Just try and follow the maths", Jeff explained. "I assume that you've got a calculator that will do most of the work for you. Look at Figure 1 again and at the point B. Here, we can see that the line has rotated in the anticlockwise direction through an angle which we denote by the Greek letter Theta (θ). Now, if we draw a line from point B to the sine wave, we can see that it meets the sine wave on the rising slope of the positive half cycle". "Yes, I see that", said Natalie.

"Now, because of the angular velocity", Jeff continued, "it means that after a certain time, t , the angle, Theta, through which the line has rotated is ωt or to put it another way $2\pi ft$. If you remember back to basic trigonometry, you will recall that the line AB can be found by multiplying the length of the line OB by the sine of the angle Theta and will be at its maximum length at ninety degrees and two hundred and seventy degrees. Hence, if the line is representing a voltage or current these will be the peak, or maximum values, both positive and negative". "Yes, I can see that", Natalie agreed.

"Now from this, we can deduce that at any point on the waveform, the instantaneous values of voltage or current can be found by"

$$v = V_m \sin \omega t \\ i = I_m \sin \omega t$$

"Where V_m and I_m are the maximum values of voltage and current. Note how we use capital

letters for the maximum values and lower-case letters for the instantaneous values. Now, I know that you said that you've covered all of this before, but I suppose that you'll want an example". "Yes please", said Natalie with a grin.

"OK, let's say that a sine wave has a maximum value of twenty volts and a frequency of one hundred Hertz, and we want to know the instantaneous value after one millisecond. Then"

$$v = V_m \sin \omega t \\ \omega t = (2\pi \times 100) \times 0.001 = 0.628 \\ v = 20 \times \sin 0.628 \\ v = 11.76 \text{ V}$$

"And don't forget that your calculator needs to be in radians mode".

"Anyway", Jeff continued, "so far we've looked at waveforms that start at time t equals zero. But sometimes they don't. Look at this one for example", Fig. 2. "Here we can see that at time zero, the waveform has already reached some positive value. So, if we want to find the instantaneous value at some point on the curve, we can't use the equations that we've been using so far. If you look at Figure 2 again, you can see that the sine wave starts at some time before time equals zero and that I've marked the difference between the two times with the Greek letter phi (ϕ). "Yes, I see that", said Natalie. "Now as well as saying that the sine wave has started a certain time before time equals zero, we can also state the difference in terms of an angle, and we can modify our original equations by adding, or subtracting for that matter Phi".

$$v = V_m \sin (\omega t + \phi) \\ i = I_m \sin (\omega t + \phi)$$

"OK, I bet that you can guess what I'm going to say next", said Natalie. "Can we do an example?" Jeff asked. "Correct".

"OK, let's say that we have a voltage with a maximum value of two hundred volts, and a frequency of fifty Hertz. We also know that it starts at twenty degrees before what we want to use as a reference point, in other words time equals zero. And we want to know what its value is after three milliseconds. So, using the equation we've just written we have":

$$v = V \sin (\omega t + \phi) = 200 \sin ((2\pi \times 50 \times 0.003) + 20^\circ) \\ v = 200 \sin (0.942 + 20^\circ)$$

"Now note here, that in the brackets we have one term in degrees and the other in radians, which we can't simply add together. So, we have

Fig. 1: Sine wave, starting at time zero

Fig. 2: Sine wave, starting before time zero.

Fig. 3: Two sine waves, starting at different times.

Fig. 4: A simple phasor diagram.

two choices. We can either convert the degrees to radians, or radians to degrees. Let's convert the radians to degrees, so":

$$0.942\text{rad} = 0.942 \times 180/\pi \text{ degrees}$$

$$0.942 \text{ rad} = 53.97 \text{ deg.}$$

"Now we can add them up to get"

$$v = 200 \sin(53.97 + 20) \text{ which is } 200 \sin 73.97^\circ$$

$$v = 192.22\text{V}$$

"Now so far", Jeff continued, "we have only looked at cases where we have one waveform, but in many cases we have two or more and we want to know things like the resultant voltage or current and the phase relationship between them. Take this for example", Fig. 3.

"Here we can see that we have two voltage waveforms of the same amplitude but out of phase. We can see that V1 starts at time t equals zero whereas V2 is already at a positive level at that time. It could also be negative incidentally. Again, we represent the phase angle between them with the letter Phi. So, we can say that"

$$v_1 = V_1 \sin \omega t \text{ and}$$

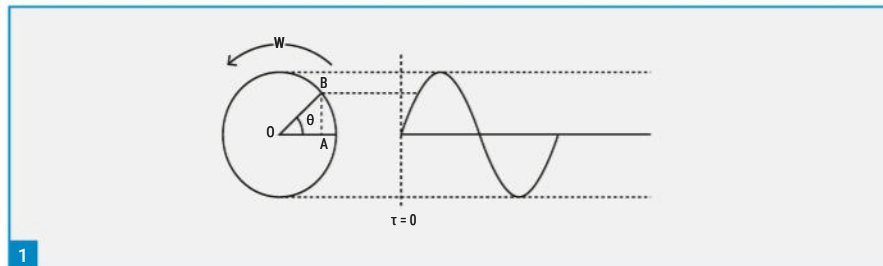
$$v_2 = V_2 \sin(\omega t + \phi)$$

"But it can be a bit difficult to visualize the relationship between two or more waveforms by just looking at a graph. Instead, things can be made easier by using what are called phasors and phasor diagrams.

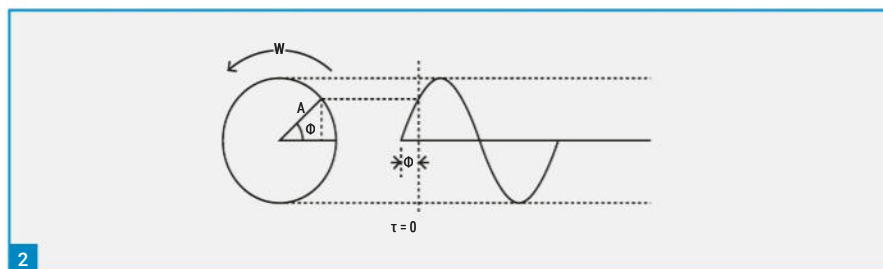
"Let me draw a simple phasor diagram for you and you'll see what I mean", Fig. 4. "Here, the lines V1 and V2 represent voltages that have both magnitude and phase angle. Such lines that represent both magnitude and direction are called vectors and we usually mark them with an arrow at the tip. The phase angle Φ is drawn to a chosen reference and a positive phase angle represents an anticlockwise direction.

"If we now go back to how we generated the sinewaves earlier in Figure 3 where we rotated the lines in an anticlockwise direction about the point O, the position of the line on the vertical axis as it rotates will vary, tracing out a sinusoidal waveform. The line V1 has a magnitude of zero at time zero and so this is a useful reference phasor.

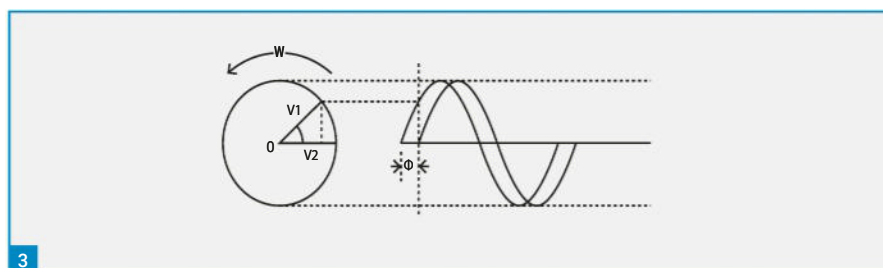
"Now, because both lines are rotating at the same angular velocity, the phase angle between them remains fixed. Incidentally, the frequency of the two voltages doesn't matter. Looking at Figure 3, it is clear that the voltage V2 is leading V1 by the angle phi, and we say that V2 leads V1. Alternatively, we could say that V1 lags V2. "Can there more than two waveforms?" Natalie asked. "Yes, whenever two or more sinusoids have the



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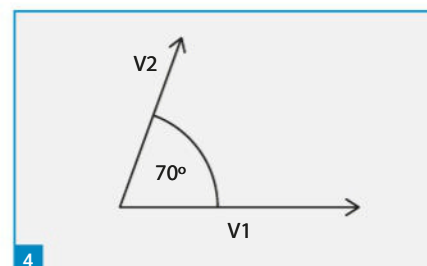
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same frequency, they can all be represented on the same diagram. Anyway, before we go any further it might be a good idea to look at phasor notation. That is to say, how we draw and label phasors".

"Yes, good idea", said Natalie.

"Phasors used in electrical work always represent sinusoidal voltages or currents and a convenient way of writing them in text is by their magnitude followed by phase angle. In textbooks and such like we use bold letters, **V** for example to represent a phasor, the voltage or current that the phasor represents non-bold italic letters, *V* and instantaneous values by lower case letters, *v*". "OK", Natalie replied, "but what about if you're writing it with a pen or pencil? It seems a bit messy to have to produce bold letters". "Ah", said Jeff. "One way of representing phasors with both magnitude and direction when using a pen, one that I use in fact is to put a tilde above the letter such as $\tilde{V}$ ". "OK, I see. Thanks", said Natalie.

"As we've said, if a single letter or other symbol is used to represent a phasor, then it is printed in bold non-italics such as **Va = 10 ∠ 0**. Here, we can see that the magnitude of the voltage is ten volts and phase angle is zero. Most likely the reference phasor, which is nearly always drawn along the X axis. If we now have a second voltage, **Vb = 16 ∠ 60°** this will have a magnitude of sixteen volts and a phase angle of sixty degrees. Because the phase angle is positive, it will be leading **Va**". "We've covered something similar to this with Arthur in engineering science, but he called them



4

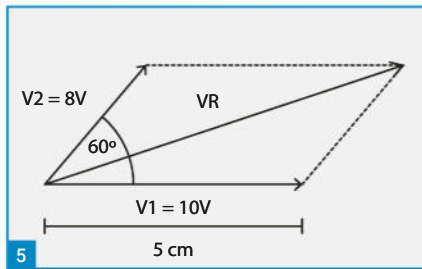
vectors", said Natalie. "Yes", Jeff explained, "we can use either term phasor or vector to describe a line that rotates and has both magnitude and direction, the main difference in electrical engineering is that we use vectors to represent peak or maximum values and phasors to describe Root Mean Square (rms) values".

"Right, OK. Now that we've looked at what phasors are and how we denote the various quantities, let's have a look at how we can use them. One thing that we often want to know is what the sum of two voltages or currents in an alternating current circuit is. As we have already said, because they're not in phase we can't just simply add them up. One method would be to draw the sine waves to scale along with the phase angle on graph paper and then select certain points and add the magnitudes of the two waveforms at those points. But that gets a bit tiresome". "Yes, I can imagine", said Natalie. "So, I'm assuming that we can use phasor diagrams?"

"Correct", said Jeff. "What we have to do is

called phasor addition". "Ah, OK", said Natalie. "We've already done this in maths with Reggie and engineering science with Arthur as well as with Archie but hearing your descriptions are often clearer". "Thanks for the compliment", said Jeff, "Anyway, let's say that we have two voltages one of ten volts, and the other eight volts, which we can represent by the phasors V_1 and V_2 and that V_2 leads V_1 by sixty degrees. Now, the first thing that we need to do is to draw these two voltages to scale on a phasor diagram", Jeff explained, reaching into his desk draw to get a ruler and a protractor and drew the diagram, Fig. 5.

"Here, I have drawn the phasor diagram to scale where one centimetre represents two volts. And if you notice I have drawn two other lines in dashes and a third with an arrow at the end". "I was just going to ask about those", said Natalie. "Well, if you notice the two lines in dashes along with the lines V_1 and V_2 form a parallelogram. The other line with the arrow is drawn between the point where V_1 and V_2 meet and the opposite corner of the parallelogram. This line is called the resultant. If we have drawn our diagram accurately and we now measure the length of the resultant, we can find what the total voltage of V_1 and V_2 is". Jeff took his ruler and measured the line. "I get", he said, "the length of the line to be seven point eight centimetres, which since one centimetre equals two volts represents a voltage of fifteen point six volts, and with a phase angle of twenty-six degrees with respect to V_1 . So, we can say that the sum of V_1 and V_2 is fifteen point six volts and leads V_1 by twenty-six degrees. Now, have a go at one yourself. Say we have two currents of I_1 equals eight Amperes and I_2 which is three Amperes and I_2 leads I_1 by forty-five degrees". "OK", said Natalie, taking a sheet of paper and Jeff's ruler and protractor. While Natalie was drawing her phasor, Jeff took the opportunity to go and make himself another mug of tea. When he got back, Natalie had finished drawing the phasor diagram and said, "I get the resultant current to be one hundred and two millimetres which since I drew the diagram to a scale of one centimetre equals one ampere, the resultant current is ten point two amperes". "And the phase angle?" said Jeff. "Oh, yes", Natalie replied, "I get that to be twelve



degrees". "OK, fine", said Jeff. "Seems reasonable. Anyway, time is getting on. So, we'll just have a quick look at subtracting phasors before we have to call it a day". "OK", said Natalie, also looking at her watch.

"Subtracting phasors is pretty much the same as adding phasors", Jeff explained. "In fact, to subtract one phasor from another we do go through the addition process that we've already done. The best way to explain is by doing an example. So, let's say that we have two voltages which we can represent by $V_1 = 70 \sin(0^\circ)$ and $V_2 = 45 \sin(70^\circ)$. We can draw these as a phasor diagram like this", Fig. 6. "And let's say that we want to subtract V_2 from V_1 ". "OK", said Natalie.

"Now, with numbers we can say that subtracting a number from another one is the same as adding minus the second one so, for example eight minus four is the same as eight plus minus four ($8 - 4 = 8 + (-4)$). In phasors we do this by drawing a line representing the phasor that we want to subtract of equal length but in the opposite direction to the original. Like this", Fig. 7. "Here you can see that I've labelled the line as $-V_2$. Now all we need to do is to complete the parallelogram as before and measure the resultant, VR. Which for our example I get to be sixty-eight volts at an angle of minus thirty-eight degrees to V_1 ".

"So, there you have it. The accuracy of your answers depends upon how accurately you draw your diagrams and as you can imagine it's a tedious process if you have to do a lot of them. Fortunately, there's a fairly simple mathematical way of achieving the same results but we'll have to leave that for later. But drawing phasors give a good insight to understanding the theory purely because it's visual and you can see what's happening".

"OK, thanks", said Natalie. "Can you write some

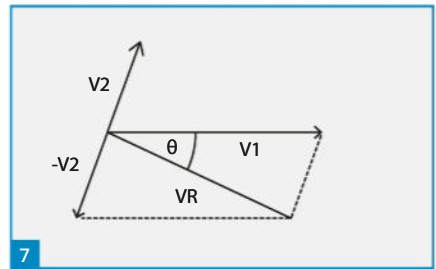
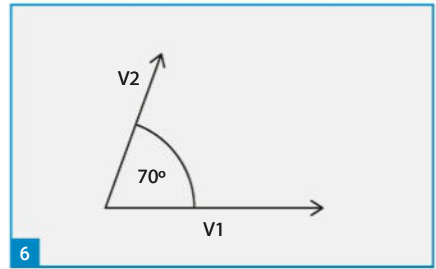


Fig. 5: Two voltages (drawn by Jeff to scale) showing the resultant.

Fig. 6: Two voltages, V_1 and V_2 .

Fig. 7: Subtraction of the two voltages in Fig. 6.

questions for me as usual please. I'll copy those and the notes that we've written today and pass on to Isla, Poppy and Tommy as usual". "Sure", said Jeff.

Jeffs questions

1. Convert 80 degrees to radians. (1.396 rad)
2. Convert 0.90 radians to degrees (51.57 deg)
3. If a voltage has a maximum value of 200V and a frequency of 60Hz, calculate its value after 500μs. (37.48V)
4. If a current has a maximum value of 0.5A and a frequency of 5kHz, calculate its value after 30μs. (0.40A)
5. A voltage has a maximum value of 150V, a frequency of 60Hz and at time $t=0$, a phase angle of 40 deg. Calculate its value at time 1.5ms. (142.98V)
6. There are two voltages, V_1 and V_2 where V_1 is 80V and V_2 60V. V_2 leads V_1 by 50 degrees. Draw a phasor diagram and find the resultant voltage and its phase angle to V_1 . (126V, 22°) **PW**



WORKED ALL BRITAIN TRIG POINT SUMMER SAUNTER:

It has been ten years since the popular WAB Trig Point Award was introduced. To mark this WAB is holding a Trig Point Summer Saunter during June, July and August. The final requirements have yet to be finalised and will be published on the website and in the Facebook group. 'Saunter' has been chosen in the title to reflect the fact that WAB is not a contest, nor a frantic race. It is also worth noting that the trig point activation zone has been extended to 100m from

the trig. This will hopefully encourage greater participation by less mobile members as it will increase the number that can be activated from the roadside, or very close by.

www.worked-all-britain.org.uk

www.facebook.com/groups/Worked.All.Britain

CESSATION OF NEWSLETTER

The WAB Newsletter has been terminated, due to the lack of volunteers to take on the editorship. However, the WAB programme continues as before.

Sign up to our FREE email newsletter at www.mymagazinesub.co.uk/practical-wireless

Colin Redwood G6MXL
practicalwireless@warnersgroup.co.uk

It has been a long time since I looked at any aspect of home construction. My local club recently started a project for members new to home construction. For many of the members it was a voyage of discovery. I thought it seemed a good idea to pick out some of the issues that members encountered and to provide some hints and tips for *PW* readers.

Printed circuit boards

Most commercial equipment uses printed circuit boards (PCBs). In its simplest form, a PCB is a sheet of epoxy or fibreglass board about 2 or 3mm thick with a thin layer of copper bonded to it. The usual approach is to etch, with an acid, gaps between the copper tracks which link the lead of one component to the next. The tracks required are printed or painted on the copper before etching to protect them from the acid. Holes are drilled where a component lead is to be inserted and then soldered to make an electrical contact between the component and the copper track. Sometimes double-sided PCBs are used, often with one side being predominantly a common ground plane – a technique that is often used at VHF and higher frequencies, **Fig. 1**. It is also the most common type of PCB encountered in modern day commercial transceivers.

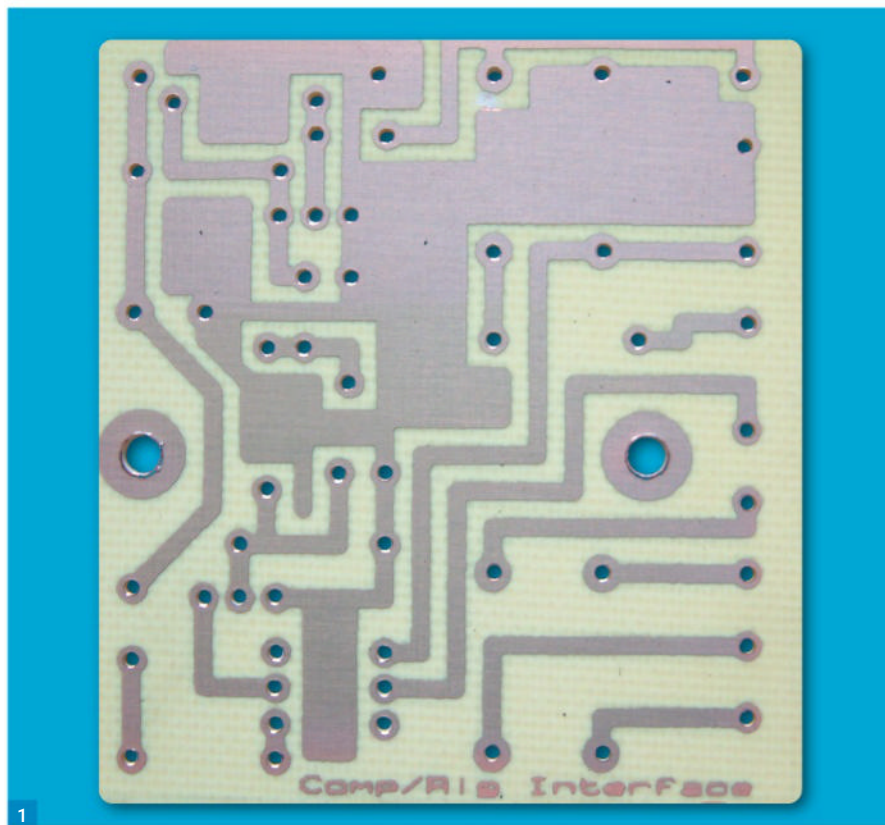
There are computer programs available to design the track layouts on PCBs, and the resulting files can be sent to a PCB production facility to produce the PCB. Such an approach might not be considered economical if you just want a single PCB, but can be quite a good option where quantities of upwards of five or so are required, such as for a club project.

Matrixboard

A variation on the PCB theme is matrix board. This is basically like a PCB, but it is bought with holes pre-drilled on a 1/10th inch matrix – to suit the pin separation on integrated circuits. It is available with no copper tracks whatsoever or with parallel copper tracks in one direction, **Fig. 2**. Many amateurs will be familiar with the name 'Veroboard' – the UK manufacturer. If you need a break in the track, it is easy to do this by using a 3mm drill to just remove the copper at the relevant hole. If you do this, make sure that you have removed all the copper by checking for no continuity with a meter.

Manhattan islands

My club's project used the 'Manhattan' or island technique, which adopts an alternative to etching tracks. I was intrigued to have a go, as in my admittedly limited experience of home construction, it is a technique that I hadn't



Home Construction

Colin Redwood G6MXL's theme this month is construction.

used before. I've used Veroboard and both manufactured and home-etched printed circuit boards.

At its simplest, Manhattan construction uses a piece of un-etched PCB material as a ground plane. With a Manhattan board, small PCB pads, typically about 7mm x 7mm in size, are super-glued to the PCB to form insulated islands to which component leads can be soldered. The pad sizes can be cut to suit the project, so a pad for a supply rail could extend across the entire board if desired. The technique is quite easy to use. You'll need to have some tweezers to position the islands so that you don't super glue your fingers to the board! You'll also need to make sure that you don't leave any surplus glue on the tip of the tube, otherwise you can all too easily end up with the cap glued to the tip of the glue tube: if you do then almost certainly, you'll need to write off the tube!

I'm sure that many established constructors will cringe when they see my first attempt at Manhattan-style construction, **Fig. 3**. It certainly wasn't pretty, and could no doubt be improved upon in numerous ways with experience. By comparison, **Fig. 4** shows a much neater version than mine. Either way, the technique works

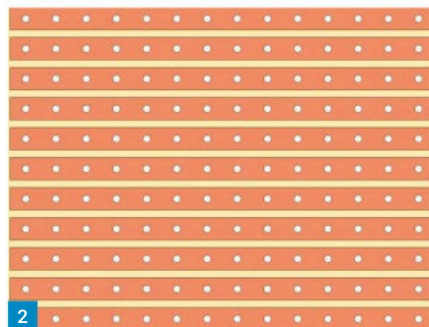
and is a lot cheaper and quicker than etching or buying a pre-etched PCB, and can be useful if you are prototyping or experimenting. It is also a useful technique if you find you need an extra pad or two on a commercial or home-made etched circuit board where you want to make a small modification to the design. It's probably not suitable for use at VHF and higher frequencies due to potentially longer leads than absolutely essential – perhaps *PW* readers may disagree?

Soldering

No matter whether you use a traditional PCB, matrix board or Manhattan islands, you'll need to make sure that the copper isn't tarnished (greasy finger prints or oxidised) so that the solder will flow properly. You can rub the copper with wire wool or emery cloth.

Component tray

These days, with ever smaller components, it is all too easy to drop a small component on the floor when constructing. One of our club members produced a small wooden component tray to keep components in for a specific project, **Fig. 5**. This was about 15cm x 15cm



with walls about 1.5cm deep (the dimensions are not at all critical). Wood is a good choice of material as it won't cause static build-up unlike some plastics, is not brittle so won't crack, and won't melt if a soldering iron accidentally touches it. Provided there are no static sensitive components, the tray with the components can be sealed into a plastic bag for storage between construction sessions. This can also be a useful way to store a project where you are awaiting some components to arrive from a supplier.

Tolerance

Some of my fellow constructors were a bit confused when they started to measure the various components and found that they weren't exactly the value listed in the component list. Resistors and capacitors have tolerances (the amount by which the measured value can vary from the marked value). Historically resistors could be $\pm 20\%$ of the marked value. These days 5%, 2% or 1% are very common. The final colour band, **Figs 6 and 7**, on a resistor shows its

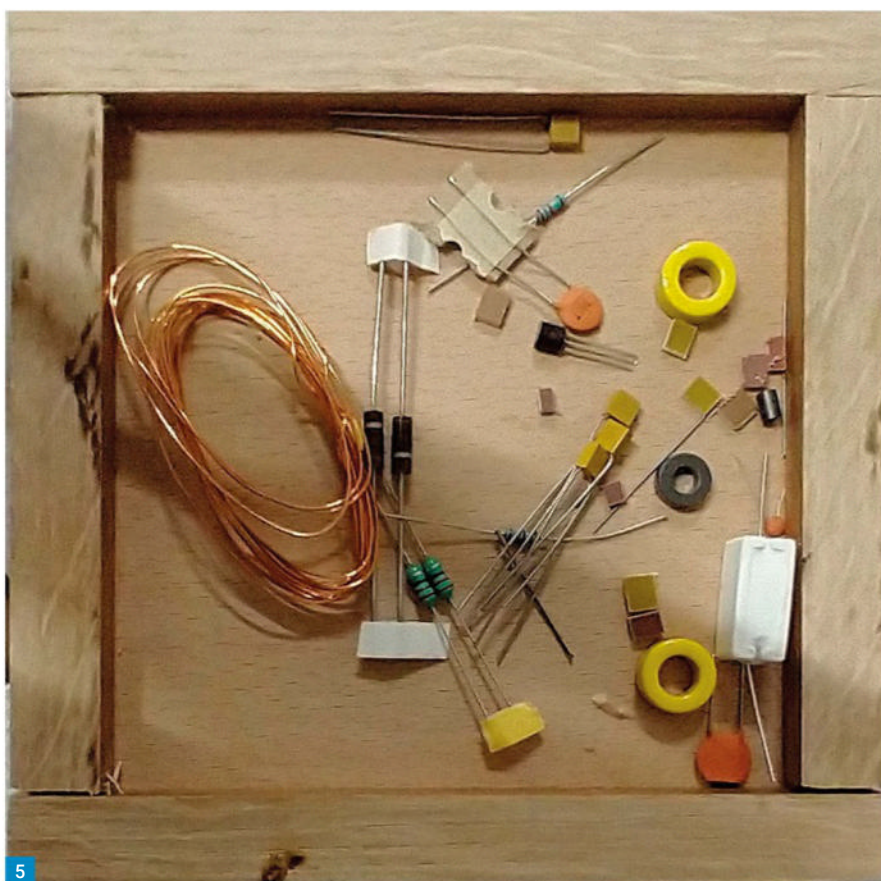


Fig. 1: A printed circuit board. **Fig. 2:** Matrix board or Veroboard. **Fig. 3:** The author's rather messy first attempt at Manhattan or Island construction. **Fig. 4:** A much neater version of the same project by Dave (Jake) Wills 2E0BAQ. **Fig. 5:** Wooden component tray. **Fig. 6:** The resistor colour scheme for those with 4 bands - tolerance is band 4. **Fig. 7:** The resistor colour scheme for those with 5 bands - tolerance is band 5. **Fig. 8:** The centre of a dipole. Don't forget to waterproof it!

tolerance.

As an example, a 1k Ω resistor with a $\pm 5\%$ tolerance might measure between 950 Ω and 1050 Ω at the time of manufacture. With time even this range can be exceeded. If you are using an analogue meter to measure components, then you'll also need to consider how accurately it is showing the value and your ability to read it. Don't forget to adjust for a zero reading on a short circuit. Digital multimeters are certainly more accurate than analogue multimeters.

Capacitors, even today, can have wide ranging tolerances. Electrolytic capacitors can easily have a tolerance of -20% to +50%. The type of capacitor will give a good clue. For example, ceramic capacitors generally have a lower tolerance than polystyrene capacitors. Tantalum capacitors will generally have a lower tolerance than the equivalent electrolytic capacitor.

Small inductors

Small radio frequency inductors can look very much like resistors. This can be a bit confusing for those new to construction. If you are unsure, I think the easiest way to check is to

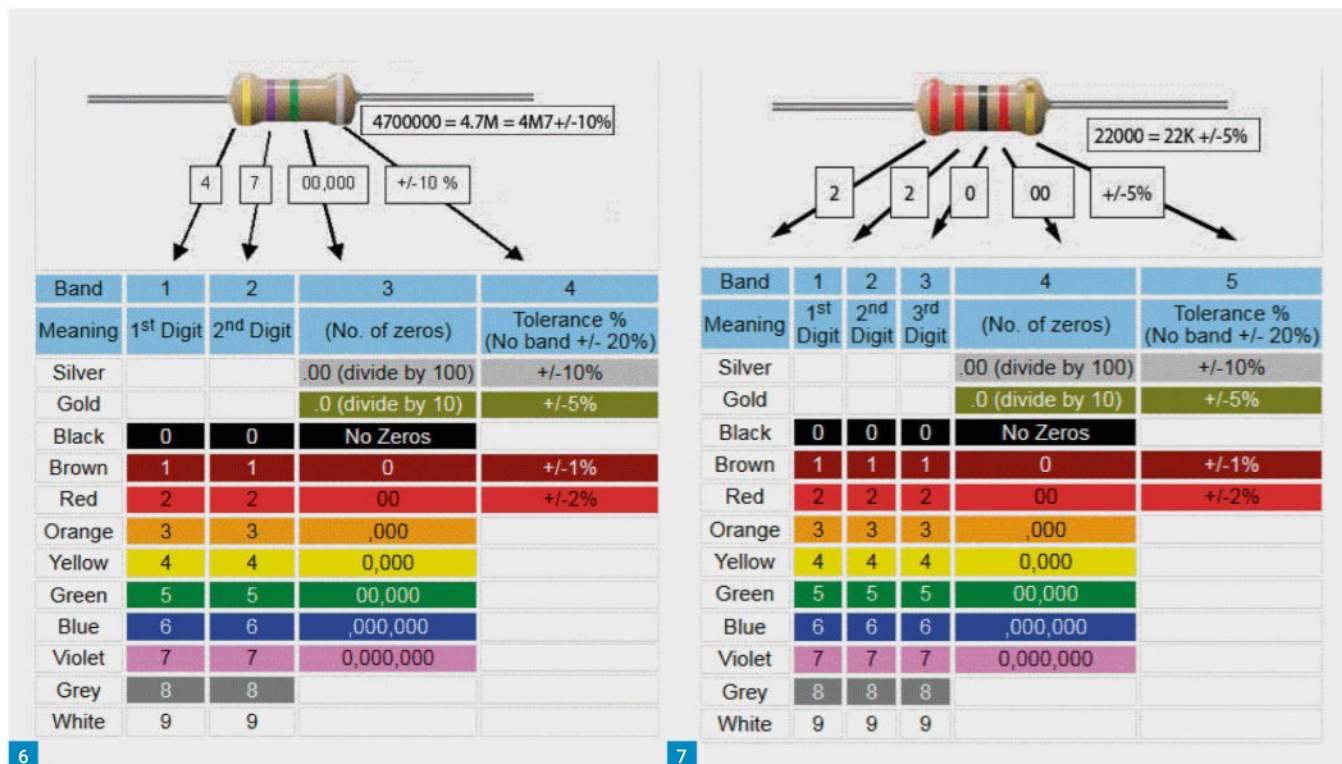
use a multimeter on the resistance setting. An inductor will measure as a short circuit (well under 1 Ω), while a resistor will measure according to its colour bands.

Multimeter batteries

If you are returning to home construction after a number of years, I'd suggest checking the batteries in any test gear such as multimeters. If you always make a habit of turning off digital multimeters when you aren't actually using them, then the internal battery (often a PP3 square battery) should last many months.

6m dipole

Remaining with the construction theme, let's look at a simple antenna for the 6m (50MHz) band. This issue of *PW* should be hitting readers' door mats around the start of the annual Sporadic E season. These days many HF transceivers are also equipped for the 6m (50MHz) band, yet I suspect many readers have yet to explore the band. It is very easy to make a dipole for the band. Two lengths of wire, each about 1.4m long are the main requirements.



At the centre they need to be attached to some feeder to go to the shack. If don't have a proper dipole centre, you can use 'choc block', **Fig. 8**. Don't forget to waterproof the connection so that you don't get water into the coax! At the ends, away from the centre, you'll ideally need some sort of insulator and then some string or rope to attach to a suitable support. If you don't have 'proper' insulators, you could use cable ties or even the plastic loops used to hold a pack of four beer cans together. Back at the shack you'll need to terminate the feeder in a suitable plug for your transceiver (e.g. PL259 in many cases).

While this is a 'cheap and cheerful' non-permanent design, it will at least get you on the band without costing a fortune, so that you don't miss out on the summer openings, which will tail-off in late July or early August. Keep an ear on the band. The FT8 frequency is 50.313MHz and is a good place to listen for any activity that might indicate an opening, even if you then go on to operate on phone or CW.

Exam question queries

There have been a number of criticisms concerning exam questions over recent years, with some complainants not satisfied that their concern has been appropriately addressed. To address these concerns, the RSGB Examinations and Syllabus Review Group have provided two forms to centrally capture issues with exam questions.

The first form is designed for exam candidates to formally challenge a question in an actual exam (not a mock or example exam). Examples

of grounds for challenging a question could be a question not within the scope of the syllabus or a question with more than one correct answer.

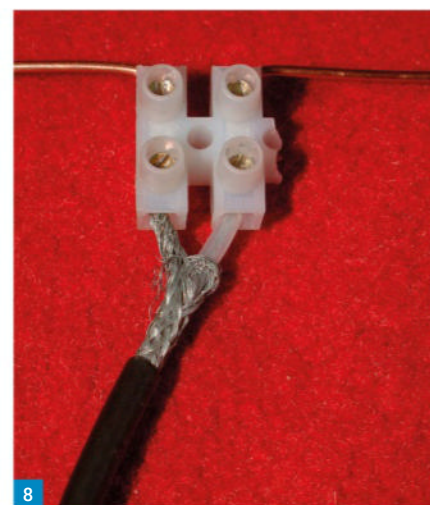
The second form is for anyone who spots errors in published questions that are not encountered in an actual exam. This might include exams appearing in RSGB published mock exams.

In both cases, the complainant needs to complete a separate form for each question they wish to challenge. The RSGB Examinations and Syllabus Review Group will consider queries submitted and let the challenger know the outcome. Both forms can be found at:

www.rsgb.org/exam-challenges

Ofcom licences

Ofcom announced in mid-February 2025 that they anticipate the implementation of their new system for handling various radio spectrum licences (including amateur licences) in September 2025. This will enable Ofcom to implement many of the changes to the administration of amateur licences announced back in 2023/2024. This includes cancelling callsigns where an individual has more than one licence (e.g. a Full, Intermediate and a Foundation licence). It also includes offering amateurs with Intermediate callsigns starting '2x0' the chance to migrate to the equivalent in the M8 series and those with a '2x1' licence the chance to migrate to a M9 series callsign. While I sense that many Intermediate licence holders like the idea of having an M8 or M9 callsign, I don't think this is universal, with some



Intermediate licence holders regarding the rarity of a callsign starting 2 as an attraction to DX stations working towards prefix awards and in contests with prefixes as multipliers. Others may have invested in QSL cards pre-printed with their 2x callsign, and won't want to change.

Perhaps the most important action that all amateurs need to do in preparation for September 2025 is to make sure that they visit the current Ofcom website and revalidate their licence, so that Ofcom don't revoke a licence just because it hasn't been re-validated in the last five years. This is something that perhaps local clubs and amateurs can help fellow amateurs with limited access to IT systems to do.

www.ofcom.org.uk/licences/spectrum

Keith Rawlings G4MIU
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One of the more obvious uses of a NanoVNA is that of checking antenna matching. This is easily done using a Port 1 S11 Single Port Reflection measurement.

When checking an antenna the most common functions that the VNA traces could be set to read are VSWR, LogMag (for Return Loss) Impedance, Resistance and the Smith Chart. Once these parameters are set and a suitable frequency span has been added the VNA needs a User Calibration set. As this test is a Single Port set-up then an SOL (Short, Open, Load) should be carried out.

I know I have mentioned this previously but it is worth repeating, the frequency span needs to be given some consideration. The sweep points on devices such as the NanoVNA can be limited. Some models have only 201 points while others have up to 801. As there are variations of NanoVNA models some may have more, my VNA-3G derivative for example can sweep 1001 points. It is therefore important not to set too wide a sweep in relation to sweep points available as resolution will be lost resulting in missed detail.

How you calibrate depends on the individual circumstances which, naturally, will vary greatly from scenario to scenario. Usually, we will want to measure the antenna itself and not the feeder. The options here are to connect the VNA directly at the antenna feedpoint so in this case a calibration would be needed at the VNA itself, or a short length of coaxial cable could be used with the calibration made at the end of this. Another option is to have access to the end of the feeder being used and calibrate this at the antenna end, removing the effect of the cable.

One problem to look out for using this method is cable loss on longer runs of cable. The VNA's have a specific noise floor and if this comes close to the cable loss, the VNA will have limited resolution due to the round trip dB loss in the cable and this effectively reduces the dynamic range of the VNA. This becomes more prominent the higher in frequency we measure and of course, also depends on the losses of the cable being used.

You may ask why we can't just directly connect to the radio end of the feeder so the VNA can see what the radio does. Well, we can but when we calibrate a NanoVNA at the antenna end of the feeder, we help to ensure more accurate measurements as we are compensating for any errors introduced such as false zero reactance crossings due to line mismatch, cable losses and connector mismatches within the combined test setup.

There is a way around this and that is to use a feedline length (as a substitute for the



VNA's (Pt III)

Keith Rawlings G4MIU continues with the series on VNA's, particularly the NanoVNA and its variants. This month he starts to look at some of the real-world measurements that can be undertaken with these cheap but versatile instruments.

main feeder or otherwise) of exactly one half wavelength long. If this line is an electrical half wave, or a multiple of a half wave, measurements taken at the end of the line should be exactly the same as those taken at the antenna. Clearly there will only be one frequency where this will be valid and multiple lines would be needed for different bands.

To calculate a half wave line (in feet) we use the calculation $492 \times V_f / F$, where V_f is the velocity factor of the cable used and F is frequency in MHz. If the result from this calculation is added to itself, we can determine the half wave multiples. Just remember to only use lengths that fall on these half wave multiples.

Making a measurement

As mentioned previously, when we are ready to measure our antenna the VNA needs to be set up. For an example I will use the Civil Airband Flower Pot antenna which I recently described in *PW*.

First set up a suitable frequency span. For this example I chose 100-140MHz. Select the Traces you require. In this case just Trace 1 is selected and is set to S11 Reflection. Then the Trace format is set, here I used VSWR, but

you could also select LogMag for Reflection Coefficient or the Smith Chart.

Set the Scale and Reference Position on the display as required. It is a good idea to also set any markers you may wish to have. I also ensured the maximum number of Sweep Points was set, in the case of the VNA-3G 1001 points.

We are now ready to Calibrate. To match my connectors, I used a BNC/SMA adaptor on the VNA and then used a short lead of RG58 fitted with BNC plugs which was 200mm long. I connected the Cal kit to the end of this and then reset the Calibration state of the unit before going through the SOL Calibration process. This was then saved to the VNA. See **Fig. 1**.

I have mounted my Flower Pot in my attic so it was easy to obtain access to the feedpoint. I attached the VNA using the short lead. As the Flower Pot has a trailing lead of some 230mm of RG58 I added a 1.1 Nano Second Delay to extend the reference plane of my measurement to the point on the antenna where the choke starts.

An awkward to take photo of how I set this up may be seen in **Fig. 2**. Here, unfortunately, thanks to attempting to hold the camera and the VNA at the same time I had the VNA a bit skew-whiff making the screen appear blank!

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Fig. 1: VNA-3G with Calibration Kit Load connected to the end of a short lead.

Fig. 2: VNA Measuring the Flower Pot directly at its feedpoint. Fig. 3: The Airband flower pot VNA trace at the feedpoint. Fig. 4: The antenna trace when measured at the radio end including the feeder.

The choke at the bottom of the flower pot can be seen at the top of the photo.

The resulting measurement displayed using the VNWA software can be seen in **Fig. 3**. Here I have transferred an s1p file of the measurement that was saved on the VNA-3G's SD card and the result viewed by importing it into the DG8SAQ VNWA software.

I had a bit of a surprise. The minimum VSWR was 1.06:1 at 116.6MHz. Previously, when I had made the antenna and checked it outside in the clear on a short mast, the lowest VSWR point was at around 121.0MHz.

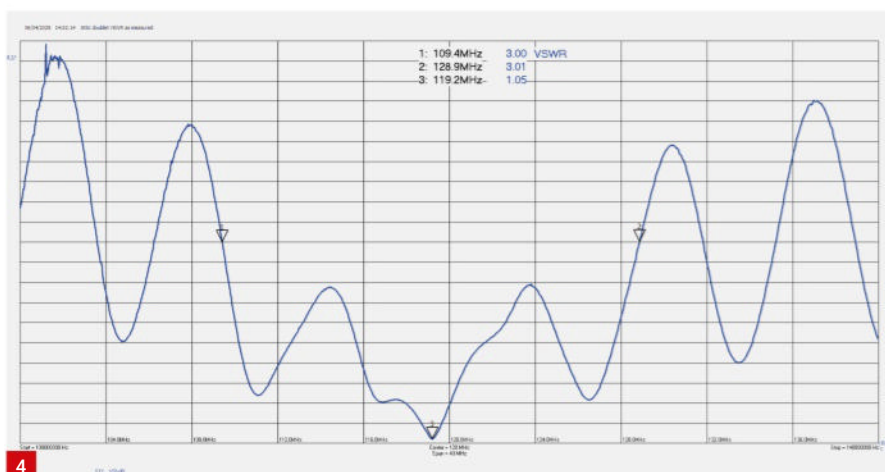
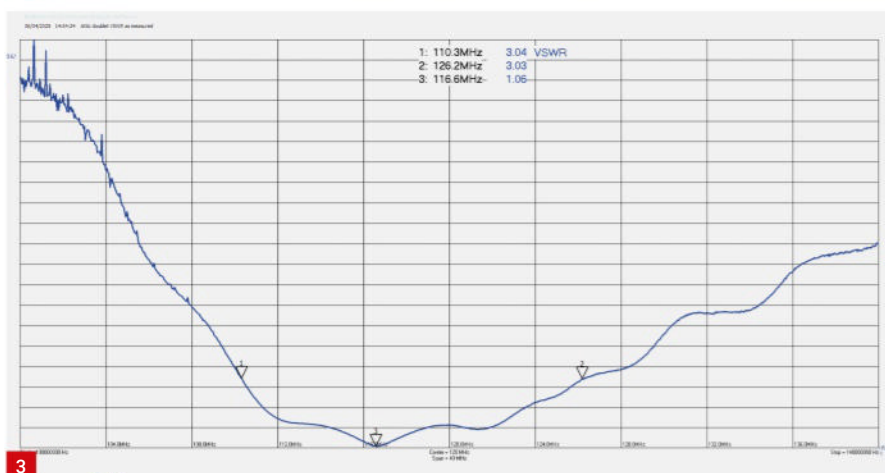
After locating it in my attic I hadn't bothered to check the antenna as it was only for reception after all. I knew the proximity to the rafters would probably affect it but not quite to that extent that it has! I'm sure the proximity of my presence to the antenna while making the test didn't help either. Well, it's working so it will be OK for now but for some personal pride I think I will be making some adjustments when time permits.

I then moved to the shack and connected the VNA to the radio end of the feeder, which is a run of RG58, and then ran the sweep again. The resulting test can be seen in **Fig. 4** where the effects of the cable can be clearly seen. Something I wasn't expecting was the shift in the lowest point of VSWR to 119MHz.

The photos in Figs 3 and 4 show a computer screen image from the VNWA software where I have selected three markers on the VSWR trace.

Markers may also be set on the NanoVNA itself and moved to make measurements at any frequency across the range. Each marker has to be selected as Active before it may be moved along a Trace. The markers are then moved with the aid of the Toggle switch on the top of the NanoVNA or by using the buttons on the side of the VNA-3G (other variants may vary).

A Marker may also be made active by touching its icon on the screen. To make life easier for the operator, markers may be set to read Normally where they are manually moved by the user or they may be set to read Maximum or Minimum where the VNA searches for the Max or Min points and the marker moves automatically to this point. When tuning an antenna, a marker could be set on a target frequency and the trace monitored as it moves (hopefully!) towards resonance.



When it comes to tuning an antenna, you may find it is quite useful to select the Smith Chart display to see how the tuning is affecting resonance. (I'll cover the VNA's Smith Chart in a future column).

When using a VNA to adjust a single band antenna, such as a Dipole or other basic single

band antennas, then a reasonably narrow swept bandwidth can be set resulting in better sweep point resolution. When adjusting something like a multiband Off Centre Fed Dipole, Multiple or Fan Dipoles or a multiband vertical, it is handy to be able to monitor a whole span of bandwidth to see how adjustments affect other

Fig. 5: BNC four-piece Calibration Kit.

Fig. 6: Image Depicting the E and H Fields around a dipole.

bands, but with VNA's that have low resolution important detail may be lost.

VNA's such as the Mini1300 and, sadly defunct, FA-VA5 analysers, have a 'Multi SWR' feature where the unit may be pre-set to scan multiple bands of interest and the VSWR is displayed simultaneously so the effects of adjustment may be seen on the other bands. Also, these units both have a useful Audible Tone feature where the tone varies in frequency as the VSWR varies, making it easier to 'hear' how your adjustments are going if you can't read the display while you are 'tweaking'!

Fig. 5 shows my four-piece Amphenol Cal Kit which was bought from SDR kits. Starting left is the female in-line connector, then the Short, the Open and then the Load and is accurate up to 600MHz. It comes with a printout of the calibration parameters that may be entered into the VNA where this is possible.

Near field and far field

After I wrote about the latest EMF article published on the AN-SOF website two individual *PW* readers contacted me specifically regarding what they considered to be the 'grey' area between the Near Field and Far Field regions of antennas.

Rather than stick my neck out to describe a definitive answer to this I decided that I would hand the subject over to the experts, namely the team at AN-SOF!

AN-SOF's **Tony Golden** readily agreed to write a detailed article and this has now been published and made available to all on the AN-SOF website.

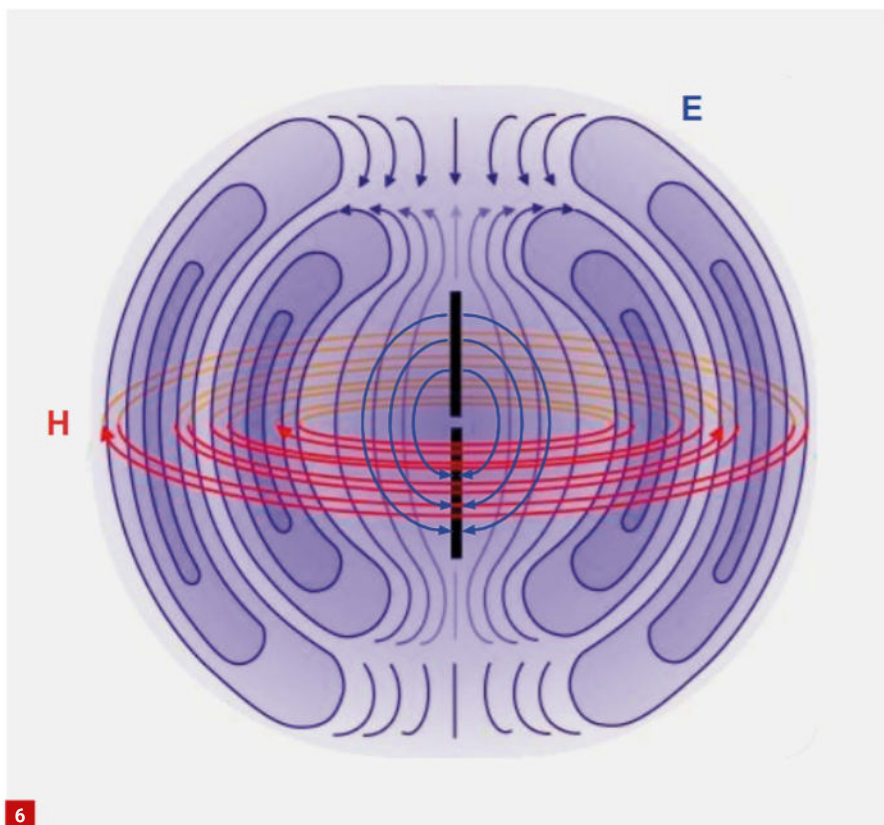
<https://tinyurl.com/zewthpbr>

It is titled 'Understanding the Antenna Near Field: Key Concepts Every Ham Radio Operator Should Know'.

The article describes the essentials needed to understand the concept of Near Field radiation and also its effect on EMF safety. While this subject is quite a complex one, the article goes a long way to describe the niceties in a detail that most amateurs will be able to comprehend. The subject is set out over a number of comprehensive paragraphs with detailed illustrations that back up the text.

Naturally, an example of calculating the Near Field is made using the AN-SOF simulator and a model is available for download from a link on the page but, that said, even without the simulation the article itself provides a good reference on the subject.

Fig. 6 shows a diagram from the article depicting the E and H Field Lines of a dipole antenna.



While I'm on the subject, thanks to the recent interest shown in using AN-SOF by *PW* readers Tony has kindly offered to make AN-SOF DX available to *PW* readers at a discounted price.

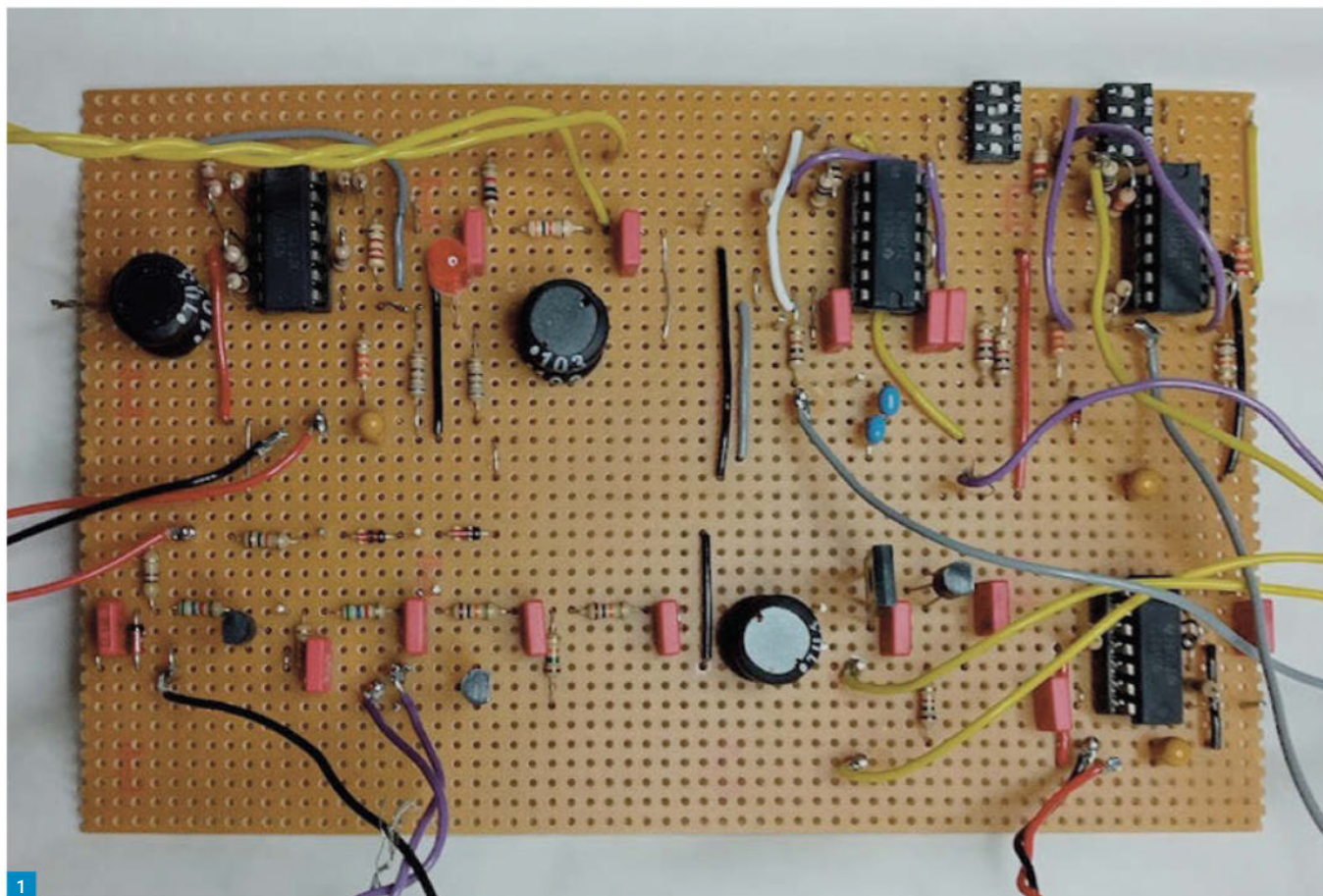
He tells me "Licensed amateur radio operators subscribed to *PW* magazine can purchase AN-SOF DX for USD 199 until July 31st 2025, which is a significant reduction from the regular price of USD 325". Tony states, "I'm not promoting this offer extensively, only on a person-to-person basis. Many retired amateurs have limited financial resources, and I'm always

happy to help them access AN-SOF DX at an affordable rate".

Tony points out that although Eznec, 4nec2, and other NEC-based tools are free; AN-SOF's goal is not to compete with these packages. However, for amateurs who need a versatile simulator and reliable technical support for their projects, or indeed, those designing and selling antennas, AN-SOF DX is proving to be a solid alternative.

Readers may contact Tony at this email address: tony@antennasimulator.com

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Mark Foreman G7LSZ / SA6BID
SA6BID@outlook.com

As radio amateurs we are commanded that "Radio Equipment is designed, constructed, maintained and used so that its use does not cause any Undue Interference to any wireless telegraphy". An important part of this is to reduce as far as possible both in-band and out-of-band spurious emissions. Spurious emissions are the emission of radio waves other than those required to communicate. One contributor to in band spurious emissions is noise in the output of a VFO (Variable Frequency Oscillator) or some other frequency generator. Normally a lot of effort goes into making VFOs which are stable and are very clean. While there are plenty of articles about clean oscillators, it is fun to consider for a moment unclean oscillators some of which can lurch from one mode of oscillation to another. I present the G7LSZ chaos lab, which is packed with unruly circuits, **Fig. 1**.

The normal unchaotic oscillator faithfully traces out the same path, consider for a moment a phase shift oscillator made of a BC547B, some resistors and capacitors. While it does not quite give us a sine wave, it does give the same distorted sine wave each time. If we plot the voltage on the collector against the voltage on the first capacitor in the delay line, we get a simple loop. But if we

Chaotic Oscillators

Mark Foreman G7LSZ / SA6BID offers an unusual look at oscillators.

follow in the steps of **Jan Danckaert et. al.** [1] and add an additional BC547B whose collector is wired via a 15kΩ to the second capacitor in the delay chain while the base is attached to a potentiometer circuit and a 47nF capacitor, then with the right value of the variable resistor the oscillator jumps between two different modes. The circuit is shown at **Fig. 2**. If an oscilloscope in the XY mode is used to plot the collector voltage of the first transistor (TP1) against the voltage across the first capacitor in the delay chain, then we can see a range of interesting loops, **Fig. 3**. Always remember with these circuits to connect the ground wire of the oscilloscope to the ground point in the circuit. I imagine on those days when propagation has gone on strike that these circuits will be a source of consolation.

While the addition of a second transistor was needed to make the phase shift oscillator chaotic, it is possible by suitable (or unsuitable) choices of component values to make the Colpitts oscillator chaotic. **Michael P Kennedy** was able to make it chaotic by selecting the right resistance in series

with the coil [2]. With a resistance of 40Ω his oscillator is chaotic, but with a higher value series with the coil the oscillator is not chaotic. I altered his design a little, I increased the resistor between the emitter and the negative rail to decrease the quiescent current in the oscillator. I also changed to a power transistor as pulses of almost one amp occur when the transistor shorts out the capacitor between the collector and emitter. I also changed from a single transistor to a Darlington pair to increase the current gain. I used a quad operative amplifier to bias the Darlington pair and to compute the current passing through the capacitor between the emitter and the 'ground'. The circuits are shown at **Fig. 5**. While chaotic behaviour can be observed by connecting the oscilloscope probes to the collectors and the emitter of the larger transistor, **Fig. 4**. A more aesthetically pleasing image can be seen by connecting one oscilloscope input the operative amplifier output which computes the capacitor current TP4 and one of the other test terminals. You will have to adjust the series resistance in series with the coil

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Fig. 1: The chaotic four – all four circuits on one board. Fig. 2: Circuit of the two transistor oscillator. Fig. 3: The chaotic phase shift oscillator and the double scroll generated by the circuit of Fig. 2.

to make it chaotic.

To observe the chaos connect the two channels of the oscilloscope to the collectors (TP1) and emitter of the larger transistor (TP3). I considered using one operative amplifier as a current to voltage converter in the way Michael Kennedy did for Chua's circuit, but during LTSPICE simulations it was found with low resistances between the coil and the positive rail that strange things happened in the current to voltage converter. As the circuit is very sensitive to this change I would suggest that if you want a simple life you should not do this. I tried adding an additional winding on a ferrite toroidal 100mH inductor, this was put in series with the variable resistor. The new winding was connected to the oscilloscope. This current sensing transformer will allow you to sense the rate of change of the current in the inductor. I am sure that by suitable choice of test points and resistor setting you will be able to pretty images.

While the chaotic Colpitts circuit proves an interesting point, sadly the patterns generated by this circuit are not quite so pretty. I have to confess that I have a bias towards the circuits which generate multiple scrolls. We next present Chua's circuit [3], **Fig. 6**. This is a fun circuit which has single variable resistor. Michael P. Kennedy in Dublin has published an easy recipe for Chua's circuit which includes a means of sensing the current in the inductor [4]. When I wanted to build a Chua's circuit I used his implementation of it. By careful adjustment of the resistor it is possible to tune the circuit between simple oscillation, chaotic behaviour and also at one extreme complete stability. To observe the chaos it is best to connect the two channels of the oscilloscope to the two ends of the variable resistor and the ground connection of the oscilloscope to the other side of one of the capacitors. Set the oscilloscope to the XY mode, sit back and enjoy the patterns, **Fig. 7**.

In Chua circuit we have a simple parallel LC circuit attached via a resistor to a second capacitor and a negative resistance circuit which is known as Chua's diode. It is not possible to buy Chua's diode as a simple two leaded component but instead it can be emulated with two operative amplifiers and six resistors. Now I will confess that the mathematics of Chua's circuit are complex, but thanks to **Julian Clint Sprott W9AV** we have a mathematically simpler system. If we consider a mass (M in kg) attached to a perfect spring (force constant k in Nm^{-1}) which has displaced from the equilibrium position and then let go it will undergo simple harmonic motion (SHM) which is a simple sinusoidal vibration. Then if have no loss of energy from the system then the following equations will

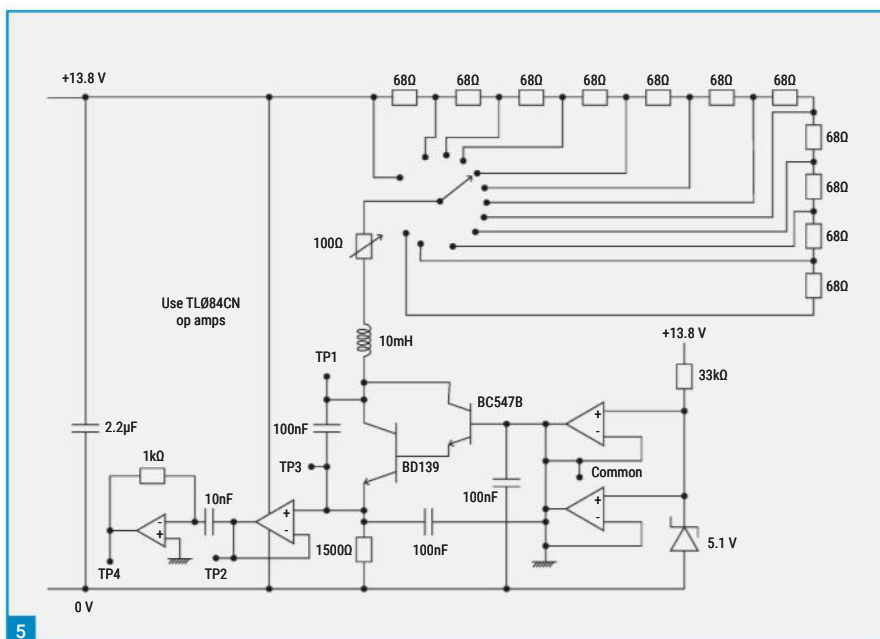
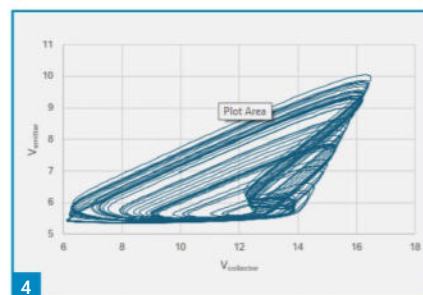
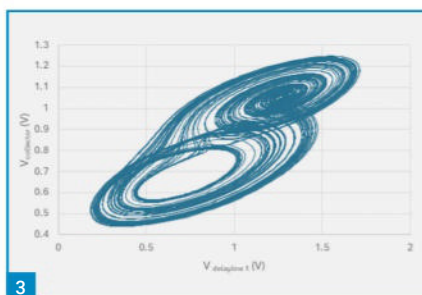
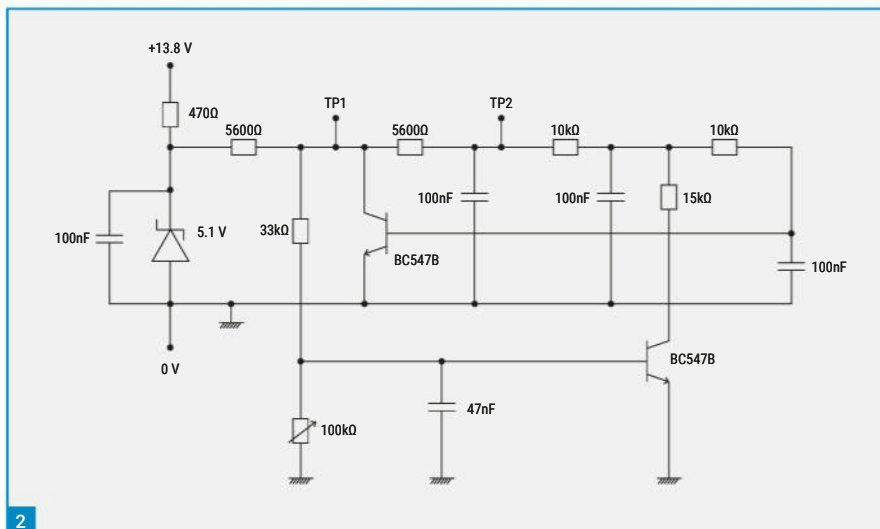


Fig. 4: Another pattern produced by the chaotic oscillator. Fig. 5: The Colpitt's version.

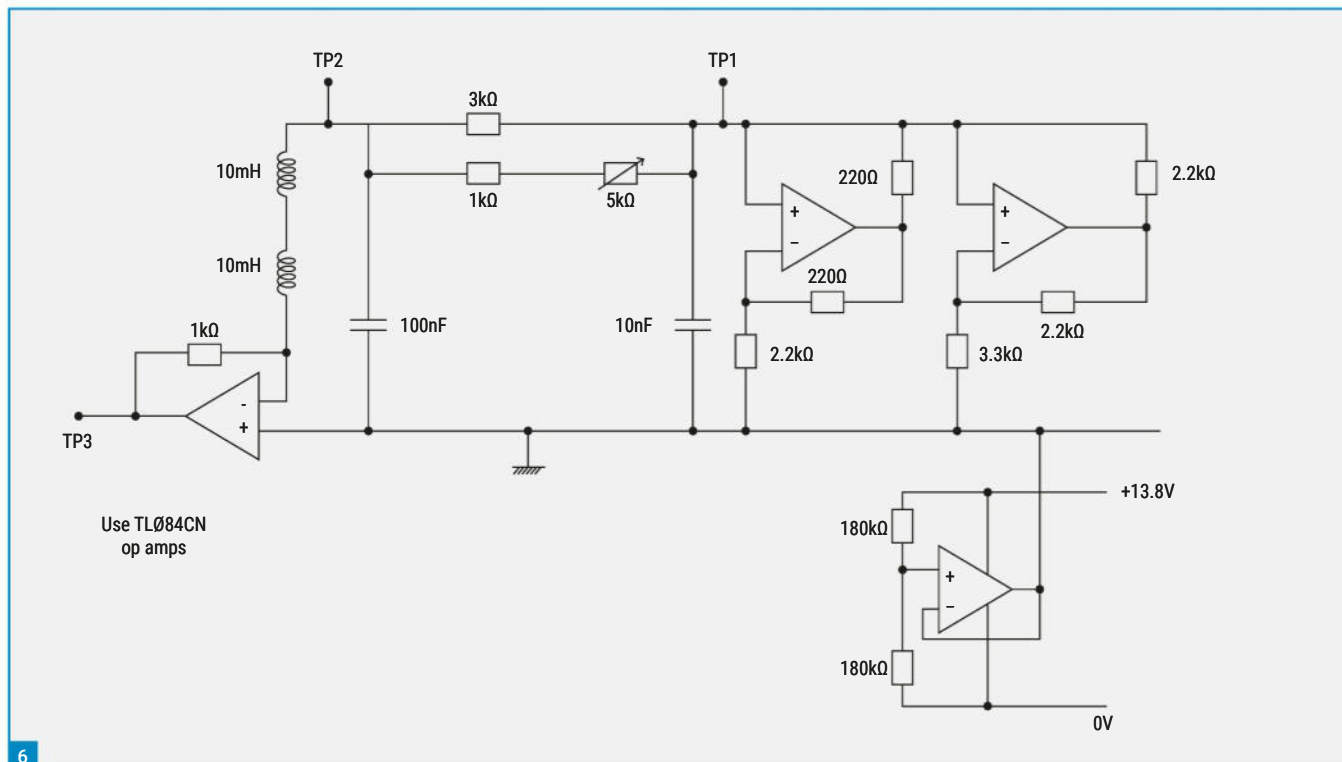
describe it. In these equations $w^2 = k/M$, where $w = 2\pi f$ and we need to use radians instead of degrees.

$$X(t) = A \sin \omega t, \quad v(t) = dx/dt = -A\omega \cos \omega t \text{ and } a(t) = d^2x/dt^2 = -A\omega^2 \sin \omega t$$

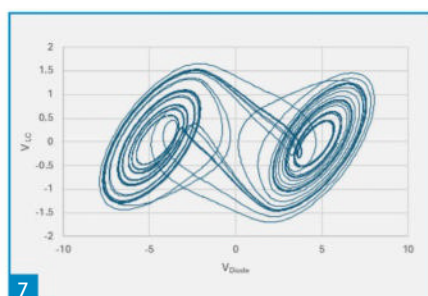
If we add air resistance to the system, then the equation for the acceleration of the mass will be a bit more complex. While in SHM we can write

$$A = -kx/M$$

For a damped system we write the following equation where b is a damping term [5]. This gives a system where the amplitude of the oscillation will decay away exponentially. If we plot a graph of v on the y axis against x on the x axis, then we will see how the damped system will



6



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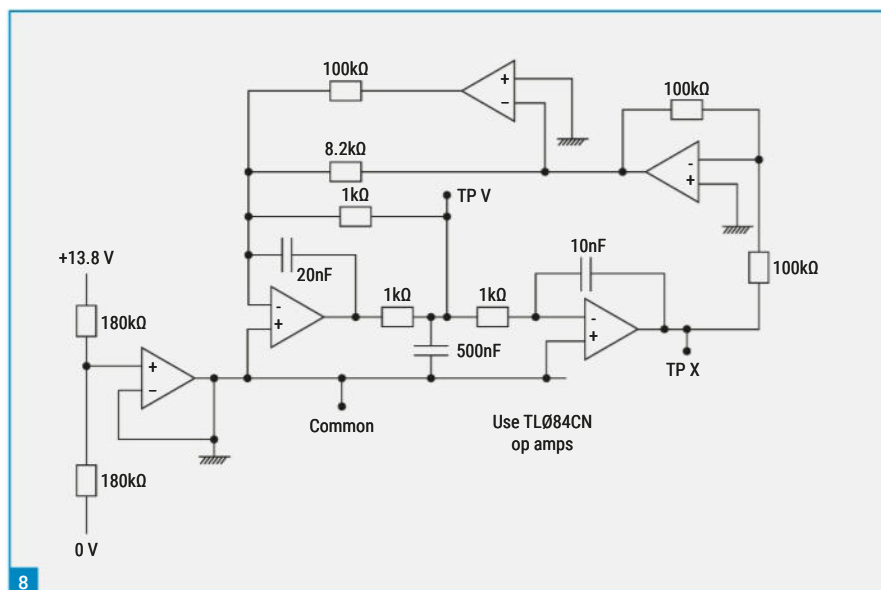
Fig. 6: Chua's circuit. Fig. 7: The pattern generated by Chua's circuit. Fig. 8: The Sprott circuit.

tend towards a single point on the graph where the system is at rest while the undamped system will simply orbit eternally around the point which the damped system gravitates to.

$$A = (-kx/M) - bv$$

If we consider the rate of change of acceleration (jerk, d^3x/dt^3 written as G), then it is possible to make a simple circuit, Fig. 8, which computes a (d^2x/dt^2) , v (dx/dt) and x from the value of the jerk (G). Then the circuit has a section which computes the value of G from x and then the value of G is fed back into the part of the circuit which computes a , v , and x [6].

By careful design of the circuit which generates G it is possible to get different traces on the oscilloscope screen. A series of nonlinear feedback elements have been published by Julian Sprott, rather than fixing the values three of these have been adapted to allow some variation of



8

the parameters. Compared with the other circuits this one has been more challenging, while I have been able to observe the double scroll. I found that sometimes when the circuit is powered up it

gives the double scroll but also it can give a less interesting big loop. So far I have not been able to make the other three circuits which generate G work for me. **PW**

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The popular *Practical Wireless* 144MHz QRP Contest is the ideal way for newcomers to the VHF bands and contesting to get a good feel for many aspects of amateur radio contests. It is an excellent way to experience the thrill of making contacts over many km on the 2m band. This year certificates will again be distributed by email.

Power

The power limit will again be **5 Watts** at the transmitter so that participants with all types of UK licence can participate equally.

Equipment

The only equipment you'll need is a low-power 2m transceiver and an antenna. While you can expect to make some contacts with a basic 2m FM handheld transceiver, most of the activity is likely to take place using single sideband (SSB). Most stations use horizontally polarised Yagi antennas when using SSB or CW.

Location

As always at 2m, a clear take-off such as a hilltop will certainly help. Every year new entrants are surprised just how far their signals can travel between hilltops.

You'll need to find the 6-character IARU locator (sometimes known as 'Maidenhead Locator' or 'Grid') for your station's location, for example IO92KL. I think the easiest way is to visit:

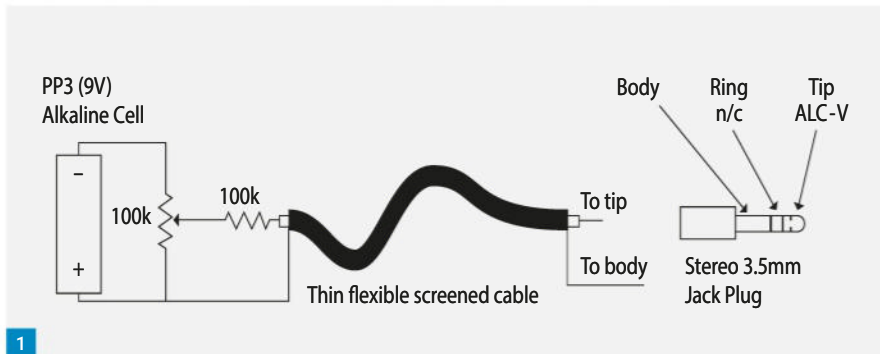
<https://tinyurl.com/rt8m4vjc>

Contest exchange

For each contact to count towards your score, you'll need to exchange your callsign (**including any /P**), signal report using the standard RS(T) code, serial number and locator. The RS(T) code consists of readability on a scale of one to five and signal strength from one to nine. The serial number starts at 001 for your first contact and increases by one for each subsequent contact you make. So, the fourth contact you make will have serial number 004. For Morse contacts there is also the tone (on a scale of one to nine).

Exchange example

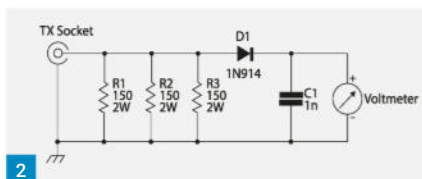
Imagine your callsign is M6ABC/P, you are located in IO91GI and have a contact with M7ZXT/P as your fourth contact. You might transmit, "Mike seven Zulu X-Ray Tango Stroke Portable from Mike six Alpha Bravo Charlie Stroke Portable, you are five and six, zero zero four, in India Oscar nine one Golf India". Using phonetics will make sure that similar sounding letters (e.g. B, D, P, V) are clearly understood by the station you are in contact with.



1

The 42nd Annual Practical Wireless 144MHz QRP Contest

Colin Redwood G6MXL, our QRP Contest adjudicator, introduces the 2025 event, which takes place on Sunday 15 June 2025.



2

Fig. 1: A useful technique to reduce power to 5W on higher power transmitters. Fig. 2: A small power meter, to verify the power output. A 21.7V level indicates 5W output. 2W metal film resistors are available from CPC (Farnell).

Hints and tips

Most newcomers to contesting find that replying to other stations' "CQ Contest" calls is a good way to start. As your confidence in exchanging reports, serial numbers and locators increases, then finding a clear frequency, calling "CQ Contest" and waiting for stations to reply to you is also a good technique. A mix of the two techniques can be an effective strategy.

Make a point of accurately recording in your log the details of each contact as required by the rules – in particular the callsign of each station you contact, **including any /P suffix**, their locator and the time in UTC (not BST). If you are transferring a paper log to a computer log, be careful to transcribe the details accurately. The format of locators is letter letter number number letter letter.

Directional antennas

If you use a directional antenna, then I would strongly recommend that you rotate it to point in different directions during the contest (e.g. South

West England, Northern Ireland, the Republic of Ireland and Scotland). This will not only enable you to make more contacts, but will likely increase the number of different locator squares you contact, which is a part of your overall score.

Batteries

Many entrants use rechargeable batteries for power. Make sure you have enough power to run your station for the full duration of the contest. I'd suggest making three diary entries: the first a couple of days before the contest as a reminder to charge your batteries, the second for the day of the contest (Sunday 15 June 2025), and the third a few days after the contest to remind you to submit your entry. The rules appear on the next page. The contest website is also a valuable source of information and has a link for downloading log sheets and an online entry form (known as a cover sheet).

www.pwcontest.org.uk

Submitting an entry

Don't forget to submit your entry after the contest. Electronic entries via email are much preferred, make the task of adjudication easier and minimise the risk of transcription errors. Paper entries may be transcribed for adjudication purposes at entrants' risk. All entries that provide an email address will be acknowledged.

entries@pwcontest.org.uk

Have a go

There will certainly be plenty of other *PW* readers on the air, keen to exchange reports, serial numbers and locators. Good luck in the contest! **PW**

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The 2025 Rules

The 42nd Annual Practical Wireless 144MHz QRP Contest, 2025 Rules.

1. General: The contest is open to all licensed Radio Amateurs operating fixed or portable stations, using SSB, CW, AM or FM in the 2m (144MHz to 146MHz) band. Entries may be from individuals or from groups, clubs, etc. The contest runs from **0900 to 1500 UTC on Sunday 15 June 2024.**

All stations must operate within the terms of their licence. Entrants must observe the band plan and must keep clear of normal calling frequencies (144.300MHz and 145.500MHz) even for "CQ" calls. Entrants must allow other users of the band to carry out their activities without hindrance. Please avoid frequencies used by GB2RS (144.250MHz and 145.525MHz), ATV talkback (144.750MHz) and other frequencies in use for non-contest purposes. The station must use the same callsign throughout the contest and may not change its location.

2. Contacts: Contacts will consist of the exchange of the following minimum information: callsigns of both stations (**including any /P suffix**) signal reports, standard RS(T) system serial numbers: a 3-digit number incremented by one for each contact starting at 001 for the first contact. locator (i.e. full 6-character IARU Universal Locator for the location of the station).

Information must be sent to, and received from, each station individually using **just** the 2m band, and contacts may not be established with more than one station at a time. Simultaneous operation on more than one frequency is not permitted.

If a non-competing station is worked and unable to send their full Universal Locator, their location may be logged instead. However, for a square to count as a multiplier (see rule 4), a full 6-character locator must have been received in at least one contact with a station in the square.

Contacts via repeaters, satellites, or using digital voice modes (including D-STAR, Fusion, DMR and Echolink) and data modes or machine-generated modes such as FT8, JT65, RTTY and PSK31 are not permitted. Neither is the use of DX Clusters, ON4KST chat (even just logging on), social media or any other method of enabling contacts or contest exchanges.

3. Power: The output power of the **transmitter or transverter** final stage must not exceed **5 Watts** peak envelope power (PEP). If the equipment is capable of higher power, the power must be reduced and measured by satisfactory means. With most modern transceivers, power can be reduced by using a menu setting.

An alternative is to apply a (variable) negative voltage to the transmitter ALC line reached via the accessory socket, **Fig. 1**. Stations cannot rely on feeder loss to meet the 5W power limit.

The output power can be accurately measured using the simple circuit of **Fig. 2**. Connect this to the 50Ω output of the transmitter and adjust the power so that the voltmeter does not exceed 21.7V on a 'good whistle' into the microphone.

4. Scoring: Each contact will score one point. The total number of points gained during the contest will then be multiplied by the number of different locator squares with which contacts were made (a 'square' here is the area defined by the first four characters of the IARU Locator).

Example: 52 stations worked in IO81, IO90, IO91, IO92 and JO01 squares; final score = $52 \times 5 = 260$.

Only one contact with a given station will count as a scoring contact, even if it has changed its location, e.g. gone /M or /P. If a duplicate contact is inadvertently made, it must still be recorded in the log and clearly marked as a duplicate (not necessary in computer log files).

5. The Log: Logs must contain the following information for each contact:
time (**UTC – not BST**)
callsign of the station worked (**including any regional secondary locator and any /P suffix**)
report sent (e.g. 56)
serial number sent
report received (e.g. 54)
serial number received
locator received

The preferred form of a log is a computer file in REG1TEST, .log, .adi or .edi formats sent by email. This may be generated by contest logging software such as MINOS or E15DI's SDV, provided it contains all the information listed above. Alternatively, a file in any other suitable format (such as the spreadsheet available on the contest website) or in plain text, provided each of the items above is separated by a separating character such as a comma or tab, is acceptable. Give the file a name including the station callsign (e.g. g6mxl-p.log), and send as a standard email attachment to **entries@pwcontest.org.uk**. **Email entries will be acknowledged within 8 days.** If there is any problem with your entry, you will be contacted by email.

Log sheets and covering information sheets for paper-based entries are available for downloading from the contest website:

www.pwcontest.org.uk

6. Entries: The covering information listed below must be provided with each entry. Please submit this using the online facility on the website. For postal entries, it should be written on a separate sheet of A4-sized paper.

The information required for every entry is:
name of the entrant (or of a club etc. in a group entry) as it is to appear in the results table and on the certificate
callsign you transmitted during the contest, **including any regional secondary locator required to identify your country and any /P suffix** (e.g. G6MXL/P)
name and address for correspondence
location of the station during the contest
full 6-character locator you transmitted during the contest

whether single or multi-operator (a single operator is an individual who received no assistance from any person in operating the station, which is either his/her permanent home station or a portable station established solely by him/her); if multi-operator, include a list of operators' names and callsigns
a full description of the equipment used, to include transmitted PEP output power
if the transmitting equipment (including any transverter employed) is capable of more than 5W PEP output in the 144MHz band, a description of the methods used to (1) **reduce** and (2) **measure** the 144MHz output power
antenna used and the approximate station height in metres above sea level (ASL)

the following declaration must be included in the email text or written and signed by the entrant: *"I confirm that the station was operated within the rules and spirit of the event, and that the information provided is correct"*.

Failure to supply the required information may lead to loss of points or disqualification.

Entries by email must be sent to

entries@pwcontest.org.uk

Paper entries should be sent to: Practical Wireless Contest, c/o Colin Redwood G6MXL, 53 Woodpecker Drive, Poole BH17 7SB.

Entries must be received not later than Tuesday 2 July 2025. Late entries will be disallowed.

Any other comments about the station, the contest and conditions during it are welcome along with photographs. Please note these cannot be returned and may be published in Practical Wireless or on the contest website. Please send them by separate email or post, **to arrive by Tuesday 2 July 2025.**

When entering, you will be asked to agree to the storing and processing of your entry and to the publication of the results. Warners Group Publications data policy can be seen at:

<https://tinyurl.com/5n85tm35>

7. Miscellaneous: When operating portable, obtain permission from the owner of the land before using the site and observe any restrictions on access. Always leave the site clean and tidy, removing all litter. Observe the Country Code.

Take reasonable precautions to avoid choosing a site which another group is also planning to use. It is wise to have an alternative site available just in case.

8. Poor Signals: Make sure your transmitting equipment is properly adjusted and is not radiating a broad or poor-quality signal, e.g. by over-driving or excessive speech compression. On the other hand, be aware that your receiver may experience problems due to the numerous strong signals it will have to handle, which may lead you to believe that another station is radiating a poor signal. Before reaching this conclusion, try heavy attenuation at the received input. Using a high-gain RF preamplifier is likely to worsen strong-signal problems, so it is best to be able to switch it off when necessary.

If after making the checks above, you are certain that another station participating in the PW 144MHz QRP contest is radiating poor quality signals, please call the station, giving your callsign, and tell them about the problem. You cannot expect a station with a poor signal to do something about it if they are unaware! If you receive or send a report of poor-quality signals, you must record on the cover sheet full details of the complaint including time, callsigns of stations involved, nature of complaint and actions taken **during** the contest to investigate and resolve.

9. Adjudication: Points will be deducted for errors in the information sent or received as shown by the logs. Unmarked duplicate contacts in paper-based logs will carry a heavy points penalty. Failure to supply all the information required in Rule 6 may also lead to deduction of points. A breach of these rules may lead to disqualification. In the case of any dispute, the decision of the adjudicator will be final.

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Tim Kirby GW4VXE
gw4vxe@icloud.com

Many readers will be familiar with the concept of moonbounce or Earth-Moon-Earth (EME) communications. With the advent of digital modes such as JT65 and Q65 it has become relatively commonplace and even quite modest stations have been able to experience the thrill of making a contact with a station by bouncing signals off the moon.

When I read a story from the Deep Space Exploration Society (DSES), **Fig. 1**, about a project to bounce signals off the planet Venus, I did a double take, wondering if this was a rather elaborate April Fools' story. But no! You can read the full story, written by **Paul Sobon N00T** at this link:

<https://tinyurl.com/4zpz3bc2>

It's worth summarising the story though – with grateful thanks to Paul Sobon and the DSES.

In March 2009, a German AMSAT-DL team had successfully reflected a 13cm signal off Venus using approximately 6000 watts of continuous wave transmission (under special governmental authorization) with the Bochum Observatory's 18.3 meter dish. The concept resurfaced in January 2023 when **Alex Nersesian K6VHF** joined The Deep Space Exploration Society. DSES developed a proposal for the DSES Board of Directors, outlining their intention to utilize the amateur radio legal limit of 1500 watts RF power on 23cm wavelength band - significantly less power than previous experiments. Following thorough deliberation, the board approved the DSES initiative, commencing the race against time. Venus would reach its closest approach to Earth in March 2025, giving the DSES team just one year to secure funding and develop a system capable of generating 1500 watts of continuous RF transmission for the approximately five-minute round-trip signal journey.

By January 2025, Nersesian had finalized a viable design, and we had produced an initial prototype. At this juncture, the DSES team initiated collaboration with other large-aperture antenna facilities, establishing connections with **Wolfgang Herrmann** at Astropeler in Stockert, Germany, and **Dick Harms** at Dwingeloo in the Netherlands - both operating 25 meter dishes.

Thomas Telkamp from Dwingeloo independently analyzed the initial path loss link budget and concluded that Earth-Venus-Earth communication was infeasible under the estimated parameters. Telkamp's calculations indicated path losses exceeding initial estimates by at least 24dB, effectively eliminating any possibility of signal detection using the digital Q65 mode. After a thorough review, DSES concurred with his analysis.

Concurrently, looking for ways to make up the 24db shortfall with larger receiving antennae, a West Australia DSES team member, **Mark Drayton**, engaged with the Commonwealth Scientific and Industrial Research Organization (CSIRO), which



Venus bounce?

Tim Kirby GW4VXE has a packed column, starting with a rather unusual experiment.

operates the 64-meter radio telescope at Parkes Observatory, Australia. While interest existed, authorization proved unattainable within their timeframe. Potential support for a 13cm experiment in October 2026 remains under consideration.

DSES member **Michelle Thompson**, co-founder and CEO of the Open Research Institute (ORI), and colleague **Lee Blanton** developed a sophisticated mathematical model reassessing the link budget with additional parameters (link below). After weeks of ORI collaboration with the DSES and Dwingeloo team, and running multiple simulation scenarios, Thompson determined that utilizing a continuous carrier wave with a Rubidium clock frequency stability might enable Venus signal detection.

<https://www.openresearch.institute>

On March 22, 2025, Haswell and Dwingeloo prepared to transmit 23cm signals toward Venus. Dwingeloo had secured authorization from the Dutch Authority for Digital Infrastructure (RDI), which determines which frequency you can use (their regulatory equivalent to the FCC) to transmit power at one kilowatt within a two-hour window at 1299.5MHz. Due to recent GNSS navigation system protection protocols, the Dwingeloo team moved their frequency up to 1299.5MHz, to avoid any chance of interference to the primary user of the 23cm band. Europe's earlier viewing window with Venus allowed them to commence testing before the USA. The RDI staff was also excited and brought their whole office to see it happen. After four transmission sequences, their time ran out.

By this point, the DSES mutual observation window of Venus with Dwingeloo and Astropeler was diminishing, limiting their transmission to a three-minute window using a non-GPS-controlled ICOM 705 transceiver. These abbreviated transmissions proved insufficient for European stations to detect a Venus-reflected signal.

Fortuitously, despite equipment failure after four transmissions in the EU, both Dwingeloo and Astropeler successfully processed their data and confirmed signal detection - with signal strength as the mathematics models anticipated with the Doppler spread. The experiment, conceptualized years earlier, materialized on March 22, 2025, through the dedicated collaboration of numerous individuals across two continents.

The chart, **Fig. 2**, is courtesy of Dwingeloo, NL and Astropeler DL Radio Astronomy.

What an amazing story! Although it's not as if a two-way Earth-Venus-Earth contact has been made, it's exciting to learn that signals were detected.

Breathing new life into FT-290, FT-790 and FT-730 transceivers

Steve Macdonald G4AQB (Bolton) writes, "With all the interest in the 145 Alive and 433 Alive events recently, it is good time to dig out your old Yaesu Transceivers not used for years. Unfortunately, if you are using a FT-290, FT-790 or FT-730 you may find that the displays have disintegrated! (see photo, **Fig. 3**) This was very common with the old

Fig. 1: The Control Room at the Deep Space Exploration Society in Colorado, monitoring the attempt to bounce 23cm signals from the surface of Venus. **Fig. 2:** It worked! Processed data, showing the 23cm signal reflected from Venus. **Fig. 3:** An old FT-730 with a damaged LCD display, which can be repaired as G4AQB describes.

LCD displays used at that time. Without a display it makes the radio almost unusable, however, all is not lost. I have managed to replace the broken LCD displays on all three transceivers for an OLED driven by an Arduino Nano Microcontroller that works well (see photo, **Fig. 4**) First, I replaced the display in a FT-290R and followed the instructions written by **Nigel Stevens G6RZR**.

https://g6rzt.com/?page_id=1281

"I then used the same instructions for the FT-790 and FT-730 as they have the same display driver. You will need to change the connections of the colours on the display plug cable as the wires are in a different order, this can be done easily by looking at the circuit diagrams and comparing it to the instructions by G6RZR. It is quite a fiddly project, but very satisfying when the display works again!"

What a fantastic project! I know there are many, many of these rigs around and it would be good to think that this could help see get at least some of them back on the air.

SVXLink

Jef VanRaepenbusch ON8NT writes about SVXLink and says that in the Flemish part of Belgium 14 UHF repeaters are linked together, in this way giving more activity on FM repeaters and better coverage. You can see some of the linked repeaters shown on these dashboards:

<https://tinyurl.com/4twnyudh>
and

<http://35.189.215.208>

In the UK, SVXLink is used too and you can see some of the linked repeaters and nodes here:

<http://portal.svxlink.uk:81>

and with some information about setting up nodes here:

<https://g4nab.co.uk/svxlink>

Analogue hotspots such as this can be used to connect to the network:

<https://shop.rf.guru/products/2025-ce-041-u>

Irish beacon cluster

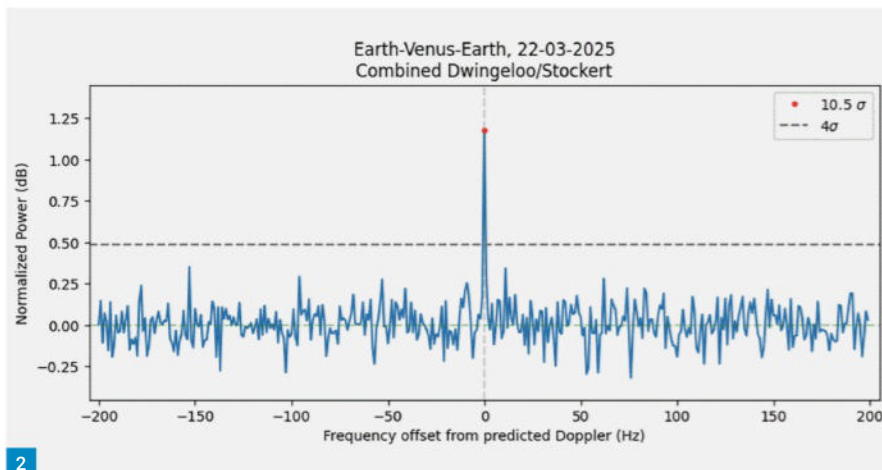
John Desmond EI7GL, **Ray Bokor** and **Paul Farley G7PUV** all kindly reported that the Irish 40, 50, 60 and 70MHz beacons are on again from their new location. They transmit in a sequence as shown in **Table 1**.

You can read more details on EI7GL's blog at:

<https://tinyurl.com/y3fzsjax>

The 8m band

Roger Laphorn G3XBM (Cambridge) is looking forward to the Es season although he hasn't been



2



3

on much of late. Roger says that he probably won't renew his 8m permit, feeling disappointed with the negative attitudes of RSGB, OFCOM and FCC.

Paul G7PUV, operating on the band as G9PUV, says that F2 has pretty much fizzled out with just the path to South Africa clinging on! Paul says that as there have been some signs of Es on 10m recently, he's hopeful that will soon start to affect 8m.

The 6m band

Tony Collett G4NBS (Cambridge) is back on the air, with building works progressing, although he can currently only use his aerials at restricted height. Tony worked TZ1CE last month. On 6 April, Tony noticed FT8 activity and saw several loud EA stations although he wasn't able to make any QSOs. Tony also saw ZD7BG pop out of the noise around 1830, Tony called him, got a report but unfortunately didn't decode the RR73 (although he knows it was sent).

Roger G3XBM has been on using 6W of FT8 and has had spots across Europe but no real DX.

Dave Edwards G7RAU (The Lizard) was one of the lucky ones who worked DP0GVN in Antarctica on the band in early April. Dave says that they peaked well over S9 on the meter. Interestingly, apparently, the station was using 100W from an IC-7300 through a long length of feeder to a broadband dipole. Dave says the signals were there

Min	Callsign	Freq	Power
0	EI0SIX	50.004	30W
1	EI1MMH	40.013	25W
2	EI0SIX	50.004	30W
3	EI1MMH	60.013	20W
4	EI4RF	70.013	25W
5	EI1MMH	40.013	25W
6	EI0SIX	50.004	30W
7	EI1MMH	60.013	20W
8	EI4RF	70.013	25W
9	EI1MMH	40.013	25W

Table 1: Irish beacons sequence

for hours! Dave says that other countries heard/ worked over the last few weeks have been PY, CE, LU, CX, 9Y, 9J, J79, KP4, VP8, ZS, 5Z4, 3B9, V5, XV and VK on various days. Brazil and South Africa are heard most days although with a low SFI, the openings are very brief. St Helena is often heard in the evening, so perhaps there is still some hope of working DP0GVN!

Here at **GW4VXE** (Goodwick) I missed all the DX, although did catch some Es to Scandinavia on 23 March, working SM6MNS (JO67) and SA4JEA (JP70). Late evening on 8 April, saw the band open into Spain when I worked EA5QE (IM98) as well as **Roger EI8KN**.

The 2m band

Jef ON8NT (Aalter) worked M0ICK/P (IO93) on SSB

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Fig. 4: FT-290, FT-730 and FT-790 all with repaired LCD displays. Fig. 5: Ken M0BQH. Fig. 6: Test DAB transmissions from Ireland as received by Adam Wisner in Cheltenham.

on 2 March and G0LTG/P (IO81) on CW on 4 March. On 5 March, on FT8, Jef worked GW4HDF (IO81).

During the 145 Alive session on 12 April, **Ken M0BQH** operated from close to the beach side at Moreton shore on the Wirral, using his Baofeng UV-5R and a homemade T2LT Flowerpot aerial attached to a 6ft electrical conduit tube, **Fig. 5**. Ken's best DX was 150km to G4ATH at Gummars How in Cumbria.

Also, during the 145 Alive event, **Nick M1DDD** operating from the Peak District made an impressive contact into Devon, which again, is a good distance for FM.

Dave G7RAU says that in early April, the ED1ZAG/b beacon from IN53 has been up to S9+50 with French beacons similarly strong. Dave's TV reception was interrupted by signals from France and Spain!

Steve Rawlings G4ALG (Lydney) has his new aerials on his main mast and is pleased with their performance. He mentions how active John G3YPZ (Long Sutton) is on VHF CW and is very grateful for the useful reports that he's received during the development of Steve's homebrew antennas. Steve mentions the following stations as being regularly active during Two Metre Tuesdays: **Ken G3LVP** (Cheltenham); **John G3TYB** (Sittingbourne); **John G3YPZ** (Long Sutton); **Pete G4IOA** (Cheltenham); **Andy G4KKU** (Bristol); **Allan G4NNJ** (Lydney); **David G4OGW** (near Hereford); **Ken G4HRH** (Felixstowe); **Mike G8EJN** (Minchinhampton); and **Paul M0GSX** (Dudley).

The 70cm band

During the April UK Activity Contest, **Allan Duncan GM4ZUK** was active from near Slains Castle near Peterhead in IO97 square as GM4ZUK/P. Allan made 53 contacts with the best DX being an SM in JO66 square as well as plenty of contacts to the south. Allan says it's the first time he has been portable on 70cm in around 25 years!

Stewart Cooper G4AFF (Norfolk) was active during the April UK Activity Contest and says that GM4ZUK/P was a huge signal throughout the event. At the start of the contest, Stewart heard the OY6BEC beacon, having been prompted to listen by Allan. The beacon was around S1, but unfortunately there were no other contacts in that direction.

Tony G4NBS was also pleased to work GM4ZUK/P for a new square during the UKAC and as Tony says, on SSB rather than data! The tropo didn't reach Tony during the contest, although he worked a good number of Dutch stations in JO21/JO22 for a change.

Roger G3XBM is always surprised how many QSOs he can make with 10W PEP on SSB and his 2m big wheel, during the UK Activity Contests.

During the FT8 Activity Contest in early April, Dave G7RAU worked a few stations in locators JO01, JO02, JO03, IO62 and IO91.

Steve G4ALG says that he made his first portable outing of the year on 11 April when he took part in the 70cm Friday CW activity from Ruardean

(IO81RU) in the Forest of Dean. Running 5W, Steve worked M0GSX (Dudley), G0SDD (Bream) and G3YPZ (Long Sutton).

The 23cm band

On 18 March, Jef ON8NT copied the GB3MHZ/B beacon in JO02 and worked G3XDY (JO02) on CW.

During the contest in early April, Dave G7RAU found conditions above average and worked stations in IO93, IO91, IO90, IO81, IO71, IO74, JO01, JO02 and JN18. The best DX was F6DKW (JN18) at 555km.

Steve G4ALG says that he has started his next antenna project, a portable Yagi for 23cm. He is hopeful of being active from the local hilltops by the end of August, using an SG Labs transverter.

The 3cm band

Stewart G4AFF says that he is yet to make a QSO on the band but that he is hoping to do some tests with G3SGC soon.

Satellites

Jef ON8NT reports that **Patrick ON4PN**, gave a presentation (in the UBA-TLS/ARCDP radio club in De Pinte (Belgium)), of a 'portable QO100 station, that fits in a rucksack' with a 33cm dish! Here is some information of the different components used in his setup:

<https://tinyurl.com/ycy385ed>



Once again this month, Jef has been very active on RS-44 using FT4 and has worked the following stations: LA2XNA (JP50), EA3DME (JN01), OZ3AEV (JO55), LB2WG (JO59), G1YEF (IO83), EB3FWC (JN11), SV1ABB (KM18), EA3DME (JN01), N2YZH (FN22), W2GDJ (FN32), M0LNB (IO91), EA3GCV (JN01), EA3HAH (JN01) and EA3EA (JN01).

Patrick Stoddard WD9EWK (Phoenix) writes with his usual interesting round up of satellite activity. "Satellite operating continues, with the recently completed FRAM2HAM mission flying over the poles, complete with a scheduled contact between **Rabea Rogge LB9NJ/KD3AID** and the Technical University of Berlin using an Icom IC-705 mounted inside the Crew Dragon craft, followed by SSTV transmissions during much of the mission. The contact with the university is in a video:

<https://youtu.be/bmyXfmfhTJE>

"As we move into springtime, more operators are starting to go out and work satellites from different places. I have been doing that here in Arizona, before the summertime heat reaches the deserts here. I saw a mention that **Mark N8TLV/VO1ONE** plans to visit an island in Nunavut, in northern Canada, working satellites and HF as VY0SAT from the rare grid EP28. Mark is also planning to activate a POTA park for the first time while he is there. It will be interesting to see how well he does out there. Mark is a long-time satellite operator, having been on the birds for many years while attending university in St. John's, Newfoundland, and regularly operating from the Signal Hill site in St. John's. Newfoundland is a great

place to work stations across much of Europe and North America via satellite.

"In March, I made another trip to southern Arizona and the rare grid DM31, while **Endaf N6UTC/MW1BQO** went to central California. Endaf activated three grids around Kettleman City (CM95, CM96, DM06), between Los Angeles and the San Francisco Bay Area along the I-5 freeway. Those grids, along with grid DM05, come together near Kettleman City, and I appreciated Endaf's road trip to put those three on the satellites - adding to my satellite VUCC from that area of southern Arizona. Endaf and I were happy to make contacts with other stations from our respective locations that day.

"SO-124, AKA HADES-R... this small FM satellite has been popular. AMSAT-EA started scheduling digital modes on Wednesdays (UTC time) in March and April. One of the Wednesdays in April was dedicated to digital voice. D-Star works through the normal FM repeater, and many satellite operators already have D-Star in the Icom IC-9700. These schedules for digital operators haven't been widely publicized, and the digital voice Wednesday saw a lot of FM activity on those passes. In an ironic twist, I was able to work stations using D-Star on the days leading up to the digital voice Wednesday on 9 April. AMSAT-EA has just launched HADES-ICM, which is going through testing before it is opened up for satellite operators."

FM and DAB DX

Adam Wisher (Cheltenham) says that he has been

enjoying the recent tropo to receive the DAB tests from Ireland on block 7C, **Fig. 6**. Adam says that the signal has locked several times in the recent tropo, especially in the mornings and says that at one point it was strong enough to receive on his Majority portable radio and telescopic whip. Adam uses the QIRX software an RTL-SDRv3 dongle and a 3-element DAB Yagi. Adam says that the 7C signal is from Three Rock Mountain near Dublin, running 20kW ERP but that there are other sites testing, including 5B (Mount Oriel, Louth) and 10D (Saggart Hill, west of Dublin), but Adam hasn't received those yet.

Simon Evans (Twynning, Gloucestershire) says that on 10 April he had a tropo lift well into France and the best DX was France Musique from Bourges at a distance of 629km on 91.8MHz.

On DAB, Simon had a tropo opening into the low countries on 5 April and says that a couple of ensembles came in from Goes in the Netherlands (5B and 4C) and that on 7 and 10 April on 5B, signals came in from Caen. Simon also notes that a new ensemble has opened for Poole on 9C and that he receives this on some days.

Simon also mentions the Irish DAB trials run by FailteDAB which you can read about here:

<https://failedab.ie>

Finally!

Another packed column – thanks for all your varied news across the VHF/UHF spectrum. See you again next month. **PW**

Broadcasting history

Join **Keith** and **Garry** once again for a canter through the archives.

Keith Hamer

Keith405625.kh1@gmail.com

Garry Smith

Garry405625.gs@gmail.com

BBC coronations: Part XXVI

The original plan for television coverage in Europe of the Coronation on 2 June 1953 was for the French television service, *Radiodiffusion-Télévision Française (RTF)* to provide a direct link from Cassel to Lille of the BBC 405-line signal. Meanwhile, the Dutch broadcaster, *Nederlandse Televisie Stichting (NTS)*, in co-operation with the *Institut National Belge de Radiodiffusion (INR)*, the Belgian French-language television service), and the *Belgisch Nationaal Instituut voor Radio-Omroep (NIR)*, the Flemish-language service), arranged for the signal to be relayed across Belgium to Lopik in the Netherlands via relay points at Flobecq, Brussels, Antwerp and Breda. The conversion from the BBC 405-line standard to the European 625-line system was planned to be carried out at Breda. In the Netherlands, the signal was broadcast by the Lopik transmitter and the associated outlet at Eindhoven.

From Breda (Belgium), the 625-line signal was taken via four centimetric-wave links to Cologne where it was fed into the *Nordwestdeutscher Rundfunk (NWDR)* television network which served the Köln, Langenburg, Hanover, Hamburg, Berlin and Frankfurt-am-Main transmitters.

According to our copy of the *List Of Television Stations No. 5*, published by the *European Broadcasting Union* on 1 March 1960, INR used the 819-line standard whereas NIR employed the 625-line system. The synchronising waveform of the Belgian 819-line system was different from the French 819-line standard. INR broadcasts were based on the 625-line, 7MHz system. Does anyone know if this was the situation in 1953?

The accompanying audio consisted of sound effects from London (free from any description), the BBC commentary in English, and the RTF narration in French. The European countries relaying the programme were given the opportunity of taking the sound effects and superimposing either their own commentary, or the English and French commentaries as appropriate.

Vintage coronation audio equipment

This month's excursion through vintage copies of dilapidated newspapers and magazines has revealed an advertisement by *The Trix Electrical Co. Ltd.*, **Fig. 1**. The advertisement dates from

May 1953.

The text has been left in its original format to reflect the spelling, grammar and punctuation of the time. This is the full text of the company's advertisement offering various equipment for the Coronation.

The Trix B65 equipment was designed in the Fifties for use on motor coaches. The B65/MX was a small, simplified, battery-operated amplifier, which provided an output of 5W.

100 years ago: June 1925

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

1 June 1925, saw the opening of the Japanese radio station, *JOBK*, in Osaka. This was one of the first three local radio stations to receive permission from the government to start broadcasting. The other locations were based in Tokyo and Nagoya. The three stations were the forerunners of the national public-service broadcaster, *Nippon Hōsō Kyōkai (NHK)*.

On 13 June, **Charles Francis Jenkins** achieved the first synchronised transmission of a moving silhouette (or 'shadowgraph') with sound, using a mechanical 48-line system. A 10-minute film, showing a miniature windmill in action, was sent from Anacostia to Washington, DC, a distance of approximately 8km. The images were viewed by representatives from several influential organisations, including the *National Bureau of Standards*, the *United States Navy* and the *Department of Commerce*. He described this event as "the first public demonstration of radiovision". The equipment used a Nipkow disc with various lenses.

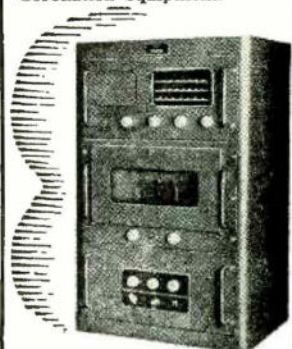
He later progressed to sending films by radio from a standard domestic projector to a small screen on a radio receiver in his laboratory.

The well-known British television newsreader and broadcaster, **Richard Baker**, was born on 15 June.

On 17 June, a new Spanish radio station began broadcasting, mainly for listeners in Catalonia. *Unión Radio de Madrid (EAJ-7)* was a commercial station, inaugurated by **Alfonso XIII**. This station had previously been formed as a company in November 1924 by **Ricardo Urgoiti** with the participation of leading Spanish electrical companies. EAJ-7 (formerly known as *EAJ-20*) initially began broadcasting without a government licence. Between 1925 and 1930, it was the first to create a chain of commercial stations in Spain.

SOUND'S GOOD!

Sound amplification is only as good as the equipment can make it. Through TRIx installations it always sounds good—for TRIx have pioneered the development of equipment for faithful reproduction and equally faithful service. Ask for specifications of our wide range—place your orders NOW for Coronation equipment.



Model RGA 3/633 enclosed rack-type Radio-Amplifier equipment. Combines amplifier with radio and 3 speed record changer.



This TRIx Portable Battery equipment, B65, is unique, being self-contained with amplifier, speaker, 6v accumulator and microphone.

TRIX

The TRIx ELECTRICAL Co. Ltd.
MAPLE PLACE,
TOTTENHAM COURT ROAD,
London, W.1. MUSEum 5817
Telegram: Trixadio Wesdo London.

1

"SOUND'S GOOD!"

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MAPLE PLACE, TOTTENHAM COURT ROAD. London.
W.1. MUSEum 5817

Telegram: Trixadio Wesdo London."



Fig. 1: An advertisement placed by *The Trix Electrical Co. Ltd.*, in May 1953 for their Coronation audio equipment.

Fig. 2: The Radio Zürich studios located at Brunnenhofstrasse in 1933.

Fig. 3: One of the first Outside Broadcast units to be used by Radio Zürich. Many vehicles used by +PTT Postauto (the Swiss post-bus service) were manufactured by Saurer AG.

One of the most unusual BBC radio Outside Broadcasts came from the underground working of *Nunnery Colliery* at Darnall, near Sheffield, on 27 June 1925.

The rise and fall of 198kHz: Part XIX

In preparation for broadcasts of the new *Scottish Regional Programme* from the Westerglen transmitter, test transmissions were broadcast from 2 May 1932. The tests were radiated outside normal programme hours.

The alternative *Scottish National Programme* began public test transmissions on Monday 22 August 1932.

The old transmitters based in Glasgow, Edinburgh and Dundee were subsequently closed down, although they were kept on standby in case of any breakdowns at Westerglen.

When the full service was officially launched on 25 September 1932, the *Scottish Regional Programme* began broadcasting programmes specifically designed for a Scottish audience.

60 years of BBC-2: Part XV

The official opening of BBC-2 on the evening of 20 April 1964, had to be delayed until the following morning due to a total power failure at the *Battersea Power Station* in London. This resulted in the first programme being *Play School* for the under-fives!



Radio Times described the programme as follows: "Are you an exhausted parent of a child under the age of five? If so, *Play School* may be just what you are looking for. Without actually leaving home, for half an hour every day (from Monday to Friday, beginning today, Tuesday), your child can benefit from the advice of leading authorities on nursery education and enjoy the undivided attention of a changing panel of presenters.

"Every day our story chair will be occupied by a storyteller of outstanding talent - in this first week **Athene Seyler**, followed by **Charles Leno**, **Eileen Colwell**, and **David Kossoff**. Through our magic windows we shall invite children to explore the real world which they long to discover - the world of buses and elephants, flowers and snails, rain and shadows. There will be a *Pets' Corner*, a *Play School* garden, songs, and surprises, and opportunities for joining in both new and traditional games."

The authors aren't quite sure what happened to this lofty idea. All they can remember from fleeting glimpses of the programme (admittedly when they were well and truly over the age of five) are Humpty, Little Ted, Big Ted, Jemima, the three shaped windows, the *Play School* clock

with music, and various presenters, including **Brian Cant**, **Johnny Ball** and **Floella Benjamin**! The programme aired for 24 years until it was replaced in 1988 by *Playbus*, which soon became *Playdays*.

Service information, Switzerland: Part XXVIII

Prior to 1932, the *Radio Basel* co-operative was able to accommodate its studios in rooms at the local railway station owned by the *Schweizerische Bundesbahnen (SBB)*. When the radio service expanded, the studios moved to an historic villa in *Margarethenpark*.

Radio Zürich opened the first studio in German-speaking Switzerland in 1924 in *Amthaus IV*, located on *Uraniastrasse*. The programmes at that time mainly consisted of music, played 'live' by a small house-band. Other programme formats were soon introduced, including song evenings, lectures, and children's programmes. An hour's programme was specifically reserved for women.

When broadcasting operations began to expand, the studios moved into a commercial building on *Sihlporte* in 1927. In 1933, the studios moved once again, this time to *Brunnenhofstrasse*, Fig. 2.

Radio Zürich began experimenting with broadcasts produced away from the studios. One of the first Outside Broadcast units (known then by the Swiss as a *Reportage-Wagen*) is shown in Fig. 3. The vehicle was designed and manufactured in Arbon, Kanton Thurgau, Switzerland, by *Adolph Saurer Aktiengesellschaft*.

Stay tuned!

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

Roger J Cooke G3LDI
 roger@g3ldi.co.uk

Norfolk ARC recently held two meetings locally in Norwich. Our club meets at the local City of Norwich (CNS) School and we were asked to take part in their Super Science Saturday. This involves several different aspects of the hobby, but one of the most popular with the youngsters is the display that **Jim G3YLA** usually mans. He demonstrates the use of Morse and gives a challenge to each youngster to look at the code and work out what their names are in Morse and then send it on the Morse key on the bench, a straight key obviously!

If they are successful, Jim then presents them with a 'Morse Code Certificate' stating that they were able to send their name. This is always very popular with the youngsters.

I well remember my own experience when I was about 12 or 13. My Dad found a piece in the newspaper about the local amateurs demonstrating the hobby so I went along. There they had somebody operating on the key, talking to another local. Now whether this was a genuine 'radio' link or just a link to another room I don't know. I was asked my name and then asked to send a message to the 'other amateur'. He replied with a personal message to me and I was hooked!

Jim also set up a station in the Forum in Norwich when the Club put on another display for Science Week. This was even more popular because it involved the general public, whereas the school display was for pupils only. At the Science Week Jim found there were also quite a number of adults interested.

Catching them when they are young and impressionable is the way to go. At the School display Jim gave around 25 certificates away and at the Science Week he was inundated with people who wanted to send their name and he managed over 50 certificates there!

Taking pictures of youngsters is fraught with problems, from the legal aspect in this modern age, but we did manage a picture of one youngster using the Morse key but without any identification. Hence it is a rear view. **Fig. 1**.

SleepyGal

You might wonder what relevance this header can have to CW! I was talking with **Jose KP3W** on an FOC Zoom meet and he showed us his bug key. This, I would think, must be a unique key as you can see from the picture, **Fig. 2**. I am not sure of the process involved with getting the picture onto his key, but it makes a change from the usual keys and gives a new perspective when using it!

I must admit however, it does nothing for the actual keying. I worked Jose in the BWQP and I



Teach 'em young!

Roger Cooke G3LDI starts his column with a report on some public demonstrations of Morse code.

would not rate very highly the CW coming from the bug key. I feel there is no improvement added by the picture on the key, but each to his own.

Giving back.CWopsscheme

I saw this email from **Stew GW0ETF**, **Fig. 3**, on the CWops reflector and thought it worthy of a mention in my column.

I'm called by a variety of CW users during my 'Giving Back' sessions, including some just after the GW prefix. But most are QRS, many are clearly learners dipping their toes and I often get nice follow up emails. I thought I'd share a couple of quotes from the latest after a 25 minute rag-chew on 7.037MHz at their 'upper copy limit of 16wpm':

"Many thanks for the nice QSO this evening. I haven't been on the air much in the last couple of weeks but I thought I'd get some copy practice by listening to a web-SDR on my phone. I heard you calling CQ DE GW2CWO, so I went upstairs and connected the radio....."

".....Thanks for all you do for the hobby. I used CW on air for the first time last summer and I really enjoy it. I'm seeing steady improvement in my copy speed, thanks to ops like yourself who are patient and encouraging".

*It's very rewarding and gives me a warm glow of satisfaction when this happens. I'd recommend it! If anyone is kicking around the shack around 7pm local time looking for something to do why not wind the speed down and give it a go. You may inspire a new CW op. If you like it and feel you can do this most weeks, **Rob K6RB** will put you on the*

schedule but anyone can do it as a one off - 7pm local time, normally on 40/80 or 30m. Details at: <https://cwops.org/giving-back>

73, Stew GW0ETF

This scheme should be more widely known and used by more experienced operators who want to encourage those trying their hand at becoming good CW operators. Originally intended as a way to provide practice for CW Academy students, the Giving Back programme is really open to anyone who wants to enjoy a casual, conversational QSO.

Most Giving Back volunteers get on the air, at 7pm their local time, and look for opportunities to QSO at a moderate speed (15-20 wpm). During northern hemisphere winter months, they can be found on 40 and 80m, and during the northern hemisphere summer months, you will find them on 20 and 40m. Typical frequencies are 30-39kHz above the lower band edge. You will recognize their CQs by the 'GB' sent before the 'K' at the end (e.g. CQ de K6RB GB K).

FOC operators usually like to make QSOs between themselves on the 025s or thereabouts, so why not try to make a difference to lesser mortals and give them a chance to experience good CW and improve their situation. Do give it some thought and 'make somebody happy'!

New internet site for Newbies

While talking about learning and so on, I was sent this by a local student, **Martin G7RXR**.

This is the website that I mentioned yesterday:

Sign up to our FREE email newsletter at www.mymagazinesub.co.uk/practical-wireless/



Fig. 1: CW at the Science Festival. Fig. 2: The Sleepy Gal key. Fig. 3: Stew GW0ETF. Fig. 4: Betty Webb.

<https://tinyurl.com/5n8xxhvu>

There's lots of interesting stuff there, I found the Instant Character Recognition page particularly useful. There are several parameters you can adjust. I configured it to send characters one at a time followed by a pause of about a second after which it would speak the character in English. My theory was that if I hadn't recalled the character myself after a second it would implant the answer in my memory!

Thanks for all your help and support so far, the journey continues!

The instant character recognition practice looks very interesting, something that most CW programs don't have. If you have difficulty in a few characters, and they are usually the XYZ variety, then try this and get them implanted forever in your memory.

How Practice pays off. (Sort of blowing my own trumpet here! Oh no, I'm a pianist.)

Steve and Marie were a couple in my class and then they went onto CWops Academy. Over the last year they have done pretty well as you can see from this email that Steve sent me.

Hope you are keeping well and that your antennas are still pointing in the right direction!

Marie and I caught the tail end of your CW class last night. We are pleased to confirm that we managed 100% copy! I bet you never thought you would see the day when that happened! It seems so long ago now, when we were struggling to copy anything in your class, I think it must have been about this time last year when we started?

It has been a long journey to get where we are now, and there is still so far to go. Marie and I are currently doing at least six two-hour classes every week, plus many Zoom sessions that we arrange with fellow students. Hearing your students last night reminded us of a time where

we never thought we would ever get to improve, but we have! We still have all the usual problems. I cannot write code fast enough (not helped by arthritis) and I seem to have a 4-character buffer when head copying (after four characters the first ones start dropping off!). Marie's memory buffer seems slightly better than mine.

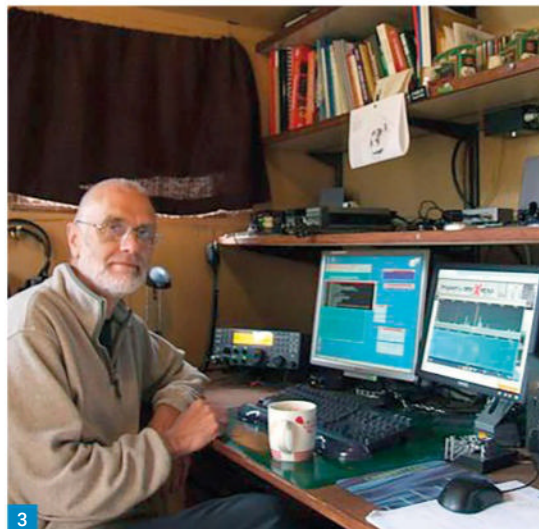
However, I would like to emphasise to your current students that progress is slow. Very slow. So slow that you don't even notice it yourself until somebody points it out to you. This is not a quick fix endeavour; it takes a lot of time and a lot of practice. I believe that it is a never ending journey (we are always striving to improve), but expect two years to become a competent operator (at least for us old people!). But keep going! The rewards are very great. We have found CW to be a lot of fun, and I have a motto, 'The speed will come if you're having fun!' Get some more classes from somewhere, we have found CWops to be very good and we have also just joined the Long Island CW club to see what they have to offer. The point is, to get as much training and information as you possibly can.

I read a quote from **Winston Churchill** the other day which I found very appropriate - 'Success is going from failure to failure without loss of enthusiasm'.

Keep it up! You are doing great!!

Marie and I still struggle with all the usual things, copying, especially head copying, sending good code, but most of all the anxiety of getting on the air! I can practice my callsign a hundred times perfectly but as soon as I press the break-in button it all goes to pot! However, we have met some great people who have always offered understanding, patience and encouragement.

Marie managed 33 QSOs in the recent 9A CW contest! I was very proud of her! I have over 100 QSOs now and still counting. But the anxiety remains! We have even worked a number of CWTs but so fast! Takes ten minutes just to copy the call!



We would like to thank you Roger for starting us off on that first leg of our journey, it has been a pleasure to know you and we wish you well.

73, Steve & Marie M0YRU M7YRU

Areal Morse operator

I was taking a break from writing this column when news appeared on the screen mentioning the death of **Betty Webb**, Fig. 4, at 101 years of age. She was a Code Breaker at Bletchley Park during the war and she was a very revered lady, having been appointed MBE in 2015 and Knight of the Légion d'Honneur in 2021, a prestigious order of merit awarded for both military and civil service in France.

She was even sent to America to help them decipher the Japanese codes. Ever looked at the Japanese Morse Code? Daunting is an understatement!

At the very least, read this PDF and learn more:

<https://tinyurl.com/bdsm5hht>

If you have never been to Bletchley Park, you should!

Please send all your comments, offerings, information and especially pictures to:

roger@g3ldi.co.uk

73 and May the Morse be with you! Roger G3LDI. **PW**

Michael Jones GW7BBY/GB2MOP
michael@gb2mop.org

Tektronix 465

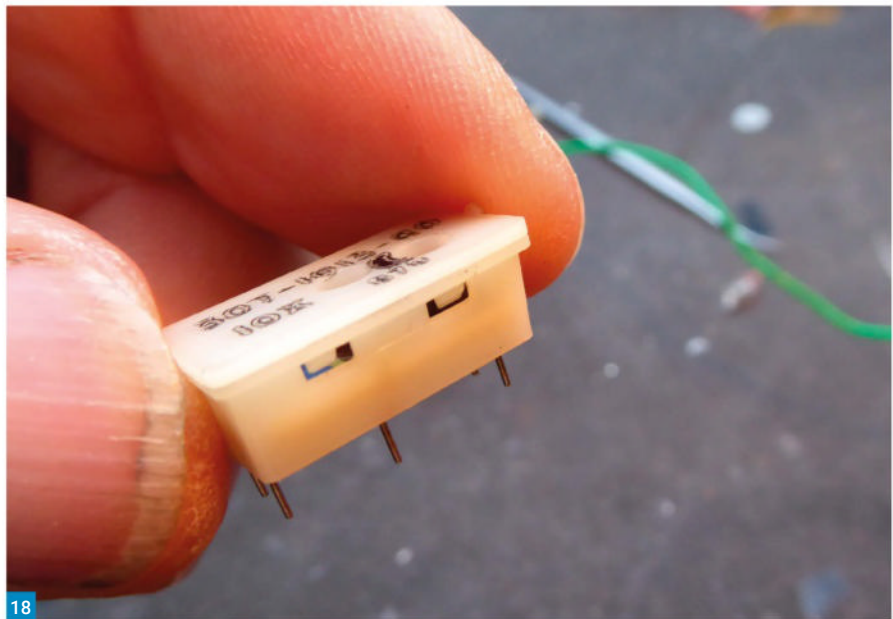
I have had this 'scope for some time. Channel 1 worked perfectly but at first channel 2 did not work at all. After re-seating the attenuator blocks and some of the transistors channel 2 trace was restored but was jittery and showed a reduced amplitude and has been this way for a few years. Now was the time to fix it! A more minor fault was that the channel 1 Un-Calibrated light was not working.

Given that channel 1 was working correctly and channel 2 worked after a fashion I thought that a power supply issue was unlikely. However, if you need to check these the test points are TP1510: +110V, TP1536: +55V, TP1548: +15V, TP1558: +5V, TP1568: -8V

As with the 465B my first move was to clean the attenuator switch contacts with IPA to no avail. However, it was apparent that the attenuator modules, the 100X in particular, was very sensitive to being touched. Swapping channel 2 100X attenuator with the one from channel 1 cured the problem. So, the 100X attenuator was the culprit. The top of these can easily be popped off and looking inside with a magnifying glass the soldered joints looked as though they might be dry: not an unknown problem, **Figs 18 & 19**. I carefully re-flowed the five joints I could reach with a fine soldering iron, the sixth I couldn't reach and left.

I was now left with the problem of the borrowed transistor from the trigger pick-off amplifier that was now in the 465B 'scope. Why, I wondered, was a 2GHz transistor required for a 100MHz 'scope? I can only surmise that it is not the Transition Frequency (f_t) itself that is significant, but the speed is needed to reliably capture very fast rise times. After a bit of research I ordered some BQ241 transistors. These have an f_t of 1GHz and are otherwise very similar to the original part. After fitting these the 'scope worked well but would only trigger up to 85MHz, which is quite respectable. However, I was subsequently able to order the correct part (151-0271-00) from test_equip on eBay and this restored full functionality.

The UnCal light illuminates when the red variable (VAR) control is moved from the calibrated position to variable. It consists of a neon bulb in a white housing with a light pipe to transfer the light to the front panel (see **Figs 21 & 22**). The bulb is a standard miniature neon, 90V nominal striking voltage: 4.8 x 12mm. After prising the light pipe out from the front panel, soldering the replacement in is straightforward but the vertical amplifier board needs to be removed first. I already had the Vertical Amplifier board out for the previous repairs, so it was a convenient repair.



Fault-finding Tektronix Oscilloscopes 465 / 465B / 475 (Pt II)

Michael Jones GW7BBY/GB2MOP completes his look at these useful oscilloscopes.

Replacement of the other neon indicators, X10 Mag, UnCal (Horizontal), Ready, Trig and Low Power is similar.

Tektronix 475

On powering up, either trace 1 or trace 2 would appear depending upon selection, but the trace could not be adjusted above the horizontal centre line of the screen. The operation of the adjustment controls was very noisy and the channel 1 and channel 2 trace vertical adjust controls interacted, that is to say, either trace could be adjusted to a greater or lesser extent by either control, but not above the centreline. The trace would disappear after five minutes or so and eventually it disappeared altogether. The fan was very noisy and the probe coding light for X1 was not working.

The fact that no trace was visible was a concern as that would point to an EHT issue. However, pressing the Beam Finder either showed the beam, or if it was off the screen, a green haze with the intensity turned right up showed some activity so I put the possibility of an EHT issue to one side while I considered other options.

Check voltages

All the low voltages checked out correctly and remained so for at least 30 minutes. Note that on the 475 the test points are marked with the voltages: +50V, +15V, +5V, -8V, -15V and 110V rather than test point numbers as in the 465 and 465B. It was still possible that a faulty tantalum capacitor might be causing issues without pulling the power rails down. These 'scopes are renowned for strange faults caused by failing tantalums. Tantalum capacitors can be replaced with ordinary modern electrolytic capacitors provided that the working voltage is equal to or greater than that of the original tantalum part. Ideally, they should have a low Equivalent Series Resistance (ESR) although this is not critical. The main smoothing capacitors can fail. They are not difficult to replace, but a lot of dismantling is required to access them.

With this in mind I set about a visual inspection for discoloured tantalums or shiny spots where the tantalum metal has punctured the coating. What I did find was a rather browned-off resistor, R916, **Fig. 23**. It proved to be open circuit, so getting somewhere. The parts list showed it to be 2.26kΩ 1% 0.5W resistor. It turns out that this

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Fig. 18: Attenuator block unplugged.

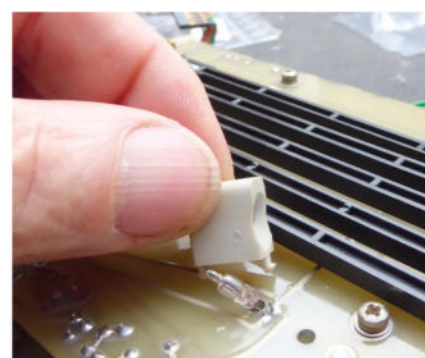
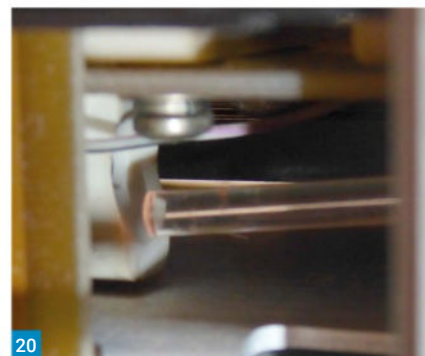
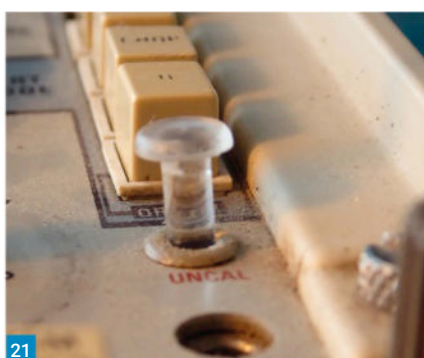
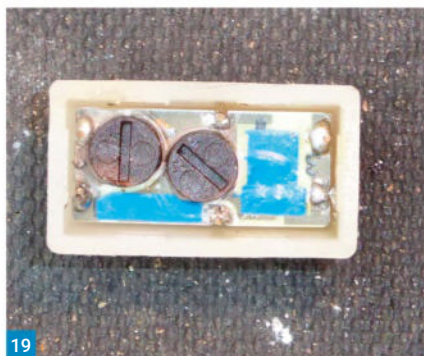
Fig. 19: Inside attenuator block showing solder joints to reflow. **Fig. 20: Light pipe pulled out from bulb enclosure.** **Fig. 21: Uncal Light pipe pulled out from front panel.** **Fig. 22: Uncal neon bulb exposed.** **Fig. 23: Burned out R916; critical to Beam Start Amplifier.** **Fig. 24: Combined Trigger View and Bandwidth switch.**

resistor is critical to the Beam Start Amplifier. I was feeling hopeful that provided it hadn't taken anything else with it, replacement would effect a cure. I didn't have a 2.26kΩ resistor, but used a 2.2KΩ instead.

That brought both traces back up very nicely, so being late at night I went to bed. The following morning there were no traces present. After pressing a few buttons I found that pressing and releasing the Trigger View button sometimes caused the trace to appear. This button when pressed shows the trigger setting. In its normal position 200MHz bandwidth is selected, when pulled out to one stop the bandwidth is restricted to 100MHz position and two stops to 20MHz, **Fig. 24**. The relevant switch contacts are on the Vertical Amplifier board and easily accessible, **Fig. 25**. Cleaning these with IPA restored both traces at all bandwidth settings.

Feeling pleased with myself I then discovered that the chopped and alternating trace modes were not working. Referring once more to the block diagram and the circuit description pointed to a fault in the Vertical channel Switching Circuit, **Fig. 25**. A 2MHz oscillator based on U330, a 7400 quad NAND gate that is used to clock U350, a 7474 Dual Flip Flop that controls the Chop and Alt functions via U370, a Tektronix in-house IC. Some corrosion was evident around the legs of U350. Re-seating it restored both the alternate and chopping modes but only intermittently. Testing U350 showed up one faulty gate. I replaced this with a new one, but dipped the legs in IPA before inserting it in its socket. I also re-seated all the associated transistors. All functions were now working correctly.

The probe coding indicator on channel 1 was not working, and while not essential it is a nice feature as it automatically shows the correct setting for X1 and X10 probes. A continuity check quickly showed that the X1 bulb had blown. It was also apparent that Q312 and Q314, **Fig. 26**, the bulb drivers, had been changed at some point and were different transistors; they should both be PNP transistors 2N2907. I had some in stock so changed them both. The bulb is inside the white plastic enclosure, **Fig. 26**, and is a 5V 60mA grain of wheat wire ended type, **Fig. 27**. Now getting at this was going to be tricky and not worth removing the vertical amplifier boards and the front panel. My solution may not meet with universal approval, but here it is. I drilled a



hole in the plastic enclosure, fed the bulb into the hole and glued it in place, **Fig. 28**. the wire ends were then soldered to pins 2 and 3 of the three-pin socket. It works correctly, **Fig. 29**. At some time in the future I'll buy another faulty 'scope for parts and do a proper repair.

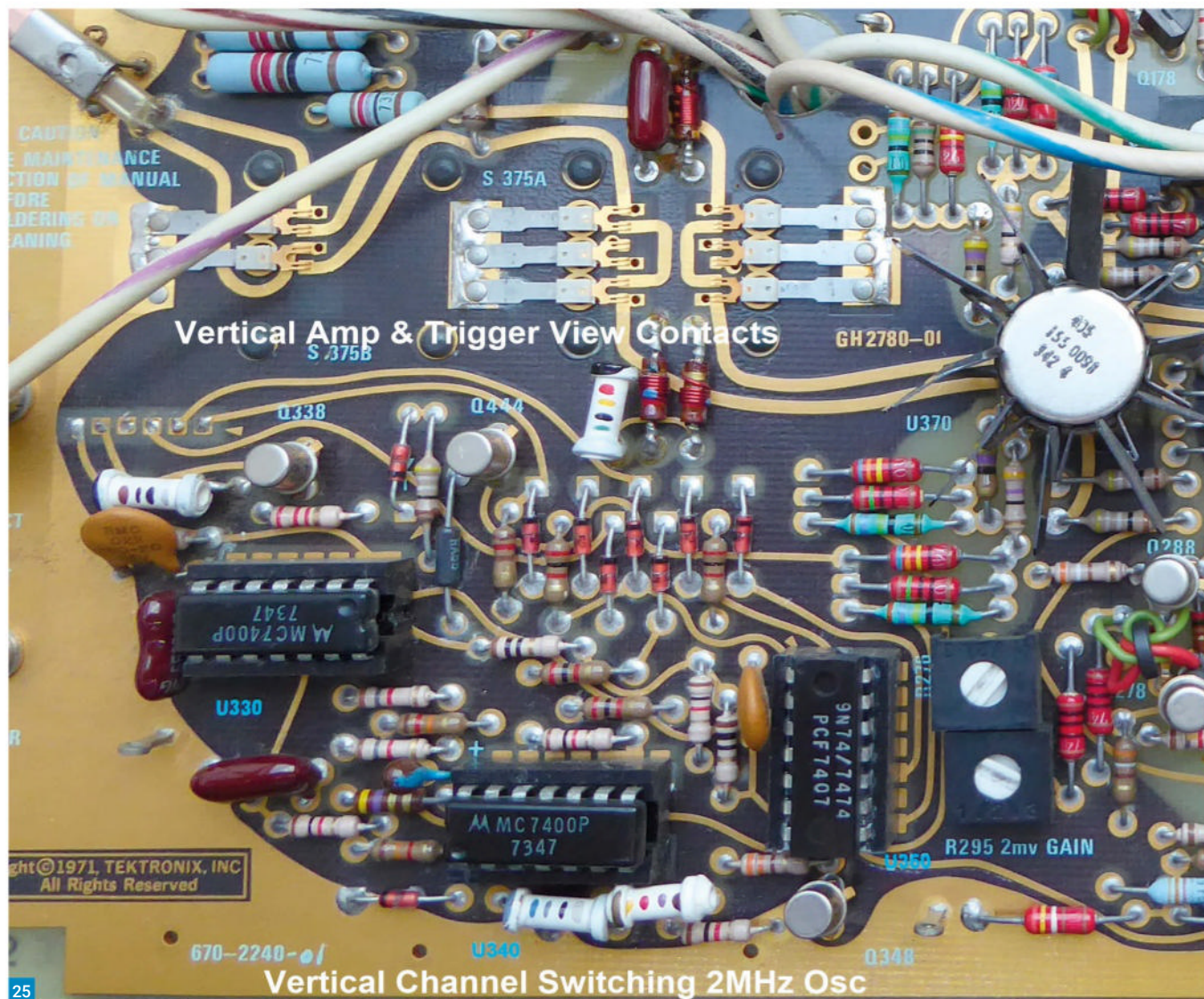
Other common issues

Although all the problems I have so far described have not involved the power supplies, power supply faults are very common and if the low voltage supplies are not within tolerances, some very strange behaviour can result. The required low voltage supplies for the 465 and 465B are +55V, +15V, -15V, +8V, -8V and 5V, while the 475 also has -15V. The 15, 8 and 5V supplies are derived from the 55V rail so the first priority is to ensure that the 55V supply is correct. All the supplies have foldback current protection. This means that if a short or near short develops on a particular rail, say +15V, the foldback protection circuit will activate to reduce the voltage supplied to keep the current demand within the limits for the particular rail.

The most common cause of shorts across the power rails is failing tantalum capacitors and there are plenty of them in these 'scopes, usually for decoupling the power rails where they enter different parts of the circuit. Failed tantalums will have a brown or blackened appearance, they may also show a silvery extrusion where the tantalum metal has melted and punctured the resin encapsulation. If you measure them, they will be either short circuit or nearly short.

If you can't find the guilty capacitor visually, the classic method is to use a very sensitive resistance meter: a milliohm-meter. With the equipment turned off and disconnected from the mains long enough to discharge the main capacitors, measure the resistance from ground to the test point so you are measuring the combined resistance of the failed component plus the small resistance of the PCB tracks. You might have an initial reading of, say, 400mΩ, take another measurement further along the rail. If the resistance is less than 400mΩ you are getting nearer the faulty component.

The use of tantalum allows for a very



thin dielectric layer. This results in a higher capacitance value per volume. Consequently, they are much smaller than contemporary aluminium electrolytic capacitors of the same capacitance and permit higher component density on PCBs. Tantalum capacitors also possess a lower ESR than aluminium electrolytics. They also tolerate higher operating temperatures and exhibit lower leakage, but the drawback is that they cannot pass high levels of current. Despite being happy under normal running conditions, repeated inrush

currents during switching or other faults that increase current draw across the tantalum can shorten their life. Tantalum capacitors were very commonly used in the 70s and 80s. I don't know if modern tantals are any better, but after 50 years or so they are a very common cause of grief in older equipment.

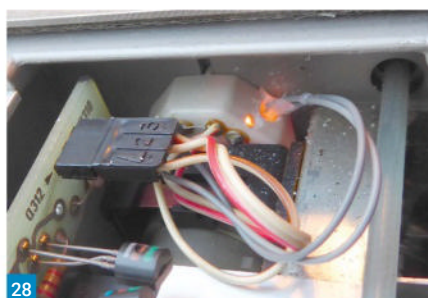
The main filter capacitors can fail and when they do, the tops may be domed, more likely corrosion will be evident around the base of the capacitor where the electrolyte has leaked. They are not difficult to replace, but much dismantling is necessary to access them. The Horizontal Amplifier/Triggering board has to be removed; fortunately almost all connections are plug-ins. Just be methodical and take lots of pictures before removing anything so that the wire colours and locations are recorded.

Tunnel diodes, usually only mentioned in hushed tones owing to their perceived rarity and cost, are used in the horizontal triggering circuits as they provide very fast clean switching needed for reliable high speed triggering. They are

usually germanium, sometimes Gallium Arsenide (GaAs), and have very low peak currents (10 – 50 mA) and moderate to low capacitance (1.5 – 30pF). Both *Qservice* and *Sphere Research* list the Tunnel Diodes used in the 465 (152-0125-00) at \$10.00 - \$11.00 but out of stock. The 152-0125-00 equates to the 1N1312 and is rated for a peak current of 4.7mA and capacitance of 15pF. A germanium tunnel diode close to this spec will get your 'scope working again. There are some suitable Russian ones around such as 11308D, G or V. There are currently some Mullard AEY25s on eBay from *Langrex* that would appear to be suitable. So, all is not lost if you have tunnel diode failure, but take great care soldering them: clip a heatsink on the leads to divert the heat from the body of the component.

High voltage issues

As previously stated, the EHT circuits are usually best left alone. One problem that occurs is that the high voltages create an electrostatic field that attracts a fine dust, usually black, that



adheres to the components and can become conductive creating a tracking path for the EHT. The EHT board shown in **Fig. 30** is not badly affected, but you can see how the dust is building up on some components. A cracking sound from the EHT area is an indication that tracking is taking place, the display will probably flicker as tracking occurs. If you suspect this to be the case, turn the 'scope off, unplug it and leave it for 60 minutes to allow the capacitors to discharge. Remove the cover, then use a clean soft 15 – 25mm paint brush to clear the dust away.

DM44

The DM44 shown on top of the 465B is an optional extra. It is essentially a digital multimeter built into the scope so that the service man doesn't have to carry a separate multimeter. It is also capable of measuring the period between two points on a waveform displayed on the CRT screen and giving either the period, or the frequency. Mine is not working and apart from a superficial look at it, I've gone no further.

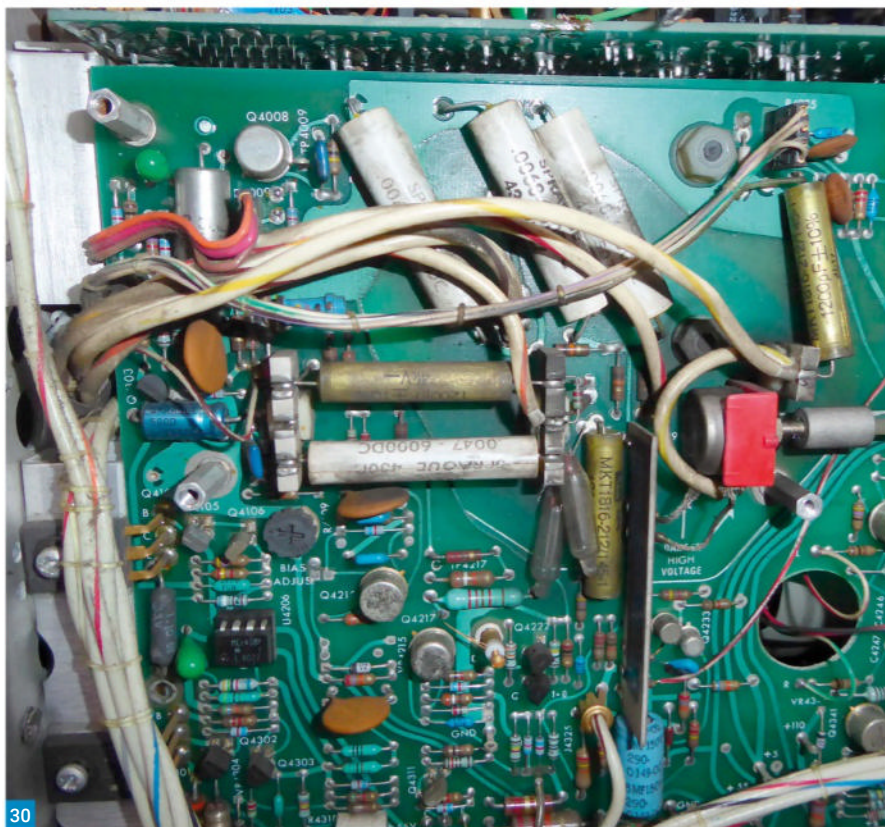


Fig. 25: Top Trigger View and Vertical Bandwidth contacts, bottom Vertical Switching 2MHz Oscillator. Fig. 26: X1 & X10 indicator bulb enclosure, Q314 & Q312 on left. Fig. 27: Grain of Wheat bulb. Fig. 28: X1 & X10 after repair. Fig. 29: X1 indicator working. Fig. 30: Dirty EHT board.

By modern standards, it's not a particularly good multimeter and while the period measurement might be useful, it's generally not hard to do manually. I decided to let it be.

Parts

Parts lists in Tektronix manuals refer exclusively to Tektronix part numbers in the format: 151-0671-00. One eventually learns that the 151 prefix refers to transistors, 152 refers to diodes, 120 refers to transformers and so on. Fortunately, there are a number of cross reference tables available on the internet such as tek_xref.free. This is a photocopied document which cross references Tektronix parts to manufacturer parts and vice versa. There is a very useful guide on the *Sphere* parts site, After clicking on 'Used Electronic Test Equipment + Parts', you will find 'Tek to Industry Cross-Ref Data' in the left-hand side bar. Google 'List of Tektronix Part Numbers' for another useful guide.

These guides are important as in most cases the Tektronix part number refers to a standard industry component: i.e. 151-0140-00 is a 2N3055 transistor. Where an obscure industry component is indicated a datasheet can be downloaded and from that an equivalent can be usually be found. Tektronix also used many integrated circuits and other components that

are unique to them. These can often be obtained, at a price, from *Sphere Research* or *Qservice* (see references). *Qservice.eu* has slightly better shipping costs than the American parent company.

eBay seller 'test-equip' is well worth checking: search on 151-xxxx-xx for transistors, 152-xxxx-xx for diodes and so on. When you get to the eBay page just select the part you need from the drop-down list., *Qservice* sell through eBay as well. So far, I've found that with a bit of digging around parts can be found at reasonable prices.

References

www.sphere.bc.ca/oldsite/test/tekparts.html
www.qservice.tv
www.qservice.eu

(Qservice UK is totally unrelated, it's a commercial maintenance company)

Conclusion

Any of these oscilloscopes are very capable instruments that hold their own extremely well in spite of their age. A good one need not cost a lot of money, probably £100 - £150. Even faulty ones are worth considering as they are usually repairable. I bought the 465B to use for spares to repair my 465 and ended up repairing them both. 475s are a bit more expensive and worth it if you need the extra bandwidth. **PW**

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WhatsApp Communities

Dear Don,

After noticing, over a prolonged period, that calls put out on many different repeaters are frequently unanswered, I've also talked to a number of repeater keepers and users, who often described the repeaters as 'quiet', 'underused' or 'it could do with more activity'.

Amateur Radio is a hobby with many facets - not everyone uses repeaters, and some never use UHF or VHF on which most repeaters are based. Nevertheless, for those that do, or would like to, it would be helpful to have a way of improving chances of making contacts. Having a backchannel to talk with other users of a given repeater - to set up skeds or announce when you'll be operational, for example - would be useful.

I have set up two WhatsApp Communities which provide for this: each of the two Communities has a Group - a chat channel - for each of the respective 2m and 70cm analogue repeaters in IO91.

This means that user can choose to monitor/interact on chat threads for their preferred repeater or repeaters, whichever those may be, in IO91. It also means that they can, if they wish, take an interest in discussions around other repeaters.

There's also an Announcements section and a General Group. These cover the whole Community, so users can monitor and discuss matters that are of relevance beyond just their selected repeaters. For anyone who'd like to join either (or both) of the IO91 repeater WhatsApp Communities, please drop me an email at

m7get@protonmail.com

and I will send an invite link.

Rich French M7GET

Barns Green, West Sussex

Selhurst

Dear Don,

Today, May's copy of *PW* arrived. Sitting down and leafing through my attention was taken by Fig. 1 [bottom Page 20], part of Messrs Hamer and Smith's 'Broadcasting History'.

The word 'Selhurst' caught my eye, and then the loudspeaker image. I immediately thought of the sight I had of two sari clad ladies using a side entrance to a facility in Bensham Manor Road, Thornton Heath, Croydon. I was aged in my early twenties, putting this event sometime

between 1970 and 1975. The entrance led to a loudspeaker factory behind a component store, RCS situate on Whitehorse Road. Opposite was a set of wide steps, alongside a railway track. The road at the bottom provided a short walk to the rear entrance of Selhurst Railway Station. I immediately thought that Bakers Selhurst Radio was the factory behind RCS radio component stores.

I do not recall the Bakers Dingwall Road address stated in the early fifties. At the time Dingwall Road itself was host to a few bomb sites, running parallel to the main line railway tracks between East Croydon and Selhurst Shunting Yard.

Between 1956 and 1961, as a child, I had the pleasure of experiencing life in Aden [South Yemen]. I returned with a reasonable tongue of Arabic, now mostly forgotten, and a really decent tan, now also long gone. I also returned with an interest in Radio thanks to the use of the Bush EBS44 receiver, also called the Bush Imperial Receiver. Coverage on I think six bands was from 550 to 30000kc/s [kHz]. The only thing missing was a BFO.

The next road down from Bensham Manor Road on Whitehorse Road is Pawsons Road. It was well known amongst local radio amateurs, SWL and the like as well as hobby engineers. The reason was the 'emporium' on the junction with Whitehorse Road; Huggett's Radio. If you wanted anything radio it was there, literally anything. My pocket money was spent there of odds and ends, surplus tools, meters, bulbs and sort of resistor, condensers [capacitors]. **Mr Huggett** himself used to wear a brown warehouse coat and was always very much in demand, either to serve or offer advice. I purchased a R107 receiver there, it was priced at £10.00.00d I only had ££8.10.00d [£8.50 for the youngsters]; Mr Huggett saw me looking at it, asked if I was interested and I told him I didn't have enough. He noted I almost spent my Saturday's there and let me spend my £8.10s on it.

It is notable that Top Band was host to local amateurs who spent Sunday morning discussing that local emporium; what they had purchased and what they would buy the next week or so. Always interesting. Having my log book out for the years as I wrote this I noted all those mentioned are no more.

Back to RCS, Bakers and so. I married and moved to Selhurst in a property near the Station. I

had changed my job and used Norwood Junction for access to London Bridge and rarely went to Selhurst or Thornton Heath. SWL'ing had gone into hibernation as I was working all hours made and it wasn't until I purchased a Trio 9R59DS receiver from Lisle Street I decided I needed to pay Mr Huggett a visit for a couple of 500pf variable capacitors for a pi-tuner project to go ahead of my receiver. Shock indeed, Huggetts had gone. I walked the few yards to RCS and purchased the same there.

Sometime after that, and a divorce, I moved, with my new wife, to the house where we still are, 43 years on, second owners of the 1936 property [also the only property in the road with a 2m/70cm colinear antenna mounted on the stack].

Needing a metal box for a filter project, taken from an old PW copy, I nipped down to RCS; I discovered that had gone too. I spoke to an Indian chap who was passing and he said it was a shame to see it go. I asked if he was into radio and he said, "No, my missus used to wind loudspeaker coils for the loudspeaker factory behind". He also stated that the shop and factory were owned by the same company.

RCS used to advertise in *PW* [yes, I'm that sad I have been taking *PW* off and on since I was 16, a mere 59 years ago] and I'm sure that if the editorial team picked up a copy from the late 60's to the end of the 70's they'd find an advert for RCS with a similar, if not the same, loudspeaker image seen at the bottom of page 20. Their address was 337 Whitehorse Road, Thornton Heath. nowadays the shop front is bricked up and used for housing.

Notwithstanding that image, a search on the internet revealed the heading 'Loudspeakers hall of fame' and shows an address for Baker Reproducers Ltd as Bensham Manor Road Passage, Thornton Heath. All this detail can be had from the URL:

<https://www.ajaudio.co.uk>

I certainly recall discussing the then new use of the nanofarad on capacitors with one of the male assistants behind the counter at RCS as well as him helping with a metal chassis he was selling me cut price, it had a dent.

It is interesting how many memories Messrs Hamer and Smith have invoked. I'd never really paid much attention to the two ladies entering a side gate but now all seems obvious!

Paul Beaumont G7VAK
London

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Rallies & Events

All information published here reflects the situation up to and including **17th April 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

11 May

RETROTECHUK (BVWS): Sports Connexion, Leamington Road, Ryton-on-Dunsmore, Coventry, CV8 3FL. Doors open 10.30am. £10 Entry (£25 early-doors entry at 9am). Annual event organised by the British Vintage Wireless Society. Nearly 200 stalls of dealers, clubs and private sellers. Retro and vintage radios, televisions, hi-fi and audio, vinyl records (LPs, 45s, 78s), communications and test equipment. Gramophones, telephones, spares, early video games and computing. bring-and-buy stall.
Greg Hewitt info@retrotechuk.com
www.retrotechuk.com

16 to 18 May

DAYTON HAMVENTION: Greene County Fair & Expo Center, Xenia, Ohio. 2025 theme is Radio Independence
<https://hamvention.org>

18 May

LOUGHERNE AMATEUR RADIO CLUB, 41ST ANNUAL RADIO RALLY: Share Discovery Village, 221 Lisnaskea Rd, Lisnaskea, Enniskillen BT92 0JZ. Usual facilities - Food and Drink, Bring & Buy. Doors Open 11:00 Hrs (Traders to arrive around 09:00 Hrs), £/Euro 5 Admission to include Draw Ticket, Usual Draw RSGB Books/QL Bureau, IRTS, All our usual variety of traders. To arrange a table contact:
Alan: argault91@gmail.com

18 May

THE DUNSTABLE DOWNS RADIO CLUB ANNUAL NATIONAL AMATEUR RADIO CAR BOOT SALE: Stockwood Park in Luton. This is the 40th year without a break (bar COVID) that this event has been run. All the usual facilities will be there, further details on:
www.ddrcbootsale.org

25 May

DURHAM DISTRICT ARS RADIO RALLY: Bowburn Community Centre, Bowburn, Co Durham, DH6 5AT. Doors open from 10.10am to 2.30pm with disabled visitors gaining access at 10am. Admittance is £3. **THERE WILL BE A BRING-AND-BUY SALE, TRADE STANDS, SPECIAL INTEREST GROUPS AND AN RSGB BOOKSTALL. CATERING ON SITE.**
Michael Wright G7TWX: 07826 924 192
dadars@gmx.com

1 June

SPALDING & DARS ANNUAL RADIO RALLY: Spalding Rugby and Football Club, Centenary Park, Drain Bank North, Spalding, Lincs, PE12 6AF. General Admission £3 per person. Free on-site car park, inside and outside traders, on-site catering and bar.
www.sdars.org.uk/spaldingrally
rally2025@sdars.org.uk
Graham G8NWC: 07754 619 701
What3words: ///jumpy.either.pipe

8 June

THE MENDIPS RADIO RALLY: Farrington Gurney Memorial Hall, Church Lane, Farrington Gurney, BS39 6UA. Doors open at 9.30am, Free Parking, Refreshments. For more details please contact Luke on:
07870 168197
email Luke@mymixradio.co.uk

14 June

ROCHDALE & DISTRICT AMATEUR RADIO SUMMER RALLY: St. Vincent de Paul's Hall, Norden, Rochdale, OL12 7QR. Doors open at 10am with entry still only £3. Usual Traders and caterers. Plenty of free parking. Contact Martin Shore on:
07587 709006
Email: rally.radars@hotmail.com

15 June

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

21 June

LIVINGSTON AND DISTRICT ARS GOLDEN ANNIVERSARY: We are also moving to a new clubhouse hosted by 6th West Lothian (Broxburn & Uphall) Scouts. To mark these events the society is holding an Open Day in the grounds of the Scout Hall on Station Road, Broxburn from 10am to 4pm.
Email: secretary@ladars.org.uk
<https://ladars.org.uk>

Next Month

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



SINAD: Tony Jones G7ETW explores the significance of SINAD (Signal In Noise And Distortion) measurements.
HAMMING WITH MY PACEMAKER: Tom Morgan ZT1T offers reassurance to radio amateurs using pacemakers.
REFURBISHING CRT EQUIPMENT: Geoff Theasby G8BML offers advice on refurbishing old oscilloscopes and similar.
VINTAGE TELEVISION & RADIO: Keith Hamer and Garry Smith offer yet more insights into the history of TV and radio, both at home and abroad.
ANTENNA RESURRECTION: Tom Tierney G0JSV tackles the challenge of replacing aged antennas.
KISS ANTENNAS: Ray Howes G4OWY recommends building antennas, but keeping it simple.

There are all your other regular columns too, including HF Highlights, World of VHF, Antennas, The Face Behind the Call and Data Modes as well as your Letters, Rallies, the latest News and more.

PRACTICAL WIRELESS www.mymagazinesub.co.uk/practical-wireless
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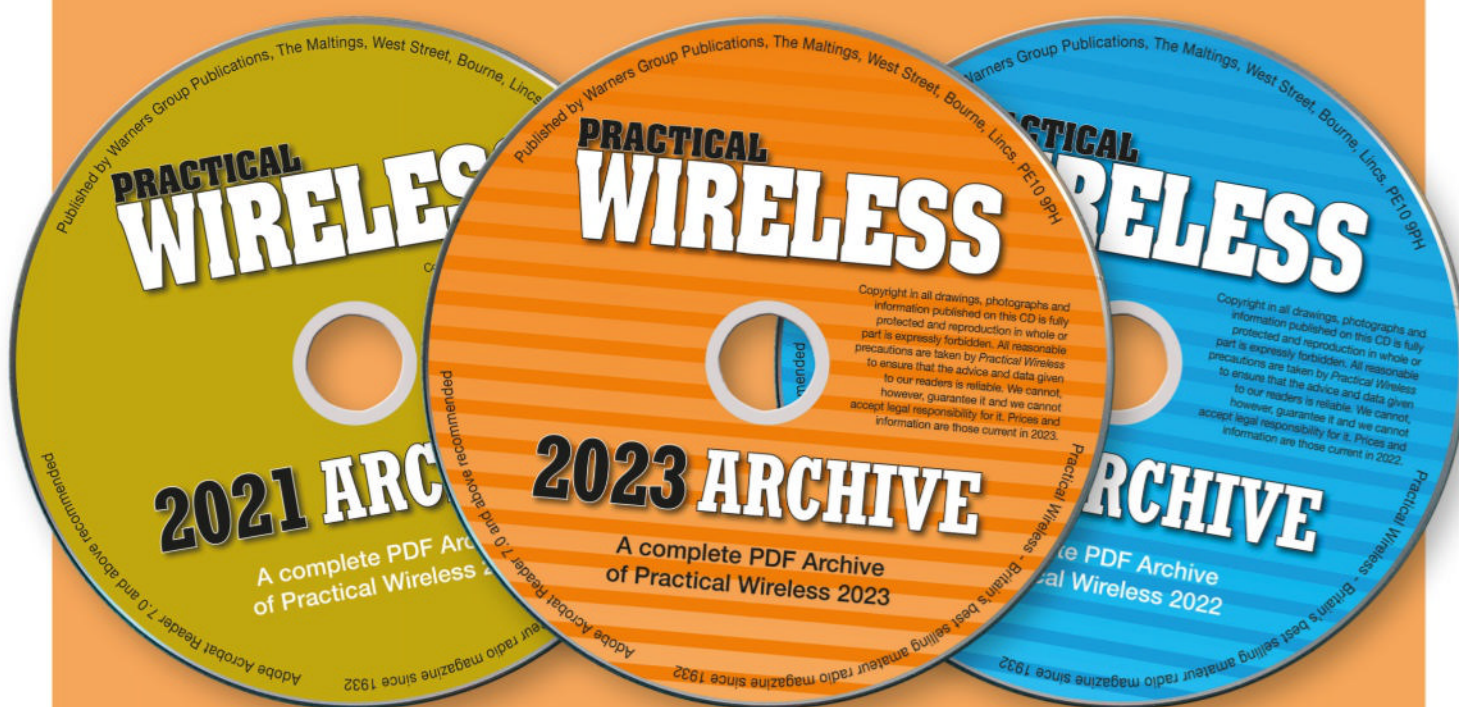
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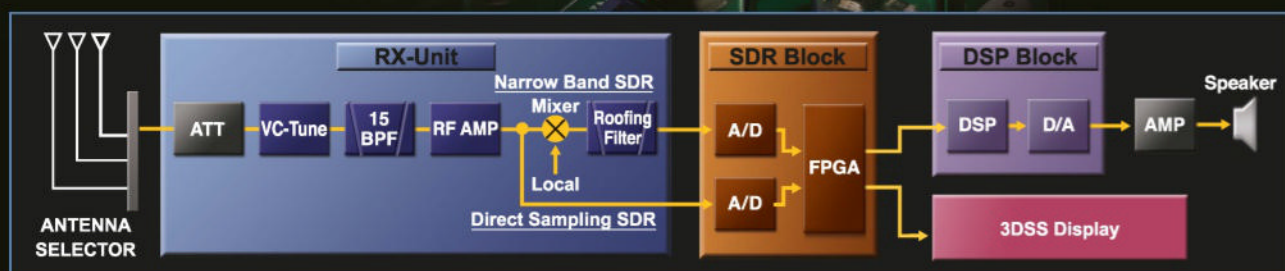
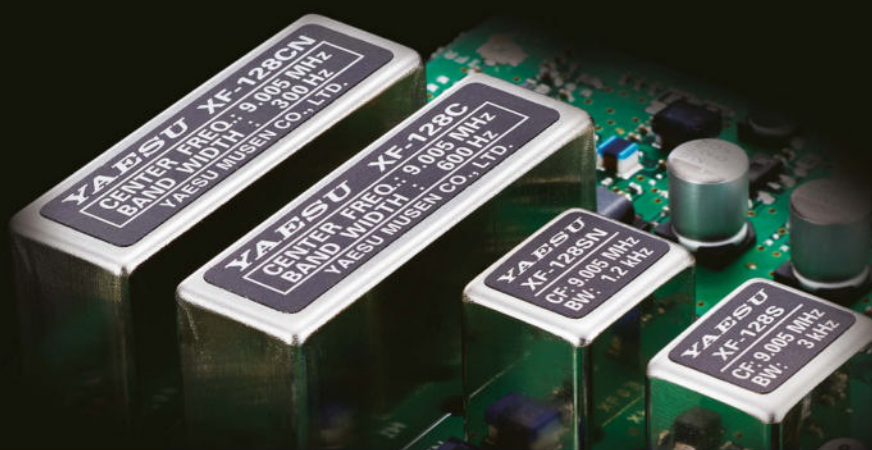


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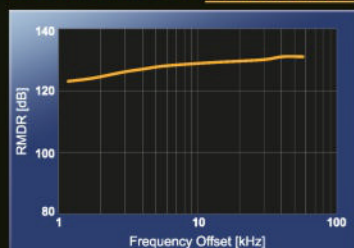
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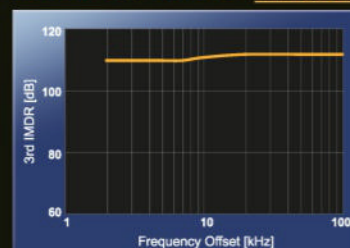
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