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PRACTICAL WIRELESS

JANUARY 2022 THE UK'S NUMBER ONE AMATEUR RADIO MAGAZINE SINCE 1932

OUR 90TH BIRTHDAY | New Series Celebrating PW Through the Decades

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Yaesu's FT5DE vs the FT3DE

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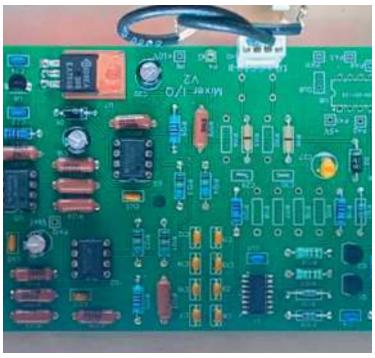
Profiling radio amateurs in the first of a new series



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Photocopies & Back Issues
We can supply back issues, but we only keep them for one year. If you are looking for an article or review that you missed first time around, we can still help. If we don't have the actual issue we can always supply a photocopy or PDF file of the article.

Technical Help
We regret that due to Editorial timescales, replies to technical queries cannot be given over the telephone. Any technical queries are unlikely to receive immediate attention so, if you require help with problems relating to topics covered in PW, please either contact the author of the article directly or write or send an email to the Editor and we'll do our best to reply as soon as we can.

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Keylines

Another year has gone and 2022 will see *PW* celebrating our 90th birthday! Many other radio magazines have come and gone in the meantime so this is quite an achievement. *PW* has enjoyed quite a run and each month this year we will celebrate a decade of its history, starting this month with a look at the very first issue. The focus has remained fairly constant over the years although, at various times, the magazine has strayed into the wider world of wireless, TV and even hi-fi. These days the focus is principally on the amateur radio hobby, largely because other aspects of wireless (radio!) are covered in our sister magazine *RadioUser*. But we still try to keep readers informed about relevant developments elsewhere and, of course, inevitably need to cover wider matters relating to home construction such as test equipment.

Apropos of which, we have a couple of relevant pieces on test equipment and home construction coming up next month, useful perhaps as this month we begin a seven-part constructional series on SDR and next month will be starting a series on the construction of a QRP transceiver for the 40m band. I'm delighted that we have these new constructional articles, which are always welcome but more difficult to source nowadays with so many radio amateurs, understandably, relying on commercial equipment.

Club News

For the past couple of months we have been seeing a return of news from a few clubs. It's great to see activities getting underway again after the long Covid-related lay off. While we don't have space in *PW* to list all forthcoming club activities, we are always pleased to report on any interesting events that have taken place – whether a special event station, club expedition or whatever. Do let us know so that it isn't always the same clubs reporting! It's a shame, though, to see some events, even into the New Year, being cancelled because of Covid worries. I do understand that many in the hobby are elderly and worried about the disease but I do hope we can see an increasing return to normality as 2022 moves on. Personally, I am looking forward to the CDXC Convention in May and a resumption, all being well, of the German Friedrichshafen event in June.

Letters

It's often remarked to me that the number and diversity of our *Readers' Letters* is indicative of an engaged readership and I like to think that is true. This month's collection are, once again, thoughtful and provocative. We always welcome Letters to the Editor – don't feel that it should always be the same few who write (though some certainly are more forthcoming than others!). We welcome views from all aspects of our readership, whether new to the hobby or long-in-the-tooth. The good news is that our readership does indeed encompass the full spectrum of active or would-be radio amateurs.

Acronyms

One of the problems faced by newcomers is getting to grips with all the acronyms that pervade the hobby (a problem, of course, that is common to most hobbies and professions). Rather than list them each issue, I plan, with **Georg**, editor, of *RadioUser*, to compile a list and post it on the radioenthusiast website. That way, all being well, we can keep adding to it as time goes by. I will advise when that has been done.

Activity

And finally, I can't help but note that both our HF and VHF columns are a little longer this month. Both authors get plenty of reader input, with new contributors on a regular basis. Long may it continue!

Don Field
Editor, *Practical Wireless Magazine*

Newsdesk

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

ID-52E D-STAR Digital Handheld Transceiver

The ID-52E, VHF/UHF dual-band digital transceiver is the latest in a long line of D-STAR handportables from Icom and was due to be available from authorised Icom dealers from the beginning of December.

The ID-52E succeeds the popular ID-51E PLUS2 and is the latest Icom model to work on the D-STAR (Digital Smart Technologies for Amateur Radio) network.

This model features a large transflective colour display that makes it easy to see outdoors, even in bright sunlight. The size of the display has also been increased to 2.3in from 1.7in on the ID-51A/E.

The ID-52E supports Bluetooth communication as standard. You can wirelessly connect to Android devices with the ST-4001A/ST-4001I Picture Utility Software, and RS-MS1A Remote Control Software installed. The optional VS-3 Bluetooth® headset is also available, for hands-free operation.

Other features include:

- Simultaneous reception in V/V, U/U, V/U as well as DV/DV.
- Waterfall Scope Function
- Can be charged via a microUSB connector.
- Airband reception is expanded from VHF to UHF (225 to 374.995MHz).
- Audio output has been increased from 400mW to 750mW.
- The latest D-STAR functions allow you to send, receive and view saved photos on an installed microSD card using only the ID-52E.
- Accessories for the ID-51E, including battery packs and microphones, can be used.

In addition to the above, the ID-52E includes a DR function with easy set-up, built-in GPS receiver, microSD card slot, IPX7 waterproof construction (1m depth of water for 30 minutes), and Terminal/Access Point modes.

It is expected that the ID-52E will appeal not only to beginners but to those experienced operators who want to get even more out of the D-STAR network.

The ID-52E will be available from Icom Amateur radio dealers with a suggested retail price of £519.99 (inc.VAT).

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

SUPERVISED OPERATION OF FOUNDATION LICENCE CANDIDATES: The RSGB Exam Standards Committee has clarified the licence conditions regarding the supervised operation of Foundation licence candidates.
The full announcement can be found on the examination announcements page of the RSGB website:
https://tinyurl.com/4vmb2ymn

RSGB CONVENTION PRESENTATIONS ON YOUTUBE: The RSGB online Convention's keynote presentation is now available separately on the Society's YouTube channel. This inspiring talk by Professor Cathryn Mitchell M0IBG explores the connections between radio and space, and also looks at the many ways in which everyone can get involved.
The other presentations from the Convention are also available on YouTube. Go to the RSGB YouTube channel and choose the RSGB Convention 2021 playlist:
www.youtube.com/theRSGB

RSGB NATIONAL RADIO CENTRE – VOLUNTEERS REQUIRED: The RSGB National Radio Centre (NRC) welcomes thousands of people through its doors each month and introduces them to amateur radio.
The Society needs to expand the team of volunteers and is particularly looking for people who can be part of the team during the week. If you are interested in becoming an NRC volunteer, you should enjoy meeting people and be prepared to work a minimum of one, preferably two, days per month.
Full training is given. Please email NRC Coordinator Martyn Baker G0GMB for further information:
nrc.support@rsgb.org.uk

BOARD APPOINTMENT AND HONORARY TREASURER VACANCY: The RSGB Board is pleased to announce that Richard Horton G4AOJ has been co-opted as a Board Director until the 2022 AGM. Many members will know Richard as he has served as the RSGB Honorary Treasurer since 2011.

NEW MOCK EXAM PAPERS AVAILABLE: At a recent meeting of the Examination Standards Committee it was agreed that the current mock exam papers on the RSGB website should be replaced by a fresh set, with one mock exam paper per licence level.
Unlike the previous mock papers, which were based on example questions, these new papers are generated from the same, ESRG-vetted, RSGB question bank as real exam papers, using the same question selection process.
You can find the new mock exam papers for all three licence levels on the RSGB website.

KW DAYS 2022: KW Days, a celebration of the UK's largest ever specialist amateur radio manufacturing company, returns once again at the start of the year.
Although stations will be operating throughout the month, this year's main activity will take place slightly later than usual on the weekend of 8/9 January 2022. KW group members voted to move the event from the traditional first weekend of the year so as to avoid clashing directly with New Year's Day. It's hoped that this will enable more stations, clubs and groups, to take part.
GB8KW will be again be active from Cray Valley radio club's HQ in Eltham showcasing a range of equipment and accessories made in Dartford from the 1950s to the 1970s.
A number of other special event calls throughout the UK and several overseas stations are also expected to be on the air. Hopefully more clubs will be able to take part as a result of the lifting of Covid-19 restrictions.
2021 has seen more examples of KW gear and accessories rediscovered. The numbers of KW owners both old and new, continues to grow. Hopefully, even more refurbished equipment. will be active this time.
The extensive range of KW made products has through the support of, KW-Radios@groups.io become increasingly appreciated. This active group of collectors and ex-employees continues to provide help and support to those undertaking restorations and an extensive archive of manuals, circuits, and associated material continues to be curated.
Vintage KW, AM & CW equipment will be found on VMARS or FISTS frequencies.
Classic SSB equipment and in tribute to the famous KW77 Rx, will be using frequencies ending in 77kHz ±QRM. i.e. 18.77MHz, 3.77MHz, 7.177MHz, 14.177 & 14.277MHz, 21.277MHz, 28.377MHz.

146/147MHZ NOV EXTENSION: Ofcom has agreed to the RSGB request to extend the 146/147MHz Notice of Variation (NoV) for a further year. However, it is made available on a non-interference basis and applicants should note that as the band is increasingly used by other users, the NoV is subject to a 30-day notice period of change or withdrawal. Full licence holders can apply for the 146/147MHz NoV via the RSGB website:
www.rsgb.org/nov

DIGITAL RADIO: Those interested in digital radio can download a copy of the Digital Radio Operating Manual from the Galway Radio Club web page.
This manual is packed with information about the various digital modes, information about repeaters and gateways, maps and lists of EI, GI and UK talk Groups.
https://tinyurl.com/skzjmu7c

Moonraker News

Moonraker are delighted to be stocking the InnovAntennas range of products. These antennas are the choice of many DXers globally. They have also been appointed UK distributor of the Rig Expert range of Antenna Analysers and radio interfaces.
https://tinyurl.com/86dv6pa7
https://tinyurl.com/yrzevv73
https://rigexpert.com/where-to-buy
Moonraker also tell us that the popular Senhaix 8800 Bluetooth Programmable Dual-Band Handheld radio now has receive capability on the airband:
https://tinyurl.com/y3tdy44m

MILTON KEYNES AMATEUR RADIO SOCIETY : MKARS have continued to be an active club during the Covid pandemic with a regular programme of talks presented over Zoom and also archived on YouTube, including speakers such as Bob Heil talking about getting the best from your audio, Carl Luetzelschwab K9LA on solar cycle 25, as well as speakers from across the UK and club members. Special Interest Groups (SIGs) have been formed to discuss construction, data modes and CW training and these are well supported by club members.
In addition to the existing HF and 70cm nets a new coffee chat was introduced on Zoom on Friday mornings and has been well received.
Over the summer months several outdoor events were held, including a boot sale, BBQ and portable setups.
With the approach of autumn, the committee reviewed the current meeting venue and decided that a new venue was required to enable members to start to meet indoors safely. The club AGM in October was a hybrid zoom and in person meeting with the committee proudly announcing that the club had secured a new venue at The National Museum of Computing (TNMoC) within the grounds of Bletchley Park. The following week was a social evening for members to get together again in the new venue. With pizza and cake on the menu – who could resist getting back to an in person event again! A busy programme of monthly talks, SIGs and a new skills night/drop in workshop has been introduced to let members help each other learn new skills and progress in the Beyond Exams club scheme. The general monthly programme format is:
Week 1 - committee meeting
Week 2 – Talk
Week 3 – special interest groups
Week 4 - skills night
The constructors SIG will soon be starting to build the latest club project, which is a single band transceiver for 80/40/20m with CAT control, CW, SSB and data modes. This has been designed by club member Steve G6ALU.
New members are always welcome. See the website (below) for more information or search for MiltonKeynesARS on Facebook.
www.mkars.org.uk

CANVEY RALLY 2022 CANCELLED: It is with a great deal of disappointment that the organisers felt the need to announce the cancellation of the February 2022 Canvey Rally.
They said *"We feel at this time, with rising Covid numbers and while we are heading into the winter, where these figures will no doubt rise further, it would be unwise to hold such an event, Our concerns above all, have to be for our Visitors safety. This is very disappointing as I am sure you will agree, but we feel it for the best. There has also been discussions about the possibility of running a rally later in the year if circumstances allow. We will keep you posted. Stay safe everyone."*

EXERCISE BLUE HAM 21-2 : Across the UK Cadet Stations came together and took part in Exercise Blue Ham over the weekend of 16/17 October (See above photo). Blue Ham is a radio communications exercise on the 5MHz (Shared) Band. The exercise has been running for a number of years. Introduced to broaden the Cadet experience of radio operation and to reach out to radio amateurs who may be interested in joining the Cadet organisations as Radio Instructors.
During the exercise, Cadet Forces Adult Volunteers (CFAV) and Cadets operated HF radio stations contacting radio amateurs with the purpose of exchanging specific information during their QSOs.
Band conditions on Saturday morning were much better than previous exercises and improved a great deal in the afternoon. When Sunday came around, conditions had improved further. On both days the MUF was hovering around 9MHz. The band suffered from very little QSB (fading), which allowed contacts across Europe. A total of 200 amateur callsigns were logged, which indicates how popular the exercise is becoming.
There were four data-capable stations on air using mainly OLIVIA 16/500 operating on a designated frequency. This attracted a number of amateurs. It seems the interest in Exercise Blue Ham Data Modes is growing.
During the Exercise amateurs were contacted across the UK, Republic of Ireland, Sweden, Norway, Denmark, Netherlands, Germany, reaching out to Jersey in the south and the Shetland Islands in the north. The organisers thank all of the CFAVs and amateurs for the time and effort they put into the exercise weekend. There are more planned for 2022; the best place to find out is to check out the webpage at:
https://alphacharlie/blueham

NETHERLANDS TELEGRAPHY CLUB (NTC): A new Telegraphy club in the Netherlands? Yes, you are correct! Apart from the well known Benelux QRP Club and VHSC, there are no CW clubs in the Netherlands; the founders of NTC would like to change this.
What is the goal of the NTC? Quite simply, a wish to promote Morse Code by reaching as many Telegraphy operators as possible in order to promote more CW activity on the bands and to reach operators who use other modes and help them to explore Morse Code. Encouraging inter-Club CW cooperation, joint activities with clubs in countries around the Netherlands in order to increase the CW activity in general and to enjoy our hobby and mode together. NTC wants to be there for all kinds of CW operators, newbees, slow ops, high speed devils and everyone in between. Let's keep CW alive together, preserve and promote our heritage.
Meanwhile, NTC has been accepted as a member of EUCW and International CW Council.
Because NTC aims to be inclusive for all Telegraphy operators they have a very simple 'low level access rule'.
Only two active NTC members need to be contacted to complete a membership application. The application form can be found on the website; download, complete and forward it by email. Membership is completely free.
The activity program includes;
• Work NTC Members (W-NTC-M) award
• Monthly QSO party
• The development of a second award is in progress
Find out more by visiting the website (also still work-in-progress) or send a message to:
nettelclub@outlook.com
You can also check directly if you have already worked some NTC members or start with this directly. Check the website for the membership list. Members are also listed in the CW Club RBN Spotter. Non-NTC members are also welcome to participate in NTC activities.
www.qsl.net/ntc

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

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PW at 90 Years

As Practical Wireless approaches its 90th birthday, we take the opportunity to look back at its illustrious history, decade by decade.

This year *PW* celebrates 90 years of publication. The first edition (see cover photo) was published on 24 September 1932. Over the course of this year we will look back at each decade of the magazine, culminating, in September, in bringing things completely up to date nine decades on.

Here is an extract from the very first editorial – hopefully the magazine has managed to achieve those early aims in the decades that have followed:

Introducing Ourselves

PRACTICAL WIRELESS makes its début in the confident belief that it will receive a hearty welcome from the large and ever-growing circle of wireless enthusiasts, more particularly those interested in home construction and the experimental side of wireless. Although in the brief space of a very few years the knowledge of this fascinating new world of the ether has grown to large proportions, we are still little more than on the threshold of the intriguing possibilities the future holds forth. Rapid as the advances have been, the near future will bring forth new discoveries, new ideas, and new technique just as certain as day follows night, and every wireless enthusiast, if he is to derive full pleasure and interest from his hobby, will require as an absolute necessity that his knowledge be kept right up to date.

Keeping Up to Date

It will be part of the policy of PRACTICAL WIRELESS to keep its readers abreast of everything new. Writers, acknowledged as authorities in various branches of wireless and in touch with every new development, will contribute on every subject that has a practical value to the reader. Skilled designers, with many successful sets standing to their credit, will exercise their ingenuity in the design of new sets combining for the constructor and experimenter the essentials of novelty with efficiency, bearing in mind also the important question of cost. Everything that is new, when tested and proved in its practical worth, will find its way into the pages of PRACTICAL WIRELESS.

Simplicity of Treatment

And, of great importance, particular care will be taken in presenting the contents in clear and simple language. Highly technical terms will be dispensed with wherever simple description can be employed, and diagrams will be prepared and explained so as to be readily understood. Thus the reader with a modest technical knowledge, or even the keen amateur will find PRACTICAL WIRELESS appeals to him as well as to the reader with a sound technical knowledge.

New sets appearing at frequent intervals will be an attractive feature of PRACTICAL WIRELESS. Every set described will first be thoroughly tested under varying and stringent conditions so that the reader may know that it will do all that is claimed for it. It is the intention also to cover every need of the home constructor in the sets featured. It will be explained how a set may be modified to suit particular conditions; how it may be adapted for use as a radiogram or as a short-wave receiver; how flat dwellers with restricted space can adapt a set to meet these conditions. PRACTICAL WIRELESS plans to deal with each set adequately rather than to produce too many new designs, a policy which is apt to leave readers with difficulties to surmount after a set is made.

Our Laboratory

A well equipped laboratory staffed by enthusiastic experts closely associated with the home constructor movement, will examine and test the latest components, the results of which will be reviewed in PRACTICAL WIRELESS. This feature will be of invaluable help to the home constructor in planning and making up sets. Every component used in PRACTICAL WIRELESS sets will pass our laboratory tests, and our Advice Bureau will help readers with their difficulties and problems. Expert advice is available and readers are invited to use it freely. In view of the constant and marked progress that is being made in the design and construction of components, this service will be of the greatest value to those planning and making sets.

Readers' Ideas Invited

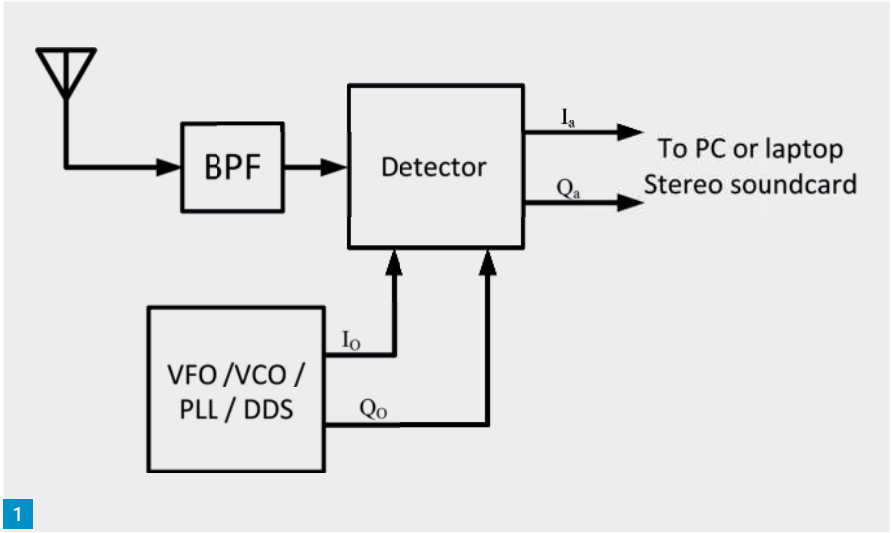
New ideas from readers are invited. If you have a clever notion or an ingenious gadget you have discovered for yourself, it will be printed if approved and paid for at our usual rates. We shall also welcome suggestions and criticisms. They will assist us in carrying out our policy of fully satisfying the reader in the service we give him.

Our Presentation Volume

One word more. To signalize the appearance of our first number we are offering to all who become regular readers a most attractive Presentation Volume, which will be of the greatest help to wireless constructors.

That first issue, incidentally, retailed at 3d (yes, three old pence, or just above 1p!), was published by George Newnes Ltd and included the very first of the famous PW blueprints. I do, though, read enviously about the well-equipped laboratory – those were the days! Nowadays you just have me! I'd be interested to know what the early circulation figures were but I suspect the magazine filled a much-needed void at that time and sold well.

Dr Samuel Ritchie EI9FZB
samuel.ritchie.8@gmail.com



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SDR (Part I)

Dr Samuel Ritchie EI9FZB describes the design and building of an SDR receiver, starting with the quadrature product detector.

Software Defined Radio (SDR) is invading many aspects of our hobby, as a casual look through the advertisements in just this magazine will demonstrate. I would like to present an SDR project that I have been working on for a few years and, as a result of COVID, was able to give this task the time it required. Hopefully it will encourage some construction activities, be it copying my work, improving on it, or modifying it for your own use.

This project comes in seven parts and progresses from a description of the quadrature product detector to a single-band receiver, and eventually to general coverage of the HF band. There will be lots of examples of what can be achieved, and you can pick and choose where you would like to start and what you want to focus on. You can even choose between building from scratch, assembling some parts from a kit, or even occasionally buying an already-made module.

Where is the Software Part of this SDR?

I have played with several 'black box' SDRs (professional, semi-professional and amateur). These are the devices to which you connect power, an antenna, and a personal computer (PC), for example the SDRplay RSP1a and the FUNcube dongle. For these types of SDR the software is running on the PC and all the magic of decoding is handled by the PC.

Then there are standalone SDRs that look more like traditional receivers, with a screen and knobs that do not require a PC to work as the processor and the decoding software is all included in the one device, for example the Elad FDM-DUO-R and the ICOM IC-R8600.

This project is a bit of a hybrid – there are a few knobs and an LCD screen on the front panel, but you need to connect to a PC to handle the software part.

Block Diagram

The basic block diagram is shown in **Fig. 1** and consists of four parts. A suitable antenna is connected to a bandpass filter (BPF) to attenuate strong out-of-band signals. This helps to prevent unwanted spurious responses at the output.

The bandpass filter is followed by a detector, which converts the RF signal of interest into two audio frequencies. These are the reference or the in-phase signal (I_a) and a 90° out-of-phase signal (Q_a). These go into the stereo input of a PC or laptop sound card, which does all the decoding work.

Also needed for the detector are two signals from some form of oscillator that determines the frequency of the signal you are receiving – it could be a capacitor tuned variable frequency oscillator, a voltage-controlled oscillator (VCO), a phase locked loop (PLL) synthesiser, a direct digital synthesiser (DDS), or some form of agile clock generator. This oscillator needs to supply two frequency inputs to the detector. Again, one reference or in-phase signal (I_o), and one 90° out-of-phase (Q_o) signal.

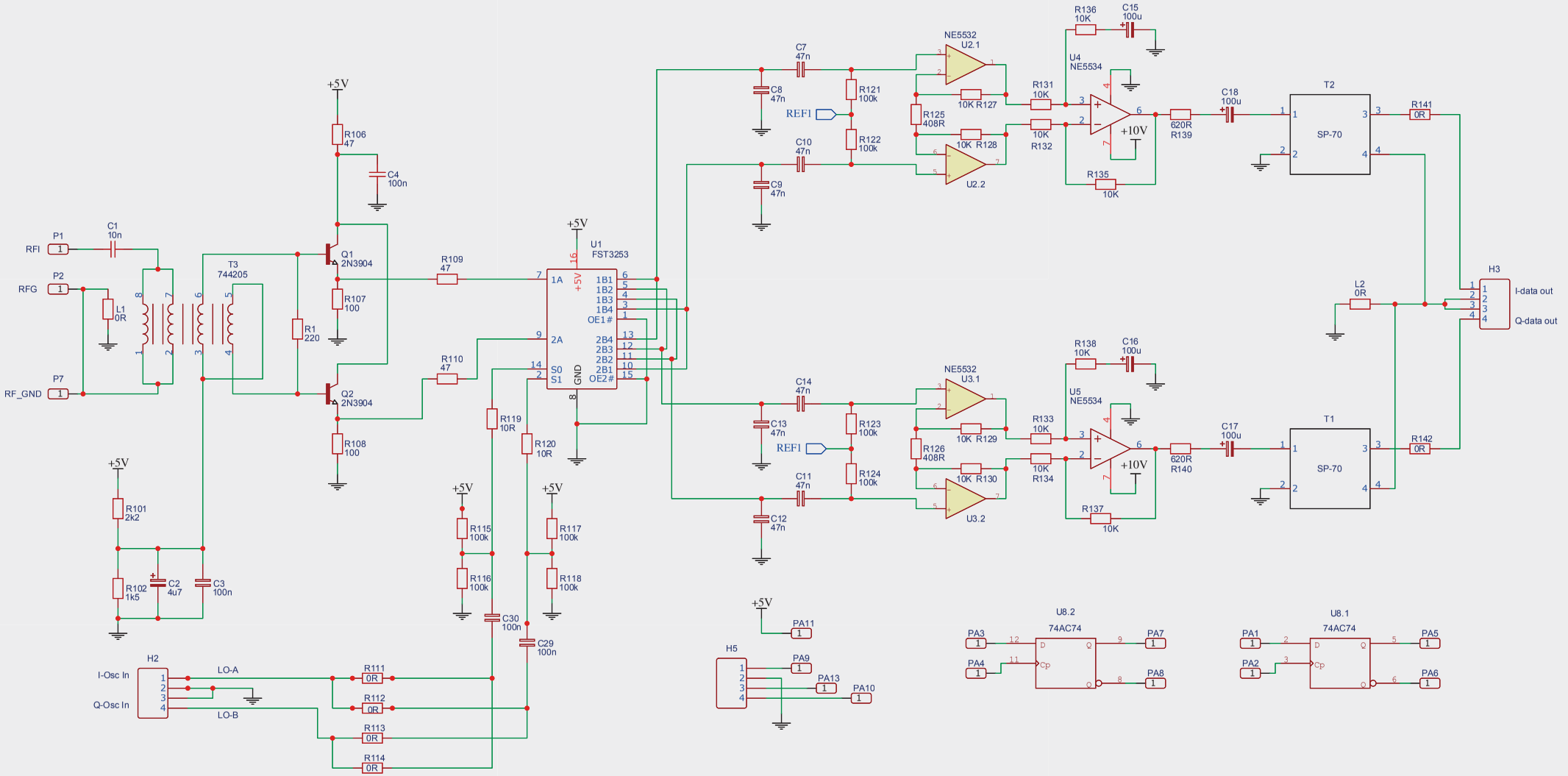
The Quadrature Product Detector

The circuit diagram of the detector appears in **Fig. 2**. As far as the circuitry goes, I can claim little credit for anything but the implementation. The concept of the Tayloe mixer was published in 2003 by **Dan Tayloe N7VE**, and aspects of my circuitry have come from advances and refinements made in designs by **João De Marco PY2WM**, **Tasić Siniša YU1LM**, **Juha Niinkoski OH2NLT** and **Matti Hohtola OH7SV**.

The Tayloe detector (also called the Tayloe Mixer) is described by Dan Tayloe as a Quadrature Product Detector (QPD). It is a low noise, high-performance device with less than 1dB of conversion loss, a high third-order intercept (+30dBm), and a simple and compact design. In this implementation the QPD is arranged as a double-balanced detector for maximum performance, and this circuit is similar to that used in most direct conversion SDR front ends.

The RF signal, from the BPF, goes directly to the wideband transformer T3 to achieve good dynamic range. The two primary roles of transformer T3 are to transform the unbalanced 50Ω antenna signal into a 200Ω balanced signal, and to split the incoming RF into two paths, 180° out-of-phase. I have kept the ground of the antenna separated from the circuit ground so that T3 can also act as a galvanic isolator, but if you prefer to connect the

Fig. 1: Basic block diagram. Fig. 2: Schematic of the detector and I/Q amplifiers. Fig. 3: Schematic of power supply and voltage reference. Fig. 4: PCB installed in enclosure. Fig. 5: Views of the enclosure. Fig. 6: Square wave oscillator requirements. Fig. 7: Complementary Oscillator inputs to Quadrature generator. Fig. 8: Single input clock to quadrature generator.


RFI
RFG
RF_GND
P1
P2
P7
C1 10n
L1 0R
T3 744205
R1 220
Q1 2N3904
Q2 2N3904
R106 47
C4 100n
R107 100
R108 100
R109 47
R110 47
+5V
U1 FST3253
1A
2A
S0
S1
GND
OE1#
OE2#
1B1
1B2
1B3
1B4
2B1
2B2
2B3
2B4
R101 2k2
R102 1k5
C2 4u7
C3 100n
R119 10R
R120 10R
R115 100k
R116 100k
R117 100k
R118 100k
C30 100n
C29 100n
H2
I-Osc In
Q-Osc In
LO-A
LO-B
R111 0R
R112 0R
R113 0R
R114 0R
H5
PA11
PA9
PA13
PA10
C7 47n
C8 47n
C10 47n
C9 47n
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R122 100k
NE5532 U2.1
U2.2
R125 408R
10K R127
10K R128
R131 10K
R132 10K
R135 10K
U4 NE5534
+10V
R136 10K
C15 100u
620R R139
C18 100u
T2
SP-70
R141 0R
C14 47n
C13 47n
C11 47n
C12 47n
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U3.2
R126 408R
10K R129
10K R130
R133 10K
R134 10K
R137 10K
U5 NE5534
R138 10K
C16 100u
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C17 100u
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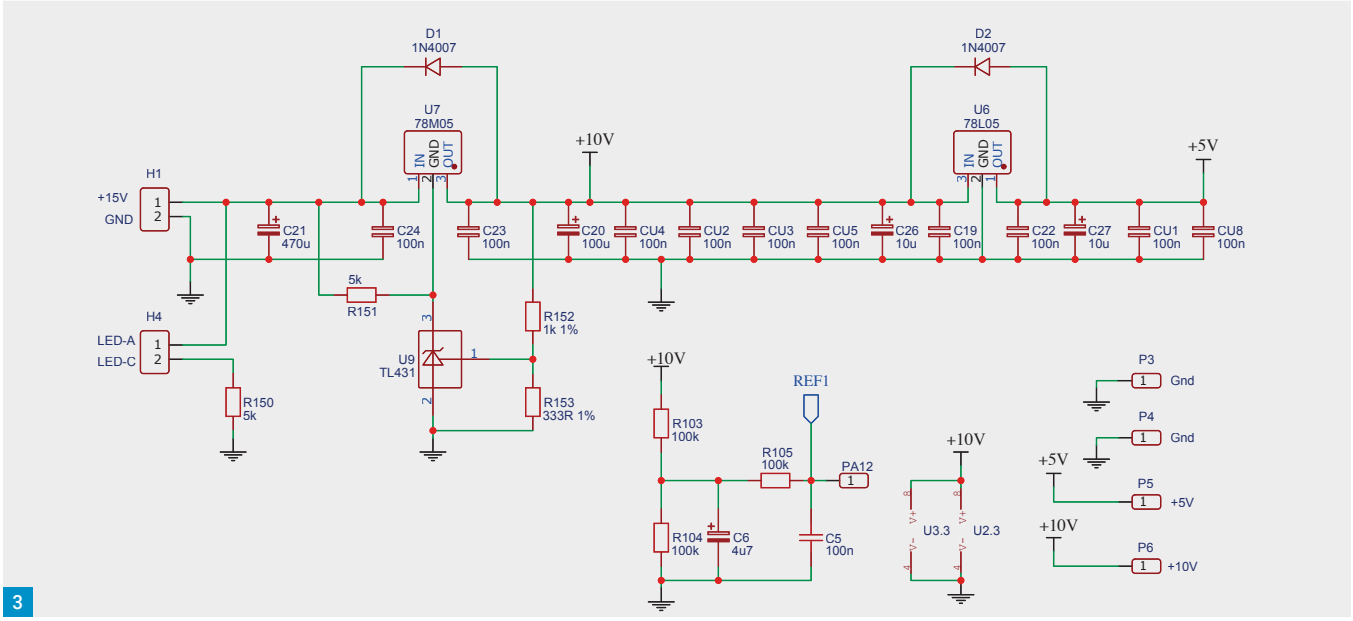
L2 0R
H3
I-data out
Q-data out
U8.2
74AC74
U8.1
PA3
PA4
PA7
PA8
PA1
PA2
PA5
PA6



3

antenna ground to the circuit ground, then insert a link (or a zero-ohm resistor) into L1.

For T3 I have used a common mode line filter made by Wurth Elektronik (€2.95), instead of the usual three or four bifilar windings on a binocular core (£1.50) or ferrite toroidal core (£0.80) that comes with the usual winding and mounting issues. It is one of only two SMD devices on the board, but it has large pads (2.2 × 1mm), which make for easy soldering.

Q1 and Q2 are used to improve the impedance matching between T3 and the FST3253 (U1). The FST3253 has two high-speed, low-ohmic analogue 1:4 multiplexers in the package, configured as a doubly-balanced product detector, which is controlled by dual local oscillator signals. These dual local oscillator signals are in quadrature (which is explained and discussed later) and cause the multiplexer to transition through all four outputs in every complete cycle. At the receive frequency it converts the incoming RF signal into four baseband (audio) signals with phase shifts of 0, 90, 180 and 270° across the four sampling capacitors C8, C9, C12 & C13.

The audio signals across these four capacitors all have equal signal amplitudes, but the phase of each of these four signals is different. The 0° and 90° are the I and Q signals, and the 180 and 270° are their complement signals. The four phases are combined into I and Q outputs using low noise operational amplifiers (U2, U3 U4 and U5), connected as instrumentation amplifiers with a gain of 50. This configuration provides excellent common-mode rejection and each of the four paths see a constant, high-impedance load, which helps maintain a good balance between the paths. The 'I' output signal at pin 6 of U4 is derived from the difference between the 0° and 180° phases, and the 'Q' output at pin 6 of U5 is derived from the difference between the 90° and 270° phases.

The output of each instrumentation amplifier is fed into an audio isolation transformer (T1 and T2) to reduce or eliminate ground loops that can cause audio hum, and which can easily occur in these designs. The ground output of both audio transformers is isolated from circuit ground, but I provide the option to link the grounds by inserting a link or a zero-ohm resistor into L2. The output is now ready to be fed into a stereo soundcard. Here you need to be careful, as I have found that some laptop soundcards have only mono inputs. I provide resistors R141 and R142 so that you can match the output to the input impedance of your soundcard. I found this was not necessary in my case and I used zero-ohm resistors.

You will see when we come to discuss the software options, that some of the more sophisticated packages can compensate for both phase and amplitude imbalances. I, however, chose to ensure good balancing in the hardware. I used multi-layer ceramic capacitors (C0G dielectric) with 10% tolerance for the eight capacitors C7 to C14, as I had a bag of these on hand. Using an LCR meter I found the whole bag to be better than 5% tolerance and quickly sorted out eight matched capacitors. While it does affect the detector bandwidth or *Q*, for our purposes, the value of C7 to C14 is not critical and I have seen designs use 10nF to 1µF in this position. In general, I use 1% tolerance metal film resistors but for the two 408Ω resistors (R125, R126) I matched these as best I could. For the twelve 10kΩ resistors (R127 to R138), I have a bag of military specification resistors that have very low-noise and low-voltage coefficient specifications (the Vishay RN series), and close tolerances.

Not mentioned so far is U8, a 74AC74 dual type-D flip-flop – this is discussed under the section dealing with the local oscillator requirements.

Power Supply and Voltage Reference

The circuit diagram of the power supply and voltage reference appears in **Fig. 3**. The input voltage is +15V DC with an LED driven directly from this input voltage to indicate that the power is on. A TL431(U9) adjustable shunt regulator, together with a 78M05 (U7) linear-voltage regulator, produces the +10V rail that is used by the op-amps. A second 78L05 (U6) linear voltage regulator provides the +5V for the logic circuitry.

The +10V is divided in half (R103 and R104) to supply the reference to the op-amps. A test point (PA12) is provided to easily measure this. All the 100nF capacitors that have a designator CU are power supply decoupling capacitors, and the number indicates which integrated circuit (IC) it is located at. For example, capacitor CU5 is located next to IC U5 on the PCB.

The PCB and Enclosure

The populated PCB in its enclosure is shown in **Fig. 4**. There are only two surface mount devices (SMD) devices (T3 and U1) and all the rest are through-hole components with lots of spacing between components to permit easy assembly, easy to read labelling, space for test probes, space for IC holders and even five M3 holes for mounting the board.

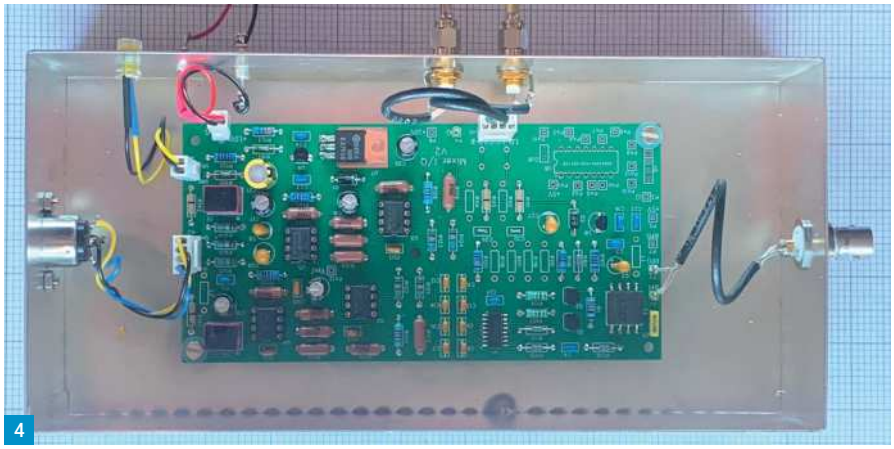
I found that I only needed to use two of the mounting holes – top right and bottom left. The RF from the BPF comes in the left-hand side through a BNC connector. This connector is isolated from the metal box so that galvanic isolation is maintained. The two signals from the local oscillator come in via two SMA connectors. Short lengths of RG-174 are used to connect to the PCB from the BNC (left-hand side) and the SMA connectors (bottom). The power supply has its ground connected to the metal box and the +15V DC enters via a feedthrough capacitor. I used a yellow LED with a clear mounting lens. On the right-hand side is the DIN connector used to take the I/Q feed to the sound card. **Fig. 5** shows the front and side panels of the enclosure.

Ideas to Reducing the Cost

I know that I am spoilt with resources available to me and leftovers from other projects, so here I focus on the most expensive parts rather than quibble over a few tens of pence or euro cents. For example, I use four Molex connectors (the white connectors), which could easily be avoided with direct soldering to the PCB, but both sides of the connector and the pins cost less than 50p in total (although you may have to buy them in bulk).

The frame and two-finger lid box (€25) is an extravagance, and there are many options such as building an enclosure from PCB, a cheaper Hammond box or any other metal enclosure that will provide some shielding. I found these dramatically reduced the mains hum and many low-level RF signals floating around my study.

The isolated BNC connector (€17) could be targeted. Just be careful not to use a connector that is only good for audio frequencies (like a lot that you see on offer on eBay) – you need an RF specified connector. The two SMA bulkhead connectors (€6 each) could be replaced with something cheaper if just the coax was fed through a hole in the enclosure – although this will reduce the shielding effect of the enclosure.



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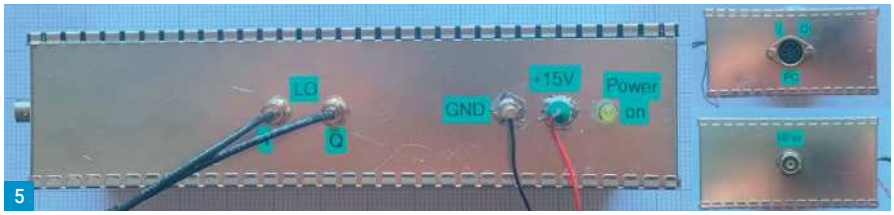

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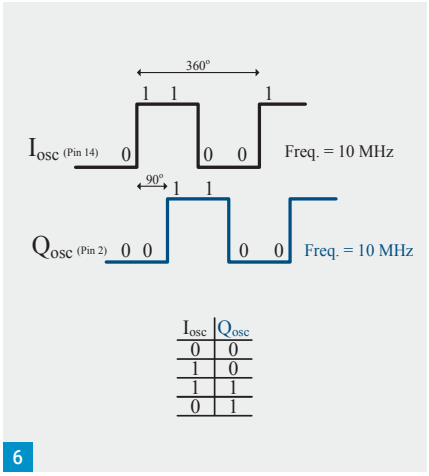
Another extravagance are the quality audio transformers (T1 and T2 at €15 each) that could be replaced with the far cheaper versions found on eBay, and at component suppliers that focus on serving us amateurs.

Local Oscillator Requirements

To better explain, let us assume we want to receive a signal that is at 10MHz. The QPD requires on pin 14 of U1 an input (I_{osc}) that is a square wave running at 10MHz, and on pin 2 of U1 another input (Q_{osc}) that is also a square wave but in quadrature with I_{osc}. See **Fig. 6**, which shows what quadrature means, simply that one square wave oscillator is 90° out of phase with the other. The truth table also reveals why the eight outputs of U1 are not quite connected in a two-bit binary sequence.

The FST3253 (U1) is running with a power supply of +5V, so the maximum amplitude of the local oscillator square waves is limited to 5V. The FST3253 is a CMOS TTL-compatible device, and an input voltage on the digital pins from 0V to 0.8V is guaranteed to be read as a 'low' or zero. An input voltage greater than 2V is guaranteed to be recognised as a 'High' or 1. So, any square wave that meets these criteria can be used. This is useful as there are a number of clock generators and DDS whose output meets this criterion.

I am going to describe three scenarios that you may come across when putting



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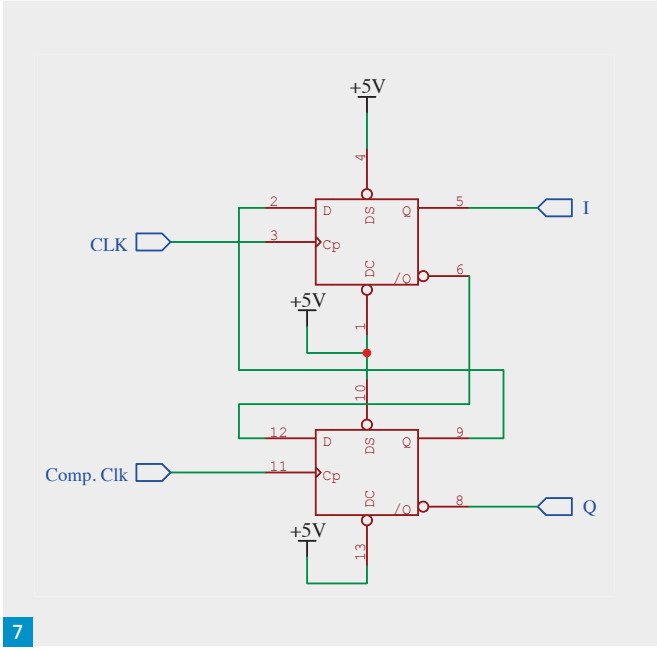
together a local oscillator that meets the criteria noted above. This will also reveal why the PCB has been provided space for U8, a 74AC74.

First, the easy one. There are a number of ICs that can generate these two square waves with the quadrature criteria directly. These include the SiLabs Si5351A clock generator, which synthesises the two separate square waves, and allows the phase between the two to be modified with great accuracy. The trade-off is that this IC needs to be controlled via an Inter-Integrated Circuit (I2C) serial communications bus, requiring a form of microprocessor to control the synthesiser and provide details of what frequency you are receiving. In a future article I will show such a device, built from a kit, that can be used.



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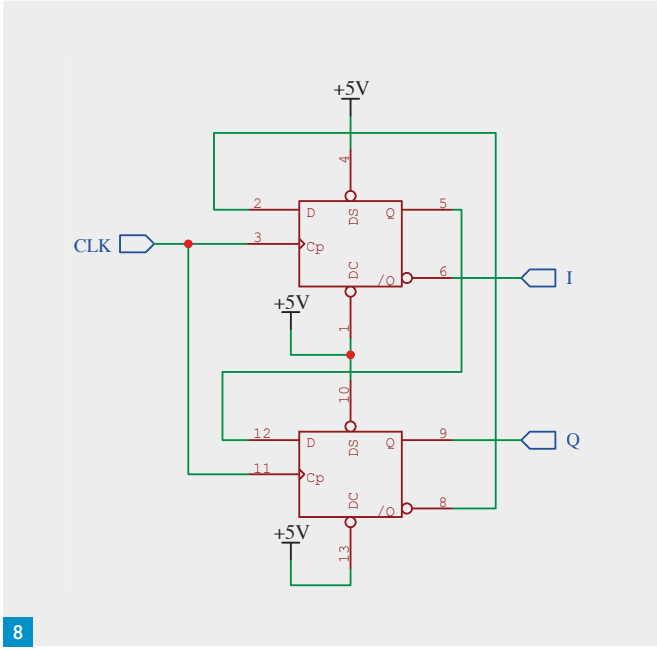

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Secondly, the situation where you have an oscillator that provides accurate complementary outputs. In this situation you can use U8, a 74AC74 dual D-type flip-flop logic IC, to generate the required square waves using the configuration shown in **Fig. 7**. The trade-off is that the oscillator needs to run at twice the frequency that you want to receive. This is necessary as the flip-flop, in this configuration, divides the input by two.

Do not be fooled into thinking you can just convert a single clock into a complementary clock with an inverter – the delay through the inverter causes a non-90° phase shift to occur. I have attempted to invert the input as well as one of the flip-flop outputs, and while this works, it requires a 50% duty cycle clock on the input – any deviation from this again causes a non-90° phase shift to occur.

Beware, there are numerous devices that provide complementary outputs, but you will find that the clock edges are not synchronous – there is some delay between clock edges and when you compare, often one or both of the resulting clocks do not have a 50% duty cycle.

Thirdly, the situation where you have a single oscillator (and in this situation you can again use U8 to generate the required square waves as shown in **Fig. 8**). The trade-off is that the oscillator needs to run at four times the frequency that you want to receive. This is necessary as the flip-flop, in this configuration, divides the input by four. One of the advantages of this circuit is that it does not matter what the input clock duty cycle is as the circuit only has one input that triggers on the leading edge. This is the most common configuration I have seen in designs.

On the PCB, U8 is connected to power, decoupled, and the control pins (pins 1, 4, 10 & 13) are already connected to +5V. I have, however, not used U8 as I have a range of oscillator configurations that I have been playing with, and each has its own 74AC74 fitted.

I specify a 74AC74 as it has a claimed toggle speed of 140MHz, but you could use another 74-logic family depending on what band(s) you want to cover.

There are two more advantages to dividing your frequency source before applying it to the QPD. First any frequency instability is also divided by 4, and secondly the phase noise (the close in phase noise that we are interested in) is reduced by 20 Log N, which in our case is a 12dB reduction.

Options to Consider

I used the online services provided by EASYEDA (website below) to capture the schematic, lay out the PCB, generate the gerber files, and then used the associated JLCPCB service to have the PCB manufactured for delivery to my home. I have made the design open access so anyone can, for example:

- order PCBs – you can even take the gerber files and use another PCB manufacturer;
- modify the schematic to suit your needs and components you might have;
- change the layout to accommodate the cheaper audio transformer options;
- change the op-amps to even lower-noise SMD devices;
- make everything SMD; and
- add a BPF(s) and even an oscillator to the PCB.

easyeda.com

You may not have the capacity or ability to face a project like this so there is an option to purchase a kit of a similar unit produced by **Hans Summers G0UPL** at QRP Labs ($25, URL below). There are some differences. It is aimed at but not limited to a single band unit, there is no power supply, a small PCB and numerous other trade-offs are used to keep the price down. I have built it and played with it, and it is a decent receiver.

www.qrp-labs.com

End Notes

I have made more information available on my website (below). This includes a link to the PCB design at EasyEDA, larger schematic diagrams, high resolution pictures, more details on some of the components used, etc.

www.samuelritchie.com

I have no personal connection with or financial interests in EasyEDA, JLCPCB or QRP-Labs.

In the next instalment we are going to talk about the PC software, add a BPF as well as a suitable local oscillator that does not require any inductors to be wound, and start receiving some broadcast and utility stations in the long wave and medium wave bands.

Richard Constantine G3UGF
practicalwireless@warnersgroup.co.uk

FT5DE vs FT3DE

Richard Constantine G3UGF asks, "Yaesu's FT5D or FT3D…stick or twist, which one offers better value?"

You can't blame any manufacturer for wanting to get the best return on their investment in terms of design, development, sales and marketing.

Car makers and others have been in doing it to us since **Henry Ford** was a boy. Same engine and running gear, just change the body panels add a few more features as standard and convince buyers it's all new and time to upgrade.

How many models of Yaesu's original, ground-breaking FT101 can you recall? Not to mention subsequent models based on the same core design.

Therefore, I was in one sense surprised and in another not, when I heard about the coming of the FT5D as it seemed not that long ago that we were applauding the FT3D, it's colour screen and features, a significant advance from its predecessor, the FT2D.

I've always been pleased with my FT3D and many features and facilities remain unchanged in the new radio. Now that it is being discontinued remaining stocks and little used pre-owned FT3Ds offer good value for those wishing to experience C4FM digital audio and the benefits of internet Wires X Fusion for the first time, while not losing out on traditional FM.

I've dabbled out of curiosity but, I've never really favoured closed digital radio systems, despite their benefits. To me, the strength of amateur radio is that it's always been about making friends, sharing ideas and communicating as widely as possible. Ironic then that some of the pure digital systems once seen as the future and the death of analogue, are now linking and cross-linking back into the mainstream. FM +C4FM is one system that offers the best of both without disenfranchising anyone, despite being a proprietary brand specific system.

Why an FT5D and Why Now?

Is the new radio simply a revision of the FT3D or is it more than that?

Unconfirmed rumours with credence are that the current worldwide chip shortages forced some unavoidable design/production changes. Is it true or simply a marketing trick? Sorry but this time I didn't remove the ABS covers to reveal the cast alloy chassis construction so as to confirm. I really didn't want to compromise its upgrade to IP7X rating i.e. waterproof for 30 mins in a metre depth of water.

The makers claim both older and new radios are all but the same size and weight. Handling the FT5D for the first time it feels slightly wider, deeper and heavier. Clever design contouring and near flush mounting of the rubberised Orange, PTT and other left-hand side buttons to enable waterproofing, is likely the reason. Similarly, the microphone has been moved to the front and is now much less likely to be covered when holding in the right hand, a problem solved.

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

Photo 1: The FT5D & FT3D + Quick release bracket (FT5D only).
Photo 2: Side view, showing the much improved, contouring of controls.
Photo 3: FT5D in new PMG mode. FT 3D in spectrum analyser mode.
Photo 4: FT5D GPS Location & Satellite, illuminated keys in the dark – find your way home!

1


2

Weight has increased by 20 grams more than the published claims. The depth is said to be only 1.5mm more but it looks and feels a little more than that, even with the same SBR-14LI, 2200mAh battery.

The new case now has shock mounting rubber lower corners and raised top corner shoulders, on either side, to prevent drop damage to the antenna connector and multi-function rotary controls, a good move.

Behind the top and slightly more streamlined 66 channel, GPS antenna bulge, there's a small indent on both radios On the FT5D this allows the new, spring loaded, quick release full length belt bracket to attach to the radio. The idea being that the standard spring belt clip supplied is fitted to the bracket, not the radio, if desired. The radio can be body worn and quickly released for use, without the extra bulk of a battery-mounted belt clip in the hand.

This setup isn't practical with a protective case and isn't compatible with the FT3D as the raised lip and locating indent is for a hand loop cord and isn't centrally positioned.

While it may suit some, I'm not so keen. I've encountered many a damaged commercial radio that's fallen to the ground when bending, stretching or running, as the belt clip has come away from the wearer's belt. I much prefer the professional D-clip cases. Each to his or her own, I suppose.

D-lock systems use a separate loop, with a metal stud socket, and threaded over a belt. The radio case has the mating connector and works by rotating the case through 90° to securely lock and unlock it from the belt loop. This means the radio is always secure in its case.

An interesting thought is that the supplied bracket might easily be adapted as an in-car dash mount with a little ingenuity. I might experiment with that later.

Checking it Out

The excellent touchscreen size is largely unchanged. Some claim the screen resolution is now improved. If so, my aging eyes can't detect it. I do suspect a possible tiny, marginal increase in legend size, perhaps that's it or is it just me? I do like that the colour of the active band can now be changed to either White, Blue or Red. The edges of the display bezel have been made flush with the body making it feel more secure in the hand, especially for smartphone generation risking RSI by 'thumb pushing' the touchscreen while holding the radio.

Unlike its predecessor that had a single Red/Green LED to indicate TX/RX, the new model has multicolour indicators for both A and B bands along the front of the top edge. A useful addition in low light or when monitoring. You immediately know which dual-band receiver is active, without chasing the signal strength bar. Incidentally, the monitor level of the non-active band can be adjusted up/down or muted in three increments. A nice feature, especially if using an earpiece.

On its right-hand side, the rubber ancillary socket cover is now a single strip, held in place by just one screw. The previous radio has two covers and two screws. Presumably, it's a manufacturing and waterproofing thing but, operationally, it's not such a good idea in my opinion.

The position of the 32GB max, microSD card has been swapped with the external microphone socket position, that is now at the top. As the cover screw is just below it, it means that you can plug in an external microphone without exposing the data connector, SD card and external supply socket. So far, so good.

For those already owning the reasonably priced SSM-17a speaker microphone it's not an issue but, for those like me that already have a camera microphone that plugs into the 1200/9600 AX25 data port,

it means exposing the other sockets and SD card to the elements. Having 4.5cm of rubber cover flapping in the breeze or fouling the mic lead, is not so convenient and it's likely to be damaged.

Alternatively, invest in Yaesu's professional grade (Vertex-Standard) SSMBT-10 Bluetooth mic/earpiece. I've enthused about this item before. The transmit sound quality is excellent and it can be set for VOX or PTT operation. For similar cost to the wired speaker/mic, the waterproof covers can remain in place.

It's also usable with other models such as the FTM300D and 400D mobiles and with no wires gives added freedom.

Microphone levels can be adjusted to suit individual voices via a software menu. As a general observation, many of the menus have gained additional functions. Voice recording capability for both TX/RX audio remains and is available on both radios.

Controls

The seven front buttons now have different and to my mind, more logical names and positions.

These now make the operation of the radio much more straightforward and intuitive. Anyone upgrading will have to get used to some changes in the button and screen pressing department. Previously, access to the main *Function* menu was from the touchscreen only.

Now it's the top left button and the associated *Back* button is bottom right, both easy to find and remember. Access to Wires X and cancellation used to take up two of the buttons. Combining them in a single *GM/X* on/off format makes more sense, allowing room for the new *PMG* facility. For the older licensees among us it doesn't mean Post Master General!

Memories, Features and Benefits

Priority Memory Group *(PMG)* gives immediate access to up to five favourite channels and more than enough for anyone, I should think. Simply store your favourite channels such as a repeater, call and club frequency and you're good to go. On pressing the *PMG* button, 'Active Monitor' is displayed. A bar chart, with included channel signal strength indication, appears across the lower screen. 'Touch and Go' (their words not mine) via the screen allows direct access to any one of the channels. I really like this feature and can see a real benefit to not missing out on the local traffic All buttons are now better back illuminated so, no need for a head-torch in the dark – a simple but excellent move Yaesu!

3

The rest of this review could be taken up with a detailed explanation of the 900 memories (has anyone ever used them all?), 99 skip search memory channels, 11 Home channels, 50 pairs of Pre-Set Memory Search channels (*PMS*, e.g. Marine), and a myriad of other features, many new to the FT5D. It's obvious that the radio has to appeal to the widest possible audience by incorporating the maximum play value and it certainly does.

A few other features that I can see of benefit are:

The selectable 79, 39 or 19 channel, spectrum band scope, to quickly find signals.

Channel Activity Monitor *(CAM)* – Up to 10 groups with 5 channels each registered and displayed as a bar chart on the lower part of the screen. That is, in addition to the current active channel – You could be operating on 2m while checking for activity on 6m, 4m and UHF all at the same time.

Memory Auto Grouping *(MAG)* – Allows the recall of only memory channels in the same frequency band. Whereas the FT3D requires memories to be pre-loaded into any one of the 24 memory banks. A great new feature.

The rest can be found in the comprehensive 76-page manual although I do wish Yaesu would provide durable manuals with decent hardback covers. Complex radios such as these need durable handbooks.

It's worth noting that actual finger push, memory programming is relatively straightforward and slightly easier on the FT5D, due to the button changes. A PC data lead is included in the radio box but, unless you actually do want to fill all 900 memories, spending another £50.00 on programming software isn't actually necessary unless someone offers to buy it for you.

Functions and Frequencies

As standard, the outer ring of the dual rotary controls adjusts the Volume. It's also used to preset the Squelch via the function menu. The smaller, top and more exposed inner rotary being the channel change. It's really annoying if accidentally touched, because it results in an unwanted channel change, unless the radio has been channel locked.

Thankfully, the control functions can be swapped over to a more usable state via the '*config*' menu (option 23). It beats me why Yaesu continue to offer this awkward default position as reversing the controls is operationally much more user friendly.

The differing weights of the two radios caused me to look more closely at the published specifications. Having noted a few things that don't match the published specifications I remain open minded about the rest. The frequency coverage, modes, RF power and sensitivity are published as almost identical. The receiver remains a double superhet design with direct conversion for AM/FM broadcast. It looks as if the extra facilities and perhaps component/chip changes have resulted in some minor differences to that of the manual.

Not wishing to bore readers with the minutiae of detail any further, the current consumption in all receive modes has

increased slightly, while 5W transmit current on VHF/ UHF bands remains unchanged at 1.6A and 1.9A respectively.

I have never considered it an issue but, some vocal users complain of the FT3D's lack of receive volume. For this reason, the advertising gurus now make a big thing of the FT5D's 'loud' 1W output available from the internal waterproof speaker. AF output is reduced to 500mW from the external speaker/mic socket.

Output is now 300mW more than before and likely to help on a windy mountain top. The original 16Ω speaker has been replaced by an 8Ω device. The circuit may or may not include a chip change. All could be revealed when and if Yaesu publish the full maintenance manual, not available at time of press.

Both radios follow the same convention of having the receive only, DC to near light wave reception on the A band. Actually, it's 520kHz – 999.00MHz This includes AM short wave up to 30MHz and also in the Air Band. FM receive being possible on 6m, 4m, Marine, PMR and licence free.

Receive sensitivity outside of 2m/70cm varies considerably, requiring an appropriate external antenna. Reception of VHF FM broadcast is quite acceptable using the standard dual-band antenna. That also works reasonably well on other VHF/UHF frequencies. No doubt band-specific antennas such as for Air or Marine monitoring would provide better results.

Frequency coverage on the B band is limited to 108-580MHz. Both UK 'E' version radios transmit only on the allocated 2m and 70cm bands with incremental power outputs from 0.3W to 5.0W.

There are ten options for channel stepping for the world market. Frankly, for normal use, *Auto* mode is all you need in Britain, for either model.

The standard SAD-25, 110/240V charger arrived with a 2-pin and clip-on 3-pin UK plug. Travelling overseas this could prove useful. Charging being indicated on the A band TX/busy LED.

APRS & Fusion

Automatic Packet Reporting System (*APRS)* is included in both radios. It's perhaps something I might log on to and dabble with in future. I do like looking at the excellent electronic compass display. APRS may be something that you are already familiar with. With the GPS satellite receiver switched on, the radios consume around an extra 15-18mA. It can be disabled. Once registered, APRS mode displays the other station's callsign, direction, distance and location, course speed and altitude. You can exchange text messages, see other messages, beacon your position and with the data lead connected to a PC a full map view of the system around you. It is something I have considered using as a backup for hill walking, just in case my phone battery should give up – I'm told there's a full APRS manual available on Yaesu's website and as usual a lot of information on websites and YouTube.

What does appeal to me is that the GPS is also part of both radios' Wires X C4FM Fusion system. Simply by pressing the GM/X button and connecting to a dual-mode FM/C4FM Fusion repeater it's the easiest way to access either the UK or world networks and speak with others via the many virtual 'rooms.' Stations using the system can be identified by name, callsign and distance from your location.

Incidentally, if you haven't already discovered whether there's a Fusion repeater near you, download the 'Repeater Book' App. It lists all repeaters, modes of operation and their distance from your current location – indispensable when travelling.

Summary and Conclusions

While I could fill the whole of this edition of *PW* with facts, features, options and choices available on either radio, it would clearly become information overload, if not already. The software has jumped from 7.1 to 7.11. This review has prompted me to find things I didn't know about either version. I now realise that I haven't been making the most of my investment and both do more than I realised. I should have read the manual sooner!

The challenge as always is to give readers enough detail so as to make their own judgement. If you're a first-time potential buyer you could also do worse than spend an hour – yes, an hour (with coffee breaks) – viewing the FT5D beginners YouTube video made by **Frank WC0O**. It's short on the all too familiar superficial stuff of some 'tubers' that I really don't care for. What his videos give the viewer is a nice measured and steady introduction to the basics.

If you already own the FT3D and you're happy with it, wait for the next big thing!

If, perhaps, you're wishing the radio was a little more intuitive in use, especially the way the F *menu* and *Back* keys now work, plus the significantly enhanced memory function operation, and monitoring, think about changing.

4

If you're concerned about the ruggedness or waterproofing, the FT5D is better equipped for both the great outdoors and for low light levels. It has some quirks, but what radio doesn't? You can't please all of the people, all of the time.

For example, in scan mode you can see the frequencies changing on the FT3D All you get on the model 5 are the words, *'VFO scan.'*

Neither is actually full duplex, there's no SSB on any band, even SW SSB receive would be nice.

For the visually impaired there's no voice assistance that you get in much lower cost radios

The USB data lead doesn't include the ability to charge either radio.

It may be asking a lot for its size right now but these and other things may be the next generation.

It you simply fancy a change for no particular reason, are willing to spend a little more but not have to invest in costly all new accessories apart from a case, the FT5D is a no-brainer.

The FT 3D has for me always been a 5-star radio. This makes it hard for me personally to justify change for changes sake, but we all do it sometimes. The FT5D builds on the heritage of model 3 so, it could be argued that the model 5 is heading for 5 stars plus a few dB.

Christmas is coming, will I or won't I change my personal radio? For now, I will leave you to guess.

The FT5DE launch price is circa £399.95, while for the FT3DE, check out the current offers. My thanks to ML&S for early supply of the FT5D for this review.

NEW DEFINITION OF DIGITAL HANDHELD

Meet the Advanced Technologies

《Actual Size》

C4FM/FM 144/430MHz DUAL BAND
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FT5DE

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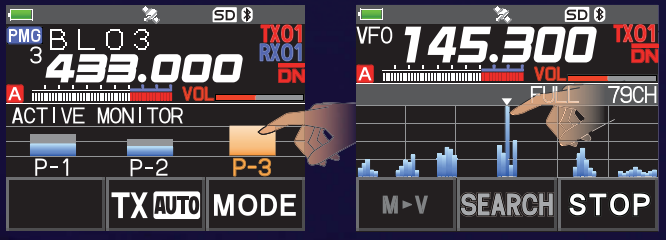

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Roger Dowling G3NKH
practicalwireless@warnersgroup.co.uk

1

The Face behind the Call

With this new series, **Roger Dowling G3NKH** aims to put a face to the call, starting with Alan Balmforth G3RKQ.

For many, one of the pleasures of our hobby is the opportunity it presents to learn something about fellow radio amateurs that often extends beyond the soldering iron. In this occasional new series we meet amateurs with an interesting story to tell.

Former bank manager **Alan Balmforth G3RKQ** (86) is a self-confessed 'old-timer'. His interest in amateur radio dates back to his membership of Barnsley Amateur Radio Club in the 1950s, shortly after coming out of the RAF, and he became an SWL member of the RSGB in 1957. He and his former grammar school friend, the late **Rodney Bray G3KEL**, learned Morse together while at Grammar School so the test at the GPO offices in City Square Leeds presented no problem. Then, having passed the RAE, he was proudly awarded the callsign G3RKQ in September 1962.

Alan and Rodney were both keen constructors, greatly helped by the availability of vast amounts of cheap 'government-surplus' equipment and components in Lisle Street, Tottenham Court Road and Edgware Road. *PW* and *Short Wave Magazine* readers of this era will remember with fondness the shops of Lasky's and GW Smith, both later taken over by Comet. Another popular shop was Proops, still going strong today though now relocated to Leicester.

Early Days

Alan's entry into the world of amateur radio followed the path that was traditional for the times: a government-surplus receiver and a home-built topband (160m) transmitter. *"My receiver was a BC348"*, he recalled, *"It was an excellent receiver, covering six bands from 1.5MHz to 18MHz, that had been manufactured in vast numbers for use by the US army and air force during World War II"*. His transmitter was, of course, home-built: a topband three valve 10W rig, comprising a 12AU7 Franklin VFO, EF50 buffer and a TT11 PA. *"I started out on CW but soon added a three-stage push-pull modulator for phone"*, said Alan.

Success on topband encouraged Alan to build more gear for use on the HF bands. *"I bought a Geloso VFO, which had become very popular at the time. They had been imported from Italy in the 1960s by KW Electronics, who used them as an integral part of their Vanguard, Victor and Valiant transmitter range. They covered all amateur bands from 80m to 10m, and with a small modification could even be used on topband"*, said Alan. *"The only drawback was that it needed a lot of work doing on it to stop it drifting!"* Alan used this for a 50W CW/AM transmitter covering the HF bands.

Going 'Commercial'

Alan enjoyed making all his own equipment in those days and his move towards commercial equipment only came about by accident. *"By the 1970s we had moved from Barnsley to Sheffield and by chance there was a radio shop owned by a former licensed amateur near the bank where I worked. He had left the hobby and asked me if I would like any of his old gear"*.

Of course, Alan's answer was, *"Thank you very much!"* and he became the proud owner of his first commercial transceiver, a National NCX-3. Little heard of today, the NCX-3 was an early SSB/AM/CW rig covering 80m, 40m and 20m. Based in Massachusetts, the National Radio Company was known to UK radio amateurs mainly as the manufacturer of the famous HRO receiver, which had a place of honour in many shacks in years gone by.

The NCX-3 did reliable service for many years, providing some 120W of SSB/CW and around 40W of AM. Meanwhile, Alan explored other aspects of amateur radio, including RTTY, SSTV and PSK31.

In the years that followed, Alan was active in all modes, ranging from CW using a home-made electronic keyer, AM, SSB, and digital modes, including RTTY, slow-scan TV and PSK31. Later the NCX-3 gave way to a Kenwood TS-530, followed by a Kenwood TS-950. His current shack appears at **Fig. 1**.

House Moves

Alan moved house numerous times over the years. The sizes and shapes of the associated gardens have obliged him to try numerous antennas and feeders. These have ranged from simple long wires to trap dipoles; from half-size G5RVs to more sophisticated directional mast-mounted antennas. These included the tribander for 80m, 40m and 20m on a 30ft Tennamast in the small garden of a house in Sheffield in the 1990s, **Fig. 2**. I was interested to know if he had encountered any problems from his neighbours or the local council. His an-

Fig. 1: Alan in his shack. Fig. 2: Working on the antenna. Fig. 3: The three-manual organ.

swer was an object lesson to those who may face a similar challenge in the future.

"A fatal mistake is to put the antenna up and hope that no-one will notice but believe me, they will", he told me. *"I decided to be open from the start. I began by taking a number of photographs of the house and garden, and then I marked up the photos to show exactly what it would look like from different viewpoints. Our neighbours appreciated being allowed to comment in writing before the mast went up and raised no objections. And once the council knew the neighbours were happy, they raised no objections either"*.

Alan retired in 1989, remaining in Sheffield until 2000 when he relocated, with his wife **Nina**, to a purpose-designed house in the fens of south-east Lincolnshire. He recently downsized his station, which now comprises a Kenwood TS-590, with a recently purchased TS-480 as a standby. His current antenna is a 107ft long trap dipole supported at the centre by a 30ft pole and fed with 75Ω twin feeder via a 1:1 balun.

Other Interests

But radio is not by any means Alan's only interest. Since childhood he has been deeply involved in the world of classical music. Son of a headmaster, organist and music teacher, he was introduced to the piano at the age of six. Two years later, still with legs too short to reach the pedals, Alan was playing the organ at his father's choir rehearsals at their local church. He continued to study music to 'A' level at grammar school but reluctantly decided that the life of a professional concert pianist was a step too far and left school to become a bank clerk, where his aptitude for mathematics was well suited to a life of adding up figures. He progressed well, becoming a branch manager in 1974.

Quite by chance, this led to a further development in his musical life. It was suggested to him that he might be able to help with the administration of the London College of Music Society, an organisation for alumni of the LCM conservatoire of which Alan in due course became a Fellow. The Director at that time was organist and composer **William Lloyd Webber**, father of Starlight Express composer **Andrew** and cellist **Julian**. It was a happy period during which Alan was able to benefit from organ studies with Lloyd Webber and attend many LCM functions in London and throughout the country.

Alan's activities in the world of music enabled him to recruit a new member to the amateur radio community in 1982: none other than top international concert pianist **John Lill CBE**. Having attended Sheffield City Hall to see him play a Rachmaninov concerto, Alan and a friend collected John from his dressing room to escort him to the friend's house about 12 miles away where he was staying. Alan's car had a 2m whip antenna on the roof and John asked Alan about this 'strange aerial'. *"I gave him an explanation and demonstration and he was very impressed"*, said Alan. *"He said that he thought it would be a hobby suitable for him, particularly working mobile while driving in his BMW to venues around the UK. I suggested he contact the RSGB for details of how to proceed, and in due course he became a radio amateur himself."*

Alan's life today continues to be a happy mix of music and radio. Pride of place in his home is his 'Norwich Classic' three manual and pedal 38-stop organ, **Fig. 3**, which he bought back in 2002. In 2009 he had the whole instrument digitally rebuilt with sampled sound reproduction, providing a total of 43 speaking stops plus the usual couplers. There are four 200W loudspeaker units, one each for Swell, Great, Choir and Pedal. An electronic reverberation system enables Alan to replicate the sound of a large church or cathedral organ from a digital display panel.

Alan's interests of radio and music reminded me, as we talked, of the great **L H Thomas G6QB** who contributed the *Communication & DX News* feature in *Short Wave Magazine* for 20 years up to his death in 1966. 'Tommy' was also a talented organist who, under his stage name Howard Thomas, regularly 'modulated the BBC transmitters', on the Light Programme and the Home Service many years ago.

Alan continues to enjoy both of his hobbies. He regularly plays organ and piano, though nowadays mainly for his own pleasure rather than public performances. He enjoys chatting, mainly on 80m, plus occasional CW using his still-working homemade electronic keyer.

"The great thing about amateur radio is that it's always changing, as new techniques come along", he said. *"Today it is FT8, D-STAR and Fusion, and no doubt there'll be other new developments in the years ahead. So, there's always something new to learn!"*

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

Three More Ideas

Geoff Theasby G8BMI offers a Panadapter for your Rig, an idea for Meter Illumination and a Graphic Audio Display.

Geoff Theasby G8BMI
geofftheasby@gmail.com

Long known as the sign of a sophisticated receiver, from the days of the Racal RA17, little did I know that panadapters would become financially viable within my lifetime.

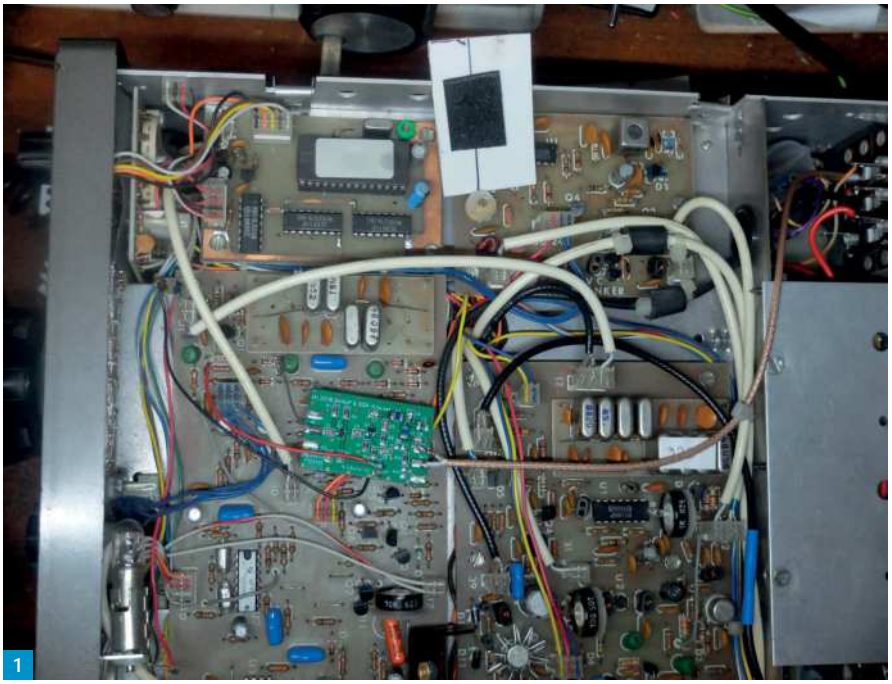
The late **Dave Powis G4HUP** designed an interface board, to fit inside almost any receiver, tuned to the IF frequency, and displaying the output on a computer, using software such as GQRX, as an RF spectrum with a waterfall display. The interface PCB measures only 40 x 25mm, picks off a signal from the IF chain (before the main filter, usually) and sends it to an SDR receiver that covers that frequency, and Lo, a panadapter! Be aware that not all SDR receivers will tune down to, for instance, 9MHz (the Ten-Tec). I was using a FunCube Pro+ dongle. I fitted the PAT (Panoramic Adapter Tap) board to my Ten-Tec Argosy II, which is nearly 40 years old, from a time when digital frequency displays on AR gear were a new thing. The PAT internal construction uses mainly using discrete components, which makes building the kit version easy. Here it is, **Fig. 1**, coloured green, centre, which also shows it located in my Argosy. The white rectangle top centre is a stick-on insulator to protect the PAT board.

When it is up and running, take time to learn its facilities, which are very useful in contests, for picking a quiet frequency, or spotting nearby signals.

G4HUP became SK in 2017, but SDR Kits now sell the PAT boards ready built for about £12. Usage notes, 22 pages, were written by OZ9AEC and can be found at:
www.gqrx.dk

Meter Illumination

I bought a KW 202 valved receiver 'as seen' and am restoring it to working order. The receiver has a signal strength meter ('S' meter) but it is unlit. This type has a clear plastic cover, removable from the front (I couldn't drill through from the back), so I gently drilled the top edge to take a 3mm diameter light emitting diode, and powered it through two very, very thin wires (38 swg) across the panel and over the top, retained by Pritt adhesive and kapton tape over the edge. Spot the wires, **Fig. 2**! Kapton tape is thin, very tough and puncture and abrasion resistant. Inside, normal hook-up wires connect to the 6.3V circuit. The thin wires are almost invisible to a casual observer, operating within their rated current capacity of 50mA, and the insulation is rated to an astonishing 1500V! To reduce the white LED brightness to an acceptable level, I had to run it through a 4.7kΩ resistor, meaning it is taking only 1.3mA! Even more discreetly, the LED could be a surface mount device, which is beyond my eyesight nowadays, and which would require no drilling. The tuning dial lights were blown, so I added two LEDs there too.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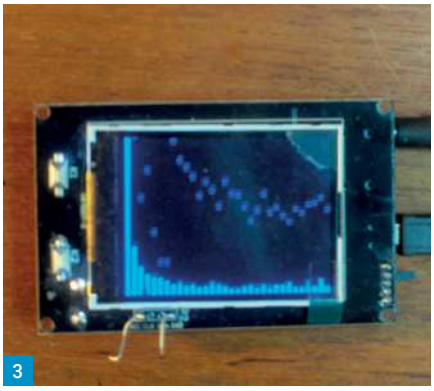
3

Graphic Audio Spectrum Display

Despite its name, this is not in any real sense a spectrum analyser, only a visual indicator of an audio signal without any calibration, **Fig. 3**. The STM32-driven ARM microcontroller is wasting its time here. Reacting to sounds detected by its internal microphone, high or low level 3.5mm jack sockets, and powered through its USB connection, Geek Teches SA600 offers a variety of visual modes in differing colours and styles on its 2.8in screen. Costing about £20, it is an expensive toy, but it may entertain casual visitors, children or the cats. A newer version, Frontier MS3264 V3 offers similar facilities.

Fig. 1: The panadapter fitted to the Ten-Tec Argosy transceiver. Fig. 2: Spot the wires! Fig. 3: LCD graphic display.

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Orbital Dynamics

Godfrey Manning G4GLM explains that Apollo 11 never left Earth's gravity.

Godfrey Manning G4GLM
practicalwireless@warnersgroup.co.uk

You can try orbital dynamics for yourself at home. Tie an M10 nut to an arm's-length of string. Grasp the other end of the string and whirl the nut round your head. If the nut flies off, you didn't tie it properly. Otherwise, it stays in orbit round your head. It tries to fly off but can't, because a force is holding it in orbit. You can feel that force as tension in the string.

An orbiting satellite (like the one in the illustration, **Fig. 1**) is also held in orbit by a force but, instead of tension in a string, this time it's the pull of the Earth's gravity. The spacecraft is weightless but, without being subjected to gravity, wouldn't stay in orbit.

It's not flying, it's falling, pulled towards the centre of the planet by gravity. It's also moving forward over the curved surface of the (approximately) spherical planet. As it moves forward a tiny distance, the surface of the planet falls away from below the spacecraft, all because of that curved shape.

At the same time, the spacecraft falls a tiny amount so as to maintain its distance from the centre of the Earth. Forward-and-falling movements, perfectly synchronised, keep the spacecraft going round the planet. It's the forward speed that has to be correct; too fast and the orbit is raised (even to the point of the satellite shooting off into the distance). Too slow and the orbit lowers (even to the point of re-entry into the atmosphere).

Try it at Home!

You can also experience weightlessness at home (only to be tried by able-bodied readers please). Either jump off the lowest step of the stairs and land gracefully on your feet on the floor beneath you, or stand on the floor and jump up in the air, again arranging a careful landing back where you started. On the way down, for that brief moment of free-fall, you are weightless.

You remain the same mass. That's to say, you're composed of the same amount of matter whether you are falling or not. It's mass that causes gravity. Any two objects will attract each other by gravitational pull. In your case, the Earth wins and pulls you back down because its mass is vastly more than yours. In theory, your mass pulls the Earth an immeasurably miniscule distance up to meet you. Weight is the consequence of action (gravity pulling you to the centre of the Earth) and reaction, an equal and opposite resistance met when the floor prevents your headlong fall into the planet's centre. Take away the reaction, fall towards the Earth and there's nothing pressing against your mass to make you feel weight.

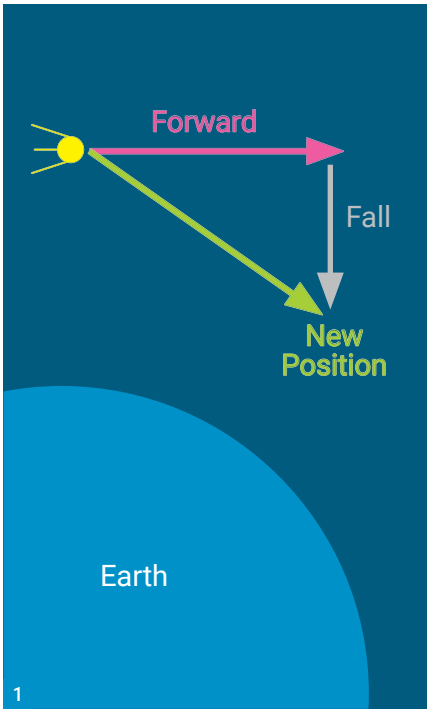

Fig. 1: A satellite 'falls' towards earth.

Isaac Newton felt the weight of an apple when he got in the way of its fall from a tree. This made him realise that everything attracts everything else. The pull of an object's gravity wanes the further we go from it, according to the inverse square law. You already know this law because it also explains how our radio signals weaken the further you get from the transmitting antenna. Hence, a very distant object can only exert an immeasurably miniscule gravitational force.

Apollo 11

For Apollo 11 to leave Earth's orbit, it has to accelerate to a speed at which the forward motion is so great that the downwards fall has almost no effect in comparison. It leaves low-Earth orbit. It doesn't leave Earth's gravity. It overcomes the pull of gravity by fighting back with superior speed. The rocket motor fires (burns) at trans-lunar injection to boost the spacecraft into what is really a very high Earth orbit. This orbit is so high that it takes the spaceship close to the Moon. At this point, the pull of the Moon's gravity becomes greater than that of the Earth's. The Moon is smaller (has less mass than Earth) but Apollo is now much closer to it than Earth.

Part-way along the path, the forces are in balance, but Apollo still has enough forward speed (momentum) to keep going. Once the third stage motor shuts off for the final time at the end of establishing trans-lunar injection, Apollo is on the way to the Moon but slowing all the time because of Earth's pull.

To demonstrate that the Earth is in the pull of the Moon's gravity, all you have to look at are tide tables. The effects of the solar and lunar gravitational attractions pull and tug at the body of water that covers two-thirds of the surface of our planet. Greatest tidal movement (springs) occurs when the pulls of the two celestial bodies line up (un?)favourably.

Get the orbital speed (and hence height) just right and the satellite will orbit the Earth at the same speed at which the planet turns on its axis. This is how communication satellites such as QO-100 Es'hail 2 (Canopus) can appear to stay in a fixed place in the sky. This is known as geostationary. Science fiction author **Arthur Clarke** first described this, only it's no longer fiction and we now refer to the Clarke Belt, the orbit where geostationary satellites are found.

Once a spacecraft is on its trajectory and the rocket motor shuts off, it continues by its momentum and is influenced by gravitational attraction. The same applies to a thrown cricket ball. That's all rocket science is.

(The above article first appeared in *Edgware Ham News*, the newsletter of the Edgware & District Radio Society. Its relevance, of course, is to the various satellites we use in our amateur radio communications, both low earth orbit and, as described, to our very own geostationary satellite, QO-100).

Both my staff and I wish you a very happy Christmas and healthy new year!

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Mike Devereux - G3SED
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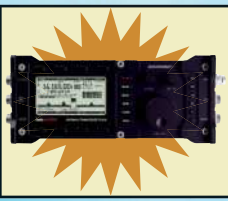

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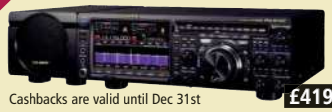

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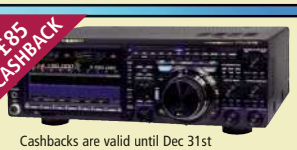

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Most capacitance measurement functions on digital multimeters, where there is one, have a resolution of about 1pF but an accuracy of perhaps 5pF on the lowest range. In radio and instrumentation work it is often useful to have a way of measuring low capacitance values, for example, for comparing and or matching them. I have been meaning to build a simple accurate and cheap capacitance meter for some time, partly to see how hard it would be and partly to measure variable capacitor characteristics.

I would usually use a microprocessor for such a design but in this case the use of a multimeter to display results seemed simple and the pure analogue design aspects were the ones that interested me the most.

In theory you can 'simply' measure how long a capacitor takes to charge to a given level at a given current and calculate the capacitance. In practice many circuits use a fixed voltage and a current limiting resistor and then solve the exponential equation $V/Vo = e^{-t/RC}$ For example, if the threshold is half the supply voltage $0.5 = e^{-t/RC}$ then $\ln(0.5) = -t/RC$ so $C = 0.693t/R$. This means that to measure 1pF resolution with a 50% voltage threshold and a 1µs timer tick you need a 690kΩ resistor.

An alternative approach is to use a current source to provide the measurement current. This eliminates the exponential function and the equation is simplified to C=It/V so for 1pF resolution you might use a 2.5V threshold, 2.5µA current source.

To achieve 1pF resolution the currents become difficult if not impractically small. The usual current source circuits such as a fixed base bias pnp transistor with a load resistor in the emitter circuit and the collector providing the current would need a reasonable amount of headroom for stability, hence the charge time would be short or the current would be very low and potentially less stable.

Alternatively, a pnp current mirror programmed by a resistor would effectively double the headroom, allowing the supply voltage to be 5V while still having a reasonably long charge period, see **Fig. 1**, which illustrates the measurement of charge vs. time in various circuit configurations.

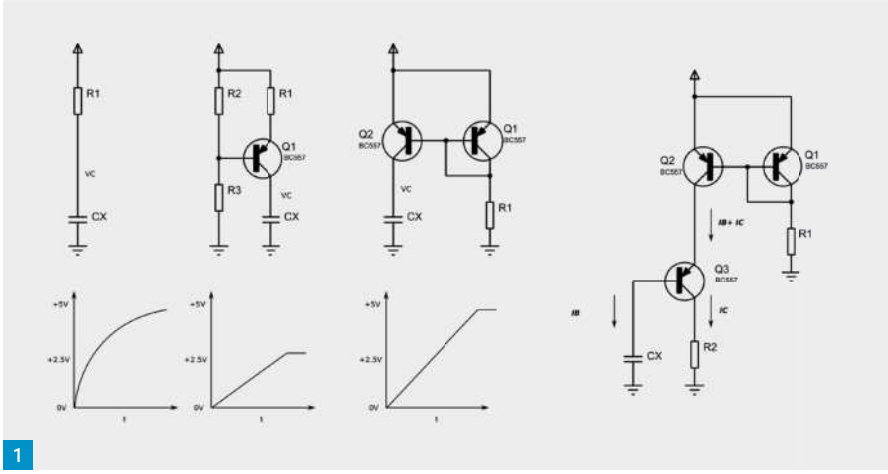

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Fig. 1: Measuring capacitor charge time.
Fig. 2: Schematic of the meter adapter.
Fig. 3: The PCB. Fig. 4: Measuring a 22pF capacitor. Fig. 5: Graph comparing measured data.

Even so the required current is still rather low. What I wanted was a way of maintaining stability and having a reasonably long charge time so that measurement accuracy was maintained.

Current Splitter

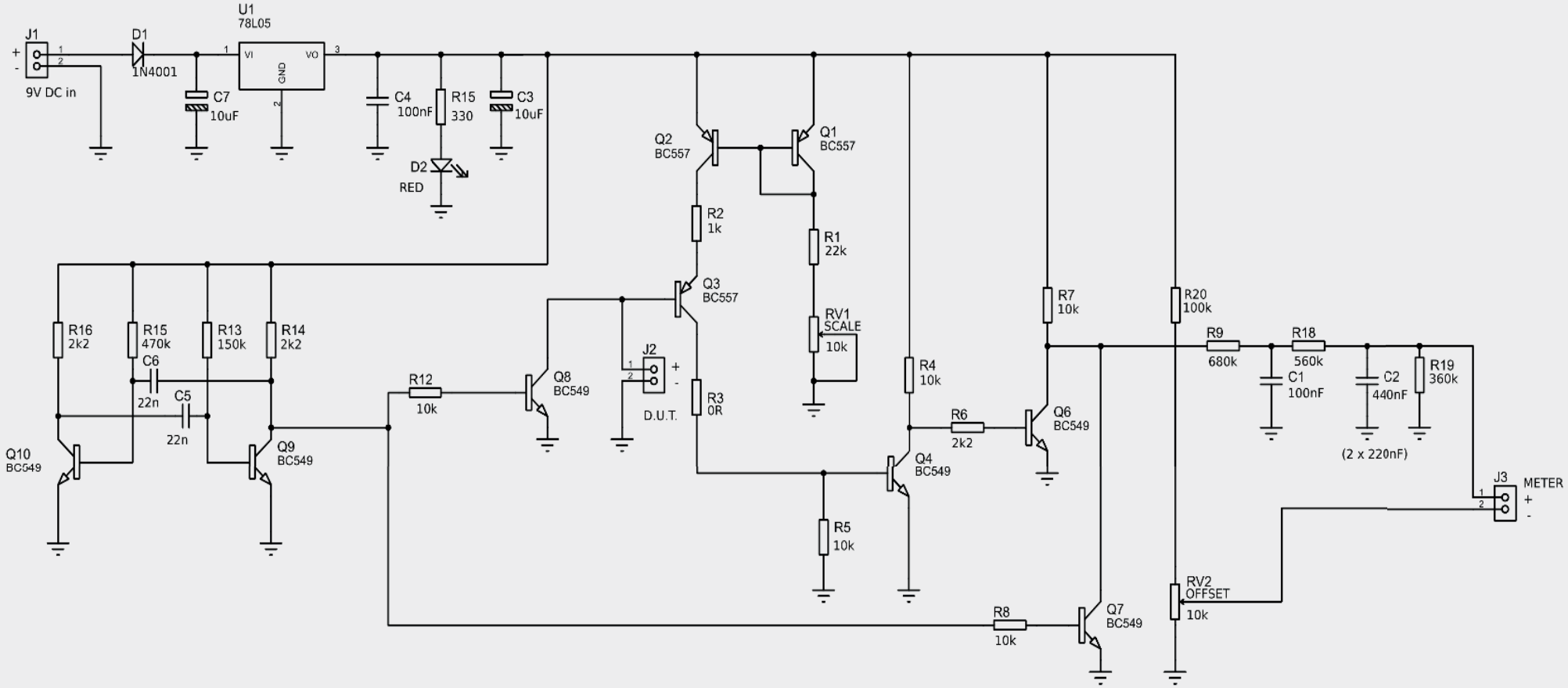
Then it occurred to me that it might be possible to use a transistor as a 'current splitter', feed the current mirror output to the emitter of another pnp transistor and so long as the collector is not allowed to saturate, the base current should be a stable fraction of the emitter current, $Ie = Ic + Ib$ and $Ic = h_{FE}Ib$ hence re arranging $Ib + h_{FE}Ib = Ie$ so $Ib = Ie/(1+h_{FE})$. So, for a transistor with an h_{FE} of 200 we get $Ib = Ie / 201$. This might work and give relatively long stable charge times. We can have a stable current mirror operating at 20µA with a charge current of 100nA.

Now another thing occurred to me. Looking at the sketch of the circuit there would be a change in collector current, which could act as an indicator of capacitor reaching the charge threshold. And because the base current would cut off when there was no headroom remaining, there is no need to load the measurement point with any detection circuitry and this simplifies the circuit. See **Fig. 2**.

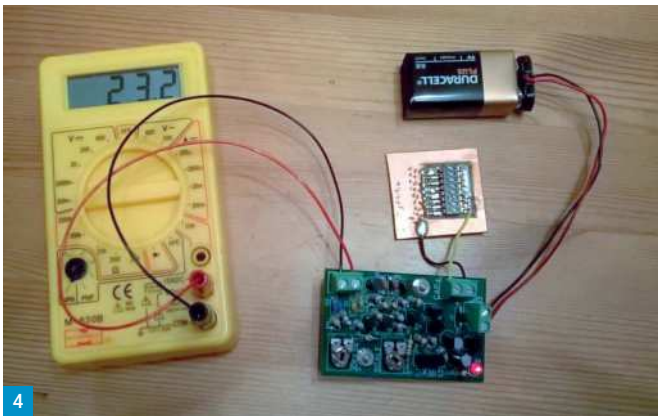
In order to make a measurement the capacitor has to start from a known state, preferably fully discharged, giving the maximum time to measure the charging to the threshold. Initially I tried a 2N7000 NMOS transistor but the RDSon of approx 6Ω series resistance meant that discharge times were quite long. If the capacitor is relatively small, then discharging it with an open collector transistor should work, without the need for current limiting, setting a limit of 200mA for 1µs (the maximum a typical small signal bipolar will take repeatedly safely) gives approx 40nF so we can use a BC547 etc. VCEsat is less than 0.25V at 10mA and will drop rapidly as the capacitor discharges.

First Experiments

A first experiment using a pulse generator to drive the base of the discharge transistor produced a waveform that varied with the capacitor connected and looked quite like pulse width modulation (PWM), which gave me an idea for generating an output to be measured on a meter. Adjusting the duty cycle of the pulse generator gave a good range for measurement and found the minimum time needed to fully discharge the largest capacitor.


J1
9V DC in
D1
1N4001
U1
78L05
VI
GND
VO
C7
10uF
C4
100nF
R15
330
C3
10uF
D2
RED
Q2
BC557
Q1
BC557
R2
1k
R1
22k
Q3
BC557
RV1
SCALE
10k
R16
2k2
R15
470k
R13
150k
R14
2k2
C6
22n
C5
22n
R12
10k
Q8
BC549
J2
D.U.T.
R3
0R
R4
10k
R7
10k
R20
100k
R9
680k
R18
560k
C1
100nF
C2
440nF
R19
360k
R6
2k2
Q6
BC549
Q4
BC549
(2 x 220nF)
J3
METER
Q10
BC549
Q9
BC549
R5
10k
RV2
OFFSET
10k
R8
10k
Q7
BC549

3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A free running astable, using two npn transistors with RC networks giving a narrow reset pulse and a wider reading window was built and connected (Q9 and Q10).

Open collector transistors Q6 and Q7 generate the PWM waveform that represents the charging time.

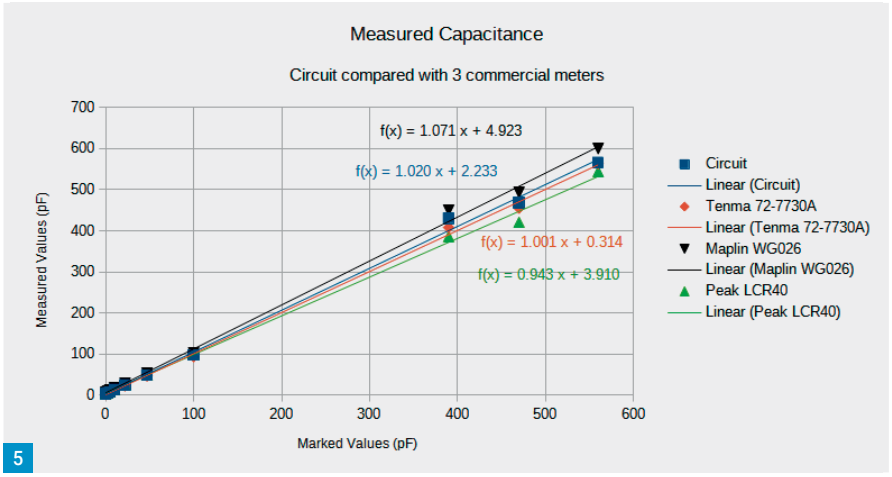
Building a PWM reconstruction filter to provide a stable output for a meter display I chose to use a two-pole RC network similar to that recommended for simple PLL like the 4046. This was successful and the meter display on the 2V range was nice and stable. There was an offset due to a combination of the stray (parasitic) capacitance of the circuit and the reset pulse width. Adding a potentiometer to allow adjustment of an offset voltage for the negative terminal of the meter allows the circuit to be set to zero when no capacitor is connected or to null out the contribution of leads etc.

Results on breadboard were very good so I decided to make a PCB, **Fig. 3**, to see how good it could be made as a stand-alone battery powered circuit. The circuit is very simple, and only uses 9 transistors, 13 resistors and 3 capacitors, to which I added a 5V regulator and power-on LED and a couple of trimmers for calibration and offset adjustment. The 5V regulator is important as otherwise the voltage threshold will be dependant on battery level and so will require frequent re-calibration.

As designed the adapter has a range of 0pF to approx 600pF, limited by the PWM generation and the measurement current. Changing the charging current can provide other ranges.

Calibration procedure is simple. Connect the output to a DMM set to the 2V range. With no capacitor connected set the adjust trimmer to mid-range and adjust the offset to give zero. Then connect a 560pF 1% 50V C0G/NP0 capacitor and set the adjust to give an output of 560mV. Remove the capacitor and adjust the offset to zero, replace the capacitor and readjust to a measurement of 560mV. Things to watch out for: some capacitors dielectrics are voltage sensitive e.g. Z5U and some dielectrics are very temperature sensitive e.g. N750. I made up a switched test board with 2.2pF to 100pF caps (0603 and 0805 C0G 50V parts). The photo, **Fig. 4**, shows the unit being used to measure a 22pF capacitor.

I made measurements of capacitors with the circuit and compared them with measurements on three commercial meters that I have: a Peak LCR40, and two DMMs with capacitor ranges, Tenma 72-7730A and an old Maplin WG-026.



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Marked Value (in pF)	Circuit	Tenma 72-7730A	Maplin WG026	Peak LCR40
0 (+strays)	3	2	5.3	3.5
2.2	5	4	8.1	5.8
4.7	7	6	10.8	8.3
10	13	11	16.6	13.9
22	24	22	28.7	24.8
47	48	46	53.6	48.8
100	97	93	102.8	97.4
390	430	408	450	386.6

Table 1: Measured capacitance values.

Results

The results (see **Table 1** and **Fig. 5**) correlated well, the difference between the measurements over a range of 0 to 500pF being relatively small, and less than the difference between the commercial meters. The sensitivity was sufficient for measuring variable capacitors, using two circuits connected to show difference between the outputs mechanically connected. For example, chain drive ganged capacitors can be quickly aligned.

I hope the circuit ideas are of interest. The circuit can be built on Veroboard or even solder-less breadboard and works reasonably well if care is taken.

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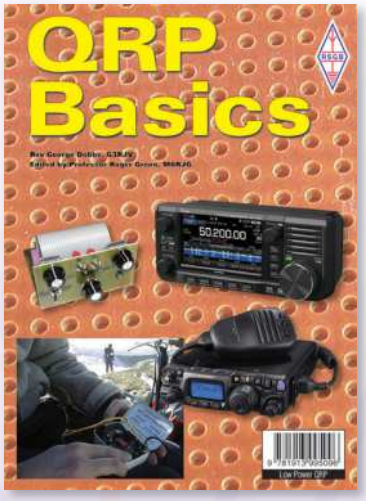

Originally written by the famous QRP guru Rev. George Dobbs, G3RJV (Silent Key) this book has been updated by experienced QRPer Professor Roger Green, M0RJG and is now for the first time in colour. True to George's original text this new edition of *QRP Basics* continues to provide the ideal guide to low power amateur radio.

QRP Basics starts with a personal introduction by George before moving to the 'What' and 'Why' of QRP. Everything QRP is discussed in the following pages from what can be achieved using QRP stations and portable QRP operation. There is good, solid advice on a wide variety of topics including choosing commercial QRP equipment, QRP kits, simple antennas and homemade QRP equipment.

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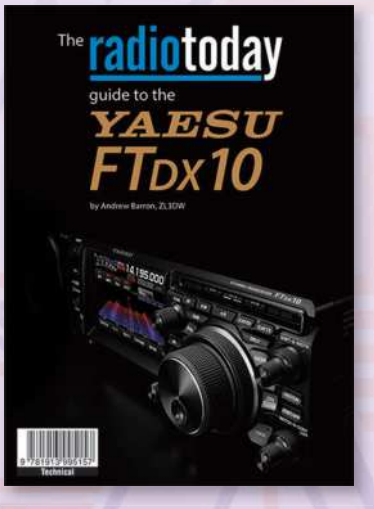
radiotoday guide to the Yaesu FTDX10

Andrew Barron, ZL3DW

NEW TITLE



The Yaesu FTDX10 is much more than just a cut down version of the Yaesu FTDX101D/MP. Andrew Barron, ZL3DW again brings you the practical guide to getting the most out these highly rated transceivers.

The *radiotoday guide to the Yaesu FTDX10* provides a practical and easy to understand guide to these radios. This is not simply a 'rehash' of the Yaesu User Manual, nor does it try to replace it. Andrew, for example, explains not just what the control does, but also how and when to use it. The FTDX10 employs the same cutting edge 'Hybrid SDR' (software defined radio) receiver architecture as the FTDX101 and Andrew explains how to get the most from it. You are also offered tips on how the author set up his FTDX10 and his 'real world' experiences. In the 208 pages of the book you will find information on a huge array of functionality, physical features, connections, interfaces and more alongside the incredibly useful troubleshooting guide.

These are great radios and Andrew provides the insight into its features and how achieve their full potential. No owner or potential buyer should be without a copy.

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roger@g3ldi.co.uk


1

CWops Open

Roger Cooke G3LDI has a cornucopia of Morse-related topics, starting with a report on the recent CWops Open event.

The CW Open is different from most annual contests. It is divided into three sessions and you can enter as you are able, i.e. all three sessions or just one or two. There are awards for most situations and power levels. The three sessions were as follows:
Session 1: Sept 4 (0000 – 0359UTC)
Session 2: Sept 4 (1200 – 1559UTC)
Session 3: Sept 4 (2000 – 2359UTC)

Team UK took part and in fact sported two teams this year, Team UK and Team UK Casuals. Several took part in all three events (they are judged individually), including our high scorer **John G4RCG**, operating as M2G. John had some huge scores and leads the team easily. However, we all did what we could and it was good to see enough for two teams. We shall have to wait to see how we fare in the final results. Nobody used G2CWO this year.

Eddystone Morse Keys

I have heard from **Andy 2E0NDZ** again, this time with an Eddystone Morse key. I was under the impression that the Eddystone 289 black bug was the only key that they made, but this is a straight key.

The key is marked Eddystone with P2743 stamped on its base. Andy would appreciate any feedback you might have. Email him direct to:
andrewhumphriss@tinyworld.co.uk

Pictures of the key, **Figs. 1** through **4** show that a ball bearing race was used on the lever. I don't remember ever seeing this on any straight key before.

GB2CW

Roger MI0WWB reported on his GB2CW activities: *"Since the end of December we have only missed one Tuesday evening session.*

"I started with two students, one dropped out quickly and the other has remained with me throughout to the present. He is in his mid-70s but making steady progress.

"A couple of months ago I picked up two more students, but they too dropped out after just a few weeks. The key issue was I could tell they were not putting in the practice. They were failing to get basic stuff. So, I am back to one student."

This seems to be par for the course. We suffer the same here in Norfolk with people dropping out after thinking they can become proficient CW operators in a couple of weeks. It's their loss, of course, but quite frustrating when trying to run a class. If only they would stick with it, they would find that the satisfaction would come, albeit gradually, and not without a lot of effort! As the old saying goes, *"Nothing worthy of achievement is attained without effort"*.

NARC started classes at the beginning of October so we are hoping that we get a few new students coming along. We do have two raw beginners, and a few returning ones so having a summer break does seem to work quite well. We are hoping to cover sending techniques this winter on Zoom, not having any real Club meetings.

Fire Alarm System

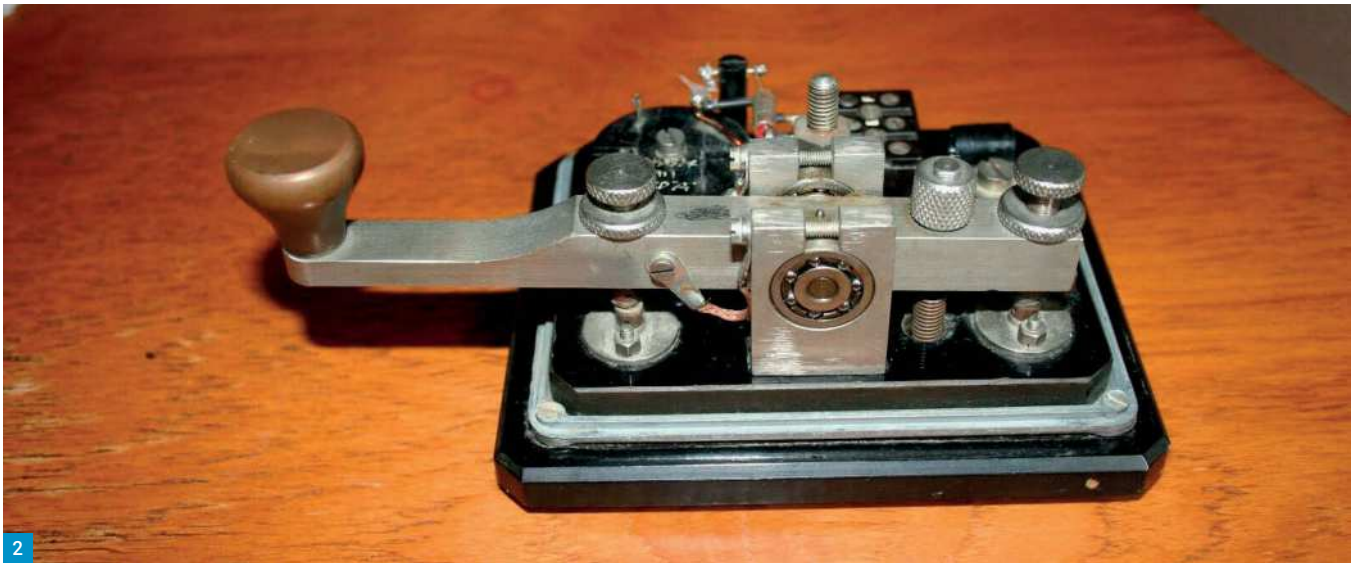
I saw this on the CWops reflector. It was reposted from Twitter by **Don Greenbaum N1DG**: *"Did you know every 1000ft in the City of Boston, there's a fire alarm box that summons Boston Fire Brigade in three minutes or less, using a 170 year old system to send Morse code along wires! Works even if the internet is down or phone lines jammed. In an emergency or feel unsafe? Pull the nearest hook!"*
https://tinyurl.com/wz67a847

Actually, it was then corrected by **Skip K6DGW** who said: *"That the 175 year old system is still there is amazing. That it still works is astounding. However, the boxes don't send actual Morse code; they send a series of pulses representing a box number, not unlike a 'real' dial phone. Reporters and journalists often conflate that with Morse code. Ironically, had **Alfred Vail's** scheme of short and long signals representing letters/numbers not replaced Sam's original idea of sending numeric codes and looking them up in a dictionary to get the original message, the reporters would be correct."*

I still think it neat, however.

Wine Label

This was sent to me by **Bob Houlston G4PVB**: *"Check out this Morse Code label on Shiraz, Australian wine. Quote: 'This label continues on the winery's postal theme and recalls the craft of the Postal Telegraphists. For decades their Morse signals, dexterously delivered across Australia's great telegraph line, connected the island nation with the world and helped to save countless lives.'"* See **Fig. 6**.



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3

4

Galbraith GK11

And this item came from **Steve VK6VZ**. Steve was looking to purchase one of these keys for portable operation. I had never heard of the key so thought it would be of interest to the readers.

The Galbraith GK11 iambic module was manufactured for a short time for the NZ Association of Radio Transmitters (NZ equivalent of the RSGB) by Galbraith Products in Christchurch NZ back in the 1980s. The module was strongly made of aluminium and steel, with long plastic paddles, so a CW operator could mount it on a baseplate of their choice using four screws or bolts.

The reputation of the durability and smoothness of these paddles was such that they were also purchased by amateurs in Australia and even North America, although I am unsure if they were ever purchased by any/many Europeans.

They were extremely reasonably priced (around $20 - 30 NZ dollars I think). For /P or mobile operation, mounted on a lightweight wooden base, with nylon webbing to strap the key onto your thigh, the Galbraith is still ideal even today, especially for those of us whose fine motor skills are getting ancient.

5

In the picture, **Fig. 5**, by **Christopher VK5LTD**, the GK11 iambic module is screwed to a small aluminium/plastic box, filled with pieces of lead.

Just enough room to wish you all season's greetings. Please send all your comments, offerings, information to: roger@g3ldi.co.uk

73 and may the Morse be with you!

Roger G3LDI.

6

Figs. 1 to 4: Views of the Eddystone P2743 key.
Fig. 5: The Galbraith GK11.
Fig. 6: A cool wine label.

Practical Wireless Christmas Quiz

Some nice easy ones to keep you amused over the holiday period! Our thanks to the Cockenzie and Port Seton club magazine Elements for the technical questions.

Operating

Q1. The recent Russian 3D0RU expedition operated from the Kingdom of Eswatini. What was the previous name of this country?
a. Lesotho b. Nauru
c. Swaziland d. Tajikistan

Q2. Greek stations this year were signing SX200 instead of their usual prefix. What were they commemorating?
a. 200 years of amateur radio in Greece b. the bicentennial of the 1821 Greek Revolution c. The 200th anniversary of opening of the first Eastern Orthodox cathedral d. The 200th global running of the modern Marathon

Q3. December marks the 100th anniversary of the first amateur radio contacts across the Atlantic. What special suffix have UK amateurs been allowed to append to their callsigns in commemoration?
a. /2ZE b. /100 c. /TA d. /Marconi

Q4. Club stations may use alternative regional secondary locators to the issued one. Which two countries are able to use the alternative RSLs H and N?
a. Wales and Scotland b. England and Guernsey c. Jersey and Northern Ireland d. Scotland and the Isle of Man

Q5. The principal FT8 frequencies on 20 and 6m are:
a. 14.074 and 50.213MHz b. 14.064 and 50.313MHz c. 14.074 and 50.313MHz d. 14.064 and 50.213MHz

Technical

Q6. The ratio between the input signal that can just be heard on a receiver and the signal level at which it overloads is known as the receiver's:
a. dynamic range b. overload margin
c. receive threshold c. noise factor.

Q7. A waveguide may be chosen instead of coaxial cable when the frequency is so high that:
a. the losses in coaxial cable are far higher than those in a waveguide b. wavelength is such that it is significantly greater than the diameter of the coaxial cable c. standing wave ratio is too high for coaxial cables d. frequency is sufficiently low that a waveguide connec-tion will be far more efficient in handling the power.

Q8. The feed impedance of a half-wave dipole is ap-proximately 75Ω. A folded dipole for the same frequency will have a feed impedance of approximately:
a. 37Ω b. 75Ω c. 150Ω d. 300Ω

Q9. The capacitor in the trap of a trapped dipole antenna has become disconnected. What effect, if any, will this have?
a. Difficulty will be experience in achieving a match on the lower of the two designed frequencies. b. Difficulty will be experienced in achieving a match on the higher of the two designed frequencies. c. Difficulty will be experienced in achieving a match on both of the designed frequencies. d. No effect will be readily apparent.

Q10. The sum of the forward and reverse signal voltages on a feeder, divided by their difference, is known as the:
a. standing wave ratio b. maximum working voltage c. vector sum d. return loss.

Practical Wireless 2021

Q11. Who was overall winner of the 2021 PW 144MHz QRP Contest?
a. Malvern Hills ARC GW4IDF/P b. Simon Gosby GW8OVZ/P c. Galashiels & District ARS GM4YEQ/P d. Hereford VHF Contest Group GW1YBB/P

Q12. Who took the IC-705 on a Field Trip to put it through its paces?
a. Daimon Tilley G4USI b. Richard Constantine G3UGF c. Tim Kirby GW4VXEd. Joe Chester M1MWD

Q13. Which transceiver was not reviewed in PW in 2021?
a. Lab599 TX-500 b. Icom IC-9700
c. Yaesu FTdx10 d. Xiegu G90

Q14. The QCX Mini is available from:
a. SDR Kits b. QRP Labs
c. Bowood Electronics d. Radio-Kits

Q15. Which UK vendor has become exclusive distributor for the Hilberling range of equipment?
a. Nevada Radio b. Moonraker
c. Martin Lynch & Sons d. Lindars Radio

General

Q16. Which of these is not a CW Club?
a. CWops b. FOC c. GMDX d. FISTS

Q17. How many short and medium range coast stations were there in Great Britain? (Clue: see book review in this issue!)
a. 40 b. 32 c. 19 d. 25

Q18. Which of the following was not a UK radio magazine?
a. Amateur Radio b. Radio Constructor
c. Wireless World d. 73

Q19. Which is a program for data modes operation?
a. FLDIGI b. EZNEC
c. Echolink d. CW Skimmer

Q20. Which of the following is not an amateur radio awards programme?
a. IOTA b. WAB c. CDXC d. WWFF

The answers can be found on on page 51

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Steve Telenius-Lowe PJ4DX
teleniuslowe@gmail.com

A Busy Month!

Steve Telenius-Lowe PJ4DX has a packed postbag as a result of good conditions, a major contest and plenty of DXpedition activity.

"It was the best of times, it was the worst of times..." What the Dickens am I on about? Well, in the month under review we have had some of the best propagation since the last solar maximum – as well as some of the worst. Welcome to the January 2022 *HF Highlights*.

The Solar Flux Index peaked at 113 on 29 October, with the Sunspot Number at 96. During the CQWW DX contest on 30/31 October world-wide contacts were being made on 28MHz SSB for the first time in several years. With higher solar activity, though, comes an increased likelihood of solar storms and, sure enough, an X1.0 flare took place on 28 October. NASA posted a spectacular YouTube video of this: **tinyurl.com/5janh27x**

Then coronal mass ejections caused the planetary K-index to reach 7 (on a scale of 0 – 9) on 4 November, leading to badly depressed HF conditions for days and visual auroras in the UK as far south as Devon (and having grown up in Devon in the 1960s and '70s I know that to see an aurora there is extremely rare!).

Instead of providing a monthly 'snapshot' look at the SFI and SN in this column, this year we will look at the somewhat longer-term trend, with figures from six months and a year ago, **Table 1**.

DXpeditions Galore!

After the plethora of DXpeditions reported last month even more DXpedition activity livened up the bands during the month in review. Before the Russian 3DA0RU team had closed down, a Latvian-led group started operating as 3DA0WW from the Kingdom of Eswatini. After a few days with both 3DA0 stations active simultaneously, the Russians moved on to Lesotho, from where they made over 85,000 QSOs as 7P8RU.

While 7P8RU was still active, they were joined by HD8R (Galapagos Islands, with over 110,000 QSOs) and smaller operations from C5C (the Gambia) and PJ7P (Sint Maarten). To cap it all, on 30 October **Kenneth Opskar LA7GIA** returned to Bangui, Central African Republic. He was active as TL7M on CW and FT8 (often simultaneously, using two radios) and, at the end of his operation, as TL8AO on SSB. Ken had previously operated as TL8AO in 2016, **Fig. 1**.

Readers'News

Owen Williams G0PHY was one who commented on the excellent conditions at the end of October: *"At last, a sustained rise in the SFI combined with some DXpeditions and the CQWW contest meant that there was plenty of activity this month. I managed another contact with S90K, this time on 18MHz, and also contacts with J5T on 14 and 21MHz.* ***Janusz SP9FIH*** *provided a new band-slot from Sint Maarten on 21MHz as PJ7P. On the Saturday of the CQWW phone contest the BBC weather forecasts were saying the aurora could be visible in the UK (it was seen from Bedford). I initially thought that this would have an adverse effect on conditions during the contest but my fears were unfounded. VY0ERC on Ellesmere Island in the Canadian Arctic had a pronounced polar flutter on their signal on Saturday evening... It was good to hear activity on 28MHz; on Saturday morning I worked P33W using my 14MHz dipole but the band was really buzzing on Sunday afternoon... One of the fun parts of contests involving 'big gun' USA contest stations is winding the power down and seeing if they are workable on 10W. The contact with K3LR in Pennsylvania on 21MHz was made with 10W and using the 14MHz dipole!"*

1

In contrast, **Carl Gorse 2E0HPI** was affected by the very poor conditions in early November. He enjoys operating portable but wrote: *"This morning* [4 November – **Ed**] *I tried to operate from GFF-0348 Hartlepool Foreshore* (**Fig. 2**) *and ENG-154, Cleveland Lighthouse, but the recent solar storm had other ideas! But I have managed to work some from home over the past week on the Icom IC-705 with my indoor loft antenna... Hope to get more activity/portable in the coming weeks."*

Tony Usher G4HZW was another who mentioned the great propagation at the end of October. *"I've remained on 28MHz during the latest period... Excellent conditions from 26 October with the SFI at 109, right through to the CQWW phone contest on 30/31 October. On the 26th I worked BG, UA0, VR2 and VK2. On the 29th I was pleased with JA, although I saw others working KH6 and 3D2. Over the contest weekend I fired up the TS-830 and with 100 watts was pleased to work VR2, BY and even PY0F on Fernando de Noronha on phone. 28MHz FT8 has been very congested at times, with more than 40 decodes after each 15-second period and I sought sanctuary on FT4, much more civilised but I'm certain that will change as conditions get even better!"*

Kevin Hewitt ZB2GI wrote: *"I worked a 10m SSB pile-up into South America on 17 October. I also operated SSB from my home station on the 31st and worked stations participating in the CQ World Wide DX Contest* (see **Fig. 3**). *I*

Fig. 1: Ken LA7GIA with columnist Steve PJ4DX at Friedrichshafen. Fig. 2: 2E0HPI/P location on Hartlepool Foreshore. Fig. 3: 15m SSB on Sunday during the CQ World Wide DX Contest at ZB2GI. Fig. 4: The G3JNB/P QRP station on Brighton sea front. Fig. 5: Some of the antennas at PJ4K: a stack of 5-over-5-over-5 21MHz Yagis and a pair of 7MHz 2-element Yagis on a 130-foot tower. The small tower to the left has 3-element monoband Yagis on 14, 21 and 28MHz, fixed on the USA. Fig. 6: Ken EA5/G4VZV operating from the salt lagoons. Fig. 7: Plot of polar mesospheric winter echoes, 16 – 18 October 2021 (courtesy Leibniz Institute for Atmospheric Physics). Fig. 8: The new Yaesu FTdx10 (and a nice sunset!) at the shack of Tim GW4VXE.

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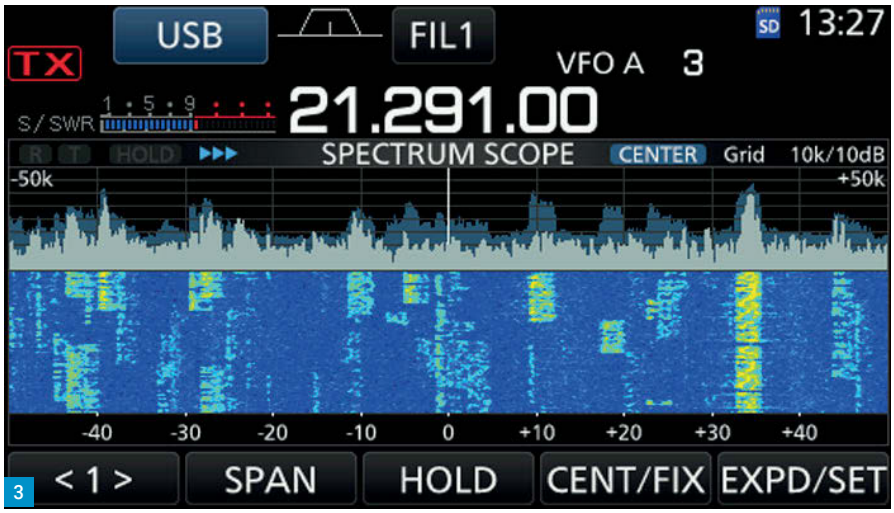

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*was also pleased to work **Eva PJ4EVA** on 12m FT8."*

It was good to hear again from our new contributor to the column, **Jim Bovill PA3FDR**, who wrote that all his contacts this month were made using FT8. *"I have had considerable problems with interference on SSB, one possible factor being the increasing use of solar panels in the neighbourhood, which many of my neighbours have now installed."* Jim also mentioned working two European special event stations: EM30HUARL, commemorating the 30th anniversary of the establishment of the Ukrainian Amateur Radio League, and CQ750RSI, commemorating 750 years since the birth of Queen Saint Isabel in Portugal.

Steph Foster G4XKH reports that the Riviera Amateur Radio Club is celebrating its 10th anniversary on 10 January 2022. The club was formed to offer training and special events in Torbay and has helped 36 people through the exams, from Foundation to Advanced. Steph said, *"We are a social club priding ourselves on friendship and mutual support. Here's to the next ten years!"*

Victor Brand G3JNB says that on 3 October *"it was a real pleasure to hear a strong CW signal from **Eddie 3W1T** in Hanoi. Then, it was off to Brighton for a short break, with the FT-818 and 'Miracle Whip' packed for a spot of leisure operating from our hotel's sixth floor,* **Fig. 4***... Amazingly, with 5W on 20m CW I worked EA6NB for a 539 and LZ3NB at 559. Wednesday's sunshine permitted short sessions on the balcony. Within five minutes, on 20m I had worked EA5IUY, SM6F and 9A5MX. Later, I could copy VE1WY and others but made no further contacts until 1415UTC when I had a delightful chat with **Nando EA4BB** near Madrid. He was using his Collins line-up to a vertical and 100W. My final QSO was with **Ruda OK1HB** near Dubne, who had 300W to a G5RV. Back home in the shack... on the 12th the Russians operating 3DA0RU on 17m CW heard my call and, despite a huge pile-up, I was in their log. 40m surprised me early evening with a solid signal from VK2GR but he was being smothered and, although I was struggling fruitlessly with J5T, on 30m 5T1GM Mauritania just to his north responded first call! I logged PJ4NA Bonaire for a delightful 'hat trick' on 17m, 30m and on 40m where he was booming in and answered my QRP immediately. I did finally work J5T Guinea Bissau on Saturday morning 22nd through his humongous 17m pile up!"*

Etienne Vrebos OS8D said that in Belgium *"Covid starts again very strongly and we expect again severe restrictions. Makes ham radio a good challenge to meet as many people as you like without mask, without danger... that microphone is mine, those radios are mine, my desk is mine: it means no disinfection after every use."* Etienne made about 300 QSOs during the month (see 'Around the Bands').

Reg Williams G0OOF reports that *"A few months ago I bought a DX Commander Rapide 7, recently introduced to the range of vertical antennas from **Callum M0MCX**. The six-band antenna included 12m, which would be a new band to try out on FT8, along with 30m FT8, which I compared with the Hustler vertical... The results were pleasing on both counts, with the usual European stations being worked and some DX stations... I was pleased to work the S9OK Sao Tome and Principe DXpedition on four bands FT8 and one band on SSB, the 3DA0WW Eswatini DXpedition on three bands FT8, and the 7P8RU Lesotho DXpedition on one band FT8.*

"The UK/EI SSB contest took place towards the end of [October]. This is becoming a popular contest with more entries each year... At the end of the month was the CQWW SSB contest... Good openings were experienced on

	Nov '21	May '21	Nov '20	Difference
SFI:	87	78	86	(+1)
SN:	37	36	27	(+10)

Table 1: Solar Flux Index and Sunspot Numbers on 11th of the month: this month, six months ago and one year ago. The final column shows the difference between now and the same time last year.

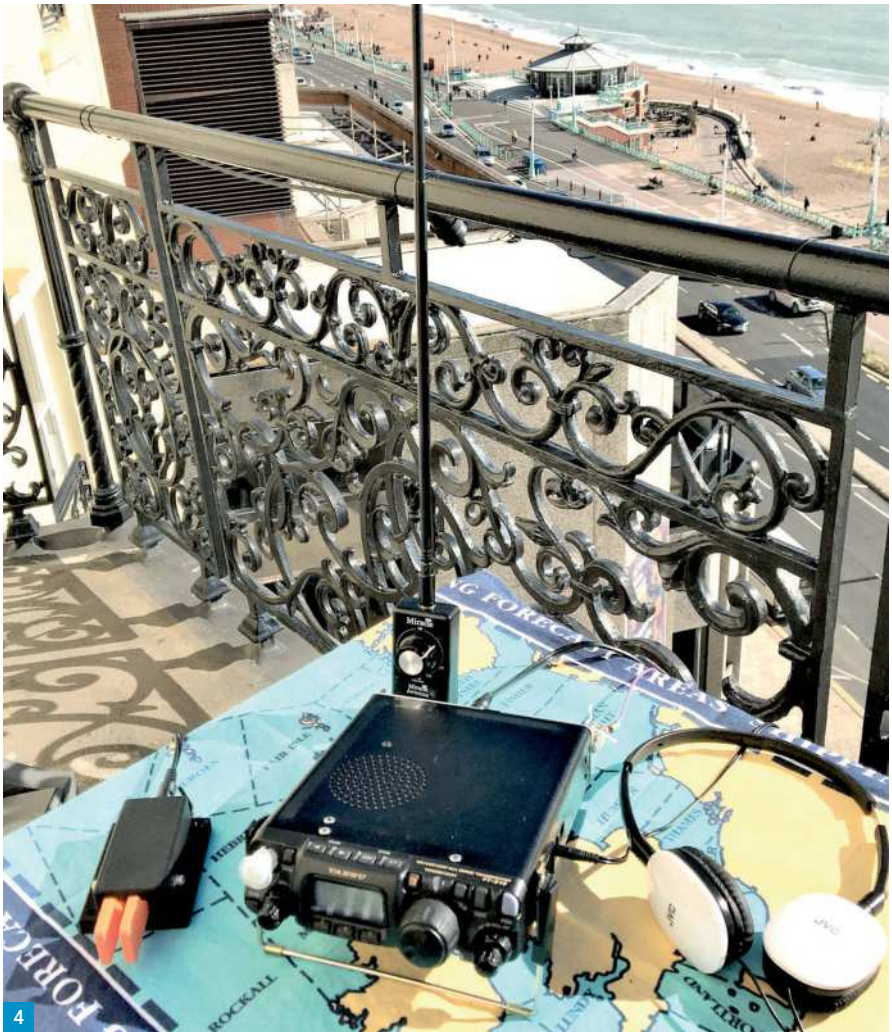
the upper HF bands. My score was very low but I did manage to work a few wanted stations. Best DX was FR4KR Reunion Island on 10m. As always, a pleasure to work contest station PJ4K Bonaire (**Fig. 5**) *on 15m, with* ***Steve PJ4DX*** *at the helm."*

Ken Churms G4VZV has continued to operate from south-east Spain, **Fig. 6**. *"In October I focused mainly on using the pedestrian mobile station at the salt lagoons of Santa Pola and Bon Mati in locator squares IM98QE and IM98QD. I used Santa Pola as it allows me to position the pedestrian setup at one corner of the lagoon and gives me a clear westwards and south-westwards (long path) take-off to the Pacific area. The 40m band opens up earlier than 20m and I used both bands, being in position for 40m as early as 0530UTC."* Ken says that 14MHz opened at about 0630UTC: *"It was fascinating to listen to QSOs in which I could hear the VK stations coming up out of my minimal S1 noise level and rise to 59+ in the space of 15 to 30 minutes... Towards the end of October I decided to change tack and do some short path work and so repositioned the trolley pedestrian station against the sea. This meant going to the empty beach of El Pinet in IM98QD."*

Ken's station comprises a two-wheeled aluminium sack trolley that provides the ground bus, a ground tuning unit (GTU), Yaesu FT-857D, ATU and the antenna, which is a 1/4-wave wire on a DX Commander telescopic fibreglass pole. Under the trolley is a plastic sheet so there is no direct contact with earth. Ground current is forced on to the trolley's earth bus, which is capacitively connected to ground through the plastic sheet.

John Rowlands FRAS MW1CFN (Fellow of the Royal Astronomical Society) sent in a report saying that, as a result of the various geomagnetic disturbances in October and November, *"polar mesospheric winter echoes have been occurring quite often. On most, but not all, occasions the presence of PMWE will indicate good conditions on upper HF. A number of days in October saw PMWE extensive in both vertical extent and duration,* **Fig. 7**. *The formation of polar mesospheric echoes is closely related to conditions that lead to Es and, in summer, noctilucent clouds."* John added, *"It's now widely accepted that PMWE are correlated with the Ap index. I do see better propagation some hours to a day following the geomagnetic disturbances that clearly result in PMWE, because I can see both the magnetometry data and the radar echoes."*

Tim Kirby GW4VXE says he had been saving his pennies for a while and had just bought a Yaesu FTdx10, **Fig. 8**. *"It arrived at the start of the month and I must say I am delighted with it. The receiver is significantly quieter than other HF receivers I have been using recently. I have mostly been hanging around on 10m CW and have been pleased to find band openings most days... Since the start of November, I have been finding openings into Russia most mornings and sometimes further afield. Afternoon openings into South America have been good too, with PY, LU, CX and CE stations all worked fairly easily on CW. I was extremely pleased to catch ZD7BG the other morning on CW. When 10m hasn't been good, I've had a look on 15m which has been interesting too. There have been... some nice QSOs with the USA and signals from the Far East coming through in the morning time here."*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Around the Bands

Owen G0PHY: 7MHz SSB: K5TR, UP4L, V31XX. **14MHz SSB:** A73A, CR3A, J5T, P33W, PP4T, PY0F, VE3EG, VP9I, VY0ERC, ZF1A. **18MHz SSB:** S90K. **21MHz SSB:** CQ3W, D4Z, J5T, K3LR, PJ4K, PJ7P, V3A, VE2IM, ZZ2T. **28MHz SSB:** K5ZD, P33W, VO1CH.

Carl Gorse 2E0HPI: 7MHz SSB: F4GYG/P (FFF-1880), ON/PD0RWL/P (ONFF-0765), PA/OT4V/P (PAFF-0182).

Tony G4HZW: 28MHz SSB: BY8DX, K0DEQ, KP3Z, PJ2T, PY0F, VO1CH, VR2XAN. **28MHz FT8:** 3DA0RU, 3DA0WW, 4L1R, 4S7AVR, 7P8RU, 7X3WPL, A41ZZ, BG0BBB, BV2LA, CE3VBK, E20EHQ, HS2KYA, JH6VXP, LU8EMI, LW3DAO, PY3TO, R0SCG, TI3ATS, UA0SE, UN8FR, V31DL, VE3EP, VK2IS, VK4KEE, VK6EI, VP5/NU4Y, VR2XYL, VU2NKS, XE1KK, YB1BA, ZS1AN. **28MHz FT4:** CA3SOC, CX8AF, LU8QFC, VK2WJ.

Kevin ZB2GI: 14MHz SSB: 4I1EBD, JA1QJE, JA7MBT, JH9AUB, JI4OHV, PX8L, TA3YJ, VK2ACK, VK3BNR, VK4OZI, VK5KV, VK7GH, ZL1BBW, ZL2MF, ZM11X. **14MHz FT8:** E72DX. **18MHz SSB:** W1AW. **21MHz SSB:** 9Y4D, KB1YXM, LU2MCX, OC200E, PY1GV, PY2FZ, PZ5GE, VA3CQG, VP2EIH, W2KV, ZS3Y. **21MHz FT8:** JR6FC, K6EI, K9NW, R9FE, W0IZ, W4GEH, WA3LXD. **24MHz SSB:** 9Z4FE, K2AX, KC1XX, P33W, PX2A, PU7BCG. **24MHz FT8:** 3F200AT, AA3S, CO2CMI, HC1HC, HI3T, K0DD, K1XE, K4SIR, K7BV, K8SL, KE5BR, KE9ET, LU1CFU, PJ4EVA, PP5XA, PU2STZ, VA3DX, VE2GCE, W6TK, YV5KTM. **28MHz SSB:** AA8WZ,

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CE4JZO, CX5CDV, D4F, FY5KE, K4QH, K9CT, KC1XX, KP4AE, N2TK, P33W, PT5J, PU2VMD, PU4RGM, PU8PSF, PY1GV, PY3PDR, PY6RT, W8ALP, WG3C, WP4JAZ, XQ6CF, ZP9MCE, ZS3Y. **28MHz FT8:** AE0DC, AE4AN, CM2RSV, CO3JR, CX7SS, HI8DL, K2BOB, K3FM, K4KEW, KA0AZS, LU3ETY, N5OB, NE8Z, NR1DX, PT7YV, PU2SWR, PY4BL, V31DL, VA2VT, VA3NCD, VE9NC, W7AH, WE9R, XE1MEX, XE2X.

Jim Bovill PA3FDR: 7MHz FT8: 4X5AJ, OD5KU, N1BAT, W3SOX, WB2REM, WB4CTX, TF5B, VO1IV, ZA5G. **14MHz FT8:** 4X5MZ, A41ZZ, KJ7JDH, KP4MAQ, R9MBC, UN7ZV, VE9LOV, W0IZ, W3MJ, YC1ING, YC4AOK, YV5DRN. **21MHz FT8:** A41ZZ, BG0BBB, EA9QD, N3MK, OD5ZZ, PT2CSM, R8AU, VE3ELL.

Etienne OS8D: 7MHz SSB: 3A/MM0NDX. **14MHz SSB:** 3A3A, 5T5PA/P, D4L, DV1IIW, E29TGW, EK6RX, EP2ABS, J5T, JI1ICF, OX7AKT, PZ5ZS, SU1AS, UN8LWZ, YI1WWA. **18MHz SSB:** 3DA0WW, FR4PJ, S01WS. **21MHz SSB:** 3DA0RU, 9J2RD, 9Y4D, CQ3W, CX8TC, D4Z, FY5KE, HD8R, HI3LT, J5T, KP4VET, P40W, PY6HD, PZ2YT, PJ4K, PJ7P, S9OK, UN7RM, VU2XO, YB9MX, ZW2T. **24MHz SSB:** 3DA0RU, 7P8RU, EY7AD, FM5DN, J5T, OX7AM, PZ5GE. **28MHz SSB:** 3DA0RU, 4K6FO, 9Z4FE, B0A, CA5UBR, HI3T, JA6MWW, KP4AA, LQ5H, LT1F, LW7DX, OX7A, P40W, PJ2T, PJ7P, PR7AR, UN8LWZ, UN9L, VR2T, VR2ZQZ.

Reg Williams G0OOF: 7MHz FT8: 5Z4VJ, CE1PTT, CM6GBR, KH6M, S9OK, VK6EI. **10MHz FT8:** JA0GCI, K0HQW, OX7AKT, S9OK, VK3AUQ, ZL1CVD. **14MHz FT8:** 9G5FI, JA3BOA, S9OK, VP8BTR, W0IZ. **18MHz FT8:** 3DA0WW, S9OK. **21MHz SSB:** CR3DX, D4Z, PJ2T, PJ4K, PY2KJ. **24MHz FT8:** 3DA0WW, 7P8RU, VP8LP, ZS4JAN. **28MHz SSB:** 4X1DX, CQ8M, D4F, FR4KR, KP4AA, OD5TX, OX7A, PJ2T.

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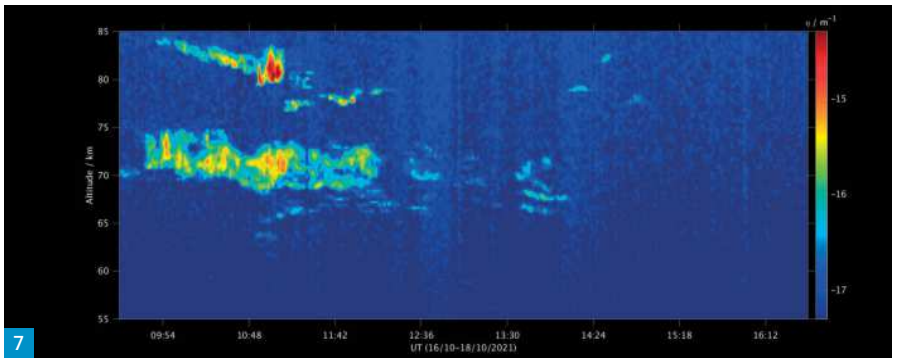

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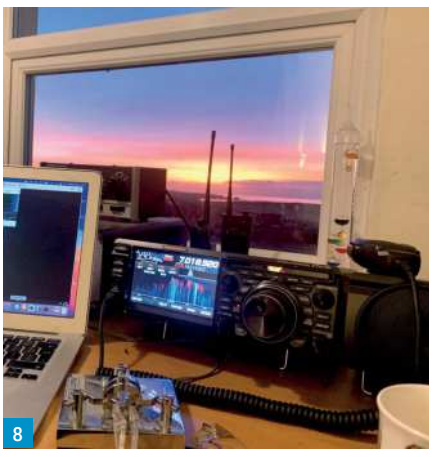
Ken EA5/G4VZV/M: 7MHz SSB: OA4DSN/P, VK2JPR, VK3EY, ZL1PWR, ZL3CHE, ZL4RMF. **14MHz SSB:** VK2AUS, VK3EY, VK4IM, VK5PAS, VK6CF, VK7ROY, YB0JVZ. ZL1ACE, ZL3ET. **18MHz SSB:** 4X4MN/M, HS0ZJK, HZ1NN, YB0IBM. **21MHz SSB:** HZ1HZ, VU2DSI, XW1FAN, ZD7FT. **24MHz SSB:** A41KJ.

Signing Off

Thanks to all contributors. Please send all input for this column to teleniuslowe@gmail.com by 11th of each month. For the March issue the deadline is 11 January. 73, Steve PJ4DX.



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199 WATTS

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MFJ-250X 1kW Dummy Load

Key Features/Specifications:
- 1MHz-400MHz
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- Impedance 50 Ohms
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- Great high power dummy load

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MHR-100 Marine Handheld Transceiver - VHF 156-162MHz

The Moonraker MHR-100 VHF Marine Transceiver has large keys and easy to grip body for smooth operation. It includes 200 programmable channels with quick channel selection, falling water flash alarm and is water resistant.

Key Features/Specifications:
- Frequency 156-162MHz
- High/Low Power Selectable
- Call Channel Function
- Dual Watch and Triple Watch
- Priority Channel Selection
- 2 Step Power Saver
- Scan Function
- Battery Save
- Keypad Lock

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Revolutionizing the world of USB SDR ADS-B Receivers with the FlightAware Pro Stick and Pro Stick Plus, high-performance USB R820T2 software defined radios (SDR).

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29 WATTS

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AV-SW2M Antenna switch

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- Insertion Loss: DC-500MHz 0.05dB, 500-1GHz 0.10dB
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34 WATTS

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The Comet CTC-50M Through Window Connector Cable - a new flat cable assembly, for through-window connection to external antenna. Comet CTC-50M cable assembly is a high quality flat ribbon lead in for easy installation through a window

Specifications:
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FT-5DE 5W C4FM/FM 144/430MHz Dual Band Digital Transceiver

he FT5DE is a full-featured C4FM handheld transceiver with superior operability and new sophisticated functions.
The FT5DE provides reliable 5W RF power output and achieves loud 1W audio power that has been tuned for quality audio. Real Dual Band Operations (V+V, U+U, V+U, U+V) are available with two independent receivers. Large individual LED indicators for A band and B band present the status and communication modes (C4FM or Analog) of each band instantly. The new FT5DR supports simultaneous C4FM digital (C4FM/C4FM standby).
A high-resolution display highlights the frequency of the operational band. The colour of the operating band frequency can be selected from white, blue or red. Three (3) touch panel keys and seven (7) operation keys below the display offer intuitive operability.
The new TOUCH and GO operation is convenient in order to immediately start the communications on an often-used frequency.
The C4FM digital communication features which are already popular in the market, such as: Automatic Mode Select (AMS), Digital Group ID (DG-ID) operation, and Smart Navigation function are available.

Buy the FT-5DE for just

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399 WATTS

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LWHF-40 Multiband Wire Antenna

This is a great end fed antenna complete with a 9:1 Unun . Ideal for 40-6m and when used with a good quality ATU a perfect match can be obtained on all bands. There is an extra benefit of a ground connection for an earth rod if required

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39 WATTS

bhi

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NES10-2 MK4 Noise Eliminating Speaker

The NES10-2 MK4 Noise Eliminating Speaker replaces the MK3 version and removes unwanted background noise, hiss, hash, QRM, QRN, computer hash, plasma TV interference, white noise etc from speech, so that you can hear more clearly and listen stress free. Works across all radio bands and is also suitable for shortwave listening and for use in radio base stations. The MK3 has a new rotary filter control knob on the rear of the speaker that replaces the DIP switches that were on the MKII. This makes it much easier to change the filter level whilst using the speaker. The NES10-2 MK3 greatly improves the clarity and intelligibility of speech in a variety of radio communications applications.

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129 WATTS

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This means hand held to hand held or handheld to mobile comms around the world. Companies like ID offer a suitable sim with EU roaming from £3.99 a month or if you are in the UK FreedomPop is available otherwise you can use it on Wi-Fi!
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Please note this radio does not transmit on the amateur bands.

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149 WATTS

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The M-70 utilizes a directional condenser microphone element which is specially tuned the frequency response to create clear and crisp audio for radio communication. The PTT uses three Air-Cylinder tubes similar to the Reference Microphone M-1 to provide a solid and smooth extended operation. A simple one-touch PTT keylock button is placed just above the PTT key for those long rag chews.

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129 WATTS

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The newest addition to the President family is the impressive President McKinley - A multi-mode mobile CB which has been manufactured to Presidents usual high standards. The McKinley operates in the legal 40ch UK FM and 40 (CEPT) FM channels. Also, AM/FM/SSB on the European channels.

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229 WATTS

MASTR ANT

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Key Features/Specifications:
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CMX-400 140-525MHz SWR/Power Meter

New CMX-400 meter, up to 200 watts power handling on VHF/UHF 140-525Mhz. Large, clear cross needle display reads FWD/REF and SWR simultaneously, and to minimize power loss CMX-400 has a built-in low loss sensor. The meter is very well illuminated in red and green.

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119 WATTS

DIAMOND ANTENNA

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BB6W HF 2-30 MHz Antenna

HF wide-band antenna ideal for limited space gardens or apartment dwellers similar to the BB7V except that it has a horizontal wire section after the loading coil/balun instead of a vertical section. It is a non-adjustable antenna and may require an ATU to get the SWR to less than 1.5:1.

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GQ Electronics

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EMF-390 Multi-Function EMF Meter

Just what you need to make your EMF measurements. The EMF-390 multi-function digital EMF meter is designed to be a portable device. It can be used as industrial, commercial maintenance, research, evaluation, simulation and other analytical or scientific applications in areas such as industrial plants, public utilities, universities, laboratories, and electronic repair shops. The device integrated testing features include three axis Electromagnetic Fields, Electric Field, Radio Frequency and Radio Spectrum Power Analyzer.

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115 WATTS

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Infra-Red Remote Controlled Antenna Rotator with Base Controller Designed for use with the smaller antennas up to 45Kg loading. typical antennas are small 6m beam, UHF, VHF, TV and FM antennas only

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CHA MPAS 2.0 250W Portable Antenna System with backpack

This is the CHA MPAS 2.0 - the most popular Modular Portable Antenna System in the WORLD!
Use the Ideal NOALOX 4 oz. Antioxidant Compound to improve the efficiency of aluminium conductor connections. This compound provides additional inner-strand and inner-conductor current paths.
The Modular Portable Antenna System (MPAS 2.0) is a concept allowing the radio operator to configure and deploy the antenna system in a variety of configurations.

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549 WATTS

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The SDR-Play RSP1A is a major upgrade to the popular RSP-1, it is a powerful wideband full featured 14-bit SDR which covers the RF spectrum from 1kHz to 2GHz. All it needs is a PC and an antenna to provide excellent communications receiver functionality. Combined with the power of readily available SDR receiver software

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50 Metre reel of RG58

Key Features/Specifications:
- Size: 5mm standard
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- Core: Stranded
- Braid: 69%80 X 0.12
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This is a must have collection for any one working towards there advanced amateur radio licence. This collection includes: • Foundation licence • Intermediate licence • Advanced licence • Exam secrets

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RM

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AT-779UV Dual Band Transceiver

The Anytone AT-779UV Dual band Mobile radio is a compact rugged 25 watt mobile radio. Factory pre-programmed with the Moonraker code plug including all UK repeaters, 2m Simplex, 70cm Simplex, PMR446 (TX disabled), Marine Band (TX disabled)

Key Features/Specifications:

- Memory Default power set at 10 watts making it an ideal Foundation license Radio • 1.44 inch Colour TFT display • CTCSS, DCS, DTMF, 2Tone, 5Tone, settings for each channel • Scrambler with self-selectable code • Compander Function for improved weak signal intelligibility

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- RCA Female • RCA Male and 8 Universal adaptor Couplers

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129 WATTS

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IC-705 All Mode Portable Transceiver

The portable HF/VHF/UHF IC-705 has many great features such as SDR platform, internal battery, GPS, Bluetooth and D-STAR, all in a compact and lightweight body. The ICOM IC-705 uses the same 4.3 inch colour touch screen display as the best-selling IC-7300 and IC-9700 featuring real-time spectrum scope and waterfall display.

- HF/50/144/430 MHz Multimode Operation • RF Direct Sampling System • Real-Time Spectrum Scope and Waterfall Display • Compact and Lightweight Design/li> • BP-272 Li-ion Battery Pack or 13.8 V DC External Power Supply • Maximum Output Power 5 W (BP-272), 10 W (13.8 V DC)

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1299 WATTS

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VV-898 VHF/UHF Mobile Transceiver

What a great entry level dual band rig, with only 10 Watts it is ideal for the new foundation pass holders. Comes complete with radio bracket and keypad microphone

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Buy the VV-898 for just

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59 WATTS

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A high power DC regulated Switch Mode power supply providing up to 23 amp maximum current. Ideal for two way radios and multiple other applications such as technical workshops, laboratories, mobile fast food vans, gold plating to name but a few.
This power supply also has over voltage, current limiting and short circuit protection thus offers peace of mind to the user.

Key Features/Specifications:

- Lightweight • Compact design • Current Limiting protection
- Short Circuit protection • Over Voltage protection
- Excellent line, load regulation, low ripple and noise capabilities
- Main DC output at rear and a front mounted cigar socket

Buy the LWHF-40 for just

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59 WATTS

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MAT-705 PLUS Automatic Antenna Tuner for the ICOM IC-705

Specifically built for the new ICOM IC-705, the mAT-705 Plus is the latest compact and fully portable Micro-ATU powered by an internal pair of Lithium batteries Charges by USB lead (Supplied)
The new version of the tuner eliminates the mechanical power switch.
Its power supply is automatically controlled by the transmitter
After connecting the control cable, it will be turned on and off along with the transmitter, no need to manually turn on and off
The aluminium shell makes it sturdy, shock-resistant, and suitable for portable use.

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179 WATTS

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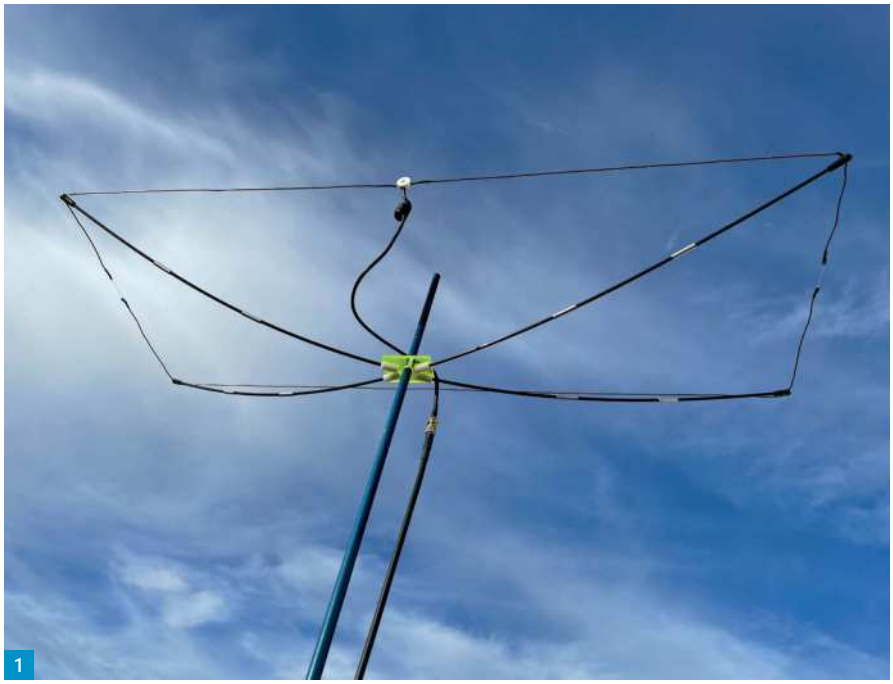

1

Two Portable Antennas to try!

Tim Kirby GW4VXE starts this month's column with a look at two interesting antennas for portable VHF operation.

It's always nice to get details about people's projects. It was good to have an email from **David Johnson G4DHF** who explained that he had been working on a portable version of the Moxon antenna for 2m, **Fig. 1**. It's so highly portable that it collapses down into a small pouch, which would pack into a coat pocket, let alone a rucksack, and that includes a small mast! I'm not going to say too much about its design as I know it's going to feature in an article here in *PW* before too long. But, to whet your appetite, I can tell you a little about the results that David has been getting. During the Marconi Memorial CW contest on 2m, David used the portable Moxon, along with 8W from his Icom IC-705. David writes of his activity, "*Under flat conditions, I was able to work TM7M, OR6T, F6DWG/P and ON7RY/P at distances of between 300-400km. I had a partial contact with a DL, who was over 560km away. And all this running just 8W to the beam at 10ft agl! I would have completed more QSOs had I run more power or raised the antenna. I cannot wait for better conditions and now have the antenna fixed East at 10ft on the G6LI station in my lounge*".

David very kindly sent me an antenna to test here. This is what I wrote to David regarding my first bit of testing, "*The target of my testing was the APRS digipeater on Mount Leinster, 85 miles away across the sea in EI. Firstly, I tried an FT5DE on its rubber duck with 5W output. Although I could hear the digipeater at S6, I could not get a packet through it. I connected up the portable beam and the digipeater was now S9+20 (I'm not sure how accurate the FT5 S-meter is, but it's clear there was more signal!). Transmitting a beacon, it was easily heard and digipeated through Mount Leinster. Turning the beam to the SE, away from the digipeater, the signal level dropped to S4, so nice front-to-back.*

"I thought I'd tune around the FM portion to see if there was anything else audible (not a given here!). The AO-91 satellite was passing and I had great copy of it and, of course, I was able to hand track the satellite. Changing from horizontal to vertical was quite a sharp pattern, which was quite surprising".

All in all, this looks like a lot of fun and I think some of you will enjoy the chance to put one of these antennas together and try it out portable.

These experiments put me in mind of another portable antenna I used many years ago. **John Hawes G8CQX** built a portable 2m quad with wooden spreaders, **Fig. 2**. When carrying the quad, the spreaders and wire elements fitted neatly into the tube. Back in the mid-1980s, John kindly lent me the antenna for my summer holiday when I was going to Cornwall with my parents. Armed with 3W from an Icom IC-202 and the antenna, I was able to work into the south of France from a local high spot. After reading about David's experiment, I asked John if he remembered the antenna. John replied, "*I did some simulation and found the two ele was not quite right, it tuned a bit high. Redesigning in xnec2 and matching with a quarter wave 75Ω section brought it in with 7dBi gain and proper 50Ω match that the FT-817 cares about more than the old IC-202 did. In the attic shack it's not a lot down on the 5ele outside".*

John continued, *"I literally made this in a couple of hours. The boom is just standard tube cut to size and eight holes for spreaders carefully marked and drilled 6mm. The elements are 25mm poly-something rod, cut to length (you can work it out with Pythagoras's theorem!). You need to just open out the boom holes for an interference fit. Then, notch one end of the spreaders to take the elements. Although they will then hold the element in tension, I hot glue the elements to the spreaders to make assembly in the field quicker. The feed uses a small triangle of Perspex for strength. I trimmed the 75Ω matching section with a NanoVNA for a short circuit on 2m with open circuit far end, so that it was an electrical quarter wave. The feedpoint in nec2 is 100Ω (hence min 2:1 VSWR) so this transforms to 50Ω nicely with the 75Ω quarter-wave section connected to the T-piece and the 50Ω feeder on the other end, so my FT817nd will drive full power to it".*

John kindly provided the measurements. The element spacing is 0.455m, driven element is 4 x 0.53m and reflector element is 4 x 0.55m. To save you the bother of looking up Pythagoras' Theorem, I make the spreaders for the driven element to be 0.375m in length and those for the reflector to be 0.389m. John's quad is a little larger to carry about than the portable Moxon, but you might still enjoy putting one together to try when you are out and about.

Fig. 1: David G4DHF's portable 2m Moxon antenna. Fig. 2: John G8CQX shows off his portable 2m quad. Fig. 3: Patrick WD9EWK stopped off for a little while in Winslow, Arizona during one of his roving trips around the state. Fig. 4: Strumble Head in IO72 square is a great location for working low satellite passes out over the sea.

DX alerts via email

Rob Harrison G4UJS asked me the other day if there was any site that would issue message alerts when a tropo opening occurred. I didn't know, but Rob went off, looked around and found that the DXMAPS.COM site can issue alerts by email when openings occur. If you're interested, you can sign up here:
www.dxmaps.com/spots/alerts.php

The 6m Band

Steve Telenius-Lowe PJ4DX emailed to say, *"Last night I received an email from **Gerard PJ4GR** saying he had just worked into Argentina on 2m SSB via TEP. Gerard uses less than 100W to a home-made Yagi. Alerted by Gerard's message, I went on 6m FT8 and worked a string of South American stations using my 40m inverted-V dipole (the 6m Yagi is still only partially constructed and is at ground level!).*

"From here it is easy to work PY, YV, HK, HC by Sporadic E during the summer Es season, but LU, CE and ZP were all new ones on 6m. I also worked HC, CX, and PY. The Galapagos HD8R DXpedition was also on 6m FT8 but I was unable to decode them on the 40m dipole (wish I had the beam up!). There was also an OA station on from Peru who I was similarly unable to decode.

"The QSOs were made between 0200 and 0330UTC (by which time only PY stations were being decoded) on 29 October, but the opening had obviously started a lot earlier. The average distance of the LU, CE and ZP contacts was between 4300 and 5300km. HD8R is much closer at only 2800km but, being on the equator, was inaudible, presumably because TEP requires roughly the same distance north and south of the geomagnetic equator".

Keith Watkins G8IXN (Redruth) caught a brief opening on 31 October, working SA7DXN and IK2QEB around 1130UTC.

Peter Taylor G8BCG (Liskeard) writes *"I spent much of my radio time on 50MHz EME monitoring **Lance W7GJ** on his fantastic dual DXpedition to the Austral Islands and Marquesas Islands. Despite the best effort of Murphy who seems to be working as an intern on the WSJT-X Q65 programming team at Princeton, I managed to work both FO/W7GJ and TX7MB quite early in his activations and so was able to spend time monitoring and watching Lance's signals through my moon-set ground gain.*


2

*"On 5 Nov **Lance TX7MB** was peaking –15 and copyable virtually every period. Then around 1630 a brief A-TEP opening to S America. As soon as I saw PYs into EA I knew I had a chance! Just two QSOs PY3KN and PU3LYB but I was probably a bit late. Later, around 1830, HD8R worked into Spain – but I was not QRV.*

*"On 12 Nov I was monitoring EME with **Bint YB2MDU** working an HA and then trying to work **Fred PY2XB** when I noticed that there was 50MHz TEP into the Med so decided to take a look. About an hour of listening to white noise and watching a faint trace and then V51JH came up out of the noise. 20 anxious minutes later he peaked and we managed a QSO before he faded down again".*

Tony Collett G4NBS (Cambridge) took part in the UK Activity Contest on 11 November and found that conditions seemed good with the noise level lower than usual. Tony says there were very strong signals from the portables in IO94 and GI4SNA was louder and clearer than normal, but strangely GD8EXI was 'at or below ESP level'! GW0RHC in IO71 was the only other contact of note. Tony was unable to complete with F1CBC, but made 82 contacts in all, which is his best total ever in a 6m UKAC.

Looking back through the GW4VXE log there are a surprising number of 6m QSOs in the last month, since the last column, with openings on 17, 19, 25 and 31 October plus 1, 5, 6 and 7 November. Only European stations have been worked here, with perhaps

the highlight being CU3EQ (HM68) on 1 November. In reality, at this time of year any QSO is special on the band.

The 4m Band

Brian Williams GW0GHF (Cardiff) writes, *"Having got set up at last on 4m FM and SSB with my Icom 7300 and homebrew 4m antennas, I am fast becoming disappointed by the lack of activity! I hear stations regularly in 4m contests, but where are they at any other times? On the positive side, there is a weekly 4m. FM 'net' run by* ***Chris G0UZL*** *from a high spot in Dorset, on a Wednesday evening. The net starts off initially, about 8pm on 10m (28.360 MHz USB), then he QSYs to 70.425MHz, usually about 8.50pm. Signals are good into South -East Wales using just a half-wave vertical. Normally, two or three Welsh stations, including myself, are on. There is some activity on a Friday evening from the Gloucester/Cheltenham/Bristol area".*

Quite a few stations follow the contests and only appear on the band at those times, I'm sure. I certainly find 4m FM reasonably busy on my journeys through Southeast Wales and into Gloucestershire, it's unusual not to have a QSO or two.

Please keep your activity reports about 4m coming. As I said to Brian, if more people read about activity on the band, the more likely it is that they will spend time there operating.

The 2m Band

Simon Evans G6AHX (Twyning) took part in the November 144MHz UK Activity Contest and made 21 contacts in 16 squares. The best DX was GM3SEK (IO74). Simon also mentions a regular net on 144.210MHz around 1600 on a Sunday. Simon says that this was started by **Steve G4NZV** as a means of chatting with his father-in-law, **John G3SQQ** in Nottinghamshire. All are welcome to join.

Tony G4NBS took part in the 2m FT8 Activity session on 3 November making 57 QSOs in 28 locators. Highlights were EI3KD (IO51), GM4CXM (IO75), GM4JTJ (IO86), GM0EWX (IO67), GM8MJV (IO85), MI0IHH (IO74), EI8KN (IO62) and GW4VXE (IO71). Tony says he worked the 'usual' JO21/22/31/32 but nothing unusual. He heard G8AOE/P (IO84) a couple of times despite the noise to the North but was unable to make a contact.

Andy Adams GW0KZG (Letterston) says that he was looking around on the evening of the Aurora (3 November), but despite high solar flux levels, did not hear any auroral signals. Similarly, here at GW4VXE, but I noticed that **Dave Butler G4ASR** (Herefordshire) had worked GM stations earlier in the day.

3

Highlights of the GW4VXE 2m log are a little sparse this month, but it was good to work F4IFG (IN96) and F1IXQ (IN96) on 17 October. EA1UR (IN53) was worked on 23 October. IO84 had been eluding me for some time, but it was nice to catch G8AOE/P (IO84) on 3 November during the FT8 Activity period. It was obviously a great aircraft reflection as I was beaming east at the time. Finally, on 13 November, EA1NL (IN52) came up to a huge signal for few minutes before fading down. No other Spanish stations were heard in the opening, or heard me, so it was obviously quite localised.

The 70cm Band

Tony G4NBS made 58 QSOs in 27 locators during the 70cm FT8 Activity Session on 10 November. Highlights from the UK and Ireland were EI8KN (IO62), GI6ATZ (IO74), MM0CEZ (IO75), GM0HBK (IO77), GM4FVM (IO85) and GM8MJV (IO85). Tony says he also worked 20 Dutch stations, 6 German, 3 French, Belgian and Danish stations. He felt there was good UK activity from IO91 but nothing heard from IO92 or IO83. OV3T (JO46) was worked by aircraft scatter although there also seemed to be some residual tropo. DG9BFE (JO33) and DL8DAU (JO40) were other notable contacts from the continent.

During the UK Activity contest on 9 November, Tony thought conditions were a little up and there seemed to be lots of activity. Tony made 99 QSOs but feels he didn't work as much as he should have. In hindsight he wonders if he was sharing frequencies so was not being heard so widely. The best DX was DK1PZ (JO41). During the FMAC, Tony worked seven stations. including G4RRA and G4JMM/P (IO80), G4FZN/P (IO94) and G0XBU (IO83).


4

The 23cm Band

Jef VanRaepenbusch OS8NT (Aalter) listened during the October UK Activity contest using his IC-9700 and Flat Panel antenna. He said conditions were poor and he was able to hear some weak signals fading in and out on SSB, but could not make any QSOs. The GB3MHZ beacon was weak at the same time.

Satellites

Jef OS8NT has been continuing his FT4 activity across a number of satellites: RS-44, CAS-4A, CAS-4B, XW-2B, XW-2F and JO-97. Jef was delighted to receive a QSL card from

Oleg A65BR for an FT4 QSO. Jef monitored the ARISS schools contact on 18 October, easy copy on his Wouxun UV-9D and rubber duck antenna when he was out for a walk.

Peter G8BCG writes of QO-100 operation, *"QO-100 is the opposite of 50MHz DXing. It's not about power, antennas, location, propagation. Working a new one in a QO-100 pile-up is purely about skill and timing (oh, and a lot of luck)! New DXCCs seem to pop up all the time. Simple setups and QRP are enticing some 'rare on any band' operators on to the satellite and many HF/Contest DXpeditions now seem to take QO-100 capability along as it's easy to do so.*

"New QO-100 DXCCs worked this month are ZA/HB9ERD, Z38/HB9ERD, 7P8Z (and 7P8RU), HV0A, C5C, 3X2021 and this afternoon tucked in between EME and TEP, S21RC".

From North America, **Patrick Stoddard WD9EWK** (Phoenix) has his usual interesting round up of recent satellite activity, *"With AO-91 still near apogee in its orbit for the morning passes over North America, long-distance contacts are still being made. Satellite operators are going out to work from many different locations, before winter sets in.*

"Over the past couple of weeks, I have been able to work stations in places like Puerto Rico and Venezuela via AO-91 from my house in Arizona. Others from different Central American countries are popping up, and even some Cuban satellite operators too. Great to see the activity from places where satellite activity was usually limited to hams visiting from other countries. I have given presentations via video links to gatherings in Mexico and Central America on satellite operating over the past couple of months, talks in Spanish, and I think this may have sparked more interest in this corner of our hobby.

"In mid-October, I made a road trip to eastern Arizona, operating from the DM54/DM55 grid line near Petrified Forest National Park. I parked along old US-66 and spent half of a Saturday working stations around North and Central America. I was up there in June, so I wasn't looking to spend the whole day out there. I wanted to help some get those grids before the winter snows set in up there. I started with a low AO-91 pass that came up just after I arrived at the grid line spot, and worked several passes in FM and SSB to put those grids in the logs of many satellite operators.

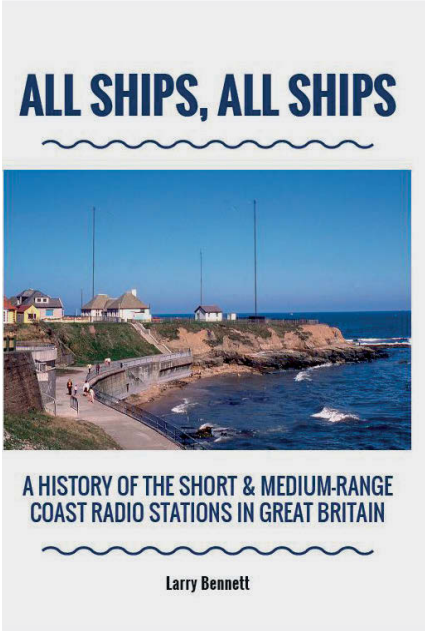
"On my way home from DM54/DM55, I stopped in the small town of Winslow, along the I-40 freeway in northern Arizona. I stood on the corner in Winslow, Arizona, **Fig. 3***, made famous in the Eagles' track 'Take it Easy', for a couple of minutes to take some pictures.*

"As I write this, ***Justin N5BO*** *is going around the US east coast working from some rarely-heard grids, and* ***Mitch AD0HJ*** *is going around Nebraska, heading to Wyoming, and working from other rarely-heard grids in those states".*

Here at GW4VXE I operated portable from IO72 square near Strumble Head lighthouse, **Fig. 4**, to give **Chris AA8CH** a new square on satellites, which we managed, despite AO-91 shutting down for most of the very low pass. It was also good to work N2FYA (FN41) on the same pass. Back at home in IO71, I went on for the AO-91 low pass on 2 November, working K8YSE (EN91), KB1HY (FN31), VO1SW (GN28) and AA8CH (EN71).

That's it for this month, and another year! Thank you to everyone who has contributed to the column and to everyone who's read it. Let's hope for a good 2022 and, if you've been thinking about writing with your VHF news, make it a New Year's resolution that you do. In the meantime, I wish you and your loved ones a great time over the Christmas and New Year period.

All Ships, All Ships



Don G3XTT reviews the most recent book by Larry Bennett G4HLN.

We reviewed Larry's previous book about the history of Portishead Radio in the September 2020 issue of *PW*. Larry had worked there and was familiar with much of the history. Since then, though, he's clearly been busy because this latest book is a history of all the short and medium range coast stations of Great Britain. And that's quite a list, 32 in all, with the book running to almost 500 pages.

Larry says, *"It's a complete history of the UK Coast Radio Station service, and will act as an updated/expanded version of my former GKA colleague* ***Brian Faulkner's*** *excellent publication* Watchers of the Waves*, which was published in 1995. Sadly, Brian passed away a few years ago but his family have given me kind permission to use extracts from his book to act as an excellent source of reference".*

The book starts with a look at the early days of wireless and how it quickly became a valuable tool in communicating with ships, thanks to the work of Marconi and others. I found those early chapters particularly interesting. The book then goes on to devote a chapter to each of the coast stations, looking at their history, key moments in their lives (such as the *Torrey Canyon* disaster, handled by Lands End Radio) and their eventual closure. Larry has done well to track down so much of the history and, especially, to find so many great photos of the various stations, not just from the recent past but also from the early days. The equipment and antennas get good coverage with plenty of mentions, for example, of the ubiquitous CR100 receiver.

The book also has several detailed appendices covering all the stations, including standby stations set up during WWII, with information about callsigns, frequencies, receivers used, etc.

All in all, this is a book to be recommended, not just to ex-professional radio operators but to anyone with an interest in how radio has been used for maritime communications during the last 100 years or so. Sadly, the advent of satellite services led to the end of the traditional coastal stations, with their remaining duties largely taken over by the Coastguard service, but for many years they offered satisfying employment not only to the coastal station operators but also, of course, to thousands of seagoing radio officers (many of whom became radio amateurs either during their careers or subsequently, in order to continue to use their Morse and other operating skills).

All Ships, All Ships is available via Amazon UK for the RRP of £17.99. A limited number of signed copies will be made available for UK customers via the GKA website in due course: www.portisheadradio.co.uk

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

Adrian Whatmore G4UVZ
practicalwireless@warnersgroup.co.uk

The GB3KBQ 10GHz Beacon

Adrian Whatmore G4UVZ describes the GB3KBQ beacon and how amateurs can benefit from it.

Reception of signals at 10GHz (10,000MHz, 3cm wavelength) is usually only via line-of-sight paths. This begs the question as to the value of having beacons at such a high frequency. There are currently 12 active beacons in the UK but these have been received over a wide area of the UK and into Europe. GB3KBQ in Somerset has been received as far away as Andorra and Denmark, pretty impressive for just 10W ERP!

Rainscatter, tropospheric ducting and aircraft scatter all enhance the potential of the 3cm band.

Rainscatter

Rainscatter in particular produces some very surprising results. Living in Taunton I have a regular QSO with stations in Basingstoke and Salisbury. On one occasion during these QSOs I was called by a station in Plymouth, the complete opposite direction from my 1° beam heading. The contact was possible by the signals being re-radiated by a heavy rainstorm over Salisbury Plain!

Troposperic Ducting

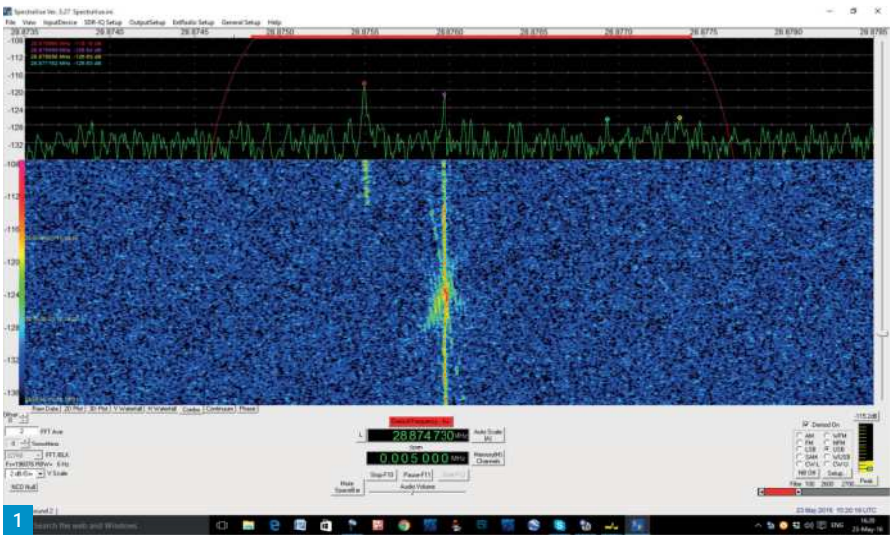
Troposperic ducting contacts follow similar enhancements seen on the lower VHF UHF and microwave bands. A couple of years ago I set the current UK 10GHz Digital TV record working **Rob M0DTS** in north Yorkshire using just 4W into a small satellite dish.

Aircraft Scatter

Aircraft scatter is fairly self-explanatory. On the lower VHF and UHF bands it is commonplace to have low frequency amplitude changes in reception when an aircraft is in the signal path.

Working stations on the path between Taunton and Bristol, this happens regularly on 2m when aircraft fly on a path from Bath to land at Bristol airport. On 10GHz the enhancements are best seen on a waterfall display where the significant doppler shift can be seen on the signal being scattered by the aircraft.

This type of propagation can be used for reception of microwave signals using CW and more recently digital encoded signals such as JT4G, which are now radiated by a number of beacons. G0API regularly reports



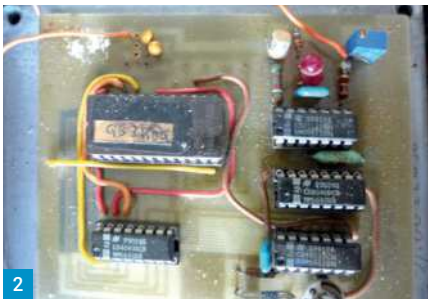


Fig. 1: Aircraft Scatter from GB3KBQ, Flight Radar showing twin engined jet heading SSW over Yeovil, nearer mid-path and at normal height.
Fig. 2: The original GB3KBQ keyer.
Fig. 3: The GB3KBQ waveguide antenna.

aircraft scatter on GB3KBQ from Wimborne in Dorset.

GB3KBQ

GB3KBQ was built 27 years ago in memory of **John Moxham G8KBQ** a local amateur radio legend in the south-west.

The original line-up was a 27MHz crystal-controlled PLL-schooled oscillator. The frequency shift keying being achieved with a reed relay switching a 2.2pF capacitor in the tuning circuit of the 5MHz precision oscillator. The head end of the system was the local oscillator from a White Box system, which were current at the time. This produced all of 60mW into an omnidirectional slotted waveguide antenna.

Over the years the power has been increased using a variety of different PAs. Last year when the current PA was failing, we were very fortunate to be gifted a brand new PA by a local company.

Continued on page 65

The answers to this year's quiz

1: c. **2:** b. **3:** a. **4:** c. **5:** c. **6:** a. **7:** a. **8:** d. **9:** b. **10:** a. **11:** d. **12:** b. **13:** b (but the IC-9700 was reviewed in the July 2019 issue) **14:** b. **15:** c. **16:** c (GMDX is the Scottish DX Club) **17:** b. **18:** d (73 was a US magazine). **19:** a. **20:** c (CDXC is a club for DX-minded amateurs)

Tony Smith G4FAI
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Morse Code from Moscow, 1926

Tony Smith G4FAI has the story of an early superhet.

Until 1927, most receivers in use, commercial or home-made, were relatively inexpensive crystal sets. A single local station could be received quite satisfactorily with these sets using headphones, and loudspeaker reception was possible by the addition of an audio amplifier. However, as more local stations came on-air it became increasingly difficult to separate their transmissions with a crystal set. Improved performance valve sets were becoming available which, although considerably more expensive, were more selective and provided better speaker performance.

Unpopular with Neighbours

The early valve sets had reaction (regenerative) controls which, when carefully manipulated, increased the sensitivity of the set by feeding back part of a detector valve's output to its input. However, over-feedback caused the detector to oscillate, making the set a transmitter feeding into its antenna and producing howling noises in receivers tuned to the same station in the vicinity.

This was an unpopular practice, forbidden in the early licence conditions and frowned on by the authorities later. Despite this disadvantage, when properly adjusted the regenerative receiver offered the opportunity of listening to previously undreamed of more distant wireless stations.

Enter the Superhet

A dramatic improvement came about with the invention of the supersonic heterodyne (superhet) receiver with improved circuitry and no regenerative function.

The invention of the superhet is generally credited to **Edwin Armstrong** while working with the US Expeditionary Force in Europe in WW1 but the patent claim of a Frenchman, **Lucien Lévy**, dated 4 August 1917, pre-dated Armstrong's claim by seven months.

Lévy's patent was held in the UK by Standard Telephones and Cables Ltd (formerly Western Electric Co. Ltd) under Patent No. 143583 (1920). However, before 1930, due to ongoing legal disputes between Armstrong and Lévy, STC would not licence other companies to manufacture receivers under this patent.

Above: Supersonic Heterodyne Radio c.1926

They did, however, licence amateur constructors who wished to make their own superhets and the set illustrated here, see photo, bears an amateur's Licence Plate, No. 1015, which confirms that the maker has paid the necessary royalty fee to the patent holder.

The patent dispute was finally resolved on 5 November 1929 and Lévy's original claim was confirmed with a patent priority date of 4 August 1917.

Excitement in Doncaster

This large Lévy superhet in a polished wood cabinet was made by **Mr FC Scarborough** of Doncaster sometime in the early 1920s. It was probably made from a kit judging by its internal structure. When photographed by the author some years ago it was on display at the Muckleburgh museum in North Norfolk in the much-lamented Radio Hut which, sadly, is no longer located at the museum.

In its time, this set was an object of great interest in the local community. A special report in the *Doncaster Gazette* in 1926 describes with some amazement how Mr Scarborough, in Doncaster, was able to hear church bells in Manchester, 46 miles (73km) away ringing in the New Year and, on another occasion, to hear *"the big town clock there chime the hour!"*

Even more amazing, said the report, when he tuned in to foreign stations he heard Morse code messages *"coming from the Bolshevik station in Moscow"* and, a minute or two later, *"a great radio station in the United States sending its wonderful waves across the Atlantic to be picked up in Elmfield Road, Doncaster!"*

It also describes how, previously, when local boxer **Roland Todd** fought **Kid Lewis** to become British Middleweight Champion, Mr Scarborough was *"something of a public benefactor as he had his loud-speaking device arranged at one of the windows of his house"* while the match, at the Albert Hall in London, *"was described to a waiting crowd of Doncastrians round by round."* For its time, as the report concluded enthusiastically, it was a *"marvel of marvels, indeed!"*

Coaxed back to Life

Received as a donation to the Radio Hut, the set appeared to be reasonably intact internally, albeit with evidence of previous attempts at repair. Happily, after some considerable work by a member of the radio group at the Hut, including tracing out the circuit manually, it was coaxed back to life linked to a vintage horn speaker.

Mr Scarborough would have surely been pleased to know that his pride and joy eventually became a working museum exhibit. Sadly, much of the radio group's collection has been disposed of and the present location of this historic example of Lévy's Supersonic Heterodyne Receiver is not known to the author.

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Mike Richards G4WNC
practicalwireless@warnersgroup.co.uk

More on VACs

Mike Richards G4WNC has more on setting up VACs and has news of yet another Raspberry Pi incarnation.

Following on from last months detailed look at Virtual Audio Cables (VACs), I thought it might be helpful to add some more step-by-step examples for popular data modes software.

The first step is to create a pair of VACs, one for receive audio and the other for the transmit. I covered this last month, but I'll briefly repeat it here, so you don't have to refer back. I'm assuming that you're using **Eugine Muzichenko's** VAC, as this offers the best value and performance balance.

- Open the VAC control panel (right-click and choose run as administrator)
- In the Driver parameters box (top left), set the number of cables to 2 and press Set
- Exit the control panel

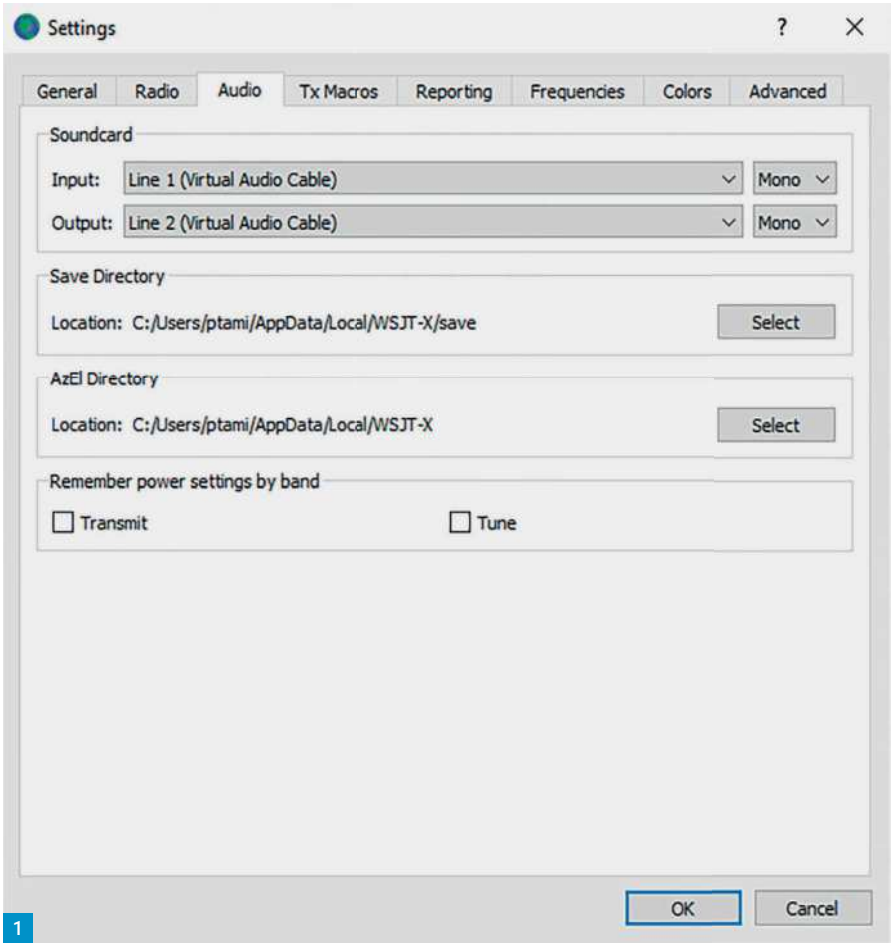
I'm aware that's it's easy to get confused with audio cables, so it's worth setting a rule or convention, so you always use each of the two cables for the same role. In my case, Line 1 (virtual audio cable) is always used for receive audio while Line 2 (virtual audio cable) carries the transmit audio. This simple convention makes it easier to select the correct cable when setting up your data modes software. You may be aware that Windows 10 has a facility to rename audio devices. However, I've found this confuses the situation and is best avoided. The confusion arises because the Windows name change is only visible if the VAC audio device is accessed using the Windows preferred method. However, several data programs use low-level access that bypasses the name change. As a result, the name change doesn't show in the data modes software or you may find the cable has two appearances, once with the original name and again with the new name!

SDR Receiver Configuration

In your SDR receiver, you need to set the audio output to use Line1 (virtual audio cable) and the transmit input to use Line 2 (virtual audio cable). Some SDRs include a VAC or two to send the audio output to more than one device. If that is true of your receiver, use the second output to send the receiver audio output to the soundcard connected to your speakers. That way, you'll be able to listen to the receiver. If you don't have the option of multiple outputs, you can still listen to the audio by using the VAC repeater software, as follows:

- Go to the Windows Program menu and open the Virtual Audio Cable folder
- Select Audio Repeater (MME)
- When this opens, set the Wave in to Line 1 (virtual audio cable). This is the receive audio
- Set Wave out to the soundcard that's connected to your speakers
- Press Start

That will automatically relay any audio produced by your SDR receiver to your speakers.



1

Data Modes Setup

With the receiver set up and the audio attached to the Line 1 and Line 2 VACs, we can configure the data modes software. One point to note here is that most data modes software checks for the presence of audio devices during the start-up process. Therefore, you must launch the data modes software after you've created your VACs, or the VACs may not be visible.

WSJT-X: This is by far and away the most popular data modes package. Here are the configuration steps:

- Open the File menu and choose – Settings – Audio, **Fig. 1**
- In the Soundcard section, use the Input drop-down to select Line 1 (Virtual Audio Cable)
- Next use the Output drop-down to select Line 2 (Virtual Audio Cable)
- Click OK to finish and save the settings

FLDIGI: This package is the most popular choice for pretty much everything but the WSJT-X weak signal modes. Here are the VAC configuration steps:

- Open the Configure menu and choose – Config Dialog – Soundcard – Devices, **Fig. 2**
- Make sure you click the PortAudio box

Fig. 1: WSJT-X VAC configuration.
Fig. 2: FLDIGI VAC configuration.
Fig. 3: JS8CALL.
Fig. 4: Dire Wolf VAC configuration.
Fig. 5: New Pi Zero 2 W.
Fig. 6: FLIRC case for the Pi Zero 2 W.

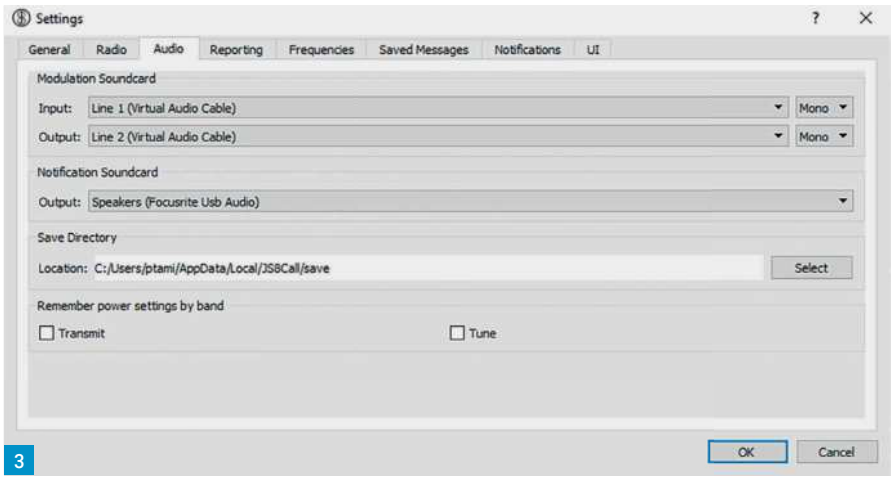
- Use the Capture drop-down to select Line 1 (Virtual Audio Cable)
- Use the Playback drop-down to select Line 2(Virtual Audio Cable)
- Click Save to save the configuration

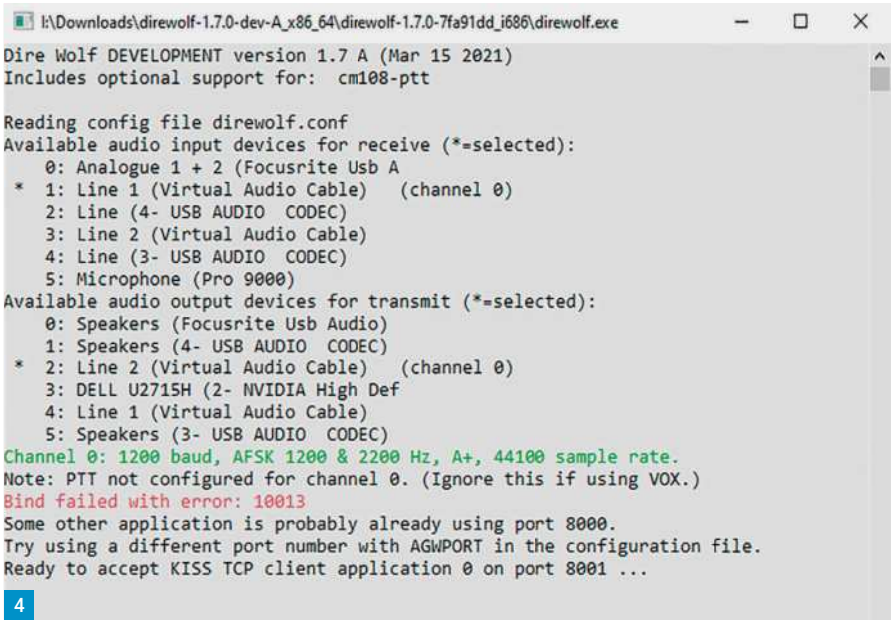
JS8CALL: A popular choice for those that want to chat using FT8. The program is derived from **Joe Taylor's** weak signal software, so settings are very similar to WSJT-X, as shown here:

- Open the File menu and choose – Settings – Audio, **Fig. 3**
- In the Modulation Soundcard section, use the Input drop-down to select Line 1 (Virtual Audio Cable)
- Use the Output drop-down to select Line 2 (Virtual Audio Cable)
- Click OK to save the settings

Dire Wolf packet radio software: This is an excellent packet radio application with everything you'd typically find in a hardware TNC. Configuring the inputs and outputs is done using the configuration file, as follows:

- Run Dire Wolf, and you will see a screen similar to **Fig. 4**.
- Make a note of the device number for Line 1 (Virtual Audio Cable) in the audio input section (1 in this example)
- Make a note of the device number for Line 2 (Virtual Audio Cable) in the audio output section (2 in the example)
- Close Dire Wolf and navigate to the Dire Wolf installation folder
- Locate and use a text editor to open the file named direwolf.conf
- Scroll down to the line: #ADEVICE 3 4
- Delete the # and enter the device numbers you noted earlier. In my example, the like would be: ADEVICE 1 2
- Save the direwolf.conf file
- Run Dire Wolf again and you should see that your VACs have been selected





New Raspberry Pi

The pleasant surprise for Halloween was launching a new model in the Raspberry Pi range, **Fig. 5**. The new Pi Zero 2 W provides a significant upgrade to the popular Raspberry Pi Zero W. The main headline of the Pi Zero 2 W is a brand new, custom-built, 64-bit quad-core processor chip, the RP3A0. The original Pi Zero used a single-core 32-bit, 1GHz device, but we now have a 64-bit quad-core device clocked at 1GHz.

As with all the Pi range, the processor is a system-in-package (SIP) device that includes the graphics processor and many other essential peripherals. Including the peripherals in the chip reduces PCB complexity and significantly reduces the production costs. Most reviews I've seen so far estimate that the new Pi Zero 2 is around 4-5 times faster than the original Pi Zero, so it's a very worthwhile upgrade.

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Daimon Tilley G4USI
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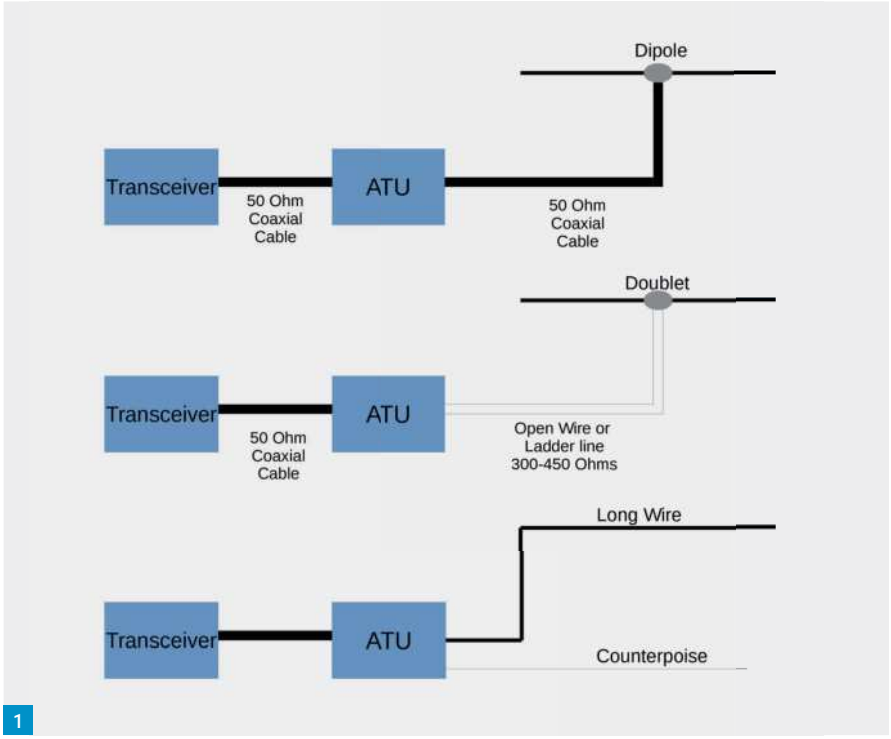
ATUs

Daimon Tilley G4USI turns his attention this month to antenna tuning units.



1

In this instalment of *On a Budget* we are going to take a look at Antenna Tuning Units (ATUs.) Before we examine our budget options, I want to just take a brief look at what an ATU is and why we might want to use one, as well as very briefly looking at the different types.

An ATU is really nothing more than an impedance matching device. Indeed, many people dislike the use of the word 'Tuning' and would prefer to use 'matching' instead because the device does not actually 'tune' an antenna, but matches the impedance between the transmitter and the antenna. In my previous article on building HF antennas, I briefly explained that modern transceivers are designed to be connected to an antenna of 50Ω impedance. By matching the impedance of the antenna to the impedance of the rig we improve efficiency by reducing our SWR (Standing Wave Ratio) ensuring more power is radiated from the antenna, and protecting our rig from damage if the mis-match is too high. But even an ATU cannot make a poor antenna a good one. While almost anything can be made to radiate using a good ATU (I have used my cowshed roof, cowshed gate, stock trailer, electric fence and even a polytunnel (see link below!) it doesn't make them do so well!
https://tinyurl.com/yfvtvw6b

A resonant antenna such as a dipole fed in the centre, is already reasonably efficient, as the impedance at the feedpoint will be around 50Ω already. Theoretically the impedance at the feedpoint of the dipole (in free space) will be 73Ω. This is close enough to 50Ω for all practical purposes and no ATU is required.

We also looked, in the previous article, at how we might match the impedance of end-fed wires using a transformer (e.g. an end-fed half wave.)

So why an ATU?

Why then do we need an ATU at all? Well, there are two main reasons. The first is that on a band that covers a large frequency range such as the 450kHz of 21MHz, when we cut the dipole to resonance, say for the centre of the band, the SWR will rise towards the band edges. This may rise to a level that is acceptable (say below 2:1) or it might rise more. In any event, what is happening is that the impedance of the antenna is changing the more you move away from the resonant point. By using an ATU, we can 'touch-up' this higher SWR to improve your impedance match between antenna and rig. Some modern rigs will have an in-built ATU, which will conveniently allow you to do this without taking up more space on your desk with another device.

The other reason is that we may wish to use a non-resonant antenna on multiple bands, so that we have a single antenna capable of multi-band use. In these cases, an ATU needs to handle a wider range of impedances than required for just 'touching up' a dipole. A classic example might be the G5RV or a random Long Wire antenna. In cases of antennas like these, some rigs with internal ATUs are not capable of matching such wide ranges of impedance and alternatives will need to be sought, either in the shape of an external ATU or the use of an impedance transformer to bring the mismatch within the range of an internal ATU's ability.

Purists will nearly always argue that ATUs should be unnecessary and that resonant antennas are the only way to go. But for many people this is just not a practical proposition. For example, a modern small garden, with near neighbours, might mean that a single wire antenna for multi-band use is the only practical proposition. For the portable operator, an ATU provides a degree of 'frequency agility.' For example, I operate portable quite regularly, but I like to travel light with radio gear and don't want to carry enough wire or enough antennas to have a resonant antenna for every band. I will usually take a resonant antenna if I can, but what if that band is dead, but other bands are busy? An ATU will often allow me to match my antenna to that busy band and make contacts where I might not otherwise have been able to do. In my case, I predominantly use QRP rigs with internal ATUs, which is very convenient.

Types of ATU

So, having discussed the 'use case' let's now turn our attention to type. There are many different designs of ATU available, depending on whether or not you wish to match your rig to a balanced or unbalanced antenna. It is beyond the scope of this article to examine Pi-Networks, T-Networks, L-Matches,

Fig. 1: The three methods of feeding an antenna via an ATU. Fig. 2: Feeding an antenna via an ATU and a matching transformer. Fig. 3: The LDG Z-100Plus. Fig. 4: The MFJ-949.

Z-Matches, etc. If you are interested in understanding more about these, plenty of literature is available online and in reference books.

For practical purposes, there are three broad types of antenna connection we may wish to make to an ATU. These are by means of coax, by balanced line feeder such as open wire or ladder line, and finally a single wire, such as a random length end-fed. Each of these configuration methods is shown in **Fig. 1**.

Many of today's 'convenience' tuners are designed only to accept a coax connection from the antenna. If you want to use one of these types of tuners with either open-wire or ladder line feeds, you need to make use of a matching transformer of some type. Typically, for a doublet or G5RV using ladder line or open-wire feeder, a 4:1 BalUn is used. For a random long wire, usually a 9:1 UnUn. These configurations look like those pictured in **Fig. 2**.

Finally, there is a choice of automatic or manual tuning. With a manual tuner, there are typically between two and three controls to be operated and these controls are used in conjunction with one another and an SWR meter to achieve the minimum SWR and therefore best match to the antenna. This can take a little practice to get used to but it is not difficult and soon comes easily. However, all controls will need adjusting when you change frequency by 100kHz or more, or change band. On the other hand, automatic tuners are just that – they will do the tuning for you. Some tuners require you to merely press a button to initiate an automatic tune and the ATU does the rest, while others sense both RF and SWR and will automatically tune when needed with no operator intervention at all. In these automatic tuners there are often a number of 'band memories', which when tuning the same antenna, store 'learnt' settings based on frequencies, making tuning much quicker still.

So, let's take a look at tuners that won't break the bank. We will start with tuners capable of operating with 100W or more and end with QRP tuners, fit for up to about 10W.

Up to 100Watts

Recently there has been an increase in the availability of new tuners to the market, which is great for the consumer. Automatic tuners are quite abundant on both the new and used market. It is in this power category that automation is typically, but not exclusively, found.

On the new market, LDG offer over half a dozen different models. To the best of my knowledge, most of these require the user to press a tune button when they wish a new tune to be undertaken. Popular models at the lower end of the range are the Z-817, designed specifically for the FT-817/8 at £140, and the Z-100Plus, **Fig. 3**, at £170. I used to own and use this latter tuner at home, until I moved to all-resonant antennas. It was a good performer.

You generally find, with LDG and other brands, that as you move up the range, this is largely concerned with the devices handling greater power. For example, their 250W unit is priced at £280 and the 1kW model comes in at £530.

MAT tuners are now on the market and becoming more widespread. Prices start from £140 to around £250. Again, these are automatic models.

Both LDG and MAT are designed for coax-fed antennas. More expensive ATUs come from other manufacturers such as Palstar and can reach as high as £1,600.

If you are content with a manual tuner, then on the new market you could not go far wrong with an MFJ-949, **Fig. 4**. These are pretty bombproof and handle 300W,

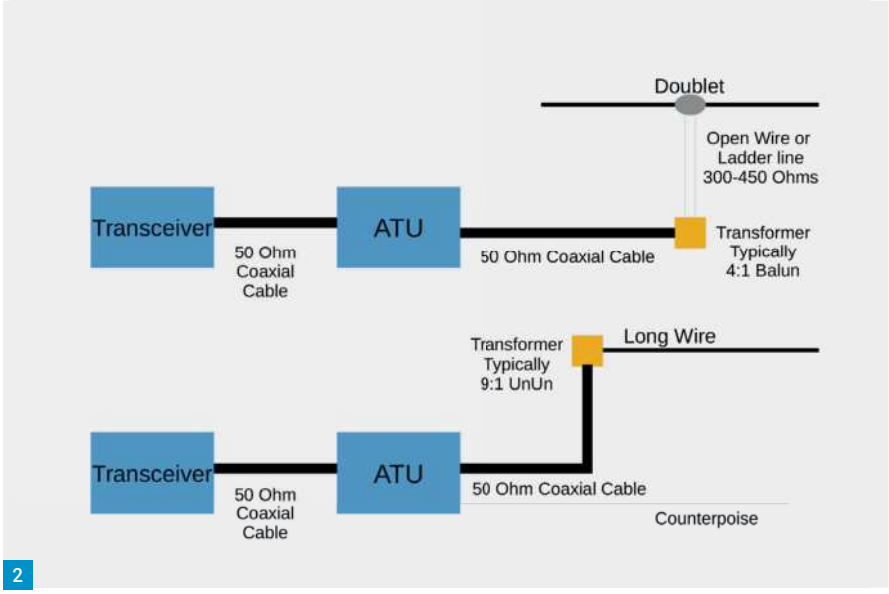


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Fig. 5: The Elecraft T1 tuner.
Fig. 6: The MTM-ATU.
Fig. 7: The Kanga pocket transmatch.
Fig. 8: A homebrew mini-whip.

with a built-in SWR/Power meter, dummy load, 4:1 balun and the ability to switch between two antennas, either connecting them directly to the rig, or allowing the ATU to tune them.

This is handy when using a resonant antenna on a different band. In addition, it has connectors on the rear for antennas that are either coax fed, ladder line fed or random wires. Priced new at £250, they can be found used for around £100 to £150. I was very lucky a few years ago and picked one up in a charity shop for just £50. Although I don't use it currently, this a device I will probably never sell as you never know when it might be useful for antenna experimentation, and it is pressed into service as the main shack dummy load and general coverage receiver ATU too.

There are also a number of remote tuners available. Often waterproof, and fully automatic, with no operator input required, these are ideal for situating outside right at the feedpoint to a long wire or loop, etc. Brands include SGC, ACOM, Icom, Kenwood, LDG, MFJ and Yaesu. These are typically more expensive to buy and less often seen on the used market, but if you are going to use an ATU, they are the most efficient means of doing so.

Luckily, in the 100W and above tuner category, there are always used units available from either main dealers or your favourite private selling spaces online. Don't be put off by older manual units either, as often they are both cheap and very effective. For example, the SEM TransMatch and the KW E-Zee match are both very old but effective tuners for balanced feeder antennas such as a doublet, and can be picked up for less than £50.

But how about an ATU that is new, cheap and effective as well as automatic? Impossible? Read on. Commonly branded as the ATU-100 and produced in quantity in China, this is a clone of the open-source ATU of the same name designed by N7DDC.

A capable automatic ATU for coax fed antennas, the device can handle 100W and includes an OLED screen showing power, SWR and other information. A complete kit of parts to build the device, including the case, can be purchased for around £55 from AliExpress. It is also possible to buy the kit without the case and buttons, but including the display, for less than £20. I should stress that I have no personal experience of this tuner, but have read many good reviews. As is usual, these prices are available only direct from China, but if you prefer to buy from a UK reseller on auction sites, be prepared to pay about £35 for the PCB kit and £70 for a fully ready-assembled unit.

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QRP Units

Here there are also plenty of options, although much less on the commercial products front. That said, many of the 100W+ tuners work well at QRP, but do be aware that some require a minimum of 5W to tune, although the LDG Z-100 Plus claims to tune at just 0.1W.

Commercial QRP tuners include the excellent Elecraft T1, **Fig. 5**, at £250, the LDG Z817 mentioned earlier that can also be used with rigs other than the FT817/8, and the MAT-10 at £175. All of these are automatic.

But at QRP power levels, components are both smaller and cheaper and it becomes much less daunting to make your own ATU. It is possible to do this from a kit if you lack a little homebrew confidence, and there are some very good kits available. The G-QRP Club offer the *Limerick Sudden ATU* kit with case for £40 to members. This is a Z-Match design for 80-10m, can match any type of antenna, balanced or unbalanced, and has an LED as an SWR indicator. The coax connector provided is merely a phono socket, once common for QRP, but you could replace this with a BNC or similar.

Similar looking to the *Sudden* ATU is the MTM-ATU, **Fig. 6**, from Kanga Products. This is a TransMatch design and also has an LED SWR indicator, where you tune the ATU for no LED or minimum brightness. It can be bought as a kit for £40 or fully assembled for £50. A similar version, marketed as the Pocket TransMatch, **Fig.**

7, is more designed for field use and is £40 as a kit. Finally, Kanga also produce a tuner kit for an End-Fed Half Wave, for £27. I have not tried any of these myself, but I have just built their Low Pass Audio filter for CW use and found the kit quality and instructions to be excellent.

If you wish to purchase from farther afield, then you will find a good few examples of kits in the US, but I often find that the postage costs are prohibitive and I have no experience of any import duties from the US. For example, the EMTECH ZM-2 tuner is available for $88 (£63) built or $62 (£45) as a kit, but shipping is another $27 (£20).

But these QRP ATUs are very simple and often you will find they are designs that are well published, tried and tested. The designs tend to be completely open source, so you would not be doing anyone a disservice if you merely looked at the schematic and decided to build it yourself. The EMTECH ZM-2 schematic is freely available on the manufacturer's website, along with detailed build instructions, so copying the design and building it for yourself should be straightforward.

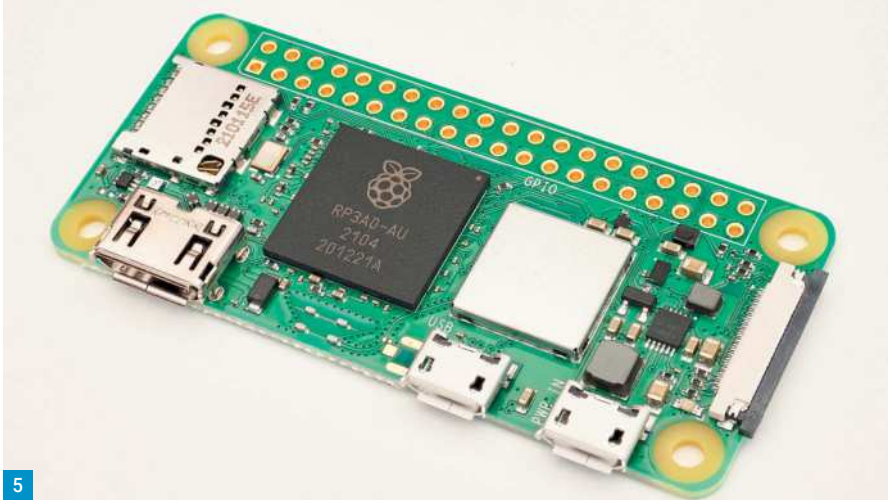
Indeed, a couple of years ago, for fun, I built a small (1.2m) whip, **Fig. 8**, with integral tuner, a design I copied from **Peter Parker VK3YE**, but I also added a resistive SWR bridge to it to improve tuning. It worked well and only took a few hours to make. The basic design without the SWR bridge can be found at:
https://tinyurl.com/ev4kupax

Peter has lots of other ATU designs for homebrew here:
https://tinyurl.com/dpwa9ttf

I also recommend many of the designs that have appeared in *SPRAT* (journal of the G-QRP Club) and a complete copy of all *SPRATs* from number 1 to number 184 can be purchased by members on USB stick for only £5 and it is fully indexed too. At only £6 per year to join, membership is very worthwhile.

To conclude, in a perfect world, where we have resonant antennas for every band, no ATU would ever be required, but of course we live in a far from perfect world and face many constraints in achieving this, from garden size to portability for field operations. In these cases, ATUs can allow us operating freedom on bands that might not otherwise be possible, and therefore they can be a very useful tool.

In the next instalment of the series, we will examine Linear Amplifiers. Until then, happy operating.



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Continued from page 55

The Pi team has always worked wonders with the price, and the new model costs just £13.20! As with most Pi launches, the initial batch sold out within a few days, but they should be available again when you read this.

I bought my Pi Zero 2 W on launch day and have been busy testing its capabilities. The first test was to run it with one of my data modes microSD cards. I'm happy to report that it worked fine and was happily decoding FT8 and FT4 signals. The processor loading was well within its capabilities, running 5% during the receive cycle and 30% during decode. As with the other Pi models, you still need to add an external USB soundcard to handle the audio ins and outs for data modes. I recommend using the Ugreen USB sound card because it has a short USB tail, so the bulky body doesn't block adjacent USB ports. In addition, you will need a small USB hub. The ideal type is those sold as OTG (On The Go) and fitted with a micro-USB plug. One of these will plug straight into the Pi and give you three or four standard USB sockets that you can use for a wireless keyboard/mouse combo and the USB soundcard.

My next test was to try the Pi Zero 2 W running Spy Server software. This is quite a demanding test as the Pi has to take the high-speed raw IQ signals from the SDR, down-sample them and create the FFT (Fast Fourier Transform) spectrum display. The stiffest test is to handle the 10MSPS (Mega Sample per Second) stream from an Airspy-2 SDR. As I suspected, this proved too much for the Pi Zero 2, so I reverted to the 2.5MSPS rate, and that worked very well with no dropouts and a steady processor load of about 50%. While running Spy Server at 2.5MSPS, I kept an


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eye on the processor temperature. Not surprisingly, with the Pi Zero 2 W mounted in the standard Pi Zero plastic case, the processor temperature quickly rose to its throttling temperature at around 85°C. I left it running to see what would happen and, after a while, the processor shut down. This is not a surprise as the case was designed for the original single-core Pi Zero and there's virtually no air movement inside the Pi case. In fact, its plastic construction probably makes it a pretty good thermal insulator! I tried the same test with the Pi Zero out in the open, and the temperature stabilised at 57°C (ambient temperature was about 20°C). The best enclosure I've found so far is the Pi Zero case from FLIRC, **Fig. 6**. As you can see from the photo, the aluminium chassis is in contact with the processor via a thermal pad, and this transfers the heat to the case. The cooling effect proved to be very effective. With the same test conditions, the processor temperature stabilised at just under 50°C, which is a safe working temperature and well below any throttling. I've updated all my pre-configured microSD cards to work with the Pi Zero 2 W, see:
http://g4wnc.com/shop-2

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DMR on 80m?

Joe Chester M1MWD ponders Magic, using a DMR handheld on 80m!

Was it **Arthur C Clarke** who once famously remarked that *"any sufficiently advanced technology seems like magic"*, or something close to that phrase (yes it was! **ed**). Over the past several *Notes*, I have been reporting on my activities with a DMR handheld transceiver. It's been fun. Yes, there was an initial learning curve, but it wasn't as steep as I expected, or had been told it would be.

Of course, this was down to the very excellent Guru/Elmer, **Nigel G4RWI**, who took me through the process and provided the initial codeplug. I'm now officially flying solo, so to speak. I know how to change settings on my hotspot, and in my codeplug, as required. So, what next, I thought?

The Magic Begins

It didn't take long. So, to jump to the end of the story (in case your too busy right now to read on). Today, I joined the usual NRC 80m morning net, using a DMR handset from a hotel in Dublin. Magic!

At least it felt that way to me. Logically, what I together with the aforementioned Guru have created, is a DMR-to-80m gateway. It's a bit rudimentary, but it worked. It's not quite a two-way gateway just yet, and it does require a bit of a fudge, but it's a work in progress. And, in the words of the poet, it can only get better.

Technically, there isn't that much to tell. I mentioned fudge, but it was really quite simple once we got our heads around it. But first a word about an actual DMR-80m gateway, which worked and allowed two-way conversations. **Steve G4HPE** got a special research permit from Ofcom, with the help of the RSGB, to build what he called a frequency-agile gateway linking HF bands with digital modes. Steve was motivated by the need for emergency communications in disaster zones. He reasoned that it would be easier for first responders to carry a handheld radio than have to set up an HF amateur radio station.

Identifying the requirements was relatively easy, and Steve, with others, built the gateway interface, **Fig. 1**. He spent two years on the project, and he graciously gave me access to some mp3 files of demonstrations he ran with his hardware solution. Impressive.

Now I contacted Steve, in order to try to beg a loan of his equipment, but then I realised that amateur radio technology has moved on a bit, even since Steve got his hardware solution running. Our requirements were not as severe as Steve's, as we were just playing radio, rather than designing a stand-alone solution. And I also began to see possibilities with a couple of audio cables. And that is the road we are following.

The basic concept is shown in the diagram, **Fig. 2**. The problem is getting the audio into and out of two transceivers. You may see this as a simple crossband working solution, and indeed that's what it is currently. But imagine if we could get the procedure set up properly. Then anyone could use it transparently. But let's stick to what we have actually done for now.

The Reality

Of course, the key issue isn't moving the audio around, or in and out if you prefer. It's keying the two transmitters involved, and in the correct part of the sequence. OK, here comes the fudge, because we ain't got this part actually working automatically, if you see what I mean. It does work, but we have had to use an actual human to trigger the PTTs! For now, at least. So, this is what happens.

It's approaching 0930UTC and time for the NRC net to come on air. We are on air every weekday morning on 3727kHz plus or minus the QRM. By way of background, this net was set up when the first lockdown started, by RSGB members who also volunteer to man the National Radio Centre (NRC) in Bletchley Park. But it's not exclusive – anyone can call in, and many frequently do.

We know of one amateur who uses the net as a source of quality signals to help his DIY radio activities (you know who I mean!). But others just call in for a chat. There is a set of regulars, both NRC volunteers and non-volunteers, and it's not unusual to have reports of activities on various bands and modes, from HF to VHF, and reports of sunspot numbers, and propagation predictions, and news


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from Devon (**Keith G0CUT**), Scotland (**Simon GM0SCA**) and elsewhere too – everything you would normally get at the club meetings we all miss.

This morning, I am in a hotel in Dublin and Nigel is in his shack in Chinnor. Nigel, back from early retirement(!), is Net Controller this morning (like the NRC itself, we have a team of volunteers now, who take turns to run the net). At my end, all I have is my RT3S handheld and my hotspot. I have changed the WiFi in the hotspot to use the hotel's WiFi. I then key up, and see my handheld light up on the Phoenix Dashboard. So, I know my hotel room 'station' is switched on and working. I also know Nigel is getting everything up and running on his Icom 7300, ready to run the net.

I switch my handset to Talk Group 83, key up and make a call. And back comes Nigel. Of course, Nigel also has a DMR handset (actually it's the same make as mine, but it doesn't have to be – any DMR radio would work as well). TG83 is an open TG, used more or less as a sort of chat line, to ease the load on wide area TGs such as Hubnet or Phoenix. We are almost set.

There is only one more piece of magic to light up. At my end, I have an internet tablet (it's an iPad – thanks for asking – but again any tablet or computer would do). I use this to open the webpage of a well know SDR receiver – I used the one by **Mark G4FPH**, located near Stafford for this experiment (many thanks Mark) – again others are available. Noise levels locally on 80m are generally rather high these days (yeah, that problem again!), so many of us routinely use the online web SDRs for the net anyway.

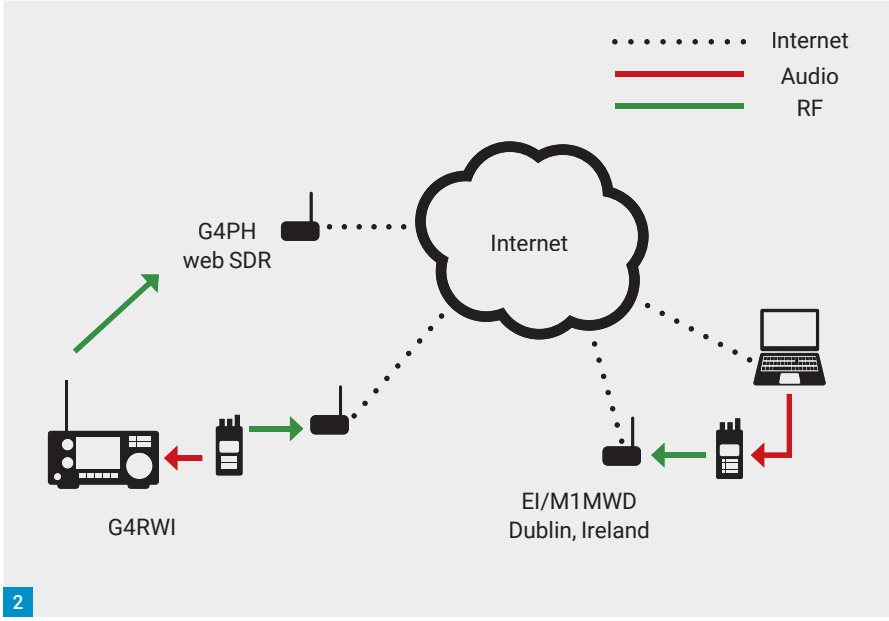

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Fig. 1: The gateway interface.
Fig. 2: Basic concept of interconnection.

You have to understand that with the current state of 80m propagation, indeed of propagation in general, using an HF radio to call into an 80m net from a long way away is just not feasible for a small station. On my trip to Ireland, I brought my KX3 and its KXPA100 amplifier. I have used this with an 80m vertical mounted on the roof-rail of the car with some success in the past.

One morning, just for the fun of it, I drove up a small hill just north of Dublin and set up on 3727kHz in the car park there. The band was very quiet, but there were signals on the Stafford SDR. However, I could not get a reply to my CQ calls.

Of course, I understand that it might be possible to call in on 3727kHz if I had a larger and more powerful station – several kilowatts of power and a monoband beam to match! But this is not feasible from a room on the fifth floor of a hotel. So back to station in the hotel. It's small, very small, but nevertheless it is a licensed amateur radio station. And with the online SDR up and running, I can, of course, hear the net very well. Yes, I can't transmit using that web SDR. But you've probably guessed what is coming next.

Nigel gets the net started and hears a few calls in reply. A discussion about updating SatNav software erupts, as everyone airs their favourite grievance. I'm frequently asked by friends and family what we talk about every morning on the net. I've grown tired of pretending we discuss the techniques involved to taking apart and building radio transceivers (although sometimes we do!).

These days I settle for an easier to understand metaphor, and ask in reply *"what do you talk about when you go down the pub?"*. Because that is exactly what we talk about on air (there are a few topics we avoid – things like politics and religion to name just two, but isn't that true of most pub conversations too?).

Anyway, back to the net. Three or four stations call in, and the net gets going. Nigel calls in **Tony G0LAX**, and he starts his over. Then on TG83 on the DMR handset I hear Nigel say *"you're next"*. I settle into my armchair, scratch a few scribbles on a piece of paper, and listen to Tony, awaiting my turn. Tony says *"over to you, Nigel"*, and on the web SDR I hear Nigel say *"and now for a little surprise. Joe M1MWD is sitting in his hotel room in Dublin, so over to you Joe"*. I pick up the handheld and speak. *"This is EI/M1MWD calling from Dublin, good morning gentlemen, good to hear you all on air today. The weather here is….etc…..so with that back to you Nigel"*. We told no one we were going to do this, so unsurprisingly, the next station Nigel calls into the net reported my signal as 55! **Roger G8VLR**, who had an inkling of what was happening, said my audio was the best he had ever heard from me on the net! Have you worked it out yet? All Nigel did was to hold his DMR radio up to the microphone of the IC-7300 and push its PTT! Trivial almost, but don't underestimate what we achieved here.

My turn came around again, but tipped off on TG 83, I was asked to explain what I was doing. I plead guilty to perhaps not convincing anyone who heard my explanation, because I was still on a high from my previous over. It would have been easier to just say 'magic'. For it was just that, in my view.

We repeated this experiment a week later. There were a few technical issues, but we got it going again, and it worked. And I did it again with Roger G8VLR on another occasion, just to prove it was an easy process. There are also other experiments we can do with this setup, such as retransmitting the 80m net onto a DMR talk group, and so completing the loop so to speak.

On Reflection

Let's step back and look at this again. Yes, there are things we can do better. Nigel, for instance, has a mixing desk, so there might be things we can do with that to improve operations. And longer term there must be a way to trigger the PTT on the IC-7300 – VOX maybe? And I was using a WebSDR to hear the net, rather than back through my handheld. OK, we get it – room for improvement.

But what if? Clearly 80m propagation is limiting who can join in with the many of the 80m nets run every morning, including the NRC net. But DMR (and Fusion, and D-STAR) are not similarly limited. And there are thousands of licensed operators with digital capability. And there are also thousands of operators without the possibility of mounting external antennas. So, would it be feasible to imagine running a joint DMR-80m net? Why not? How much fun would that be? I don't think we are there yet, but with a modest improvement in operational issues, it should be possible. I can even imagine doing this mobile with my DMR handset set up in the car. Magic indeed!

Finally, might I ask for your help with an administrative issue. We are quite happy that this type of crossband working is legal, under the terms of the current licence (anyone differ with this viewpoint?). But the callsign issue is a bit puzzling. My handset is registered to my UK callsign, so using my callsign in the UK is not an issue. Under the CEPT rules, operating from Ireland, the use of EI/ callsign is allowed. But I also have an Irish callsign. So, to operate a UK registered DMR handset from Ireland, what is the correct form of callsign I should be using?

Continued on page 65

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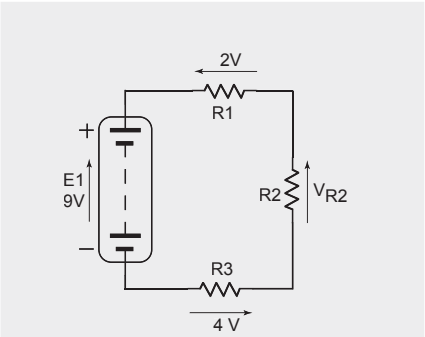
A Lab Tutorial

This month's tutorial turns to Kirchoff's Law, Thévenin's Theorem and Norton's Theorem.

*Morning **Jeff**, how's your Norton?"* **Natalie** shouted as she breezed into the lab. *"I don't, and never have owned a Norton"* said Jeff without looking up from the *Practical Wireless* that he was reading. *"Ey, what are you talking about"* Natalie asked. *"Just answering your question about my Norton motorbike"* Jeff replied. *"No, not motorbikes, Norton constant current sources"* explained Natalie. *"Yes, I assumed that's what you were talking about"* said Jeff grinning and looking up from his *PW*. *"And I assume that you want to spend lunchtime discussing them". "Yes please"*, said Natalie, *"along with a couple of other things like Kirchhoff's voltage law and Thévenin. **Archie** says that this is the last that we'll be doing on direct current circuits for the time being although **Reggie** and **Arthur** might cover other theorems". "Who are Reggie and Arthur?"* asked Jeff. *"Oh, Reggie takes us for maths and Arthur for engineering science"*, said Natalie. *"Archie says that there are things like more complicated Kirchhoff's circuits, and something called the Superposition theory that need to be understood." "Yes, that's right"*, said Jeff. *"But I don't know. Archie, Reggie, Arthur. It was always **Mr Heywood** and **Mr Davidson** when I was at college. No first name terms"*, Jeff mused.

Lunchtime arrived and after they'd eaten their lunches and Jeff had brewed another cup of tea he wandered over to Natalie's desk. *"Can we start with Kirchhoff's second law, his voltage law"*, Natalie asked. *"Yes. OK, what do you already know about it"*, said Jeff. *"Well, Kirchhoff's voltage law says something like the algebraic sum of the electromotive forces acting in a circuit will equal the algebraic sum of the voltage drops, or potential differences around that circuit."*

"Yes, that's right", said Jeff. *"Let's consider a simple circuit consisting of a single voltage source, or emf, and three resistors connected in series across it"*. Jeff sketched the circuit, **Fig. 1**. *"Now, if we're told the value of the emf and the value of all of the resistors, we could calculate the voltage, or potential difference across each resistor using Ohms Law. But let's say that something is missing. We don't know the value of the resistors, or what the emf is"*, said Jeff. *"Let's say that we need to know the value of the voltage across R2 and we know the voltage produced by the emf to be 9V and the voltages across R1 and R3 to be 2V and 4V respectively. From Kirchhoff's law we know that the value of the voltage drops across all three resistors must equal the voltage of the emf source so we can say that the voltage across R2 will be 9V minus 6V, which is 3V."*



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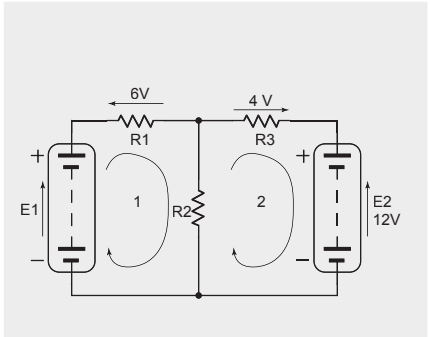
E1 = VR1 + VR2 + VR3,
9 = 2 + VR2 + 4,
9 = 6 + VR2,
VR2 = 3V

"Jeff, one thing that confuses me is the directions of the arrows representing the voltages", said Natalie. *"I was coming to that"*, Jeff replied. *"The arrowheads point to the end of the voltage source or resistor that we assume will have the highest potential on it. For voltage sources, batteries etc it's usually pretty easy to determine but for resistors it's sometimes necessary to do a bit of guesswork. If you get it wrong, it will come out in the calculations". "OK, I think I see what you're saying"*, said Natalie. *"If we were to say connect a voltmeter to the negative terminal of the battery in the circuit that you drew, and measured the voltages around the circuit, we would find the end of R1 to which the arrow points would have the same voltage as the positive terminal of the battery. The end of R1 that connects to R2 will be at a lower voltage because of the voltage dropped across R1". "Correct"*, said Jeff. *"There's no real right and wrong place to start when analysing circuits using Kirchhoff's voltage law but a good place to start is at the positive end of the highest voltage source and then work in a clockwise direction around the loop. Arrows pointing in the clockwise direction can be taken as being positive and those in the anti-clockwise direction as negative. You have a go at writing them down for our simple circuit"*, said Jeff. *"OK"*, said Natalie. *"So, starting with the single voltage source and working clockwise we have E1 and then the voltages across the resistors all need to be written as negative because the arrows are pointing in the opposite direction to E1"*, and Natalie wrote the equation:



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E1 – VR1 – VR2 – VR3 = 0

"That's right, well done", said Jeff. *"Now let's look at another example that's a bit more complicated. We'll add a second voltage source"*, and Jeff drew another circuit. **Fig. 2**. *"Let's say that we need to find the voltage across R2 and the value of E1"*.

"Now", said Jeff. *"Here we have two voltage sources, or emfs and more than one loop – three in fact. We need to start by analysing each of the loops in turn. Let's start with loop 2. Here we have an emf, E2, and the voltage drops across R2 and R3. From Kirchhoff we know that these must all add up to zero. We know that E2 equals 12V and that the voltage across R3 is 4V"*, Jeff explained. *"So, using the same method as we did before we can deduce that the voltage across R2 will be 8V."* Jeff wrote down the sums. *"Is it because we're going around the loop in a clockwise direction that E2 is written as being negative?"* Natalie asked. *"Correct"* said Jeff. *"You seem to have grasped this quite well"*.

–E2 + VR2 + VR3 = 0
–12 + VR2 + 4 = 0
so, VR2 = 8V

"So, now we need to find what E1 is", said Jeff. *"If we look at loop one, we can say that the value of E1 will be equal to the sum of the voltages across R1 and R2. And using Kirchhoff we can say that E1 minus VR1 minus VR2 equals zero from which we can conclude that E1 equals VR1 plus VR2 and that E1 is 14V"*, explained Jeff, writing down the equation:

E1 – VR1 – VR2 = 0
E1 – 6 – 8 = 0
so E1 = 6 + 8 = 14V

"Yes, OK, follow that", said Natalie, *"But you said that there was a third loop"*. *"Yes, there is"*, said Jeff. *"Look at the series combination of E1, R1, R3 and E2. If you apply Kirchhoff to this loop, you will get this"*, Jeff explained and wrote down more equations:

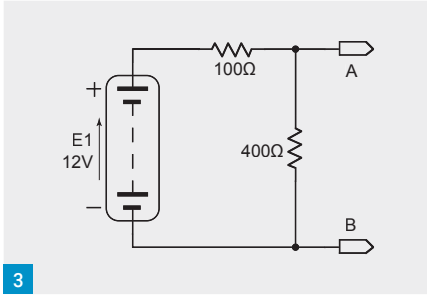
E1 – VR1 +VR3 – E2 = 0
so 14 – 6 + 4 – 12 = 0

"Which I think you'll find satisfies Kirchhoff's Voltage Law", Jeff said. *"Mmm yes, great, thanks for that Jeff"*, Natalie enthused. *"To be honest it was the bit about the direction of the arrows that had me confused but I understand now"*. *"Good, glad to be of help"*, said Jeff. *"You said you covered Thévenin as well. What do you know about that?"*

"Without looking at my notes for the exact words, I think that Thévenin's theorem says that any network with multiple voltage sources and resistors that has two output terminals can be simplified to an equivalent network consisting of a single voltage source and single resistance". *"Yes, that just about sums it up"*, said Jeff. *"Actually, Thévenin can be applied to alternating current networks as well where you'll need to use the impedances instead of resistances but let's not complicate things for the time being"*.

"Let's start with a simple example", said Jeff and drew a circuit on his notepad, **Fig. 3**. *"Now, to find the equivalent Thévenin circuit, we need to find out what the open circuit voltage, V_T, the voltage across A and B is and also what the equivalent resistance, R_T, will be, the resistance looking into A – B with the voltage sources replaced by a short circuit – or whatever their internal resistance is. Now for this simple circuit we can find the open circuit voltage by using the potential divider equation that we talked about a couple of weeks ago"*, said Jeff and wrote down the equation. *"So"*, he continued, *"The open circuit voltage is 9.6V"*.

"Now for the resistance, with the voltage source replaced with a short circuit, the two resistors are connected in parallel and have a combined resistance of 80Ω", Jeff



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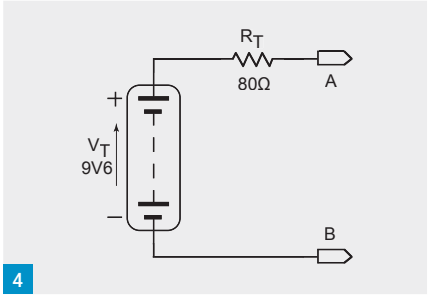
explained. *"OK, got that"*, said Natalie. *"So, the equivalent Thévenin circuit is a voltage source of 9.6V in series with an internal resistance of 80Ω"*. *"Correct"*, said Jeff and drew the circuit, **Fig. 4**.

$V_T = 12 \times 400/(100+400) = 9.6V$
$R_T = (100 \times 400)/(100+400) = 80\Omega$

"Now let's look at a more complicated example", said Jeff. *"We'll stick with one voltage source but add more resistors"*. Jeff drew another circuit, **Fig. 5**. *"Let's say that we want to know what the current in the 20Ω resistor is. The first thing that we need to do is to disconnect the resistor from the circuit so that we have an open circuit voltage across A and B. Now, since there is no current flowing in the 50Ω resistor there will be no voltage dropped across it so we can deduce that the voltage across A and B will be the same as that across X and Y, which from the potential divider equation works out to be 4.5V"*. *"Yep, follow that"*, said Natalie.

"For the resistance", Jeff continued, *"With the voltage source replaced by a short circuit, we have the 1kΩ resistor in parallel with the 600Ω resistor, which equates to a resistance of 375Ω. This will be in series with the 50Ω resistor so the Thévenin equivalent circuit is a voltage source of 4.5V in series with a resistance of 425Ω"*. Jeff added the circuit complete with the 20Ω resistor in which we need to find the current, **Fig. 6**. *"Now, from simple Ohms law, the current in the 20Ω resistor will be 4.5V divided by the total series resistance of 445Ω across it, which works out to be 10.1mA"*, said Jeff tapping the numbers into his calculator. *"Mmm, yes, I follow that"*, said Natalie. *"Can we look at one with more than one voltage source?"* *"Yes, sure"*, said Jeff and drew another circuit, **Fig. 7**.

"Let's say that we want to find the current in the 25Ω resistor", Jeff said. *"The first thing we need to do is to find the open circuit voltage across A and B so we need to remove the 25Ω resistor"*, he explained. *"We now have a simple series circuit consisting of E1, E2, R1 and R2. So, we can find the current flowing from Ohms Law. Since the voltage sources are opposing each other, the*



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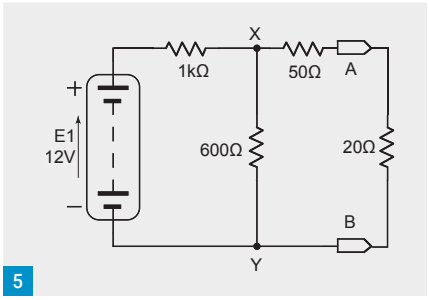

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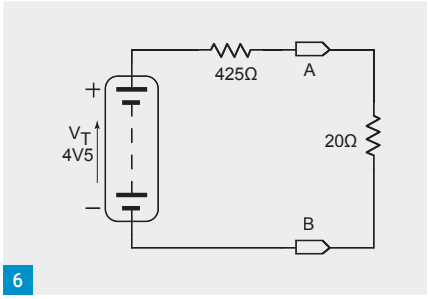

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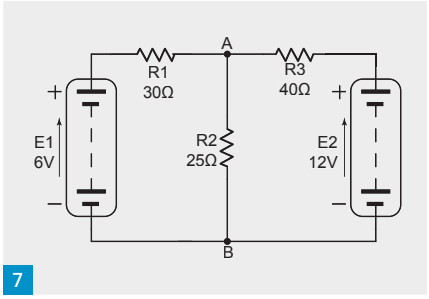

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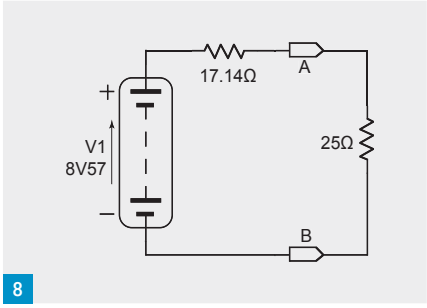
voltage will be E2 minus E1, which is 12V minus 6V, which works out to be 6V". Jeff wrote down the equation:

E2 – E1 = 12 – 6 = 6V

"Now", Jeff continued, *"The total series resistance is 30Ω plus 40Ω, which is 70Ω. We can now find the current, which will be 6V divided by 70Ω, which works out to be 85.7mA"*. Jeff wrote down the figures. *"And now we know the current, we can work out the voltage drops across the 30 and 40Ω resistors"*, Jeff explained.

VR1 = 0.0857 x 30 = 2.572V
and VR3 = 0.0857 x 40 = 3.428V

"We now have two ways of finding the voltage across A and B", Jeff said. *"First*



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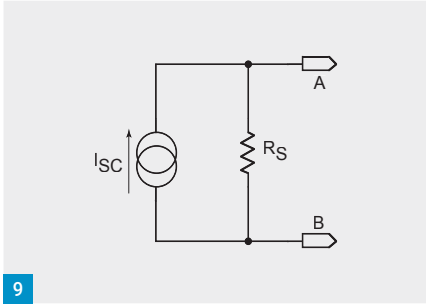

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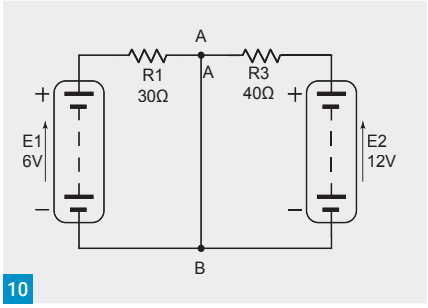

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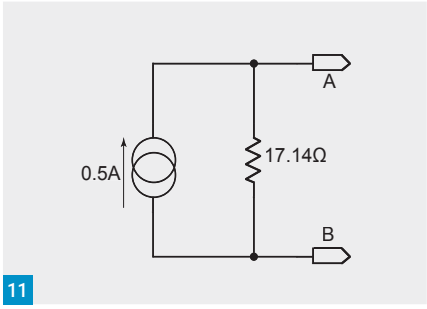

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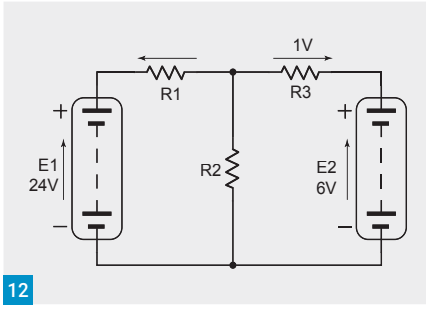

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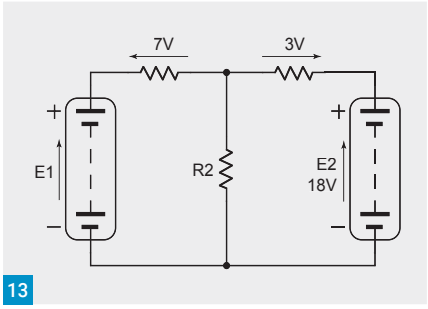

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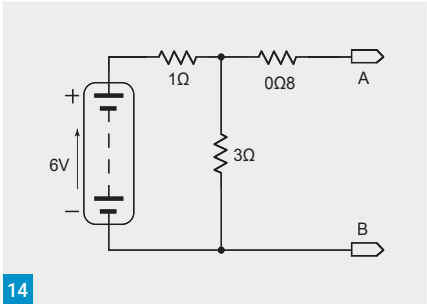

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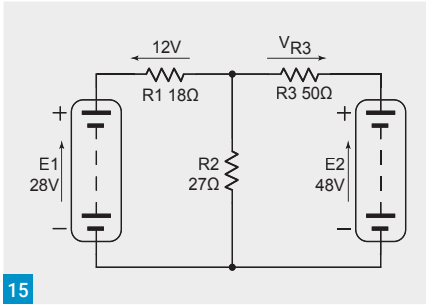

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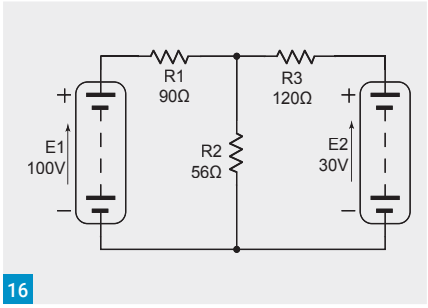

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we can subtract VR3 from E2, which gives us 8.572V, or we can add VR1 to E1, which gives the same result", Jeff explained. *"So, the Thévenin voltage is 8.572V. The Thévenin resistance is simply the 30 and 40Ω resistors in parallel, which works out to be 17.14Ω"*, said Jeff and drew the equivalent circuit including the 25Ω resistor in which we need to find the current, **Fig. 8**. *"So, from this"*, Natalie jumped in, *"We can find the current in the 25Ω resistor by dividing the Thévenin Voltage by the total series resistance". "Correct"*, said Jeff, *"And the current works out to be 203.4mA":*

I = 8.572/42.14 = 0.2034A = 203.4mA

"Happy with that?" Jeff asked. *"Yes, fine, can we have a look at Norton?"* Natalie replied. *"Yes, OK, what can you tell me about it?"* Jeff asked. *"Well, Norton is similar to Thévenin except that instead of having a constant voltage source with a series resistance, you have a constant current source with a parallel resistance". "Yes, that's right"*, said Jeff. And drew the circuit. **Fig. 9**. *"But instead of finding the open circuit voltage as we do in Thévenin, with Norton we have to find the short circuit current. Shall we do an example?" "OK"*, Natalie said enthusiastically. *"Right, let's use the last Thévenin example that we did, Fig. 7, and find the Norton equivalent"*, Jeff said.

"Again, we need to find the current flowing in the 25Ω resistor", said Jeff. *"Now for Norton, instead of removing the resistor, we replace it with a short circuit like this"*, **Fig. 10**. *"We now need to find the currents flowing in R1 and R3, which work out to be 200 and 300mA respectively":*

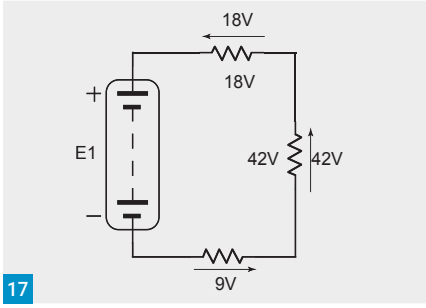
IR1 = 6/30 = 0.2A
IR3 = 12/40 = 0.3A

"So", said Jeff, *"From Kirchhoff's current law the short circuit current will be 0.5A. The resistance will again be the 30 and 40Ω resistors in parallel, which is 17.14Ω. Thus, the Norton equivalent is a current source of 0.5A in parallel with a resistance of 17.14Ω"*, **Fig. 11**. *"If we now put the 25Ω resistor back into the circuit, it is in parallel with the Norton resistance, which works out to be 10.17Ω." "So, let me guess"*, said Natalie, *"We can now find the voltage across the parallel resistors and then the current?" "Absolutely correct"*, said Jeff. *"The voltage will be 0.5A times 10.17Ω, which is 5.084V. By Ohms law, the current in the 25Ω resistor will be this"*, said Jeff and wrote down the sums:

I R Load = 5.084/25 = 0.203 A

"Hang on a minute", Natalie said, *"These are the same figures that we got for the Thévenin example". "Exactly"*, Jeff said with a grin. *"That's why I wanted to use the same example. You see, you can use either Thévenin or Norton to simplify a complex network and you'll come up with the same results".*

"OK", said Natalie. *"That's worth knowing. Can you write me some examples to work through? By the way, I hope that you don't mind but I share the examples that you give me with a couple of other girls in the class – **Isla** and **Poppy**. We've formed a bit of a self-help group where we help each other with parts of the lessons we don't understand. I'm lucky that I have you to ask but they're pretty much on their own so they appreciate the examples that you give me". "No problem at all, glad to be of help"*, said Jeff, beaming.



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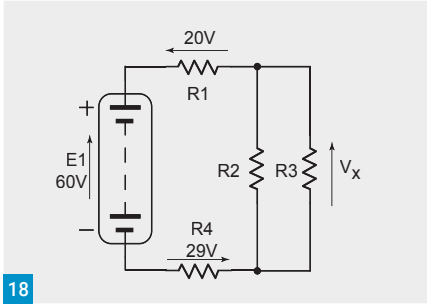

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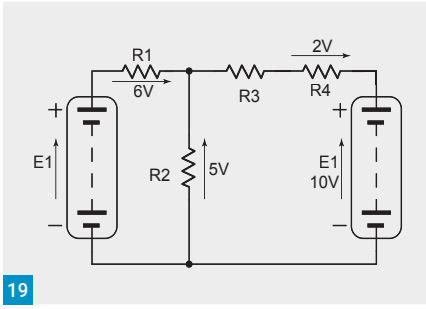

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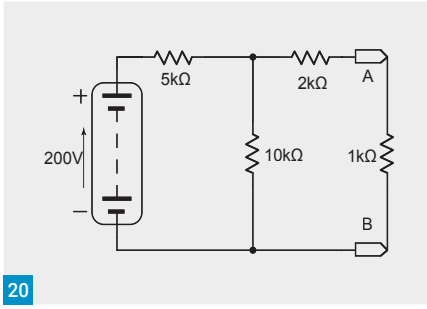

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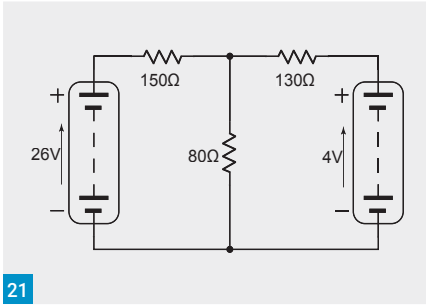

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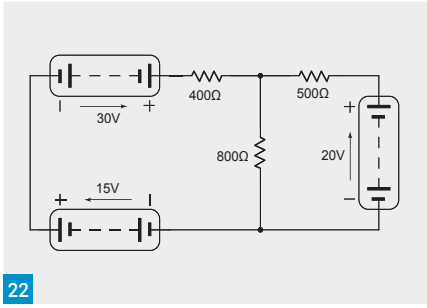

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Class Examples

Q1. For the network shown in **Fig. 12**, find the voltage across R2. (5V)

Q2. For the network shown in **Fig. 13**, find E1 and the voltage across R2. What current will flow in R2 if R2 = 20Ω? (E1 = 22V, VR2 = 15V, IR2 = 0.75A)

Q3. For **Fig. 14**, determine the Thévenin equivalent circuit. (V_T = 4.5V, R_T = 1.55Ω)

Q4. For Fig 15, find the voltage across R3 and the current flowing in R2. (VR3 = 32V, IR2 = 0.59A)

Q5. For **Fig. 16**, find the Norton equivalent circuit and the current flowing in the 56Ω resistor. (I_{SC} = 1.36A, R = 51.43Ω. Current in 56Ω resistor = 0.65A)

Jeff's Questions

Q1. For the circuit in **Fig. 17**, find E1. (69V)

Q2. For **Fig. 18**, find V_X, and the current in R3 if R3 = 200Ω. (V_X = 11V, IR3 = 55mA)

Q3. For the network in **Fig. 19**, find E1 and the voltage across R3. (E1 = 11V, VR3 = 3V)

Q4. For **Fig. 20**, find the Thévenin equivalent circuit and the current in the 1kΩ resistor. (V_T = 133.33V, R_T = 5.33kΩ, current in 1kΩ resistor is 21mA)

Q5. For **Fig. 21**, find the current in the 80Ω resistor. (94.98mA)

Q6. For **Fig. 22**, find the Norton equivalent circuit and the current in the 800Ω resistor. (I_{SC} = 0.15A, R = 222.22Ω, current in 800Ω resistor = 33mA)

Continued from page 50

At the same time, it was decided to build a new driver modulator unit which would incorporate GPS-controlled digital modulation. JT4G was decided on as this is used by GB3SCX and the beacon keeper for SCX **Andy Talbot G4JNT** kindly agreed to programme a PIC for KBQ.

The new driver was completed at the end of 2020 and following extensive testing and a period of soak testing the new system went live in early March 2021. Early results are very encouraging with six UK stations decoding the new modulation in the first week. JT4G modulation is usually decoded on a PC where the received signal is monitored every other minute and the received data integrated over the period to produce a decode.

If you fancy trying to receive a microwave beacon, there is a very cheap route to achieving this. Satellite LNBs are now extremely cheap, less than £10 for some models, add to this an SDR USB dongle, around £20 and you have a complete receive system!

Most LNBs have a local oscillator around 9500MHz. 10GHz beacons can be found just below 10369MHz. A receiver tuned to 869MHz will therefore be listening in the right place. GB3KBQ is on 10368.870MHz.

The upgrade to GB3KBQ would not have been possible without the support of G8ACE, G4JNT, G4NNS and G4UTM. Thanks also to the UK Microwave Group for financial reimbursement for much of the hardware.

Continued from page 61

matter in this discussion? This topic has aired on the NRC net, and **Ed G3ZLX** made a lengthy submission on the topic, all very correct.

But in the end, the conclusion seemed to be that I should be using several callsigns at once – including my Irish callsign for the 70cm transmission into my hotspot and also G4RWI/A as I was also transmitting on 80m from Nigel's QTH. Amazing! Any help would be very much appreciated. Finally, for the fun of it, if you are interested in joining in with all or indeed any of this, please don't hesitate to contact us.

Rallies & Events

All information published here reflects the situation up to and including 23rd November 2021. Readers are advised to check carefully with the organisers of any rally or event, before setting out for a visit. The Radio Enthusiast website will have updates, please check here regularly. To get your event onto this list, please, e-mail full details as early as possible: wiessala@hotmail.com

2 January
SPARKFORD WIRELESS GROUP RALLY: Davis Hall, Howell Hill, West Camel, nr. Yeovil BA22 7QX. Open 9.30 am to 1 pm, entry is £2. (FP | CR)
wjh069@gmail.com

30 January
LINCOLN SHORTWAVE CLUB WINTER RADIO RALLY: Wragby Town Hall, Louth Road, Wragby, Market Rasen, Lincolnshire LN8 5PH; Doors open at 10 am, with disabled visitors gaining access at 9.30 am. Indoor event; CR; entry £2.
contact@m1dhv.co.uk
m5zzz@outlook.com

6 February
RED ROSE RALLY: St Joseph's Hall, Mather Lane, Leigh WN7 2PR; (D | FP | CR | RSGB | TS). Individual stands, LAMCO dealership stand, low-cost Bring and Buy.
rally@wmrc.co.uk
http://wmrc.co.uk/rally.htm

22 February
RADIOACTIVE FAIR: Mid Cheshire ARS; Nantwich Civic Hall, Cheshire CW5 5DG (BB | CR | D | FP | RF | RSGB | TS)
https://midcars.org
http://www.radioactivefair.co.uk

6 March
EXETER RADIO & ELECTRONICS RALLY: America Hall, De La Rue Way, Pinhoe, Exeter, EX4 8PW.
g3zvi@yahoo.co.uk

9 April
YEOVIL ARS 36TH QRP CONVENTION : The Digby Hall, Sherborne, Dorset, DT9 3AA. Doors open 09:30 am to 2:00 pm; Admission £3 (regrettably, no dogs except guide dogs) BB | TS | Club Stalls.
Supported by RSGB, RAFARS & BYLARA. Regrettably, there will be no talks this year, due to Covid.
https://tinyurl.com/fyj9vtca

1 May
NORTHERN AMATEUR RADIO SOCIETIES ASSOCIATION EXHIBITION: Blackpool Rally, Norbreck Castle Exhibition Centre, Blackpool FY2 9AA
www.narsa.org.uk

20-22 May
DAYTON HAMVENTION
https://hamvention.org

11 June
ROCHDALE & DISTRICT AMATEUR RADIO SOCIETY SUMMER RALLY: St Vincent de Paul's, Caldershaw Road, off Edenfield Road (A680), Norden, Rochdale OL12 7QR.
m0nvq@outlook.com

12 June
JUNCTION 28 RADIO RALLY: South Normanton, Alfreton and District Amateur Radio Club
www.snadarc.com

24-26 June
HAM RADIO FRIEDRICHSHAFEN
www.hamradio-friedrichshafen.de

26 June
NEWBURY RADIO RALLY: Newbury And District Amateur Radio Society (NADARS)
http://www.nadars.org.uk

17 July
McMICHAEL RALLY
https://mcmichaelrally.org.uk
rally@radarc.org

24 July
FINNINGLEY ARS RALLY : Car-boot style rally. Food bar. Near J2 M180, Doncaster.
www.g0ghk.com

12-14 August
19TH INTERNATIONAL EME CONFERENCE, PRAGUE
http://www.eme2020.cz

BB Bring-and-Buy **CBS** Car Boot Sale **CR** Catering /Refreshments **D** Disabled visitors **FP** Free Parking **L** Lectures **RF** Raffle **RSGB** (RSGB) Book Stall **RU/PW** RU/ PW in attendance **SIG** Special-Interest Groups **TI** Talk-In (Channel) **TS** Trade Stalls

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Heathkit

Dear Don,

I was interested to read the article about Heathkit in the December issue of *PW*.

In the 1970s I built several Heathkit kits and still have a couple of their catalogues. The one that I've attached an image of would be from the early 1970s. Unusually it doesn't seem to have the year on it. The other image shows a couple of kits that I built.

I built the IT-27 transistor tester (centre) when I was about 12 so that would have been in 1972. The IT-27 had been introduced in 1968 and was a fairly simple device. I'm not sure what happed to mine. I also built the IT-18 transistor tester. This would have been a couple of years later and being a better instrument than the IT-27 the latter became redundant.

I foolishly gave the IT-18 away when I acquired a digital multimeter that had transistor test facilities.

Yes, Heathkit provided an excellent range of kits with excellent instruction manuals.

Chris Murphy M0HLS
Derby

Dear Don,

Many thanks to **Ray Howes G4OWY** for his most interesting article on this iconic brand.

When I had completed my National Service in the early 1960s, I was employed by James Holding to develop an audio side to his photographic business, which then traded as Holdings Camera Corner. First of all, I needed some test equipment but 'the sky was not the limit'.

I soon obtained an AVO and the necessary tools, but how about an audio generator? At that time H.J. Leak were making a big shout of the fact that their amplifiers gave less than 0.1% harmonic distortion, yet quite expensive audio generators had an inherent distortion of much more than this!

Just as I was thinking about this our copy of *Hi-Fi News* arrived with, rather cheekily, two technical reviews of audio generators. One was of an expensive commercial generator, with a harmonic distortion level of around 1% while the other was that of a Heathkit audio generator, at almost a tenth of the price, which also gave less than a tenth of the harmonic distortion of the commercial unit.

I ordered one, and while I had to build it myself, this was quite a pleasant experience. Heathkit instructions are a wonderful example of how to break down a complex process into simple steps. It worked first time, and 60 years later it still functions! This was to be the first of many pieces of Heathkit.

We developed an extensive workshop full of Heathkit test equipment, and had several engineers, but, having always been known for many years as Holdings Camera Corner, we had an image problem when we started selling Hi-Fi equipment. *"What does a camera firm know about Hi-Fi?"* was a common comment locally, so I decided to do something about it.

We set up all the test equipment over one bench, and took a photograph with myself and technician **Derek Fielding** holding test prods, intending to put it in the shop window. It came out even better than expected and so, just on the off chance, I sent a copy to *Hi-Fi News*. The editor wrote back quite enthusiastically, and explained that they had been stuck for something to fill the front page, and that our photo would do nicely. Goodness knows what it would have cost to book the front page of *Hi-Fi News*, probably more that we spent on all our test equipment, and yet we got it for free!

Thank you Heathkit.

Harry Leeming G3LLL
Morecambe

What has Happened to the Hobby?

Dear Don,

I don't expect this will get published, as it may get a backlash, but here goes anyway.

I have had my licence since 1973, and started out with a modified AM Pye Bantam. Over the years I have seen some amateurs hating repeaters, and jamming them. I have built a few myself; GB3FJ is still going strong.

Way back, some class A operators would not speak to a class B operator because they had not leant Morse, and even a well-known G3 was caught jamming GB3LO, the London repeater.

When I took the exam it was a two hour, if I recall correctly, written paper. Now my wife, who knows nothing about radio, can pass the novice exam, just by guessing the correct answer.

I remember the days of 'ragchew' contacts, that may last hours, or even DX contacts on the HF, VHF and UHF bands that were meaningful. But today all one seems to get is "you are 5.9, good luck". If one is very lucky you may get a DX contact that lasts five minutes. Some operators, if that is the correct word, do not even want to speak but rely on a PC to make contacts. Yes, I have done it myself, but not now, I know using WSPR I can get all over the world using mini watts, but that is a PC contacting another PC, not real amateur radio to me.

★Star Letter★

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

Voice over IP

Dear Don,
Doubtless **Joe Chester M1MWD (Dec issue)** knew his article extolling the virtues of voice over IP would raise some comment. I found his examples of the benefits to radio amateurs interesting but not convincing.

Take the chap who buys a DMR handheld and, through a hotspot access point to the internet, contacts an amateur on the far side of the world. Wonderful! But where is the skill or satisfaction in that?

Now consider the chap who has a smartphone and, via his network provider, also contacts a friend on the other side of the world. What is the difference? Both are using a communications link that comprises radio to network provider to radio. Does that not make the smartphone user the same as the DMR user? By that analogy they are both radio amateurs. The only added benefit that the DMR user has is the possibility to access a talk group. That may be important to some. But how about Zoom? That gives you a piccie as well. It seems to me that big business has done it all already.

Interestingly all the equipment required for DMR use requires a cheque book, much the same as the smartphone user. The possible exception is a homebrew hotspot.

It is no accident I live on the Jurassic Coast. My definition of amateur radio, whether digital or analogue, is that it does not require third party involvement. There is plenty of scope for innovative development and experiment, ideally incorporating as much homebrew as possible. Just look at the work of **Joe Taylor K1JT**. How about a shot at EME? Or communicating intercontinental with a few hundred milliWatts? Now that's real radio and does not necessarily require a big fat cheque book!

Barrie Raby G8GTV
Sidmouth

*(**Editor's comment**: Thanks Barrie. Of course, you could argue that amateur radio in the past was exactly like commercial radio but undertaken on amateur frequencies. So, the fact that present amateur radio utilises the internet simply mirrors what the commercial world now offers. We follow, sometimes lead as in packet radio, the rest of the world. And as for Joe Taylor's WSJT, there are plenty of radio amateurs who don't consider that 'proper' radio either! My own interests, weak signal DXing and contesting, are all about making two-way communications via the ionosphere but I accept, and value, the fact that our hobby is so diverse nowadays. If part of the link is via amateur radio frequencies, then an amateur licence is required and it's amateur radio. But I realise that other views may vary! As always, I'd welcome input from other readers.)*

I have had a lot of transceivers in my time, including an FT-991a and IC-7300. But now I am down to my trusty twenty-year-old IC-718, it gets me out all over if the conditions right. I bought it some 15 years ago, second-hand for £275. Today I opened up my *Practical Wireless* and inside the back cover I was amazed to see a well-known dealer selling a new 'State of the Art' transceiver for a starting price of £12,249.95! I am sure if I were to buy one, I would not get any better contacts than I do from my old 718, and my quad-band TH9800. As we all know, unless the conditions are right, and you have decent antennas, no mater how much you spend on a transceiver you will not get far. I will not be spending £12,249.95 on the latest transceiver, even if it is individually built to the customer order. The world of amateur radio has truly gone mad.....

Len Baddeley G8LXI
Southend-on-Sea

*(**Editor's comment:** Thanks Len. Do read Pete M0PSX's letter in this issue as he explains that gaining a Full licence is still far from trivial. As for ragchew contacts, while I sympathise, I suspect that WhatsApp, Skype and the like have rendered them largely irrelevant although I'm happy to note that a number of regular nets still operate on, for example, the 80m band, as you will have read in Joe Chester M1MWD's column. Like you, I don't intend to spend over £12k on a radio but I would argue that modern rigs such as my IC-7610 make a big difference when undertaking weak-signal DXing or contesting, whatever the mode.)*

Licensing

Dear Don,
As an active and passionate trainer, I'd like to respond to the letter from **Pat M1BNH** (*PW* December 2021) on the subject of the removal of practicals.

First off, let me state that I'm all for hands-on practical sessions, and with exams now largely online through necessity, I feel that there is an even greater requirement for practical help and support from local clubs after the entry-level theory exam, not before.

While the RSGB's practicals did serve a purpose, in recent years their delivery has suffered from two problems: Relevance and availability. Here's a reminder of the Foundation practicals:

SSB and FM QSO: Typically scripted, with a friendly club member at the other end

SWR: Adjusting the length of two telescopic halves of a 2m dipole and checking the meter

Setup: Plugging together a PSU, transceiver, ATU and an antenna

CW: Using an oscillator to send and receive half a dozen words, slowly, to a club official across a table

In many cases, these were regarded as tick-box exercises crammed into a short theory-heavy training course. Given that most newcomers wouldn't be building 2m dipoles or sending Morse across a table, they were of questionable benefit. Even the QSOs had limited value, in some cases not being fully explained and often under the watchful eye of a scary club official – not great for the mic-shy. Now, clubs are free to decide what practical elements to use, possibly more relevant ones, such as programming repeater settings, using an SDR, or making up PL259 leads.

Then there's availability. Mandatory practicals require a network of clubs and trainers, and the admin overhead of finding and approving venues, vetting assessors, etc. The club landscape differs wildly across the UK, with reports of candidates having to travel several hundred miles to find a club offering training, or, more commonly, having to wait for the local club to run its annual training course. The majority of clubs offer no training at all. For newcomers dead keen to get started, course costs, travel issues and lengthy waits were major barriers to entry until recently. In recent months, more groups have moved 'online' for training and now that the Covid restrictions have been lifted (at the time of writing), many clubs appear reticent to restart in-person training. If the popularity of Essex Ham's online course is any indication, many students

seem to prefer to study for, and sit, their exams online from their own homes, making practicals… impractical.

I take issue with Pat's assertion of a lowering of standard due to this decision. Getting a Full pass is demonstrably more challenging than it was under RAE (which, as **Don** points out, also had no practical element), with a greater number of licensing and operating questions than RAE, a significantly more broad syllabus, a total of three exams and new content on topics such as DV and SDRs. The 2019 syllabus update has made Foundation and Intermediate even more challenging. Those who feel that today's amateurs have an 'easy ride' may want to review the current 95-page exam specification and try a few mock tests.

I guess a key factor, is the dreaded 'c' word… change! One of the reasons that I love amateur radio, is that it is constantly evolving – there's always something new to try. The Foundation practicals were introduced 20 years ago – before the advent of YouTube, Facebook, Zoom, tablet computing and smartphones. In schools and industry, online learning is the way of the future, and in our hobby, newcomers are more likely to turn to YouTube or social media for practical help than to wait for a talk on a particular subject at a local club. Rather than being 'disheartened' by the changes to the exam system as Pat suggests, I'd hope that a good percentage of active amateurs appreciate the need to move with the times to attract the next generation, for trainers to adopt current teaching technology, and for everyone to appreciate the value in presenting amateur radio as an interesting and evolving hobby, not a last-century anachronism.

Pete Sipple M0PSX, Essex Ham
Leigh-on-Sea

Multiple Individual Callsigns

Dear Don,

In an attempt to resurrect an old G6 callsign as a secondary callsign. Primarily for the purpose of dual registrations on digital systems (DMR, D-STAR etc) Ofcom have stated the following:
1: Radio Amateurs can have one callsign only.
2: This is to ensure that the station can be identified.
3: Enabling two callsigns would add redundant entries to the licensing records.
4: It would make it more difficult to contact the licensee.

My correspondence with Ofcom has been ongoing for the past year and a half.

Their response has been consistent even when referred to the internal policy team. I did ask if Ofcom were still using typewriters for correspondence and some

type of card index for their database.

If you login to the Ofcom licencing portal and can see an active M3, 2E0 and M0 callsign, only the M0 is actually active in Ofcom's eyes.

If you are lucky enough to have come to some prior arrangement in the past to use a G8 and a G4 call, that is now incompatible with the current Ofcom policies.

Tom Tierney G0JSV
Eye, Suffolk

*(**Editor's comment**: Interesting one Tom, as this appears to be a change from what has been the case in the past. I wonder what the experience of others has been? Personally, I've only ever had one callsign so the issue doesn't arise. But I do know that some have got round that particular challenge by establishing a 'club' and getting a club callsign!)*

Imperial and/or Metric Units

Dear Don,

I am 70 years old and have been using the metric unit of measurement in my job since about 1973. However, I still see reviews written referring to and mixing metres and feet together. Now I am very happy to use metric or imperial units but please, please, please don't mix them together!

Alistair Burgess 2E1AJB
Birchington

*(**Editor's comment**: Thanks Alistair. Unfortunately, we live in a country that has yet to decide whether it is imperial or metric! So, for example, road distances are imperial while milk is sold in litres. Often, here in* PW*, we give both, to play safe!)*

Next Month

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

BUILD THE PW PASTON: Mark Tuttle G0TMT embarks on building a homebrew CW, QRP transceiver for the 40m band.

TEST EQUIPMENT FOR THE SHACK: Chris Murphy M0HLS advises on the purchase of basic test equipment for the workshop.

MICROWAVES: Ian Dilworth G3WRT returns, discussing suitable test equipment for microwave work.

VALVED RADIO REPAIR: Bernard Nock G4BXD advises on how to set about repairing and restoring old valved radios.

A POCKET PORTABLE 2 METRE BEAM ANTENNA: David Johnson G4DHF describes a lightweight antenna for the 2m band that is ideal for portable operation.

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THE BATTLE OF BRITAIN IN COLOUR

The Battle Looms

The Battle of Britain was one of the most iconic battles of the Second World War, embedding itself indelibly into the nation's consciousness. Earlier, the Battle of France could easily have spelled defeat before the air battles got underway in July 1940.

After the outbreak of war in September 1939, there followed eight months of what became known as the 'Phoney War'. However, it was clear that large-scale fighting would ultimately follow, and a British Expeditionary Force was sent to France before the end of that year. As part of that BEF, a large Air Component was supplemented by an Advanced Air Striking Force. In total, these air forces amounted to 25 squadrons, six of which were Hawker Hurricane-equipped fighter squadrons. The remainder of the RAF force in France comprised largely light bombers and Army Co-Operation squadrons. Eventually, however, the 'Stukoj' became the 'Blitzkrieg'.

On 10 May 1940, German forces launched their all-out assault on France and the Low Countries and what followed in Belgium, the Netherlands etc. was the complete collapse of those countries under the overwhelming might of German military power. Across France, German forces rolled inexorably onwards towards the English Channel and while the French and British tried desperately to stem the advance, so the situation became ever more hopeless.

Predicted Catastrophe

When the fighting had broken out in earnest on 10 May 1940, aircraft of the Air Component were in almost constant combat, and losses had to continually be made good from squadrons based in Britain. The Commander-in-Chief of RAF Fighter Command, Air Chief Marshal Hugh Dowding, had already stated as early as September 1939, that if he was expected to defend Britain's skies, then he would need 52 fighter squadrons. At that time, he had only 32 under his command and was told it would be impossible to produce the number he required. However, efforts would be made to provide him with a further eight.

During the fighting in France, increasing numbers of fighter squadrons were sent across the Channel, urged on by desperate appeals from the French Prime Minister, Paul Reynaud. Dowding saw his resources 'slipping away like

BACKGROUND TO BATTLE

THE RAF FIGHTER PILOT

THE RAF FIGHTER PILOT